Special Publication SJ2002-SP9

LEVY LAKE

Flood Attenuation/ Wetland Restoration Plan

February 2001

For: ALACHUA COUNTY

By: Berryman & Henigar

In association with:

LEVY LAKE
Flood Attenuation/Wetland Restoration Plan

Final Report prepared for:

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February 2001

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Executive Summary

Kanapaha Prairie, which consists of some wetland systems, a sinkhole and residential areas, is located downstream of Levy Lake. Surface water runoff from Levy Lake and its contributing basin areas, flow northwest, crossing under State Road 121, through existing triple culverts to the Kanapaha Prairie.

Historically, Levy Lake was a shallow marsh system, providing habitat for various species and flood attenuation for the Kanapaha Prairie basin. Large-scale land alterations, such as construction of berms and pumping for agricultural use, have changed the Levy Lake hydraulic function and wetland characteristics.

During the prolonged rainfall period of 1997, known as El Niño, Kanapaha Prairie experienced severe flooding. Saturated ground conditions reduced the soil percolation rate and the intake capacity of the sinkhole. This caused an increase in water surface elevations throughout the Prairie, flooding some residences and threatening others.

Alachua County Public Works Department, responding to citizens' complaints, has spearheaded an effort to propose a design, which reduces the risk of flooding in Kanapaha Prairie. In a parallel development, the Natural Resources Conservation Service (NRCS) is also working with the property owner of Levy Lake area to rehydrate Levy Lake and restore the historic wetlands and associated habitat. The mutual objectives of Alachua County and the NRCS make it possible to use Levy Lake for stormwater runoff attenuation, reduce the flood elevations in the Kanapaha Prairie, and restore the wetland systems on Levy Lake.

Berryman & Henigar, Inc., working with the St. Johns River Water Management District (SJRWMD) under the directions of the Alachua County Public Works Department, has examined two (2) alternatives for reducing the flood elevations in the Kanapaha Prairie by storing stormwater in the Levy Lake area. The findings of this report, supported by a stormwater model, performed by SJRWMD, indicate that it is possible to reduce the flood stages within the Kanapaha Prairie and rehydrate the wetland systems on Levy Lake.

1.0 Introduction

1.1 General & Background

The Alachua County Public Works Department has proposed the conceptual design and the evaluation of two possible alternatives to reduce the risk of residential flooding within the Kanapaha Prairie. The proposed alternatives include methods of utilizing storage in the Levy Lake area to attenuate the stormwater runoff to the Kanapaha Prairie.

On September 28, 1999, Berryman & Henigar, Inc. (BHI) was authorized by Alachua County Public Works Department to perform the conceptual engineering design for this project. Based on agreements reached with Alachua County, St. Johns River Water Management District (SJRWMD) assisted BHI with the conceptual design by performing basin analysis and computer modeling of the existing conditions and the proposed alternatives. Ashton & Ashton is also involved in this project as a sub-consultant to BHI. They have provided selected environmental services on this project, including the study of wildlife habitat and how the habitat is affected by changes in water surface elevation.

1.2 Purpose

The purpose of this report is to perform a thorough engineering review and analysis of two alternatives in a coordinated effort with the SJRWMD. The alternatives are aimed at reducing the risk of flooding to the Kanapaha Prairie and restoring wetlands within the Levy Lake area. This report will document the effects of the proposed alternatives on the Kanapaha Prairie as well as Levy Lake and its surrounding areas. It also provides an estimated construction cost for the two (2) alternatives.

2.0 Project Description

2.1 Location

The Levy Lake area is approximately 6.9 square miles and is located in Sections 13, 14, 15, 22, 23, 24, 25, 26 and 27 of Township 11S, Range 20E and Sections 19, 20, 21, 28, 29 and 30 of Township 11S, Range 20E in Alachua County. Currently, Levy Lake is divided into two sections, eastern and western, and separated by a berm. Levy Lake is located west of I-75, south of County Road 18 and just east of State Road 121(Figure 1).

The Kanapaha Prairie lies on the county line between Marion and Alachua counties, in Sections 7, 8, 15, 16, 20 & 21, Township 11S, Range 19E. The prairie is located west of State Road 121 and 2.6 miles southeast of State Road 24, also known as Archer Road (Figure 1).

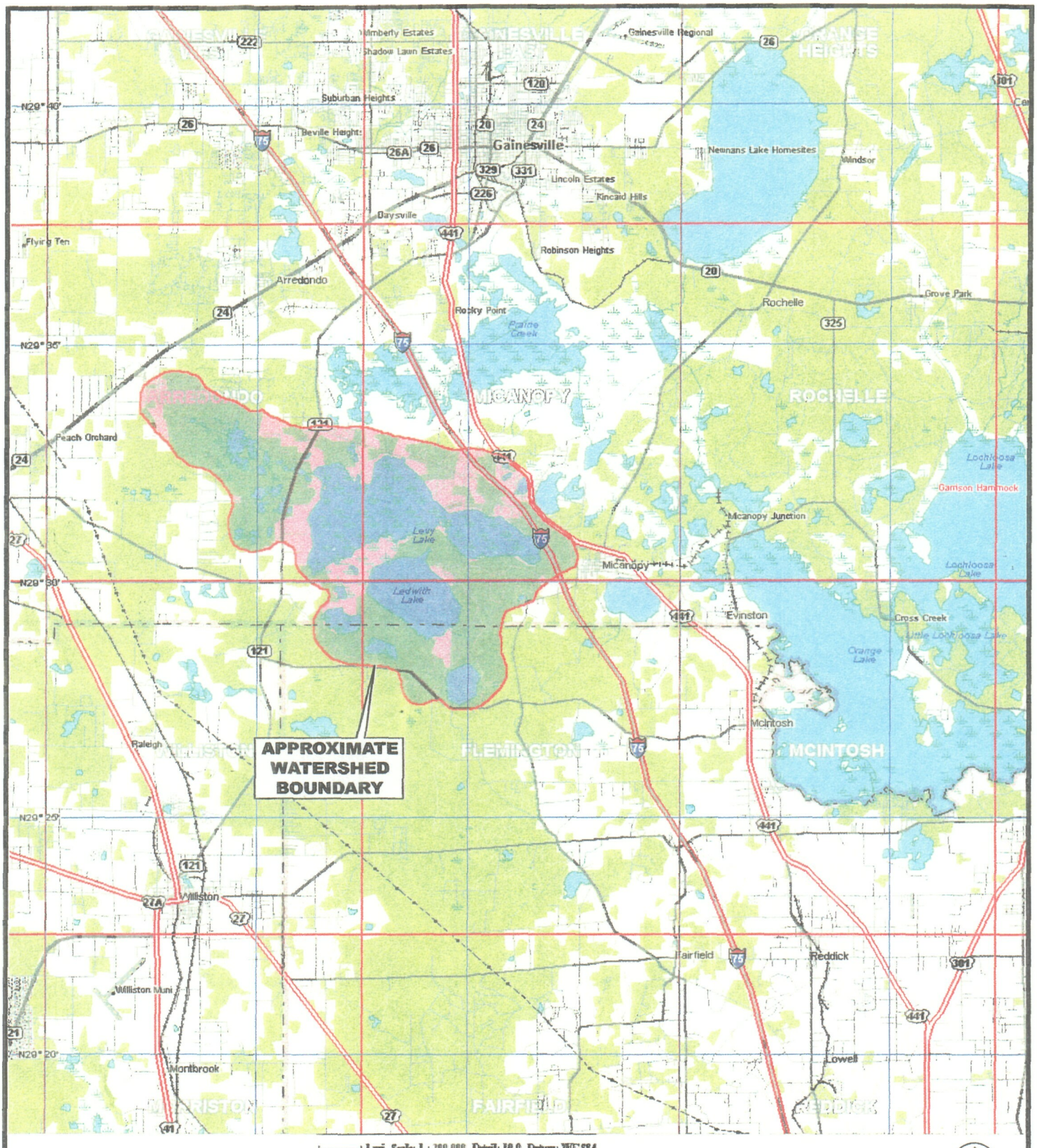

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FIGURE 1
LEVY LAKE / KANAPAHA PRAIRIE
STUDY AREA

2.2 Existing Conditions

The predominant land use within the Levy Lake area in its current conditions is pasture. There is a man-made levee along the northern and southern borders of Levy Lake which prevents offsite sheet flow from entering the lake area. The levee acts as an access berm for the lake area. There is a ditch adjacent to the levee, which intercepts offsite flow and directs it north towards the Ramsey Property, located north of Levy Lake, then west towards the Kanapaha Prairie. The levee prevented Levy Lake from attenuating excess floodwaters and caused excess flow to enter the Kanapaha Prairie (Figure 2 indicates the existing flow patterns within the basin).

During the prolonged rainfall period of 1997/1998, known as El Niño, the flooding of Kanapaha Prairie became a serious issue. Floodwaters damaged some homes and threatened many others. See Finished Floor Elevation Report by Causseau Ellington Inc., provided by the Alachua County Public Works Department in Appendix III.

Modeling simulations have been performed to understand the water surface elevations through Levy Lake and the Kanapaha Prairie for the existing condition. The long-term simulations have helped in determining the relationship between water surface elevations and storm frequencies.

2.3 Proposed Alternatives

Two alternative plans are proposed to better utilize the storage capacity of Levy Lake, restore the wetlands and reduce the flood levels in the Kanapaha Prairie. The two alternatives are identical in allowing offsite water to enter Levy Lake, and only differ in the location of a control structure at the outfall of Levy Lake.

2.4 Alternative One (1)

Alternative One (1) includes the following (Figure 3 illustrates the proposed improvements associated with Alternative One (1)):

1. Construction of a double 24" pipe under the berm at the eastern end of the Eastern Levy Lake, with elevations of 60.5 and 60.2 on the eastern and the western end of the pipes respectively.

2. Providing four (4) 300-foot breaches in the southern berm of the Western Levy Lake, located approximately as shown in Figure 3.

3. Providing a 300-foot breach in the northern berm of the Western Levy Lake, located approximately as shown in Figure 3.

4. Construction of a 20-foot rectangular weir in the berm, separating Eastern Levy Lake from Western Levy Lake with flashboards. The weir crest elevation to be set at 62.0 feet and flashboards to raise the elevation when necessary.

5. Providing a 20-foot trapezoidal weir with 4:1 side slopes and a crest elevation of 64.0, as a discharge control structure at the northwest corner of Levy Lake.

6. Extension of the existing berm on the north side of the Western Levy Lake by 1200 feet, westward, to block runoff from Levy Lake to the north.

7. Placing a 24-inch pipe under the berm extension with invert elevations of 60.0 and 59.8 on the south and the north end of the pipe respectively, to maintain base flow out of Levy Lake and into the Kanapaha Prairie.

2.5 Alternative Two (2)

Alternative Two (2) includes the following (Figure 4 illustrates the proposed improvements associated with Alternative Two (2)):

1. Construction of a double 24"-pipe under the berm at the eastern end of the Eastern Levy Lake.

2. Providing four (4) 300-foot breaches in the southern berm of the Western Levy Lake, located approximately as shown in Figure 4.

3. Providing a 300-foot breach in the northern berm of the Western Levy Lake, located approximately as shown in Figure 4.

4. Construction of a 20-foot rectangular weir in the berm, separating Eastern Levy Lake from Western Levy Lake with flashboards. The weir crest elevation to be set at 62.0 feet and flashboards to raise the elevation when necessary.

5. Providing a 20 foot trapezoidal weir with 4:1 side slopes and a crest elevation of 64.0, as a discharge control structure at the northwest corner of Levy Lake.

6. Placing a 24 inch pipe under the berm extension with invert elevations of 60.0 and 59.8 on the south and the north end of the pipe respectively, to maintain base flow out of Levy Lake and into the Kanapaha Prairie.

NOT TO SCALE

WESTERN LEVY LAKE

EASTERN LEVY LAKE
(WHITEHURST PASTURE)

NO.	DATE	REVISION	APP'D BY
-	-	-	-

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ALACHUA COUNTY
PUBLIC WORKS DEPARTMENT

LEVY LAKE
EXISTING CONDITIONS

Figure 2

PROFESSIONAL ENGINEER
STATE OF FLORIDA
DATE

JOB NO.	90387
DRAWN	PH
CHECKED	-
DWG FILE	-
DATE	-
SHT	1 OF 1

NOT TO SCALE

NOTES:

1. DOUBLE 24" RCP TO ALLOW SURFACE FLOW TO ENTER THE WHITEHURST PASTURE FROM THE EAST.

2. FOUR 300' BREACHES IN THE EXISTING SOUTHERN BERM TO ALLOW SURFACE RUNOFF TO ENTER LEVY LAKE.

3. A 300' BREACH IN THE NORTHERN BERM TO ALLOW SURFACE RUNOFF TO LEVY LAKE.

4. A 20' WIDE WEIR WITH FLASH BOARD RISERS TO CONTROL THE FLOW BETWEEN THE WHITEHURST PASTURE AND LEVY LAKE.

5. 20' TRAPEZOIDAL WEIR TO CONTROL FLOW TO THE KANAPAHA PRAIRIE DOWNSTREAM.

6. 1200 LF BERM TO HOLD BACK WATER IN THE LEVY LAKE.

7. 24" RCP TO MAINTAIN BASE FLOW TO HYDRATE THE WETLANDS DOWNSTREAM.

⑤ PROPOSED TRAPEZOIDAL WEIR (20' WIDE)

⑦

⑥ PROPOSED EXTENSION OF BERM (APPROX. 1200')

PROPOSED 24" RCP

③ PROPOSED 300' BREACH

④ PROPOSED RECTANGULAR WEIR (20' WIDE WITH FLASHBOARDS)

WESTERN LEVY LAKE

② PROPOSED 300' BREACHES (TYPICAL AT 4 PLACES)

EASTERN LEVY LAKE (WHITEHURST PASTURE)

① PROPOSED 40 LF DOUBLE 24" RCP

NO.	DATE	REVISION	APP'D BY
-	-	-	-

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ALACHUA COUNTY
PUBLIC WORKS DEPARTMENT

LEVY LAKE
PROPOSED DRAINAGE PLAN
ALTERNATIVE 1

FIGURE 3

PROFESSIONAL ENGINEER
STATE OF FLORIDA
DATE

JOB NO.	90367
DRAWN	PH
CHECKED	-
DWG FILE	-
DATE	-
SHT	1 OF 1

NOTES:

1. DOUBLE 24" RCP TO ALLOW SURFACE FLOW TO ENTER THE WHITEHURST PASTURE FROM THE EAST.

2. FOUR 300' BREACHES IN THE EXISTING SOUTHERN BERM TO ALLOW SURFACE RUNOFF TO ENTER LEVY LAKE.

3. A 300' BREACH IN THE NORTHERN BERM TO ALLOW SURFACE RUNOFF TO LEVY LAKE.

4. A 20' WIDE WEIR WITH FLASH BOARD RISERS TO CONTROL THE FLOW BETWEEN THE WHITEHURST PASTURE AND LEVY LAKE.

5. 20' TRAPEZOIDAL WEIR TO CONTROL FLOW TO THE KANAPAHA PRAIRIE DOWNSTREAM.

6. 24" RCP TO MAINTAIN BASE FLOW TO HYDRATE THE WETLANDS DOWNSTREAM.

NOT TO SCALE

⑥ PROPOSED 60' LF 24" RCP

⑤ PROPOSED TRAPEZOIDAL WEIR (20' WIDE)

③ PROPOSED 300' BREACH

④ PROPOSED RECTANGULAR WEIR (20' WIDE WITH FLASHBOARDS)

WESTERN LEVY LAKE

② PROPOSED 300' BREACHES (TYPICAL AT 4 PLACES)

EASTERN LEVY LAKE (WHITEHURST PASTURE)

① PROPOSED 40 LF DOUBLE 24" RCP

NO.	DATE	REVISION	APP'D BY
-	-	-	-

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ALACHUA COUNTY
PUBLIC WORKS DEPARTMENT

LEVY LAKE
PROPOSED DRAINAGE PLAN
ALTERNATIVE 2

FIGURE 4

PROFESSIONAL ENGINEER
STATE OF FLORIDA
DATE

JOB NO. 90357
DRAWN PH
CHECKED -
DWG FILE -
DATE -
SHT 1 OF 1

3.0 Environmental Issues

3.1 Habitat/Land Use/Land Cover Mapping

A copy of SJRWMD Land Use Land Cover Maps of the Study Area (as modified by Berryman & Henigar) are provided in Appendix II-A. Review of the land use / land cover changes and updates to the designated habitat types (FLUCFCS codes) are provided in the following sections and related appendices.

3.2 Historical Aerial Photo Review

In accordance with the scope of work, a review of a minimum of three (3) dates of aerial photography (earliest available historic, current and an in-between date) of the study area was evaluated for significant changes in land use, drainage and hydrology. Particular attention was paid to documenting the alterations occurring on the Whitehurst and Ramsey properties, land use changes within the immediate basin and wetland trends over the pertinent interval. The evaluation included an assessment of hydrologic conditions associated with the dates of the photography as well as overall analysis of period of record (POR) rainfall (at NOAA, Gainesville, Florida) and Floridan Aquifer levels in nearby wells. Rainfall data were examined for each date of photography to determine ambient conditions present in the historical imagery. A copy of the Historical Aerial Photo Summary, dated June 21, 2000 is provided in Appendix II-B and the results are summarized below.

The Aerial Photo Interpretation (API) analysis revealed that the Kanapaha Prairie (KP) basin has experienced a wide range of water levels over the past 60 years. Furthermore, the majority of the levee construction and alterations on the Ramsey and Whitehurst portions of Levy Lake occurred between 1968 and 1974. Based on this analysis, land use and land cover within the basin appear to have changed little since 1938, in this relatively rural area. The predominant land use in the basin currently appear to be relatively benign agricultural and silvicultural. The exception is the development of a low-density residential subdivision along the north shore of KP. Therefore it is surmised that flooding was not a direct result of increased impervious surface as a result of development activities in the basin. Drainage modifications, however, such as the Levy Lake levees and creation of drainage ditches in Fish and Mud Prairies and other wetland basins in the area, appear to be the most significant factor involved in contributing to increases in flood flow and loss of potential basin storage and flood attenuation.

3.3 Wetland And Water Level Assessments

Wetland and water level assessments were conducted in the field on April 27, July 25 and November 20, 2000 and the results are provided in field memorandum in Appendix II-C. A map showing the flow patterns along the Levy (dike/ditch) system around Whitehurst Pasture and Levy Lake under the field conditions is provided in Appendix II-D.

3.4 Listed Species / Habitat / Land Use Impact Assessment

A biological evaluation of the Levy Lake / Kanapaha Prairie Complex was performed by Ashton, Ashton & Associates, Inc. (AA&A) for the purpose of determining the potential impacts on wildlife and habitat. The scope of work specified the use of existing data, specifically the 1996 Alachua County Ecological Inventory Project, done by KBN - Golder and Associates as the primary source of data on biodiversity within the project basin and as such did not allow for extensive fieldwork or use of preferred biological survey methodologies. This was supplemented with two overview site visits made in Spring and Fall 2000, to evaluate the current environment and with other sources of information gathered by AA&A.

The resulting biological evaluation provides a listing and description of each of the significant habitats and land use within the study area, as well as the wildlife and plant communities, including listed species. Overall, the biological evaluation provides an assessment of the two (water management/ flood control) alternative management plans and their potential impact to these natural resources. The complete report entitled "The Potential Impacts of Two Flood Mitigation Alternatives on Wildlife and Habitat Diversity in The Levy Lake/Kanapaha Prairie Project" is provided in Appendix II-E and the results are summarized below.

3.5 Analysis of Impacts on Habitats

The two alternative flood mitigation management plans have been evaluated and the potential impacts on each type of vegetative community have been assessed. The results of these evaluations indicate that there should be an overall positive impact in the two manipulative alternatives. This is assuming that the status quo alternative takes into account that the Whitehurst properties will be under a conservation easement which will eliminate the management of water to sustain cattle grazing on the west side of Levy Lake. It also assumes that the owners are going to manage the property for duck hunting and other resource based activities. With these assumptions, indications are that the overall impact on wildlife diversity and protected species will be positive.

The exact changes in vegetative communities will depend on the elevation levels of each habitat within the project area. Elevations of these habitats within the basin were not available at the scale that would allow analysis to determine more accurately, the changes caused by increased hydroperiod and water depth. It can be assumed however, that there may be some decline of forested wetlands within the boundaries of the project under the two manipulative alternatives. However, it would appear that the difference between these two alternatives due to the similarities in the changes in overall seasonal depths and hydroperiod, would be so similar and variable with annual rainfall that the impacts would be virtually the same in both alternatives.

These evaluations assume that the lands within the study area would be protected under conservation easement and that these lands would have a habitat management plan that would assist in restoration of the wetland ecology. Habitat management would include burning where appropriate. It is also assumed that most of the dike features would not be altered or removed and that the spoil from alterations including breeching, would be removed outside of the study area. The lack of habitat management and monitoring to determine if in fact the management targets are being met will make a complete analysis of impacts as the mitigation strategy selected is implemented very difficult.

3.6 Analysis of Impacts on Wildlife

Under either flood mitigation alternative, taking into consideration the habitat requirements of each of the wildlife species (protected and common), it appears that at least 33 species would benefit from the changes expected to take place. For example, the increased hydroperiods could enhance populations of migratory waterfowl, alligators, Bald Eagles and Sandhill Cranes. Meanwhile, the changes may have an overall negative effect on five species, none of which are state or federally listed species. These are species that are likely to occur in currently existing pastures, which are managed through controlling water levels and are grazed by cattle.

Table 1 lists 379 species of vertebrates that may be resident or migrant species within the study area. This number is based on historic records of species found in Alachua County and the habitat requirement of each of the species. Based on this data, the biodiversity of the study area is extremely high under current circumstances. It appears that under the alternatives, which may increase overall hydroperiod and water depth, the overall impacts on wildlife diversity would not significantly change the biodiversity. In fact, the biodiversity may actually increase if fish are considered.

Table 1 - Estimated Impacts of Alternatives on Overall Vertebrate Biodiversity

Alternative	Amphibians Species	Reptiles Species	Bird Species (resident)	Bird Species (migrant)	Mammals	Totals
Existing Conditions	34 (0)	53 (0)	104 (0)	143 (0)	45 (0)	379 (0)
Alternative One (1)	34 (+1)	53 (+6)	104 (-2,+5)	143 (-1,+19)	45 (-2,+2)	379 (-5,+33)
Alternative Two (2)	34 (+1)	53 (+6)	104 (-2,+5)	143 (-1,+19)	45 (-2,+2)	379 (-5,+33)

Estimated number of species from existing conditions, Alternative One (1) and Alternative Two (2). The first number is the probable species numbers that can be expected based on species that occur in that habitat in Alachua County the second number is the net gain or loss in the other two alternatives. The Overall Net Gain or Loss indicates the numbers of species expected to possibly increase (+) or decline (-) due to changes in water levels and hydroperiods. Fish are not included due to the lack of information.

3.7 Analysis of Impacts on Protected Plant Species

Without a thorough vegetative survey it is impossible to confirm the presence or identify the locations or potential locations of specific protected plant species as suggested by the KBN study. The changes in hydrology resulting from either manipulative alternative could temporarily or permanently submerge locations of these species. The limited overall impacts expected on habitats of this primarily wetland system also indicate a low probability of impact on the plant species composition of those habitats. Wetland systems and their associated species are generally resilient, adapted to the cycles of drought and flood where human interference does not significantly alter the natural hydrology. Under any of the three alternatives the net level of hydrological change compared to natural cycles is estimated to have an insignificant impact on natural habitats and thus on plant species therein.

4.0 Permitting Criteria

4.1 St. Johns River Water Management District (SJRWMD)

Initial meetings and site visits with SJRWMD has indicated that this project is permittable due to its potential benefits. However, the issues of ownership, operation and maintenance need to be addressed before a permit may be issued. Detailed design plans with proper dredge and fill quantities and erosion control will be needed to obtain a construction permit. The required construction permit for this project is the Environmental Resource Permit (ERP). SJRWMD will forward the dredge and fill section of the permit application to the United States Army Corps of Engineers (USACOE) for their review and approval.

5.0 Hydrologic Modeling

5.1 Existing Conditions

SJRWMD has modeled the watershed system of the Kanapaha Prairie, including the contributing basins to the watershed such as Levy Lake, Ledwith Lake, Moores Pond and Fish Prairie. The model used is Streamflow Synthesis and Reservoir Regulation (SSARR), developed by the US Army Corps of Engineers (USACOE). This model uses rainfall, evaporation, evapotranspiration and physical characteristics such as basin area, lake capacity, and conveyance rating curves to determine the water surface elevations in various locations throughout the watershed. The specific parameters used in the model and the model results are presented in Appendix I-A of this report.

In order to determine the hydrologic effects on the Kanapaha basin, a long-term simulation has been performed. The SSARR model simulates the Kanapaha Prairie system between the years of 1930 and 1998. This model was calibrated using over two years of specific data (rainfall and lake elevations) to accurately simulate the elevations within the basin.

5.1 Proposed Conditions

The two proposed alternatives were input into the model to determine the effect on the water surface elevation of Levy Lake and the Kanapaha Prairie. Both of these alternatives are aimed at utilizing the storage of Levy Lake by constricting and attenuating the flow rate from Levy Lake to the Kanapaha Prairie. The results of the model indicate that the proposed alternatives result in lower water elevations within the Kanapaha Prairie and higher water elevations within the Levy Lake for various storm events. The result of the modeling simulations is presented in Table 2.

Table 2 – 10-year, 25-year and 100-year Storm Elevations

Alternatives	Kanapaha Prairie			Levy Lake		
	10-yr [ft]	25-yr [ft]	100-yr [ft]	10-yr [ft]	25-yr [ft]	100-yr [ft]
Existing conditions	58.0	59.4	61.5	63.5	64.1	65.0
Project Alternative One (1)	57.5	58.5	60.2	64.3	64.9	65.7
Project Alternative Two (2)	57.4	58.4	60.0	64.4	65.0	65.8

6.0 Review of Results

The results of the model indicate that the proposed improvements to Levy Lake will reduce the flood elevations in the Kanapaha Prairie to elevation 57.5, 58.5 and 60.2 for the 10-year, 25-year and the 100-year storm events respectively. According to the elevations of the finished floor of the residences, provided by the county all but one of the residences within the Kanapaha prairie will be above the 100-year flood elevation. The residence of Mr. Noyes has a finished floor elevation of 58.88 feet. The proposed alternatives will lower the 100-year flood elevation from 61.5 to 60.2 and 60.0 for Alternatives 1 and 2 respectively in the vicinity of that residence.

The modeling of Levy Lake and Kanapaha Prairie indicates that the increased elevation within the Levy Lake is 0.7 feet for a 100-year storm event. Given that the land area surrounding Levy Lake is generally higher than the proposed 100-year flood elevation, no adverse effects to the surrounding property are anticipated.

7.0 Cost Estimates

The estimated construction cost for each alternative is listed below. A detailed breakdown of the construction cost is provided in Appendix I-B.

7.1 Alternative One (1)

Engineering Design	= $ 30,000
Surveying	= $ 10,000
Environmental/Permitting	= $ 10,000
Construction	= $ 127,300
subtotal	= $177,300
15% contingency	= $ 26,595
TOTAL	**= $203,895**

7.2 Alternative Two (2)

Engineering Design	= $ 30,000
Surveying	= $ 15,000
Environmental/Permitting	= $ 10,000
Construction	= $ 82,300
subtotal	= $137,300
15% contingency	= $ 20,595
TOTAL	**= $157,895**

8.0 Discussion on Alternatives

Both of the proposed alternatives offer approximately equal flood relief benefits for the Kanapaha Prairie and wetland rehydration within the Levy Lake area. Alternative One (1) has a higher construction cost due to the additional earthwork related to the berm extension. However, this alternative will not require additional right of way or easements beyond the Levy Lake area.

Alternative Two (2) is less expensive, but might require acquisition of right of way or easement on the Ramsey property to the northwest of Levy Lake. The actual acquisition costs for such a right-of-way or easement are beyond the scope of this study. More detailed survey of the area adjacent to the proposed structure will be required to ensure that the offsite property will not be adversely affected.

Please note that this has been a planning level study. The actual impacts of these alternatives should be determined at the detailed design stage using specific survey information in the areas of concern.

Appendix I-A SJRWMD model and model results

SJRWMD MODELING RESULTS FOR THE KANAPAHA PRAIRIE FLOOD MITIGATION PROJECT

EXECUTIVE SUMMARY

The consulting firm of Berryman and Henigar provided SJRWMD with two alternatives (Project Alternative 1 and Project Alternative 2) for analysis of flood mitigation on Kanapaha Prairie. Briefly stated, these project alternatives involve providing flood mitigation on Kanapaha Prairie by increasing storage and stages in Levy Lake. The modeled flooding elevation results for this analysis are summarized in the following table:

Alternatives	Kanapaha Prairie			Levy Lake		
	10-yr [ft]	25-yr [ft]	100-yr [ft]	10-yr [ft]	25-yr [ft]	100-yr [ft]
Existing conditions	58.0	59.4	61.5	63.5	64.1	65.0
Project Alternative 1	57.5	58.5	60.2	64.3	64.9	65.7
Project Alternative 2	57.4	58.4	60.0	64.4	65.0	65.8

INTRODUCTION

This report details tasks performed by SJRWMD in providing modeling support for Berryman and Henigar's (B&H's) Kanapaha Prairie flooding study. B&H provided the District with two Project Alternatives (1 and 2) which will be described later in the report. Before modeling these two alternatives, the existing conditions model was updated and re-calibrated.

MODEL UPDATE AND RE-CALIBRATION

The update and re-calibration of the SSARR continuous simulation model of Kanapaha Prairie consisted of the following tasks:

1. Review of drainage areas and water–body capacities in the system
2. Inclusion of hydrologic data (principally elevations on Kanapaha Prairie and Levy Lake) which had been gathered since the model was last calibrated
3. Re-calibration of the model based on the expanded data set

The new data covered the period of time between about 15 May 1998 and 31 July 1999. This new data consisted of rainfall monitored at the Lake Wauberg site, Kanapaha Prairie gage data, and Levy Lake gage data. This new data improves the performance of the model at elevations below about 55 ft for Kanapaha Prairie and about 62 ft for Levy Lake (Figures 1 through 4).

PROJECT DESCRIPTIONS

This Kanapaha Prairie modeling dealt with three alternatives:

1. Existing Conditions. Existing conditions included pumping from the Ramsey farm but not from the Whitehurst farm. Drainage from the area east of the Whitehurst farm (including drainage from I-75) was routed directly into Levy Lake, bypassing the farm.

2. Project Alternative 1. Project Alternative 1 routed drainage from east of the Whitehurst farm through the farm; water entered the farm through two new 24–inch RCPs with inverts at 60.5 feet. The connection between the Whitehurst farm and Levy Lake consisted of a 20–foot weir with crest elevation of 62 feet. An internal berm in Levy Lake was extended westward isolating the lake; water was discharged across the berm toward Kanapaha Prairie through one 24–inch RCP with an invert elevation of 60 feet and a 20–foot weir with 4H:1V side slopes and a crest elevation of 64 feet. Pumping was continued for the Ramsey farm but was routed directly into Kanapaha Prairie.

3. Project Alternative 2. Project Alternative 2 routed drainage from east of the Whitehurst farm through the farm; water entered the farm through two new 24–inch RCPs with inverts at 60.5 feet. The connection between the Whitehurst farm and Levy Lake consisted of a 20–foot weir with crest elevation of 62 feet. A berm just downstream of the Ramsey farm road provided control of the drainage from Levy Lake to Kanapaha Prairie.

Water was discharged across this berm toward Kanapaha Prairie through one 24–inch RCP with an invert elevation of 60 feet and a 20–foot weir with 4H:1V side slopes and a crest elevation of 64 feet. Pumping was continued for the Ramsey farm but was routed through Levy Lake.

Rating curves for both the Whitehurst farm–Levy Lake and the Levy Lake–Kanapaha Prairie connections were based on HEC–RAS work done when the original model was set up during the 1998 District study. For the 1998 study three Ramsey Road outlet configurations were modeled. The principal calibration of HEC–RAS was done for all three Ramsey Road culverts operating normally (Figure 5). Discharges measured on two different dates were used to calibrate the model.

Using the cross sections and *n*–values developed for the three–culvert configuration, the configuration for three blocked culverts was calibrated (Figure 6) with discharges measured on a single date. The seepage around the blockage was accounted for by replacing all three 42–inch CMPs with three 1.4–foot CMPs. Finally, using the same configuration but replacing one 1.4–foot CMP with a 42–inch CMP, the HEC–RAS model was essentially verified (Figure 7) with discharges measured on a single date.

Project rating curves were based on *n*–values and cross sections obtained from the HEC–RAS analysis from the 1998 study. Project culverts and weirs were substituted for the Ramsey Road culverts to obtain the corresponding project rating curves.

RESULTS

Briefly stated, the two B&H project alternatives reduce flood elevations on Kanapaha Prairie by increasing storage — and therefore flood elevations — on Levy Lake. Based on modeling results, the 100–year flood elevation for Kanapaha Prairie would be reduced about 1.3 feet with Project Alternative 1 and 1.5 feet with Project alternative 2 (Figure 8). The 10–year flood elevation for Kanapaha Prairie would be reduced about 0.5 feet with Project Alternative 1 and 0.6 feet with Project Alternative 2.

Based on modeling results, the 100–year flood elevation for Levy Lake would be increased about 0.7 feet with Project Alternative 1 and about 0.8 feet with Project Alternative 2 (Figure 9). The 10–year flood elevation for

Levy Lake would be increased about by about 0.8 feet with Project Alternative 1 and 0.9 feet with Project Alternative 2.

The modeled flooding elevation results for the present analysis are summarized in the following table:

Alternatives	Kanapaha Prairie			Levy Lake		
	10-yr [ft]	25-yr [ft]	100-yr [ft]	10-yr [ft]	25-yr [ft]	100-yr [ft]
Existing conditions	58.0	59.4	61.5	63.5	64.1	65.0
Project Alternative 1	57.5	58.5	60.2	64.3	64.9	65.7
Project Alternative 2	57.4	58.4	60.0	64.4	65.0	65.8

Elevation duration curves provide information with respect to the hydroperiods of bodies of water. Figures 10 and 11 show elevation duration curves corresponding to the three alternatives for Whitehurst farm and Levy Lake, respectively.

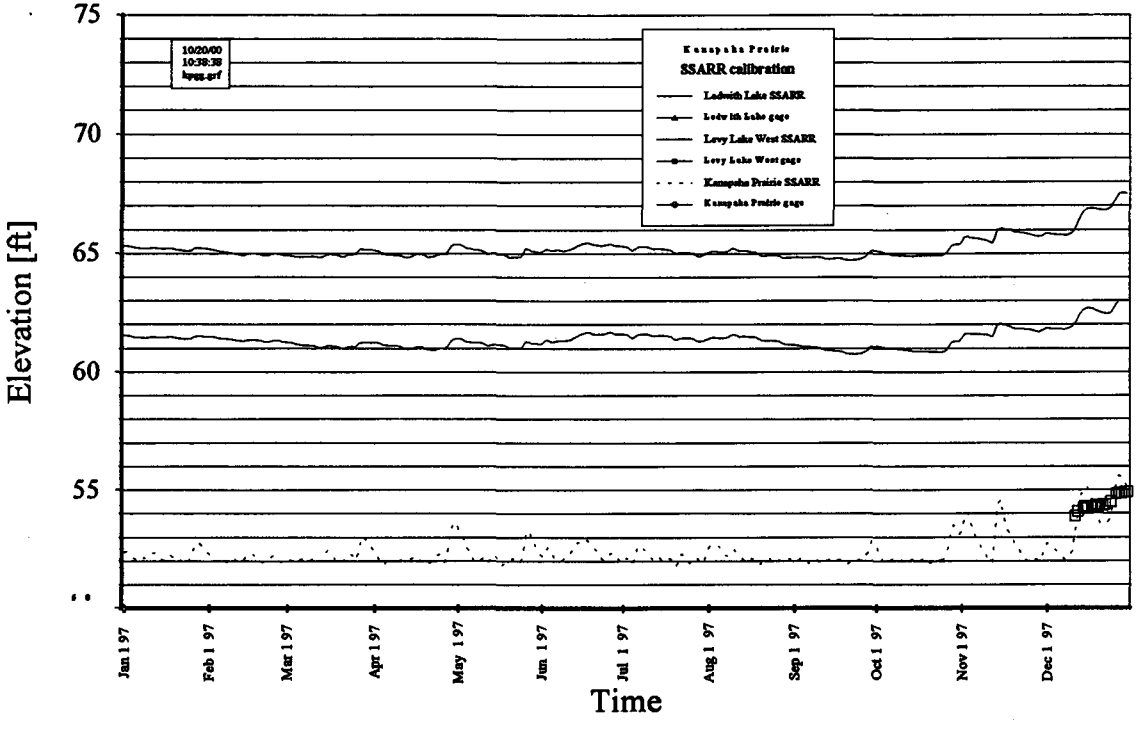

Figure 1 **Results of Kanapaha Prairie SSARR model re–calibration for 1997**

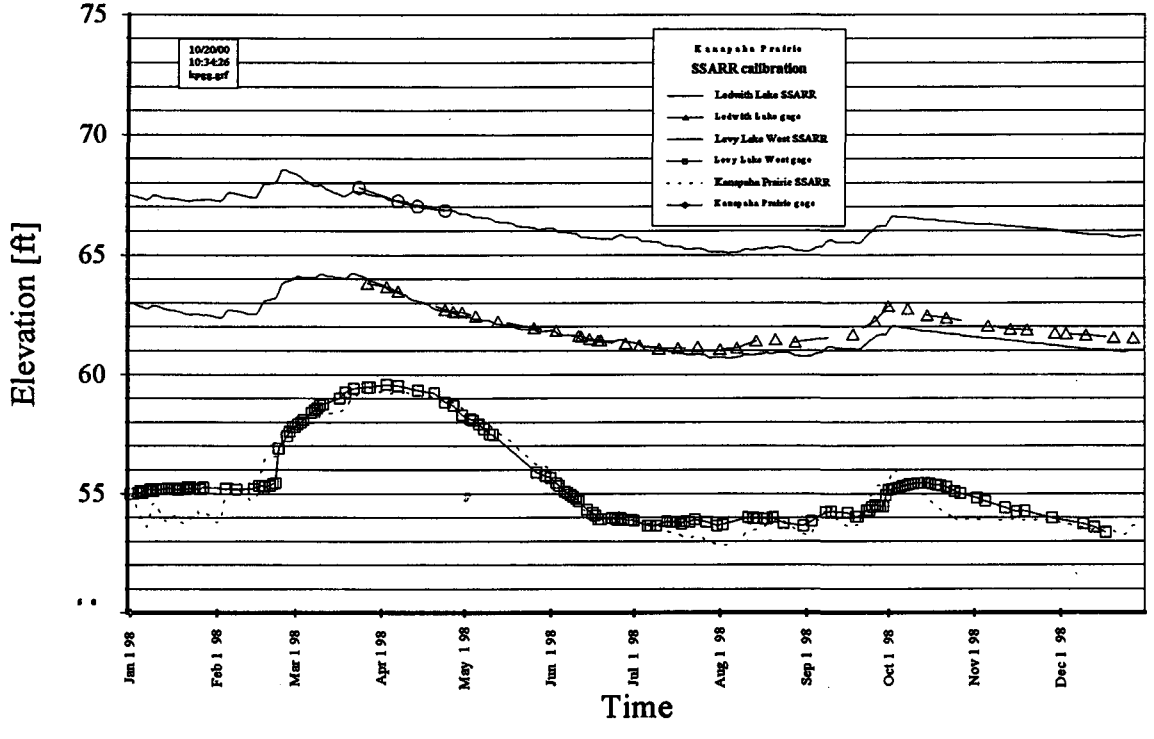

Figure 2 **Results of Kanapaha Prairie SSARR model re–calibration for 1998**

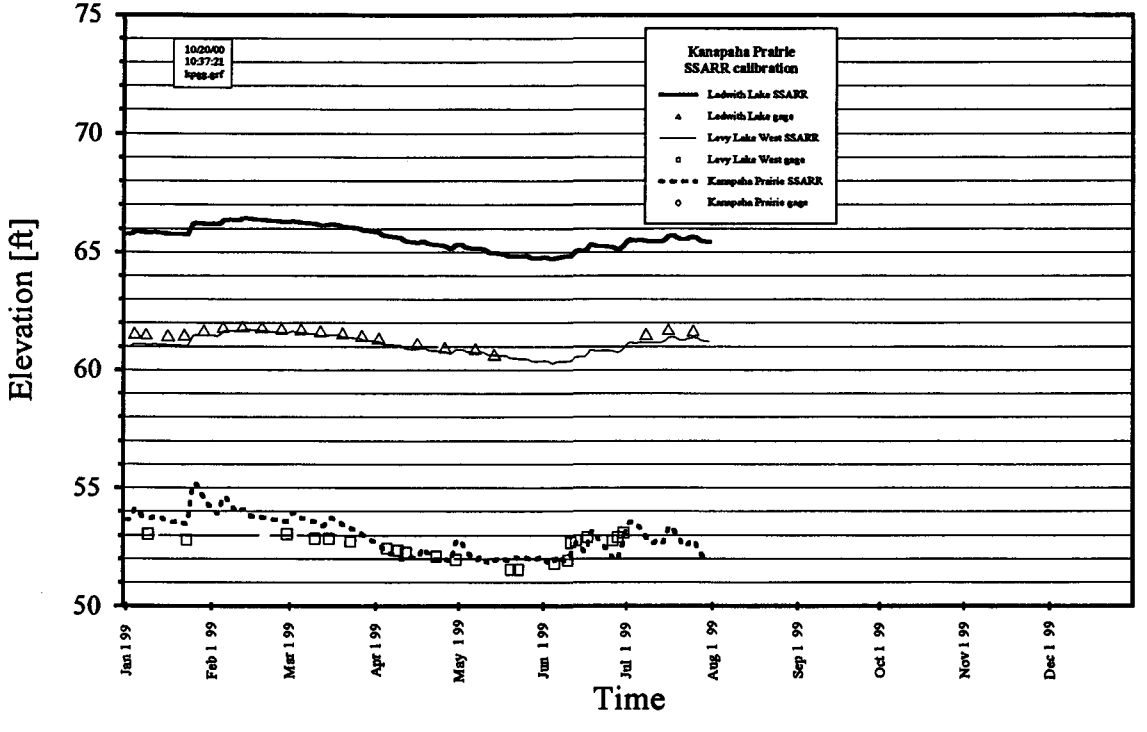

Figure 3 **Results of Kanapaha Prairie SSARR model re–calibration for 1999**

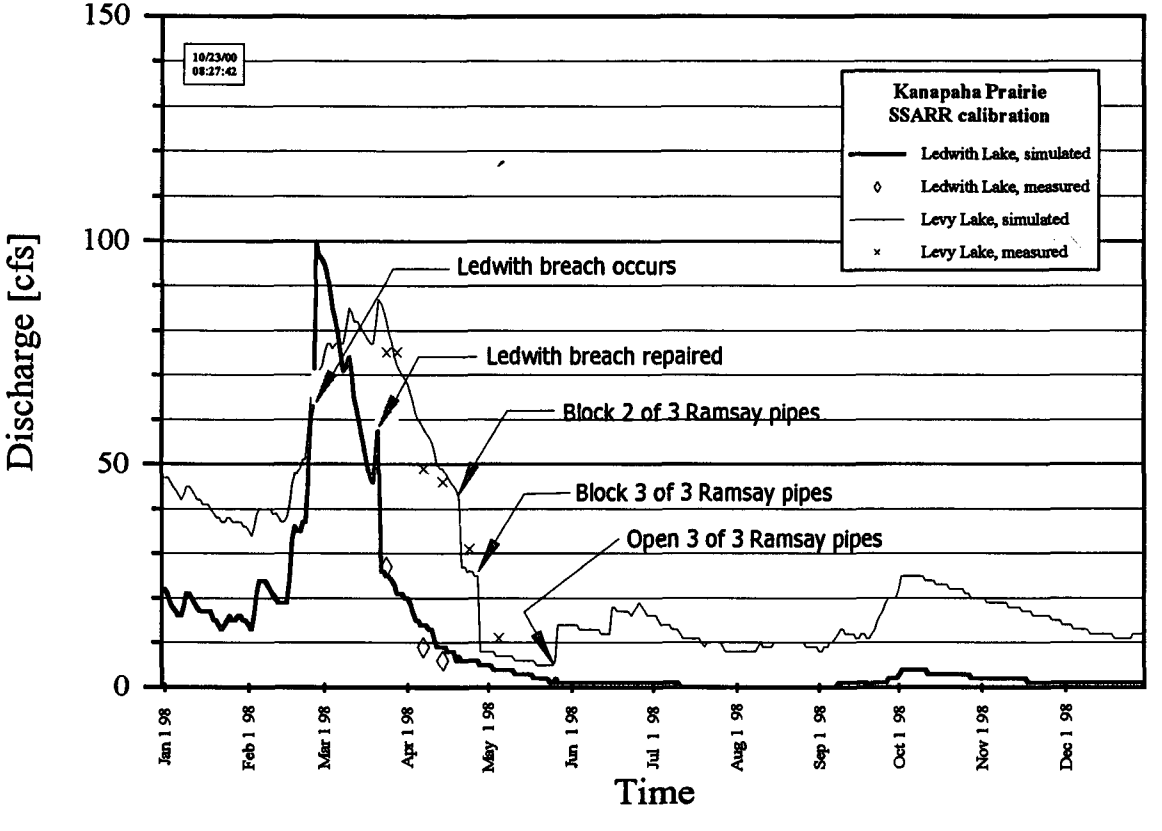

Figure 4 **Discharge hydrographs for Kanapaha Prairie SSARR model re–calibration for 1998**

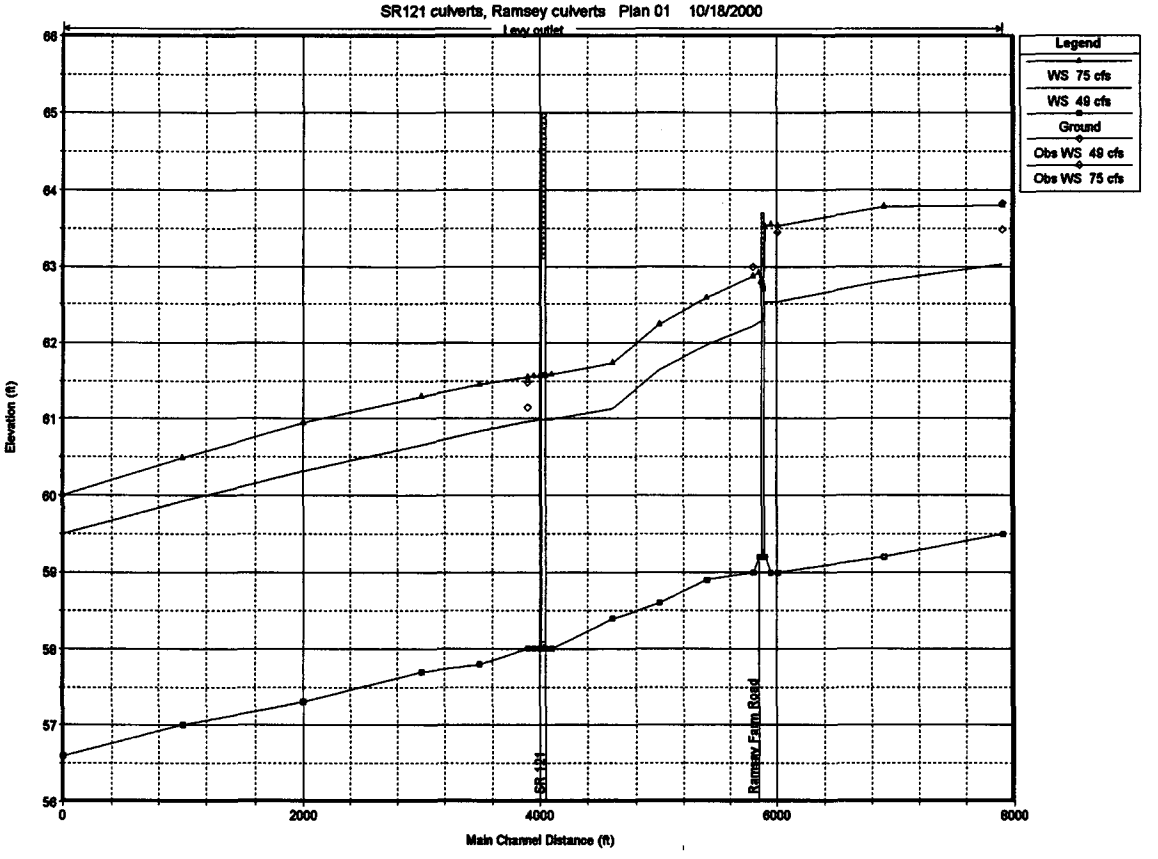

Figure 5 **Results of Ramsey Road HEC–RAS model calibration**

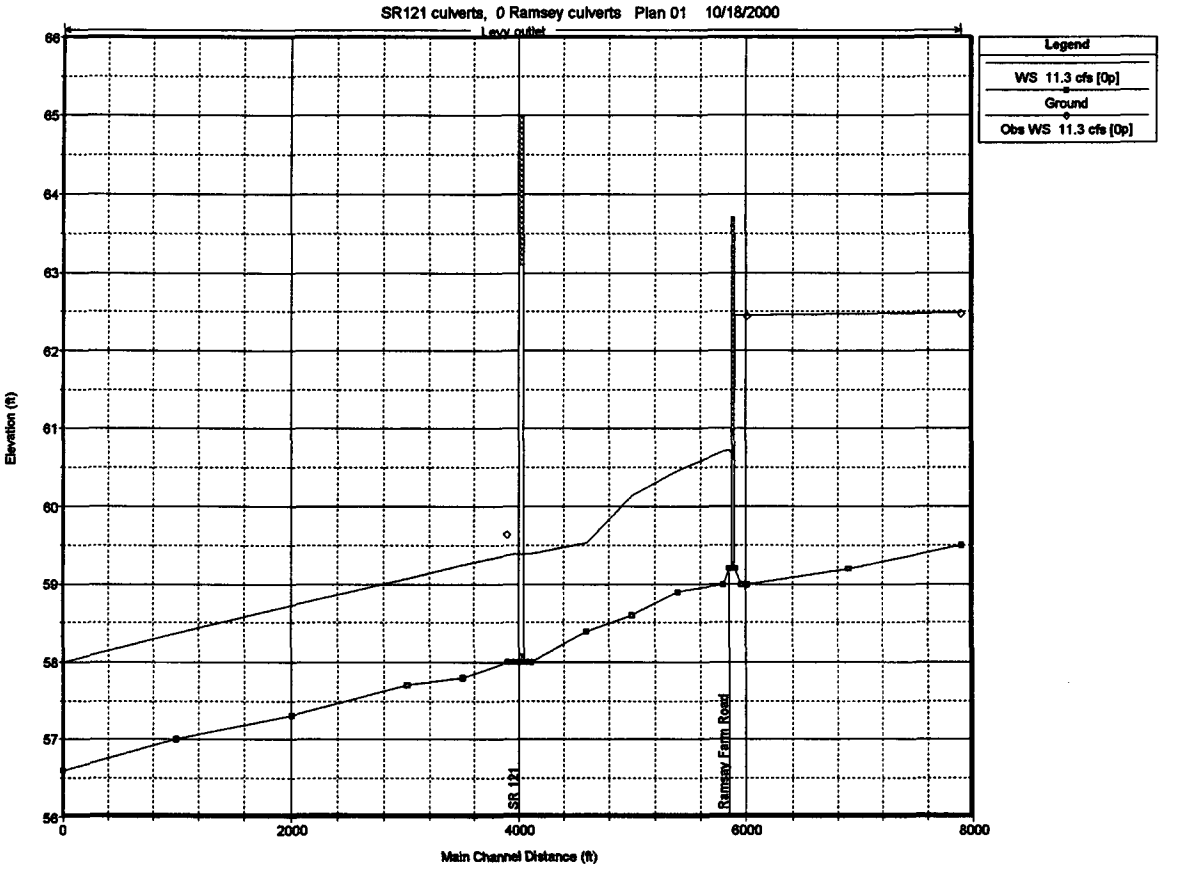

Figure 6 **Results of Ramsey Road HEC–RAS model calibration [3 of 3 pipes blocked off]**

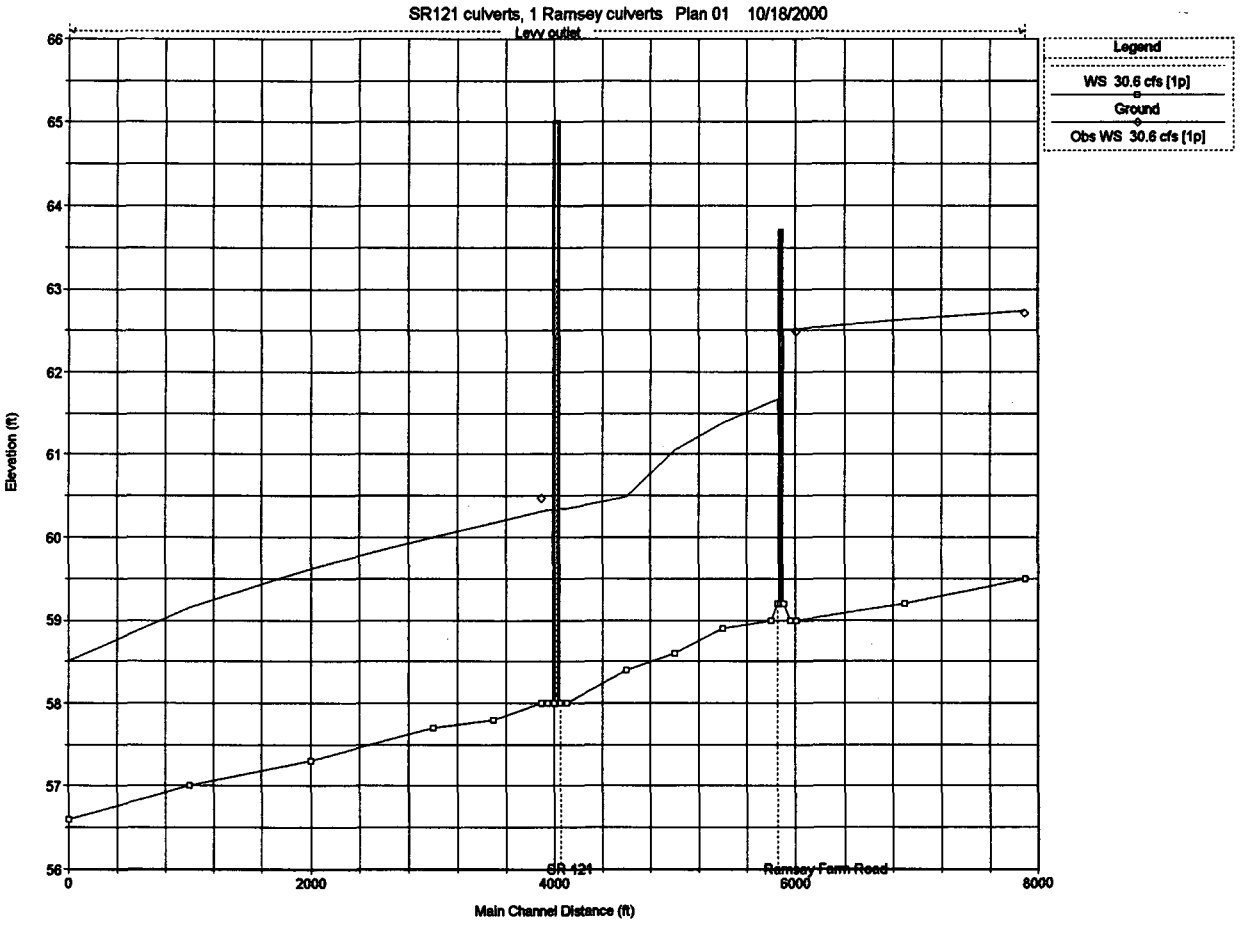

Figure 7 **Results of Ramsey Road HEC–RAS model calibration [2 of 3 pipes blocked off]**

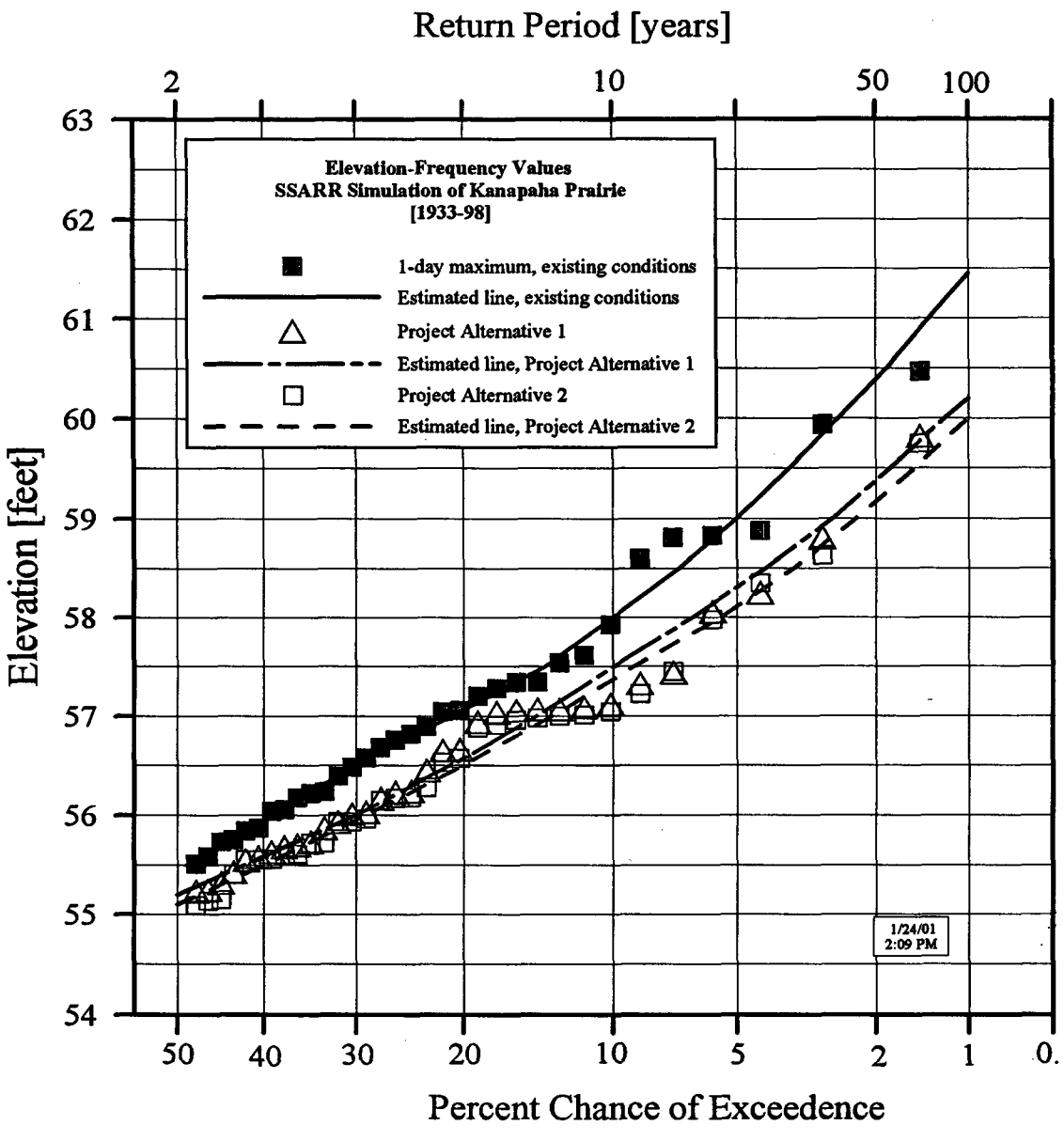

Figure 8 **Flood-Frequency plots for Kanapaha Prairie SSARR simulations**

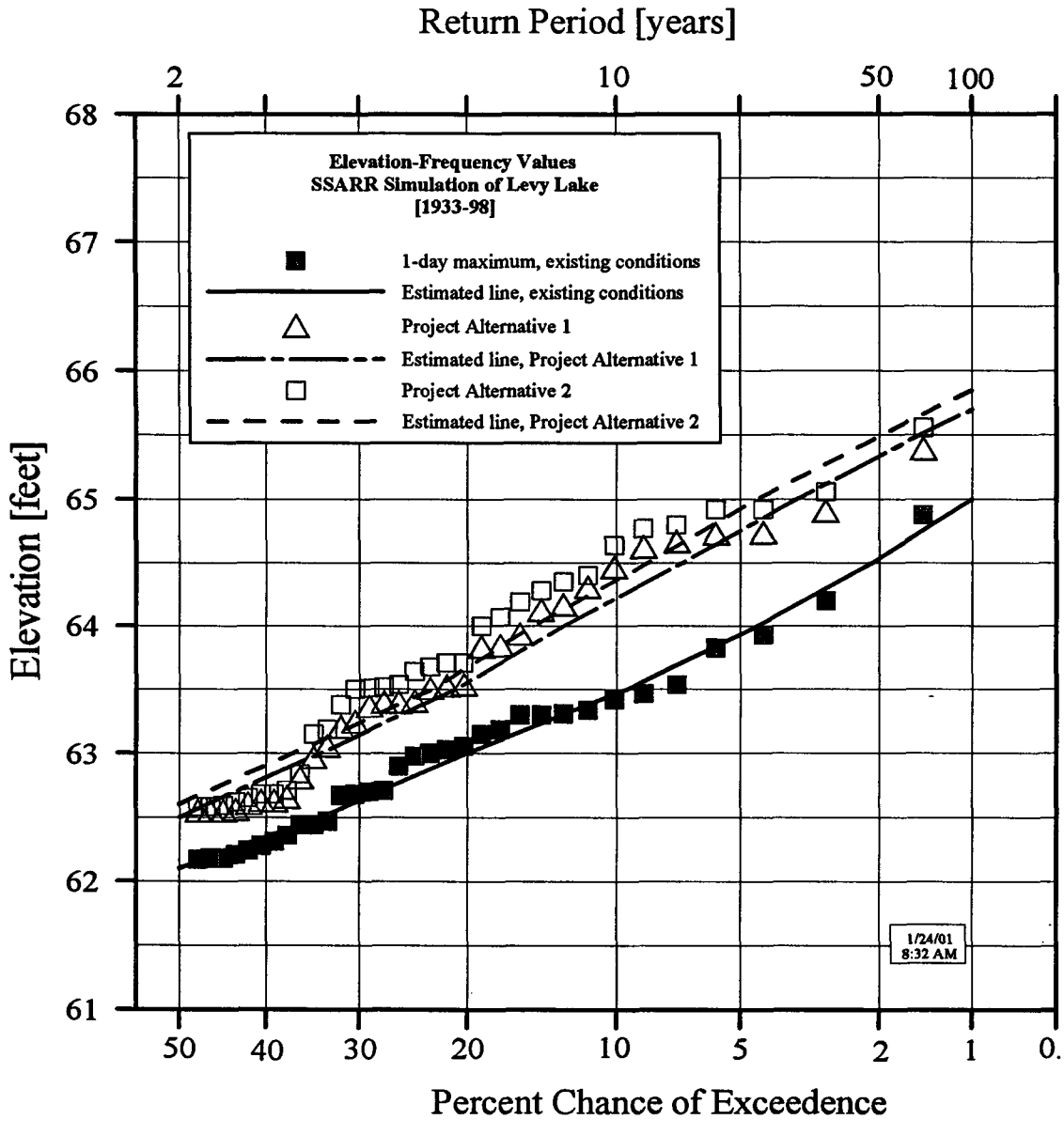

Figure 9 **Flood-Frequency plots for Levy Lake SSARR simulations**

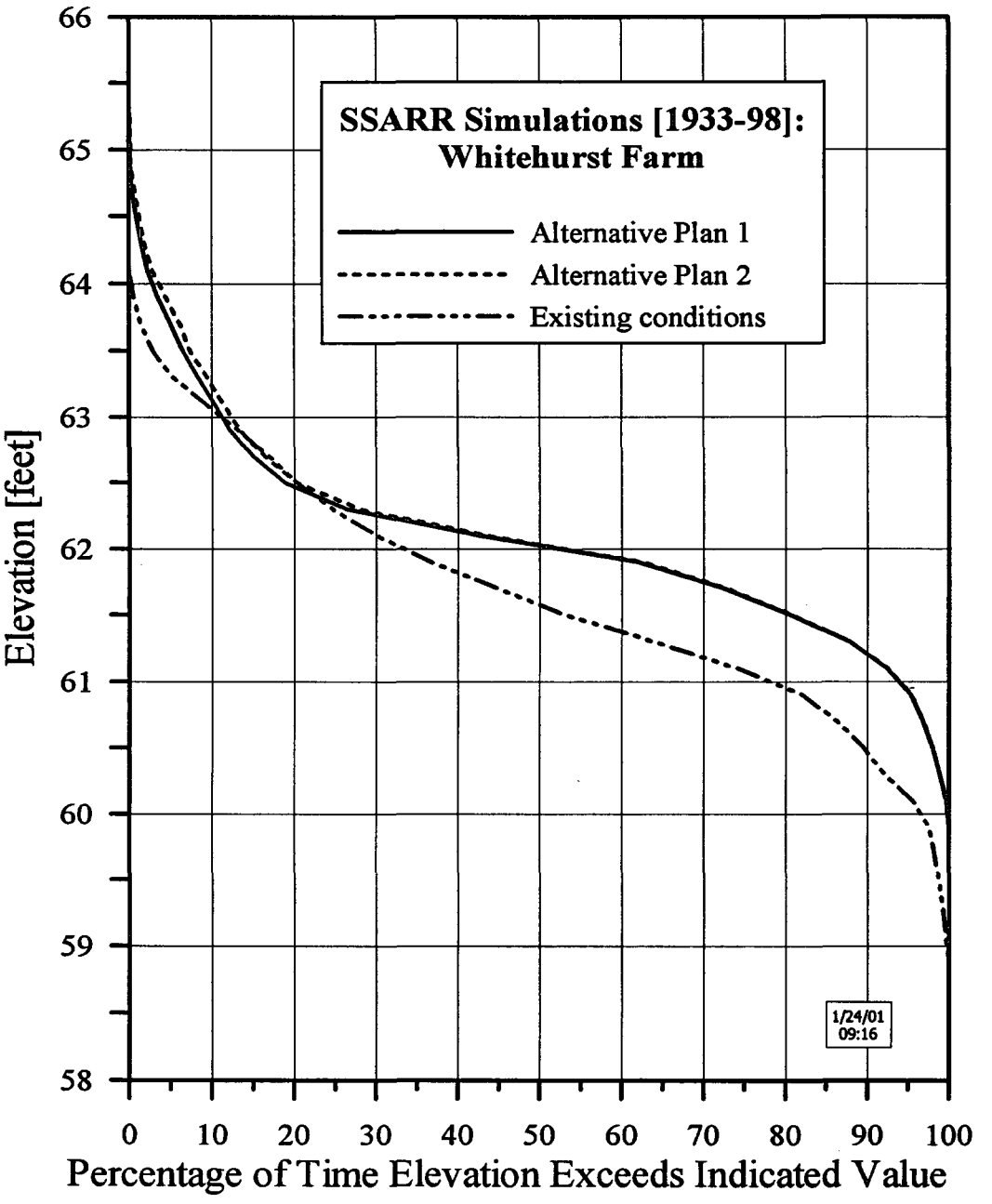

Figure 10 **Elevation duration curves for SSARR simulation of Whitehurst farm**

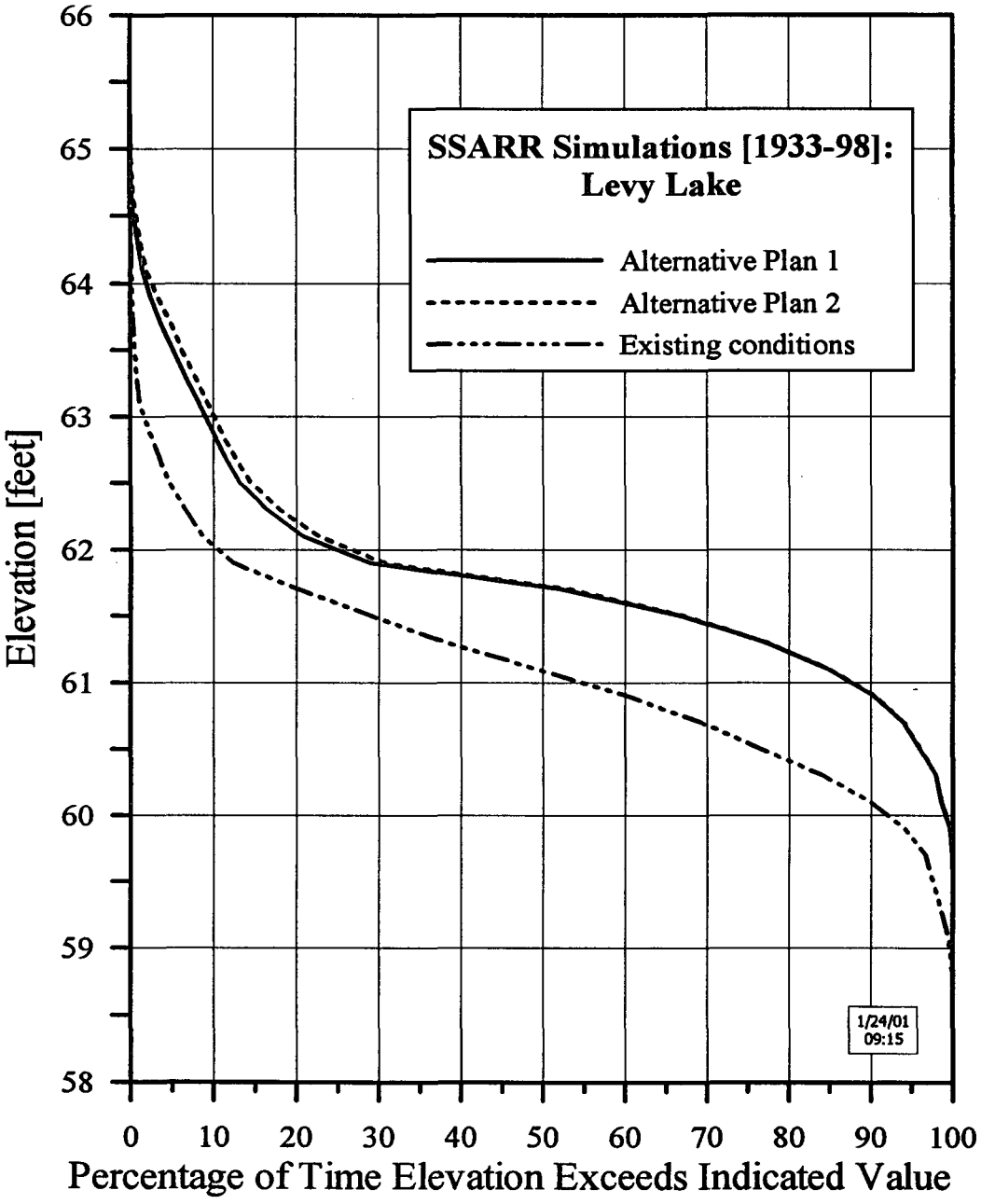

Figure 11 **Elevation duration curves for SSARR simulation of Levy Lake**

STREAMFLOW ROUTING

RUN DATE RUN NO. INITIAL DATE, HOUR
1 JAN 98 1200

SSARR MODEL

DATE-HOUR	LEDW DOWNSTREAM LAKE ELEVATION FEET-MSL	LEVY KAPA DOWNSTREAM LAKE KANAPAHA PRAIRIE ELEVATION FEET-MSL	LEDW LEVY DOWNSTREAM LAKE - KANAPAHA PRAI ELEVATION FEET-MSL	BLED BLVE DOWNSTREAM LAKE - KANAPAHA PRAI FLOW CFS	BKAN BGRS DOWNSTREAM LAKE - KANAPAHA PRAI FLOW CFS	FLOW CFS	FLOW CFS	FLOW CFS	FLOW CFS
1 JAN 98 1200	67.48	62.99	54.34	22.	25.	4.	4.	0.	4.
2 JAN 98 1200	67.46	62.99	54.27	21.	24.	3.	3.	0.	3.
3 JAN 98 1200	67.42	62.95	53.93	19.	24.	3.	3.	0.	3.
4 JAN 98 1200	67.38	62.91	53.66	18.	23.	2.	2.	0.	2.
5 JAN 98 1200	67.36	62.88	53.55	17.	23.	2.	2.	0.	2.
6 JAN 98 1200	67.33	62.85	53.49	16.	23.	2.	2.	0.	2.
7 JAN 98 1200	67.30	62.83	53.43	16.	22.	2.	2.	0.	2.
8 JAN 98 1200	67.37	62.90	53.77	18.	23.	16.	19.	97.	17.
9 JAN 98 1200	67.48	62.99	54.39	21.	24.	17.	20.	97.	18.
10 JAN 98 1200	67.49	63.00	54.52	21.	25.	3.	3.	0.	3.
11 JAN 98 1200	67.45	62.96	54.22	20.	24.	3.	3.	0.	3.
12 JAN 98 1200	67.41	62.93	53.91	19.	24.	2.	3.	0.	2.
13 JAN 98 1200	67.38	62.91	53.72	18.	23.	2.	2.	0.	2.
14 JAN 98 1200	67.36	62.89	53.67	17.	23.	2.	2.	1.	2.
15 JAN 98 1200	67.34	62.87	53.65	17.	23.	3.	3.	5.	3.
16 JAN 98 1200	67.34	62.87	53.73	17.	23.	6.	7.	26.	6.
17 JAN 98 1200	67.35	62.88	53.86	17.	23.	5.	6.	22.	6.
18 JAN 98 1200	67.33	62.86	53.89	17.	23.	2.	2.	0.	2.
19 JAN 98 1200	67.30	62.83	53.84	15.	22.	2.	2.	1.	2.
20 JAN 98 1200	67.27	62.80	53.80	15.	22.	2.	3.	4.	3.
21 JAN 98 1200	67.25	62.78	53.78	14.	22.	2.	2.	2.	2.
22 JAN 98 1200	67.23	62.76	53.74	13.	21.	2.	2.	0.	2.
23 JAN 98 1200	67.25	62.78	53.89	14.	22.	9.	10.	47.	9.
24 JAN 98 1200	67.30	62.82	54.19	15.	22.	10.	12.	51.	11.
25 JAN 98 1200	67.30	62.82	54.23	16.	22.	3.	3.	4.	3.
26 JAN 98 1200	67.28	62.80	54.02	15.	22.	2.	2.	0.	2.
27 JAN 98 1200	67.29	62.80	53.91	15.	22.	8.	9.	36.	9.
28 JAN 98 1200	67.31	62.82	54.03	16.	22.	9.	10.	39.	9.
29 JAN 98 1200	67.31	62.82	54.04	16.	22.	3.	3.	3.	3.
30 JAN 98 1200	67.29	62.80	53.84	15.	22.	2.	2.	0.	2.
31 JAN 98 1200	67.27	62.78	53.73	15.	22.	2.	2.	0.	2.
1 FEB 98 1200	67.25	62.77	53.71	14.	22.	2.	2.	0.	2.
2 FEB 98 1200	67.23	62.75	53.70	13.	21.	2.	2.	0.	2.
3 FEB 98 1200	67.31	62.83	54.13	16.	22.	20.	23.	118.	21.

4 FEB 98 1200	67.49	62.99	54.98	21.	24.	30.	36.	162.	33.
5 FEB 98 1200	67.58	63.07	55.31	24.	26.	13.	16.	43.	14.
6 FEB 98 1200	67.59	63.08	55.27	24.	26.	4.	4.	0.	4.
7 FEB 98 1200	67.57	63.07	55.14	24.	26.	3.	4.	0.	3.
8 FEB 98 1200	67.54	63.06	55.01	23.	26.	3.	3.	0.	3.
9 FEB 98 1200	67.52	63.04	54.85	22.	25.	2.	3.	0.	2.
10 FEB 98 1200	67.49	63.03	54.69	21.	25.	2.	2.	0.	2.
11 FEB 98 1200	67.46	63.00	54.52	20.	25.	2.	2.	0.	2.
12 FEB 98 1200	67.42	62.97	54.37	19.	24.	2.	2.	1.	2.
13 FEB 98 1200	67.40	62.96	54.25	19.	24.	2.	2.	1.	2.
14 FEB 98 1200	67.40	62.96	54.23	19.	24.	5.	6.	24.	6.
15 FEB 98 1200	67.41	62.98	54.28	19.	24.	5.	6.	23.	6.
16 FEB 98 1200	67.59	63.14	54.93	24.	27.	33.	39.	183.	36.
17 FEB 98 1200	67.87	63.39	55.81	33.	31.	42.	50.	217.	45.
18 FEB 98 1200	67.97	63.48	56.17	36.	33.	13.	15.	33.	14.

DATE-HOUR	LEVY LEDW DOWNSTREAM LAKE ELEVATION FEET-MSL	LEDW KAPA DOWNSTREAM LAKE KANAPAHA PRAIRIE ELEVATION FEET-MSL	LEDW LEVY DOWNSTREAM LAKE ELEVATION FEET-MSL	BLED BLVE - KANAPAHA PRAI DOWNSTREAM LAKE FLOW CFS	BKAN BGRS - KANAPAHA PRAI - KANAPAHA PRAI FLOW CFS	LEVY LEDW DOWNSTREAM LAKE FLOW CFS	LEDW KAPA KANAPAHA PRAIRIE FLOW CFS	BLED BLVE - KANAPAHA PRAI FLOW CFS	BKAN BGRS - KANAPAHA PRAI FLOW CFS
19 FEB 98 1200	67.95	63.48	56.14	35.	33.	5.	6.	0.	5.
20 FEB 98 1200	67.96	63.51	56.15	35.	33.	14.	16.	44.	15.
21 FEB 98 1200	68.01	63.57	56.24	37.	34.	13.	16.	44.	15.
22 FEB 98 1200	68.01	63.58	56.24	37.	34.	4.	5.	2.	5.
23 FEB 98 1200	68.21	63.80	56.62	47.	38.	48.	58.	227.	52.
24 FEB 98 1200	68.51	64.09	57.22	61.	46.	50.	59.	224.	53.
25 FEB 98 1200	68.56	64.17	57.42	63.	50.	6.	8.	0.	7.
26 FEB 98 1200	68.52	64.18	57.40	62.	51.	6.	7.	0.	6.
27 FEB 98 1200	68.48	64.18	57.39	60.	51.	8.	10.	16.	9.
28 FEB 98 1200	68.48	64.21	57.44	59.	52.	13.	16.	42.	14.
1 MAR 98 1200	68.49	64.26	57.54	60.	55.	12.	15.	40.	13.
2 MAR 98 1200	68.48	64.28	57.59	60.	56.	7.	8.	13.	7.
3 MAR 98 1200	68.41	64.25	57.56	56.	54.	4.	4.	0.	4.
4 MAR 98 1200	68.33	64.21	57.52	53.	52.	3.	4.	0.	3.
5 MAR 98 1200	68.29	64.20	57.51	51.	52.	3.	4.	0.	3.
6 MAR 98 1200	68.25	64.19	57.49	49.	51.	3.	3.	0.	3.
7 MAR 98 1200	68.21	64.18	57.49	47.	51.	3.	3.	1.	3.
8 MAR 98 1200	68.17	64.17	57.48	45.	51.	3.	3.	2.	3.
9 MAR 98 1200	68.21	64.23	57.60	47.	53.	15.	17.	79.	16.

10 MAR 98 1200	68.27	64.31	57.80	50.	57.	15.	18.	77.	16.
11 MAR 98 1200	68.23	64.28	57.85	48.	56.	3.	4.	0.	4.
12 MAR 98 1200	68.17	64.24	57.81	45.	54.	3.	4.	0.	3.
13 MAR 98 1200	68.13	64.23	57.81	43.	54.	3.	4.	0.	3.
14 MAR 98 1200	68.10	64.22	57.81	41.	53.	3.	3.	0.	3.
15 MAR 98 1200	68.07	64.21	57.81	40.	53.	3.	3.	0.	3.
16 MAR 98 1200	68.04	64.20	57.82	38.	52.	2.	3.	0.	3.
17 MAR 98 1200	68.01	64.19	57.82	37.	51.	2.	3.	0.	3.
18 MAR 98 1200	67.98	64.18	57.82	36.	51.	2.	3.	0.	3.
19 MAR 98 1200	67.96	64.17	57.86	35.	50.	9.	11.	43.	9.
20 MAR 98 1200	68.05	64.26	58.07	39.	55.	26.	32.	131.	29.
21 MAR 98 1200	68.16	64.37	58.30	44.	61.	21.	25.	87.	23.
22 MAR 98 1200	68.17	64.39	58.39	45.	62.	4.	5.	0.	4.
23 MAR 98 1200	68.14	64.38	58.41	43.	61.	4.	5.	0.	4.
24 MAR 98 1200	68.11	64.37	58.43	42.	61.	3.	4.	0.	4.
25 MAR 98 1200	68.09	64.36	58.45	41.	60.	3.	4.	0.	3.
26 MAR 98 1200	68.06	64.34	58.47	39.	60.	3.	3.	0.	3.
27 MAR 98 1200	68.00	64.30	58.46	37.	57.	2.	3.	0.	3.
28 MAR 98 1200	67.94	64.26	58.44	35.	55.	2.	3.	0.	2.
29 MAR 98 1200	67.91	64.24	58.45	34.	54.	2.	3.	0.	2.
30 MAR 98 1200	67.88	64.23	58.46	33.	53.	2.	2.	0.	2.
31 MAR 98 1200	67.85	64.21	58.47	32.	53.	2.	2.	0.	2.
1 APR 98 1200	67.82	64.20	58.48	31.	52.	2.	2.	0.	2.
2 APR 98 1200	67.80	64.19	58.49	30.	51.	2.	2.	0.	2.
3 APR 98 1200	67.71	64.12	58.44	28.	48.	2.	2.	0.	2.
4 APR 98 1200	67.64	64.05	58.38	26.	44.	2.	2.	0.	2.
5 APR 98 1200	67.61	64.04	58.38	25.	44.	2.	2.	0.	2.
6 APR 98 1200	67.59	64.03	58.37	24.	43.	2.	2.	0.	2.
7 APR 98 1200	67.57	64.01	58.36	24.	42.	1.	2.	0.	2.
8 APR 98 1200	67.55	64.00	58.36	23.	42.	2.	2.	1.	2.

DATE-HOUR	LEVY LEDW DOWNSTREAM LAKE ELEVATION FEET-MSL	LEDW KAPA DOWNSTREAM LAKE KANAPAHA PRAIRIE ELEVATION FEET-MSL	LEVY LEDW DOWNSTREAM LAKE KANAPAHA PRAIRIE ELEVATION FEET-MSL	BLED LEVY DOWNSTREAM LAKE FLOW CFS	BLVE - KANAPAHA PRAI DOWNSTREAM LAKE FLOW CFS	BKAN BLED - KANAPAHA PRAI FLOW CFS	BGRS BLVE - KANAPAHA PRAI FLOW CFS	FLOW CFS	FLOW CFS
9 APR 98 1200	67.53	63.99	58.35	22.	41.	1.	2.	1.	2.
10 APR 98 1200	67.51	63.98	58.34	22.	41.	2.	2.	1.	2.
11 APR 98 1200	67.44	63.91	58.29	20.	40.	2.	2.	1.	2.
12 APR 98 1200	67.37	63.83	58.22	18.	39.	1.	2.	0.	1.

13 APR 98 1200	67.35	63.82	58.21	17.	38.	1.	1.	0.	1.
14 APR 98 1200	67.34	63.80	58.20	17.	38.	1.	1.	0.	1.
15 APR 98 1200	67.32	63.79	58.19	16.	38.	1.	1.	0.	1.
16 APR 98 1200	67.30	63.77	58.17	16.	38.	1.	1.	0.	1.
17 APR 98 1200	67.29	63.75	58.16	15.	37.	1.	1.	0.	1.
18 APR 98 1200	67.27	63.74	58.15	15.	37.	1.	1.	0.	1.
19 APR 98 1200	67.20	63.66	58.09	13.	36.	1.	1.	0.	1.
20 APR 98 1200	67.14	63.59	58.02	11.	35.	1.	1.	0.	1.
21 APR 98 1200	67.13	63.57	58.00	10.	34.	1.	1.	0.	1.
22 APR 98 1200	67.12	63.55	57.99	10.	34.	1.	1.	0.	1.
23 APR 98 1200	67.10	63.53	57.97	10.	34.	1.	1.	0.	1.
24 APR 98 1200	67.09	63.52	57.94	9.	33.	1.	1.	0.	1.
25 APR 98 1200	67.08	63.50	57.92	9.	33.	1.	1.	0.	1.
26 APR 98 1200	67.07	63.48	57.90	9.	33.	1.	1.	0.	1.
27 APR 98 1200	67.06	63.46	57.88	8.	32.	1.	1.	0.	1.
28 APR 98 1200	66.99	63.39	57.79	6.	31.	1.	1.	0.	1.
29 APR 98 1200	66.93	63.31	57.70	6.	30.	1.	1.	0.	1.
30 APR 98 1200	66.92	63.30	57.68	6.	30.	1.	1.	4.	1.
1 MAY 98 1200	66.91	63.28	57.66	6.	29.	1.	1.	4.	1.
2 MAY 98 1200	66.90	63.26	57.64	6.	29.	1.	1.	0.	1.
3 MAY 98 1200	66.83	63.19	57.55	6.	28.	1.	1.	0.	1.
4 MAY 98 1200	66.76	63.11	57.45	5.	26.	1.	1.	0.	1.
5 MAY 98 1200	66.76	63.10	57.43	5.	26.	1.	1.	4.	1.
6 MAY 98 1200	66.75	63.09	57.40	5.	26.	1.	1.	4.	1.
7 MAY 98 1200	66.74	63.07	57.37	5.	26.	1.	1.	0.	1.
8 MAY 98 1200	66.73	63.05	57.33	5.	25.	0.	1.	0.	1.
9 MAY 98 1200	66.72	63.03	57.29	5.	25.	0.	1.	0.	0.
10 MAY 98 1200	66.71	63.02	57.26	5.	25.	0.	0.	0.	0.
11 MAY 98 1200	66.64	62.94	57.16	4.	24.	0.	0.	0.	0.
12 MAY 98 1200	66.57	62.86	57.07	4.	23.	0.	0.	0.	0.
13 MAY 98 1200	66.56	62.84	57.02	4.	22.	0.	0.	0.	0.
14 MAY 98 1200	66.55	62.82	56.97	4.	22.	0.	0.	0.	0.
15 MAY 98 1200	66.54	62.80	56.92	4.	22.	0.	0.	0.	0.
16 MAY 98 1200	66.53	62.78	56.86	4.	22.	0.	0.	0.	0.
17 MAY 98 1200	66.51	62.77	56.80	4.	22.	0.	0.	0.	0.
18 MAY 98 1200	66.50	62.75	56.74	4.	21.	0.	0.	0.	0.
19 MAY 98 1200	66.44	62.67	56.62	3.	20.	0.	1.	1.	0.
20 MAY 98 1200	66.37	62.59	56.50	3.	19.	0.	1.	1.	0.
21 MAY 98 1200	66.36	62.58	56.44	3.	19.	0.	0.	0.	0.
22 MAY 98 1200	66.35	62.56	56.37	3.	19.	0.	0.	0.	0.
23 MAY 98 1200	66.34	62.54	56.31	3.	19.	0.	0.	0.	0.
24 MAY 98 1200	66.33	62.53	56.25	2.	18.	0.	0.	0.	0.
25 MAY 98 1200	66.32	62.51	56.18	2.	18.	0.	0.	0.	0.
26 MAY 98 1200	66.31	62.49	56.12	2.	18.	0.	0.	0.	0.
27 MAY 98 1200	66.24	62.42	56.00	2.	17.	0.	0.	0.	0.

```
 **from Econlackhatchee River
CT01      42EC              2        0       45       30      100       50      100PRECKE
CT01      32EC              2        0        1        7        2       16       50
CT01      32EC             50       70

 ** Pierson curves
CF01      32PS            .00        0        0      999        0
CF03      32PS           .042        0        2       16        2       40       25
CF04      32PS           .042      999       25
CF03      32PS           .083        0       10       14       10       40       62
CF04      32PS           .083      999       62
CF03      32PS           .125        0       15       12       15       40       75
CF04      32PS           .125      999       75
CF03      32PS           .208        0       20       10       20       40       85
CF04      32PS           .208      999       85
CF03      32PS           .417        0       25        8       25       40       92
CF04      32PS           .417      999       92
CF03      32PS           .833        0       30        6       30       40       96
CF04      32PS           .833      999       96
CT01      42PS              2        0        0        1       40       25      100
CT03      42PS             50      100      999      100      100

 ** SMI-RI-ROP CURVES
CF01      3222            .00        0        0      999        0
CF03      3222           .042        0        2       16        2       30       25
CF04      3222           .042      999       25
CF03      3222           .083        0        4       14        4       30       62
CF04      3222           .083      999       62
CF03      3222           .125        0        6       12        6       30       75
CF04      3222           .125      999       75
CF03      3222           .208        0        8       10        8       30       85
CF04      3222           .208      999       85
CF03      3222           .417        0       10        8       10       30       92
CF04      3222           .417      999       92
CF03      3222           .833        0       12        6       12       30       96
CF04      3222           .833      999       96
CF01      3223            .00        0        0      999        0
CF03      3223           .042        0        1       16        1       30        1
CF04      3223           .042      999        1
CF03      3223           .083        0        2       16        2       30       38
CF04      3223           .083      999       38
CF03      3223           .125        0        4       14        4       30       58
CF04      3223           .125      999       58
CF03      3223           .208        0        6       12        6       30       75
CF04      3223           .208      999       75
CF03      3223           .417        0        8       10        8       30       88
CF04      3223           .417      999       88
```

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CF03      3223          .833        0       10        8       10       30       94
CF04      3223          .833      999       94
 ** SMI-RI-ROP CURVES
CF01      322W           .00        0        0      999        0
CF03      322W          .042        0        2        6        2       25       25
CF04      322W          .042      999       25
CF03      322W          .083        0       10        5       10       25       62
CF04      322W          .083      999       62
CF03      322W          .125        0       15        4       15       25       75
CF04      322W          .125      999       75
CF03      322W          .208        0       20        3       20       25       85
CF04      322W          .208      999       85
CF03      322W          .417        0       25        2       25       25       92
CF04      322W          .417      999       92
CF03      322W          .833        0       30        1       30       25       96
CF04      322W          .833      999       96
 **PRECIP INTENSITY VS. KE
CT01      4222             2        0        0        1       40       30     100PRECKE
CT03      4222            50      100      999      100      100                PRECKE
 **PRECIP INTENSITY VS. KE
CT01      4202             2        0       55       25      100       50     100PRECKE
 ** SMI-RI-ROP CURVES [SINGLE CURVE]
CT01      3202             2        0        0       30       60       50       60
CT01      3201             2        0        0       25       70       50       70
 ** SMI-RI-ROP CURVES [SINGLE CURVE]
CT01      3203             2        0       15       50       15
 **SURFACE + SUBSURFACE VS. SURFACE INPUT
CT01      0205             2        0        0     0.05     0.04      0.1    0.08SSSISI
CT02      0205          0.15     0.12      0.2     0.16      0.5      0.4     900SSSISI
CT03      0205           900                                                    SSSISI
 **BII CURVE
CT01      220N             3        0       40      .08      0.1       20     .08BIIBFP
CT02      220N           0.2       10      .08      0.4        5      .08     0.8BIIBFP
CT01      220N             5      .08      999        5      .08                BIIBFP
CT01      220S             3        0       40      .08      0.1       20     .08BIIBFP
CT02      220S           0.2       10      .08      0.4        5      .08     0.8BIIBFP
CT01      220S             5      .08      999        5      .08                BIIBFP
CT01      220D             3        0       80      .08      0.1       80     .08BIIBFP
CT02      220D           0.2       80      .08      0.4       80      .08     0.8BIIBFP
CT01      220D            80      .08      999       80      .08                BIIBFP
 ** BASIN CHARACTERISTICS
CB01      BMOO             2          - KANAPAHA PRAIRIE BASINS
CB02      BMOO    7.52 12 2  48 4 200    60 42EC             32EC
CB03      BMOO     220N   500205
CB04      BMOO     3PTN11005DETI130
CB01      BFIS             2          - KANAPAHA PRAIRIE BASINS
CB02      BFIS    2.62 12 2  48 4 200    60 42EC             32EC
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CB03     BFIS     220N   500205
CB04     BFIS     3PTN11005DETI120
CB01     BLED         2         - KANAPAHA PRAIRIE BASINS
CB02     BLED    2.62 12 2  48 4 200    60 42EC            32EC
CB03     BLED     220N   500205
CB04     BLED     3PTN11005DETI130
CB01     BLVE         2         - KANAPAHA PRAIRIE BASINS
CB02     BLVE    3.12 12 2  48 4 200    60 42EC            32EC
CB03     BLVE     220N   500205
CB04     BLVE     3PTN11005DETI130
CB01     BLVN         2         - KANAPAHA PRAIRIE BASINS
CB02     BLVN    0.82 12 2  48 4 200    60 42EC            32EC
CB03     BLVN     220N   500205
CB04     BLVN     3PTN11005DETI130
CB01     BLVW         2         - KANAPAHA PRAIRIE BASINS
CB02     BLVW   10.82 12 2  48 4 200    60 42EC            32EC
CB03     BLVW     220N   500205
CB04     BLVW     3PTN11005DETI130
CB01     BGRS         2         - KANAPAHA PRAIRIE BASINS
CB02     BGRS    2.82 12 2  48 4 200    60 42EC            32EC
CB03     BGRS     220N   500205
CB04     BGRS     3PTN11005DETI130
CB01     BKAN         2         - KANAPAHA PRAIRIE BASINS
CB02     BKAN    8.92 12 2  12 2  12    60 42EC            32EC
CB03     BKAN     220N   500205
CB04     BKAN     3PTN11005DETI130
CB01     BKAI         2         - KANAPAHA PRAIRIE BASINS
CB02     BKAI    0.72 12 2  12 2  12    60 42EC            320I
CB03     BKAI     220N   500205
CB04     BKAI     3PTN11005DETI 30
CT01     320I          2       0      99     999      99
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INTERACTIVE SSARR MONITOR. (ENGLISH UNITS)  ENTER ? FOR INSTRUCTIONS
*
MORE KEYWORDS?
IO
  LOAD CHARACTERISTICS AND DATA
INFILE KANAPAHA.CAL OUT

CL01      GRAS          2        DOWNSTREAM LAKE
CL02      GRAS                                100      10
C101      GRAS       5600     .01                0    5700     .01              4
C101      GRAS       5800     .01               18    5900     .01             70
C101      GRAS       6000     .01              190    6100     .01            377
C101      GRAS       6200     .01              631    6300       1            950
C101      GRAS       6400       3             1337    6500       9           1789
C101      GRAS       6600      27             2309    6700      90           2895
C101      GRAS       6800     200             3547    6900     600           4266
CF02      430G         -200    5600       .0    5700     -.8    5900     -7.2
CF02      430G         -200    6100    -18.3    6300   -29.4    6500   -40.5
CF02      430G         -200    6700    -51.6    6900   -59.9       0      .0
CF02      430G           00    5600       .0    6900      .0
CF02      430G          200    5600       .0    5700      .8    5900     7.2
CF02      430G          200    6100     18.3    6300    29.4    6500    40.5
CF02      430G          200    6700     51.6    6900    59.9       0      .0
CF02      430G         2000    5600       .0    5700     7.5    5900    72.0
CF02      430G         2000    6100    183.4    6300   294.2    6500   405.0
CF02      430G         2000    6700    515.8    6900   599.0       0      .0
CC01      GRAI        3  122    LEDWITH RAINFALL
CC02      GRAI        GRAS      RAIN 430G
CC01      GEVA        3  122    LEDWITH EVAPORATION
CC02      GEVA        GRAS      EVAP 430G

CL01      LEVE          2        UPSTREAM LAKE
CL02      LEVE 2      LEVY                100      10
C101      LEVE       5900                    0    6000                   220
C101      LEVE       6100                  881    6200                  1813
C101      LEVE       6300                 2843    6400                  3931
C101      LEVE       6500                 5035    6600                  6157
C101      LEVE       6700                 7295    6800                  8451
C101      LEVE       6900                 9625    7000                 10815
C101      LEVE       7100                12023    7200                 13249
C201      LEVE     -381.0       0         6590 -381.0   6000           6600
C201      LEVE     -381.0    6100         6604 -381.0   6200           6608
C201      LEVE     -381.0    6400         6741 -381.0   6700           6987
C201      LEVE     -140.0       0         6390 -140.0   6000           6400
C201      LEVE     -140.0    6100         6400 -140.0   6200           6404
C201      LEVE     -140.0    6400         6551 -140.0   6700           6816
C201      LEVE      -51.0       0         6290  -51.0   6000           6300
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C201    LEVE    -51.0   6100        6297  -51.0   6200        6308
C201    LEVE    -51.0   6400        6472  -51.0   6700        6748
C201    LEVE    -19.0      0        6240  -19.0   6000        6250
C201    LEVE    -19.0   6100        6252  -19.0   6200        6262
C201    LEVE    -19.0   6400        6437  -19.0   6700        6722
C201    LEVE     -2.0      0        6190   -2.0   6000        6200
C201    LEVE     -2.0   6100        6200   -2.0   6200        6220
C201    LEVE     -2.0   6400        6409   -2.0   6700        6704
C201    LEVE     -1.0      0        6090   -1.0   6000        6100
C201    LEVE     -1.0   6100        6129   -1.0   6200        6209
C201    LEVE     -1.0   6400        6404   -1.0   6700        6702
C201    LEVE      -.1      0        6000    -.1   6000        6009
C201    LEVE      -.1   6100        6102    -.1   6200        6202
C201    LEVE      -.1   6400        6401    -.1   6700        6701
C201    LEVE       .0      0           0     .0   6700        6700
C201    LEVE       .1   6000           0     .1   6009        6000
C201    LEVE       .1   6102        6100     .1   6202        6200
C201    LEVE       .1   6401        6400     .1   6701        6700
C201    LEVE      1.0   6090           0    1.0   6100        6000
C201    LEVE      1.0   6129        6100    1.0   6209        6200
C201    LEVE      1.0   6404        6400    1.0   6702        6700
C201    LEVE      2.0   6190           0    2.0   6200        6000
C201    LEVE      2.0   6200        6100    2.0   6220        6200
C201    LEVE      2.0   6409        6400    2.0   6704        6700
C201    LEVE     19.0   6240           0   19.0   6250        6000
C201    LEVE     19.0   6252        6100   19.0   6262        6200
C201    LEVE     19.0   6437        6400   19.0   6722        6700
C201    LEVE     51.0   6290           0   51.0   6300        6000
C201    LEVE     51.0   6297        6100   51.0   6308        6200
C201    LEVE     51.0   6472        6400   51.0   6748        6700
C201    LEVE    140.0   6390           0  140.0   6400        6000
C201    LEVE    140.0   6400        6100  140.0   6404        6200
C201    LEVE    140.0   6551        6400  140.0   6816        6700
C201    LEVE    381.0   6590           0  381.0   6600        6000
C201    LEVE    381.0   6604        6100  381.0   6608        6200
C201    LEVE    381.0   6741        6400  381.0   6987        6700
C201    LEVE   -999999
CF02    6302       -200   5900      .0    6000   -36.7   6200   -81.8
CF02    6302       -200   6400   -91.3    6600   -94.2   6800   -97.1
CF02    6302       -200   7000   -99.9    7200  -102.1      0      .0
CF02    6302         00   5900      .0    7200      .0
CF02    6302        200   5900      .0    6000    36.7   6200    81.8
CF02    6302        200   6400    91.3    6600    94.2   6800    97.1
CF02    6302        200   7000    99.9    7200   102.1      0      .0
CF02    6302       2000   5900      .0    6000   367.3   6200   817.7
CF02    6302       2000   6400   913.2    6600   941.7   6800   970.6
CF02    6302       2000   7000   999.5    7200  1021.1      0      .0
```

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CC01      ERAI       3  122    LEDWITH RAINFALL
CC02      ERAI       LEVE      RAIN 6302
CC01      EEVA       3  122    LEDWITH EVAPORATION
CC02      EEVA       LEVE      EVAP 6302

CL01      LEVN         2       DOWNSTREAM LAKE
CL02      LEVN                          100     10
C101      LEVN       5600    .01              0   5700    .01            174
C101      LEVN       5800    .01            699   5900     22           1414
C101      LEVN       6000     22           2166   6100     22           2962
C101      LEVN       6200     22           3803   6300     22           4687
C101      LEVN       6400     22           5615   6500     22           6587
C101      LEVN       6600     22           7602   6700     22           8662
C101      LEVN       6800     22           9766   6900     22          10913
C101      LEVN       7000     22          12105   7100     22          13340
CF02      7302          -200    5600       .0    5700   -29.1    5900   -61.1
CF02      7302          -200    6100    -68.2    6300   -75.5    6500   -82.8
CF02      7302          -200    6700    -90.1    6900   -97.5    7100  -102.9
CF02      7302            00    5600       .0    7100      .0
CF02      7302           200    5600       .0    5700    29.1    5900    61.1
CF02      7302           200    6100     68.2    6300    75.5    6500    82.8
CF02      7302           200    6700     90.1    6900    97.5    7100   102.9
CF02      7302          2000    5600       .0    5700   291.4    5900   611.4
CF02      7302          2000    6100    681.9    6300   755.0    6500   828.2
CF02      7302          2000    6700    901.4    6900   974.5    7100  1029.4
CC01      NRAI       3  122    LEVY NORTH RAINFALL
CC02      NRAI       LEVN      RAIN 7302
CC01      NEVA       3  122    LEVY NORTH EVAPORATION
CC02      NEVA       LEVN      EVAP 7302

CL01      LEDW         2       DOWNSTREAM LAKE
CL02      LEDW                          100     10
C101      LEDW       5800    .01              0   5900    .01            174
C101      LEDW       6000    .01            699   6100    .01           1487
C101      LEDW       6200    .01           2455   6300    .01           3603
C101      LEDW       6400    .01           4931   6500    .01           6440
C101      LEDW       6600      1           8130   6700      7          10000
C101      LEDW       6800     37          12050   6900     85          14281
C101      LEDW       7000    100          16693   7100    110          19285
CF02      3302          -200    5800       .0    5900   -29.1    6100   -73.2
CF02      3302          -200    6300    -103.2    6500   -133.3   6700  -163.4
CF02      3302          -200    6900    -193.4    7100   -216.0      0     .0
CF02      3302            00    5800       .0    7100      .0
CF02      3302           200    5800       .0    5900    29.1    6100    73.2
CF02      3302           200    6300    103.2    6500    133.3   6700   163.4
CF02      3302           200    6900    193.4    7100    216.0      0     .0
CF02      3302          2000    5800       .0    5900   291.4    6100   731.6
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CF02    3302        2000    6300  1031.9    6500  1332.7    6700  1633.6
CF02    3302        2000    6900  1934.4    7100  2160.0       0      .0
CC01    LRAI      3  122    LEDWITH RAINFALL
CC02    LRAI      LEDW      RAIN 3302
CC01    LEVA      3  122    LEDWITH EVAPORATION
CC02    LEVA      LEDW      EVAP 3302

CL01    LEVY        2       DOWNSTREAM LAKE
CL02    LEVY                        100     10
C101    LEVY      5600    .01             0   5700    .01           231
C101    LEVY      5800    .01           925   5900    .01          2083
C101    LEVY      6000    .01          3703   6100      4          5661
C101    LEVY      6200     12          7831   6300     25         10214
C101    LEVY      6400     42         12810   6500     94         15618
C101    LEVY      6600    220         18640   6700    320         21874
C101    LEVY      6800    420         25321   6900    520         28980
C101    LEVY      7000    620         32853   7100    720         36938
CF02    3303        -200    5600      .0    5700   -38.6    5900  -115.7
CF02    3303        -200    6100  -172.0    6300  -207.4    6500  -242.9
CF02    3303        -200    6700  -278.4    6900  -313.8    7100  -340.4
CF02    3303          00    5600      .0    7100      .0
CF02    3303         200    5600      .0    5700    38.6    5900   115.7
CF02    3303         200    6100   172.0    6300   207.4    6500   242.9
CF02    3303         200    6700   278.4    6900   313.8    7100   340.4
CF02    3303        2000    5600      .0    5700   385.8    5900  1157.4
CF02    3303        2000    6100  1720.0    6300  2074.5    6500  2429.1
CF02    3303        2000    6700  2783.7    6900  3138.3    7100  3404.3
CC01    VEVA      3  122    LEVY: EVAPORATION
CC02    VEVA      LEVY      EVAP 3303
CC01    VRAI      3  122    LEVY: RAINFALL
CC02    VRAI      LEVY      RAIN 3303

CL01    KAPA        2       KANAPAHA PRAIRIE
CL02    KAPA                        100     10
C101    KAPA      4500    .01             0   4600    .01            20
C101    KAPA      4700    .01            80   4800    .01           180
C101    KAPA      4900    .01           321   5000    .01           502
C101    KAPA      5100    .01           723   5200    .01           984
C101    KAPA      5300    .01          1286   5400    .01          1627
C101    KAPA      5500    .01          2013   5600    .01          2581
C101    KAPA      5700    .01          3470   5800    .01          4677
C101    KAPA      5900    .01          6204   6000    .01          8051
C101    KAPA      6100    .01         10217   6200    .01         12703
C101    KAPA      6300    .01         15508   6400    .01         18632
C101    KAPA      6500    .01         22077   6600    .01         25840
C101    KAPA      6700    .01         29923   6800    .01         34326
C101    KAPA      6900    .01         39048   7000    .01         44089
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C101     KAPA      7100    .01          49450   7200    .01          55131
CF02     3307        -200    4500      .00    4600   -3.35    4800  -10.05
CF02     3307        -200    5000   -16.75    5200  -23.45    5400  -30.29
CF02     3307        -200    5600   -60.70    5800 -113.95    6000 -167.20
CF02     3307        -200    6200  -220.45    6400 -273.70    6600 -326.94
CF02     3307        -200    6800  -380.19    7000 -433.44    7200 -473.38
CF02     3307          00    4500      .00    7200     .00
CF02     3307         200    4500      .00    4600    3.35    4800   10.05
CF02     3307         200    5000    16.75    5200   23.45    5400   30.29
CF02     3307         200    5600    60.70    5800  113.95    6000  167.20
CF02     3307         200    6200   220.45    6400  273.70    6600  326.94
CF02     3307         200    6800   380.19    7000  433.44    7200  473.38
CF02     3307        2000    4500      .00    4600   33.49    4800  100.48
CF02     3307        2000    5000   167.47    5200  234.46    5400  302.91
CF02     3307        2000    5600   607.03    5800 1139.51    6000 1671.99
CF02     3307        2000    6200  2204.47    6400 2736.95    6600 3269.44
CF02     3307        2000    6800  3801.92    7000 4334.40    7200 4733.76
CC01     KEVA      3  122    KANAPAHA: EVAPORATION
CC02     KEVA      KAPA     EVAP 3307
CC01     KRAI      3  122    KANAPAHA: RAINFALL
CC02     KRAI      KAPA     RAIN 3307

CC01     FLOK      3  122    LANAPAHA:SEEPAGE TO FLORIDAN
CC02     FLOK      KAPA     A004 330K
CC01     FLK1      3  122    LANAPAHA:SEEPAGE TO FLORIDAN
CC02     FLK1      KAPA     A004 33K1
CC01     FLOL      3  122    LEVY: SEEPAGE TO FLORIDAN
CC02     FLOL      LEVY     A004 330L
CC01     FLOD      3  122    LEDWITH: SEEPAGE TO FLORIDAN
CC02     FLOD      LEDW     A004 330D
CC01     FLOG      3  122    LEDWITH: SEEPAGE TO FLORIDAN
CC02     FLOG      GRAS     A004 330G

 ** BASIN CONFIGURATION
N    KANAPAHA
P013     RAIN
P013     EVAP
P005     A004
P005     KPGG
P005     LLGG
P005     LDGG
P005     KQGG
P005     DQGG
P009     BLED      LEDW
P009     BMOO      LEDW
P009     BFIS      LEDW
P007     LEVA      LEDW
```

Appendix I-B Construction Cost Estimates

1.0 Construction costs for Alternative One (1)

1. Mobilization	= $ 6,000
2. 40 linear feet of double 24 inch RCP	= $ 3,200
3. 2 headwalls	= $ 2,000
4. Removal of existing berm at 5 locations	= $56,700
5. 20 foot wide trapezoidal concrete weir	= $ 5,000
6. 1200 feet of berm	= $45,000
7. 20 foot wide trapezoidal concrete weir	= $ 5,000
8. 60 linear feet of 24 inch RCP	= $ 2,400
9. 2 headwalls	= $ 2,000
Total construction costs for Alternative One (1)	**$127,300**

2.0 Construction costs for Alternative Two (2)

1. Mobilization	= $ 6,000
2. 40 linear feet of double 24 inch RCP	= $ 3,200
3. 2 headwalls	= $ 2,000
4. Removal of existing berm at 5 locations	= $56,700
5. 20 foot wide trapezoidal concrete weir	= $ 5,000
6. 20 foot wide trapezoidal concrete weir	= $ 5,000
7. 60 linear feet of 24 inch RCP	= $ 2,400
8. 2 headwalls	= $ 2,000
Total construction costs for Alternative Two (2)	**$82,300**

Notes:

1. These estimates do not include land and/or easement acquisition or operation and maintenance costs. Costs are preliminary estimates for planning purposes only.
2. During the development of this report, it has been discussed that the NRCS (National Resources Conservation Service) will perform some of the construction activities relative to this project. This would result in the reduction of the estimated construction cost to the County. The reduction in cost is related to items two (2) through five (5) in both of the above alternatives, which will be performed by NRCS. The total construction cost to Alachua County will therefore be $60,400 for Alternative One (1) and $15,400 for Alternative Two (2).

Appendix II-A SJRWMD Land Use Land Cover Maps of the study area

Berryman & Henigar

N
W E
S

Projstr.shp
1995 landcover.shp
Urban
Agriculture
Rangeland
Forest
Water
Wetlands
Barren Land
Transp., Comm., Util.
Roads24_dlg
Interstate
US Highway
State Road
County Road
Local Road
Jeep Trail

0.5 0 0.5 1 1.5 Miles

1995 Land Use / Whitehurst Pasture & Vicinity

Berryman & Henigar

Projstr.shp
1995 landcover.shp
Urban
Agriculture
Rangeland
Forest
Water
Wetlands
Barren Land
Transp., Comm., Util.
Roads24_dlg
Interstate
US Highway
State Road
County Road
Local Road
Jeep Trail

N
W E
S

1 0 1 2 Miles

1995 Land Use Kanapaha Prairie / Levy Lake Study Area

Berryman & Henigar

N
W E
S

Projstr.shp
1995 landcover.shp
Urban
Agriculture
Rangeland
Forest
Water
Wetlands
Barren Land
Transp., Comm., Util.
Roads24_dlg
Interstate
US Highway
State Road
County Road
Local Road
Jeep Trail

0.5 0 0.5 1 Miles

1995 Land Use / South Levy Lake Vicinity

Berryman & Henigar

N
W E
S

Projstr.shp
1995 landcover.shp
Urban
Agriculture
Rangeland
Forest
Water
Wetlands
Barren Land
Transp., Comm., Util.
Roads24_dlg
Interstate
US Highway
State Road
County Road
Local Road
Jeep Trail

0.5 0 0.5 1 1.5 Miles

1995 Land Use / North Levy Lake Vicinity

Appendix II-B Historical Aerial Photo Summary

PROJECT MEMORANDUM

LEVY LAKE / LEDWITH LAKE ENGINEERING & ENVIRONMENTAL STUDY
(Whiteherst property and Kanapaha Prairie flood attenuation plan)

B&H Project No. 90387.02

Date: June 21, 2000

To: Levy Lake Team Members

cc: Chuck Pigeon (B&H), Ernie Taylor (Alachua Co.), John Shuman (SJRWMD)

From: Michael G. Czerwinski, P.G., P.W.S.

Subject: Historic Aerial Photo Review Summary

INTRODUCTION:

In accordance with the scope of work, the purpose of the historical aerial photo review is to review a minimum of three (3) dates of aerial photography (earliest available historic, current and an in-between date) of the study area for significant changes in land use, drainage and hydrology. Particular attention was paid to documenting the alterations occurring on the Whitehurst and Ramsey properties, land use changes within the immediate basin and wetland trends over the pertinent interval. Hydrologic analysis included acquisition and analysis of period of record (POR) rainfall (at NOAA, Gainesville, Florida) and Floridan Aquifer levels in nearby wells. Rainfall data were examined for each date of photography to determine ambient conditions present in the historical imagery.

This API analysis revealed that the Kanapaha Prairie (KP) basin has experienced a wide range of water levels over the past 60 years. Furthermore, the majority of the levee construction and alterations on the Ramsey and Whitehurst portions of Levy Lake occurred between 1968 and 1974. Based upon this analysis, land uses and land cover within the basin appear to have changed little since 1938, in this relatively rural area. The predominant land uses in the basin currently appear to be relatively benign agricultural and silvicultural uses. The exception is the development of a low-density residential subdivision along the north shore of KP starting in 1974 and accelerating in the 1980's. Therefore it is surmised that flooding was not a direct result of increased impervious surface as a result of development activities in the basin. Drainage modifications, however, such as the Levy Lake levees and creation of drainage ditches in Fish and Mud Prairies and other wetland basins in the area, appear to be the most significant factor involved in contributing to increases in flood flow and loss of potential basin storage and flood attenuation.

Image Acquisition

Aerial photo indices and pertinent maps were examined at the Marston Map Library at the University of Florida. Color-infrared digital ortho-quarter quad (DOQQ) coverage of the study area was acquired from the SJRWMD and used to represent the most current imagery. Table 1

provides a list of the dates that aerial photos were acquired and available. The SJRWMD provided (xerox) photo copies of 1938 aerial photos of the study area as well as scanned, un-rectified versions for analysis. The latter photos represented the earliest readily available imagery.

TABLE 1. Dates of Historical Aerial Imagery and Characteristics.

Year (water year)	Months	Approximate Scale	Media	Source/ Program	Hydro Condition
1938 (1937)	12/37-3/38	1:32,000	B&W	USDA/AAA	Normal
1949 (1948)	2/49-5/49	1:20,000		USDA/PMA	Wet
1957 (1956)	12/56-1/57	1:20,000	B&W	USDA/ASCS	Below Normal
1961 (1960)	1/61-3/61	1:20,000	B&W	USDA/ASCS	Very Wet
1968 (1968)	11/68	1:20,000	B&W	USDA/ASCS	Normal
1974 (1973)	2/74	1:20,000	B&W	USDA/ASCS	Sl. Below Normal
1979 (1978)	4/79	1:40,000	B&W	USDA/ASCS	Below Normal
1984 (1983)	2/84	1:48,000	B&W and CIR	NHAP	Very Wet
1995 (1994)	1/95	1:48,000	CIR	NAPP	Dry Normal

HYDROLOGIC CONDITIONS

It is important that photo interpretation tasks include an evaluation of the general hydrologic conditions represented by a particular date of imagery. Although the individual photographs only provide a "snap shot" of conditions, the variety of hydrologic conditions evident in all the available photos, when examined with the rainfall records, can provide a range of hydrologic conditions and valuable insight into the drainage characteristics or hydrodynamics of the basin. A hydrologic condition ranging from very dry to very wet is assigned to a date of imagery in Table 1. The hydrologic condition is based upon a comparison of the POR average annual rainfall (51.35 inches) to the total rainfall in the 12 months prior to the date of imagery as well as a general review of the three (3) months rainfall amounts immediately preceding the date of imagery.

The hydrologic conditions for the dates of photography are illustrated in Figures 1 and 2 and described below.

FIGURE 1. Annual Rainfall and Representative Water Year Dates of Imagery

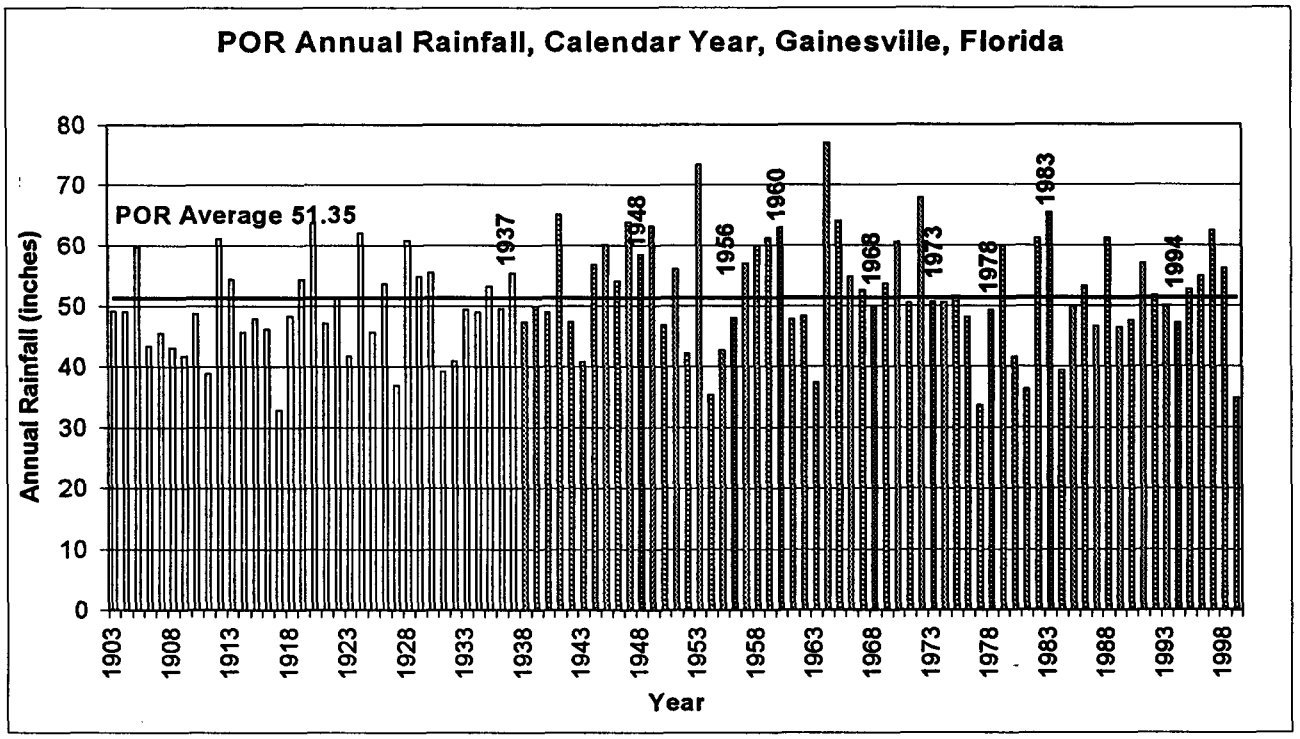
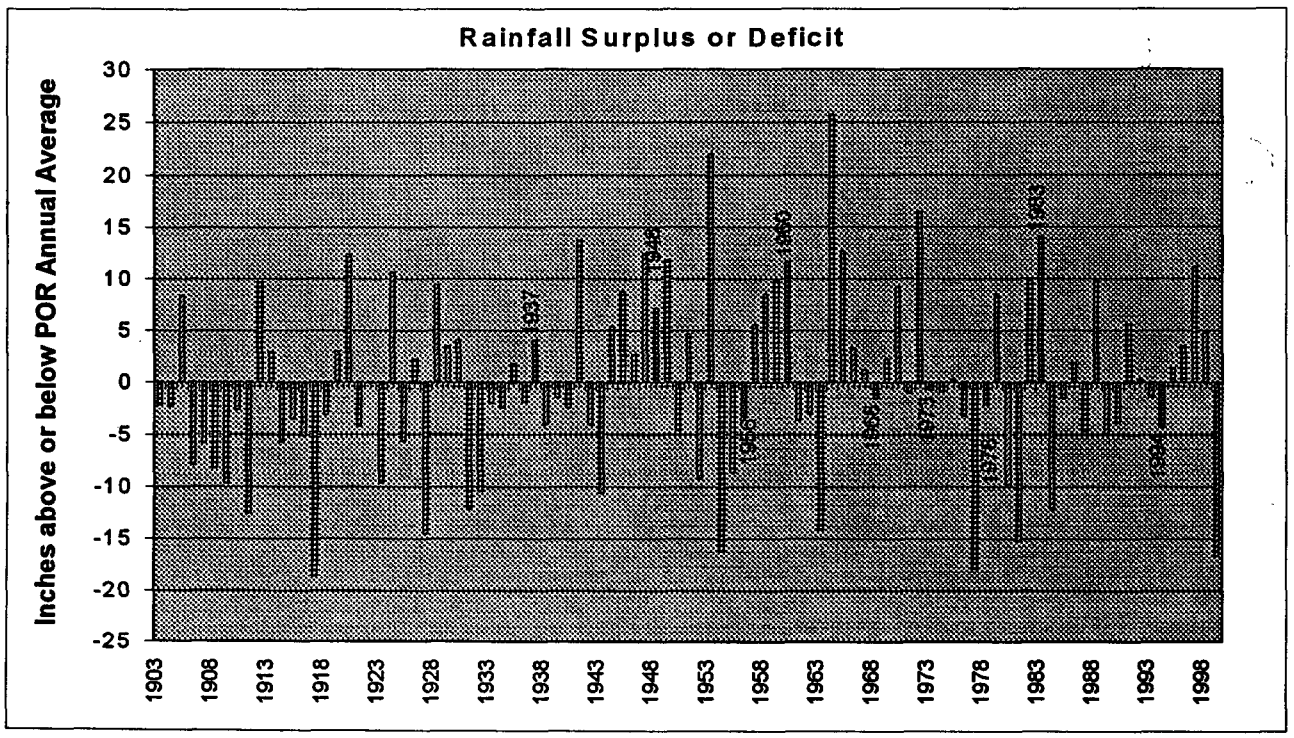


FIGURE 2. Annual Rainfall Surplus or Deficit from POR Average Annual and Representative Water Year Dates of Imagery



1937-38
The 1938 imagery was acquired between December 1937 and March 1938. Normal to slightly above normal (51.57 to 55.35 inches) rainfall was recorded for the 12 months preceding the image acquisition. However, generally lower than average monthly rainfall was recorded for 3-month periods preceding image acquisition.

1948-49
The 1949 imagery was acquired between February 1949 and May 1949. Slightly above normal (53.43 to 58.37 inches) rainfall was recorded for the preceding 12-month period. However, 8.95 inches of rainfall was reported for April 1949, a surplus of 5.93 inches and almost 300% above the long-term monthly average. Therefore, the May 1949 imagery should appear very wet.

1956-57
The 1957 imagery was acquired between December 1956 and January 1957. Below normal rainfall (47.98-48.05 inches) was recorded for the 12-month running average(s).

1960-61
The 1961 imagery was acquired between January 1961 and March 1961. Above normal rainfall (62.94-65.32 inches) was recorded for the 12-month running average(s). This correlated to a rainfall surplus of between 11.59-13.97 inches over the long-term average annual. In addition, calendar year 1960 was the 10th wettest year for the POR and the third year in a row of above-average annual rainfall.

1968
The 1968 imagery was acquired in November 1968. Relatively normal, or near-average rainfall (52.95 inches) was recorded for the 12-month running average preceding the aerial photo acquisition.

1973-74
The 1974 imagery was acquired in February 1974. Slightly below-normal rainfall (46.69 inches) was recorded for the 12-month running average preceding the aerial photo acquisition.

1978-79
The 1979 imagery was acquired in April 1979. Below normal rainfall (45.7 inches), an annual deficit of 5.65 inches from the long-term average annual, was recorded for the 12-month running average preceding the aerial photo acquisition.

1983-84
The 1984 color-infra-red (NHAP) imagery was acquired in February 1984. Above normal rainfall (63.65 inches), an annual surplus of 12.3 inches, was recorded for the 12-month running average preceding the aerial photo acquisition. In addition, 1983 was the 4th wettest year on record.

1994-95
The 1995 color-infra-red (NAPP) imagery was acquired in January 1995. Below normal rainfall (47.07 inches), an annual deficit of 4.28 inches, was recorded for the 12-month running average preceding the aerial photo acquisition.

API OBSERVATIONS:

1938

All of Levy Lake, including the Ramsey and Whithurst portion, appears to be in a relatively undisturbed state. There are very few areas of open water within the lake, and the photo signatures indicate that the lake is densely vegetated by aquatic macrophytes, representative of a shallow eutrophic lake or wet prairie system. Very few areas of shrubs or tree islands are present. This would indicate that the system either burned periodically or maintained a consistent water level sufficient to exclude invasion by trees and shrubby vegetation. The open-water areas are located along the southwestern shoreline and along the north shore in the eastern half (Whitehurst pasture portion) of the lake. The lake system appears fully hydrated to the edges in the 1938 imagery.

Improved pasture appears to be the dominant land use along the north and southwest shores of Levy Lake and forest appears to be the predominant land cover south of the lake. Wetland strands and sparsely forested pine flatwood appear to be the dominant land cover to the east of Levy Lake.

Ledwith Lake, as well as mud and fish prairie to the west and southwest of Ledwith Lake, appear similar to Levy Lake. Natural areas (flatwoods, prairie and hammocks) appear to be the principal surrounding land cover of these three systems and the only improvements appear to be pasture along the eastern edge of Ledwith Lake. Similar to Levy Lake, no internal ditches are evident on other moderate to large wetland systems in the region, which currently have these ditches, including Grass Prairie and Fish Prairie.

Pierson Sink exhibits moderate water levels. Hydrated areas of KP are limited to the interior central marshes and smaller isolated pools. Interior ditches connecting Pierson Sink and the other deeper pools do not appear to be present. A well-defined tree line surrounds and defines the outer or upper limits of the KP; however, some mature, scattered trees extend into the basin along the western edge. This would indicate that prior to 1938, the basin flooded periodically enough to keep the majority of trees from encroaching into the basin. Land cover surrounding KP appears to be principally upland forest with some improved pasture to the southwest and north.

Interestingly, Paynes Prairie appears very dry and exhibits interesting drainage patterns. One can clearly see Paynes Creek, in the eastern portion of the prairie, east of 441.

1949

The extreme western "finger" of KP, where Pierson Sink is located, appears fully inundated up to the tree line in the southern portion, and a few tens of feet away from the tree line along the northern "shoreline". Hydrologic connections between the open water pools (ponds) to the east of the KP are apparent. Some appear very linear and may have been manmade (ditch connections), while others appear non-linear or somewhat more natural.

All of the wetland / prairie basins to the south of KP appear fully inundated. These include Grass Prairie, Horse Prairie and Priest Prairie to the south, and a small, unnamed prairie system to the southwest located in the southern ½ of Sections 13-11-18 and 18-11-19. Paynes Prairie to the

north appears extremely wet as well, with the majority of the interior appearing as open water or flooded prairie. This inundation does not, however, extend to the upper edge of the prairie.

Levy, Ledwith and Mud Lakes all appear relatively unchanged from the 1938 image. State Road 121, or its precursor, first appears on the 1949 aerials.

1957

The 1957 imagery appears extremely dry. Pierson Sink, in the northwestern end of KP, is very reduced and appears similar in size and shape to that observed in the field (during extreme rainfall deficit ... drought conditions) in Spring 2000. A linear ditch between Pierson Sink and the next open pool areas to the east was present, but there is no water in the ditch. Because the conditions are so dry on the imagery, it is difficult to determine if ditch connections are present between the pools in the eastern end of KP. The prairie systems referenced in 1949 as being inundated are dry in the 1957 imagery, with most appearing as pasture or hay fields with only small, isolated, scattered interior wet "pockets". The only exception is Mud Pond which appears well saturated or inundated and vegetated by obligate wetland herbaceous vegetation. Fish Pond appears drier than Mud Pond, with the outer edges appearing pasture-like and a central interior ditch is present. Paynes Prairie appears similar, with the exception that the non-inundated areas appear at least saturated. Levy and Ledwith Lakes appear as in previous years, as completely vegetated shallow lakes, or wet prairies with a few open water areas. No new or significant development is present in the watershed as in the previous years, and the major land use / cover is agricultural uses.

A new utility right-of-way (pipeline per USGS Quad) cut is present and cuts between the eastern and western portion of Priest Prairie. This easement, projected up towards Levy Lake, coincides with a portion of the western boundary of the lake that is oriented at 30 degrees east of north.

SR 121 is improved and in the same location or orientation as it currently appears.

1961

The KP area appears very wet, with the northwest extension or isthmus (which includes Pierson Sink) inundated to the edge of the oaks. However, unlike the appearance in the 1949 imagery, it is not inundated to the oak edge along the remainder (northern, eastern, southern or western edge) of the basin. This would imply that water levels were slightly lower in the 1961 imagery, or that Pierson Sink, because of the relatively higher water levels around the sink, may at times or under certain conditions of high aquifer levels, act as a source of water to KP.

All of the prairie systems south and southwest of KP referenced above, are completely inundated. The only exceptions are Fish Prairie which appears saturated, but not inundated, and the eastern portion of Priest Prairie. The latter appears to have been altered by placing a dike along the northern portion of the basin to allow the majority of the eastern portion of the prairie to be used for pasture.

A relatively lighter band of herbaceous lake vegetation is present along the entire southern shores of Levy Lake and extends a hundred or so feet into the lake. This lighter band could be drier soils, differing vegetation type, or (vegetative regrowth) effects of a shoreline fire that

burned along the southern shoreline. The western shorelines of Levy Lake appear dark with numerous areas of open or deep water areas.

Paynes Prairie is inundated but not to the edges of the prairie. The signature gives the appearance that the upper portions or rim of the basin is "bleeding" into the deeper, wetter portions of the prairie. This appears similar to seepage slopes and perhaps indicative of the local underlying geology and hydrologic mechanisms at work in Paynes Prairie (similar to 1938 and 1949).

Highway 441 is being improved at the time of the photography, and a long access road has been constructed west from 441 into the western center portion of Paynes Prairie.

The lakes or ponds between Levy Lake and KP are linked due to high water, but it appears mostly natural.

Levy Lake (Whitehurst and Ramsey) appears relatively unchanged.

1968

KP is relatively dry in the majority of the prairie. A straight linear ditch is present from the central pool to Pierson Sink to the west-northwest. Similar ditches that connect the deeper pools are evident in the eastern portion of KP. Drainage ditches and levees are evident in Horse Prairie, Priest Prairie and Fish Prairie. These prairies are all relatively dry, with only small interior pools of wetness.

The first series of levees on Levy Lake are visible in the northwest corner on the Ramsey property. Interstate 75 is under construction, and a DOT drainage ditch has been constructed running due south along the eastern edge of Levy Lake / Whitehurst property.

1974

KP appears very dry. Only isolated pools, a larger central pool of open water and a much-reduced Pierson Sink area are inundated. A linear ditch is present between Pierson Sink and the main, central open-water pool of KP to the east. A circuitous ditch or creek appears to connect the small pools/ ponds or wetlands west of SR 121. The oak canopy surrounding the KP basin appears complete, and no significant land use changes from that evident on past imagery appear to be present (i.e., the residential subdivisions to the north and south are not yet present).

Major levees have been constructed around Levy Lake. This includes the major exterior levees within the Ramsey property. The tertiary, interior ditches are not yet present within the Ramsey property. A single levee system is present along the southern boundary of the Ramsey property. The more southern levee, which would complete the "dual levee" system, appears only a quarter complete working from east to west along the southern portion of the Ramsey property.

The Whitehurst Pasture exterior levees have all been completed and the interior ditches appear to be completed as well. The character of the Whithurst portion of Levy Lake appears to have undergone a significant change in the hydrology and resulting vegetation characteristics since 1968. In other words, it appears generally drier and with less cover by hydrophytic vegetation. The southern levee appears to be constructed from east to west and extended to approximately

burned along the southern shoreline. The western shorelines of Levy Lake appear dark with numerous areas of open or deep water areas.

Paynes Prairie is inundated but not to the edges of the prairie. The signature gives the appearance that the upper portions or rim of the basin is "bleeding" into the deeper, wetter portions of the prairie. This appears similar to seepage slopes and perhaps indicative of the local underlying geology and hydrologic mechanisms at work in Paynes Prairie (similar to 1938 and 1949).

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1974

KP appears very dry. Only isolated pools, a larger central pool of open water and a much-reduced Pierson Sink area are inundated. A linear ditch is present between Pierson Sink and the main, central open-water pool of KP to the east. A circuitous ditch or creek appears to connect the small pools/ ponds or wetlands west of SR 121. The oak canopy surrounding the KP basin appears complete, and no significant land use changes from that evident on past imagery appear to be present (i.e., the residential subdivisions to the north and south are not yet present).

Major levees have been constructed around Levy Lake. This includes the major exterior levees within the Ramsey property. The tertiary, interior ditches are not yet present within the Ramsey property. A single levee system is present along the southern boundary of the Ramsey property. The more southern levee, which would complete the "dual levee" system, appears only a quarter complete working from east to west along the southern portion of the Ramsey property.

The Whitehurst Pasture exterior levees have all been completed and the interior ditches appear to be completed as well. The character of the Whithurst portion of Levy Lake appears to have undergone a significant change in the hydrology and resulting vegetation characteristics since 1968. In other words, it appears generally drier and with less cover by hydrophytic vegetation. The southern levee appears to be constructed from east to west and extended to approximately

the western edge of Section 19 by the date of photography. A single levee is present along the southern boundary of the Ramsey property.

Significant alterations appear to be occurring in Paynes Prairie as well during this time. This would include the appearance of numerous interior roads or trails and ditches, appearance of a defined open pool at the sink location and what appear to be vegetation test strip plots southeast of the sink. Interior ditches are present in Fish Prairie.

1979

The southern Ramsey levee creating a dual levee system is complete from east to west, with a 90 degree turn to the south at the western end, similar to its present day configuration. Interior tertiary drainage ditches are present on both the Ramsey and Whitehurst Pasture portions of Levy Lake. The Ramsey and Whitehurst Pasture areas appear more pasture-like and are similar in photo signature and appearance as current conditions. The southernmost levee on the western portion of Levy Lake has been extended to the southwest, a few hundred feet short of where it presently terminates. Construction of I-75 appears substantially complete.

New subdivision roads are present to the north of KP, and an improved road or trail passing through the center of KP on the west side of the central pool is present. This road provides a corridor road crossing from the north to the south side of KP. Land uses on the south side of KP appear to be slowly converting from large farm or agricultural lands to smaller mini-farm parcels ranging in size from 5-20 acres.

KP appears slightly wetter in 1979 than 1974 as evidenced by slightly large open water areas and hydrated connections between the smaller pools. Similarly, Paynes Prairie appears wetter in 1979.

1984

Pierson Sink is inundated up to a few tens of feet short of the live oak fringe on the upper end of KP. Similarly, the marsh areas surrounding the central open water pool of KP are inundated. However, there is still a major portion of the KP basin that appears non-saturated. Some minor lot infill has occurred in the residential subdivision on the north shore of KP. Paynes Prairie appears very wet in comparison to the 1970s images.

The northern end of Ledwith Lake appears to be a lot of open water and/or flooded emergent or herbaceous wetland vegetation, indicating higher water levels. The western portion of Levy Lake appears dark and fully inundated, and the "funnel" area between Levy Lake and the Ramsey levee is primarily open water. It appears that the levee on the south side of Levy Lake is holding back water on the south side of the levee.

1995 DOQQ

The 1995 imagery appears relatively dry. Pierson Sink has been reduced to a small "puddle" and the emergent wetland fringe around the central pool appears reduced when compared to 1984. The residential subdivision(s) on the north side of KP have numerous homes with the appearance that over 50% are improved/developed. Paynes Prairie appears drier than in 1984. Both Ramsey and Whitehurst Pastures appear relatively dry and used for sod or agricultural purposes with few isolated wet pockets. Land uses and land cover within the watershed still

appear to be relatively benign agricultural and silvicultural uses predominating and no new significant areas of impervious surface.

Scanned and rectified 1938 Images

The SJRWMD provided scanned digital files of the 1938 imagery for comparison to more recent imagery. The 1938 scanned images were geo-rectified to the 1995 Digital Ortho Quarter Quads (DOQQ). Geo-recification of the scanned 1938 historical images was performed by utilizing ArcView 3.2 software with the Spatial Tools extension. Photo identifiable (ground) control points common to the scanned 1938 images and the pertinent DOQQ were selected and matched in order to "rectify" the historic image to the DOQQ. Points were evenly distributed across the images. The historic image was then converted to a grid and warped according to the nearest neighbor, second order polynomial transformation. The warped grid was then converted back to an image cropped, as necessary, to remove fiducial markings, photo data (i.e., title and date), or remove areas outside the study area, and saved as a jpeg image to reduce file size for transport. This imagery was used for a cursory analysis of current vs. historic conditions.

Appendix II-C Field Memorandum

Project Field Memorandum
Alachua County, Levy Lake Project
B&H Project No. 90387.03

Date: June 27, 2000

To: Ernie Taylor (Alachua County Assistant Director of Operations)
John Shuman (SJRWMD)
Chuck Pigeon, Hamid Ashtari (B&H)
File

From: Michael G. Czerwinski, P.G., P.W.S. (Berryman & Henigar, Inc.)
Ray Ashton (Ashton, Ashton & Associates)

cc: Kenneth Morgan (NRCS)
William J. Whitehurst
Mr. Chip Ramsey

Introduction

In accordance with the project scope, an environmental field inspection of the Levy Lake / Kanapaha Prairie Watershed, (hereafter referred to as the project area) was conducted on Thursday, April 27, 2000 by Mike Czerwinski (Berryman & Henigar, Inc.) and Ray Ashton (Ashton, Ashton & Associates, Inc). Due to the large project area as well as budget and time constraints, the inspection was limited to three main areas: The Whitehurst Pasture portion of Levy Lake, the (3- 48") culverts and Levy Lake "out fall" area on the Ramsey property, and the northeastern portion of Kanapaha Prairie. The team was accompanied by Kenneth H. Morgan, District Conservationist with the NRCS, who is in the process of developing the Wetland Reserve Program (WRP) application for the Whitehurst property. Ernie Taylor joined the team on site at the Ramsey property.

In accordance with the scope, the objectives of the site inspection principally were to: familiarize the environmental team with the project area; examine the area for any major land use / land cover changes, and wetland trends; review the environmental and hydrologic characteristics of the basin; observe and document any significant hydrologic indicators and use by listed species, and garner any additional information pertinent to the project.

Eastern Levy Lake / Whitehurst Property
The "Whitehurst Pasture" occupies what historically was the eastern portion of Levy Lake. An extensive periphery dike and adjacent canal/ditch system almost completely surrounds the basin and appears to have been constructed sometime in the 1960's. The dike and outer ditch intercept surface water and runoff that normally would have sheet flowed into the interior

of the basin and "shunts" it around the basin to the north and south and eventually to the west. A large pump located in the northwestern portion of the Whitehurst Pasture was used to pump water out of the basin. Numerous shallow interior ditches are present but are "dead end ditches" and do not appear to cut through the dike and further drain the site (pers. comm. Ken Morgan). These structures and management practices have effectively altered what was a lake or wet prairie enabling a large portion of it to be used as pasture for grazing livestock.

Ken Morgan explained that he is working with Bill Whitehurst on a Wetland Reserve Program (WRP) grant to restore this eastern end of Levy Lake to wetland conditions. The application has been submitted and they are one of only three projects in the state tentatively set for approval. The preliminary plan involves the installation of culverts (with riser boards to vary the elevations) along the eastern edge of the property near Interstate 75 and numerous cuts through selected portions of the dike system at strategic locations. The goal is to restore the wetland hydrology to the Whitehurst pasture portion of Levy Lake, rather than "shunting" the water around the pasture. In addition, this plan should provide added storage volume and detention time, and may significantly reduce or attenuate the pulse of water or flooding downstream, one of the objectives of our study. Ken has established a series of elevation bench marks around the eastern and southern portion of the basin.

We entered the property from the east and drove along the dike around the southern portion of the property. A deep, partially water-filled ditch was present on each site of the dike and limited access into the interior of the basin. Ken Morgan indicated that the pump has not operated since the pasture was flooded during the El Niño event, when it was turned off so as to not exacerbate downstream conditions in Kanapaha Prairie. As a result, numerous live and water oak (snags) were observed to be scattered across the basin and herbaceous wetland vegetation, including maidencane (*Panicum hemotomum*), soft rush (*Juncus effusus*) and various sedges appeared to dominate the ground cover in the eastern portion of the basin. These areas were inundated or exhibited saturated soil conditions during the field inspection, which is a significant observation when one considers the drought-like conditions experienced all over central Florida during this time period. In addition, numerous species of wading birds and wetland dependant wildlife, including listed species were observed in the eastern portion of the site (see attached list). Scattered cattails (*Typha* spp.) were noted in the extreme eastern portion of the basin near the ditch. On the east side of the dike was a hydric hammock with species typical of this habitat in north central Florida, including cypress (*Taxodium* spp.), sweetgum (*Liquidambar styraciflua*) and magnolia (*Magnolia grandiflora*). Despite the drought conditions, this area was still quite wet with some pools of open water present.

A variety of obligate wetland vegetation was present in the ditch to the inside of the dike and included willow (*Salix* spp.), alligator-weed (*Alternanthera philoxeroides*), flag (*Thalia geniculata*), royal fern (*Osmunda regalis*) and cinnamon fern (*Osmunda cinnamomea*). Willow were examined at selected locations along the dike for adventitious roots and other evidence or hydro-biological indicators of "high water" associated with the El Niño event. Indicators were principally absent or unreliable at these locations. Considering the snags and those indicators present, it appeared that water levels within the basin did not exceed the ground elevation of the majority of the basin by more than a few inches to 1-2 feet in some of the lower areas of the basin. In other words, no obvious hydrologic indicators were observed which would indicate that the converted pasture was "excessively" flooded during El Niño.

The western portion of the interior pasture appeared slightly higher in elevation, and lacked wetland characteristics and obvious visual evidence of recent inundation. An upland hammock was located in the southwestern portion of the site and the dominant ground cover in these areas appear to be saw palmetto (*Serenoa repens*), cabbage palm (*Sabal palmetto*), and pasture grasses and broom-sedge (*Andropogon* spp.) with some scattered soft rush.

It also was noted during the field inspection that the dike system was constructed in an ecotone between the former lake or prairie and the adjacent native habitat (principally forested upland and forested wetland), and therefore, severed the connection between these habitats. However, the neighboring deep water ditches provide an additional microhabitat type with the combination increasing habitat for alligators, turtles and many species of amphibians. This in turn expands the foraging habitat for wading birds, especially during drought periods.

Ray Ashton who has worked in and studied wildlife in most of the major wetland areas of Alachua and surrounding counties, indicated that the Whitehurst portion of Levy Prairie was among the most diverse wetland habitats in the area. It is equal to or in some ways more diverse than Payne's Prairie.

Levy Lake out fall and "funnel area" / Ramsey Property

The Ramsey family was gracious in allowing our contingent (joined by Ernie Taylor) access to and provided a guided tour of the critical outfall area of Levy Lake. According to the map, three (3), 48-inch diameter culverts transmit the majority, if not all of the flow from the Levy Lake basin to the west towards Kanapaha Prairie. This includes water coming from the dike / ditch system around (to the north and south of) the Whitehurst Pasture and the Ramsey Property, and the overflow water from the remaining relatively undisturbed portion of Levy Lake in the south where the dike system was not completed. The later area, which we will refer to as the funnel area, appears to be a broad, relatively flat area that receives overflow water from the natural southwestern portion of Levy Lake and the other ditch systems.

The Ramsey's allowed Alachua County to place weirs at the culverts during the El Niño event to restrict or block the flow and lessen the flooding impact felt downstream in Kanapaha Prairie. The county or the St. Johns River Water Management District (SJRWMD) placed gages near the culverts, slightly upstream in one of the ditches to the south and further to the south in the funnel area.

The Ramsey's provided valuable insight information on water movement, flow, restrictions and general conditions during the high water. Mr. Ramsey provided a copy of field surveyors notes from the SJRWMD which provided information on bench mark elevations as well as stage levels at the above-referenced gages during a portion of the high water periods.

Ken Morgan, explained that his plan, although primarily designed for maintenance or restoration of more natural wetland conditions in the Whitehurst Pasture, would most likely provide the added benefits of flood storage and flood stage attenuation.

Northeastern Kanapaha Prairie

Ray Ashton and Mike Czerwinski attempted access to the north portion of Kanapaha Prairie from the residential subdivisions to the north via Archer Road. Access to this portion of Kanapaha Prairie was extremely limited due primarily to private residence and gated or locked roads or entrances. An electronic gate was located at the north end of Kanapaha Prairie

Ranch Road. A private drive provided access, and the northwestern "tree line" of the prairie was inspected from the ranch road to Pierson Sink by essentially driving along the back lot lines of the adjacent subdivision. It was noted that there were a few dead oak trees (*Quercus* spp.) scattered along the "shoreline"; however, the majority of trees did not show evidence of permanent water damage. It was noted that many of the live oaks were on hummocks (small topographic humps or rises). One such hummock contained two large diameter live oaks which both exhibited a water stain line around the trunk that was approximately two feet above ground elevation. A nail and flagging tape was used to mark the water line indicator for potential future survey. It was noted that a large chain link enclosure was present in this area. Ray Ashton indicated that this was most likely the enclosure used by FFWCC as a prototype holding facility for the Whooping Crane as part of a reintroduction and feeding study.

The majority of this area of the prairie had recently been mowed or hayed. Water levels appeared extremely low at the time of the field reconnaissance. In this respect, water or saturated soil conditions were only observed in Pierson Sink, the central prairie pool and the ditch between these two areas. Other observations around the sink include numerous fish carcasses including catfish (*Ictalurus* spp.), tilapia (*Tilapia mossambica*) and Florida gar (*Lepisosteus platyrhincus*), hundreds of newly metamorphosed southern toads (*Bufo terrestris*), seven Florida banded watersnakes (*Nerodia f. fasciata*) and yellowbelly slider (*Chrysemys s. scripta*; including one excellent red phase individual). An apparent water level gage and box was located on the ditch near the sink and had been vandalized.

List of Vertebrate Species Observed during 4/27/00 field excursion to Levy Lake/Kanapaha Prairie area			
Common Name	***Scientific Binomial***	***Location***	***Frequency of Observation***
MAMMALS			
Gray Squirrel	*Sciurus carolinensis*	Levy, Ramsey	Uncommon
Otter (sign)	*Lutra canadensis*	Levy	One sighting
BIRDS			
Killdeer	*Charadrius vociferus*	Ramsey, Kanapaha	Uncommon
American Crow	*Corvus brachyrhynchos*	All	Common
Anhinga	*Anhinga anhinga*	Levy, Ramsey	Common
Bald Eagle*	*Haliaeetus leucocephalus*	Levy	One bird
Belted Kingfisher	*Ceryle alcyon*	Levy	1 bird
Black Vulture	*Coragyps atratus*	All	Common
Blue Jay	*Cyanocitta cristata*	Levy, Ramsey	Uncommon
Boat-tailed Grackle	*Quiscalus quiscula*	All	Uncommon
Bobwhite	*Colinus virginianus*	Ramsey	Rare
Brown Thrasher	*Toxostoma rufum*	Ramsey	1 bird
Cardinal	*Cardinalis cardinalis*	All	Common
Carolina Chickadee	*Parus carolinensis*	All	Common
Carolina Wren	*Thryothorus ludovicianus*	Levy, Ramsey	Uncommon
Cattle Egret	*Bubulcus ibis*	All	Common
Chimney Swift	*Chaetura pelagica*	Kanapaha	Rare
Common Ground Dove	*Columbina passerina*	Kanapaha	Uncommon
Common Moorhen	*Gallinula chloropus*	Levy	Common
Common Nighthawk	*Chordeites minor*	Kanapaha	3 birds
Common Yellowthroat	*Geothlypis trichas*	Levy	1 observation
Eastern Bluebird	*Sialia sialis*	Ramsey	Uncommon
Glossy Ibis	*Plegadis falcinellus*	Levy	One observation
Great Blue Heron	*Ardea herodias*	All	Common
Great Egret	*Casmerodius albus*	All	Common
Great-crested Flycatcher	*Myiarchus crinitus*	All	Common
Green Heron	*Butorides striatus*	Levy	Uncommon
Indigo Bunting	*Passerina cyanea*	Ramsey, Kanapaha	Common
Lesser Yellowlegs	*Tringa flavipes*	Kanapaha	4 birds
Mottled Duck	*Anas fulvigula*	Levy	Uncommon
Mourning Dove	*Zenaida macroura*	All	Common
Northern Mockingbird	*Mimus polyglottos*	All	Common
Osprey	*Pandion haliaetus*	Levy	2 birds
Palm Warbler	*Dendroica palmarum*	Levy	2 observations
Pileated Woodpecker	*Dryocopus pileatus*	Levy	1 bird

List of Vertebrate Species Observed during 4/27/00 field excursion to Levy Lake/Kanapaha Prairie area			
Common Name	***Scientific Binomial***	***Location***	***Frequency of Observation***
Prairie Warbler	*Dendroica pinus*	Ramsey, Kanapaha	Uncommon
Red-bellied Woodpecker	*Centurus carolinus*	All	Common
Red-eyed Vireo	*Vireo olivaceus*	Ramsey, Kanapaha	Uncommon
Red-shouldered Hawk	*Buteo lineatus*	All	Common
Red-tailed Hawk	*Buteo jamaicensis*	Ramsey	One bird
Red-winged Blackbird	*Agelaius phoeniceus*	All	Common
Rufous-sided Towhee	*Pipilo erythrophthalmus*	Ramsey	2 observations
Snowy Egret*	*Egretta thula*	All	Common
Solitary Sandpiper	*Tringa solitaria*	Kanapaha	One observation
Tufted Titmouse	*Parus bicolor*	All	Common
Turkey Vulture	*Cathartes aura*	All	Common
White Ibis*	*Eudocimus albus*	All	Common
White-eyed Vireo	*Vireo griseus*	All	Common
Wood Duck	*Aix sponsa*	Levy	Common
Wood Stork*	*Mycteria americana*	Levy	Uncommon
REPTILES			
Florida banded watersnake	*Nerodia f. fasciata*	Kanapaha	7 individuals
Florida softshell	*Trionyx ferox*	Levy	2 observations
Southern black racer	*Coluber constrictor priapus*	Levy	1 Observation
Yellowbelly slider	*Chrysemys s. scripta*	Levy, Kanapaha	Uncommon
AMPHIBIANS			
Pig frog	*Rana grylio*	Levy	Uncommon
Southern toad	*Bufo terrestris*	Kanapaha	Common
FISH			
Catfish	*Ictalurus* spp.	Kanapaha	Common
Florida gar	*Lepisosteus platyrhincus*	Kanapaha	Common
Mudfish (Bowfin)	*Amia calva*	Kanapaha	2 observations
Tilapia	*Tilapia mossambica*	Kanapaha	Common

* = Listed species

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Appendix II-D Existing flow patterns along the Levy System


irie
3 Large Box Culverts
24" Culvert
3 48" Culverts
Wacahoota Road
75
Ramsey Property
Whitehurst Pump
2 24" Culverts
Levy Lake
s Prairie
121
Whitehurst Pasture
75
3 36" Culverts
Ledwith
Lake
Mill Pond

Appendix II-E *The Potential Impacts of Two Flood Mitigation Alternatives on Wildlife and Habitat Diversity in the Levy Lake/Kanapaha Prairie Project* report

THE POTENTIAL IMPACTS OF TWO FLOOD MITIGATION ALTERNATIVES ON WILDLIFE AND HABITAT DIVERSITY IN THE LEVY LAKE / KANAPAHA PRAIRIE PROJECT

SECTION 1 - BIOLOGICAL EVALUATION METHODOLOGY

This biological evaluation of the Kanapaha Prairie Complex for the purpose of determining the potential impacts on wildlife and habitat was carried out within the guidelines of the scope of work, which did not allow for extensive fieldwork or use of preferred biological survey methodologies. The scope of work included the use the 1996 Alachua County Ecological Inventory Project, done by KBN - Golder and Associates as the primary source of data on biodiversity within the project basin. This was supplemented with two overview site visits to evaluate the current environment and with other sources of information gathered by Ashton, Ashton, & Associates, Inc. (AA&A). Based on the information gathered from these sources, potential impacts of the proposed flood mitigation being prepared by Berryman and Henigar in cooperation with the SJRWM were evaluated.

1.1 Analysis of Existing Data

The applicability and validity of the existing data including the KBN-Golder and Associates 1996 study was evaluated. A discussion with Robert Simons, one of the authors of the KBN study revealed that the information provided on the Kanapaha Prairie Complex (Barr Hammock, Levy Lake, and Kanapaha Prairie) was gleaned from past memory and notes made on visits to the area over the years. No specific fieldwork was done in the area to evaluate the current biodiversity or the presence or absence of state or federally listed species. This placed the applicability of that data in serious question and made any on-site fieldwork that could be funded by the project extremely significant.

AA&A searched out additional existing sources of information to determine the past and present distribution of protected species and to highlight those species or habitats that may be of interest. The sources of data are listed at the end of this report.

1.2 Site Visits, Observations and Data Analysis

Along with existing data, the project scope of work allowed for two brief field excursions that were undertaken to evaluate the current condition of the general habitats and to make general observations regarding the flora and fauna of the project area (Table 1).

Two site visits were undertaken to the area. The first site visit was made on April 27, 2000. This visit included windshield and pedestrian surveys, which extended from Levy Lake to the Ramsey Property and to Kanapaha Prairie and Pierson Sink. The second survey was undertaken on 20 November 2000 and included the Whitehurst property and along a levy which had not been surveyed before on the south side of Levy Lake.

Based on the site visits and aerial photography (1994/95 Digital Orthophoto), the current vegetative and land uses were determined. This data was then used for the analysis, along with the historic records of migrant and resident (breeding) vertebrates that exist in Alachua County, particularly those species found in similar vegetative communities in Payne's Prairie State Preserve and historic records within the study area. Based on these data, and the habitat requirements of the species, the estimated number of species within the study area were determined (Table 3). The habitat requirements of each species expected to occur within the study site, including each of the alternatives were evaluated as to the possible impacts in consideration of the mitigation alternatives. The evaluation included the possible impacts on probable increases or decreases in the number of species potentially found in the area and looked at the number of species that may be positively or negatively impacted by the alternatives.

SECTION 2 - CURRENT HABITAT AND LAND USE

The habitat classifications used in this evaluation follow those spelled out in the State of Florida DOT *Land Use, Cover and Forms Classification System* (FLUCFCS) and are in accordance with the habitat terminology used in the1996 Alachua County Ecological Inventory Project (KBN-Golder and Associates).

2.1 Project Habitats and Land Use Within the Prairie Basins

The project area is defined as the area currently within the existing dikes. This includes habitats that are primarily within the historic boundaries of the prairie basins and therefore the historic project area falls within the FLUCFCS definition of wetlands (FLUCFCS #600). Prior to alteration of the natural water regimes by dikes and various water control methods the majority of the habitats would have been classified based on the natural wetlands definitions. This historic drainage basin, similar in nature to the Payne's Prairie system and to other similar wetland systems in Florida, included a mosaic of wetland habitats with plant community composition largely determined by the topography, soil and hydrology. Also like Payne's Prairie (now largely restored), this drainage basin system in the last century was impacted by dikes and other alterations for agriculture, cattle, and other activities that resulted in changes in the natural hydrologic cycles.

Wherever methods have been utilized to alter natural water regimes or where the lands have been used for agriculture or drained for the purposes of agriculture, rangeland, or urban development, other FLUCFCS land use classifications apply to describe current land use. Following the implementation of the preferred Flood Mitigation strategy, restoring a more natural hydrologic regime the entire system would again be considered a natural wetland ecosystem as allowed for under the FLUCFCS procedure No. 550-010-001A page 33 paragraph 3 and the habitats would be reclassified in accordance with wetland descriptions.

2.1.1 Wetland Habitats within the Project Area

These are areas where the water table is at or near or above the land surface for a significant portion of most years except during drought. The technical definition of a wetland under Florida Session Law 84-79 (HB 1187), which includes soil and plant analysis cannot be achieved using remotely sensed images and thus may vary from the wetland descriptions used by FLUCFCS which is designed primarily for use with remote sensing images. Maps and other data as previously described were the method provided for by the scope of work.

Habitat definitions were ground-truthed for some areas but actual vegetative mapping was outside of the scope of work. Some plants are designated in this report in accordance with the "wetland indicator status" from the *National List of Plant Species that Occur in Wetlands: Southeast (Region 2)* by the US Fish and Wildlife Service. There are four categories, which include: Obligate wetland species where greater than 99 percent occur in wetlands; Facultative Wetland species where 67-99 percent occur in wetlands; Facultative species where 34-66 percent occur in wetlands or facultative upland species where only 1-33 percent are found in wetlands. Obligate and Facultative Wetland species are the best indicators of wetlands.

a. Freshwater Marshes (FLUCFCS #641)

The vegetative habitats of the basins within with project area include primarily Freshwater Marshes. These habitats are identified by the presence in varying proportions of the following species:

Common Name	Scientific Name	Wetland Indicator Species Status
➢ Cattails	(*Typha* spp.)	Obligate
➢ Arrowhead or duck potato	(*Sagittaria* spp.)	Obligate
➢ Maidencane	(*Panicum hemitomon*)	Obligate
➢ Buttonbush	(*Cephalanthus occidentalis*)	Obligate
➢ Needlerush	(*Juncus effusus*)	Facultative Wetland
➢ Arrowroot	(*Thalia* spp.)	Obligate

If the scope of work included detailed vegetative mapping, then the habitats could have been broken down in more detail by defining areas where a single species (cattail, maidencane, dog fennel) covers 66 percent of more of the area. This level of definition was not included in the scope of work.

The areas that could be defined using the Digital Orthophoto or that were visited that revealed freshwater marsh are as follows:

Much of the drainage basins within the dikes showed a predominance of *Panicum* spp. and low marsh grasses, intermixed with some cattails (*Typha* sp.) and needlerush (*Juncus effusus*). The more permanent wet areas had pickerelweed (*Pontedaria cordata*) which is an obligate wetland indicator species that dominated at the water edges. Some wet areas were covered with arrowroot or alligator flag (*Thalia* spp.), Arrowhead (*Sagittaria* spp.), and willow (Salix spp.) which are also obligate wetland indicator species.

b. Emergent Aquatic Vegetation (FLUCFCS # 644)

Areas with permanent or frequent water of sufficient depth may have vegetation that is both emerging from the water or that is floating on the surface of the water. These water areas included canals along the dikes as well as some natural drainage channels through the basin. Emergent Aquatic Vegetation water areas tend to be covered predominately by one of the following species:

Common Name	Scientific Name	Wetland Indicator Species Status
➢ Water lettuce	(*Pistia stratiotes*)	Obligate
➢ Spatterdock	(*Nuphar lutea*)	Obligate
➢ Water Hyacinth	(*Eichhornia crassipes*)	Obligate
➢ Duck weed	(*Lemna* spp.)	Obligate
➢ Water lily	(*Nymphaea* spp.)	Obligate

The areas that could be defined using the Digital Orthophoto or that were visited that revealed emergent aquatic vegetation are as follows:

Open water areas covered with duckweed (*Lemna* perpusilla), giant duckweed (*Spirodela polyriza*) and water hyacinth (*Eichhornia crassipes*) which are all obligate wetland indicator species. In some areas, particularly in the permanent waters along the dikes spadderdock (*Nuphar lutea*), white water lily (*Nymphaea odorata*) and water shield (*Brasenia schreberi*) were present. The interface of these wetland areas to the edges of the dikes and other higher grounds included button bush (Cephalanthus occidentalis) and elderberry (*Sambucus canadensis*) a facultative wetland indicator species.

c. Wet Prairie (FLUCFCS #643)

The areas not in agriculture on the west to north side of Levy Lake, Ledwith Lake, and Kanapaha Prairie are covered predominately by the wet prairie vegetative community. The habitats change from the east side of Levy Lake where more permanent water occurs to a Wet Prairie community to the west including the area designated as "grassy prairie". The wet prairie community is characterized by grassy vegetation over wet soils and is distinguished from marshes by having less water and shorter vegetation. Wet prairies generally have one of the following species predominate:

Common Name	Scientific Name	Wetland Indicator Species Status
➢ Maidencane	(*Panicum hemitomon*)	Obligate
➢ Yellow-eyed grass	(*Xyris* spp.)	Obligate
➢ White-topped sedge	(*Dichromena* spp.)	Facultative Wetland
➢ St. John's Wort	(*Hypericum* spp.)	Facultative Wetland

The areas that could be defined using the Digital Orthophoto or that were visited that revealed wet prairies are as follows:

Maidencane (*Panicum hemitomon*) and other grass species dominate the low ground but are mixed with nonnative species on higher ground. Pasture grass species found on higher ground include Bahiagrass (*Paspalum notatum*) and others. Where open water occurs, the vegetative communities are as described above in freshwater marshes. Many of these grassy prairie areas within the project basin have been or are currently being grazed by cattle.

d. Wetland Hardwood Forests (FLUCFCS #610)

The perimeter dike structures along the east and south side of Levy Lake appear to follow the transitional zone between Wet Prairie and Forested Wetland communities. Occasionally the dike cuts through the forested wetlands instead and sections of this community type are left in conjunction with the wet prairie community. The Wetland Hardwood Forests wetlands are communities that meet the crown closure requirements of a minimum of 10 percent closure for forestland with 66 percent or more of the tree species being wetland hardwood species. This community is dominated by relatively mature, butressed tupelo gum (*Nyssa biflora*) and water oak (*Quercus nigra*) with some loblolly pine (*Pinus taeda*). These are all facultative species. The canopy of this community seems to be less dense on the basin side of the dike than the forest on the outer side.

e. Stream and Lake Swamps or Bottomland (FLUCFCS #615)

On higher ground on either side of the dike is a community with an apparent change in tree dominance from gum to a wider variety of hardwood species with pines. This community is most closely described by the term "bottomland" swamp and is characterized by diverse associations of hardwood and pine species on lands that tend to flood at some time though not necessarily regularly.

Components of this community may include:

Common Name	Scientific Name	Wetland Indicator Species Status
➢ Red Maple	(*Acer rubrum*)	Facultative
➢ Water Oak	(*Quercus nigra*)	Facultative
➢ Buttonbush	(*Cephalanthus occidentalis*)	Obligate
➢ Sweetgum	(*Liquidambar styraciflua*)	Facultative
➢ Willow	(*Salix* spp.)	Obligate
➢ Bays	(*Persea* spp.)	Facultative Wetland
➢ Cypress	(*Taxodium distichum*)	Obligate
➢ Slash Pine	(*Pinus elliottii*)	Facultative Wetland
➢ Loblolly Pine	(*Pinus taeda*)	Facultative
➢ Tupelo	(*Nyssa biflora*)	Obligate
➢ Live Oak	(*Quercus virginiana*)	Facultative
➢ Sugarberry	(*Celtis laevigata*)	Facultative Wetland
➢ Elderberry	(*Sambucus* spp.)	Facultative Wetland

The areas that could be defined using the Digital Orthophoto or that were visited that revealed bottomland swamps are as follows:

This bottomland forest appears to include slash pine (*Pinus elliottii*) and loblolly pine *(Pinus taeda)*, water oak (*Quercus nigra*) and widely scattered live oak (*Quercus virginiana*), red maple (*Acer rubrum*), and sugar berry (*Celtis laevigata*). These areas appear to rarely flood. However, it appears that within the dikes, the forested wetland community has been reduced by the long term flooding during the El Nino event of 1998. This is evidenced by a scattering of dead oak trees, which still are holding their bark and small limbs indicating that they were killed relatively recently.

2.1.2 Open Water Habitats within the Project Area

The definition of specific water areas depends upon the scale and characteristics of those areas. Open water bodies are considered as any water area within the land mass that is predominately or persistently covered by water and if linear must be at least 1/8th miles wide or if extended, must cover at least 40 acres though bodies as small as 1 acre can be identified. Portions of the water body having emergent vegetation or observable submerged vegetation are placed in the Wetlands category (FLUCFCS # 600).

a. Open water (FLUCFCS # 500)
Under the current drought conditions open water areas without emergent or floating vegetation are more limited than they would be during high water periods. Significant expanses of open water during high water periods could be expected in the areas labeled "Ledwith Lake" and "Levy Lake" as well as in the sinks.

Pierson Sink

Pierson Sink apparently is connected to the Florida Aquifer and is the primary drain for the prairie basin complex. During drier conditions, the sink provides refugia for aquatic and semi-aquatic species since it apparently does not dry up and there are no significant dikes in this area of Kanapaha Prairie. Only herbaceous vegetation occurs around the sink proper however some of the lower areas nearby have cattails and other emergent aquatic vegetation present.

2.1.3 Agricultural Land Uses within the Project Area

Within the project area (inside the dikes) at the current time there are few land uses that can be classified as agricultural. There were no cultivated areas, tree plantations or orchards, and no improved or unimproved pasturelands evident during the course of the site visits or analysis of map and other data. The only exception is the Ramsey property and Whitehurst Pasture portion of Levy Lake, which clearly has agricultural land use. These areas have been classified by the SJRWMD Land Use Land Cover Mapping as Field Crops (FLUCFCS #2150), but are more accurately described below.

a. Sod Farms (FLUCFCS # 242)

This category includes seed- and sod areas used perennially and not rotated with crops or other uses. The north side of Levy Lake owned by the Ramsey family has been diked and developed into sod farm.

2.1.4 Rangeland within the Project Area

Historically rangeland has been identified as those areas where the native vegetation is predominately grasses, grass-like plants, herbaceous forbs or shrubs and is capable of being grazed with limited management practices. This land is not fertilized, cultivated or irrigated.

a. Herbaceous Rangeland (FLUCFCS # 310)

This category includes grassy prairies that are currently not flooded and that are being used for pasture without further improvements or irrigation. The area labeled as the Whitehurst pasture and much of Levy Lake up to the Ramsey property fits into this category except where wetland definitions apply.

2.2 Habitats and Land Use Adjacent to Project Area

2.2.1 Open water (FLUCFCS # 500)

Extensive dike work was established to control water flow in the basins between 1968 and 1974. They were constructed by taking spoil from either side of the dike to raise them substantially well above any high water level. This has developed relatively deep and permanent bodies of water on either side of the dikes. These bodies of water rarely if ever dry up. These deep ponds along either side of the dikes provide permanent water at times when most of the wet prairies may be dry thus providing refugia for many amphibian and fish species.

2.2.2 Disturbed Lands and Spoil Areas (FLUCFCS #743)

These are areas disturbed by the specific human design of creating a dike to act as an impediment to natural water flow and corresponding ditches that congregate and move the water. These dikes over time have become an important artificial upland habitat. The sides of the dikes have relatively large trees dominated by sugarberry (*Celtis laevigata*), laurel oak (*Quercus laurifolia*), red maple (*Acer rubrum*), and hickory (*Carya sp.*). The shrub layer is made up of elderberry (*Sambucus* spp.), blackberry (*Rubus* spp.) and an occasional red cedar (*Juniperus virginiana*). The top of the dike has been maintained and is covered only by grasses and herbaceous plants.

It should be noted that this artificial habitat in fact has a positive impact on many faunal species by increasing nesting and basking sites and by producing an "edge effect" which provides increased foraging areas.

2.2.3 Live Oak Forest or Hammock (FLUCFCS #427)

This plant association is often referred to as an upland temperate hammock in which the live oak (*Quercus virginiana*) is either pure or dominant. Other associated species may include:

Common Name	Scientific Name	Wetland Indicator Species Status
➢ Sweetgum	(*Liquidambar styraciflua*)	Facultative
➢ Magnolia	(Magnolia grandiflora	Facultative
➢ Laurel Oak	(*Quercus laurifoli*)	Facultative Wetland
➢ Holly	(*Ilex* spp.)	Facultative Wetland
➢ Cabbage Palm	(*Sabal palmetto*)	Facultative

The areas that could be defined using the Digital Orthophoto or that were visited that revealed Live Oak Forest are as follows:

Along the east and north sections of the Prairie basin complex, where the ground level is higher, large live oaks dominate the area. In areas bordering or extending into the prairie, there is an increase in cabbage palm (*Sabal palmetto*). In much of the area, the oak canopy is nearly closed. In areas such as Kanapaha Prairie, these habitats have been turned into housing developments. Only a few areas of this habitat occur within the project boundaries.

SECTION 3 – WILDLIFE AND PLANT SPECIES

It was not within the scope of work for this project to undertake a thorough biological survey of the project area. Limited species observation data was available from the KBN study and other sources. On-site observations were made during very limited visits and not during "prime times" or "prime seasons" for locating wildlife. The results of the site visit observations (Tables 1 A, 1B, and 1C) of various project areas indicate that the fauna is typical for the habitats and land use found within the project area and in adjacent areas outside the project area. Table 2 lists the state and federally protected wildlife that was observed on-site, for which there are historic records and/or that were listed in the KBN study. No survey for protected plant life was included in the scope of work, which called for using only the limited information provided by the KBN study.

3.1 Vertebrates

Table 1 A– LOWER VERTEBRATE SPECIES OBSERVED
Species in Lower Vertebrate groups observed during the April and November 2000 field excursions to Levy Lake area. (*) indicates State or federally listed species.

SPECIES (common name)	LOCATION	FREQUENCY OF OBSERVATION
REPTILES		
American Alligator *	Levy, Ramsey	Common
Yellow-bellied slider	Levy, Kanapaha	Uncommon
Florida Softshell	Levy	2 observations
Southern Black Racer	Levy	1 Observation
Florida Banded Watersnake	Kanapaha	7 individuals
AMPHIBIANS		
Pig frog	Levy	Uncommon
Southern Toad	Kanapaha	Common
FISH		
Spotted Gar	Kanapaha	Common
Talapia	Kanapaha	Common
Mudfish	Kanapaha	2 observations
Mosquito Fish	Levy	Common

Table 1 B– VERTEBRATE MAMMAL SPECIES OBSERVED
Species in Higher Vertebrate groups observed during the April and November 2000 field excursions to Levy Lake area. (*) indicates State or federally listed species.

SPECIES (common name)	LOCATION	FREQUENCY OF OBSERVATION
Mammals		
Gray Squirrel	Levy, Ramsey	Uncommon
Raccoon	Levy	1 family
Otter (sign)	Levy	One sighting
White-tailed deer (sign)	Levy	Common
Wild Pig (sign)	Levy	Uncommon

Table 1 B– VERTEBRATE BIRD SPECIES OBSERVED
Species in Higher Vertebrate groups observed during the April and November 2000 field excursions to Levy Lake area. (*) indicates State or federally listed species.

SPECIES (common name)	LOCATION	FREQUENCY OF OBSERVATION
Birds		
Anhinga	Levy, Ramsey	Common
Double-crested Cormorant	Levy	2 birds
Common Gallinule	Levy	Common
Great Blue Heron	All	Common
Great Egret	All	Common
Snowy Egret*	All	Common
Cattle Egret	All	Common
Green Heron	Levy	Uncommon
White Ibis*	All	Common
Glossy Ibis	Levy	One observation
Wood Stork*	Levy	Uncommon
Sandhill Crane (migrant)	Levy	Flyover 3 birds
Black Vulture	All	Common
Turkey Vulture	All	Common
Wood Duck	Levy	Common
Mottled Duck	Levy	Uncommon
Osprey	Levy	2 birds
Marsh Hawk	Levy	1 bird
Cooper's Hawk	Levy	1 bird
Red-shouldered Hawk	All	Common
Red-tailed Hawk	Ramsey	One bird
Bald Eagle*	Levy	One bird
Barred Owl	Levy	One Bird
Bobwhite	Ramsey	Rare
Turkey	Levy	Large Flock
Killdeer	Ramsey, Kanapaha	Uncommon
Solitary Sandpiper	Kanapaha	One observation
Lesser Yellowlegs	Kanapaha	4 birds
Mourning Dove	All	Common
Common Ground Dove	Kanapaha, Levy	Uncommon
Lesser Nighthawk	Kanapaha	3 birds
Chimney Swift	Kanapaha	Rare
Belted Kingfisher	Levy	1 bird
Red-bellied Woodpecker	All	Common
Pileated Woodpecker	Levy	1 bird
Crested Flycatcher	All	Common
Pewee	Levy	1 bird
Blue Jay	Levy, Ramsey	Uncommon
House wren	Levy	2 birds
Tufted Titmouse	Levy	Common
Carolina Chickadee	Levy	Common
American Crow	All	Common
Carolina Chickadee	All	Common
Tufted Titmouse	All	Common
Carolina Wren	Levy, Ramsey	Uncommon

Eastern Bluebird	Ramsey	Uncommon
Northern Mockingbird	All	Common
Brown Thrasher	Ramsey	1 bird
White-eyed Vireo	All	Common
Red-eyed Vireo	Ramsey, Kanapaha	Uncommon
Palm Warbler	Levy	2 observations
Common Yellowthroat	Levy	1 observation
Yellow-rumped Warbler	Levy	1 observation
Prairie Warbler	Ramsey, Kanapaha	Uncommon
Cardinal	All	Common
Indigo Bunting	Ramsey, Kanapaha	Common
Eastern Towhee	Ramsey	2 observations
Red-winged Blackbird	All	Common
Boat-tailed Grackle	All	Uncommon
Robin	Levy	Flock

Table 2 – PROTECTED SPECIES

State and Federally listed or rare species of wildlife recorded from the Levy Prairie wetland complex and surrounding area.

Scientific Name	Common Name	Federal or State Status	FCREPA Status	KBN Study	Status on Site	Record
BIRDS						
Nycterua americana	Wood Stork	E/E	E	P	F	O
Pandion haliaetus	Osprey	- / SSC	T		N	O
Haliaeetus l. leucocephalus	Southern Bald Eagle	T / T	T	P	N	O
Elanoides forficatus	American Swallow-tailed Kite	-	E		FN?	O
Falco sparverius paulus	Southeastern American Kestrel	- / T	T		N?	O
Grus canadensis tibida	Greater Sandhill Crane	-	-	P	C	O
Grus canadensis pratensis	Florida Sandhill Crane	- / T	T	P	N	S
Egretta caerulea	Tri-colored Heron	- / SSC	SSC	P	F	O
Egretta caerulea	Little Blue Heron	- / SSC	SSC	P	F	O
Casmerodius albus	Great Egret	- / SSC	SSC		F	O
Egretta thula	Snowy Egret	- / SSC	SSC	P	F	O
Eudocimus albus	White Ibis	- / SSC	SSC	P	F	O
REPTILES						
Alligator mississippiensis	American Alligator	T / SSC		P	R	O
Gopherus polyphemus	Gopher Tortoise	- / SSC	T		R*	O
Stilosoma extenunatum	Short-tailed Snake	- / T	T		R*	X
Drymarchon corais couperi	Eastern Indigo Snake	SSC / T	T	P	R	O
AMPHIBIANS						
Rana capito	Florida Gopher Frog	- / SSC	T		R*	X
Ambystoma cingulatum	Flatwoods Salamander	T / -	-		R*	X
MAMMALS						
Sciurus niger shermani	Sherman's Fox Squirrel	- / SSC	T		R*	Pr

Abbreviations: E, Endangered; T, Threatened; SSC, Species of Special Concern; P, Reported as present; F, Foraging Area; R, Resident; N, Nesting; O, Observed during field visits; Pr, Probable S, Studied and reported; X, species has not been reported from the study area but habitat does exist.

3.2 Invertebrates

There are no state or federally listed invertebrates known from the study area. However, the endemic Sugarfoot Fly, *Nemopalpus nearcticus* type locality is located at the Sugarfoot Hammock, which is located at the north end of the wetland complex.

3.3 Plants

The scope of work required that only the KBN Ecological Inventory Project be used to determine the presence or absence of protected species. However, the potential for federally listed plants exceeds that which is listed by this study. Since this project intent is to apply for Federal Funding, a comprehensive list of Federally Protected Species may be required.

Listing status was taken from Coile, N. C 1998. *Notes on Florida's Endangered and Threatened Plants*. Fla. Dept. of Agriculture and Consumer Services, Div. of Plant Industries, Gainesville, Fl.

3.3.1 KBN Plant Listings

The KBN study listed the following protected plant species:

1) Godfrey's Privet *Forestiera godfreyi* Federally *Endangered*

2) Little Ebony Spleenwort *Asplenium resiliens* (Identification not confirmed)*.

* Note that this species which is included in the KBN study is not on either federal or state lists. *A. plumium* is listed as Federally Endangered and occurring in the area and microhabitat described.

3.3.2 Other Potential Plant Species

Note that there are at least 10 other Federally Endangered plants listed for Alachua County that occur in habitats and microhabitats, which occur within the study area. It should be pointed out however that these plants have not been found in the area (M. Drummond, pers com).

SECTION 4 - BIODIVERSITY AND POTENTIAL IMPACTS OF THE TWO ALTERNATIVE MANAGEMENT PLANS

4.1 Analysis of Impacts on Habitats

The two alternative flood mitigation management plans have been evaluated and the potential impacts on each type of vegetative community have been assessed. The results of these evaluations indicate that there should be an overall positive impact in the two manipulative alternatives. This is assuming that the status quo alternative takes into account that the Whitehurst properties will be under a conservation easement which will eliminate the management of water to sustain cattle grazing on the west side of Levy Lake. It also assumes that the owners are going to manage the property for duck hunting and other resource based activities. With these assumptions, indications are that the overall impact on wildlife diversity and protected species will be positive.

The exact changes in vegetative communities will depend on the elevation levels of each habitat within the project area. Elevations of these habitats within the basin were not available at the scale that would allow analysis to determine more accurately, the changes caused by increased hydroperiod and water depth. It can be assumed however, that there may be some decline of forested wetlands within the boundaries of the project under the two manipulative alternatives. However, it would appear that the difference between these two alternatives due to the similarities in the changes in overall seasonal depths and hydroperiod, would be so similar and variable with annual rainfall that the impacts would be virtually the same in both alternatives.

These evaluations assume that the lands within the study area would be protected under conservation easement and that these lands would have a habitat management plan that would assist in restoration of the wetland ecology. Habitat management would include burning where appropriate. It is also assumed that most of the dike features would not be altered or removed and that the spoil from alterations including breeching, would be removed outside of the study area. The lack of habitat management and monitoring to determine if in fact the management targets are being met will make a complete analysis of impacts as the mitigation strategy selected is implemented very difficult.

4.2 Analysis of Impacts on Wildlife

Under either flood mitigation manipulative alternative, taking into consideration the habitat requirements of each of the wildlife species (protected and common), it appears that at least 33 species would benefit from the changes expected to take place. For example, the increased hydroperiods could enhance populations of migratory waterfowl, alligators, bald eagles and sandhill cranes. Meanwhile, the changes may have an overall negative effect on 5 species, none of which are state or federally listed species. These are species that are likely to occur in currently existing pastures, which are managed through controlling water levels and are grazed by cattle.

Table 3. ESTIMATED IMPACTS OF ALTERNATIVES ON OVERALL VERTEBRATE BIODIVERSITY

Estimated number of species from current level to no change, alternative 2 and alternative 3. The first number is the probable species numbers that can be expected based on species that occur in that habitat in Alachua County the second number is the net gain or loss in the other two alternatives. The Overall Net Gain or Loss indicates the numbers of species expected to possibly increase (+) or decline (-) due to changes in water levels and hydroperiods. Fish are not included due to the lack of information.

Alternative	Amphibians Species	Reptiles Species	Bird Species (resident)	Bird Species (migrant)	Mammals	Totals
No Change- Alternative 1	34 (0)	53 (0)	104 (0)	143 (0)	45 (0)	379 (0)
Alternative 2	34 (+1)	53 (+6)	104 (-2,+5)	143 (-1,+19)	45 (-2,+2)	379 (-5,+33)
Alternative 3	34 (+1)	53 (+6)	104 (-2,+5)	143 (-1,+19)	45 (-2,+2)	379 (-5,+33)

Table 3 lists 379 species of vertebrates that may be resident or migrant species within the study area. This number is based on historic records of species found in Alachua County and the habitat requirement of each of the species. Based on this data, the biodiversity of the study area is extremely high under current circumstances. It appears that under the alternatives, which may increase overall hydroperiod and water depth, the overall impacts on wildlife diversity would not significantly change the biodiversity. In fact the biodiversity may actually increase if fish are considered.

4.3 Analysis of Impacts on Protected Plant Species

Without a thorough vegetative survey it is impossible to confirm the presence or identify the locations or potential locations of specific protected plant species as suggested by the KBN study. The changes in hydrology resulting from either manipulative alternative could temporarily or permanently submerge locations of these species. The limited overall impacts expected on habitats of this primarily wetland system also indicate a low probability of impact on the plant species composition of those habitats. Wetland systems and their associated species are generally resilient, adapted to the cycles of drought and flood where human interference does not significantly alter the natural hydrology. Under any of the three alternatives the net level of hydrological change compared to natural cycles is estimated to have an insignificant impact on natural habitats and thus on plant species therein.

SECTION 5 - REFERENCES

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Other References

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The geographic files of the vertebrate systematics collections were reviewed for records of state and federally listed Reptiles, Amphibians, Birds and Mammals. The fish collections were not surveyed because the Scope of Work related to state and federally protected species and there are no listed species found in Alachua County.

Florida Fish & Wildlife Conservation Commission wading bird and eagle nesting census data, as of 1999 (Steve Nesbit, pers.com).

Alachua County Department of Environmental Protection, Mike Drummond on protected plant distribution in Alachua County (pers. com).

Appendix III Finished Floor Elevations Report by Causseaux Ellington, Inc.

CAUSSEAUX ELLINGTON INC.

FINISH FLOOR ELEVATION REPORT

TAX PARCEL	OWNER	MET ON SITE	F.FLOOR ELEV.	DATE	TIME	OTHER STRUCTURES SHOT	COMMENTS/EXPLANATIONS
7399-003-000	MORRIS, S.R.	******	62.91'	3/28/98	8:34A		WATER +/- 200' FROM HOUSE
7399-005-000	CURRY, D.E.	******	60.59'	3/28/98	8:55A		WATER UP TO RESIDENCE
7399-006-000	KEOUGH, D.A.	NOT HOME	67.59'	3/28/98	9:15A		
7399-007-000	ANDERSEN, T.L.	******	66.37'	3/28/98	10:00A	BARN = 63.11'	
7353-009-000	HAUSWIRTH, W.W.	******	63.92'	3/28/98	10:40A	GARAGE = 63.38'	WATER +/- 100' N OF RESIDENCE
7399-001-000	BEVIS, G.C.	******	66.31'	3/28/98	11:20A	GARAGE = 66.06'	
7399-000-000	KANAPAHA RANCH	TOMMY HICKS	61.58' (MOBILE HOME)	3/28/98	11:40A	OLD BLK. HOME = 63.02'	WATER SURROUNDS MOBILE HOME
7398-009-000	NORRIS, R.R.	NOT HOME	62.16'	3/28/98	2:25P		WATER SURROUNDS HOUSE
7397-004-007	BISHOP, RICK	******	64.83'	3/28/98	2:40P	BARN = 61.13'	
7398-007-000	BELLAH, KAREN	******	61.14'	3/28/98	3:00P		WATER UP TO RESIDENCE
7398-006-000	TAGG, JOSEPH	NOT HOME	62.86'	3/28/98	3:25P		
7397-004-013	CASTANOS & LEROY	******	65.78'	3/28/98	3:50P		
7397-004-003	CARPENTER	******	65.84'	3/28/98	4:10P		
7398-010-043	CLUBHOUSE		62.01'	3/28/98	9:28A		
7398-010-008	KANAPAHA	EMPTY HOUSE	64.40'	3/28/98	9:33A		
7398-010-005	MORAN, J	NOT HOME	64.28'	3/28/98	9:35A		
7398-010-010		NEW HOUSE	65.74'	3/28/98	9:42A		
7398-010-011	DEAN, PATRICIA	NOT HOME	64.39'	3/28/98	9:49A		
7398-010-012		NEW HOUSE	64.32'	3/28/98	9:52A		
7398-010-013	BJORN, T.G.	NOT HOME	64.09'	3/28/98	10:00A		
7398-010-042	MORRIS, CHARLES	NOT HOME	64.31'	3/28/98	10:10A		
7398-010-039	STONE &THOMPSON	NOT HOME	66.90'	3/28/98	10:15A		
7398-010-038	MADRY, R.F.	NOT HOME	66.73'	3/28/98	10:17A		
7398-010-037	BEDNAR, BRIAN	******	66.51'	3/28/98	10:24A		
7398-010-014	VAHLE, KURT	******	64.42'	3/28/98	10:44A		
7398-010-015	McIVER, L.L.	NOT HOME	64.57'	3/28/98	11:05A		
7398-010-016	McIVER, L.L.	NOT HOME	63.62'	3/28/98	11:09A		
7398-010-017	BEAUMONT, BEV.	******	64.07'	3/28/98	11:17A		
7398-010-019	UDY, R.W.	NOT HOME	65.01'	3/28/98	11:22A		
7398-010-020		NEW HOUSE	65.17'	3/28/98	11:29A		
7398-010-021	KOPPEL, HAROLD	******	62.71'	3/28/98	11:40A		
7398-010-022	SINGLETARY, R.D.	NOT HOME	65.16'	3/28/98	11:52A		
7398-010-023	KNAVEL, BERKERY	NOT HOME	64.56'	3/28/98	11:57A		
7398-010-034	PIERCE, R.F.	******	64.20'	3/28/98	12:15P		
7398-010-026	BOOTH	NOT HOME	63.38'	3/28/98	12:19P		
7398-010-027	CULVER, J.P.	NOT HOME	64.61'	3/28/98	12:20P		
7398-010-029	KORTRIGHT	NOT HOME	63.62'	3/28/98	12:26P		
7398-010-032	THALMANN JOHN	******	66.39'	3/28/98	12:32P		
7398-010-003		NEW HOUSE	64.41'	3/28/98	1:08P		
7398-012-000	HUFFMASTER	NOT HOME	65.68'	3/28/98	1:38P		
7398-013-000	BULLOCK, DAVID	NOT HOME	63.27'	3/28/98	1:49P		
7398-008-000	NEUBERGER, P.W.	******	66.06'	3/28/98	2:04P		
7398-010-008	KANAPAHA	NOT HOME	62.87'	3/28/98	1:30P		
7397-004-008	SARTAIN, J.B.	NOT HOME	68.16'	3/28/98	2:55P		
7397-004-011	KINSLER, J.R.	NOT HOME	66.46'	3/28/98	3:24P		

CAUSSEAUX ELLINGTON INC.

FINISH FLOOR ELEVATION REPORT

TAX PARCEL	OWNER	MET ON SITE	F.FLOOR ELEV.	DATE	TIME	OTHER STRUCTURES SHOT	COMMENTS/EXPLANATIONS
7397-004-009	KAHL, ROBERT	******	COULD NOT GET	3/28/98	3:24P		PERSON ON SITE REFUSED ACCESS
7397-004-015	CARTER, JAMEY	NOT HOME	65.71'	3/28/98	3:50P		
7397-004-012	******	MYERS, CHRI	65.05'	3/28/98	4:25P		
7397-004-010	?????	NOT HOME	64.24'	3/28/98	4:31P		
7376-001-000	WALKER, STEVE	******	66.22'	3/29/98	8:12A	GARAGE = 65.58'	
7376-001-001	PERDUE, DAISY	******	64.92'	3/29/98	8:40A		
7368-002-000	?????	NOT HOME	65.80'	3/29/98	8:17A		
7353-006-000	TOMLIN, TERRY	NOT HOME	64.93'	3/29/98	9:25A		WATER +/- 50' FROM HOUSE
7353-015-000	BLOOMQUIST	******	61.00'	3/29/98	9:45A	GARAGE = 61.38'	WATER UP TO HOUSE
7353-005-000	SHELDON, H.A.	******	69.41'	3/29/98	10:00A		
7353-011-000	KORHNAK, L.V.	******	70.01'	3/29/98	11:15A	BARN = 69.01'	
7353-008-000	NOYES, WARD	******	58.88'	3/29/98	11:15A		HOUSE UNDER WATER