City of Cape Coral
Gator Slough
Storm Water Model

Final Report

by

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Executive Summary

The purpose of this model report is to evaluate the flood stage implications of a one- foot increase in the crest elevation of several weirs in the Gator Slough canal system. The objective of this crest change is to store more water in the water table and canals during the wet season for use during the following dry season. The model was constructed using the Storm Water Management Model developed by XP-Software (XP-SWMM2000).

The modeling objectives are to run the 5, 25, and 100-year storm events and estimate the flood stages for these events with and without the crest elevation changes. The project area is located in Cape Coral City, between Pine Island Road (S.R. 78) and the northern edge of Lee County. Canals included in the model are Gator Slough, Shadroe, Horseshoe and Hermosa. The land area modeled in detail measures 25 square miles and is bounded by U.S. 41 on the east, Pine Island Road on the south, Matlacha Pass on the west and the Cape Coral city limits on the north. The contributing watershed to the east of U.S. 41 is approximately 33 square miles of low-density residential and undeveloped lands. This area was incorporated into the model through historical (USGS) and stochastically generated flow data sets. These input hydrographs provide boundary inflow to the modeled watershed of Gator Slough. The model was calibrated using a 24-day data set collected between 5th and 28th of September, 1996. This was considered to represent a one-year storm event. Another 24-day period (July 12th to August 4th, 2001) provided the verification data corresponding to a 25-year event. The calibrated/verified model was then run for three design events:

(i) 5-year, one-day rainfall event of 5.2 inches
(ii) 25-year, three-day rainfall event of 10.6 inches
(iii) 100-year, three-day rainfall event of 12.91 inches

These events were simulated first with the target weir crests (Weirs #11, 13, 14, 15, 19) set to their existing conditions. The model simulations were repeated with the

weir crests raised by one foot. Interconnections between sub basins 6 and 7, sub basins 7 and 9, and sub basins 9 and 10 were not included in the model since preliminary modeling show low gradients between the areas. Thus inclusion of these interconnections would provide little additional model performance enhancements. Also not included in the model is a Transfer Pump Station, which conveys water from Basin 9 to Basin 4.

When compared to data collected by USGS corresponding to a 5-year rainfall event, model flow volumes were 14% less than measured flow values on Gator Slough. Only one rainfall station was available to represent the entire 25 square miles watershed. Agreement was very good (less than 8% difference) between XP-SWMM predicted peak flow (764 cfs) for Gator Slough at S.R. 765 and the Gumbel estimates generated from USGS measured data (826 cfs). Simulated water surface elevations were approximately 0.1 foot above USGS measured values. XP-SWMM water surface elevations were less than 0.5 feet below Johnson Engineering estimates [1]. The previous Johnson Engineering modeling study was conducted using the HEC-2 program. The Johnson Engineering model was not subject to calibration using measured data. Thus, it is not surprising that the new XP-SWMM dynamic routing model delivers results that show much better agreement with stage and flow data measured by the USGS.

When compared to the verification event data collected by USGS (very similar to the 25-year design event), model flow volumes were 17% less than measured data on Gator Slough. Simulated water surface elevations were approximately 0.5 feet above measured values. However when compared to Johnson Engineering modeling results, the 25-year XP-SWMM water surface elevations were 3 feet below Johnson Engineering estimates, derived from the HEC-2 model. Agreement was very good (less than 1.5% difference) between XP-SWMM predicted peak flow (1300 cfs) for Gator Slough at S.R. 765 and the Gumbel estimates generated from USGS measured data (1281 cfs)

When the model was extended to the 100-year event, XP-SWMM simulation generated water surface elevations 3 feet below Johnson Engineering's estimates. When the target weir crests were raised, the 100-year XP-SWMM model generated water surface profiles that increase from a minimum of 0.0 feet (almost no change) at

U.S. 41 to a maximum of 0.6 feet at Weir #11. However these increased water surface elevations were still below the pre-modification Johnson Engineering HEC-2 model results. Agreement was very good (less than 2.2% difference) between XP-SWMM predicted peak flow (1692 cfs) for Gator Slough at S.R. 765 and the Gumbel estimates generated from USGS measured data (1656 cfs).

Based upon results of the new XP-SWMM simulation of the Cape Coral canal system, very little additional flooding is expected to result from raising the target weirs. Furthermore, all design event flood stages associated with the raised weir conditions are still well below the previously predicted values. Therefore, if prior Johnson Engineering HEC-2 model estimated water surface profiles were deemed acceptable according to flood stage criteria, then the post-modification water surfaces as predicted by XP-SWMM should also be acceptable. The reliability of these XP-SWMM results is supported by favorable comparisons with USGS measurements. In fact XP-SWMM results are still conservative relative to City of Cape Coral measured stage data for a 25-year event documented in July 2001. The XP-SWMM predicted water surface elevations for this event were approximately 3 feet above measured stages over the middle and upper reaches of Gator Slough.

Results of the XP-SWMM model implementation on the Gator Slough, Horseshoe, Hermosa and Shadroe canals of Cape Coral show very little additional flooding due to increasing weir crest elevations by 1 foot at Weirs 11, 13, 14, 15 and 19. For the 100-year design simulations, water surface profiles increased by a maximum of 0.6 foot in a limited reach of Gator Slough between Burnt Store Road (S.R. 765) and Chiquita Boulevard. Horseshoe canal showed a slightly greater stage increase (0.8 foot) along the lower reach between Burnt Store Road and Chiquita Boulevard. Hermosa and Shadroe canals showed little change for flooding in their downstream reaches between Burnt Store Road and Chiquita Boulevard.

The modeling results presented in this report show a worst-case scenario. These conditions should not actually occur assuming the Operating Protocol Table procedures are followed, as developed and presented in the City of Cape Coral project permit application document. This table provides conditions for the City to add or remove 1-foot stop logs in response to monitored water levels in the canals.

1.0 INTRODUCTION

1.1 Project Purpose and Scope of Work

The City of Cape Coral proposes to raise the crest elevations of some of the several weirs in the Gator Slough fresh water canal system to create additional storage availability for wet season storage and dry season drawdowns. One potential problem associated with this proposal is higher tail-water elevations in the drainage system, which may result in increased flooding. The objective of this storm water model is to evaluate the canal system enhancement plan of raising crest elevations at Weir numbers 19, 15, 14, 13 and 11 under design storm events. Interconnections between sub basins 6 and 7, sub basins 7 and 9, and sub basins 9 and 10 were not included in the model since preliminary modeling show low gradients between the areas. Thus inclusion of these interconnections would provide little additional model performance enhancements.

As agreed at the planning meeting between the South Florida Water Management District and City of Cape Coral on October 16, 2000, the Storm Water Management Model developed by XP-Software (XP-SWMM2000) was used in this study to simulate a scenario of one-foot higher elevation for the selected weirs. The simulated water levels then will be compared to the elevations of the existing structures such as roads, septic tanks, and residential houses to determine whether the elevated weirs cause any additional flooding. The three design storm events designated for this project are the 5-year 1-day, 25-year 3-day, and 100-year 3-day storm events.

1.2 Watershed Boundary

Cape Coral is located in western Lee County on a peninsula bounded on three sides by waters of the Caloosahatchee River and Matlacha Pass. Cape Coral is bounded on the north by undeveloped land. The analyzed areas are the watersheds basins within Cape Coral located north of Pine Island Road (S.R. 78) and west of U.S. 41. It covers an area extending north to the Lee County line and 7 miles beyond. The area constitutes a single drainage basin, since the North Spreader Waterway receives the discharge from all Cape Coral canals north of Pine Island Road.

Eight recharge basins (1, 2, 3, 4, 6, 7, 9, and 10) were considered in the model. The Gator Slough watershed also includes a thirty-three square mile undeveloped drainage basin located northeast of the city limits (see Figure 1), which was not a part of the project but is included in the hydrologic simulation model.

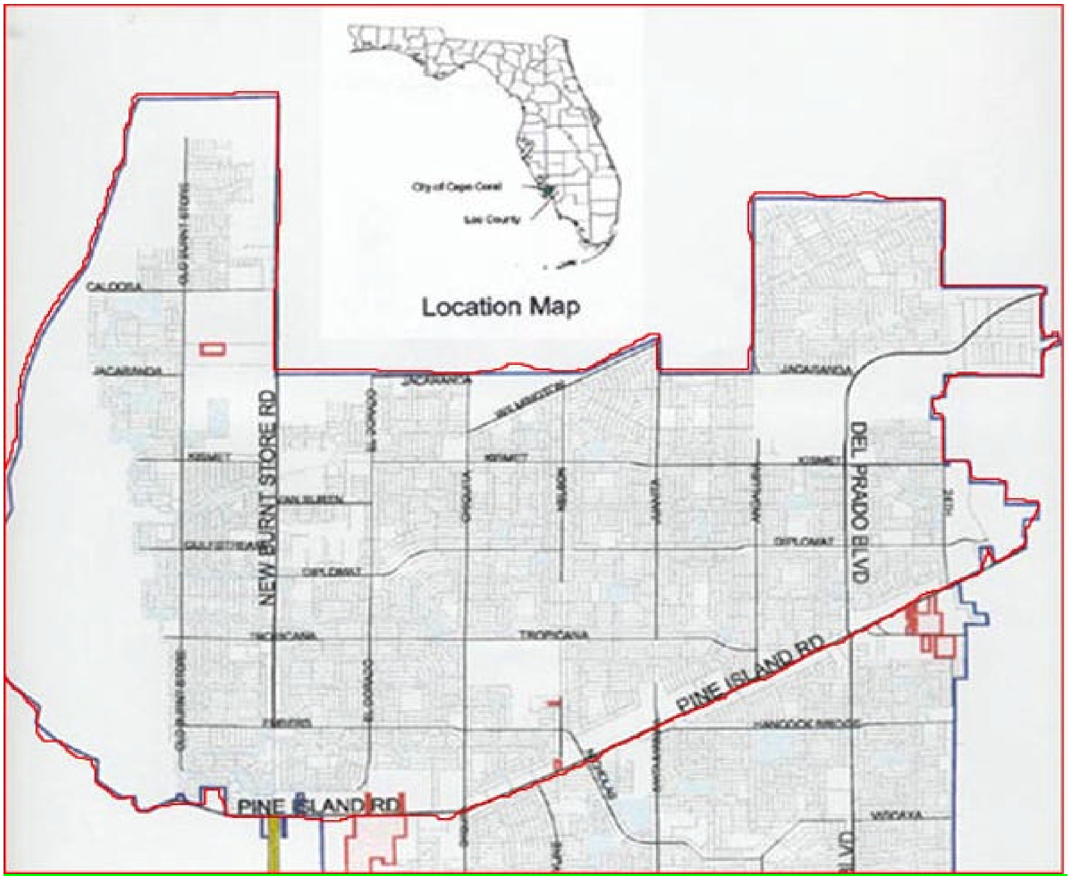

Figure 1. Map of the watershed.

2.0 GATOR SLOUGH WATERSHED AND AREA HYDROLOGY

2.1 Area Hydrology

The Gator Slough canal system watershed is located in the northwest area of Lee County and covers an area of approximately fifty-eight square miles in the counties of Lee and Charlotte. An additional thirty-three square miles are within Charlotte County mostly within the Cecil Webb Wildlife Management Area. As agreed in the planning meeting with SFWMD, this modeling study focused mainly on the Lee County portion of watershed (starting west of U.S. Highway 41). Data from the U.S. Geological Survey gauging station at U.S. Hwy 41 were used to represent runoff water entering into Lee County from the Webb Wildlife Area. The east boundary in Lee County is along portions of an abandoned railroad and U.S. 41, the south boundary is Pine Island Road, the west boundary is the Cape Coral perimeter canal. This perimeter canal outfalls to a mangrove marsh, which in turn flows to Matlacha Pass [1]. The Lee County portion of the main Gator Slough canal watershed, utilized for the calibration of the model, is relatively narrow, varying from one to three miles in width. The complete drainage basin includes Gator Slough plus three other main canals, Horseshoe, Hermosa, and Shadroe, and their secondary branches. It is about six miles in width.

The watershed is channelized for its complete length from the Lee-Charlotte County Line to the perimeter spreader waterway system in Cape Coral adjacent to the salt marsh/mangrove estuary. This spreader system was built by the developer of Cape Coral to help reduce the impact of direct flow out of the canals to the estuary in the 1970's [2].

The spreader system is a canal that parallels the salt/marsh mangroves zone with the purpose of causing the water to sheet flow into the wetlands. It also provides additional salinity control for the canals which discharge into it.

Most of the Cape Coral area in this watershed has been previously cleared for future residential area. More water can be expected to enter the system as northern Cape Coral builds out. This study's simulation has been kept consistent with current conditions. All of the existing natural wetlands on the west side of U.S. 41 are north of the main Gator Slough canal flow-way. The City of Cape Coral's canal system could be used to divert and store fresh water from the main flow-way. The final purpose of this study is to verify and quantify the opportunity of raising two weirs in the main flow-way (Gator Slough) as well as three weirs in the other main canals to retain additional runoff water. Diverting water into more of the Cape Coral canal system by raising weir elevations would be consistent with several Lee County Plan policies and would likely increase estuarine productivity, decrease the impacts of excessive fresh water discharge and increased fresh water storage.

The type of development and the general canal conditions affects the hydrology of the basin. The watershed has experienced growth in the eastern portion of its Lee County area since the late 1970's, and is currently estimated to be about 30% developed. The majority of the watershed in Lee County is just north or within the City of Cape Coral. The area within the city consists entirely of single–family residential development. The remainder of the watershed in Lee County is shown in the Lee County Comprehensive Plan as "Open Lands" with some "Resource Protection-Transition Zone" and "Suburban". The majority of the unincorporated area within the watershed is sparsely developed. Most of the single-family residential development within the watershed has little or no surface water detention [3].

The topography within the watershed varies in elevation from about +7 feet NGVD at the western boundary of Cape Coral to about +10 feet NGVD at Chiquita Boulevard, then to about +17 feet NGVD at Andalusia Boulevard, with about +24 feet NGVD at the north end of the Lee County portion of the watershed. Certain areas around U.S. 41 experience over bank flooding in the medium to large storm events. The average ground slope in both Lee and Charlotte Counties is about one foot per mile.

The majority of the upper reaches of the watershed must convey runoff via overland flow. Runoff from the remainder of the watershed is over large sheet flows areas or from residential areas noted above, directly to the channel. The runoff from the developed area is directed to the conveyance via overland flow or through ditches and/or culverts.

There are several tributary canals directly discharging to Gator Slough. These canals convey much of the northern portion of Cape Coral's surface water runoff. There are no water control structures on most of these tributary canals; therefore runoff is fairly rapid from developed areas. Canals that connect further downstream have some controls [3]. Depending on the canal water levels, water can flow in or out of the main canal. Therefore the links created to mimic the canal system include no flap gates. Bypassing of water control structures in the main canal is also possible. The watershed boundary was set to be reasonably consistent with the canal system design. Uneven rainfall pattern and/or other hydrological events and conditions could cause flow differences in the main canal. It was assumed that runoff would not be diverted in or out of the watershed.

In order to fully analyze the hydrologic characteristics of this watershed, it is necessary to consider the portion of watershed in Charlotte County. It extends into the Cecil Webb Wildlife Management Area north of Tucker's Grade. This area is the headwaters for the Gator Slough Watershed. By its very nature, the Webb Wildlife Management Area has not been and will not be developed. It is a natural flat prairie area that historically has sheet flowed south into Lee County and Gator Slough [1]. Monthly discharge coming from this portion of the watershed located north and east at Hwy U.S. 41 has been statistically evaluated and established as inflow data for the Gator Slough at its most upstream point (node 31) of the simulated canal system, just before the quadruple 10 feet x 6 feet box culvert under U.S. 41. Data obtained from United States Geological Survey gauging station located 0.5 miles west of U.S. 41, named "Gator Slough at U.S. 41 near Ft. Myers, FL" were used to represent runoff water entering into Lee County.

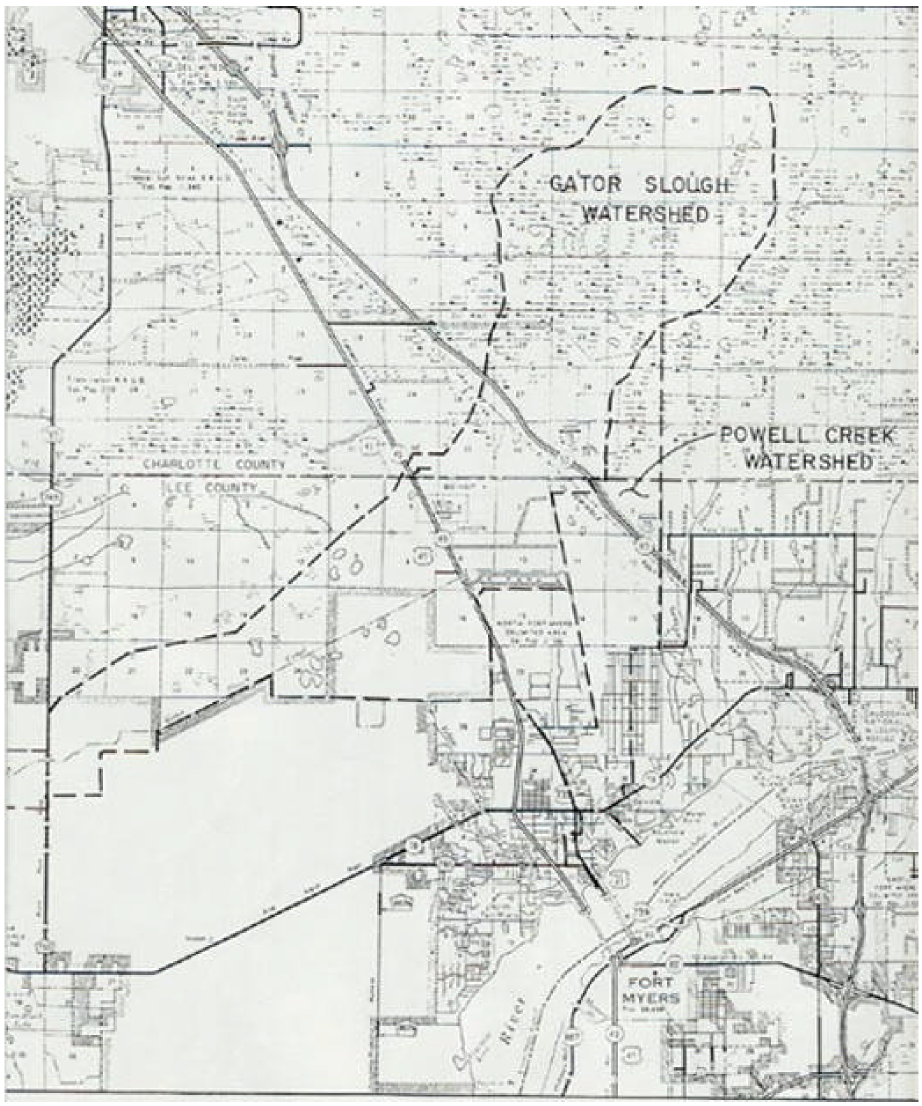

Figure 2. Gator Slough Watershed showing portions west and east of U.S. 41.

2.2 Conveyance Elements

The conveyance elements within Lee County for the Gator Slough Watershed consist of a main channel length of a little over ten miles, with an associated upstream sheet flow area. There are several culverts, bridges and weirs along the primary conveyance.

During the development of the City of Cape Coral, the canal was constructed to replace the broadsheet flow that was the original cross section. The conveyance is an excavated channel from its outflow into the City of Cape Coral's western perimeter canal to about 4,500 feet upstream of U.S. Hwy 41. The Gator Slough main channel is approximately 200 feet wide in the reach from Burnt Store Road to a point one-half mile west of U.S. 41. In this last one-half mile it narrows considerably to about 30 feet wide with several with several shallow areas in this vicinity.

In its downstream reaches, Gator Slough is interconnected with the City of Cape Coral's canal system. The canals connected to Gator Slough convey water to and from it. Some of the connecting canals have no water control structures at their confluence with the Gator Slough channel, others are culvert connection and some have weirs for control of elevation and quantity of flow [1].

At its downstream origin, Gator Slough has a bottom elevation of about – 6.5 feet NGVD. This elevation rises to about – 4 feet NGVD at Burnt Store Road. From Burnt Store Road east, the bottom elevation rises from – 4 feet NGVD to about +4 feet NGVD at Nelson Road. The channel bottom remains at a relatively constant elevation up to a point about one-half mile west of U.S. 41. At that point, the bottom rises sharply to about +11 feet NGVD. The bottom elevation at the upstream end of the Lee County portion of the watershed is approximately +21 feet NGVD.

Downstream of Burnt Store Road, the conveyance is controlled by tidal conditions. The Burnt Store Road weir was installed in 1972 and provides a salt-water barrier. It also helps to maintain higher groundwater elevations upstream during the dry season.

Most of the channel downstream of Burnt Store Road is relatively clear of debris and aquatic vegetation. The side slope vegetation varies depending on location. There are very few seawalls along the conveyance. Most of the channel side slopes are vegetated; some being maintained by the property owners while other areas are covered with Brazilian pepper and scrub vegetation [4].

The excavated channel upstream of Burnt Store Road to Chiquita Boulevard is of a fair uniform cross section. The channel from Chiquita Boulevard to Juanita Boulevard is about half the width of the channel downstream and upstream.

The channel contains excessive amounts of vegetation along most of its length from Burnt Store Road weir to the Lee County / Charlotte County line. In many places, this vegetation completely extends the complete width of the channel. The side slopes are covered with scrub brush and sporadic pepper trees. Most of the vegetation in the channel consists of cattail and other plants attached to the bottom [1].

Thirty percent of the non-Charlotte County portion of this watershed consists of single-family residential development within the City of Cape Coral. About half of the watershed in Lee County is undeveloped with the remainder in mobile home parks or sparse residential. Since most of the residential development along the channel occurred prior to current regulations, much of the flood plain in Lee County has been encroached upon and filled in the developed areas. There has been very little development in this watershed within Charlotte County. Most of the Charlotte County area is within the Cecil Webb Wildlife Preserve.

Gator Slough is currently being enhanced to provide additional water to the City. A description of the major canal components in Gator Slough and the modifications currently in progress or proposed is presented as follows [4]:

Gator Slough has been dredged to clear weeds and promote flow. The profile from where the Slough enters the City to 8 feet below the top of Weir #9 has been cleared of rock to provide unimpeded drainage flow. This has increased the flow to Cape Coral from the Slough. However, flow records show that there is little flow in the Slough during the dry season. Therefore, the change in profile would only allow some water into the Cape Coral system during the rainy season or after rain events.

Basin 1, the first canal basin that the Slough enters, contains a substantial amount of canal surface area in addition to the Slough. Weir #19 (elevation 10.37 feet) discharges from Basin 1 to Basin 2, which comprises only Gator Slough canal. The water from Gator Slough in Basin 2 can flow over Weir #9 (elevation 8.5 feet) continuing over Gator Slough or flow over Weir #58 (elevation 8.35 feet) entering Basin 4. Weir #9 is a rectangular weir that zigzags diagonally across the channel. Hence it is know as the Zigzag weir. Downstream from Basin 2, a balance structure in Gator Slough transfers water by gravity flow through four 36-inch culverts from Basin 4 to Gator Slough. Gator Slough flows through Basins 1,2,4 and 6, eventually discharging to North Spreader Canal System

Structural details

The following is a brief synopsis of each structure along the Gator Slough conveyance as given by Johnson Engineering, Inc., Camp Dresser & McKee

Inc., Hole, Monte & Assoc., and W. Dexter Bender & Assoc. (1991) [1]. Appendices C and D give the respective diagrams for some of these structures.

Bridge 74

The most downstream structure is located at Old Burnt Store Road, east of the perimeter canal outfall. The structure consists of a pair of concrete bridges, each 102 feet long with a load elevation of +12.3 feet NGVD. There are two sets of concrete support pilings at this structure.

Bridge BS

This is a 156 feet long concrete bridge at Burnt Store Road. The road elevation is about +10.8 feet NGVD. There are five sets of concrete support pilings in the channel.

Weir #11

This is the Burnt Store Road weir. It is a reinforced concrete weir, which has a crest elevation of +2.4 feet NGVD with a length of 175 feet. There is no notch in the crest. There is one slide gate on the south end of the weir. See Appendix C1.

Bridge 94

El Dorado Boulevard crosses over a 27 feet x 14 feet concrete box culvert. The top of road elevation over the structure is about +13.4 feet NGVD. The invert elevation of the culverts is – 3.1 feet NGVD. There is no center column.

Weir #4

This is the Chiquita Boulevard weir. It is a reinforced concrete weir that has a crest elevation of +6.3 feet NGVD with a length of 230 feet. This is a polygonal weir resembling interconnected boxes. The bank-to-bank distance perpendicular to the flow is 140 feet. There is no notch in the crest. There are no gates at this structure. It is modeled as 'user defined' exponential rating curve with length 230 feet at depth 0.0 feet to length 120 feet at depth 2.0 feet.

Culvert #4

Two 27 feet x 9 feet concrete box culverts provide the Chiquita Boulevard crossing. The top of road elevation over the structure is about +12 feet NGVD. The invert elevation of the culverts is +0.4 feet NGVD.

Weir #9

This is the Nelson Road weir. It is a reinforced concrete weir that has a crest elevation of +8.5 feet NGVD with a length of 220 feet. The weir shape resembles a set of stairs across the canal. The weir length is the wetted perimeter along the channel. The bank-to-bank distance perpendicular to the flow is 120 feet. There is no notch in the crest. There are no gates at this structure. It is modeled as 'user defined' exponential rating curve with length 220 feet at depth 0.0 feet to length 140 feet at depth 2.0 feet.

Weir #19 / Box Culvert

This is the structure at Andalusia Boulevard. It is a double 24 feet x 10 feet concrete box culvert, which incorporates a 46 feet long (92 feet of total length) weir structure located diagonally inside each box culvert. The flow over the weir crest is at an angle to the stream flow. The weir crest elevation is +10.37 feet NGVD. The top of road elevation over the box culvert is approximately +16.7 feet NGVD. It is modeled as a double 'user defined' weir with length 46 feet at depth greater than 5.4 feet (crest of 10.1 feet minus invert of 4.7 feet) and 0.0 feet length at depth less than or equal to 5.4 feet. See Appendix C11.

Box Culvert - West Gator Circle

A single 20 feet x 14.6 feet concrete box culvert at West Gator Circle is the next structure upstream from Andalusia. The top-level elevation over the culvert is about +21.0 feet NGVD. The invert elevation of the culvert is about +4.4 feet NGVD.

Box Culvert – East Gator Circle

This is a single 15 feet x 14 feet concrete box culvert at East Gator Circle. The top of road elevation over the culvert is about +20.4 feet NGVD. The invert elevation of the culvert is +4.5 feet NGVD.

Box Culvert - Garden Boulevard

The Garden Boulevard crossing is a single 15 feet x 14 feet concrete box culvert. The top of road elevation over the culvert is about +20.6 feet NGVD. The invert elevation of the culvert is +4.1 feet NGVD.

Box Culvert – U.S. 41

This is a quadruple 10 feet x 6 feet concrete box culvert at U.S. Hwy 41. The top of road elevation over the culvert is about +23.1 feet NGVD. The invert elevation of the culvert is about +13.1 feet NGVD.

2.3 Control Structures

2.3.1 Gator Slough Canal

Three water control structures are located downstream of Weir #19: Weir # 9, 4 and 11. Downstream of Weir #11 there is one culvert and one bridge (# 94).

Upstream of Weir #11, there are two other bridges (#74 and BS). Bridges and culverts are located on both the main channel and the branch canals.

- Weir #9 stair steps across the canal. It is represented as a rectangular weir without end contraction [2].
- Weir #4 is a reinforced concrete rectangular weir without end contraction [1].
- Weir #11 is a reinforced concrete rectangular weir without end contraction. There is one slide gate on the south end of the weir [2].
- Weir #19 is a rectangular weir with end contraction enclosed in two box culverts, one upstream and the other downstream.

For flow rate in cubic feet per second, length and head in feet, the discharge equation for a rectangular weir without end contraction is:

$$Q = C*L*H^{1.5}$$

where C = discharge coefficient

L = weir length

H = head

2.3.2 Secondary Canals

Horseshoe Canal

Three water control structures: Weir #21,16 and 13. It has 18 bridges and/or culverts upstream of Weir #13 and one bridge downstream of Weir #11. Bridges and culverts are located on both the main channel and the branch canals.

- Weir #21 is a reinforced concrete drop-inlet culvert [2].
- Weir #16 is a reinforced concrete rectangular weir without end contraction and connected to a 4-pilling bridge [2].
- Weir #13 is a reinforced concrete rectangular weir with end contraction [2].

Hermosa Canal

Two water control structures: Weir #17 and 14. It has 11 bridges and/or culverts located upstream of Weir #14 and one bridge located downstream of Weir #14. Bridges and culverts are located on both the main channel and the branch canals.

- Weir # 17 is a reinforced concrete rectangular weir without end contraction connected to a 4 pilling bridge, type D [2].
- Weir # 14 is a reinforced concrete rectangular weir without end contraction [2].

Shadroe Canal

Two water control structures: Weir #18 and15. It has 3 bridges located upstream of Weir #15. Bridges and culverts are located on both the main channel and the branch canals.

- Weir #18 is a reinforced concrete drop-inlet culvert [2].
- Weir #15 is a reinforced concrete rectangular weir with end contraction [2].

2.3.3 Branch Canals and Spreader Waterway

Three water control structures were inserted in the branch canals: Weir #58 and Weir #5 and 15N, which belong to the Spreader Waterway, located at the west-most side of the watershed.

- Weir #58 is a rectangular weir with end contraction and connected to 7 CMP pipes [2].
- Weir # 5 is assumed as a rectangular weir without end contraction,
- Weir # 15N is assumed as a rectangular weir without end contraction,

For flow rate in cubic feet per second, length and head in feet, the discharge equation for a rectangular weir with end contraction is:

$$Q = C*(L - 0.2*H)*H^{1.5}$$

2.3.4 Other Structures

(1) Canals Interconnection A: Conduit between Gator Slough (Chase Canal) and Horseshoe (Pomeroy Canal): 4 feet reinforced concrete pipe, length 1205 feet, Manning factor 0.014 [3].

(2) Canal Interconnection C: Conduit between Horseshoe Canal and Hermosa (Atkinson Canal): 4 feet reinforced concrete pipe, length 800 feet, Manning factor 0.014 [3].

(3) Canal Interconnection D: Conduit between Hermosa (Mohawk Canal) and Shadroe (Albatross Lake): 4 feet reinforced concrete pipe, length 2000 feet, Manning factor 0.014 [3].

(4) Balancing Structure - Structure #57: It transfers water by gravity flow from Gator Slough into Basin 4 through 4 open circular pipes (5 feet diameter, 100 feet of length, Manning factor: 0.025) [2]. Flap gates were installed last year to prevent reverse flow from Basin 4 to Gator Slough.

(5) North-South Transfer Pump Station: This has two pumps which convey water from Basin 4 (Regina Canal), north of Pine Road corridor, to Basin 14 (Mackinac Canal) out of the watershed under analysis. It consists of two low head, high volume axial flow pumps and a 36-inch concrete pipeline connecting the two basins. The station is manually operated and is used to replenish basins south of the Pine Island Road Corridor when the system demand is high. The pumps (model NC 3, manufactured by M&W) can deliver a combined 18,000 gpm [4]. Prior modeling assumed the basins south of Pine Island Road were full; therefore the N/S pump station was not activated during the modeling runs. As per information and agreement with Cape Coral City (January 05, 2001) this more conservative approach was used and did not include the N/S pumping station.

Table 1 gives a summary of the weirs in the watershed and their dimensions.

Table 1. Summary table of weirs located in the entire watershed.

Weir #	Location	Length (ft)	Crest elevation (ft)
4	Gator Slough - Chiquita Boulevard	230	6.5
9	Gator Slough - Nelson Road	220	8.5
11	Gator Slough - Burnt Store Road	178 / 175**	2.4
12	Gator Slough - Burnt Store Road	36	2.4
19	Gator Slough- Andalusia Boulevard	92 / 120*	10.5 / 10.1**
58	Gator Slough - Syracuse Canal	62	8.5 / 8.25*
13	Horseshoe Canal-Burnt Store Road	101	2.4
16	Horseshoe Canal-Chiquita Boulevard	100	6.5
21	Horseshoe Canal – Juanita Boulevard	52	8.5
14	Hermosa Canal - Burnt Store Road	83	2.4
17	Hermosa Canal - Chiquita Boulevard	85	6.5
15	Shadroe Canal - Burnt Store Road	99	2.4
18	Shadroe Canal - Chiquita Boulevard	35	5.0

Reference - unless otherwise stated: *A Water Management Study of the Cape Coral Canal Networks, Lee County, Florida*, Connell, Metcalf & Eddy, January 1979 [2]

**Environmental Resource Permit Staff Review Summary – Gator Slough Enhancements*. Boyle Engineering Corporation, March 2000.

***Lee County Surface Water Management Plan* (LCSWMP). Johnson Engineering, Inc, 1991 [1]

2.4 Model Geometry and Configuration

2.4.1 <u>Canal Network Configuration</u>

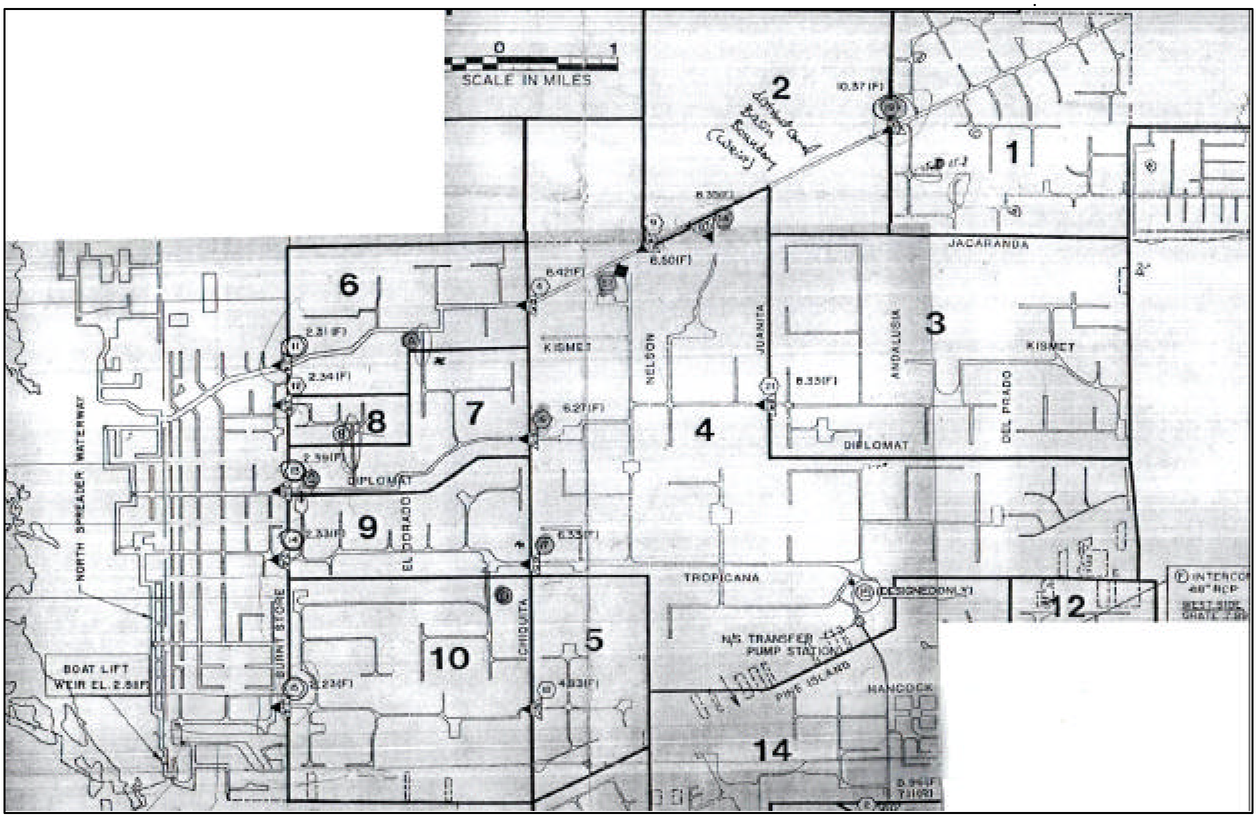

Figure 3. Project canal network area.

For the portion of the watershed north and east of U.S. 41 the model utilizes historical data as the input hydrograph to Gator Slough at its easternmost node. Between Burnt Store Road and U.S. 41 a detailed simulation of the existing canal system was performed. West of Burnt Store Road not all the branch canals were included in the model but their storage volumes were considered at corresponding nodes based on the length and width of the reaches.

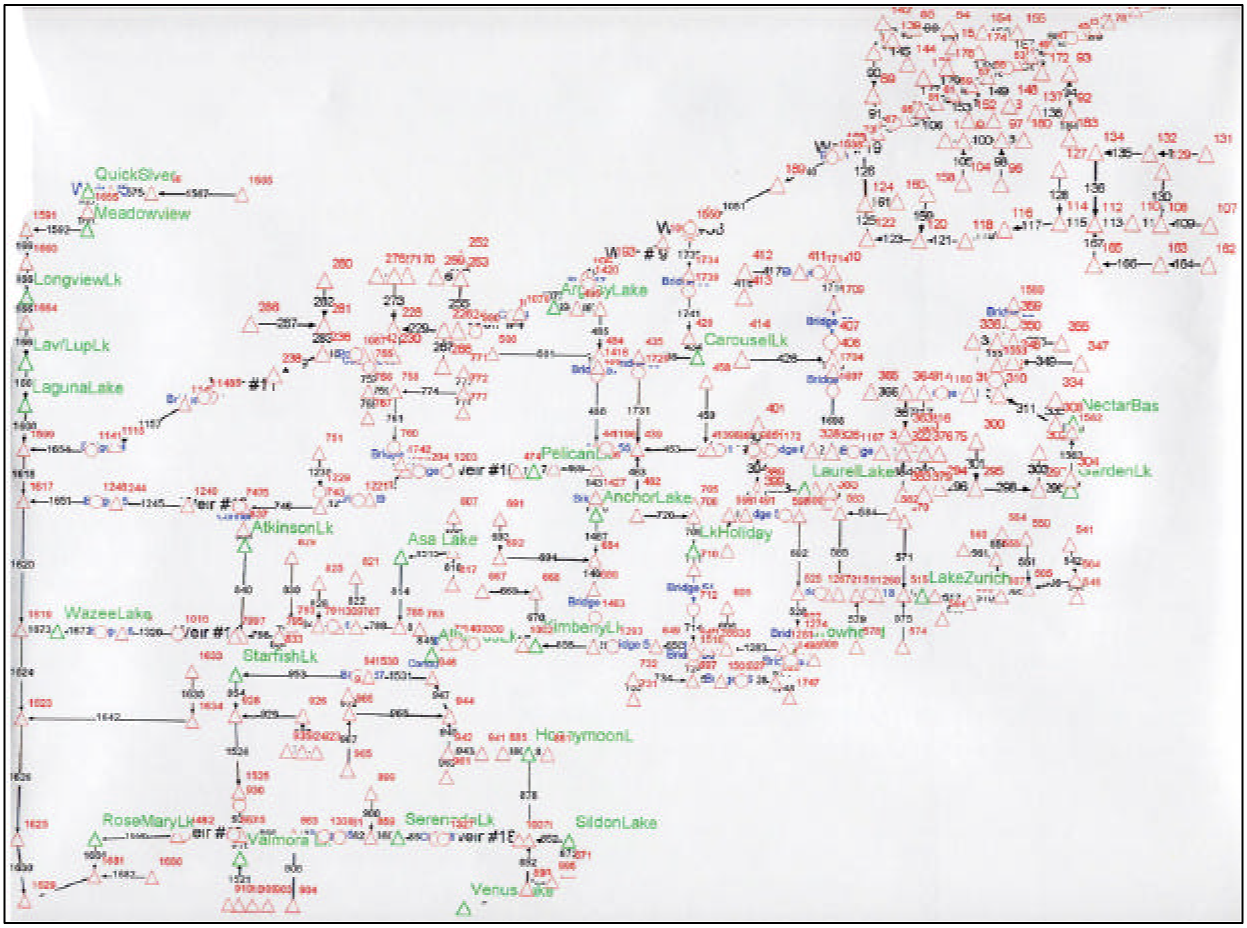

Figure 4. Simulated canal network.

2.4.2 Channel Dimensions and Lakes

The majority of the channel segments have a relatively uniform cross section with abrupt changes at certain locations. The four main channels, Gator Slough, Horseshoe, Hermosa, and Shadroe were scaled as reported by the Johnson Engineering & Co. Master Plan [1]; their branch canals were dimensioned by geometric proportion to the main canals using the City of Cape Coral Drainage Plan maps.

Lakes were inserted using a constant area storage method or a stepwise linear storage method for those cases where data were available. This second option allows use of trapezoidal section of the lakes in developing a stage-storage function.

Most of the links represent natural channels for which the shape and geometries are described through section coordinates, depth and elevation based on the width of the cross section and on the maximum depth of the canal. Main canals cross-section main geometric parameters are given in Table 2.

Table 2. Main channel dimensions [2].

Canal	Bottom width (ft)	Depth (ft)	Bank slope	Bottom slope	Trib. canal bottom slope
Gator Slough	30-200	12	2:1	0.00100 (Weir #9 to Weir #4) 0.00030 (Weir #19 to Weir #11)	-
Horseshoe	90-170	12	2:1	0.00025 (Weir #20 to Weir #13)	0.00100
Hermosa	80-200	10-13.5	2:1	0.00015 (Weir #16 to Weir #14)	0.00016
Shadroe	40-220	11-27.5	2:1	0.000200 (Weir #9 to Weir #4)	0.00016

Nodes are the storage elements corresponding to pipe and channel junctions. The variables associated with a node are volume, head, imperviousness, slope and surface area. Node data are required for every node in the network including regular nodes, storage nodes, pump nodes, and outfall nodes. Node data for the model is given in Appendix A.

2.4.3 Canal Slopes

The channel side slope varies depending on location. For the ground slope for property adjacent to the channels, a mean value of 1 ft/1 mi (0.0002) was assumed. This is consistent with previous Gator Slough studies. A complete list based on the channel elevations found in the City of Cape Coral maps (field information/road design maps) is provided in Table 2.

2.4 4 Storage Areas

Use of the storage option for each node provides additional surface storage for a canal reach, thus better reflecting the storage of excess runoff. When a canal volume is temporary inadequate, water is allowed to pond in the surrounding overbank area until there is sufficient hydraulic capacity within the canal for it to rejoin the network. To achieve this storage effect the maximum spill crest value in the storage node has been raised from the canal crown to a coordinate location determined from the node area width and slope. Beyond this coordinate, any additional water depth is considered lost from the system (to avoid double counting of the storage volume). The main purpose of this project is to evaluate the flood stage and find out any canal banks overflow risks. To obtain this information from the output file for runoff event, each link data set has been provided with a suitable “Maximum Channel Depth”. Combination of raised spill crest in each node and max depth in each link allow us to verify when the canal depth is exceeded by the water level without any loss of flooding area beyond the canal crown.

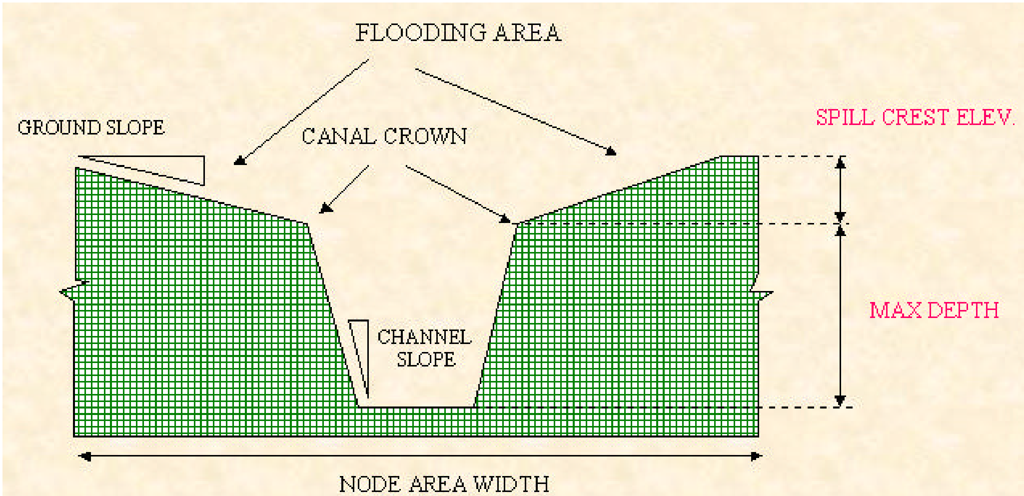

Figure 5. Sketch of a typical canal section.

2.5 Lee County Soils Classification

The majority of Gator Slough Watershed has soils from the following series: Boca, Matlacha gravely fine sand, Oldsmar, Pineda and Wabasso. These soils are all in the B/D hydrologic group except the Matlacha gravely fine sand, which is hydrologic group C. The B classification is for those areas that are well drained. The D classification refers to those areas with a high water table. The C classification has a water table two to three feet below the land surface. Most of this soil group is within the Cape Coral where the land has been reshaped and filled during the development [2]. The measured water elevations in 1990 were similar to the information provided in the *SCS Soil Survey of Lee County, Florida*.

The soil conditions of the Cape Coral area were taken from soil borings and data furnished by the U.S. Soil Conservation Service. Soil borings taken on different sites scattered throughout Cape Coral indicate that in general the uppermost 25 to 40 feet of soil is mostly silica sand, with an estimated porosity of 30%. About half of the sites had thin layers of restrictive material such as sandy silt, silty sand or sand with traces of silt occurring at shallow depths. At the depth of 25 to 40 feet there is a layer of marl, or green clay [1], [4].

According to *The Florida General Soils Atlas*, the soils of Cape Coral are classified as shown in Figures 6 and 7. The soil classification numbers indicated in the figure were defined in a report by *Connell, Metcalf, and Eddy* (1979) [2], as:

No. 2: Immokalee-Myakka-Pompano association: Nearly level, poorly drained sandy soils with weakly cemented sandy subsoil and poorly drained soils, sandy throughout.

No. 3: Adamsville-Pompano association: Nearly level, somewhat poorly and poorly drained soils, sandy throughout.

No. 5: Keri - Ft. Drum - Hallandale association: Nearly level, somewhat poorly drained soils with thin sandy layers over loamy marl under-laid by sandy and poorly drained soils with thin sandy layers over porous limestone.

No. 6: Pompano-Charlotte association: Nearly level, poorly drained soils, sandy throughout.

No. 7: Bradenton-Wabasso-Felda association: Nearly level, poorly drained soils with thin, sandy layers over loamy subsoil; poorly drained sub soils with a weakly cemented sandy subsoil layer under-laid by loamy subsoil and poorly drained sandy soils with loamy subsoil.

No. 8: Salt Water Marsh and Swamp Dunes association: Nearly level, very poorly drained soils subject to frequent flooding by tidal waters and deep droughty sands.

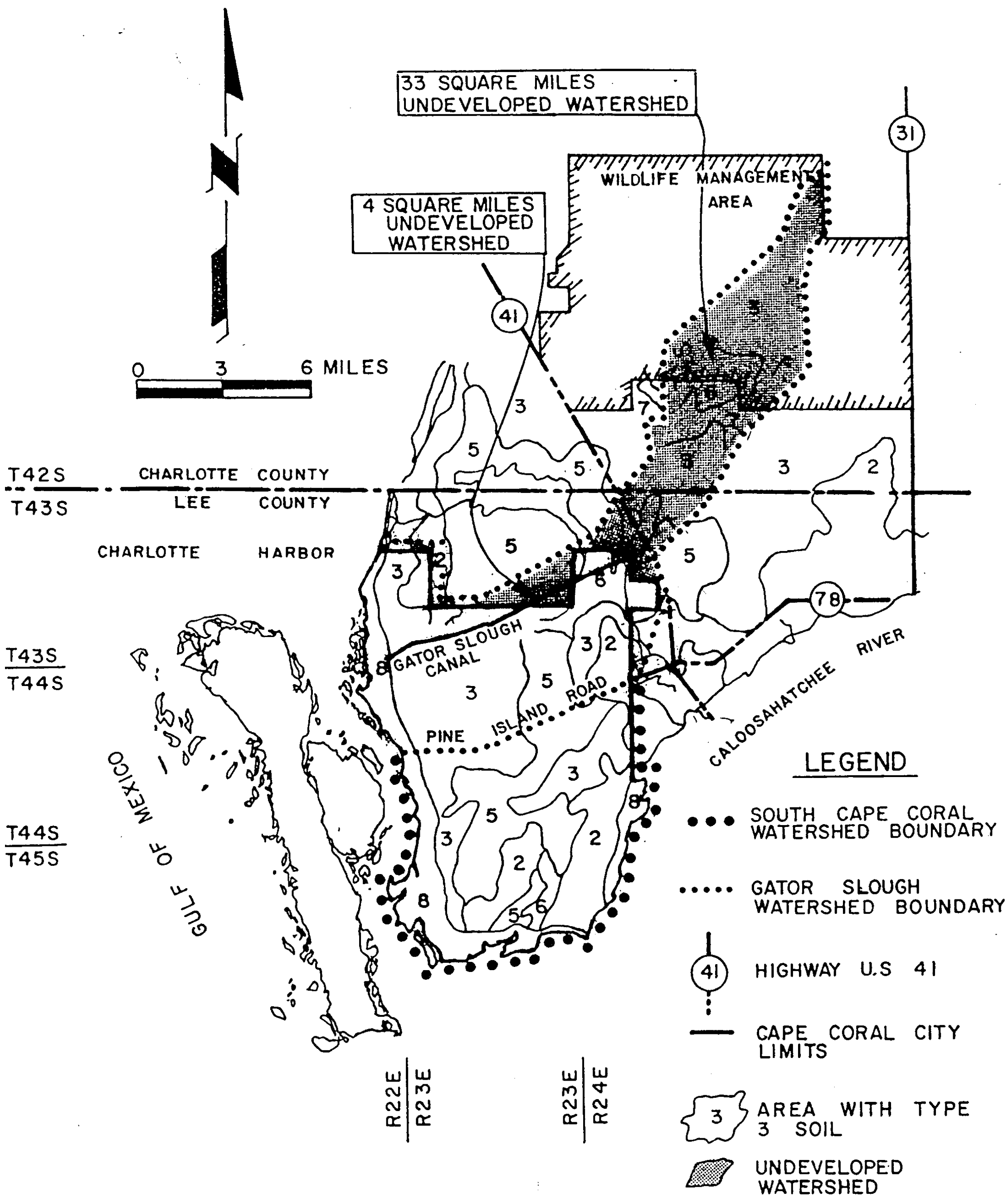

Figure 6. Soils Atlas of Cape Coral.

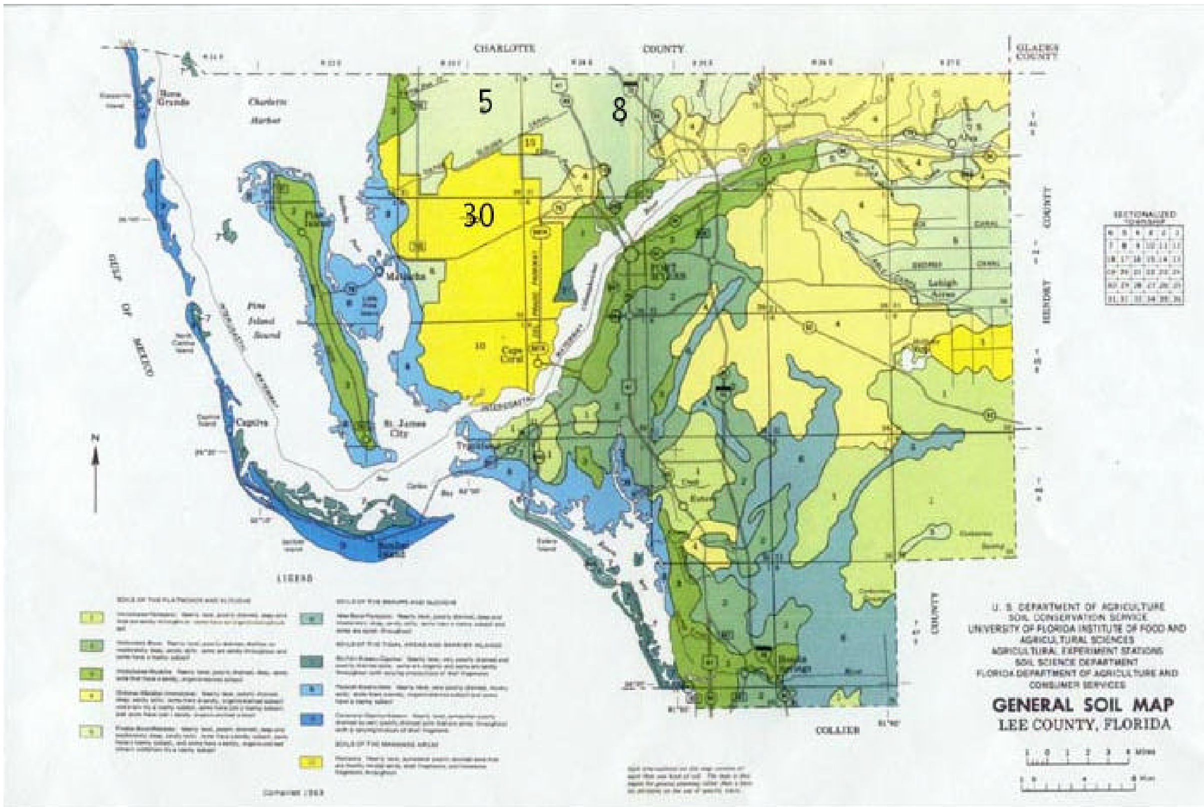

Figure 7. Lee County General Soil Map.

3.0 MODEL CALIBRATION AND RESULTS

3.1 Initial depth

For purposes of initializing the simulation, the water surface profile of the system was assumed to be at the bottom of the canals. This assumption generated zero initial depths in the canal system. Thus, all initial rainfall contributed to filling the empty canals. Using this assumption and implementing the cold restart option that provides very minimal continuity errors.

3.2 Infiltration

Infiltration from pervious areas is computed using the Horton equation. Its parameters were set to the following values, based on review of the soil surveys:

Max infiltration rate	2 inch/hour
Min (asymptotic) infiltration rate	0.1 inch/hour
Decay rate of infiltration	0.00115 sec^{-1}

3.3 Imperviousness percentages

The project area has been subdivided and assigned six different imperviousness percentages based on the projected 1993 functional population [3] computed using the New Jersey equation:

$$I = 9.6\ PD^{(0.53 - 0.0391 \log 10\ PD)} \qquad (3.1)$$

Where:

I = imperviousness [%]

PD = population density in developed portion of the urbanized area (persons/acre)

The New Jersey equation generated very low estimates of impervious percentages therefore alternate estimates were sought. A literature survey of urban area development suggested appropriate imperviousness between 5% and 30% for the Cape Coral area. Only a limited area (751 acres) was designated as high-populated area corresponding to an imperviousness percentage of 34%. These values from the literature survey were used in preference to the New Jersey equation estimates.

3.4 Manning's factor (*n*)

The canal Manning's factors were determined based on the information and photo documentation received from Lee County Environmental Services. The *n* factors used for the channels in tidal reaches of the conveyances were set as 0.03. Generally these conveyances are wide with minimal plant growth in the channel. The *n* factors in the freshwater channel portion of the conveyances located east of Nelson Road was set as 0.07. Fresh water areas tend to be narrower and have more plant growth in the channel than the tidal portions of channels. From Nelson Road due west until Weir #11, 13, 14 and 15 the factors were set as 0.06 or 0.05 [1]. For the overland flow within each subcatchment Manning's *"n"* factors are 0.05 for the impervious portion and 0.20 for the pervious portion.

3.5 Groundwater flow

The XP-SWMM Groundwater option in the present study was used in a less detailed analysis to evaluate its hydrology, focusing overall on the correct evaluation of the interflow/base flow contribution in the outflow hydrograph shape and total volume.

In the City of Cape Coral the aquifer system is comprised of unconsolidated sand or silty sand deposits interbedded with sandy limestone, shell fragments, and sandy clay. It is not under artesian pressure [1], [2]. The aquifer is reported to be approximately 20 feet thick and is under-laid with a thick (59 feet or more) layer of sandy clay. Its hydraulic conductivity varies due to lithologic changes. Results found in literature indicate that the hydraulic conductivity ranges from 10^{-5} and $2*10^{-2}$ feet/sec. The higher values would indicate sand deposits, while the lower values would indicate limestone (References [4]).

The water level in this aquifer rises in response to recharge by local rainfall and seepage from the extensive network of drainage canals. The levels fall in response to losses by evapotranspiration and seepage into the canals, the Caloosahatchee River, and the Bay. Recharge of this aquifer by vertical percolation of rainwater is inhibited in many of the undeveloped and undisturbed parts of Cape Coral because of layer of silt and clay, which exist in places at very shallow depths. This results in areas with locally perched water tables from which much of the rainfall is lost to evapotranspiration rather than infiltration to the water table aquifer.

Groundwater movement is generally radial flow in the Cape Coral area, with flow moving to the west towards Matlacha Pass, and flow directions to the south and east towards the Caloosahatchee River, the canal system, and again Matlacha Pass [4].

Groundwater elevations vary within the watershed. Adjacent to the main canals and their tributaries, water levels are low. This provides for well-drained soil conditions. This well-drained condition is evident from the dry conditions near the canals. Localized ponding of water is often attributable to the fine grain soils rather than an overall high water table. The localized ponding is usually of short duration, typically less than six hours. Wet season water levels farther from the canal, including the area east of U.S. 41, are close to the ground surface as expected. This is especially true in the areas that are not developed with canals and have not had land elevations raised [1].

In the present study the water table was assumed to be 2.0 feet below the natural ground level, to run a steady state groundwater outflow calibration. The groundwater rate that can be withdrawn from the water table aquifer into the canal system by horizontal seepage has been evaluated according to the Dupuit-Forchheimer formula resulting from a head differential of 2.5 feet between the furthermost area of the sub basins and the canals, a distance of approximately ¼ mile.

Vertical percolation is more effective than seepage from the canals in reaching the water table aquifer. The potential rate of this vertical percolation is up to 5 cfs/acres. The canal system, however, has a potential recharge rate of less than 0.01 cfs/acre with a head of 1 foot [2].

There are tributary conveyances on the north side of the Gator Slough canal. These conveyances have no control structures to maintain water levels. The net effect is to expand the overdrained areas that exist adjacent to the main canal. Control structures on these and future connections to the canal could be designed to minimize the area of overdrainage.

The *City of Cape Coral Utility Master Plan Update, Final Report* prepared by Dames & Moore in association with Black and Veatch August 1999 [4], describes a groundflow simulation performed in the area. The MODFLOW model results presented in the report have been used as a calibration target to fix the groundwater parameters of the XP-SWMM options. The Dames & Moore model showed that the base flow attainable rate would vary from 43 to 62 cfs. The XP-SWMM model has finally reached the amount of a constant 50 cfs during the simulated period (September, 1996).

Groundwater outflow data

Groundwater discharge represents lateral flow from the saturated zone to the receiving water. The Dupuit Forcheimer flow equation takes on the following general form (with reference to Figure. 8):

$$Q = K\frac{h_1^2 - h_2^2}{L} \quad \text{(cfs per linear foot of canal)} \tag{3.2}$$

where

K = hydraulic conductivity (range 10^{-5} to $2*10^{-2}$ feet/sec)

L = maximum flow distance at the upstream end of the aquifer

L is determined by the average distance of the canals reaches, and is set to about 0.25 mile

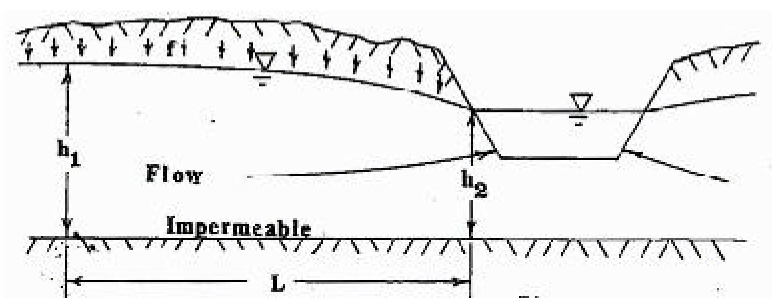

Figure 8. Definition sketch for Dupuit-Forcheimer approximation for drainage to adjacent channel.

The XP-SWMM general groundwater equation takes the form:

$$Q = A1 \cdot (D1 - BO)^{B1} - A2 \cdot BC^{B2} + A3 \cdot D1 \cdot (BO + BC) \tag{3.3}$$

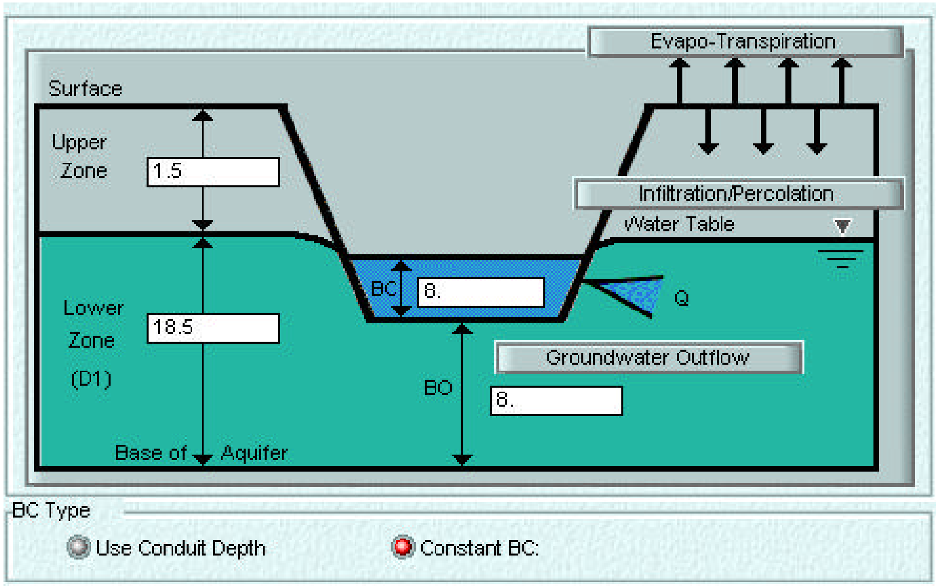

Figure 9. XP-SWMM sketch for the groundwater component.

Comparison of equations (3.2) and (3.3) gives:

$$A1 = A2 = \frac{K}{L}$$
$$B1 = B2 = 2$$
$$A3 = 0$$

To route the groundwater simulation it is necessary to enter the name of the node or conduit to where groundwater from this subcatchment will drain. The drainage name may or may not be the current node name. In the model the rate of ground flow coming from each single subcatchment (node) is chosen to drain in the subcatchment itself. A summary table with the complete set of groundwater data is provided in Table 3.

Table 3. Groundwater Required Parameters in XP-SWMM2000.

Parameter	Unit	Used
Evaporation	in	0.2
Upper zone	ft	1.5
Lower zone D1	ft	18.5
Elevation of channel base BO	ft	8
Water depth BC	ft	8
Ground water flow coefficient A1	-	$5*10^{-5}$
Ground water flow exponent B1	-	2
Channel water influence coefficient A2	-	$5*10^{-5}$
Channel water influence exponent B2	-	2
Ground water/Channel water coefficient A3	-	0
Wilting point	-	0.05
Field capacity	-	0.1
Fraction of max. ET assigned to upper zone	-	0.5
Max. depth of significant lower zone transpiration	ft	3.3
Saturated hydraulic conductivity	in/hr	2
Porosity expressed as a fraction	-	0.3
Curve fitting parameter	-	20
Initial upper zone moisture expressed as a fraction	-	0.29
Coefficient of unquantified losses	in/hr	0
Average slope of tension vs. soil moisture curve	ft/fraction	128

3.6 Tidal Boundary Conditions

The Cape Coral City canals system bounded by the Lee-Charlotte County line on the north limit and by Pine Island road to the south, flows through Basins 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 eventually discharging to the North Spreader Canal System. The spreader system is composed of saltwater canals not used for the City withdraws because of the high salinity and the detrimental impact this type of water has on the vegetation. It originally was a body of fresh water isolated from salt water by a berm between the waterway and the saline Matlacha Pass. However, breaches and channels in the berm currently allow salt water to flow from the Pass to the waterway [4].

The Spreader Canal System was designed to intercept discharge of freshwater from the Cape Coral network. The main objective of the waterway is to prevent point discharge of the canal network into the mangrove fringe along the west and southwest coastline of Cape Coral, distributing the canal discharges over all the existing mangroves. The mangroves were to be maintained by the waterway providing sheet flow through existing tidal wetlands.

Other purposes of the Spreader are to provide additional salinity control for the canals which discharge into it and to maintain higher groundwater elevations upstream during the dry season [2]. The existing Spreader Canal consists of the North Spreader Waterway to the north of Pine Island Road, taken into account in this study, and the South Spreader Waterway to the south of Pine Island Road. Both systems are physically separated and can be considered to be distinct entities [4].

Breaks exist in the berm that separates the waterway from the Matlacha Pass. Currently, saltwater flows through these breaks from the pass to the Spreader System. Therefore downstream of Burnt Store Road, in the North Spreader Waterway, the conveyance is controlled by the same tidal conditions of Matlacha Pass, also considering the capacity of the perimeter canal system in the Cape Coral and connections seaward, and it was assumed the water elevations would be similar to those in Matlacha Pass station. Each of the four main canals of the network has a weir along Burnt Store Road: Weir 11 (Gator Slough Canal), 13 (Horseshoes Canal), 14 (Hermosa Canal) and 15 (Shadroe Canal).

Matlacha Pass tide level historical information was provided by Lee County Environmental Services-Natural Resources Division, Florida Department of Environmental Protection and the U.S. Department of Commerce-National Oceanic and Atmospheric Administration National Ocean Service. The model has been assigned a constant Mean High Water Level over the full period of the calibration event. The unique node (#1756) assigned with the Outfall option and a “User Stage History” is located in the last southwest most position. The level is taken from the Tidal Bench Mark “Matlacha Pass” (Latitude: 26°37.9’N, Longitude: 082°04.1’W, USGS Quad: Matlacha). The calibration event (1 year Return Interval) has been assigned with a tide elevations of 2.0 feet NGVD. The project events (5, 25, 100 years Return Interval) were assigned with a tide elevations of 2.7 feet NGVD. The backwater analysis only accounts for conditions created by the design rainfall events.

3.7 Upstream Inflow Data

The only data available for calibration and verification was for the Gator Slough canal watershed. Insufficient data were available for Horseshoe, Hermosa and Shadroe canals. Therefore the conceptual methodology adopted to calibrate the model has been to use one year of data for only one sub watershed, the Gator Slough canal watershed, and assume that the calibrated parameters are applicable to other basins.

Upstream inflow to Gator Slough originating from the portion of the watershed located north and east at U.S. 41 (33 square miles undeveloped watershed of wildlife management area) are inserted as a “User Inflow” input in node 31 of the model. Data are from gauging station located 0.5 miles west of U.S. 41, named *Gator Slough at US 41 near Ft. Myers, FL.*

The period selected for model calibration includes 24 days from September 5th to 28th, 1996. This is consistent with the 1-year return interval (RI) event selected based on Gumbel statistical analysis performed over the outflow historical period of record for Weir #11, downstream of Gator Slough Canal. The peak Gumbel 1-year RI flow for this section is 42 cfs (daily average value)

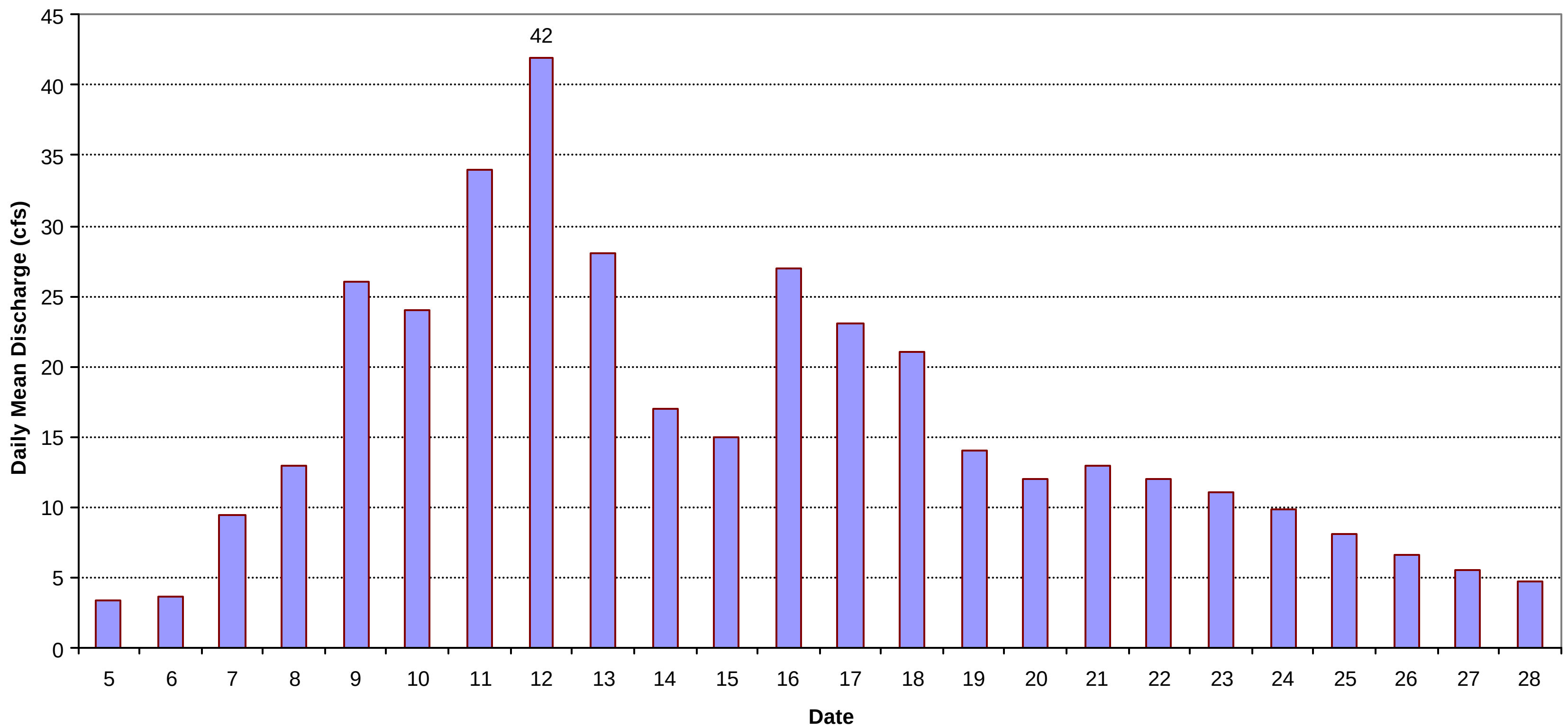

Figure 10. Input Hydrograph for Gator Slough at U.S. 41- 1 year event: September 5-28, 1996.

3.8 Evaporation and Rainfall Data

The Southwest Florida Research and Education Center, part of the University of Florida's Institute of Food and Agricultural Sciences, presents information on both the Total Pan Evaporation and the total Penman Evaporation, in the form of average monthly values for each month of the period from 1989 to 1997. Evaporation data requested as an input by the Runoff mode of the model act also as an upper bound for evapotranspiration losses from groundwater and soil moisture. The Total Penman ET values inserted are summarized in the following Table:

Table 4. Total Penman ET (inches). Monthly values.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.49	4.20	5.56	5.37	5.77	5.46	5.71	5.45	5.02	4.69	4.04	3.59

Figure 11 below gives the various locations in Lee County where rain gages are installed. Rainfall data used for the calibration was obtained from the gauging station of Lake Fairways (0.5 miles west of the bridge of U.S. 41 on the Gator Slough provided by Lee County, see Figure 12). The period of record covers 24 days from 5th to 28th September 5th, to be consistent with the 1-year RI event selected based on the Gumbel statistical analysis run over the outflow historical data of Weir 11, downstream of Gator Slough Canal. Data on storm paths is not readily available for the Cape Coral area. The local storms for the most part travel inland from the coast. The rain has been considered homogeneous over the whole watershed. The total amount of rain over the 24 days period is 8.39 inches. Reference: Lee County Regional Water Supply Authority.

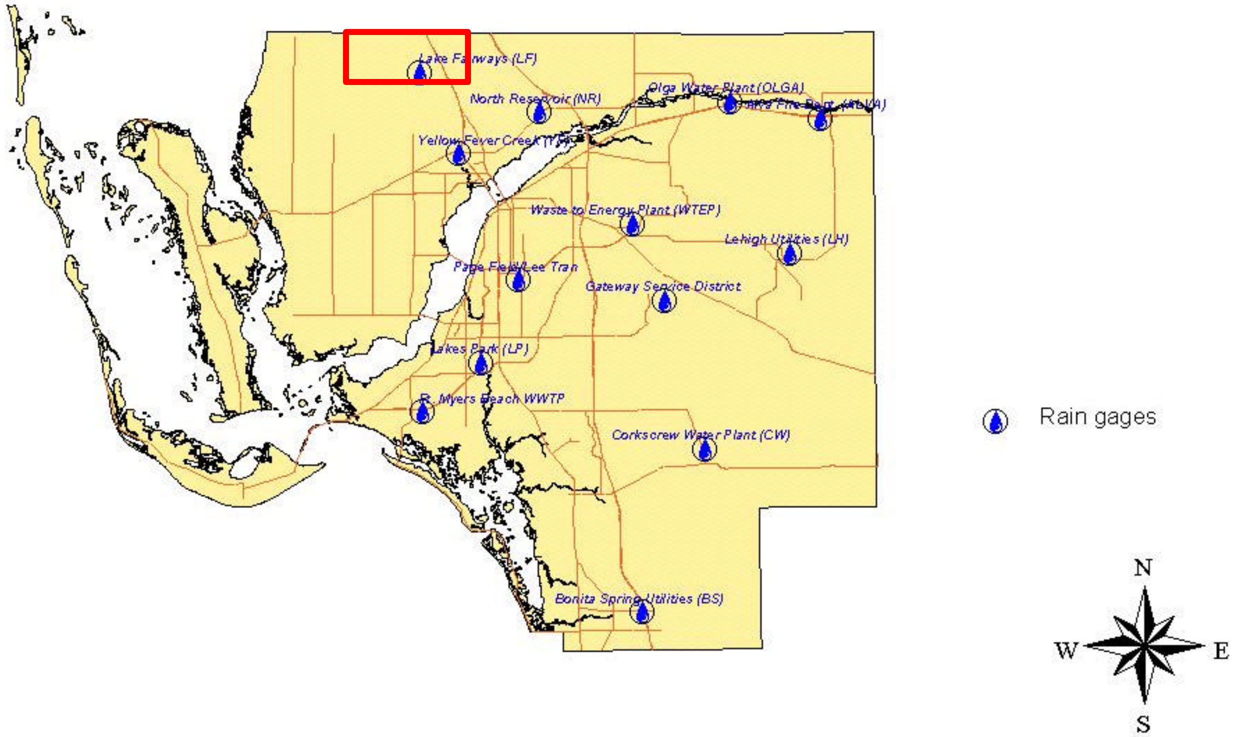

Figure 11. Lee County Rain Stations.

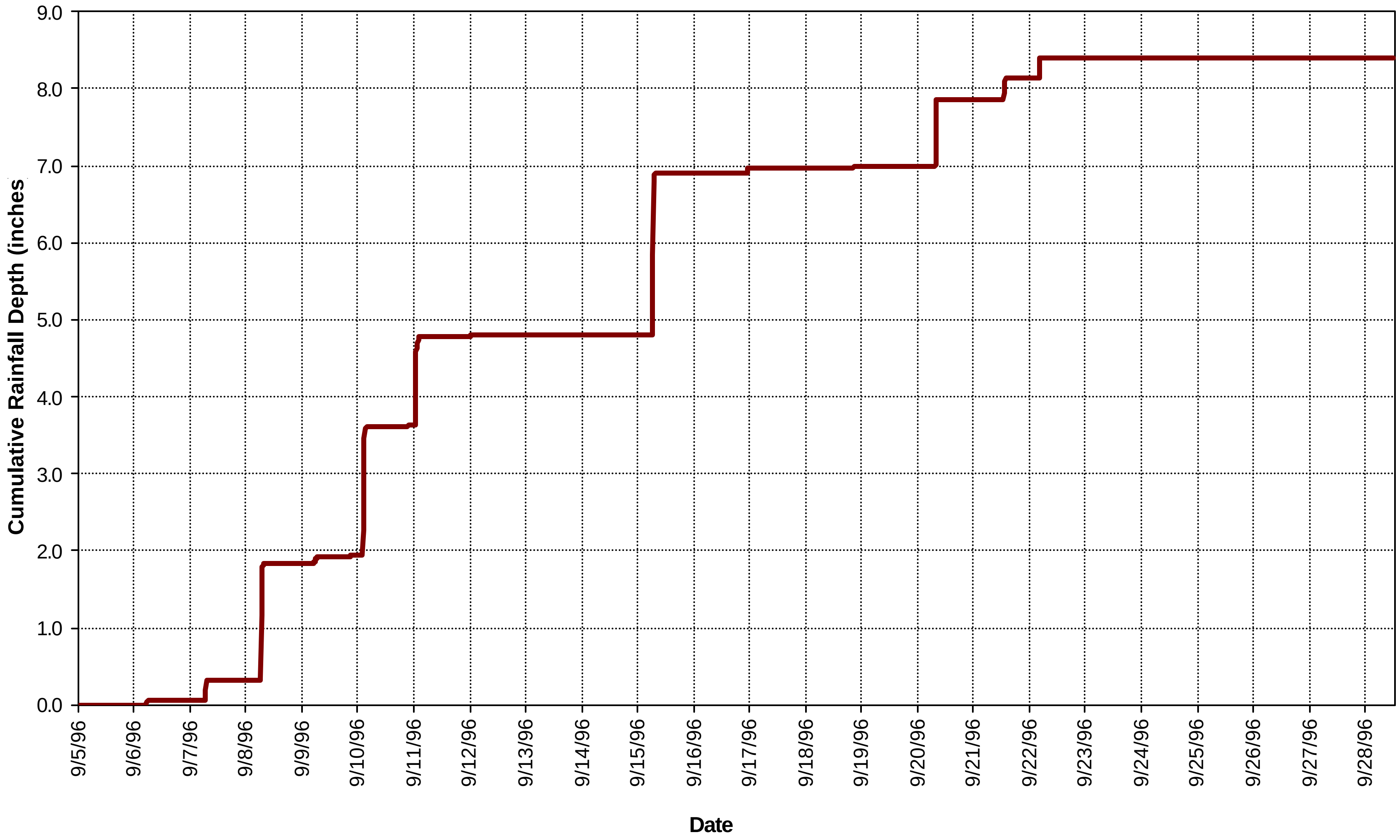

Figure 12. Cumulative Rainfall: September 5-28, 1996 (Gauge Station: Lake Fairways, 0.5 mile west of U.S. Hwy 41).

3.9 Outflow Data and Statistical Analysis

The main criteria used in selecting the calibration period of record was the Gumbel statistical analysis applied to the outflow data for the station located near S.R. 765, corresponding to Weir #11. The analysis was conducted for Weir #11 outflow data to identify that period of record most closely matching a 1-year RI runoff event and for which a concurrent rainfall record and upstream inflow record were also available.

Gumbel Statistical Analysis

The annual maximum flood flow value, in daily mean series, detected in a water stream section, is an extreme event. Since the watershed was not submitted to relevant hydrologic modifications during the period of years under analysis, those series can be treated as homogeneous and independent values. These conditions allow us to associate the probable frequency and then the return interval to a given discharge event and to apply those values to the statistical analysis methods. Gumbel analysis has been proved to be one of the most reliable methods for hydrologic series. A double exponential probability distribution allows assignment of an expected flow rate for all return periods.

The U.S. Geological Survey monthly maximum values of daily average discharge on S.R. 765 corresponding to Weir #11 are shown in Table 5.

Table 5. USGS monthly maximums of discharge (cfs) for location:
26413908202210O Gator Slough at SR 765 Near Fort Myers, FL.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max
1984					86	236	290	191	89	60	35	10	290
1985	11	8	8	2	0	2	88	154	286	139	182	16	286
1986	16	5	27	8	5	478	114	842	407	72	34	39	842
1987	108	22	172	147	152	143	308	185	131	595	77	28	595
1988	13	12	33	17	10	5	262	273	507	47	77	11	507
1989	27	8	22	5	10	118	245	504	204	54	18	4	504
1990	7	10	8	5	175	135	97	173	54	30	8	3	175
1991	139	25	24	13	177	359	604	133	91	117	16	7	604
1992	5	20	30	21	9	740	378	321	165	108	10	12	740
1993	29	29	279	30	23	191	145	121	126	101	117	14	279
1994	14	16	24	118	40	14	123	136	443	84	29	21	443
1995	42	15	19	43	70	633	951	1240	499	594	81	4	1240
1996	46	6	18	15	61	167	125	160	346	573	100	29	573
1997	0	0	0	19	27	73	301	531	781				781

Some of the annual series were not populated with all monthly values. In these cases an annual event maximum value was taken into account only when the values for the whole period between June and October were available. This is because the peak flow rates for all years occurred in this interval. A return period was then associated to each of the extreme values as shown in the following Table 6.

Table 6. Event with Gumbel associated return time for Gator Slough at S.R 765.

Order	Event Q (cfs)	Tr
1	1240	15.00
2	842	7.50
3	781	5.00
4	740	3.75
5	604	3.00
6	595	2.50
7	573	2.14
8	507	1.88
9	504	1.67
10	443	1.50
11	290	1.36
12	286	1.25
13	279	1.15
14	175	1.07

After the Gumbel analysis it is possible to find out a discharge value for every given return period as an independent variable (Table 7).

Table 7. Return period with associated discharge values for Gator Slough at S.R. 765.

Interval	Q expected (cfs)
1	**332**
1.5	400
2	523
5	**826**
10	1027
15	1140
20	1220
25	**1281**
30	1330
35	1372
40	1409
45	1440
50	1469
55	1495
60	1518
65	1540
70	1560
75	1578
80	1596
85	1612
90	1627
95	1642
100	**1656**

Given the logarithmic nature of the final Gumbel equation, the 1-year event is obtained from an interpolation trend line of the other data. Figure 13 shows the data distribution and the logarithmic trend line used to associate the discharge value to 1 year.

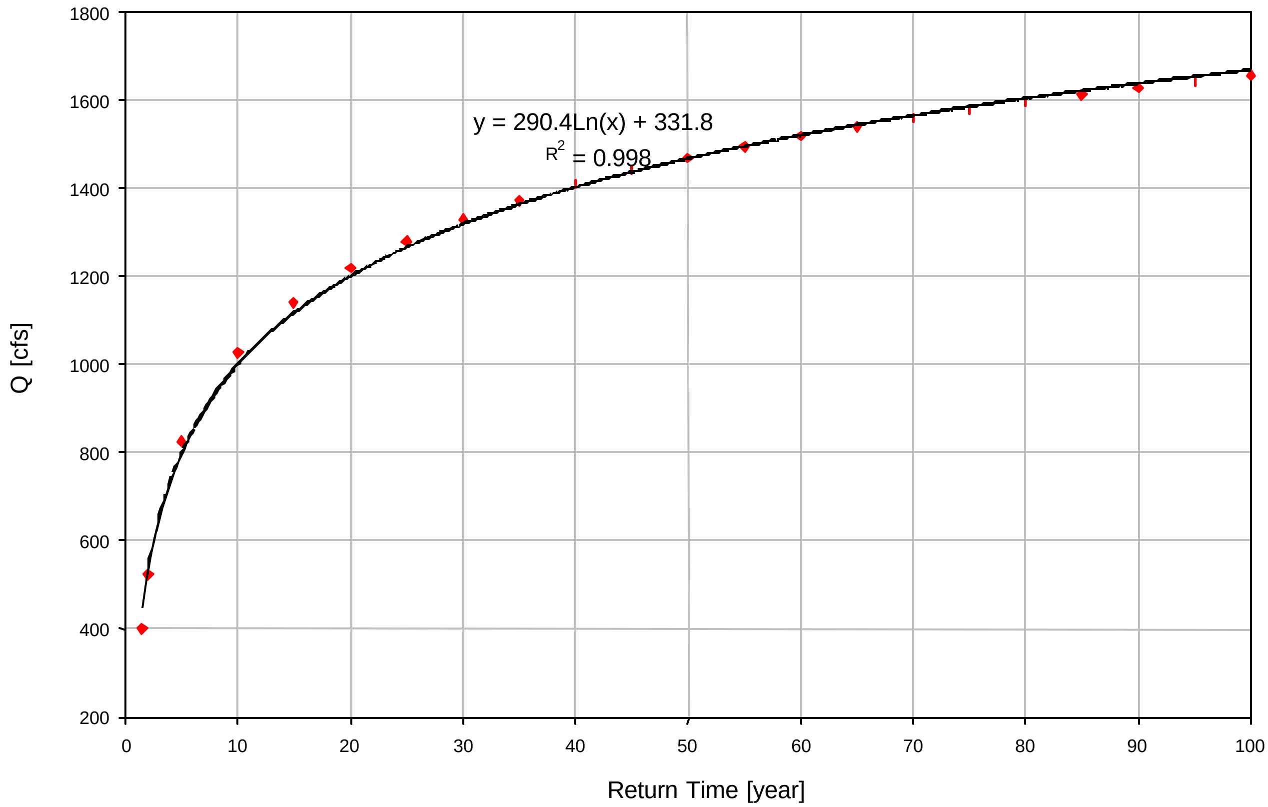

Figure 13. Discharge as a function of return time for Gator Slough at S.R. 765.

3.10 Model Calibration Results

September 1996 was selected as the period of record to calibrate the Cape Coral canals model. The period selected included all of the following basic data sets for a one-year recurrence interval storm event were available: (1) Inflow data for the Gator Slough at U.S. 41 USGS station, (2) Outflow data for the Gator Slough at S.R. 765 USGS station, and (3) Rainfall data at the Lee County Lake Fairways station.

The one-year recurrence interval event was identified based on Gumbel statistical analysis of discharge data at S.R. 765. Thus, the period of record used for the calibration run represents a documented flow event with a peak near to the statistical one-year recurrence interval flow magnitude. The calibration event was not selected on the basis of the one-year rainfall magnitude.

The historical outflow hydrograph in Figure 15 presents the measured flow rates from September 5 to September 28, 1996. The hydrograph rises to a double peak value and recedes to the completion of the complex event. The duration of the one-year event used for calibrations purposes was limited to 24 days (from 5^{th} to 28^{th} of September, 1996) to be consistent with the requirement that the system achieve the same conditions at the end of the event as it had at the beginning. The runoff data for September 1-4 and September 29-30 included either a falling or rising hydrograph limbs and therefore were eliminated from consideration.

The canal system calibration was also evaluated by comparison with the Johnson Engineering design water surface profile along the Gator Slough Canal for the one-year event [1]. The mass balance is summarized in the Table 8. Figures 14-16 describe the model calibration results. These figures show an underestimation of total runoff of approximately 10% over the 24-day period when compared to USGS discharge data. However an internal budget analysis shows approximately two additional inches of system outputs (runoff + ET) when compared to system inputs (rainfall + U.S. 41 inflow). This difference is assumed to be the result of base flow. Table 9 is a comparison of the model calibration results with USGS measured data.

Table 8. Mass balance table for XP-SWMM calibration event.

Gator Slough Canal Watershed		
1 year event Sep 5-28, 1996		
Total Area west of U.S. 41	4.0E8	ft^2
	9.1E3	acres
	Volume	depth over total area
	(cubic feet)	(inches)
Total Inflow	3.3E7	1.0
from North of U.S. 41		
Tot. Rain	2.8E8	8.4
Lake Fairways station		
Total Infiltration	1.8E8	5.4
Total ET	1.3E8	4.0
Ground Flow	1.1E8	3.2
Total Outflow	2.4E8	7.2
link weir # 11, XP-SWMM		
Total Outflow		
S.R. 765 USGS data	2.6E8	8.0
Missing Runoff	2.5E7	0.8
Percent error	9.6	
Runoff, % of inputs	52.7	

Table 9. Flow comparison between model calibration results and USGS measurements at S.R. 765.

Parameter	USGS	Model	% Error
Peak flow (cfs)	346	331	4.3
Flow depth (in)	8.0	7.2	10
Base flow (cfs)	50	50	0

As these distilled results show, the model appears to be performing well. The record of a single rain station is applied to the whole model area, whereas much of the regional rainfall occurs as thunderstorms, which strike unpredictably and locally. Is therefore reasonable to consider acceptable the 20% error in some points of the outflow hydrograph comparison and the mismatch of the two main event peaks. The fact that the first event is over predicted and the second event under predicted suggests that the model performance is correct, on average, and is limited by rainfall data. The overall agreement between the calibrated XP-SWMM model and the USGS data were acceptable. While limited rainfall data make event-by-event comparisons difficult, agreement over the 24-day period shows a model peak flow of 346 cfs compared to the USGS measured of 331 cfs, an overestimation of only 4.3%. The model underestimated discharge volume by 10% (7.2 inches were measured by the model while USGS measured 8.0 inches).

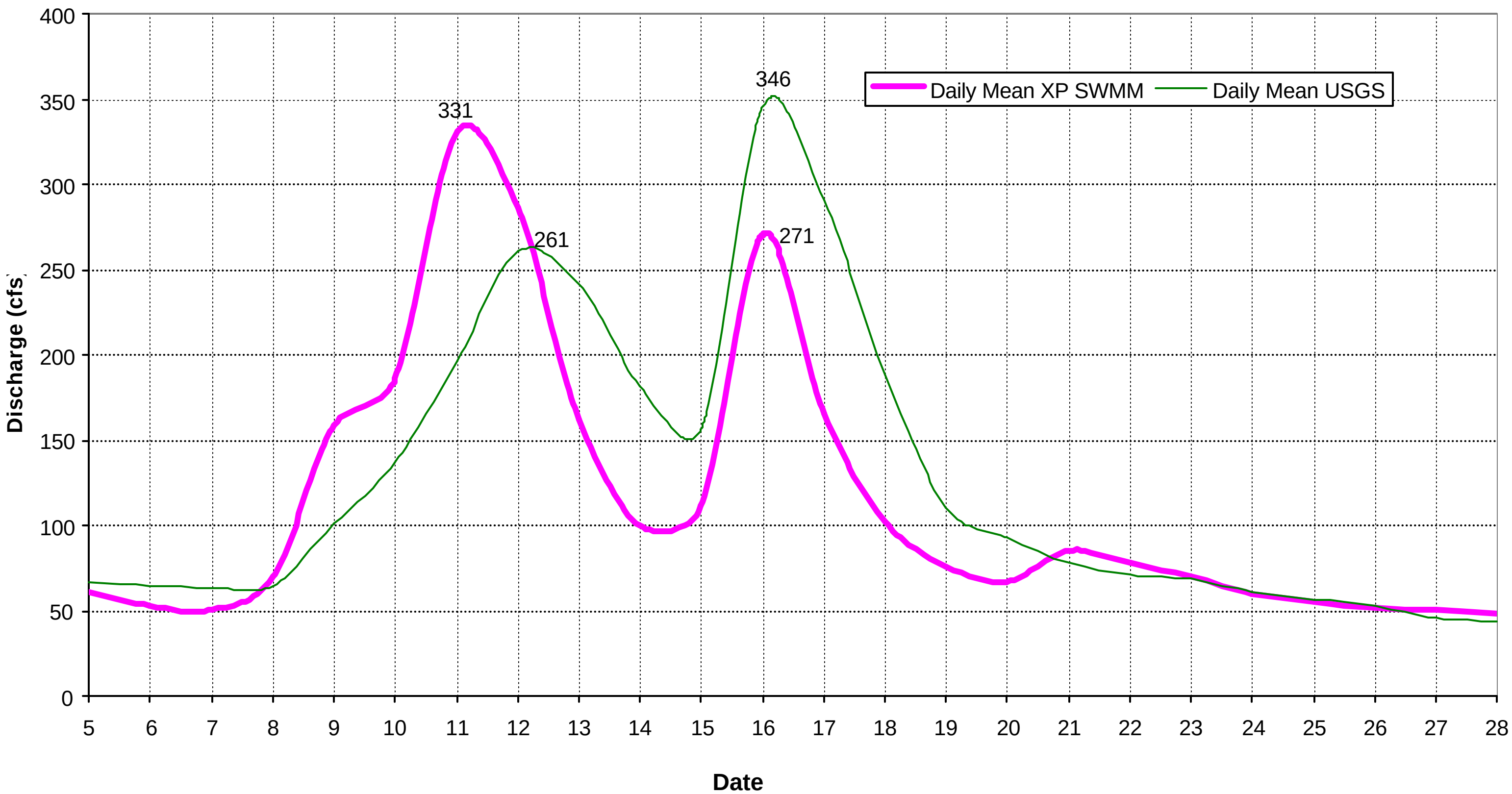

Figure 14. Outflow hydrograph comparison for September 1996.

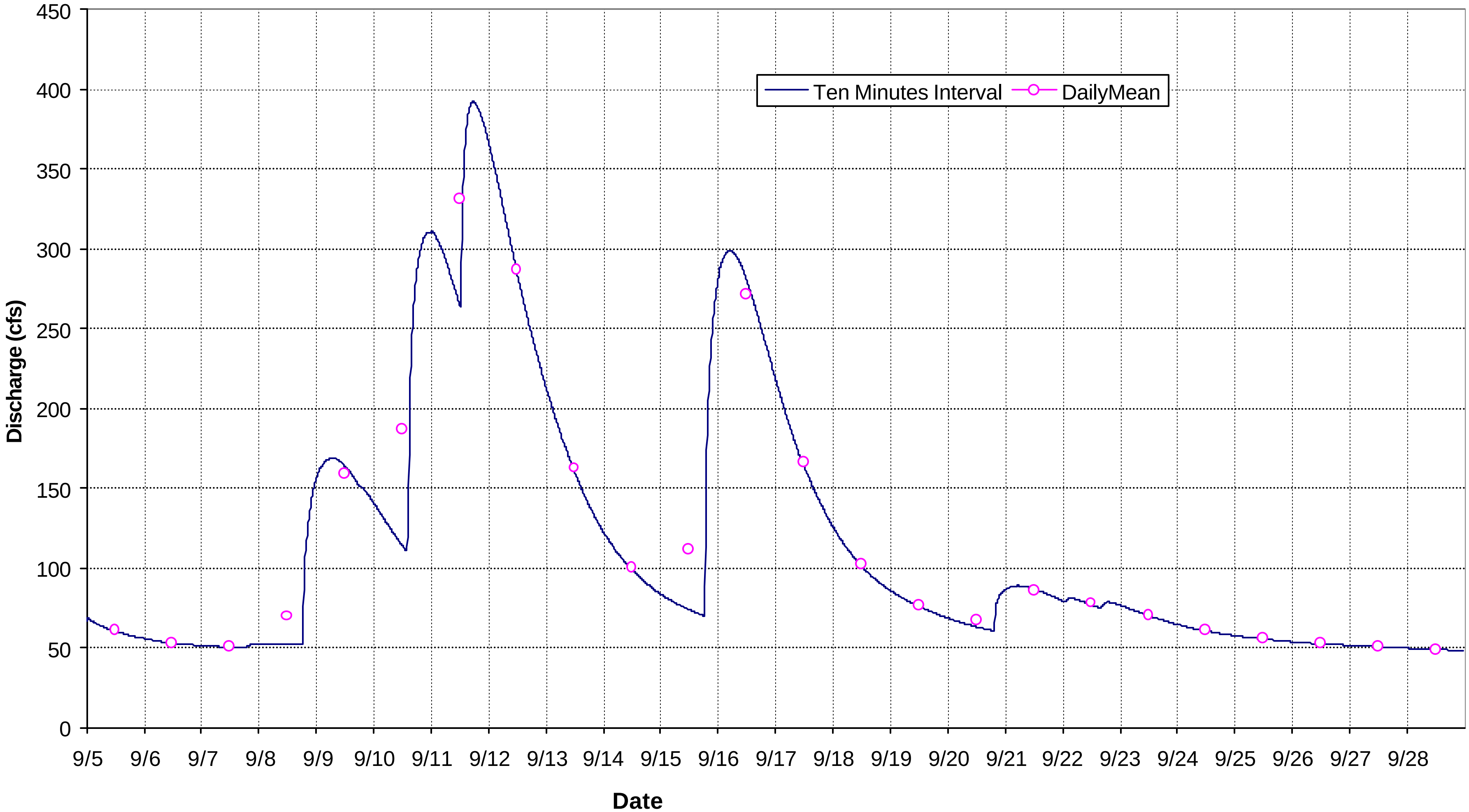

Figure 15. Outflow hydrograph Sept '96 XP-SWMM.

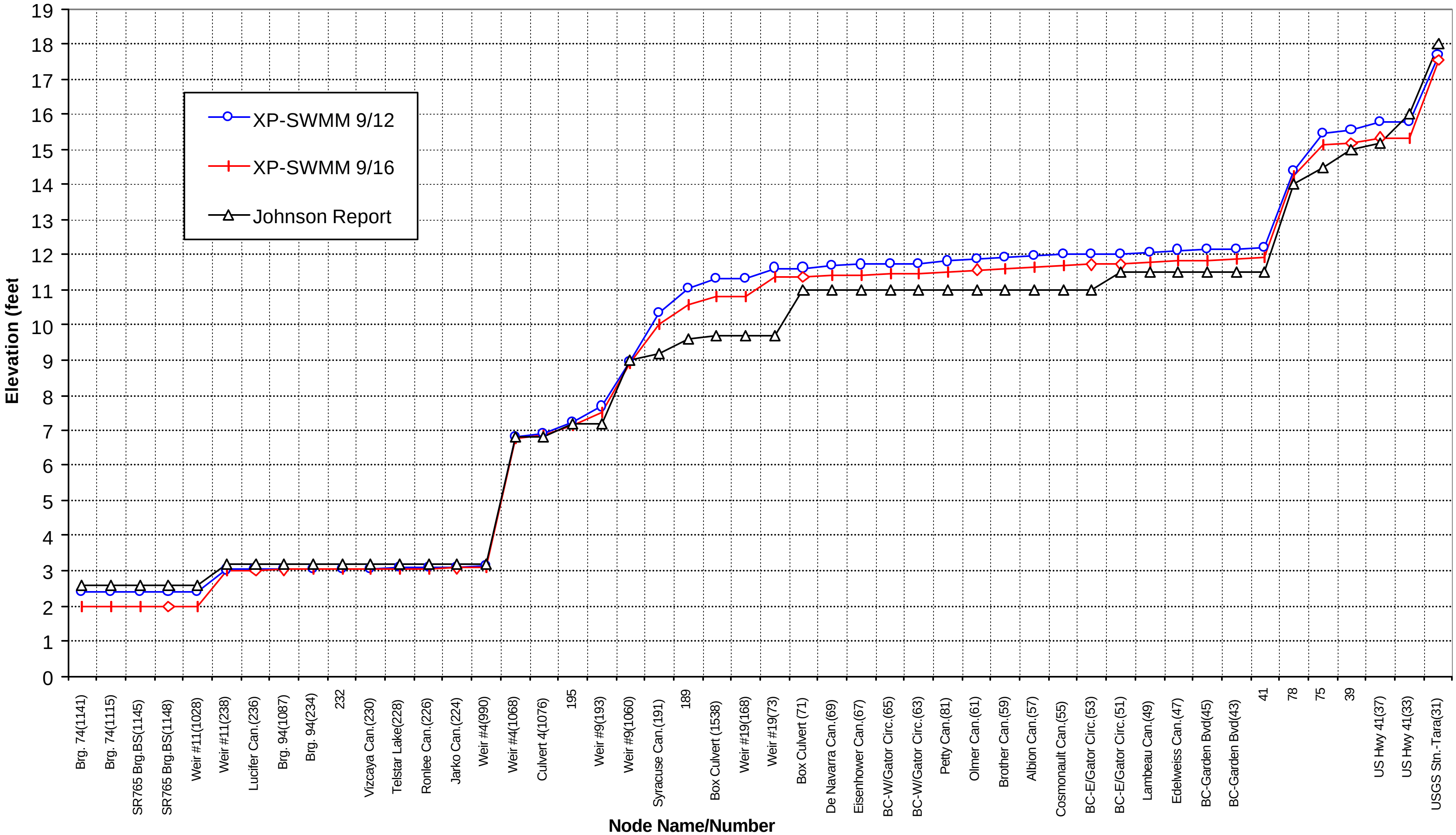

Figure 16. Gator Slough calibration: one-year event water elevations comparison.

4.0 MODEL VERIFICATION

The model verification phase compared the model results with measured stage and discharge data for a 24-day period from 12th July to 4th August 2001. The stage/discharge data were provided by the United States Geological Survey (USGS) for two locations along the Gator Slough: Gator Slough at U.S. 41, Near Fort Myers, FL (Station #264437081550100) and Gator Slough at S.R. 765 at Cape Coral, FL (Station #264139082022100). Measured data for water surface elevations at three weirs along the Slough and three dates (16th, 23rd and 30th July, 2001) were also obtained from the City of Cape Coral and Southern DataStream for one date (3rd August, 2001).

Rainfall data for this period were collected by Lee County at the Lake Fairways station (Figure 21). Figures 17 through 20 give a summary of the stage-discharge relationships for the two locations on the Gator Slough.

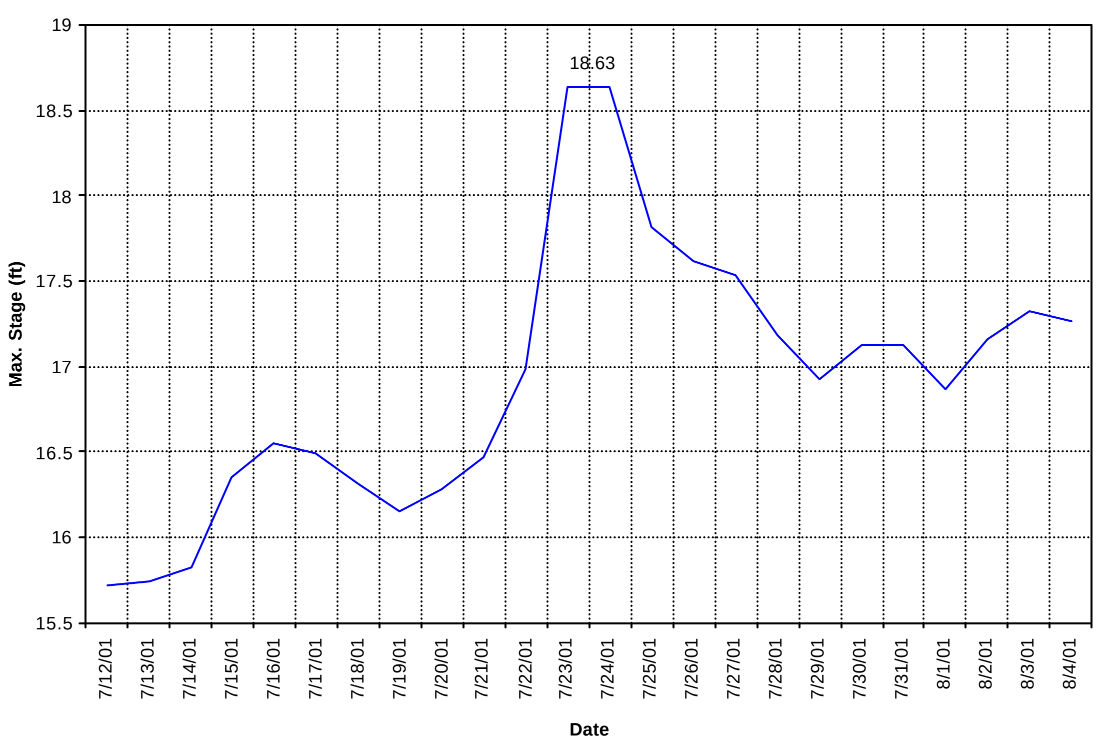

Figure 17. Water stage as measured by the USGS at the U.S. 41 station between July 12 and August 4, 2001.

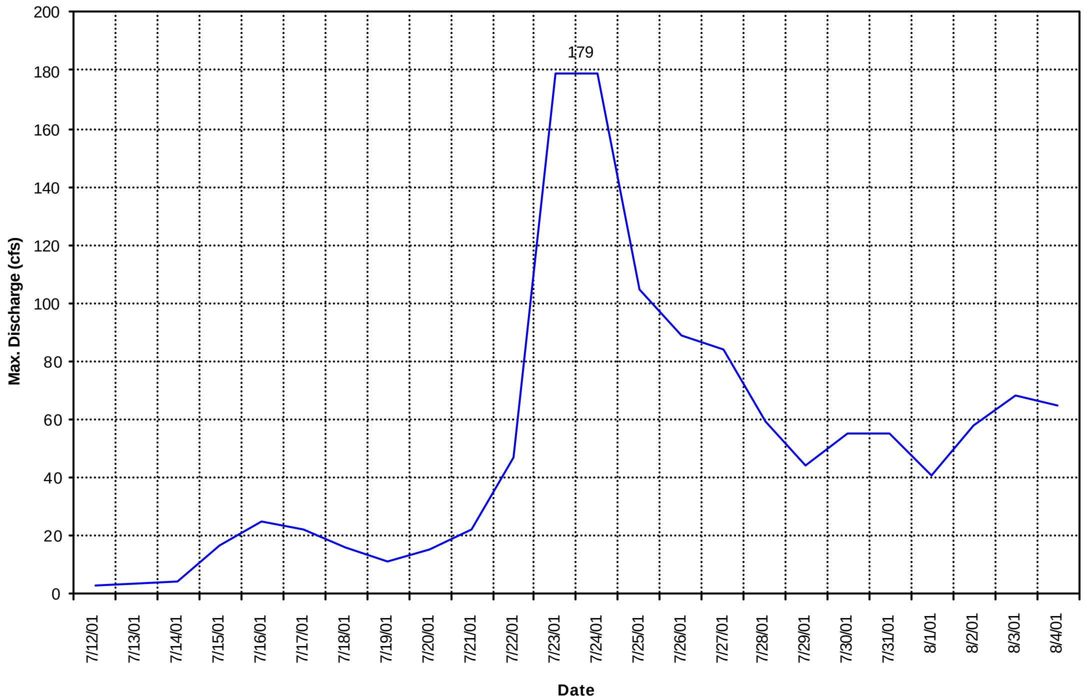

Figure 18. Discharge rates as measured by the USGS at the U.S. 41 station between July 12 and August 4, 2001.

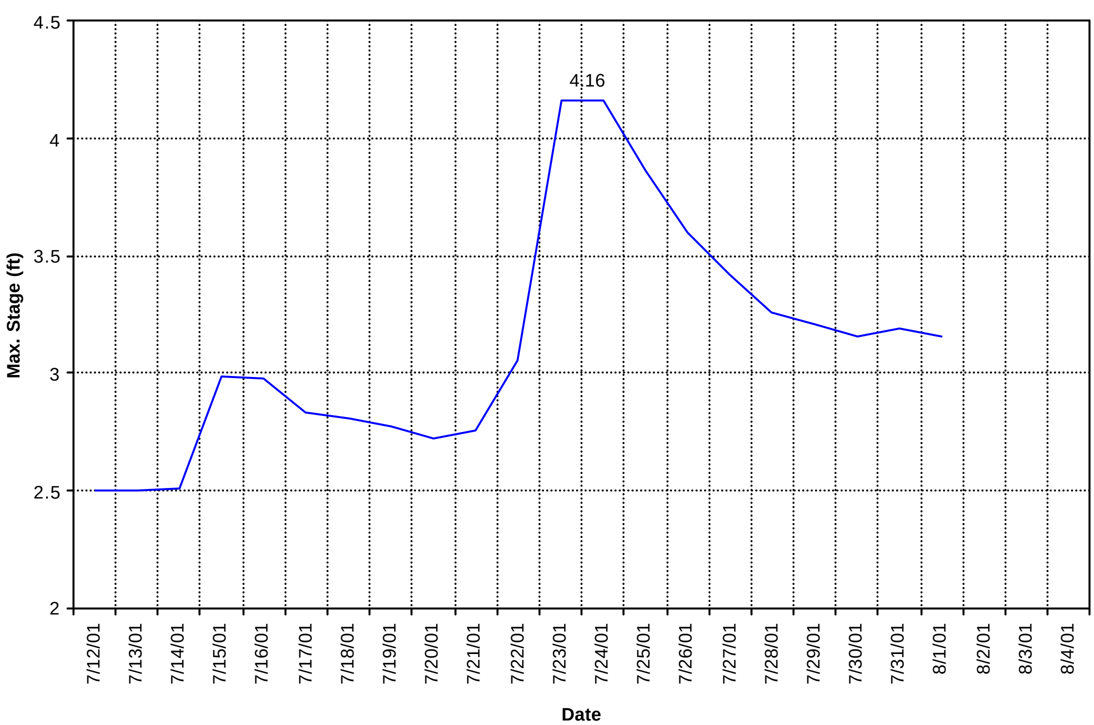

Figure 19. Water stage as measured by the USGS at SR 765 station between July 12 and August 4, 2001.

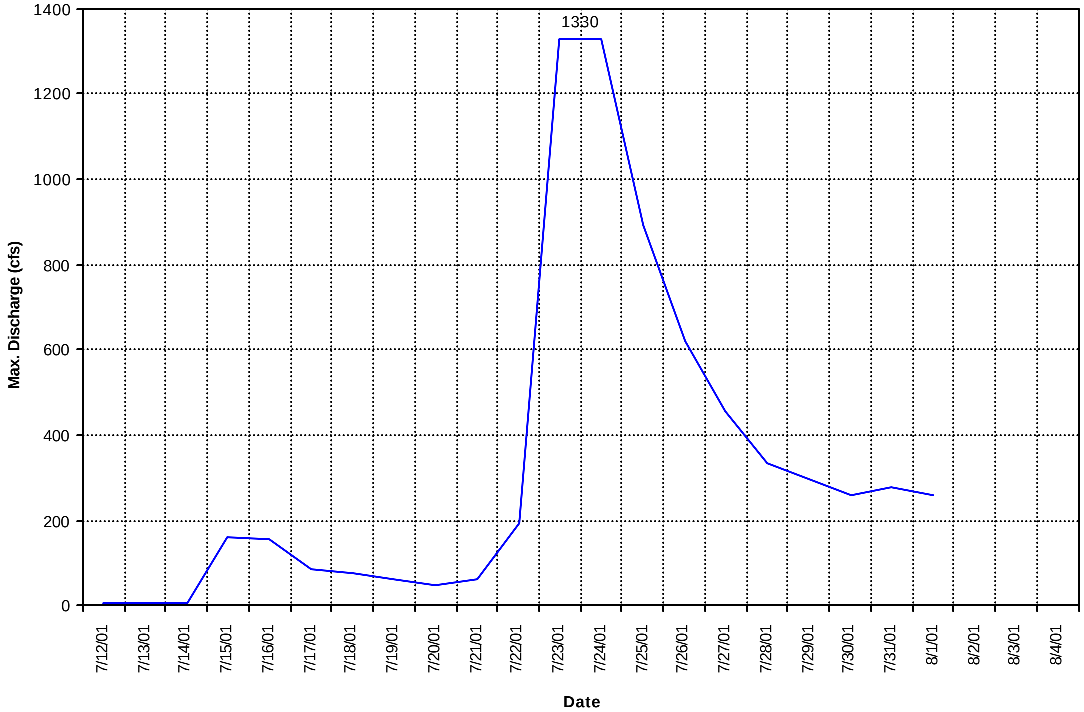

Figure 20. Discharge rates as measured by the USGS at S.R. 765 station between July 12 and August 4, 2001.

Figure 18 represents the "User inflow hydrograph" implemented for the verification run. The corresponding USGS flow data time series serves as the U.S. 41 inflow data set to the Gator Slough model.

To evaluate performance of the verification model run, the model stage results were plotted against time for five locations along the Gator Slough, at the source, the mouth and at three weir locations. There was generally very good agreement between the model and USGS data as can be seen in Figures 22-26.

Total flow for the 24-day period as reported by USGS and the (verification) model results for the two locations (Gator Slough at U.S. 41 and Gator Slough at Burnt Store Road – S.R. 765) were also compared. Table 10 shows this comparison.

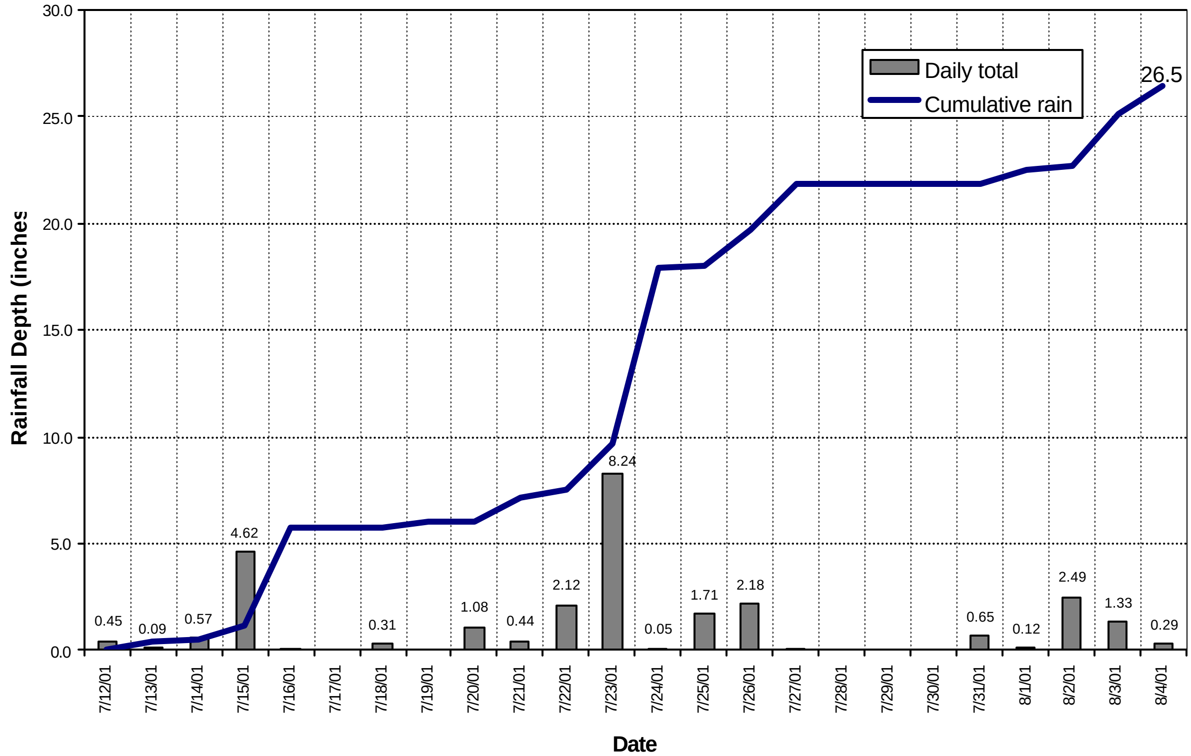

Figure 21. Cumulative Rainfall for the Gator Slough watershed as measured by Lee County at the Lake Fairways station, near U.S. 41.

It is observed from Table 10 that the model total flow at U.S. 41 on Gator Slough is higher than USGS measured values. This is possibly the result of base flow. The peak discharge and maximum stages are also shown to compare well for all the canals except Hermosa canal. The Hermosa canal exhibits a less stable solution for the modeled flows. This may be due to Interconnect C.

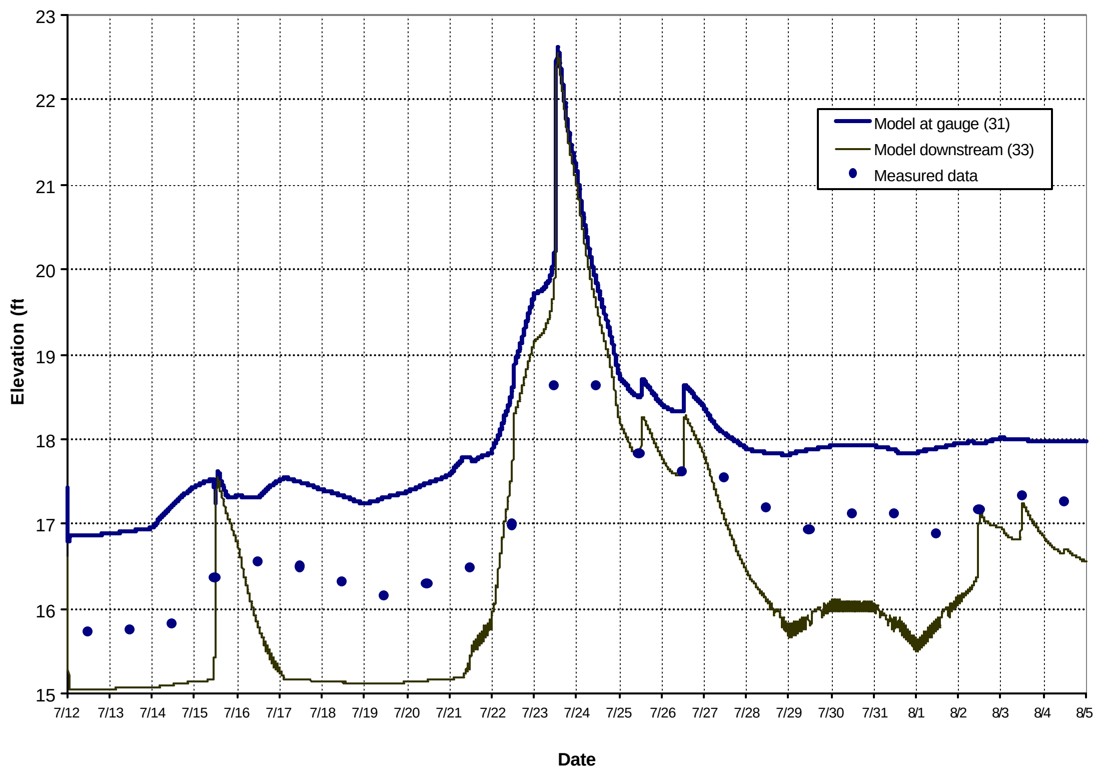

Figure 22. Model water stage compared with USGS measurements at the U.S. 41 station between July 12 and August 4, 2001.

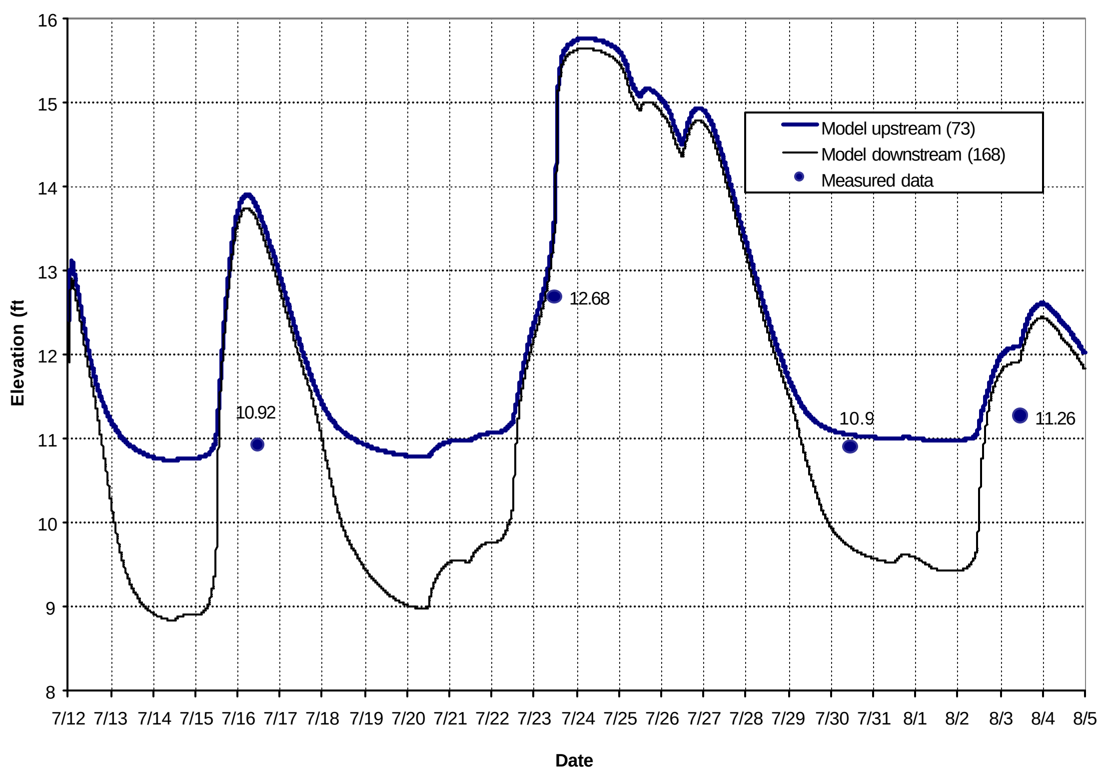

Figure 23. Model water stage compared with USGS measurements at Weir #19 between July 12 and August 4, 2001.

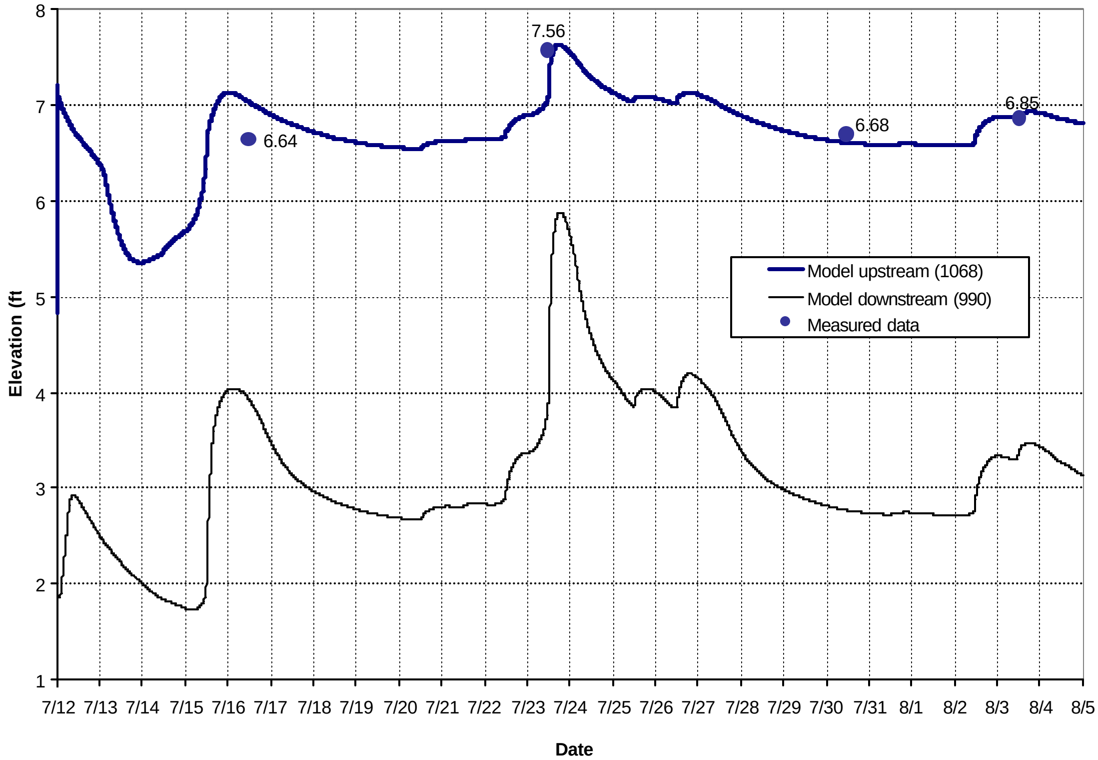

Figure 24. Model water stage compared with USGS measurements at Weir #4 between July 12 and August 4, 2001.

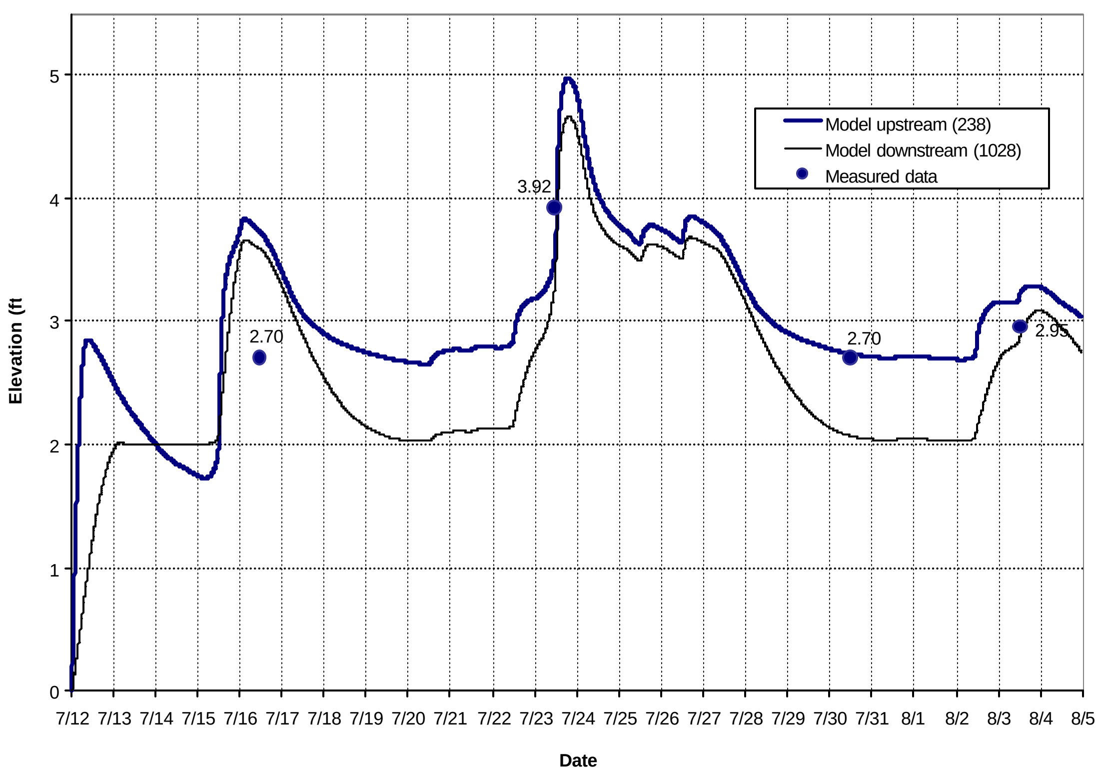

Figure 25. Model water stage compared with USGS measurements at Weir #11 between July 12 and August 4, 2001.

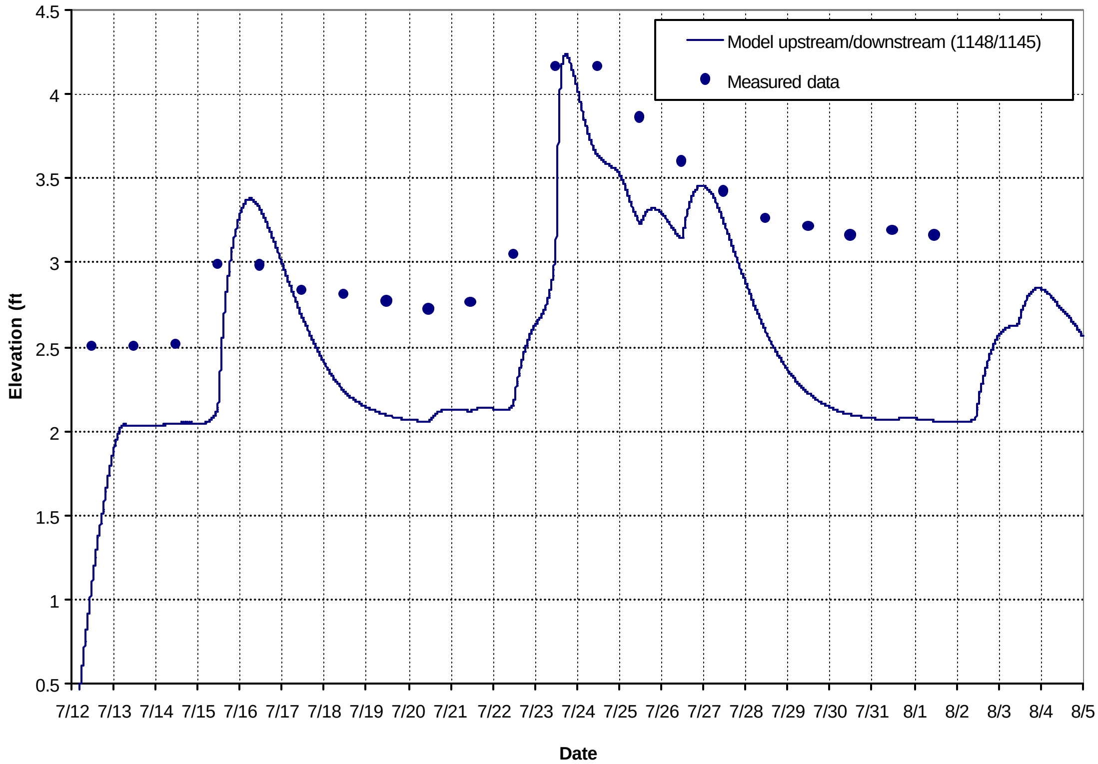

Figure 26. Model water stage compared with USGS measurements at S.R. 765 between July 12 and August 4, 2001.

Table 10. Comparison of flow parameters at 5 locations (07/12/01 – 08/04/01).

Station	**USGS total flow (cu.ft)**	**Model total flow (cu.ft)**	**% Error**
Gator Slough @ U.S. 41	9.1E+07	1.1E+08	22.7
Gator Slough @ S.R. 765	4.8E+08	4.2E+08	-12.6
Horseshoe @ S.R. 765	3.1E+08	4.0E+08	30.0
Hermosa @ S.R. 765	2.0E+08	1.4E+08	-33.2
Shadroe @ S.R. 765	1.6E+08	1.7E+08	1.4
Station	**USGS Peak flow (cfs)**	**Model Peak flow (cfs)**	**% Error**
Gator Slough @ U.S. 41	1.8E+02	1.8E+02	1.0
Gator Slough @ S.R. 765	1.3E+03	1.7E+03	25.6
Horseshoe @ S.R. 765	1.2E+03	1.4E+03	11.3
Hermosa @ S.R. 765	1.1E+03	1.5E+03	33.5
Shadroe @ S.R. 765	1.6E+03	1.1E+03	-31.2
Station	**USGS max stage (ft)**	**Model max stage (ft)**	**% Error**
Gator Slough @ U.S. 41	18.63	22.62	21.4
Gator Slough @ S.R. 765	4.16	4.48	7.7
Horseshoe @ S.R. 765	4.89	5.11	4.5
Hermosa @ S.R. 765	4.76	3.27	-31.2
Shadroe @ S.R. 765	4.49	4.82	7.4

5.0 DESIGN STORMS AND RESULTS

5.1 Design Storms

The three design storm events designated for simulation in this project are the 5-year 1-day, 25-year 3-day, and 100-year 3-day storm events. The rainfall depths and distributions for the three storm events were determined using methods presented in *Surface Water Management Design Aids (SWMDA)*, published by SFWMD [8].

- 5-year 1-day: 5.2 inches: Figure C-I-3. Rainfall depth near Fort Myers, Florida.

- 25-year 3-day: 10.6 inches: Figure C-I-5. Rainfall depth for 25-year 1-day as 7.8 inches. This value was modified for 25-year 3-day by multiplying by a factor of 1.359. Therefore, the rainfall depth for 25-year 3-day was determined as 7.8 x 1.359 inches.

- 100-year 3-day: 12.91 inches. Similar to the above, the rainfall depth from Figure C-I-6 as 9.5 inches and modified by designated multiplication factor i.e. 9.5 x 1.359 inches.

Statistically determined values for the design events are given in Table 11 below. These values are used as XP-SWMM model inputs. The U.S. 41 expected peak discharge values (Q) were determined using Gumbel statistical analysis.

Table 11. Design event statistical values for peak flows on Gator Slough at U.S. 41.

Recurrence Interval	Daily Rain	3-day Rain	Q expected at U.S.41* (cfs)	Q expected at S.R.765* (cfs)
1-year	-	N/A	73	332
5-year	5.2	N/A	202	826
25-year	7.8	10.6	331	1281
100-year	9.5	12.9	442	1656

*From Gumbel analysis on USGS records (1983 to 2000).

5.2 Upstream Inflow Data

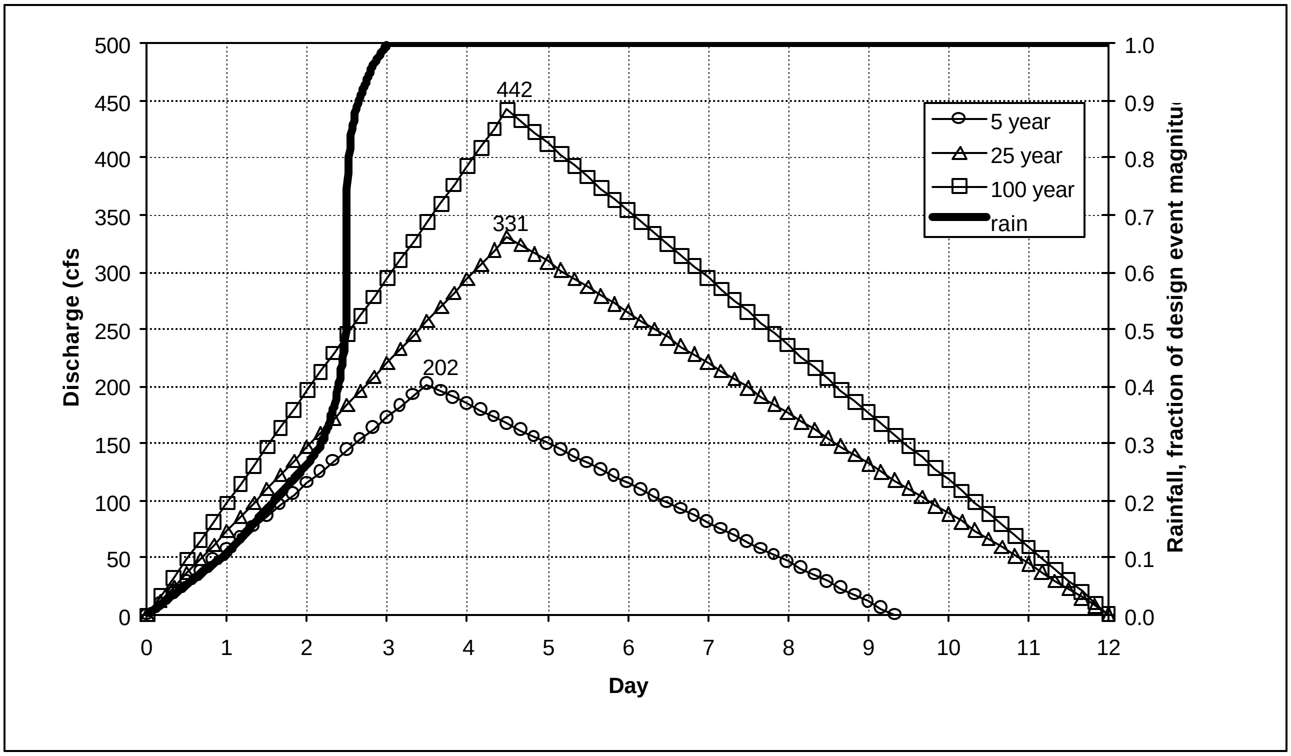

Figure 26. SCS inflow hydrographs at U.S. 41.

The input hydrographs for U.S. 41 developed using Gumbel statistical analysis are given in Figure 26. This graph also shows the cumulative rain distribution for the period. There is an observed lag of about 2 days between the maximum rainfall (point of inflection on curve) and the maximum discharge for the 100-year event.

Subsequent analysis of recently collected USGS flow data and Lee County rainfall data (July, 2001) suggests a shorter time-to-peak of approximately 1 day. Thus the inflow hydrographs used to represent U.S. 41 inflow to the Gator Slough model are overconservative and “sluggish”. This may result in an underestimation of the peak flow at the actual time of maximum runoff confluence. While the resulting model total runoff volume is unchanged, the peak flow may be underestimated in the model by as much as 30 cfs (12.4%) for the 5-year event, 110 cfs (21.1%) for the 25-year event and 220 cfs (22.6%) for the 100-year event. Project schedule constraints did not permit revised input hydrographs to be included in the modeling project.

5.3 Design Storm Results

The water budget for the design events is given in Table 12 below. The rain is given in Table 11 above for the three design events. The rain for the calibration and verification are obtained from the input hydrograph for Lake Fairways. U.S. 41 inflow is obtained from the discharge-time relationship as input in the model. The discharge is integrated over time to obtain total volume passing U.S. 41. This volume is then divided by the watershed area west of U.S. 41 to obtain depth. For example, the total flow at U.S. 41 for the 12-day period of simulation for the 25-year event is 1.72E+08 cubic feet; the total watershed area is 1.21E+08 square feet, hence giving a depth of 1.4 inches. The runoff, evapotranspiration and infiltration (storage) are calculated and reported by in the model output file. Table 13 shows the information as given in Table 12 with a comparison with Johnson Report results and Gumbel statistical analysis predictions.

Table 12. Water budgets for XP-SWMM simulations of various events on Gator Slough.

Event, years	Calibration	Verification	5-year	25-year	100-year
Duration, days	24	24	9	12	12
Inputs					
Rain	8.4	26.8	5.2	10.6	12.9
Hwy 41 Inflow	0.3	0.9	0.7	1.4	1.9
Subtotal	***8.7***	***27.7***	***5.9***	***12.0***	***14.8***
Outputs					
Runoff	**3.9**	**18.1**	**3.7**	**8.2**	**10.5**
ET	2.9	2.4	1.2	1.6	1.5
Storage	2.3	3.8	0.8	1.2	1.2
Subtotal	***9.1***	***24.3***	***5.7***	***11.0***	***13.3***
Net	**-0.4**	**3.3**	**0.2**	**1.0**	**1.5**
Runoff, % of Inputs	45%	65%	63%	69%	71%

Table 13. Summary of input parameters including input conditions at U.S. 41.

Parameter	5-year	25-year	100-year
Rainfall Depth, inches	5.2	10.6	12.91
Event Duration, days	1	3	3
Simulation Duration, days	9	12	12
U.S. 41 Inflow Volume, inches	0.7	1.4	1.9
U.S. 41 Inflow Peak, cfs	202	331	442
Total Inflow, inches	5.9	12	14.81
Total Runoff, inches	3.7	8.2	10.5
Percent Runoff, %	62.7	68.3	70.9
USGS-Gumbel Discharge, cfs	202	331	442
Johnson Peak Discharge, cfs	350	1000	1380

The outflow hydrographs for the various design events at S.R. 765 are given in Figures 27 thru 29. The profile is shown to be similar for the events including the fact that the flow attains a peak value on the third day of the storm. The water surface profiles for the Gator Slough canal for the various design events are shown in Figure 30-36. Figure 30 shows comparisons with an HEC-2 simulation done on the Gator Slough by Johnson Engineering in 1991. This comparison with Johnson results is also given in tabular form for ten locations along the Gator Slough canal (Table 14). The model peak flow for the various design events is compared with Gumbel statistical values. This comparison shows very good agreement between the model and statistical values as shown in Table 15. Similarly the peak discharge rate for Gator Slough at S.R. 765 is compared with USGS-Gumbel values and Johnson Engineering values (Table 16). It is evident that XP-SWMM results agree very well with statistical values in comparison to Johnson Engineering results, which over predict the peak flows for these events. Water Surface elevations for the three secondary canals (Horseshoe, Hermosa and Shadroe) are shown in Figures 37 thru 48.

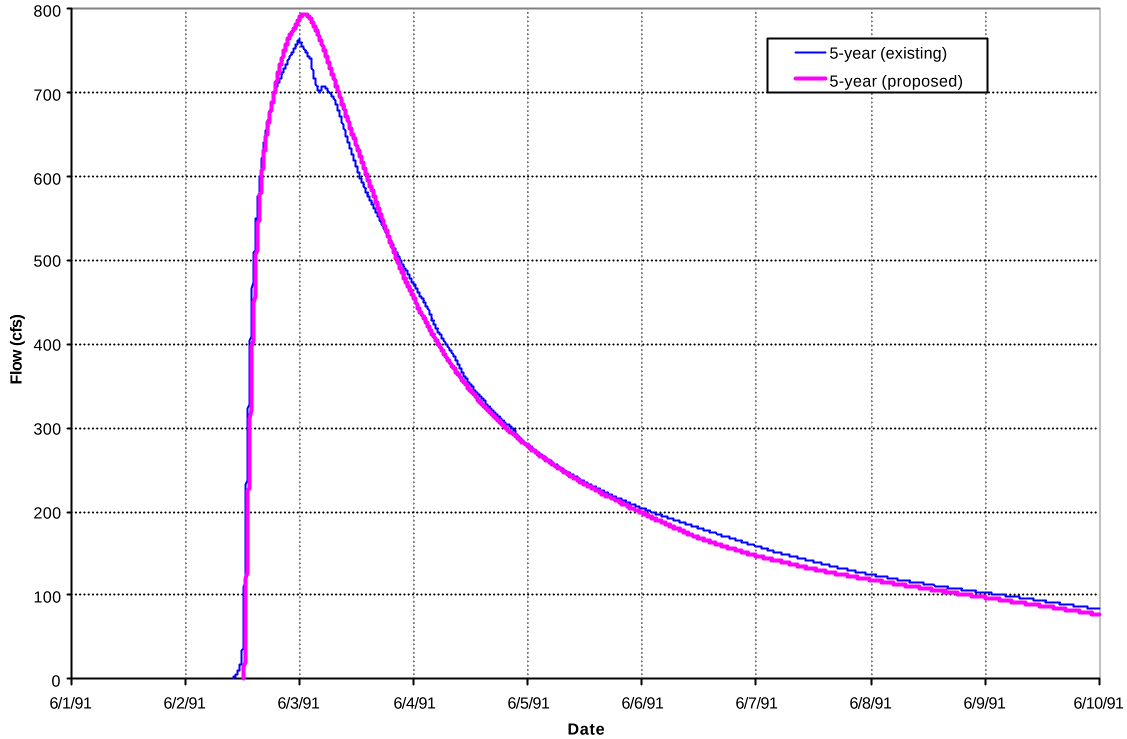

Figure 27. Outflow hydrograph for the 5-year event at S.R. 765.

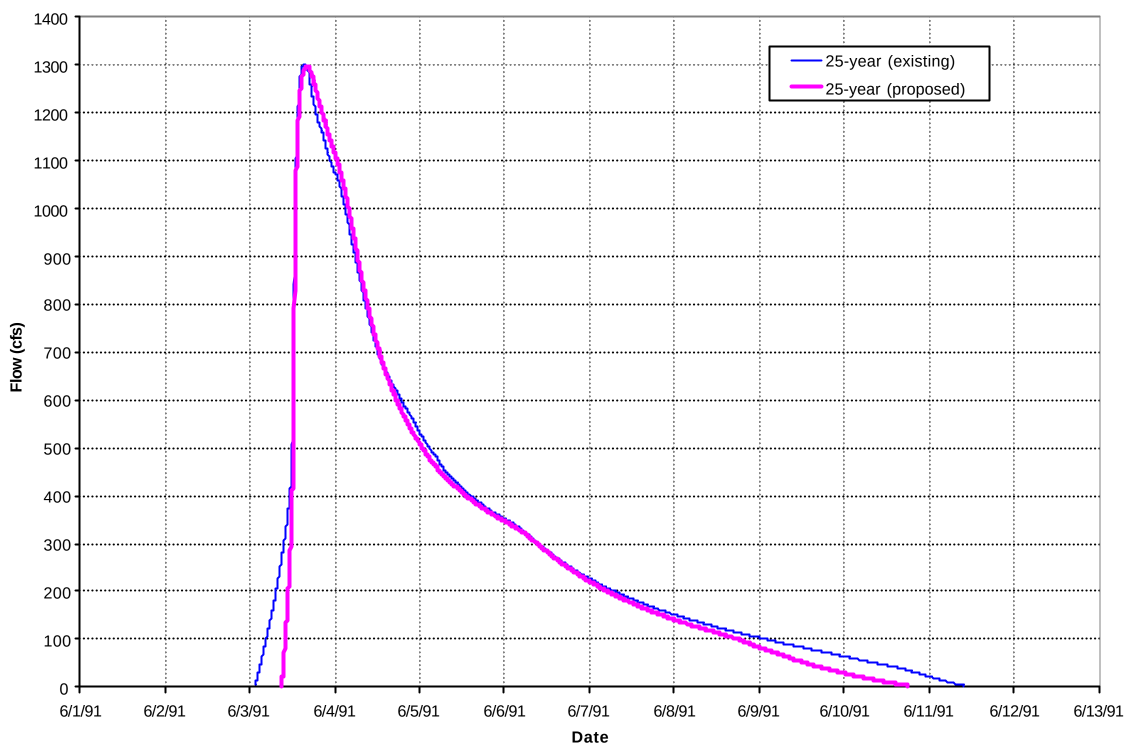

Figure 28. Outflow hydrograph for the 25-year event at S.R. 765.

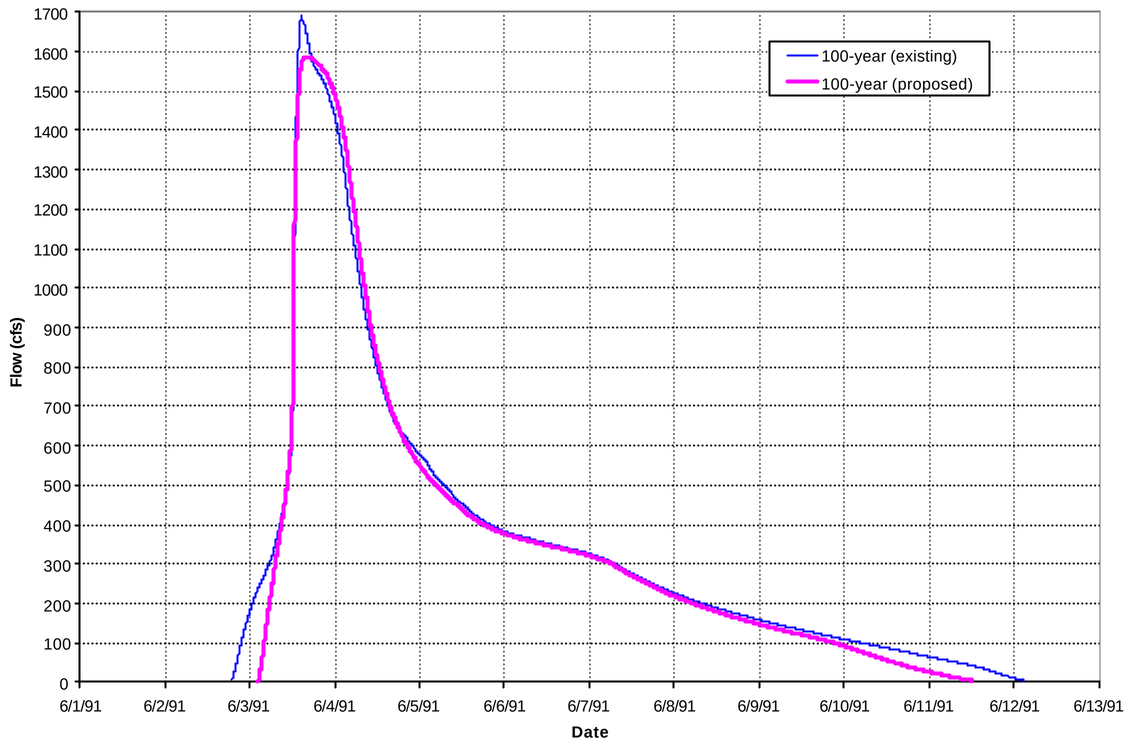

Figure 29. Outflow hydrograph for the 100-year event at S.R. 765.

Table 14. Gator Slough maximum water surface elevations for design events.

LOCATION	Maximum water surface elevations, feet								
	5-year Johnson Existing	5-year XP-SWMM Existing	5-year XP-SWMM Proposed	25-year Johnson Existing	25-year XP-SWMM Existing	25-year XP-SWMM Proposed	100-year Johnson Existing	100-year XP-SWMM Existing	100-year XP-SWMM Proposed
U.S. Hwy 41 Clvt (33/37)	17.8	19.3	19.3	22.3	22.3	22.3	23.1	23.0	23.0
Garden Blvd Clvt (43/45)	15.3	15.2	15.2	21.6	18.0	18.0	22.1	18.5	18.5
E/Gator Circle Clvt (51/53)	14.8	14.6	14.7	19.9	17.2	17.2	21.9	17.3	17.3
Andalusia Blvd Weir #19 (73/168)	14.3	14.8	15.0	18.8	15.7	15.7	20.0	15.8	15.8
Nelson Rd. Weir #9 (1060/193)	11.3	13.0	13.0	16.3	10.5	10.5	17.1	11.1	11.1
Chiquita Rd. Weir #4 (1068/990)	7.4	7.4	7.4	12.2	7.4	7.4	14.3	7.6	7.6
El Dorado Blvd Brg. 94 (234/1087)	5.0	4.0	4.8	8.4	4.8	5.3	10.1	5.3	5.7
S.R. 765 Weir #11 (238/1028)	4.0	3.9	4.6	5.6	4.5	5.1	6.3	5.0	5.5
S.R. 765 Brg. BS (1148/1145)	2.7	2.7	2.7	4.1	4.0	4.0	5.2	4.7	4.7
Old B/Store Rd. Brg. 74 (1115/1141)	2.5	2.7	2.7	2.5	4.0	4.0	2.5	4.4	4.4

Table 15. Model peak flows compared with statistical values at U.S. 41 and S.R. 765.

STATION	5-year event		
	USGS-Gumbel Peak flow (cfs)	Model Peak flow (cfs)	% Error
Gator Slough @ U.S. 41	202	202	0.0
Gator Slough @ S.R. 765	826	764	-7.5
STATION	25-year event		
	USGS-Gumbel Peak flow (cfs)	Model Peak flow (cfs)	% Error
Gator Slough @ U.S. 41	331	331	0.0
Gator Slough @ S.R. 765	1281	1300	1.5
STATION	100-year event		
	USGS-Gumbel Peak flow (cfs)	Model Peak flow (cfs)	% Error
Gator Slough @ U.S. 41	442	442	0.0
Gator Slough @ S.R. 765	1656	1692	2.2

Note: Values for Gator Slough at U.S. 41 were used as model inputs.

Table 16. Peak discharge rates for Gator Slough at S.R. 765.

Design Event	Peak discharge rate at S.R. 765, cfs			
	USGS-Gumbel	XP-SWMM Existing	XP-SWMM Proposed	Johnson Eng. Report
1-year	332	293	N/A	220
5-year	826	764	794	1140
25-year	1281	1300	1298	3500
100-year	1656	1692	1587	4655

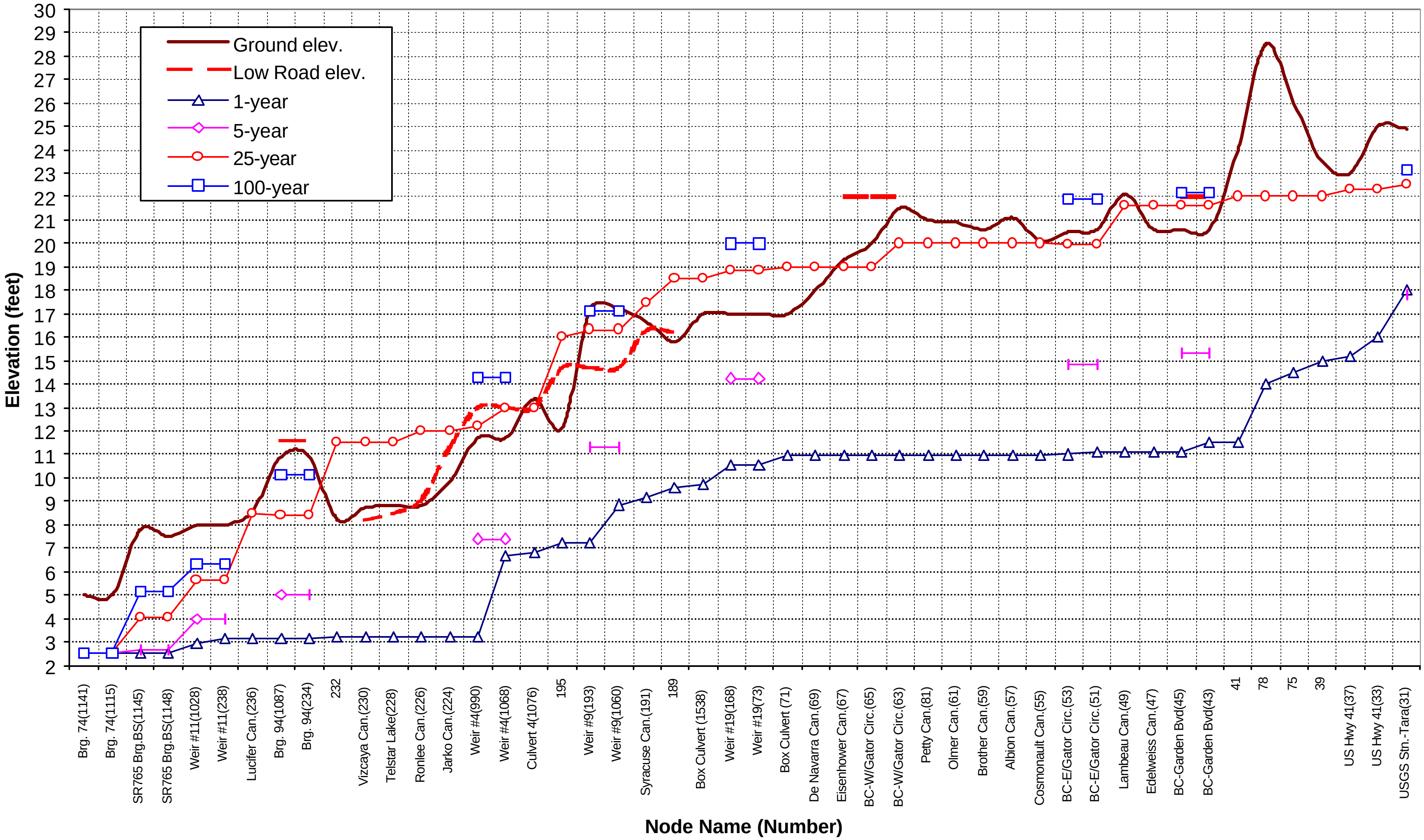

Figure 30. Water surface profiles along Gator Slough as reported by Johnson Eng.[1] for the 1,5,25 and 100-year design events.

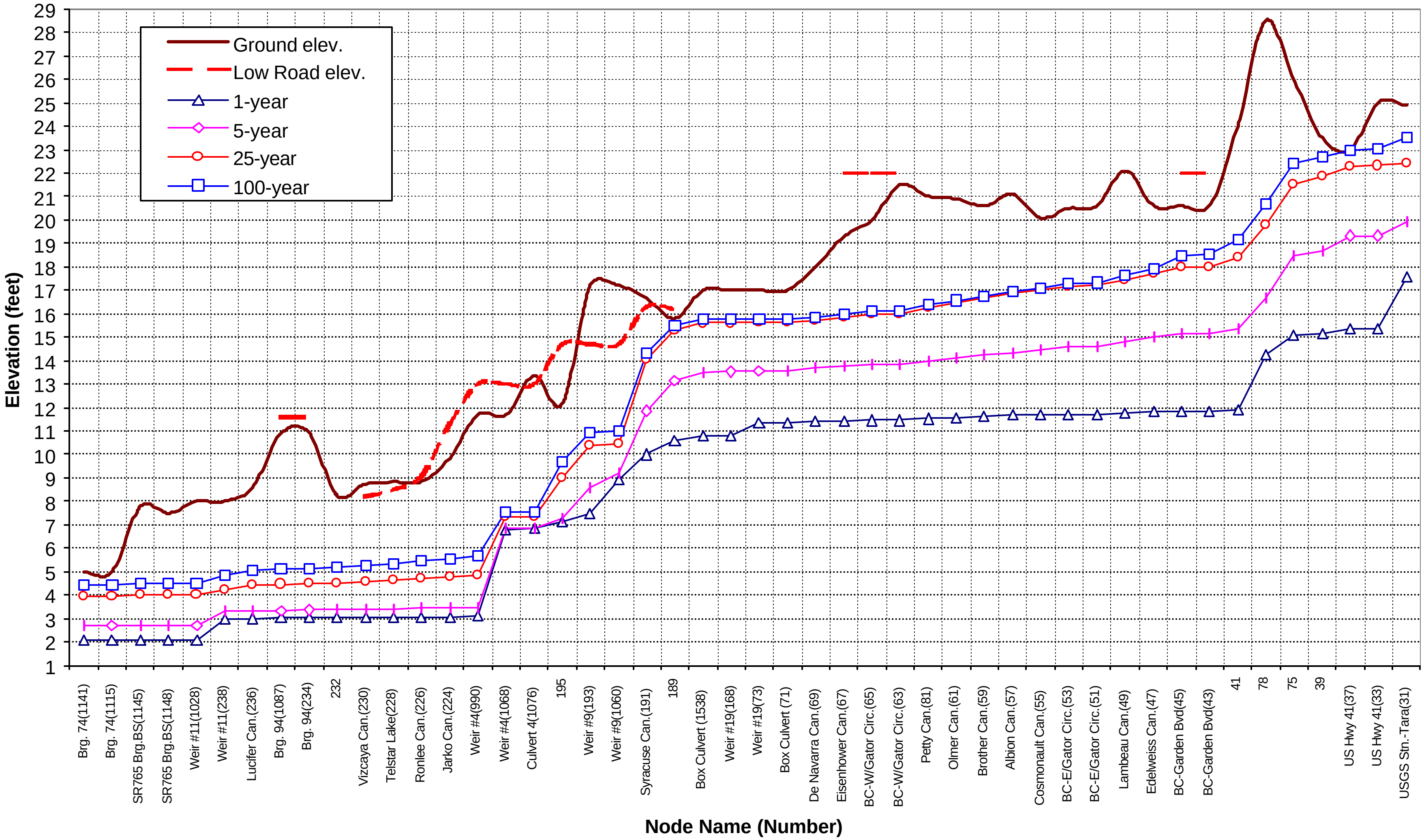

Figure 31. Water surface profiles along Gator Slough as estimated by the XP-SWMM model using existing weir crest elevations.

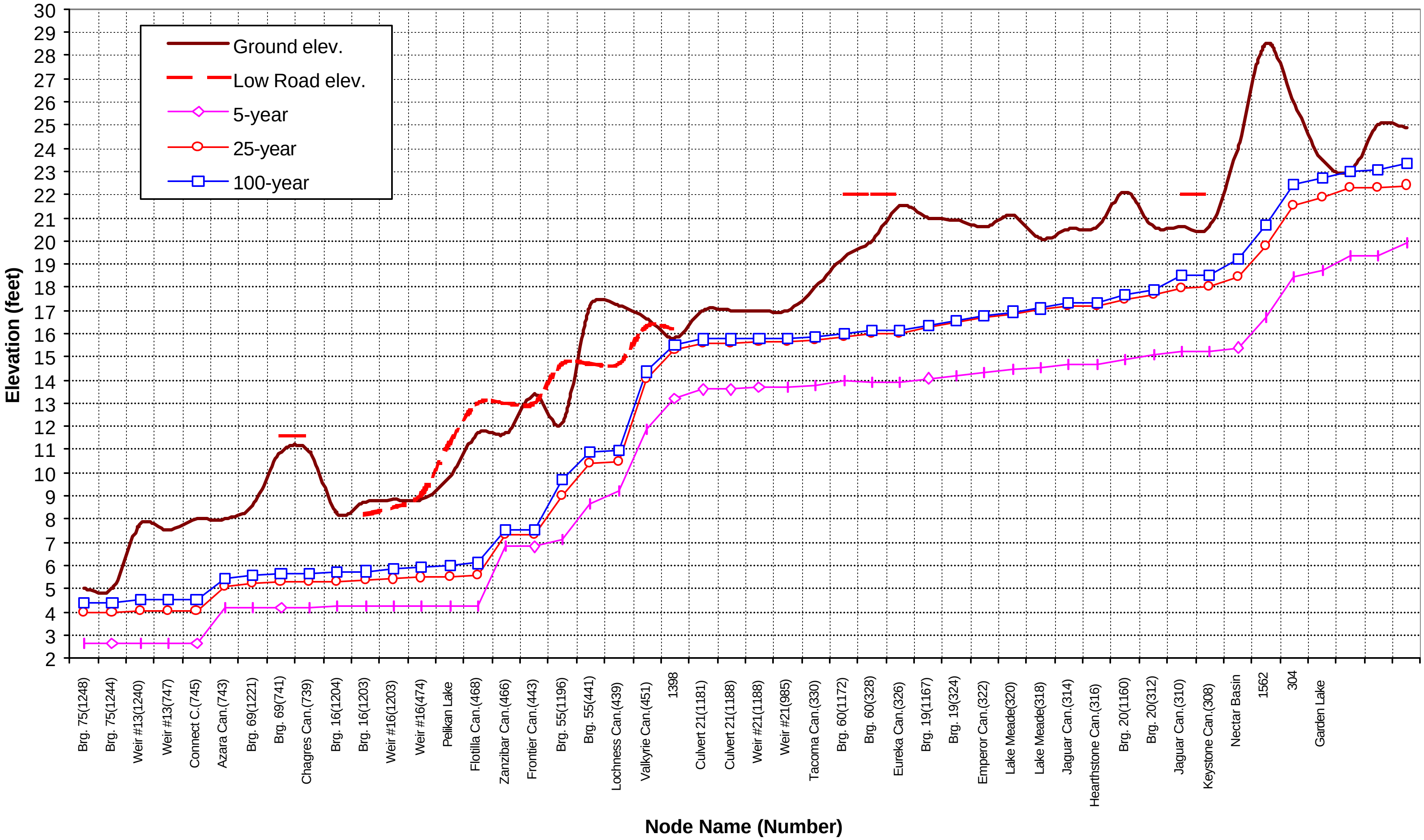

Figure 32. Water surface profiles along Gator Slough as estimated by the XP-SWMM model using raised weir crest elevations.

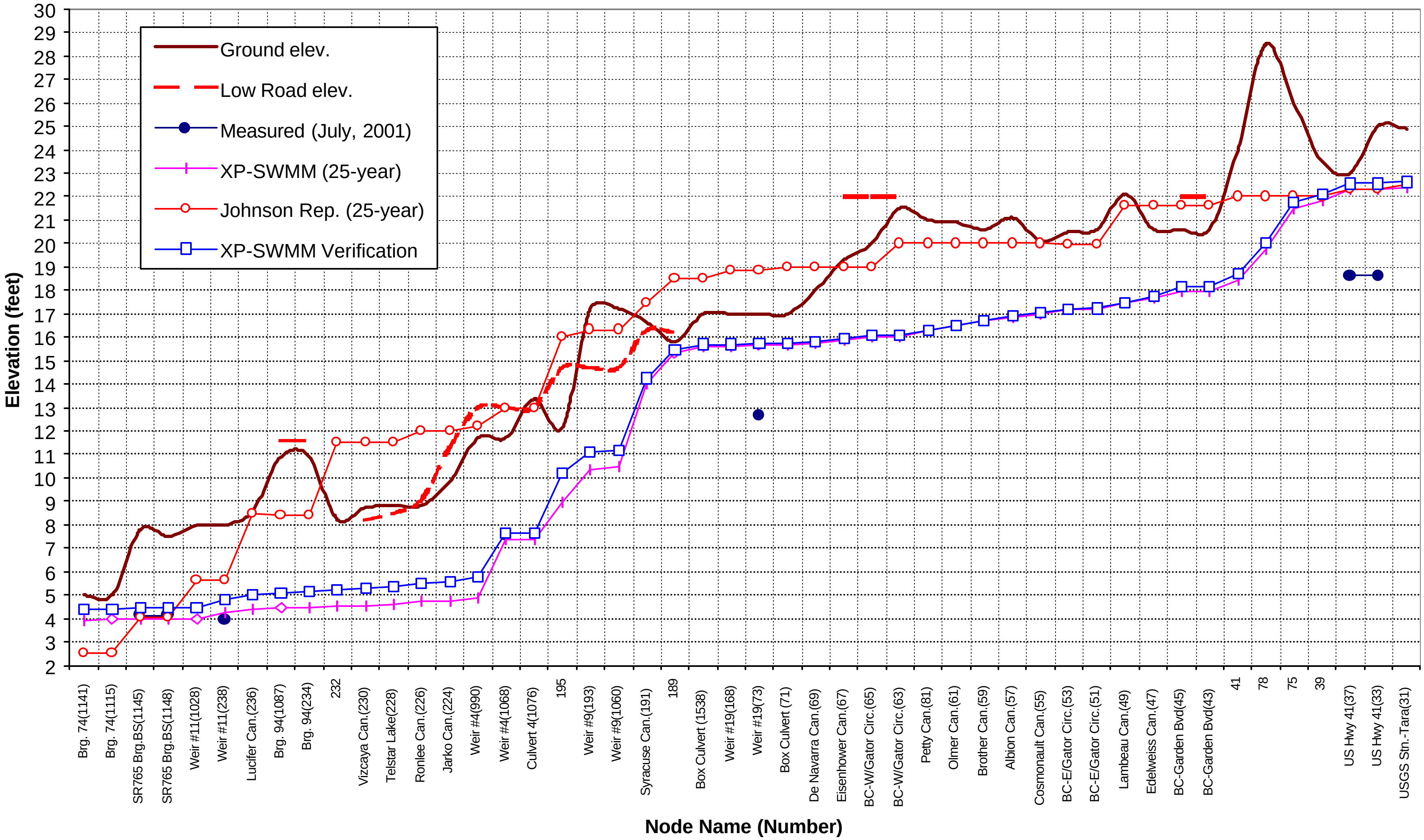

Figure 33. Water surface profiles along Gator Slough for verification compared with 25-year events.

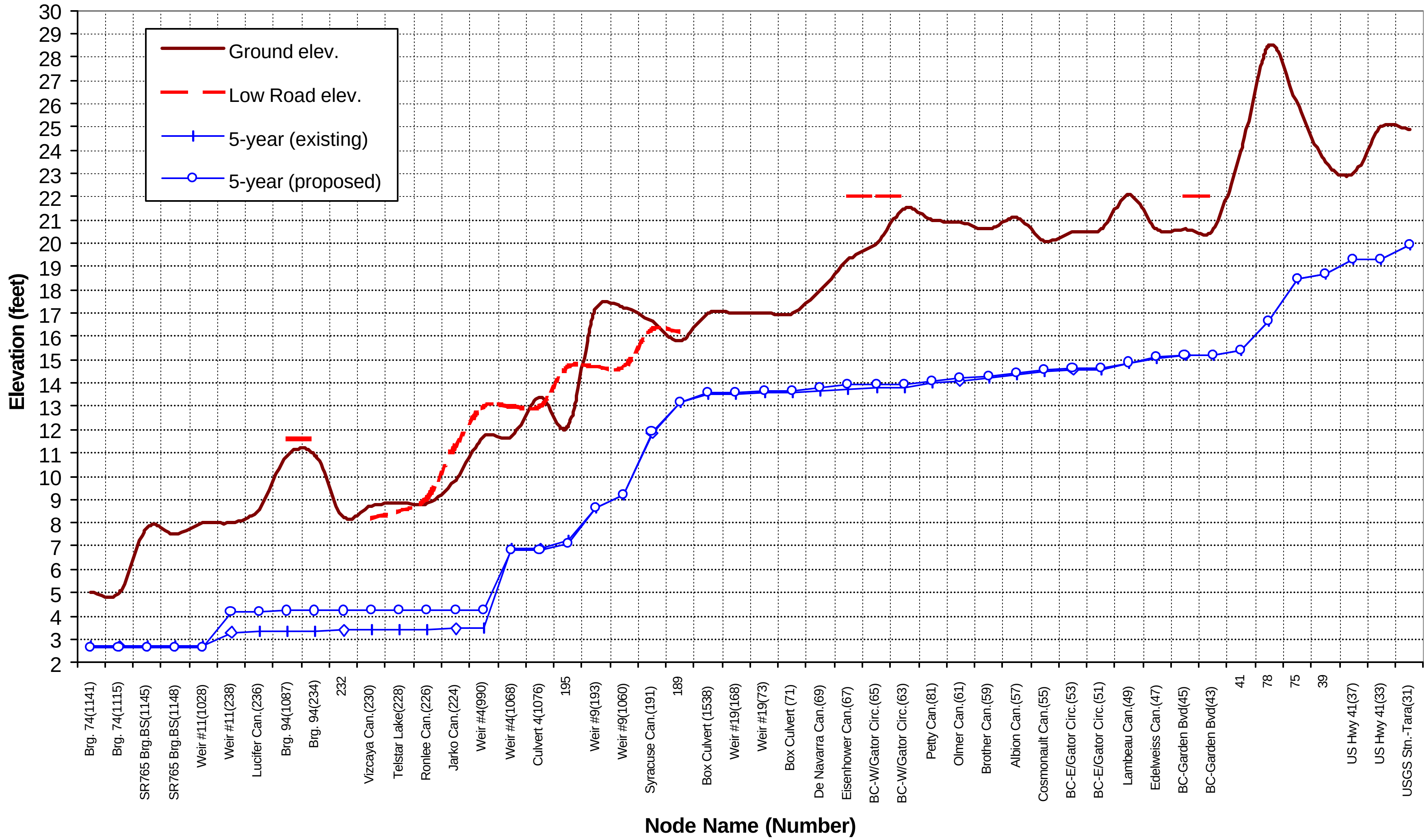

Figure 34. Comparison of Gator Slough 5-year event water surface profiles as estimated by the XP-SWMM model.

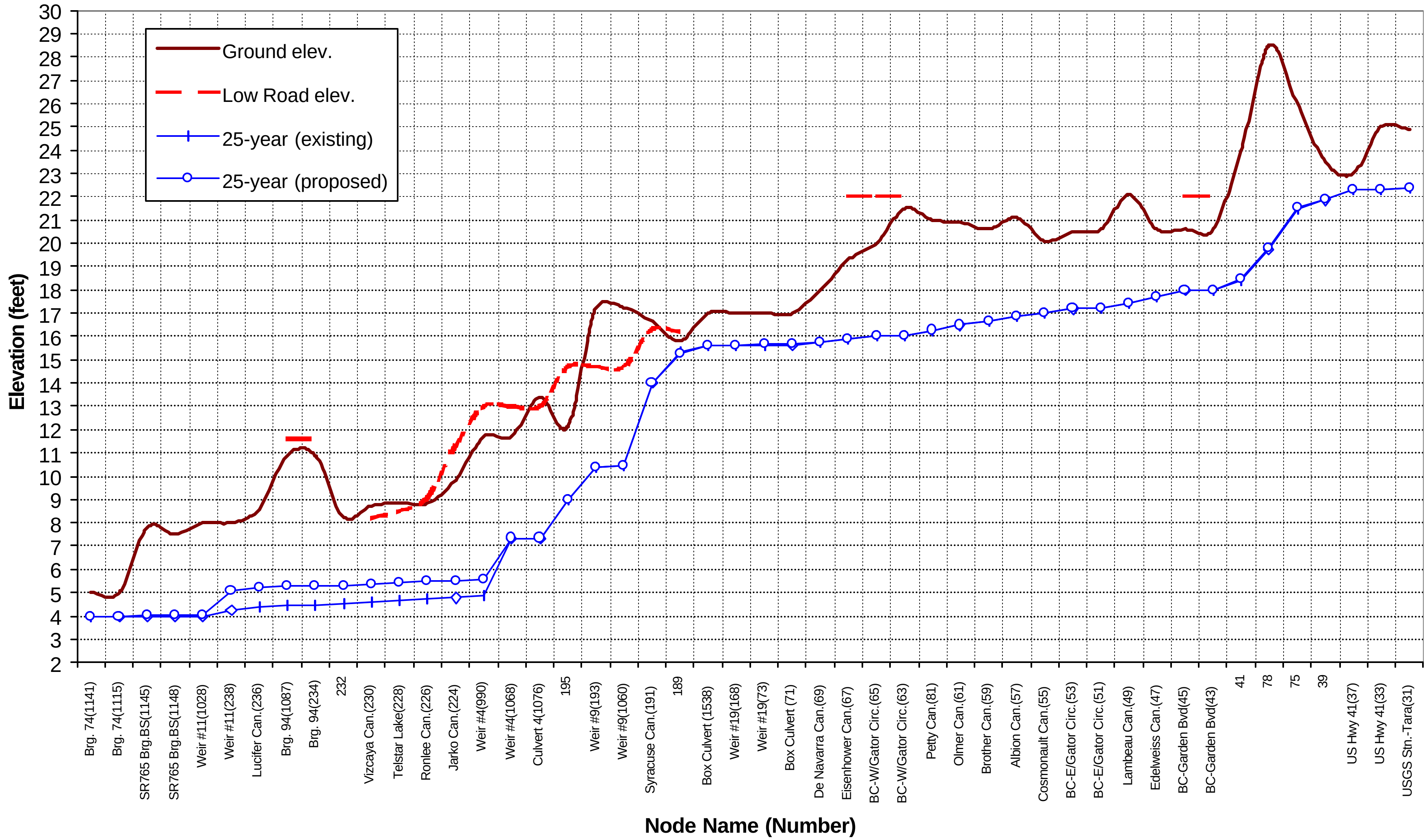

Figure 35. Comparison of Gator Slough 25-year event water surface profiles as estimated by the XP-SWMM model.

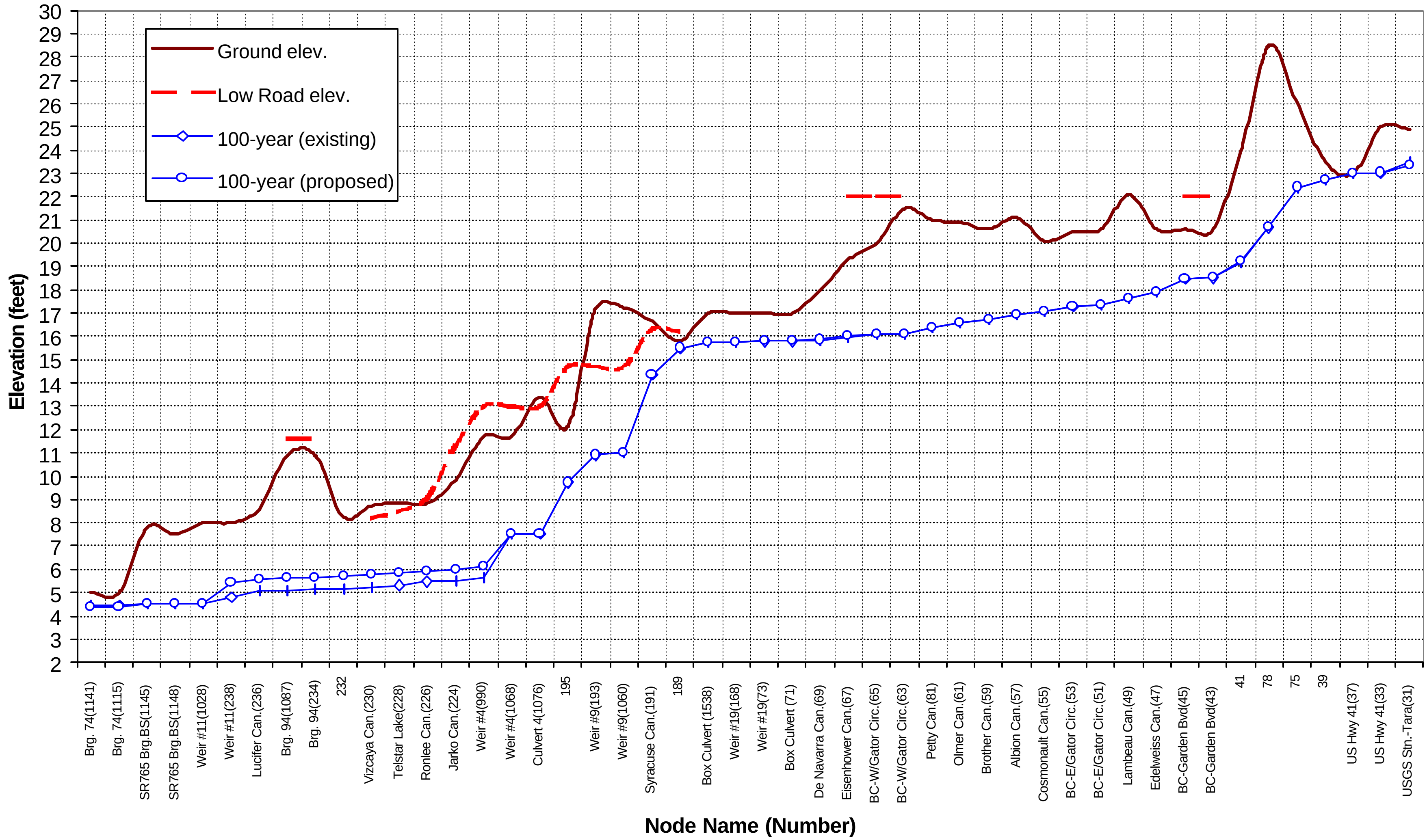

Figure 36. Comparison of Gator Slough 100-year event water surface profiles as estimated by the XP-SWMM model.

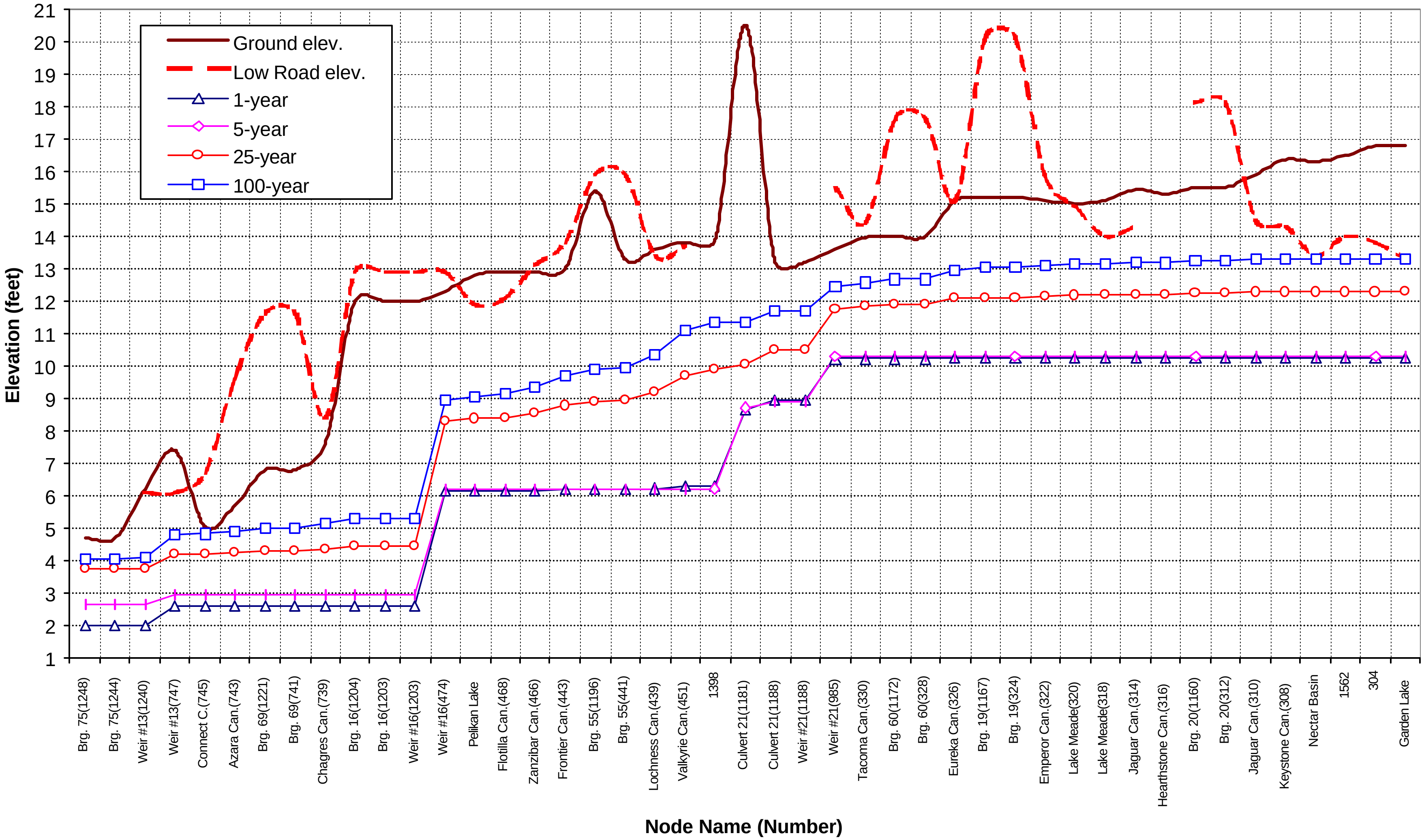

Figure 37. Water surface profiles along Horseshoe Canal as estimated by XP-SWMM using existing weir crest elevations.

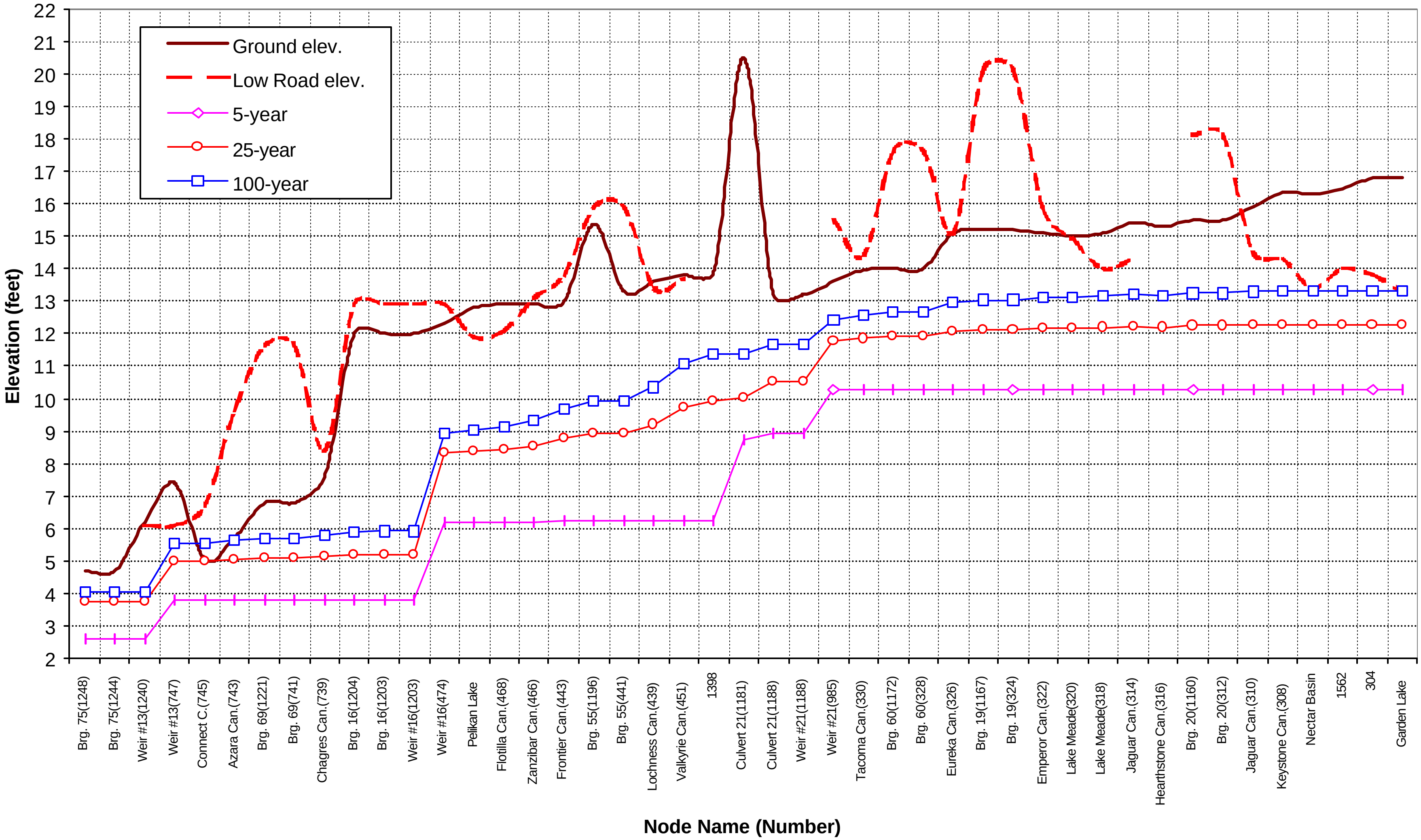

Figure 38. Water surface profiles along Horseshoe Canal as estimated by XP-SWMM using raised weir crest elevations.

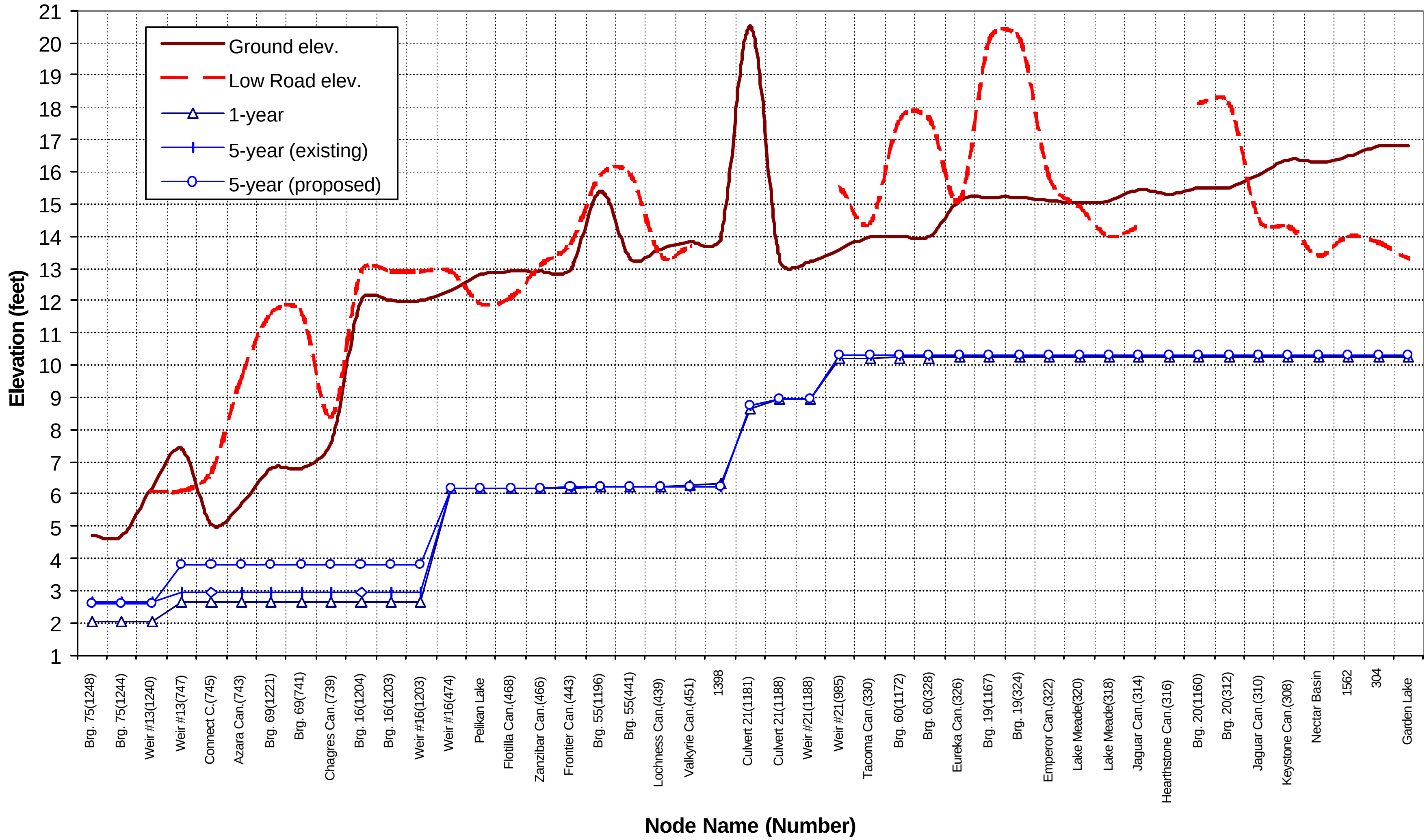

Figure 39. Comparison of 1-year and 5-year event water surface profiles along Horseshoe Canal as estimated by XP-SWMM.

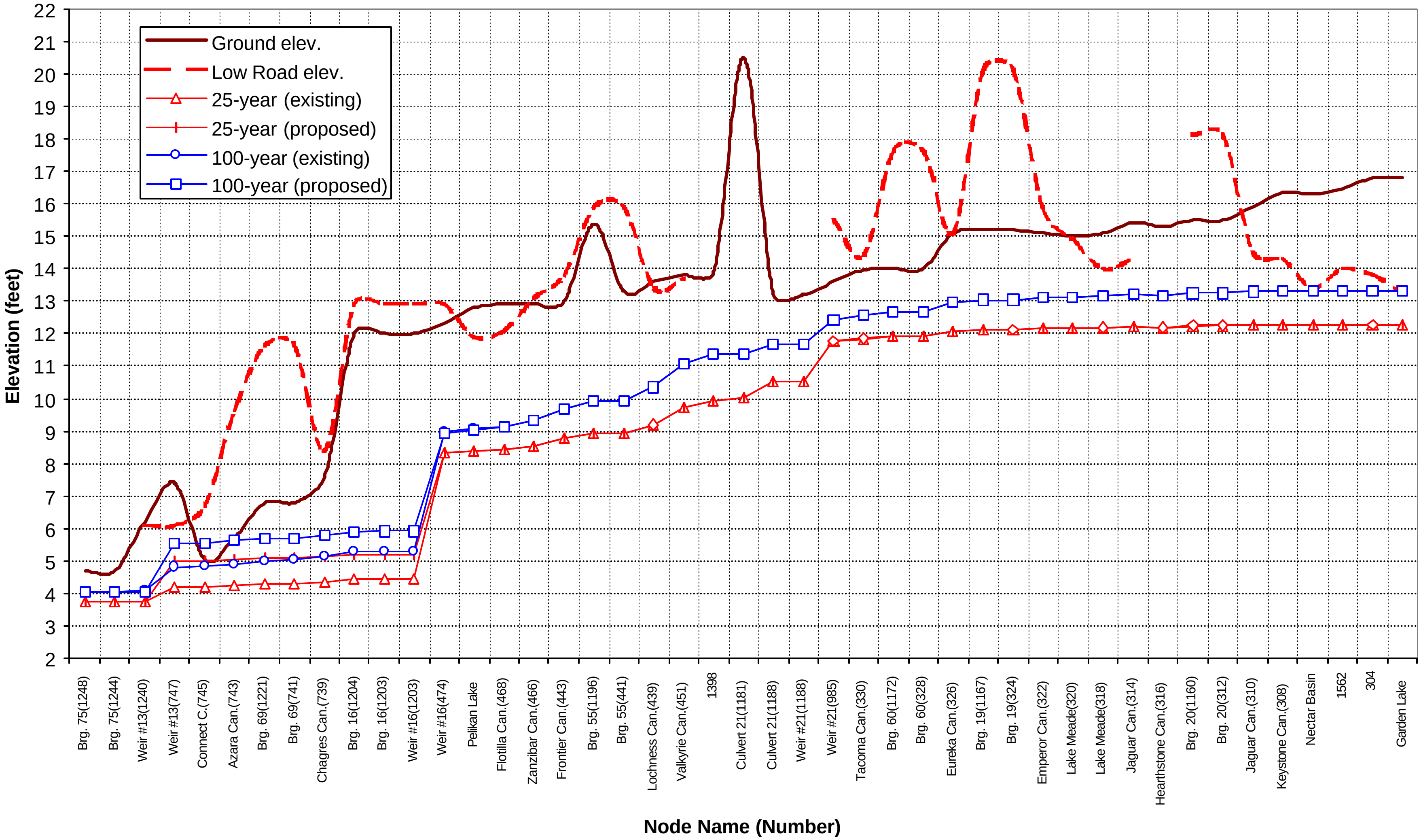

Figure 40. Comparison of 25-year and 100-year event water surface profiles along Horseshoe Canal as estimated by XP-SWMM.

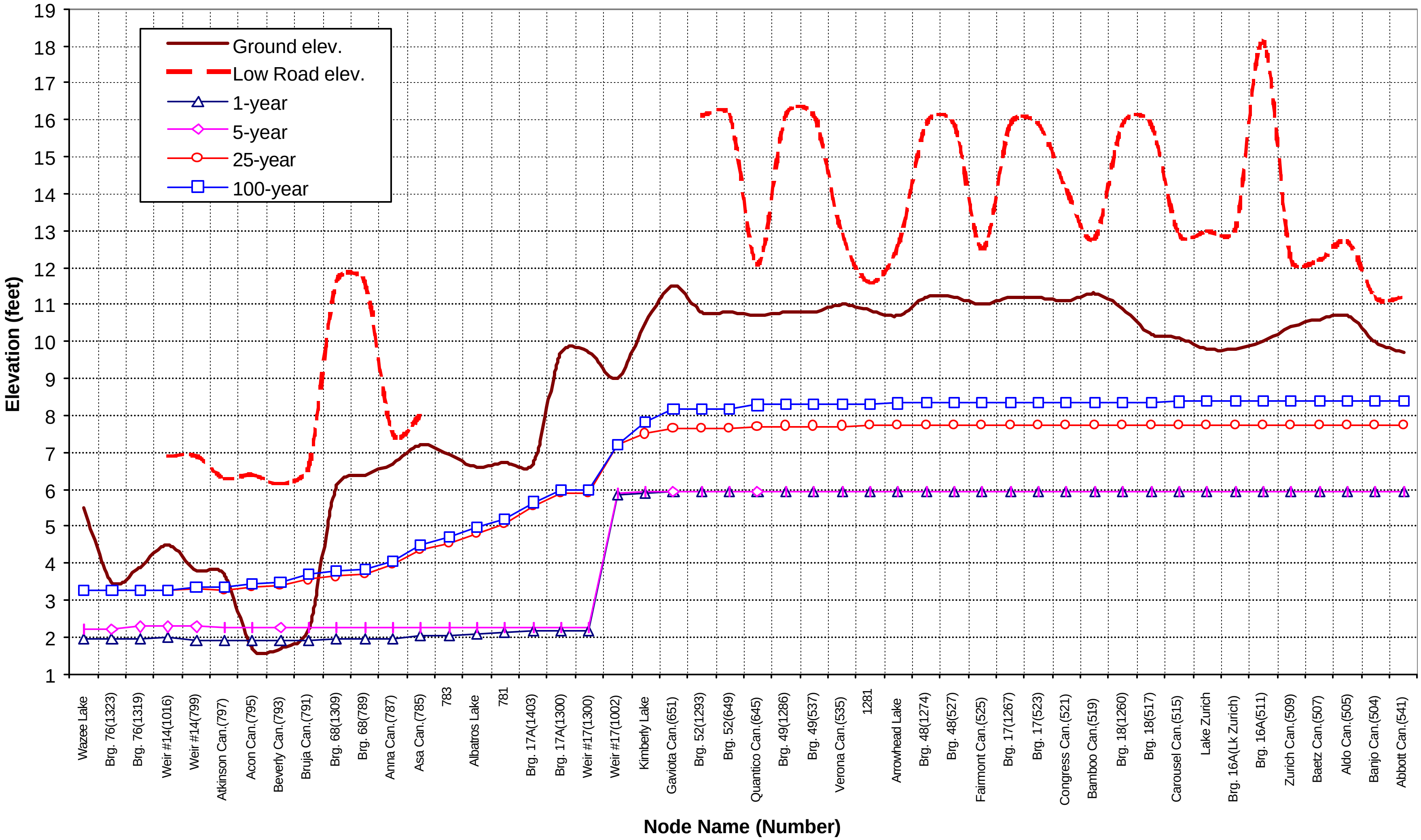

Figure 41. Water surface profiles along Hermosa Canal as estimated by XP-SWMM using existing weir crest elevations.

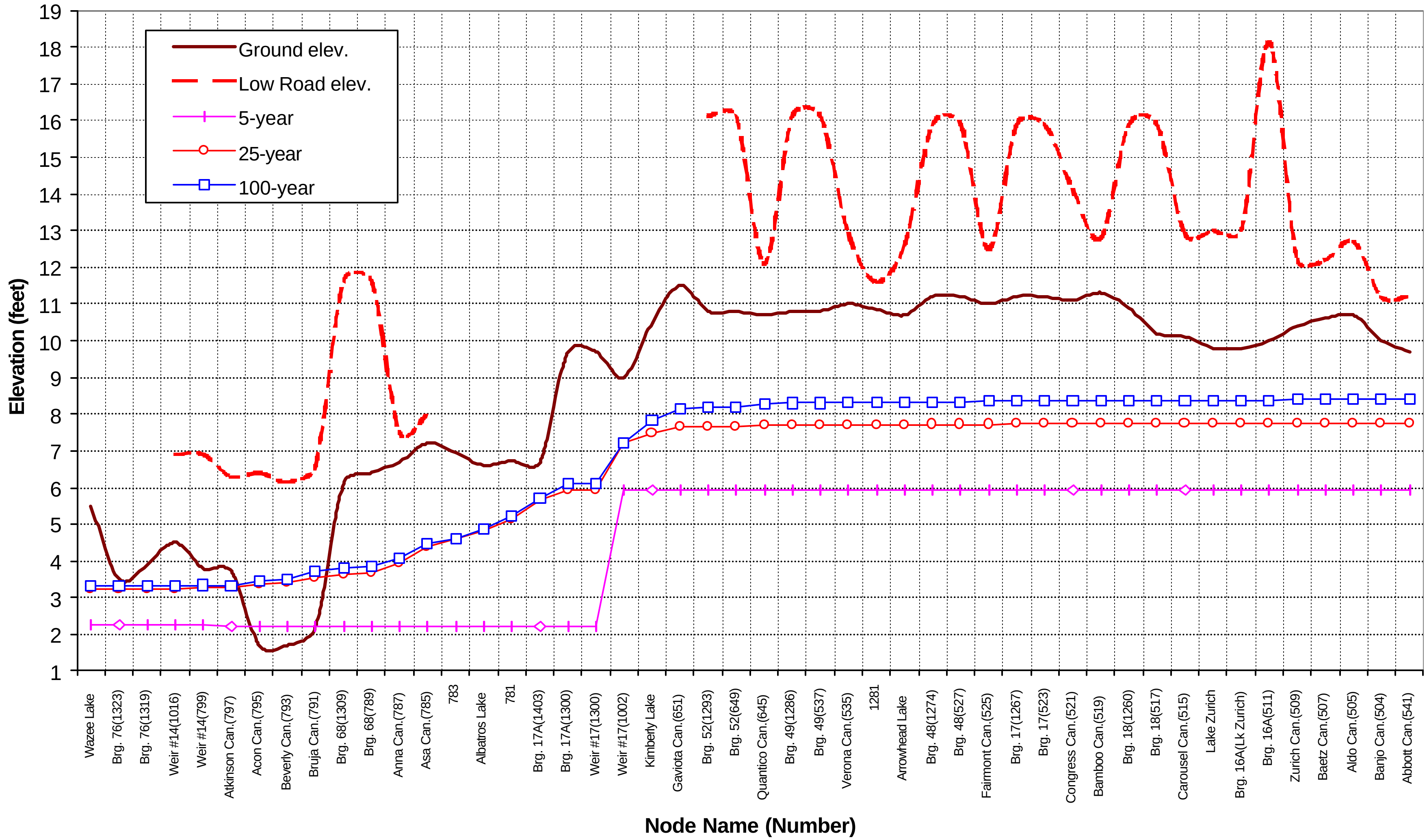

Figure 42. Water surface profiles along Hermosa Canal as estimated by XP-SWMM using raised weir crest elevations.

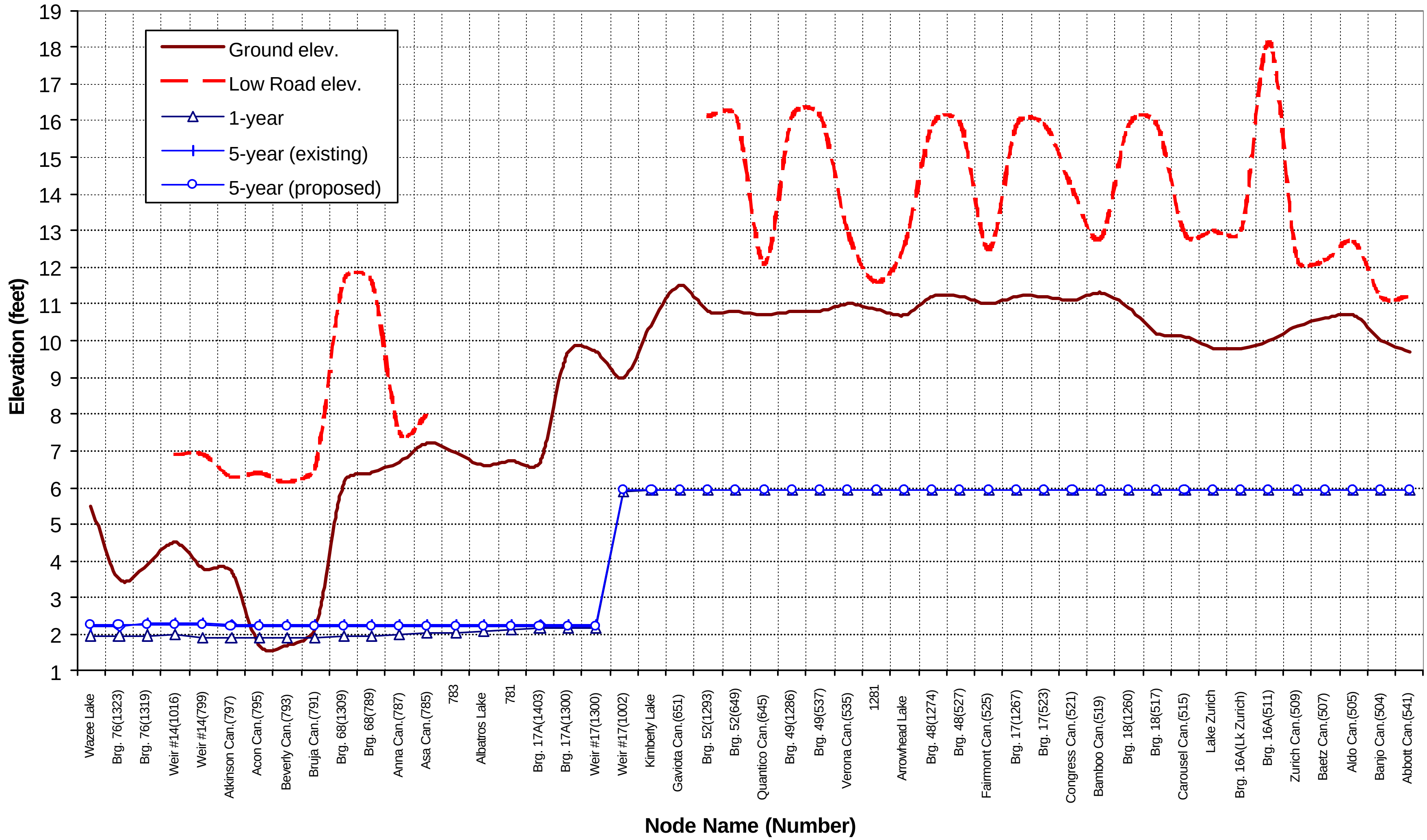

Figure 43. Comparison of 1-year and 5-year event water surface profiles along Hermosa Canal as estimated by XP-SWMM.

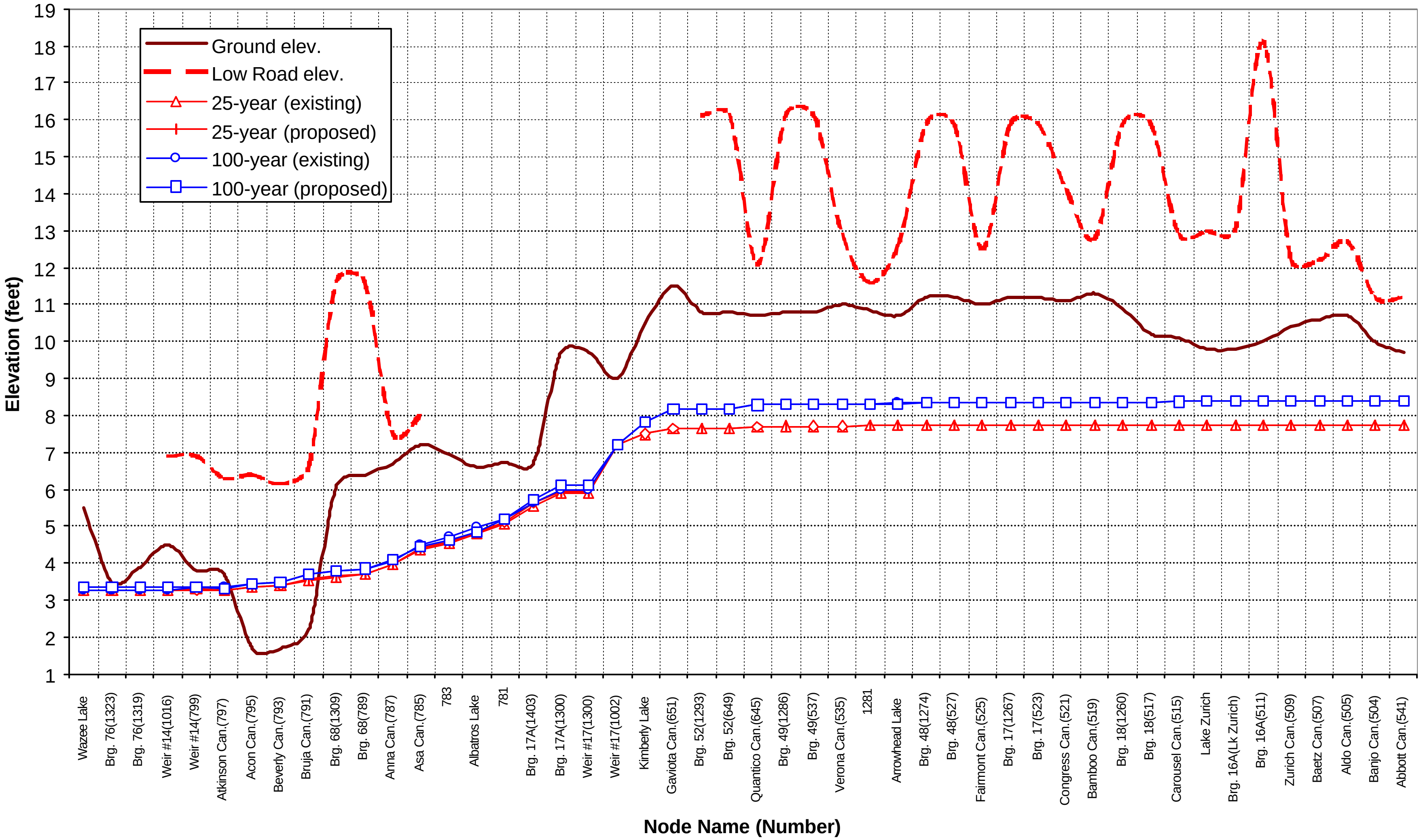

Figure 44. Comparison of 25-year and 100-year event water surface profiles along Hermosa Canal as estimated by XP-SWMM.

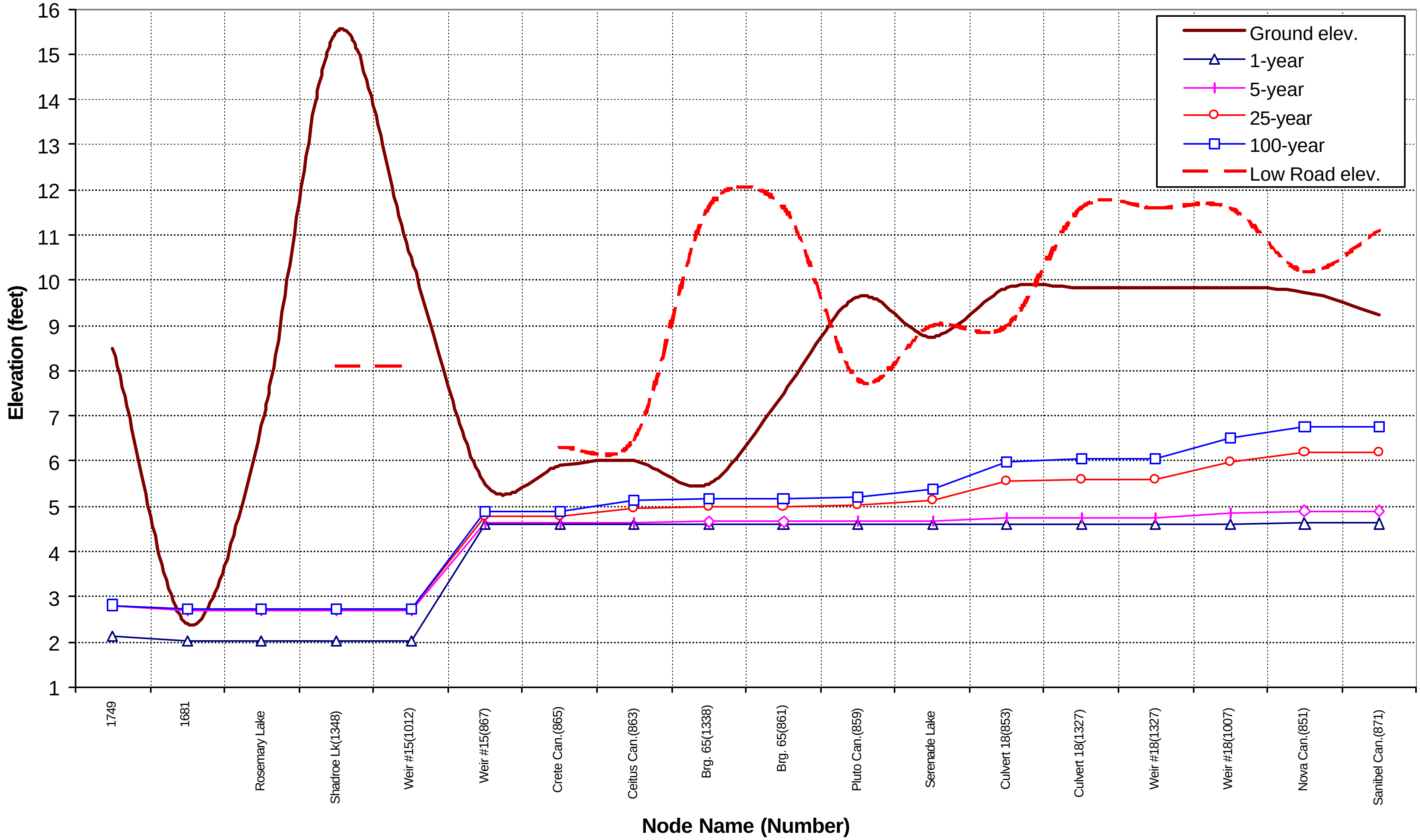

Figure 45. Water surface profiles along Shadroe Canal as estimated by XP-SWMM using existing weir crest elevations.

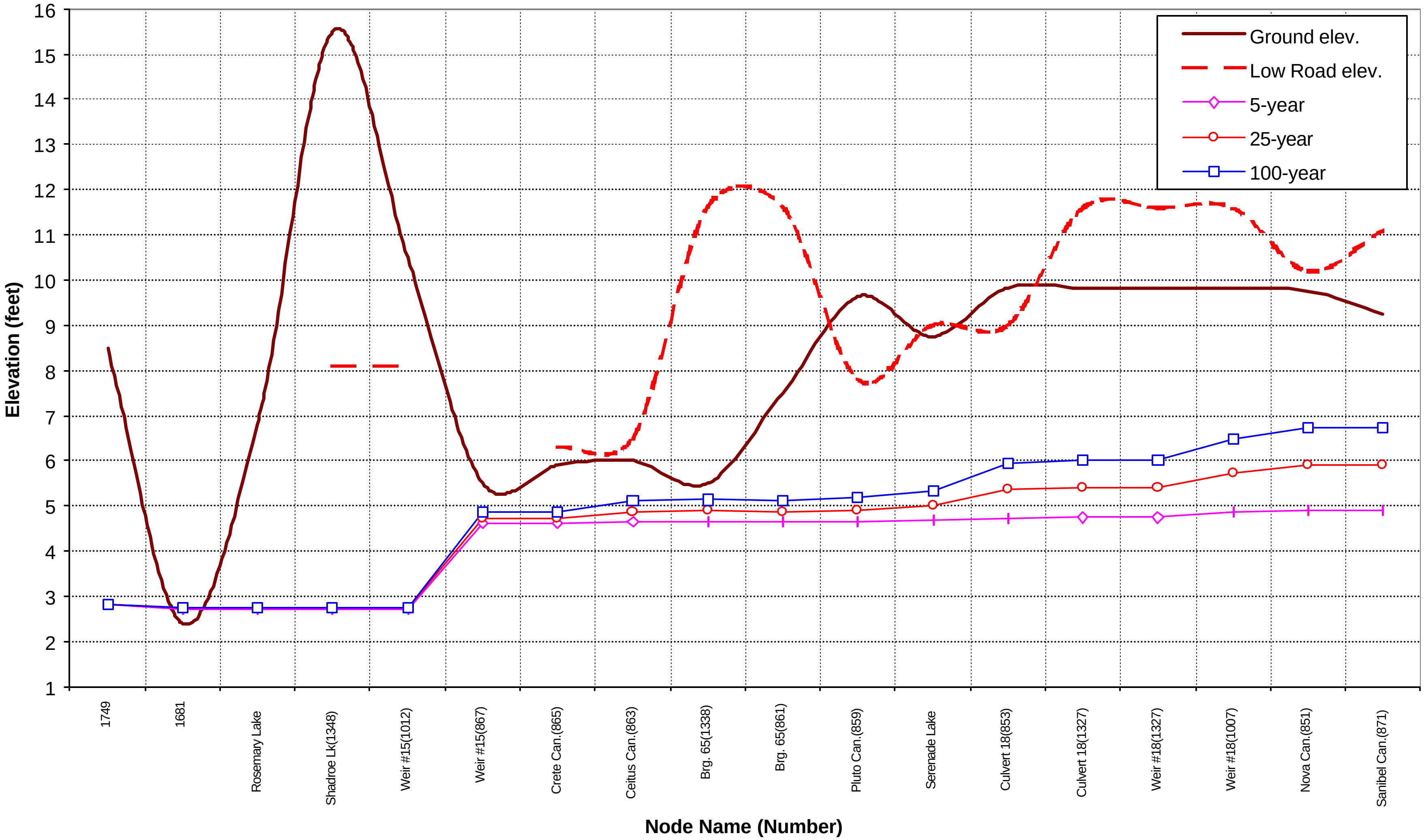

Figure 46. Water surface profiles along Shadroe Canal as estimated by XP-SWMM using raised weir crest elevations.

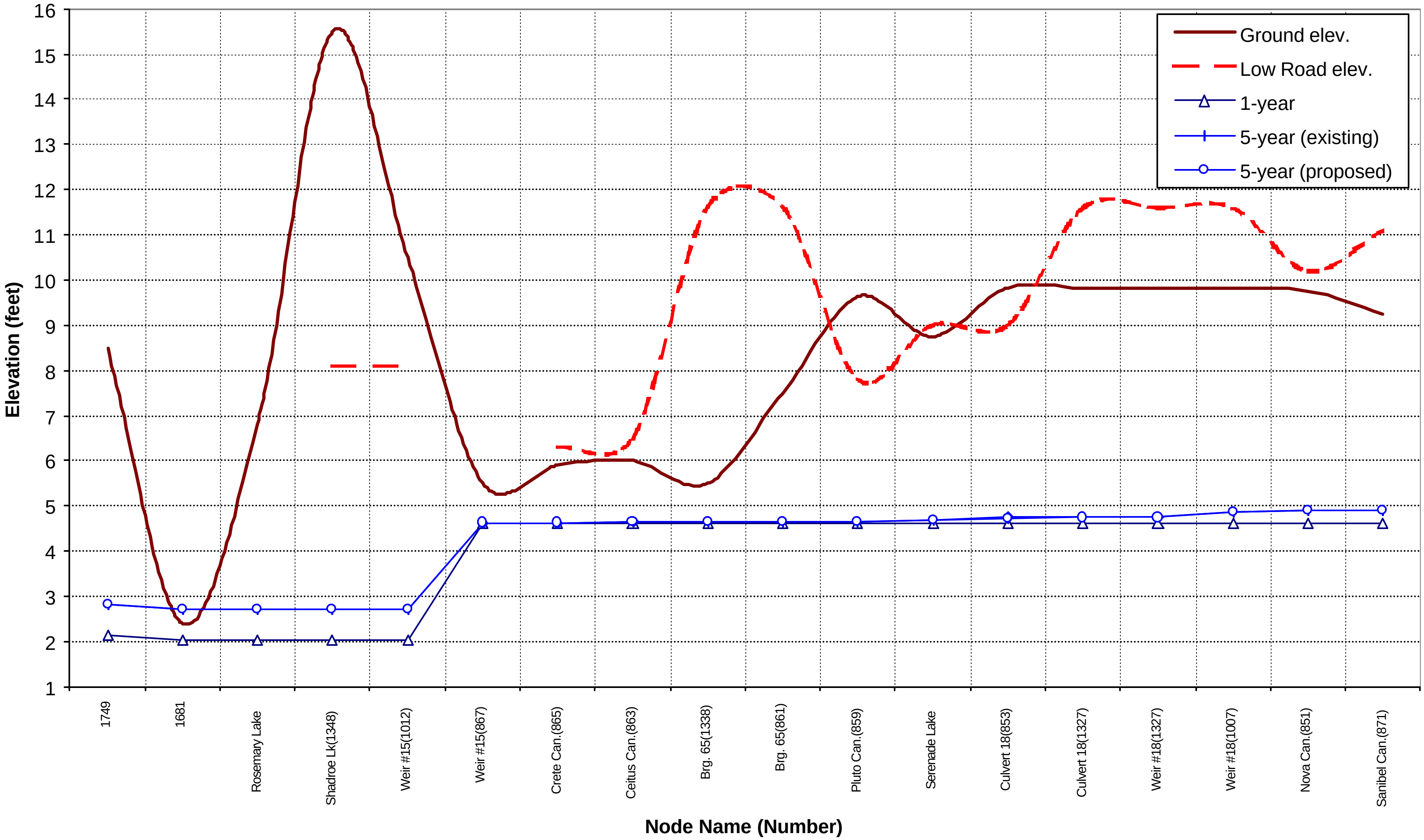

Figure 47. Comparison of 1-year and 5-year event water surface profiles along Shadroe Canal as estimated by XP-SWMM.

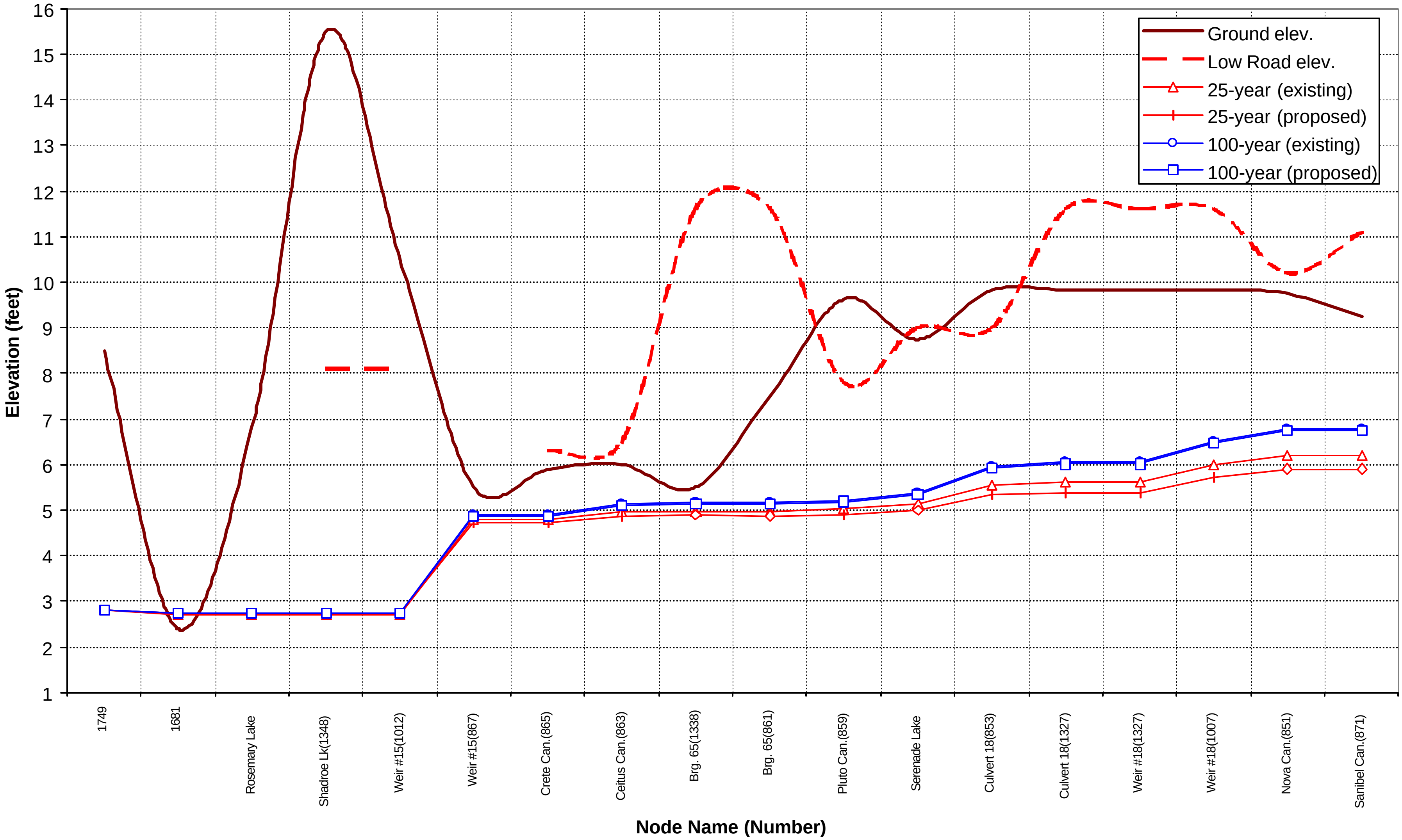

Figure 48. Comparison of 25-year and 100-year event water surface profiles along Shadroe Canal as estimated by XP-SWMM.

5.4 Flooding

The model shows flooding in specific locations for the various design storms. Table 17 gives a summary of the flood scene as predicted by XP-SWMM. The nodes given as flooded have a zero node freeboard and associated surcharge elevation.

Appendix A is a summary of adjacent roads to the node network in the watershed.

Table 17. Locations and depths of flooding resulting from 5, 25, and 100-year design events, including locations experiencing increased flood stages due to the proposed weir crest elevation increases.

Canal System	Low Road	ID	Design Event Flooding by Location, in feet above channel crown								
			100 year event			25 year event			5 year event		
			Proposed	Existing	Increas.	Proposed	Existing	Increas.	Proposed	Existing	Increase
Gator Slough	-	92	0.92	0.92		0.70	0.70				
Gator Slough	NE 17th Ave	96	0.38	0.37		0.28	0.27				
Gator Slough	NE 36th Ln.	97	0.38	0.37		0.28	0.27				
Gator Slough	NE 15th Ave	99	0.38	0.37		0.28	0.27				
Gator Slough	NE 37th St.	101	0.38	0.37		0.28	0.27				
Gator Slough	-	114	0.14	0.13							
Gator Slough	-	116	0.51	0.50		0.35	0.34				
Gator Slough	-	118	0.42	0.41		0.28	0.27				
Gator Slough	-	120	0.66	0.66		0.57	0.57				
Gator Slough	-	122	0.80	0.79		0.70	0.69				
Gator Slough	NE 34th Ter.	124	0.33	0.32		0.22	0.21				
Gator Slough	NE 34th Ln.	160	0.33	0.32		0.22	0.21				
Gator Slough	-	162	0.20	0.19							
Gator Slough	-	163	0.20	0.19							
Gator Slough	-	165	0.20	0.19							
Gator Slough	-	180	0.38	0.37		0.28	0.27				
Gator Slough	-	183	0.92	0.92		0.70	0.70				
Gator Slough	NW 30th St.	**270**	0.33		0.33						
Gator Slough	NW 22nd Pl.	**271**	0.73	0.23	0.50	0.31		0.31			
Hermosa	NW 14th Ter	**745**	0.52		0.52						
Hermosa	NW 9th Ter.	791	1.50	1.50		1.34	1.35		0.02	0.05	
Hermosa	NW 9th Ter.	793	1.80	1.80		1.69	1.70		0.52	0.55	
Hermosa	NW 29th Av.	795	1.74	1.74		1.65	1.66		0.52	0.55	
Hermosa	NW 11th Ter	825	1.40	1.40		1.24	1.25				
Hermosa	-	829	1.60	1.60		1.49	1.50		0.32	0.35	
Hermosa	NW 29th Av.	833	1.54	1.55		1.45	1.46		0.32	0.35	
Shadroe	-	1680	0.35	0.33		0.35	0.32		0.31	0.31	
Shadroe	-	1681	0.34	0.33		0.35	0.32		0.31	0.31	

6.0 CONCLUSIONS

Results of the XP-SWMM model implementation on the Gator Slough, Horseshoe, Hermosa and Shadroe canals of Cape Coral show very little additional flooding due to increasing weir crest elevations by 1 foot at Weirs 11, 13, 14, 15 and 19. For the 100-year design simulations, water surface profiles increased by a maximum of 0.6 foot in a limited reach of Gator Slough between Burnt Store Road (S.R. 765) and Chiquita Boulevard. Horseshoe canal showed a slightly greater stage increase (0.8 foot) along the lower reach between Burnt Store Road and Chiquita Boulevard. Hermosa and Shadroe canals actually showed a net reduction of flooding in their downstream reaches between Burnt Store Road and Chiquita Boulevard.

7.0 REFERENCES

Canal Dimensions/ Field Information/ Hydraulics Structures

[1] *Lee County Surface Water Management Plan (LCSWMP)*. Johnson Engineering, Inc., Camp Dresser & McKee Inc., Hole, Monte & Assoc., and W. Dexter Bender & Assoc. (1991).

[2] *A Water Management Study of the Cape Coral Networks, Lee County*. Connell, Metcalf, and Eddy (1979).

[3] City of Cape Coral – Road Design Maps. *Water Independence For Cape Coral (WICC) Master Plan*, City of Cape Coral, Boyle Engineering Corporation (1988).

[4] *City of Cape Coral Utility Master Plan Update, Final Report*. Dames and Moore in association with Black and Veatch (August 1999).

Soil Data

[5] *Soil Survey of Lee County, Florida.* United States Department of Agriculture, Soil Conservation Service (December 1984).

Discharge Data

[6] *Water Data Reports: South Florida Surface Water Gauging Stations*: 264437081550100 “Gator Slough at U.S. 41 near Ft. Myers, Fl”; 264139082022100 “Gator Slough at S.R. 765 near Ft Myers, Fl.” United States Geological Survey (USGS).

Rainfall Records

[7] *“Lake Fairway” rain gage station, historical data.* Lee County Environmental Services-Natural Resources Division Southwest Florida.

[8] *Surface Water Management Design Aids (SWMDA)*, South Florida Water Management District (1996).

8.0 APPENDICES

Appendix A. Node Parameters.

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
252	22	8.6	1722	0.0002	8.6	0.3	11.4	NW 18th Ave.	Crown
259	45	9.1	1722	0.0002	9.1	0.8	10.1	NW 20th Ave.	Tyre
253	45.4	7.7	1722	0.0002	7.7	-0.6	11.2	NW 31st St.	Tyre Lake
31		26.4			24.9	16.5			Gator Slough
33	184.3	26.5	800	0.0002	25	15			Gator Slough
37		23			23	11.5			Gator Slough
39	283.4	25	4000	0.0002	23.5	10			Gator Slough
75	283.4	27.5	4000	0.0002	26	11.5			Gator Slough
78	283.4	30	4000	0.0002	28.5	13			Gator Slough
41	283.4	25.5	10000	0.0002	24	9			Gator Slough
43	10.2	22.1	200	0.0002	20.6	6			Gator Slough
45		20.6			20.6	6	22	Garden Bvd Brg.	Gator Slough
137	50	20	800	0.0002	17	6			Mac Arthur
183	50	18.5	700	0.0002	17	6			Scottys
92	76	18.5	800	0.0002	17	6			Mac Arthur/ Scottys
93	44.8	19.5	800	0.0002	18	6			Edelweiss
47	92.2	22.1	700	0.0002	20.6	7			Edelweiss/Gator
154	23	23	600	0.0002	21.5	7.5			Robinson
155	23	23	600	0.0002	21.5	7.5			Robinson/Interuption
172	23	21	600	0.0002	19.5	7.5			Lambeau
49	23	23.6	600	0.0002	22.1	7.5	17.3	NE 43rd St.	Lambeau/Gator
51	42	22.1	800	0.0002	20.6	6.5			Gator Slough
53		20.5			20.5	5			Gator Slough
148	41.2	18.5	800	0.0002	17	6			Cosmonaut
174	31.8	22.5	800	0.0002	21	6			Oscar
55	41.2	21.6	800	0.0002	20.1	5.5			Gator Slough
146	29.2	19	800	0.0002	17.5	6.5			Albion
57	45	22.6	800	0.0002	21.1	6.5			Gator Slough
152	29.2	18.5	700	0.0002	17	6			Brother
178	20	22.3	600	0.0002	20.8	6			Opalocka
59	50	22.1	700	0.0002	20.6	6			Gator Slough
176	30	22.2	700	0.0002	20.7	6			Olmer
61	109.2	22.4	800	0.0002	20.9	6			Gator Slough
96	46.4	17.5	800	0.0002	16	6	15.4	NE 17th Ave.	Lorri
180	25	17.5	600	0.0002	16	6			Paxton
97	50.2	17.5	1000	0.0002	16	6	16.5	NE 36th Ln.	Paxton/Lorri
104	30.4	18.5	700	0.0002	17	6	15.2	NE 14th Plc.	Linda
99	46.4	17.5	800	0.0002	16	6	15.8	NE 15th Ave.	Paxton/Linda
101	150.4	17.5	800	0.0002	16	6	15.4	NE 37th St.	Paxton/Letty
81	28.8	23.5	700	0.0002	21	6	16.1	NE 37th Ter.	Letty/Gator
63	39.2	23	600	0.0002	21.5	6	22	W. Gator Circle Brg.99	Gator Slough
65		20			20	5.5	22	W. Gator Circle Brg.99	Gator Slough
150	14.8	22.2	700	0.0002	20.7	6			Ilia
84	30	22.5	800	0.0002	21	6			Eisenhower

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
85	54.4	22.5	800	0.0002	21	6			Eisenhower
142	10.2	22.5	600	0.0002	21	6			Romeo
144	20	22.3	650	0.0002	20.8	6			Romeo
139	20	22.5	700	0.0002	21	6			Eisenhower/Romeo
87	70	22.5	800	0.0002	21	5.8			Eisenhower
89	70.4	22.1	800	0.0002	20.6	5.4	15.9	NE 9th Plc.	Olga/Eisenhower
67	60	20.8	800	0.0002	19.3	5.5	22	Vogiantzis Pkwy	Gator/Eisenhower
107	36	18.5	800	0.0002	17	6			Teets
129	54.4	18.5	600	0.0002	17	6			Blaine
108	168	18.5	1000	0.0002	17	6			Blaine/Teets
110	95	18.5	950	0.0002	17	6			Teets
131	20	18.5	300	0.0002	17	6			Donald
132	22	18.5	500	0.0002	17	6			Dennis
134	66	18.5	800	0.0002	17	6			Donald/Dennis
162	51.2	17.5	500	0.0002	16	6			-
163	85.4	17.5	600	0.0002	16	6			-
165	50	17.5	500	0.0002	16	6			Moffler
112	78	18.5	1300	0.0002	17	6			Teets/Dennis
127	121.6	18.5	1300	0.0002	17	6			Mull Lake
114	278.4	17.5	2000	0.0002	16	6			Mull Lake/Teets
116	88	17	1200	0.0002	15.5	6			Teets/Lou
118	120	17	1000	0.0002	15.5	5.8			Lou/Stafford
158	60.4	17	900	0.0002	15.5	5.8			Shapiro
120	90	16.6	1000	0.0002	15.1	5.6			Ronnie/Lori
122	86.4	16.5	1000	0.0002	15	5.4			De Navarra/Ronnie
160	60	17	1000	0.0002	15.5	5.4	15.5	NE 34th Ln.	Elli
124	80.8	17	1000	0.0002	15.5	5.2	15	NE 34th Ter.	Elli/De Navarra
69	35	19.5	600	0.0002	18	5	15.6	NE 36th Ln.	Gator/De Navarra
71		17			17	5	17.3	Andalusia Bvd.	Gator Slough
73		17			17	5			Gator Slough
168		17			17	5			Gator Slough
1538		17			17	5			Gator Slough
189	1512	15.81	4018	0.0002	15.81	3	16.2	Juanita Bvd.	Gator Slough
191	609	16.65	6314	0.0002	16.65	4	16.3	Wilmington Pkwy	Syracuse
1550		16			16	4	16.3	Wilmington Pkwy	Syracuse
1409		13			13	4.1	16.3	Wilmington Pkwy	Syracuse
1042		15.76			15.76	3.76	16.3	Wilmington Pkwy	Syracuse
1734	292.7	15.7	4936	0.0002	15.7	2.8		Douglas Pkwy Brg.58	Syracuse
1739		15.7			15.7	2.8		Douglas Pkwy Brg.58	Syracuse
429	211.4	15.3	3731	0.0002	15.3	2.6	14.6	NW 25th Ter.	Syracuse
CarouselLk		15.3			15.3	2.3	13.8	NW 24th Ter.	-
435	142.8	14.2	2353	0.0002	14.2	1.8	16.12	Kismet Pkwy Brg.56	Lochness
1729		14.2			14.2	1.8	16.12	Kismet Pkwy Brg.56	Lochness
458	120	14.31	2525	0.0002	14.3	1.81	13.6	NW 23rd Ter.	Valkyrie
385	29.6	15.2	1607	0.0002	15.2	2.9	14.2	NE 5th Plc.	Fontana

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
386	41.1	14.9	1033	0.0002	14.9	2.7	13.8	NE 5th Plc.	Fontana/Jasper
387	80	14.9	1894	0.0002	14.9	2.5	13.9	NE 18th St.	Jasper
LaurelLake		14.9			14.9	2.2	14.2	NE 17th St.	-
399	31.7	14.4	1607	0.0002	14.4	2.1	13.8	NE 16th Ter.	Tacoma
389	38.4	14.2	1664	0.0002	14.2	1.9	14.3	NE 1st Ave.	Forest/Tacoma
401	76	14.5	2411	0.0002	14.5	2.1	14.4	NE 1st Ave.	Tacoma
294	65.8	18.1	1722	0.0002	18.1	5.8	13.9	NE 16th Plc.	Exotic
300	65	18.1	1825	0.0002	18.1	5.8			Paradise
295	71.4	17.8	1722	0.0002	17.8	5.5	13.7	NE 17th Ter.	Exotic/Paradise
302	30	17.4	1263	0.0002	17.4	5.2	13.9	NE 20th St.	Panama
297	48.7	17.3	1722	0.0002	17.3	5	13.3	NE 21st Plc.	Panama/Exotic
GardenLk		16.8			16.8	4.8	13.3	NE 23rd Ave.	-
304	13.5	16.78	976	0.0002	16.78	4.6	13.8	NE 23rd Plc.	Jamaica
1562	13	16.48	975	0.0002	16.48	4.3	14	NE 23rd Plc.	Jamaica
NectarBas		16.3			16.3	4.3	13.4	NE 20th Ter.	-
334	26	16.5	1062	0.0002	16.5	4.3	14	NE 23rd Ter.	Keystone
308	38	16.36	1377	0.0002	16.36	4.1	14.3	NE 22nd Ave.	Keystone/Jaguar
336	334.7	17.3	4305	0.0002	17.3	4.5			Jamaica
347	65.3	17.49	1550	0.0002	17.49	5.2	13.7	NE 25th Ter.	Midsummer
348	31.4	16.82	1194	0.0002	16.82	4.6	14.4	NE 20th Crt.	Suwanee/Midsummer
355	65.6	17	1607	0.0002	17	4.7	14.5	NE 22nd Plc.	Sweetwater
1560	236.8	17.38	4132	0.0002	17.38	4.6	17.89	NE 28th St. Brg.22	Suwanee
359		17.38			17.38	4.6	17.89	NE 28th St. Brg.22	Suwanee
350	22.7	16.56	861	0.0002	16.56	4.4	14	NE 20th Crt.	Suwanee/Sweetwater
337	54	16.4	1205	0.0002	16.4	4.2	15	NE 27th St.	Jamaica/Sweetwater
1553	48.4	16	2296	0.0002	16	3.6	18.12	Kismet Pkwy Brg.21	Jamaica
342		16			16	3.6	18.12	Kismet Pkwy Brg.21	Jamaica
310	45	15.9	1435	0.0002	15.9	3.6	14.5	NE 23rd St.	Jamaica/Jaguar
312	106	15.5	2296	0.0002	15.5	3.1	18.12	Del Prado Bvd. Brg.20	Jaguar
1160		15.5			15.5	3.1	18.12	Del Prado Bvd. Brg.20	Jaguar
314	83.2	15.43	2296	0.0002	15.43	3	14.3	NE 13th Ave.	Hearthstone/Jaguar
316	23	15.3	1607	0.0002	15.3	3			Hearthstone
375	95.3	15.8	2009	0.0002	15.8	3.4	14.6	NE 20th St.	Gondolier
379	71.3	15.95	1865	0.0002	15.95	3.6	14	NE 16th Ter.	Express
376	28.3	15.36	861	0.0002	15.36	3.2	14.1	NE 20th St.	Gondolier
318	18.4	15.1	516.6	0.0002	15.1	3	14	NE 13th Ave.	Gondolier
365	72.6	16	1779	0.0002	16	3.7	15.3	NE 23rd St.	Hyacinth
364	56.7	15.6	1148	0.0002	15.6	3.4	15.3	NE 11th Ave.	Hyacinth/Hiawantla
363	38	15.4	1521	0.0002	15.4	3.1			Hiawantla
320	11.6	15.02	402	0.0002	15.02	2.95	14.9	NE 19th Ter.	LkMaude/Frontier
383	68	15.6	1665	0.0002	15.6	3.3	14.4	NE 16th Ter.	Emperor
322	15.3	15.09	804	0.0002	15.09	2.94	15.8	NE 10th Plc.	Frontier
324	56.7	15.2	1722	0.0002	15.2	2.9	20.12	Andalusia Bvd. Brg.19	Gator Slough
1167		15.2			15.2	2.9	20.12	Andalusia Bvd. Brg.19	Gator Slough
413	76	18	2296	0.0002	18	5.6	15	NE 29th St.	Wright

Node Name	Area (acres)	Max. Elev. (ft)	Width (feet)	Slope (ft/ft)	Ground Elev. (ft)	Invert Elev. (ft)	Low Rd Elev. (ft)	Road Name	Canal Name
412	60	17.5	1148	0.0002	17.5	5.3	15.6	NE 1st Ave.	Wright/Montezuma
411	340	17.5	2583	0.0002	17.3	4.8	18.12	NE 4th Plc. Brg.63	Montezuma
1714		17.3			17.3	4.7	18.12	NE 4th Plc. Brg.63	Montezuma
410	340	17.7	5740	0.0002	17.7	4.6	15.7	NE 5th Plc.	Montezuma/Eureka
1709	166	16.9	5740	0.0002	16.9	3.8		NE 27th Ter. Brg.62	Eureka
407		16.9			16.9	3.8		NE 27th Ter. Brg.62	Eureka
414	72.6	17.1	2296	0.0002	17.1	4.7	15.3	NE 1st Plc.	Waves
415	75.6	16.7	1435	0.0002	16.7	4.4	15.4	NE 1st Plc.	Waves/Shangrila
406	133	16.47	4607	0.0002	16.47	3.6	15	NE 5th Plc.	Shangrila/Eureka
1704	75.6	15.8	2296	0.0002	15.8	3.4	18.12	Kismet Pkwy Brg.61	Eureka
1697		15.8			15.8	3.4	18.12	Kismet Pkwy Brg.61	Eureka
326	108.9	15.1	1722	0.0002	15.1	2.8	15.1	NE 19th Ter.	Frontier/Eureka
328	25.4	14	1607	0.0002	14	1.7	17.62	NE 3rd Ave. Brg.60	Frontier
1172		14			14	1.7	17.62	NE 3rd Ave. Brg.60	Frontier
330	32.9	13.96	1664	0.0002	13.96	1.65	14.4	NE 1st Ave.	Frontier
985		13.6			13.6	1.6	15.5	Juanita Bvd.	Frontier
1188		13.2			13.2	8.5			Frontier
1181		20.5			20.5	8.5			Frontier
1398	9.2	13.9	3501	0.0002	13.9	1.3			Frontier
451	104.8	13.82	2927	0.0002	13.82	1.27	13.7	NW 2nd Ave.	Frontier/Valkyrie
462	81.7	13.9	2296	0.0002	13.9	1.5	12.5	NW 16th Ter.	Loch Lomond
439	110.6	13.6	2152	0.0002	13.6	1.2	13.4	NW 6th Plc.	Frontier/Lochness
441	23.4	13.29	1550	0.0002	13.29	1	15.89	Nelson Rd. Brg.55	Frontier
1196		15.38			15.38	0.9	15.89	Nelson Rd. Brg.55	Frontier
ArgosyLake		14.33			14.33	2.22	12.6	NW 27th St.	-
495	89.4	14.33	1578	0.0002	14.33	2.03	12.6	NW 27th St.	Zanzibar
1420		16.6			16.6	4.25	14.7	Wilmington Pkwy	Zanzibar
482	49.2	14.16	1464	0.0002	14.16	1.89	12.6	NW 27th St.	Zanzibar
500	177	14.89	2985	0.0002	14.89	2.39	11.5	NW 1st Plc.	Northwind
484	72.7	13.99	2985	0.0002	13.99	1.49	13.4	NW 9th Plc.	Northwind/Zanzibar
1416	118	13.86	2985	0.0002	13.86	1.36	16.12	Kismet Pkwy Brg.57	Zanzibar
486		13.86			13.86	1.36	16.12	Kismet Pkwy Brg.57	Zanzibar
443	57.8	13	1578	0.0002	13	0.7	13.8	NW 20th St.	Zanzibar/Frontier
478		13			13	0.5	16.12	Diplomat Pkwy Brg.54	Zanzibar
AnchorLake		13			13	0.5	12.9	NW 10th Ave.	-
691	81.7	13.5	2755	0.0002	13.5	1	11.2	NW 15th Ter.	Cangrejo
692	87	13.18	1406	0.0002	13.14	0.88	12	NW 13th Plc.	Cangrejo/Don Pedro
684	85.3	13	2698	0.0002	13	0.5	12.4	NW 9th Plc.	Don Pedro/Gaviota
686	127.8	13.2	3731	0.0002	13.2	0.5			Gaviota
1463		13.2			13.2	0.5			Gaviota
705	108.9	11	2755	0.0002	11	-0.5			Ralston
719	74	10.9	2124	0.0002	10.9	-0.5			Bavaria
706	55	11	2985	0.0002	11	-0.5			Bavaria/Gaviota
LkHoliday		11			11	-0.5	12.3	NW 4th Ave.	-
710	65.5	11.1	3013	0.0002	11.1	-0.5	16.12	NW 10th Ter. Brg.51	Quantico

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
712		11.1			11.1	-0.5	16.12	NW 10th Ter. Brg.51	Quantico
605	115	11.3	3186	0.0002	11.3	-0.5	12.5	NE 1st Ave.	Verona
609	52.6	11	1607	0.0002	11	-0.5	12.5	NE 7th Ave.	Arrowhead Lk.
595	74	11	2612	0.0002	11	-0.5	11.3	NE 12th Ln.	Villanova
596	80	10.7	1320	0.0002	10.7	-0.5	12.9	NE 1st Plc.	Villanova/Valencia
1491	60.9	10.8	1780	0.0002	10.8	-0.5	15.89	NE 4th Plc. Brg.59	Valencia
598		10.8			10.8	-0.5	15.89	NE 4th Plc. Brg.59	Valencia
600	60.9	10.8	1550	0.0002	10.8	-0.5	11.9	NE 5th Plc.	Valencia/Fairmont
578	99.7	11.3	2612	0.0002	11.3	-0.5	13.1	NE 10th Plc.	Bamboo
570	77.4	10.1	1894	0.0002	10.1	-0.5	14.1	NE 13th Plc.	Carousel
574	84.7	10.2	2009	0.0002	10.2	-0.5	14.2	NE 9th St.	Bambi
541	32.5	9.7	1234	0.0002	9.7	-0.5	11.2	NE 23rd Ave.	Abbott
545	38.6	9.65	976	0.0002	9.65	-0.5	11	NE 23rd Ave.	Abbott
504	23.8	10	976	0.0002	10	-0.5	11.2	NE 23rd Ave.	Abbott/Banjo
550	47.2	9.8	1492	0.0002	9.8	-0.5	11.9	NE 21st Ave.	Aldo
505	142.6	10.7	4764	0.0002	10.7	-0.5	12.7	NE 20th Ave.	Banjo/Aldo
554	83.2	9.9	2296	0.0002	9.9	-0.5	12.4	NE 19th Plc.	Brighton
560	60.13	9.8	1435	0.0002	9.8	-0.5	12.6	NE 17th Ave.	Baetz
555	13.9	9.66	861	0.0002	9.6	-0.5	12.6	NE 19th Ave.	Baetz/Brighton
507	116	10.6	4138	0.0002	10.6	-0.5	12.2	NE 13th Ln.	Baetz/Banjo
564	99.3	10.2	2468	0.0002	10.2	-0.5			Banjo
509	77.6	10.4	3386	0.0002	10.4	-0.5	12.2	NE 13th Ln.	Zurich/Banjo
511	37	10	1262	0.0002	10	-0.5	18.12	Del Prado Bvd. Brg.16	Zurich
LakeZurich		9.8			9.8	-0.5	13	NE 11th Ter.	-
515	29.9	10.1	1894	0.0002	10.1	-0.5	12.9	NE 11th Ter.	Balmoral/Bambi/Carousel
517	30.8	10.2	1952	0.0002	10.2	-0.5	15.89	NE 13th Ave. Brg.18	Balmoral
1260		10.9			10.9	-0.5	15.89	NE 13th Ave. Brg.18	Balmoral
519	57.1	11.3	2066	0.0002	11.3	-0.5	12.8	NE 10th Plc.	Balmoral/Bamboo
582	35.2	11.1	1435	0.0002	11.1	-0.5	14.3	NE 15th Ln.	Delaware
583	94.4	11.2	2239	0.0002	11.2	-0.5	13.2	NE 9th Ave.	Delaware/Congress
521	43.8	11.1	1750	0.0002	11.1	-0.5	14.1	NE 11th Ter.	Congress/Balmoral
523	38.1	11.2	2066	0.0002	11.2	-0.5	15.89	Andalusia Bvd. Brg.17	Balmoral
1267		11.2			11.2	-0.5	15.89	Andalusia Bvd. Brg.17	Balmoral
525	111.2	11	2009	0.0002	11	-0.5	12.5	NE 12th St.	Fairmont/Balmoral
527	76.5	11.2	2640	0.0002	11.2	-0.5	15.89	NE 10th St. Brg.48	Fairmont
1274		11.2			11.2	-0.5	15.89	NE 10th St. Brg.48	Fairmont
731	207	11.2	2870	0.0002	11.2	-0.5			Tuscarora
732	86.7	11	1865	0.0002	11	-0.5	11.5	NW 6th Plc.	Tuscarora/Vermont
697	339	11.6	4821	0.0002	11.6	-0.5	12.3	NW 3rd Plc.	Vermont/Quantico
723	54	11.1	3042	0.0002	11.1	-0.5	16.12	Tropicana Pkwy Brg.50	Quantico
1510		11.1			11.1	-0.5	16.12	Tropicana Pkwy Brg.50	Quantico
1505	185	11.4	3788	0.0002	11.4	-0.5	15.89	NE 2nd Plc. Brg.46	Vermont
627		11.4			11.4	-0.5	15.89	NE 2nd Plc. Brg.46	Vermont
1747	84.8	10.9	2239	0.0002	10.9	-0.5	11.8	NE 5th Crt.	Regina
623	27.4	10.9	1033	0.0002	10.9	-0.5	12	NE 6th St.	Regina/Vermont

Node Name	Area (acres)	Max. Elev. (ft)	Width (feet)	Slope (ft/ft)	Ground Elev. (ft)	Invert Elev. (ft)	Low Rd Elev. (ft)	Road Name	Canal Name
614	26.5	11	1607	0.0002	11	-0.5	16.12	Tropicana Pkwy Brg.47	Vermont
1498		11			11	-0.5	16.12	Tropicana Pkwy Brg.47	Vermont
Arrowhead		10.7			10.7	-0.5	12.6	NE 8th Ter.	-
1281	18.4	10.85	775	0.0002	10.85	-0.5	11.6	NE 9th St.	Hermosa
535	82	11	1773	0.0002	11	-0.5	12.9	NE 1st Plc.	Verona/Hermosa
537		10.8			10.8	-0.5	16.12	Juanita Bvd. Brg.49	Hermosa
1286	35	10.8	1779	0.0002	10.8	-0.5	16.12	Juanita Bvd. Brg.49	Hermosa
645	69.5	10.7	976	0.0002	10.7	-0.5	12.1	NW 3rd Plc.	Hermosa/Quantico
649	85.5	10.8	1779	0.0002	10.8	-0.5	16.12	Nelson Rd. Brg.52	Hermosa
1293		10.8			10.8	-0.5	16.12	Nelson Rd. Brg.52	Hermosa
651	56.3	11.5	1435	0.0002	11.5	-0.5			Hermosa/Gaviota
667	49	10.8	1435	0.0002	10.8	-0.5			Portobelo
668	41	10.8	1779	0.0002	10.8	-0.5			Portobelo/Rasputin
KimberlyLk		10.5			10.5	-0.5			-
1002	51.9	9	1607	0.0002	9	-1.5			Hermosa
1300		9.7			9.7	-3.5			Hermosa
1403		6.7			6.7	-3.5			
781	24	6.73	717	0.0002	6.73	-3.6			Hermosa
AlbatrosLk		6.6			6.6	-3.6	9.5	NW 9th St.	-
783	60.3	6.95	2411	0.0002	6.95	-3.6			Hermosa
807	34	7.2	1837	0.0002	7.2	-3.2			Argyle
817	27.5	7.2	1492	0.0002	7.2	-3.2			Argyle
808	101.6	6.9	1377	0.0002	6.9	-3.4			Argyle/Asa
Asa Lake		6.7			6.7	-3.4			-
785	163.5	7.2	4138	0.0002	7.2	-3.7	8	NW 10th St.	Asa/Hermosa
821	70.7	6.8	1492	0.0002	6.8	-3.6	7.7	NW 22nd Plc.	Anne
787	56.9	6.7	2009	0.0002	6.7	-3.8	7.5	NW 10th St.	Anne/Hermosa
789	39.9	6.4	1779	0.0002	6.4	-4	11.62	El Dorado Bvd. Brg.68	Hermosa
1309		6.1			6.1	-4	11.62	El Dorado Bvd. Brg.68	Hermosa
825	93.3	2.3	1865	0.0002	2.3	-8.1	6.5	NW 11th Ter.	Bruja
791	50	2.2	1722	0.0002	2.2	-8.2	6.6	NW 9th Ter.	Bruja/Hermosa
829	77.3	1.9	1894	0.0002	1.9	-8.5			Beverly
793	63.5	1.7	1205	0.0002	1.7	-8.6	6.15	NW 9th Ter.	Hermosa/Beverly
833	22.7	1.9	2296	0.0002	1.9	-8.6	6.4	NW 29th Ave.	Acon
795	27.2	1.7	1722	0.0002	1.7	-8.7	6.4	NW 29th Ave.	Hermosa/Acon
468	215	12.9	3329	0.0002	12.9	0.3	12.1	NW 12th Ave.	Flotilla
PelicanLk		12.81			12.81	0.21	11.9	NW 17th St.	-
474	51.7	12.3	3271	0.0002	12.3	0	12.9	Chiquita Bvd. Brg.16	Horseshoe
1203		12			12	0	12.9	Chiquita Bvd. Brg.16	Horseshoe
1204		12			12	-3.6	12.9	Chiquita Bvd. Brg.16	Horseshoe
266	75	6.14	2870	0.0002	6.14	-2.4	9.6	NW 24th Ter.	Ronlee
226	41.6	8.84	1722	0.0002	8.84	-3.5	9.1	NW 26th St.	Telstar/Ronlee
270	34	5.5	1722	0.0002	5.5	-2.8	9.4	NW 30th St.	Abby
276	45	5.9	1722	0.0002	5.9	-2.4	8.8	NW 30th St.	Abby
271	22	5.1	574	0.0002	5.1	-3	9.3	NW 22nd Plc.	Abby/Alhinda

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
228	73	8.83	1722	0.0002	8.83	-3.5	8.5	NW 26th St.	Telstar/Viscaya
230	31.7	8.74	1205	0.0002	8.74	-3.5	8.2	NW 22nd Plc.	Pomeroy/Viscaya
232	14.6	8.24	1205	0.0002	8.24	-4			Gator Slough
234	57.6	10.9	2009	0.0002	10.9	-3.1	11.6	El Dorado Bvd. Brg.94	Pomeroy
1087		10.9			10.9	-3.1	11.6	El Dorado Bvd. Brg.94	Pomeroy
280	181	6.6	4592	0.0002	6.6	-2.3			Lucifer
286	119	6.6	2000	0.0002	6.6	-1.8			Luecker
281	79	5.9	2009	0.0002	5.9	-2.5			Luecker/Lucifer
236	208	8.6	3157	0.0002	8.6	-4			Gator Slough
238	187	8	2870	0.0002	8	-4.5			Gator Slough
1028		8			8	-4.5			Gator Slough
1148		7.5			7.5	-5			Gator Slough
1145	750	7.8	4305	0.0002	7.8	-5			Gator Slough
1115	750	5	4305	0.0002	5	-7.8			Gator Slough
1141		5			5	-7.8			Gator Slough
1565	272.3	6.48	5166	0.0002	6.48	-4			Ozwell/Otmos
1566	204.2	6.48	5166	0.0002	6.48	-4			Eastover/Orifans
1574	204.2	6.48	3000	0.0002	6.48	-4			Eastover
QuickSlver		7			7	-5			-
1655	869.7	6.37	4592	0.0002	6.37	-6.5			Quicksilver
Meadowview		6.37			6.37	-6.5			-
1591	476.5	6	2870	0.0002	6	-6.5			Meadowview/Flagstone
1660	366	7.9	12628	0.0002	7.9	-6.5			N.Spreader Waterway
LongviewLk		7.9			7.9	-6.5			-
1664	907.6	7.67	11480	0.0002	7.67	-6.5			N.Spreader Waterway
Lav/LupLk		7.67			7.67	-6.5			-
LagunaLake		7.67			7.67	-6.5			-
1599	589.9	6.8	3444	0.0002	6.8	-6.5			Gator Slough/Wray
747		7.4			7.4	-7.6	6.1	NW 14th Ter. Wr. 13	Horseshoe
1240	189	6.2	2870	0.0002	6.2	-8.8	6.1	NW 14th Ter. Wr. 13	Horseshoe
1244	189	4.7	2870	0.0002	4.7	-10.8			Horseshoe
1248		4.7			4.7	-10.8			Horseshoe
1617	491.6	8.5	7462	0.0002	8.5	-6.5			
799	7.5	3.8	1148	0.0002	3.8	-9	6.9	Burnt Store Rd. Wr. 14	Hermosa
1016		4.5			4.5	-9	6.9	Burnt Store Rd. Wr. 14	Hermosa
1319	272.3	3.9	2296	0.0002	3.9	-10			Hermosa
1323		3.5			3.5	-10			Hermosa
WazeeLake		5.5			5.5	-6.5			-
1619	453.8	6.5	5740	0.0002	6.5	-6.5			N.Spreader Waterway
1633	75.6	6.5	1148	0.0002	6.5	-9			Quandry
1634	605	6.3	4592	0.0002	6.3	-9.5			Bonefish/Quandry
1623	726.1	8.5	6888	0.0002	8.5	-6.5			N.Spreader Wy/Bonefish
1625	317.6	6.1	3444	0.0002	6.1	-6.5			N.Spreader Waterway
1680	30	2.4	2296	0.0002	2.4	-13			Rosemary
903	59.2	5.6	2497	0.0002	5.6	-5.3			Ceitus

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
904	116.5	5.3	2009	0.0002	5.3	-5.6			Ceitus
871	67.9	9.25	1664	0.0002	9.25	-2.8	11.1	SW 4th Ter.	Sanibel
SildonLake		8.75			8.75	-3	10.8	SW 10th Plc.	-
881	300.8	10.2	4477	0.0002	10.2	-2.4			Staple
885	225.6	10.2	4506	0.0002	10.2	-2.4			Luster
HoneymoonL		9.15			9.15	-2.6			-
VenusLake		9.65			9.65	-2.1			-
895	55.2	9.9	2267	0.0002	9.9	-2.25	10.5	SW 11th Plc.	Minerva
890	151.9	9.69	2353	0.0002	9.69	-2.5	10.9	SW 4th Ln.	Aphrodite/Minerva
851	201	9.75	2181	0.0002	9.75	-3	10.2	SW 4th Ave.	Shadroe/Sanibel/Nova
1007	62.2	10.25	2554	0.0002	9.83	-3	11.6	Chiquita Bvd. Wr. 18	Shadroe
1327		9.83			9.83	-4	11.6	Chiquita Bvd. Wr. 18	Shadroe
853		9.83			9.83	-4	9	SW 10th St.	Shadroe
SerenadeLk		8.75			8.75	-4	9	SW 22nd Plc.	-
899	36	8.45	1320	0.0002	8.45	-3.8	7.6	SW 22nd Crt.	Pluto
859	17	9.63	861	0.0002	9.63	-4	7.8	SW 1st Ter.	Shadroe/Pluto
861		7.5			7.5	-4	11.62	El Dorado Bvd. Brg.65	Shadroe
1338		5.5			5.5	-6	11.62	El Dorado Bvd. Brg.65	Shadroe
863	244.5	6	2698	0.0002	6	-6	6.5	SW 26th Plc.	Shadroe/Ceitus
909	42.8	5.5	2497	0.0002	5.5	-5.5			Alexander
919	41.1	5.5	2497	0.0002	5.5	-5.5			Alexander
910	30.5	5	545	0.0002	5	-5.6			Alexander/Bonaparte
Valmora Lk		4.6			4.6	-5.9	6.1	SW 31st Ave.	-
923	41.1	6.1	1837	0.0002	6.1	-4.2	6.2	NW 27th Plc.	Corinth
935	56.2	6	1779	0.0002	6	-4.3	6.9	NW 1st St.	Corinth
924	30.5	5.75	746	0.0002	5.75	-4.4	6.9	NW 1st St.	Balder
926	111	5.6	1894	0.0002	5.6	-4.7	6	NW 4th St.	Balder
941	51.5	7.9	2525	0.0002	7.9	-3.6			Curundu
961	84	7.85	2410	0.0002	7.85	-3.6			Mohawk
942	52.7	8.1	2353	0.0002	8.1	-3.8			Mohawk/Curundu
965	60.4	7.9	1578	0.0002	7.9	-3.4			Chandow
971	27.9	7.9	2497	0.0002	7.9	-3.6	7.6	NW 24th Ave.	Chandow
966	78.9	7.5	1377	0.0002	7.5	-3.7	7.6	NW 24th Ave.	Chandow/Ronkokoma
944	90.5	8.1	3272	0.0002	8.1	-4	9.4	NW 9th Plc.	Ronkokoma/Mohawk
946	157.3	7.9	3272	0.0002	7.9	-4.2	9.5	NW 13th Plc.	Mohawk
1530	190.5	7.2	1865	0.0002	7.2	-4.6	11.62	El Dorado Bvd. Brg.67	Mohawk
948		7.2			7.2	-4.6	11.62	El Dorado Bvd. Brg.67	Mohawk
StarfishLk		6.4			6.4	-5.1	5.9	NW 30th Plc.	-
928	224.6	6.7	2583	0.0002	6.7	-5.3	6.5	NW 4th St.	Balder/Crete
1525	65.6	5.9	1607	0.0002	5.9	-5.9	11.62	Embers Pkwy Brg.66	Crete
930		5.9			5.9	-5.9	11.62	Embers Pkwy Brg.66	Crete
865	72.8	5.9	2210	0.0002	5.9	-6	6.3	SW 31st Ave.	Shadroe/Bonaparte/Crete
867		5.5			5.5	-6			Shadroe
1012		10.5			10.5	-8	8.1	Burnt Store Rd. Brg.15	Shadroe
1348	45.4	15.5	1722	0.0002	15.5	-12	8.1	Burnt Store Rd. Brg.15	Shadroe

Node Name	Area	Max.	Width	Slope	Ground	Invert	Low Rd	Road Name	Canal Name
	(acres)	Elev. (ft)	(feet)	(ft/ft)	Elev. (ft)	Elev. (ft)	Elev. (ft)		
RoseMaryLk		6.8			6.8	-25			-
1681	242	2.4	2296	0.0002	2.4	-13			Shadroe Lake
1749	121	8.5	2296	0.0002	8.5	-6.5			N.Spreader Waterway
1756		8.5			8.5	-6.5			N.Spr Wy/Matlacha Pass
755		8.3			8.3	-3.7			Chase
767	63.5	8.7	2698	0.0002	8.7	-3.8			Chase
756	38	8.2	1406	0.0002	8.2	-4			Cape Coral/Chase
771	69.8	9.2	2525	0.0002	9.2	-3.3			Nereid
777	41	8.9	1779	0.0002	8.9	-3.4			Nereid
772	44.5	8.7	1091	0.0002	8.7	-3.5			Nereid/Cape Coral
758	112	8.2	2296	0.0002	8.2	-4.2			Cape Coral/Chagres
760		7.7			7.7	-4.6	11.62	NW 15th Ter. Brg.72	Chagres
1742	73	7.7	1722	0.0002	7.7	-4.6	11.62	NW 15th Ter. Brg.72	Chagres
739	105	7.6	1263	0.0002	7.6	-4.6	8.4	NW 15th St.	Horseshoe/Chagres
741	104.7	6.8	2239	0.0002	6.8	-5.6	11.62	El Dorado Bvd. Brg.69	Horseshoe
1221		6.8			6.8	-5.6	11.62	El Dorado Bvd. Brg.69	Horseshoe
751	99.8	6.6	4592	0.0002	6.6	-6.2			Azara
1229		5.7			5.7	-6.5	9.62	NW 14th Ter. Brg.70	Azara
743	85.7	5.7	1263	0.0002	5.7	-6.5	9.62	NW 14th Ter. Brg.70	Azara
745	65.3	5.05	1320	0.0002	5.05	-7.2	6.7	NW 14th Ter.	Horseshoe
837	31.7	2	1607	0.0002	2	-8.4			Arkinson Lake
AtkinsonLk		1.7			1.7	-8.4	6.5	NW 31st Ave.	-
797	79.4	3.7	3013	0.0002	3.7	-8.9	6.3	NW 31st Ave.	Hermosa/Atkinson
1427	116.2	13	2755	0.0002	13	0.5	16.12	Diplomat Pkwy Brg.54	Zanzibar
466	61.9	12.9	2296	0.0002	12.9	0.5	13.1	NW 9th Ave.	Zanzibar/Flotilla
1060	76	17.22	2009	0.0002	17.22	5	15.3	Wilmington Pkwy	Nelson Rd Wr.
193		17.22			17.22	5	15.3	Wilmington Pkwy	Nelson Rd Wr.
195	270	12.15	3444	0.0002	12.15	-0.5	14.7	Wilmington Pkwy	Zanzibar
1076	579	13.38	5166	0.0002	13.38	0.4	13	Chiquita Bvd. Wr/Clvt 4	Gator Slough
1068		11.7			11.7	-0.3	13	Chiquita Bvd. Wr/Clvt 4	Gator Slough
990		11.7			11.7	-0.3	13	Chiquita Bvd. Wr/Clvt 4	Gator Slough
224	64	9.84	1722	0.0002	9.84	-2.5	11.3	NW 27th St.	Telstar/Jarko

Appendix B. Link Parameters

Link Name	Length	Max	Manning's n	Upstream	Downstream	UP Invert El.	DW Invert El.
	(ft)	Depth (ft)		Node	Node	(ft)	(ft)
809	956	10.1	0.05	807	808	-3.2	-3.4
818	956	10.1	0.05	817	808	-3.2	-3.4
1515	2583	10.1	0.05	808	Asa Lake	-3.4	-3.4
814	1894	10.1	0.05	Asa Lake	785	-3.4	-3.7
707	660	11	0.07	705	706	-0.5	-0.5
720	2267	11	0.07	719	706	-0.5	-0.5
709	918	11	0.07	706	LkHoliday	-0.5	-0.5
711	631	11	0.07	LkHoliday	710	-0.5	-0.5
Bridge 51	62.5	11	0.018	710	712	-0.5	-0.5
714	1205	11	0.07	712	645	-0.5	-0.5
606	1263	11.2	0.07	605	535	-0.5	-0.5
610	804	11.2	0.07	609	Arrowhead	-0.5	-0.5
597	1435	11	0.07	595	596	-0.5	-0.5
1495	2078	11	0.07	596	1491	-0.5	-0.5
Bridge 59	62.5	11.2	0.018	1491	598	-0.5	-0.5
601	1091	11	0.07	598	600	-0.5	-0.5
602	2411	11	0.07	600	525	-0.5	-0.5
579	1837	11.3	0.07	578	519	-0.5	-0.5
571	2353	10.3	0.07	570	515	-0.5	-0.5
575	1837	10.3	0.07	574	515	-0.5	-0.5
542	1370	10	0.07	541	504	-0.5	-0.5
546	631	10	0.07	545	504	-0.5	-0.5
506	1837	10.3	0.07	504	505	-0.5	-0.5
551	2066	10	0.07	550	505	-0.5	-0.5
508	1400	10.3	0.07	505	507	-0.5	-0.5
556	1607	10	0.07	554	555	-0.5	-0.5
561	1148	10	0.07	560	555	-0.5	-0.5
557	1263	10	0.07	555	507	-0.5	-0.5
510	1500	10.3	0.07	507	509	-0.5	-0.5
565	1320	10.3	0.07	564	509	-0.5	-0.5
512	3100	10.3	0.07	509	511	-0.5	-0.5
Bridge 16A	100	10	0.018	511	LakeZurich	-0.5	-0.5
1746	1200	10.3	0.07	LakeZurich	515	-0.5	-0.5
518	850	10.3	0.07	515	517	-0.5	-0.5
Bridge 18	100	10	0.018	517	1260	-0.5	-0.5
1264	1260	11.4	0.07	1260	519	-0.5	-0.5
522	1300	11.3	0.07	519	521	-0.5	-0.5
584	2526	11.3	0.07	582	583	-0.5	-0.5
585	2554	11.3	0.07	583	521	-0.5	-0.5
524	560	11.3	0.07	521	523	-0.5	-0.5
Bridge 17	100	11.2	0.018	523	1267	-0.5	-0.5
1271	1465	11.2	0.07	1267	525	-0.5	-0.5

Link Name	Length (ft)	Max Depth (ft)	Manning's n	Upstream Node	Downstream Node	UP Invert El. (ft)	DW Invert El. (ft)
528	1200	11.2	0.07	525	527	-0.5	-0.5
Bridge 48	100	11.2	0.018	527	1274	-0.5	-0.5
1278	980	11.2	0.07	1274	Arrowhead	-0.5	-0.5
733	1263	11.2	0.05	731	732	-0.5	-0.5
734	2239	11.2	0.07	732	697	-0.5	-0.5
724	1521	11	0.07	697	723	-0.5	-0.5
1507	3886	11.2	0.07	697	1505	-0.5	-0.5
Bridge 50	87.5	11	0.018	723	1510	-0.5	-0.5
1514	517	11	0.07	1510	645	-0.5	-0.5
Bridge 46	75	11	0.018	1505	627	-0.5	-0.5
628	1492	11.2	0.07	627	623	-0.5	-0.5
1748	1607	11	0.07	1747	623	-0.5	-0.5
624	861	11.2	0.07	623	614	-0.5	-0.5
Bridge 47	100	9	0.018	614	1498	-0.5	-0.5
1502	517	11.2	0.07	1498	Arrowhead	-0.5	-0.5
1282	1035	11.2	0.07	Arrowhead	1281	-0.5	-0.5
1283	2010	11.2	0.07	1281	535	-0.5	-0.5
538	860	11.2	0.07	535	537	-0.5	-0.5
Bridge 49	100	11	0.018	537	1286	-0.5	-0.5
1290	2150	11	0.07	1286	645	-0.5	-0.5
650	3160	11	0.06	645	649	-0.5	-0.5
Bridge 52	100	11	0.018	649	1293	-0.5	-0.5
1297	890	11	0.06	1293	651	-0.5	-0.5
693	1260	12	0.06	691	692	1	0.88
694	2980	12	0.06	692	684	0.88	0.5
1466	500	12	0.06	478	AnchorLake	0.5	0.5
Bridge 54	100	12	0.018	478	1427	0.5	0.5
1431	1195	12	0.06	1427	466	0.5	0.5
496	861	12	0.06	ArgosyLake	495	2.22	2.03
497	574	12	0.06	495	482	2.03	1.89
34	880	8.4	0.09	31	33	16.5	15
BC-US41	150	6	0.014	33	37	15	13.1
40	830	11	0.09	37	39	11.5	10
76	830	13.5	0.09	39	75	10	11.5
79	830	14.5	0.09	75	78	11.5	13
80	830	15	0.09	78	41	13	9
44	830	14.6	0.09	41	43	9	6
BC-GardBlv	70	14	0.012	43	45	6	6
48	800	13.6	0.09	45	47	6	7
138	1607	11	0.09	137	92	6	6
184	1263	11	0.09	183	92	6	6
94	1837	11	0.09	92	93	6	6
95	1547	12	0.09	93	47	6	7

Link Name	Length	Max	Manning's n	Upstream	Downstream	UP Invert El.	DW Invert El.
	(ft)	Depth (ft)		Node	Node	(ft)	(ft)
50	800	13.6	0.09	47	49	7	7.5
156	1670	14	0.09	154	155	7.5	7.5
157	1200	14	0.09	155	49	7.5	7.5
173	1148	12	0.09	172	49	7.5	7.5
52	800	14.1	0.09	49	51	7.5	6.5
BC-GatrCr2	70	14	0.014	51	53	6.5	6.5
56	830	14.1	0.09	53	55	5	5.5
149	2181	11	0.09	148	55	6	6
175	1263	5	0.09	174	55	6	6
58	830	14.6	0.09	55	57	5.5	6.5
147	2411	11	0.09	146	57	6.5	6.5
60	830	14.6	0.09	57	59	6.5	6
153	1722	11	0.09	152	59	6	6
179	1263	14.6	0.09	178	59	6	6
62	830	14.6	0.09	59	61	6	6
177	1253	14.7	0.09	176	61	6	6
82	840	14.1	0.09	61	81	6	6
98	1435	10	0.09	96	97	6	6
181	1263	10	0.09	180	97	6	6
100	1867	10	0.09	97	99	6	6
105	2124	10	0.09	104	99	6	6
102	976	10	0.09	99	101	6	6
106	1435	10	0.09	101	81	6	6
83	840	15	0.09	81	63	6	6
BC-GatrCr1	70	14.5	0.014	63	65	6	5.5
68	700	13.8	0.09	65	67	5.5	5.5
151	1148	14.7	0.09	150	84	6	6
86	1837	15	0.09	84	85	6	6
140	1000	15	0.09	85	139	6	6
143	978	15	0.09	142	139	6	6
145	1607	14.8	0.09	144	139	6	6
141	1121	15	0.09	139	87	6	5.8
90	2062	15.2	0.09	87	89	5.8	5.4
91	2070	13.8	0.09	89	67	5.5	5.5
70	700	13	0.09	67	69	5.5	5
109	2411	11	0.09	107	108	6	6
130	2353	11	0.09	129	108	6	6
111	1320	9.7	0.09	108	110	6	6
113	1665	11	0.09	110	112	6	6
133	2551	11	0.09	131	132	6	6
135	2500	11	0.09	132	134	6	6
136	2885	11	0.09	134	112	6	6
164	2500	10	0.09	162	163	6	6
166	2896	10	0.09	163	165	6	6

Link Name	Length	Max	Manning's n	Upstream	Downstream	UP Invert El.	DW Invert El.
	(ft)	Depth (ft)		Node	Node	(ft)	(ft)
167	1602	10	0.09	165	112	6	6
115	2077	10	0.09	112	114	6	6
128	1894	10	0.09	127	114	6	6
117	2000	9.5	0.09	114	116	6	6
119	1444	9.5	0.09	116	118	6	5.8
121	2411	9.5	0.09	118	120	5.8	5.6
159	1832	9.5	0.09	158	120	5.8	5.6
123	2181	9.5	0.09	120	122	5.6	5.4
125	1952	9.6	0.09	122	124	5.4	5.2
161	1378	10.1	0.09	160	124	5.4	5.2
126	2525	10.3	0.09	124	69	5.2	5
72	600	12	0.09	69	71	5	5
BC-Up	60	10	0.014	71	73	5	5
Weir #19	300		0.014	73	168	5	5
Bc-Dn	60	10	0.016	168	1538	5	5
1540	2870	12	0.07	1538	189	5	3
1051	6199	12	0.07	189	191	3	4
1061	3042	12	0.07	191	1060	4	5
1552	100	12	0.07	191	1550	4	4
Weir #58	300		0.014	1550	1409	4	4
Pipes (7)	100	5	0.025	1409	1042	4.166	3.897
1735	1894	12	0.07	1042	1734	3.76	2.8
Bridge 58	100	12	0.018	1734	1739	2.8	2.8
1741	1607	12	0.07	1739	429	2.8	2.6
434	1435	12	0.07	429	CarouselLk	2.6	2.4
436	2296	12	0.07	CarouselLk	435	2.3	1.8
Bridge 56	50	12	0.018	435	1729	1.8	1.8
1731	2755	12	0.07	1729	439	1.8	1.2
459	2181	12	0.07	458	451	1.81	1.27
390	832	12	0.07	385	386	2.9	2.7
391	804	12	0.07	386	387	2.7	2.5
392	1263	12	0.07	387	LaurelLake	2.5	2.2
393	1205	12	0.07	LaurelLake	389	2.2	1.9
400	918	12	0.07	399	389	2.1	1.9
394	1148	12	0.07	389	330	1.9	1.65
402	1808	12	0.07	401	330	2.1	1.65
296	1263	12	0.07	294	295	5.8	5.5
301	1350	12	0.07	300	295	5.8	5.5
298	2296	12	0.07	295	297	5.5	5
303	1148	12	0.07	302	297	5.2	5
299	1148	12	0.07	297	GardenLk	5	4.8
305	861	12	0.07	GardenLk	304	4.8	4.6
1563	1263	12	0.07	304	1562	4.6	4.3
1564	50	12	0.07	1562	NectarBas	4.3	4.3

Link Name	Length (ft)	Max Depth (ft)	Manning's n	Upstream Node	Downstream Node	UP Invert El. (ft)	DW Invert El. (ft)
309	976	12	0.07	NectarBas	308	4.3	4.1
335	1148	12	0.07	334	308	4.3	4.1
311	2010	12	0.07	308	310	4.1	3.6
338	1492	12	0.07	336	337	4.5	4.2
349	2410	12	0.07	347	348	5.2	4.6
351	1033	12	0.07	348	350	4.6	4.4
356	1263	12	0.07	355	350	4.7	4.4
Bridge 22	62.5	12	0.018	1560	359	4.6	4.6
360	689	12	0.07	359	350	4.6	4.4
352	1004	12	0.07	350	337	4.4	4.2
1557	218	12	0.07	337	1553	4.2	3.6
Bridge #21	100	12	0.018	1553	342	3.6	3.6
344	574	12	0.07	342	310	3.6	3.6
313	2296	12	0.07	310	312	3.6	3.1
Bridge #20	100	12	0.018	312	1160	3.1	3.1
1164	2009	12	0.07	1160	314	3.1	3
317	1148	12	0.07	314	316	3	3.05
319	344.4	12	0.07	316	318	3	3
377	1033	12	0.07	375	376	3.4	3.2
380	1780	12	0.07	379	376	3.6	3.2
378	803	12	0.07	376	318	3.2	3
321	803.6	12	0.07	318	320	3	2.95
366	1320	12	0.07	365	364	3.7	3.4
367	1263	12	0.07	364	363	3.4	3.1
369	689	12	0.07	363	320	3.1	2.95
323	688.8	12	0.07	320	322	2.95	2.94
384	1780	12	0.07	383	322	3.3	2.94
325	1377.6	12	0.07	322	324	2.94	2.9
Bridge 19	100	12	0.018	324	1167	2.9	2.9
1171	1435	12	0.07	1167	326	2.9	2.8
416	1263	12	0.07	413	412	5.6	5.3
417	2353	12	0.07	412	411	5.3	4.8
Bridge 63	50	12	0.018	411	1714	4.8	4.7
1716	918	12	0.07	1714	410	4.7	4.6
1710	3272	12	0.07	410	1709	4.6	3.8
Bridge 62	62.5	12	0.018	1709	407	3.8	3.8
420	918	12	0.07	407	406	3.8	3.6
425	1263	12	0.07	414	415	4.7	4.4
426	3243	12	0.07	415	406	4.4	3.6
1705	861	12	0.07	406	1704	3.6	3.4
Bridge 61	50	12	0.018	1704	1697	3.4	3.4
1698	2583	12	0.07	1697	326	3.4	2.8
329	2296	12	0.07	326	328	2.8	1.7
Bridge 60	100	12	0.018	328	1172	1.7	1.7

Link Name	Length	Max	Manning's n	Upstream	Downstream	UP Invert El.	DW Invert El.
	(ft)	Depth (ft)		Node	Node	(ft)	(ft)
1176	900	12	0.07	1172	330	1.7	1.65
986	1000	12	0.07	330	985	1.65	1.6
Weir #21				985	1188	1.6	8.5
Clvrt 21	100	4.7	0.014	1188	1181	8.5	8.5
1401	150	12	0.07	1181	1398	8.5	1.3
1402	1400	12	0.07	1398	451	1.3	1.27
453	2950	12	0.07	451	439	1.27	1.2
463	2009	12	0.07	462	439	1.7	1.2
442	1005	12	0.07	439	441	1.2	1
Bridge 55	100	12	0.018	441	1196	1	0.9
1200	750	12	0.06	1196	443	0.9	0.7
Weir # 9	300		0.014	1060	193	5	5
196	1435	12	0.06	193	195	5	-0.5
1077	3042	12	0.06	195	1076	-0.5	0.4
Struct.57(4)	100	5	0.025	195	1420	4.45	-0.5
Clvrt 4	100	9	0.014	1076	1068	0.4	0.4
Weir #4	300		0.014	1068	990	-0.3	-0.3
1084	1263	12	0.05	990	224	-0.3	-2.5
254	920	8	0.05	252	253	0.3	-0.6
260	1378	8	0.05	259	253	0.8	-0.6
255	1923	8	0.05	253	224	-0.6	-2.5
227	689	12	0.05	224	226	-2.5	-3.5
267	1435	8	0.05	266	226	-2.4	-3.5
229	2009	12	0.05	226	228	-3.5	-3.5
272	603	8	0.05	270	271	-2.8	-3
277	1350	8	0.05	276	271	-2.4	-3
273	1952	8	0.05	271	228	-3	-3.5
231	1148	12	0.05	228	230	-3.5	-3.5
233	803.6	12	0.05	230	232	-3.5	-4
235	545.3	12	0.05	232	234	-4	-3.1
Connect. A	1205	4	0.014	232	755	-3.7	-4
Bridge 94	70	14	0.014	234	1087	-3.1	-3.1
1089	1394	12	0.05	1087	236	-3.1	-4
282	1550	8	0.05	280	281	-2.3	-2.5
287	3444	8	0.05	286	281	-1.8	-2.5
283	976	8	0.05	281	236	-2.5	-4
239	4477.2	12	0.05	236	238	-4	-4.5
Weir #11	300		0.014	238	1028	-4.5	-4.5
1151	130	12	0.05	1028	1148	-4.5	-5
Bridge BS	100	12	0.018	1148	1145	-5	-5
1157	6000	12	0.03	1145	1115	-5	-7.5
Bridge 74	200	12	0.018	1115	1141	-7.8	-7.8
1654	6888	12	0.03	1141	1599	-7.8	-6.5
1567	4018	9.5	0.03	1565	1566	-4	-4

Link Name	Length (ft)	Max Depth (ft)	Manning's n	Upstream Node	Downstream Node	UP Invert El. (ft)	DW Invert El. (ft)
1575	6888	9.5	0.03	1566	1574	-4	-4
Weir #5				1574	QuickSlver		
1656	1722	12	0.03	Quicksilver	1655	-5	-6.5
1657	1722	12	0.03	1655	Meadowview	-6.5	-6.5
1592	4018	12	0.03	Meadowview	1591	-6.5	-6.5
1661	2870	12	0.03	1591	1660	-6.5	-6.5
1663	1148	12	0.03	1660	LongviewLk	-6.5	-6.5
1665	6314	12	0.03	LongviewLk	1664	-6.5	-6.5
1667	1492	12	0.03	1664	Lav/LupLk	-6.5	-6.5
1668	7462	12	0.03	Lav/LupLk	LagunaLake	-6.5	-6.5
1600	15498	12	0.03	LagunaLake	1599	-6.5	-6.5
1618	4018	12	0.03	1599	1617	-6.5	-6.5
471	975	12	0.05	468	PelicanLk	0.3	0.21
475	1320	12	0.05	PelicanLk	474	0.21	0
Weir #16				474	1203	0	0
Bridge 16	100	12	0.018	1203	1204	0	0
1217	3150	12	0.05	1204	739	-3.6	-4.6
757	1894	12	0.05	755	756	-3.7	-4
768	1263	12	0.05	767	756	-3.8	-4
759	1292	12	0.05	756	758	-4	-4.2
773	1291	12	0.05	771	772	-3.3	-3.5
778	631	12	0.05	777	772	-3.4	-3.5
774	2670	12	0.05	772	758	-3.5	-4.2
761	2238	12	0.05	758	760	-4.2	-4.6
Bridge 72	75	12	0.018	760	1742	-4.6	-4.6
1744	40	12	0.05	1742	739	-4.6	-4.6
742	2580	12	0.05	739	741	-4.6	-5.6
Bridge 69	100	12	0.018	741	1221	-5.6	-5.6
1223	2870	12	0.05	1221	743	-5.6	-6.5
1230	1895	12	0.05	751	1229	-6.2	-6.5
Bridge 70	50	12	0.018	1229	743	-6.5	-6.5
746	2296	12	0.05	743	745	-6.5	-7.2
748	574	12	0.05	745	747	-7.2	-7.6
Connect.C	800	4	0.014	745	837	-7.2	-8.4
839	50	10.1	0.05	837	AtkinsonLk	-8.4	-8.4
840	2755	10.1	0.05	AtkinsonLk	797	-8.4	-8.9
826	631	10.1	0.05	825	791	-8.1	-8.2
822	1205	10.1	0.05	821	787	-3.6	-3.8
790	920	10.1	0.05	787	789	-3.8	-4
Bridge 68	100	10.1	0.018	789	1309	-4	-4
1313	832	10.1	0.05	1309	791	-4	-8.2
794	2240	10.1	0.05	791	793	-8.2	-8.6
830	1837	10.1	0.05	829	793	-8.3	-8.6
796	631	10.1	0.05	793	795	-8.6	-8.7

Link Name	Length	Max	Manning's n	Upstream	Downstream	UP Invert El.	DW Invert El.
	(ft)	Depth (ft)		Node	Node	(ft)	(ft)
834	689	10.1	0.05	833	795	-8.6	-8.7
798	1320	10.1	0.05	795	797	-8.7	-8.9
800	545	12.6	0.05	797	799	-8.9	-9
Weir #14				799	1016	-9	-9
1320	5650	13.5	0.03	1016	1319	-9	-10
Bridge 76	100	13.5	0.018	1319	1323	-10	-10
1672	33	12	0.03	1323	WazeeLake	-10	-6.5
1673	1377	12	0.03	WazeeLake	1619	-6.5	-6.5
1624	8036	12	0.03	1619	1623	-6.5	-6.5
1635	1952	15.5	0.03	1633	1634	-9	-9.5
1642	32718	15	0.03	1634	1623	-9.5	-6.5
1626	6888	12	0.03	1623	1625	-6.5	-6.5
1753	4592	12	0.03	1625	1749	-6.5	-6.5
1682	14350	15	0.03	1680	1681	-13	-13
905	1205	10.5	0.05	903	904	-5.3	-5.6
906	2411	10.5	0.05	904	863	-5.6	-6
872	1091	11.75	0.05	871	SildonLake	-2.8	-3
852	2066	11.75	0.05	SildonLake	851	-3	-3
882	918	11.75	0.05	881	HoneymoonL	-2.4	-2.6
886	1119	11.75	0.05	885	HoneymoonL	-2.4	-2.6
878	2296	11.75	0.05	HoneymoonL	851	-2.6	-3
891	1780	11.75	0.05	VenusLake	890	-2.1	-2.5
896	1205	11.75	0.05	895	890	-2.25	-2.5
892	1894	11.75	0.05	890	851	-2.5	-3
1008	1693	12.75	0.05	851	1007	-3	-3
Weir #18				1007	1327	-3	-3
Clvrt 18	100	4.83	0.014	1327	853	-3	-3
858	3444	12.75	0.05	853	SerenadeLk	-4	-4
860	803.6	12.75	0.05	SerenadeLk	859	-4	-4
900	918	12	0.05	899	859	-3.8	-4
862	1378	11.5	0.05	859	861	-4	-4
Bridge 65	100	11.5	0.018	861	1338	-4	-6
1342	1492	11.5	0.05	1338	863	-6	-6
866	2726	11.5	0.05	863	865	-6	-6
911	608	10.5	0.05	909	910	-5.5	-5.6
920	344	10.5	0.05	919	910	-5.5	-5.6
1521	1852	10.5	0.05	910	Valmora Lk	-5.6	-5.9
916	746	10.5	0.05	Valmora Lk	865	-5.9	-6
925	746	10	0.05	923	924	-4.2	-4.4
936	631	10	0.05	935	924	-4.3	-4.4
927	1665	10	0.05	924	926	-4.4	-4.7
929	3157	10	0.05	926	928	-4.7	-5.3
943	1550	11	0.05	941	942	-3.6	-3.8
962	918	11	0.05	961	942	-3.6	-3.8

Link Name	Length (ft)	Max Depth (ft)	Manning's n	Upstream Node	Downstream Node	UP Invert El. (ft)	DW Invert El. (ft)
945	1148	11.5	0.05	942	944	-3.8	-4
967	2009	11	0.05	965	966	-3.4	-3.7
972	631	11	0.05	971	966	-3.6	-3.7
968	2870	11	0.05	966	944	-3.7	-4
947	1062	11.5	0.05	944	946	-4	-4.2
1531	3903	11.5	0.05	946	1530	-4.2	-4.6
Bridge 67	50	11.5	0.018	1530	948	-4.6	-4.6
953	4477	11.5	0.05	948	StarfishLk	-4.6	-5.1
954	1435	11.5	0.05	StarfishLk	928	-5.1	-5.3
1526	3444	11.5	0.05	928	1525	-5.3	-5.9
Bridge 66	50	11.5	0.018	1525	930	-5.9	-5.9
932	775	11.5	0.05	930	865	-5.9	-6
868	1148	11.5	0.03	865	867	-6	-6
Weir #15				867	1012	-6	-8
1349	700	18.5	0.03	1012	1348	-8	-12
1696	6314	27.5	0.03	1348	RoseMaryLk	-12	-25
1686	804	15	0.03	RoseMaryLk	1681	-25	-13
1750	8610	15	0.03	1681	1749	-13	-6.5
1757	33	15	0.03	1749	1756	-6.5	-6.5
Weir #13	300		0.014	747	1240	-7.6	-8.8
1245	5300	15	0.03	1240	1244	-8.8	-10.8
Bridge 75	100	15	0.018	1244	1248	-10.8	-10.8
1651	3444	15	0.03	1248	1617	-10.8	-6.5
1620	3444	12	0.03	1617	1619	-6.5	-6.5
1423	33	12	0.06	1420	482	4.25	1.89
485	1607	12	0.06	482	484	1.89	1.49
501	3600	12	0.06	500	484	2.39	1.49
1418	515	12	0.06	484	1416	1.49	1.36
Bridge 57	100	12	0.018	1416	486	1.36	1.36
488	2640	12	0.06	486	443	1.36	0.7
467	805	12	0.06	443	466	0.7	0.5
469	2125	12	0.06	466	468	0.5	0.3
1467	1722	12	0.06	AnchorLake	684	0.5	0.5
1468	1435	12	0.06	684	686	0.5	0.5
Bridge 53	100	12	0.018	686	1463	0.5	0.5
1470	1722	12	0.06	1463	651	0.5	-0.5
658	2210	11	0.05	651	KimberlyLk	-0.5	-0.5
669	1722	11	0.05	667	668	-0.5	-0.5
670	1665	11	0.05	668	KimberlyLk	-0.5	-0.5
1003	2813	10.2	0.05	KimberlyLk	1002	-0.5	-1.5
Weir #17				1002	1300	-1.5	-3.5
Bridge 17A	100	10.2	0.018	1300	1403	-3.5	-3.5
1407	1220	10.2	0.05	1403	781	-3.5	-3.6
844	630	10.2	0.05	781	AlbatrosLk	-3.6	-3.6

Link Name	Length (ft)	Max Depth (ft)	Manning's n	Upstream Node	Downstream Node	UP Invert El. (ft)	DW Invert El. (ft)
845	976	10.1	0.05	AlbatrosLk	783	-3.6	-3.6
Conduit D	2000	4		AlbatrosLk	946	-3.6	-4.2
786	746	10.1	0.05	783	785	-3.6	-3.7
788	1607	10.1	0.05	785	787	-3.7	-3.8

Appendix C. Weir Data

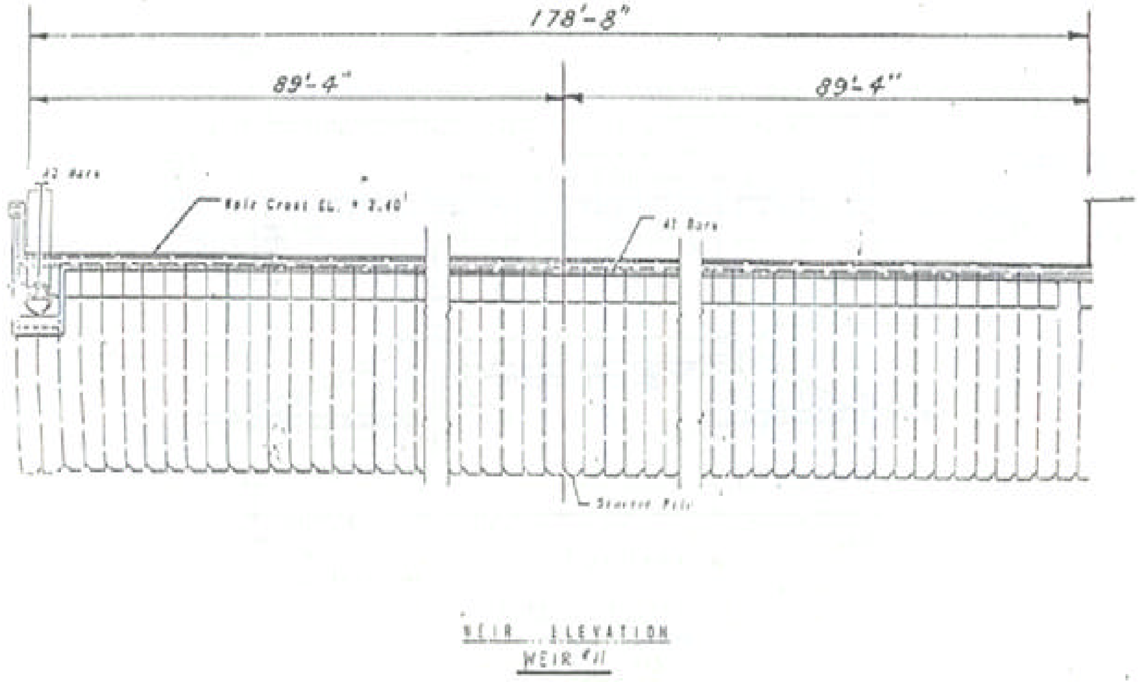

Figure C1. Gator Slough Weir #11.

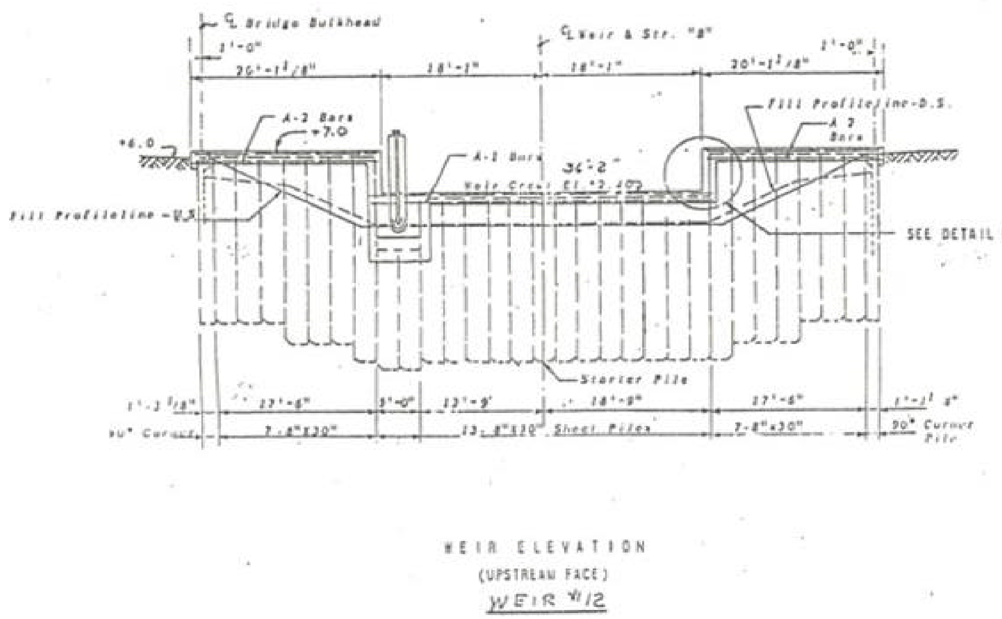

Figure C2. Gator Slough Weir #12.

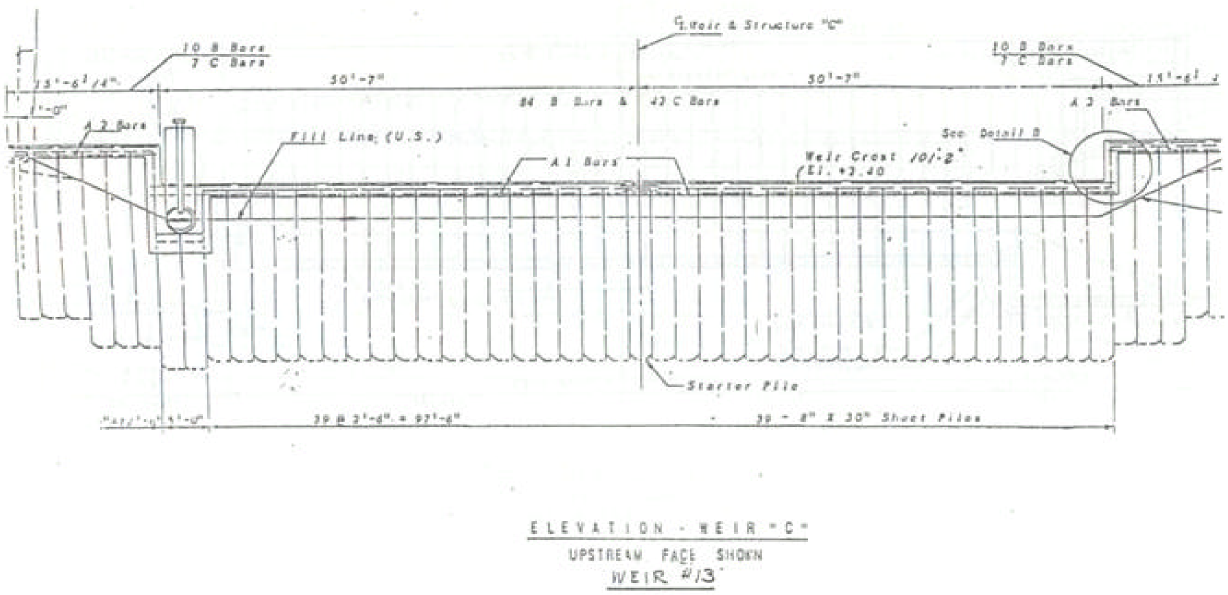

Figure C3. Horseshoe Canal Weir #13.

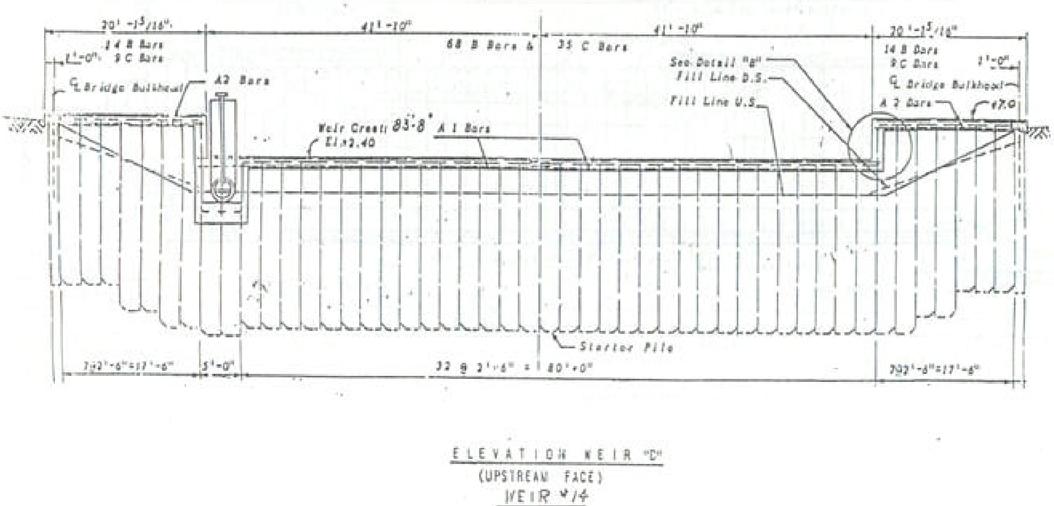

Figure C4. Hermosa Canal Weir #14.

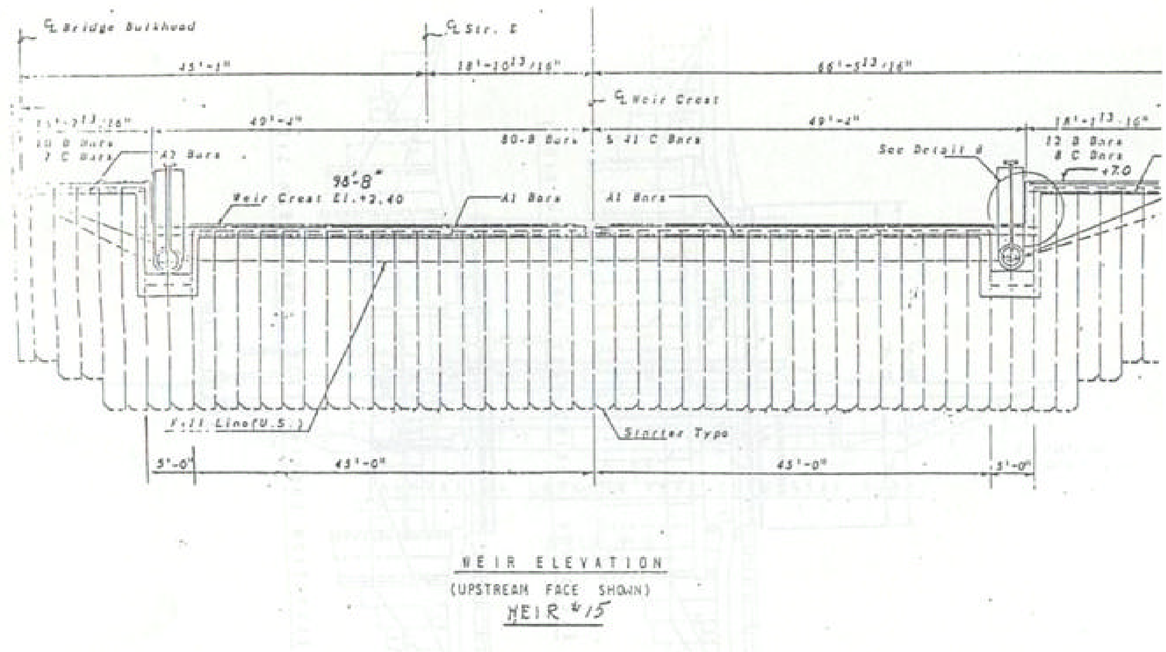

Figure C5. Shadroe Canal Weir #15.

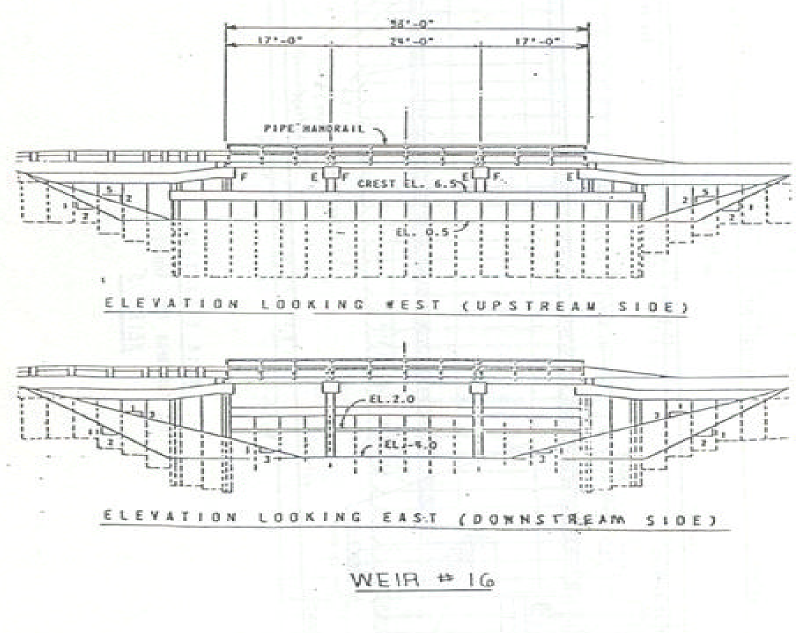

Figure C6. Horseshoe Canal Weir #16.

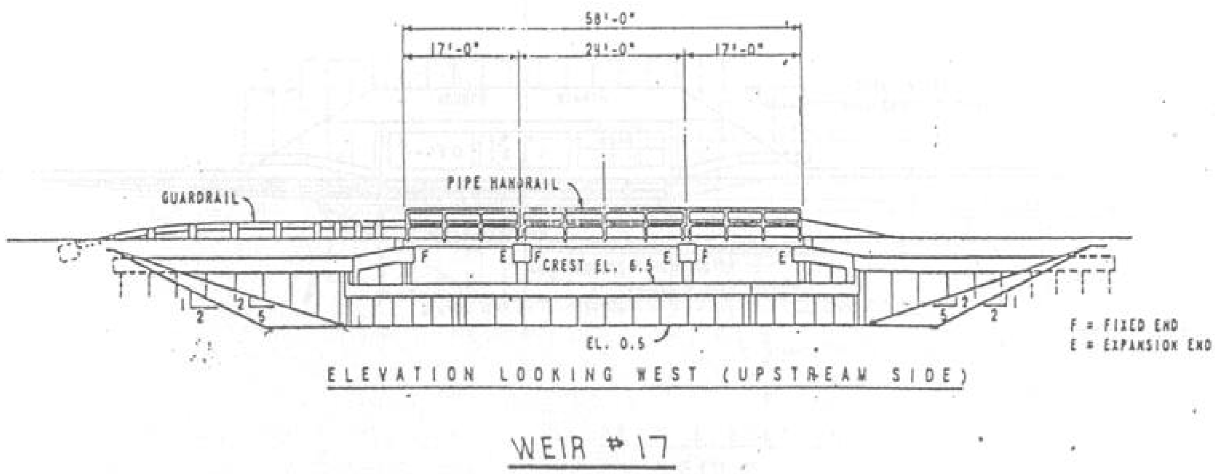

Figure C7. Hermosa Canal Weir #17.

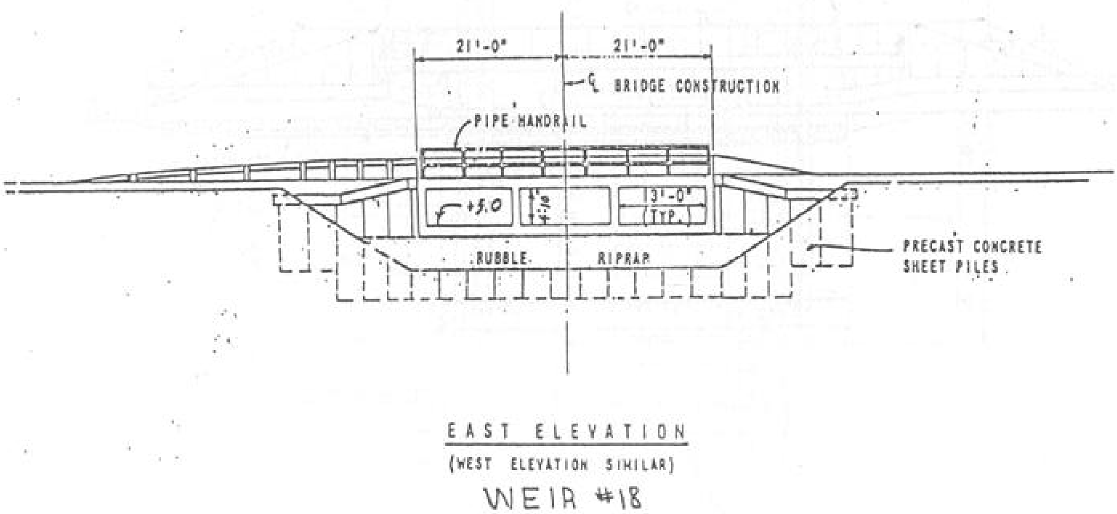

Figure C8. Shadroe Canal Weir #18.

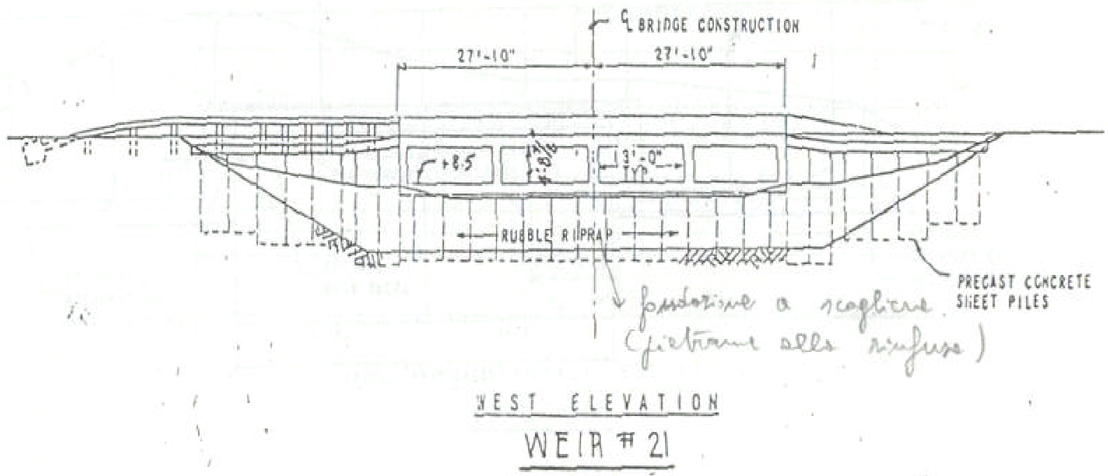

Figure C9. Shadroe Canal Weir #21.

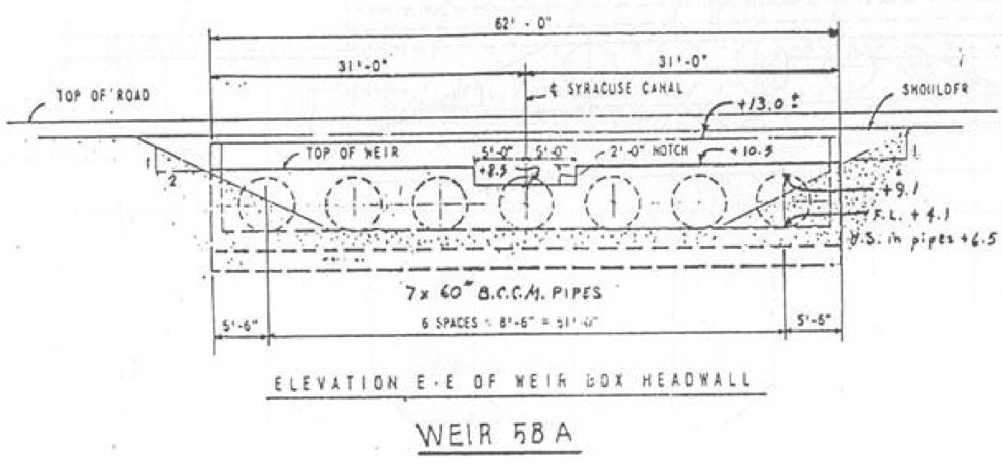

Figure C10. Gator Slough Weir #58.

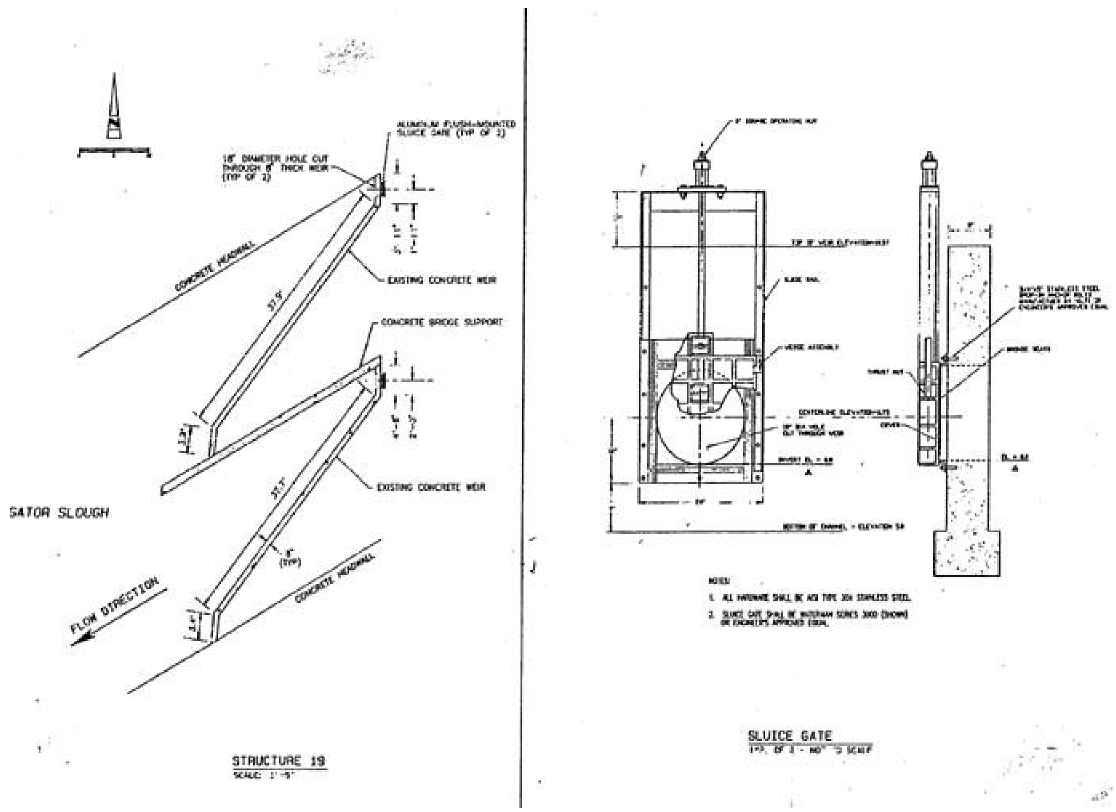

Figure C11. Structure #19 (Weir #19)

Appendix D. Bridge Data

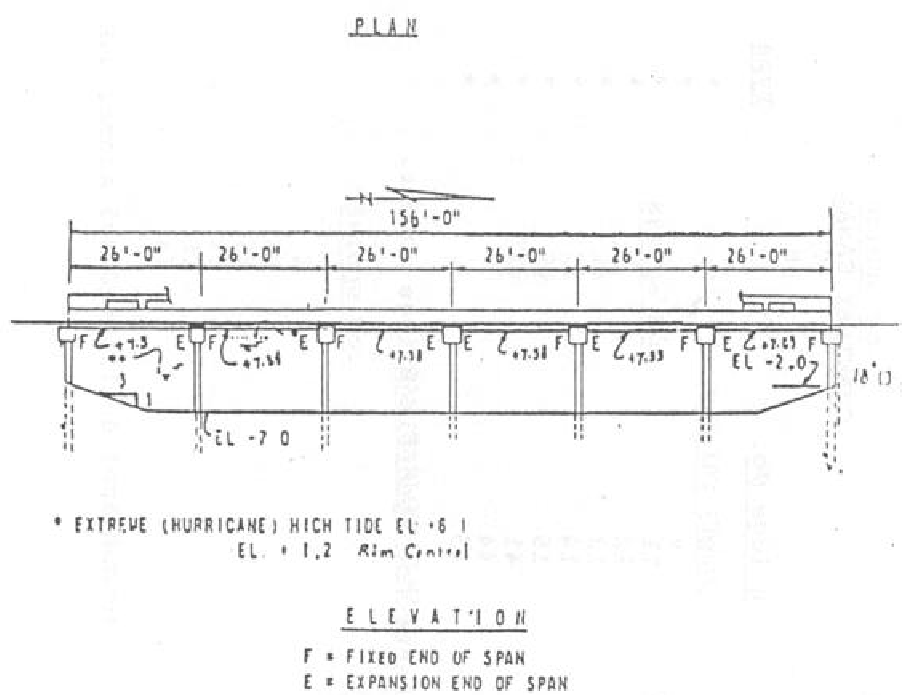

Figure D1. Bridge type 'A'.

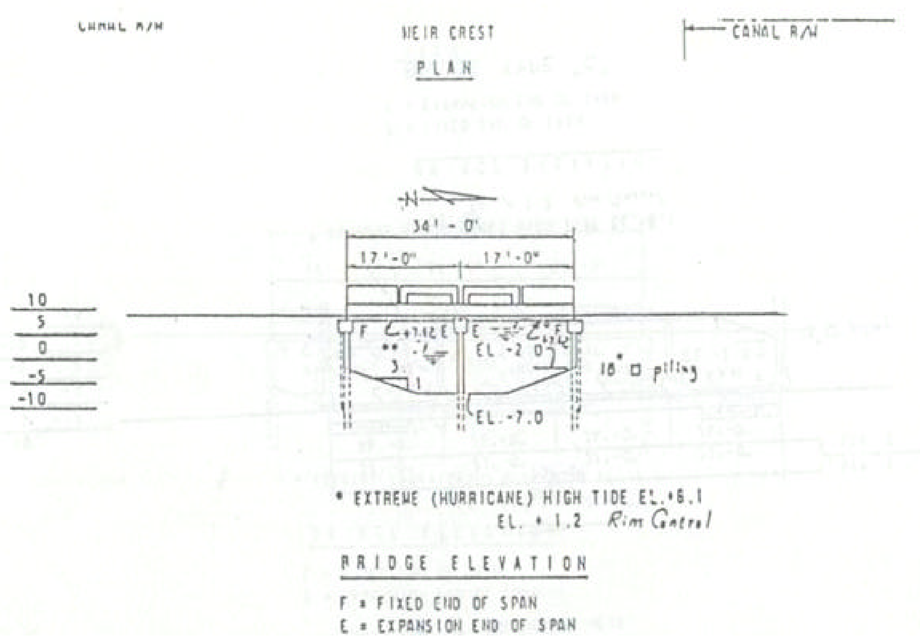

Figure D2. Bridge type 'B'.

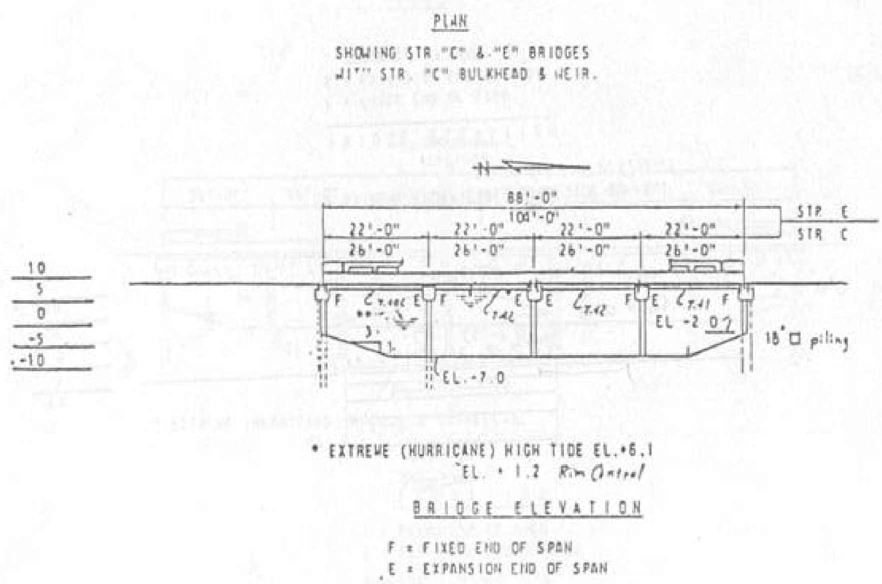

Figure D3. Bridge type 'C'.

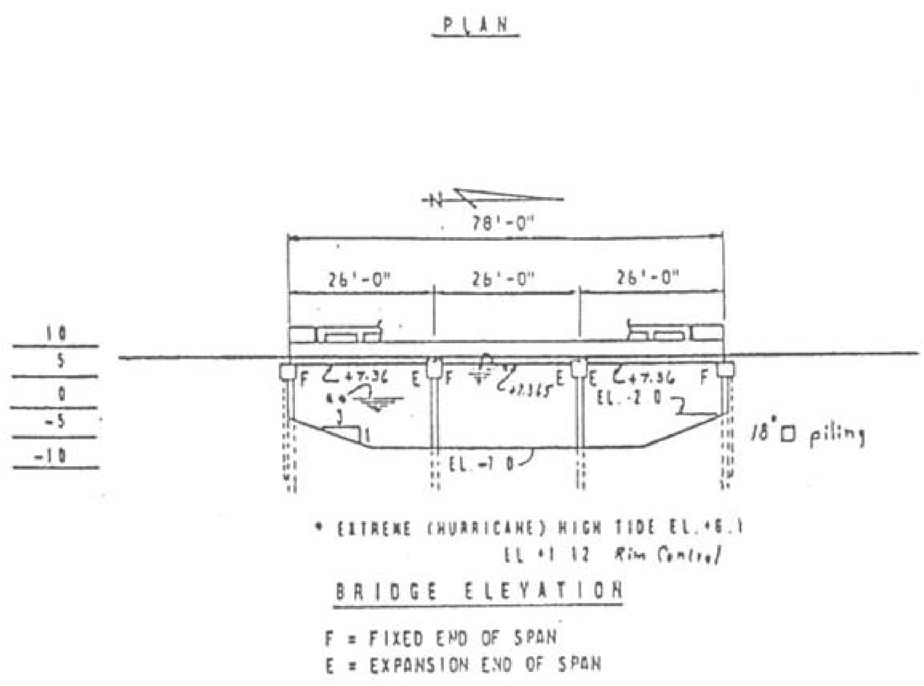

Figure D4. Bridge type 'D'.

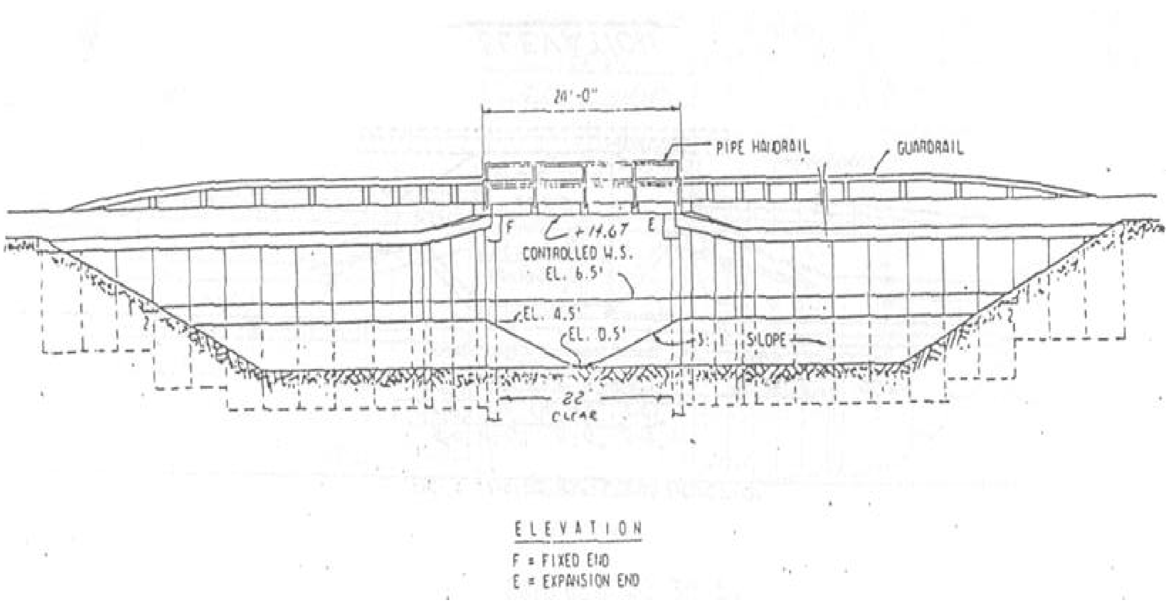

Figure D5. Bridge #51.

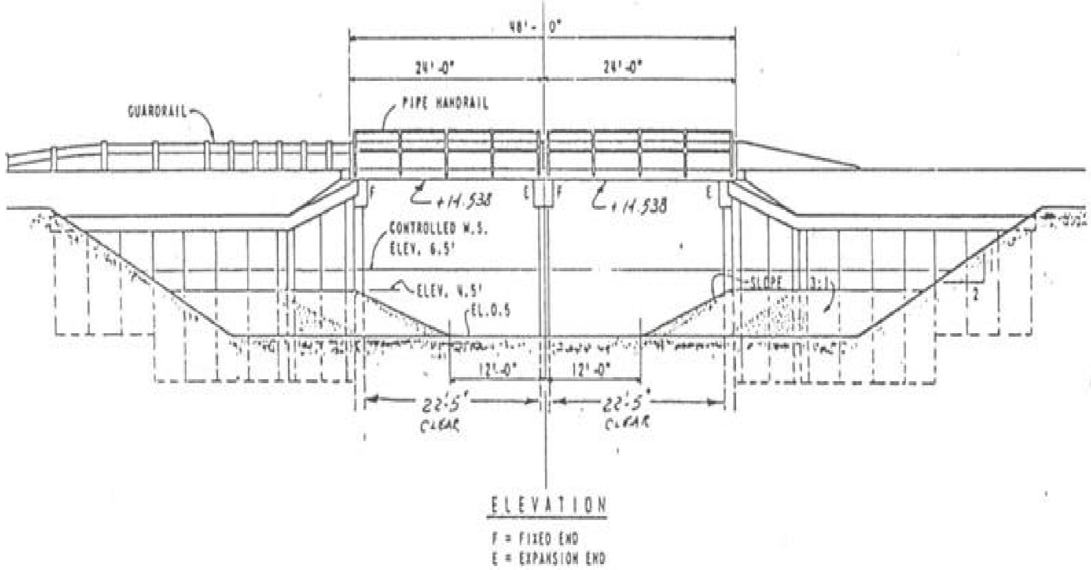

Figure D6. Bridge #52.

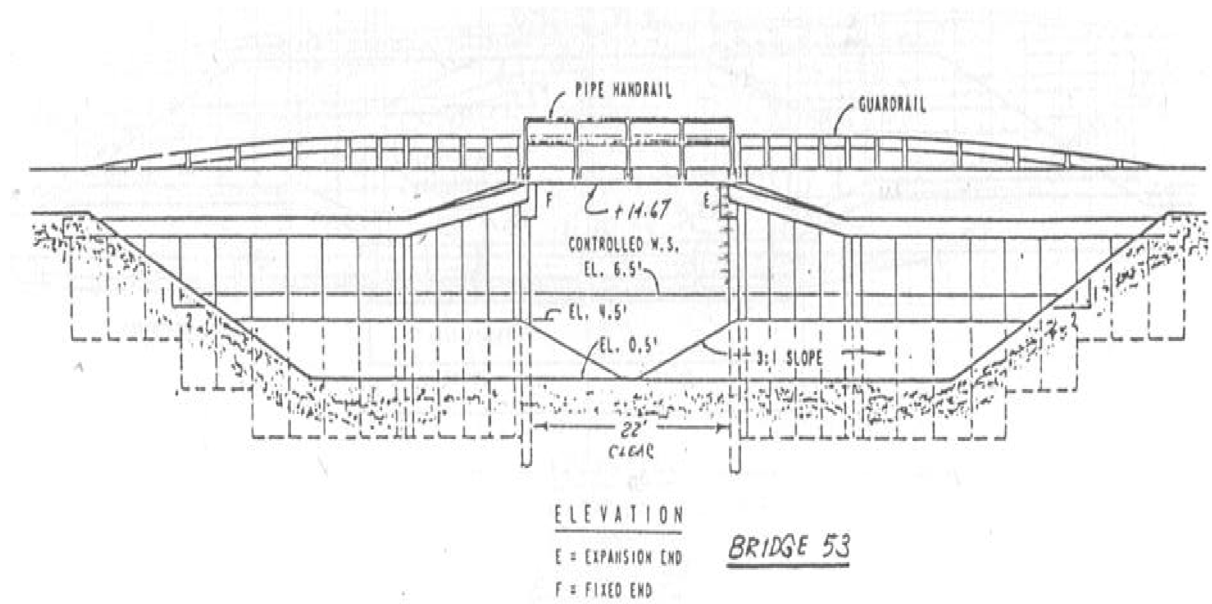

Figure D7. Bridge #53.

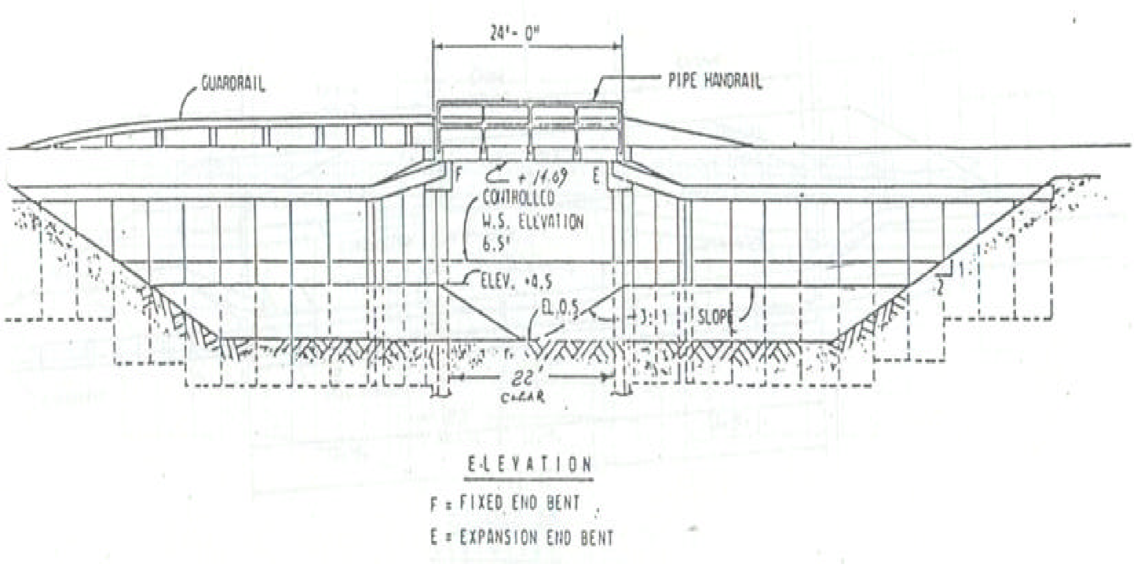

Figure D8. Bridge #54.

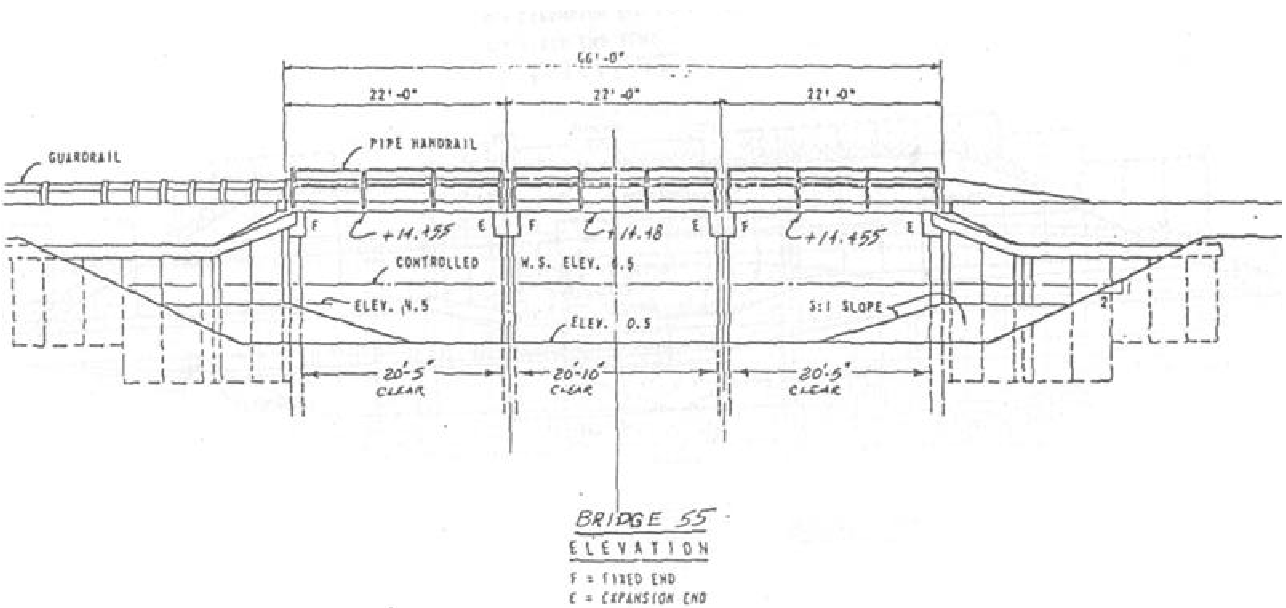

Figure D9. Bridge #55.

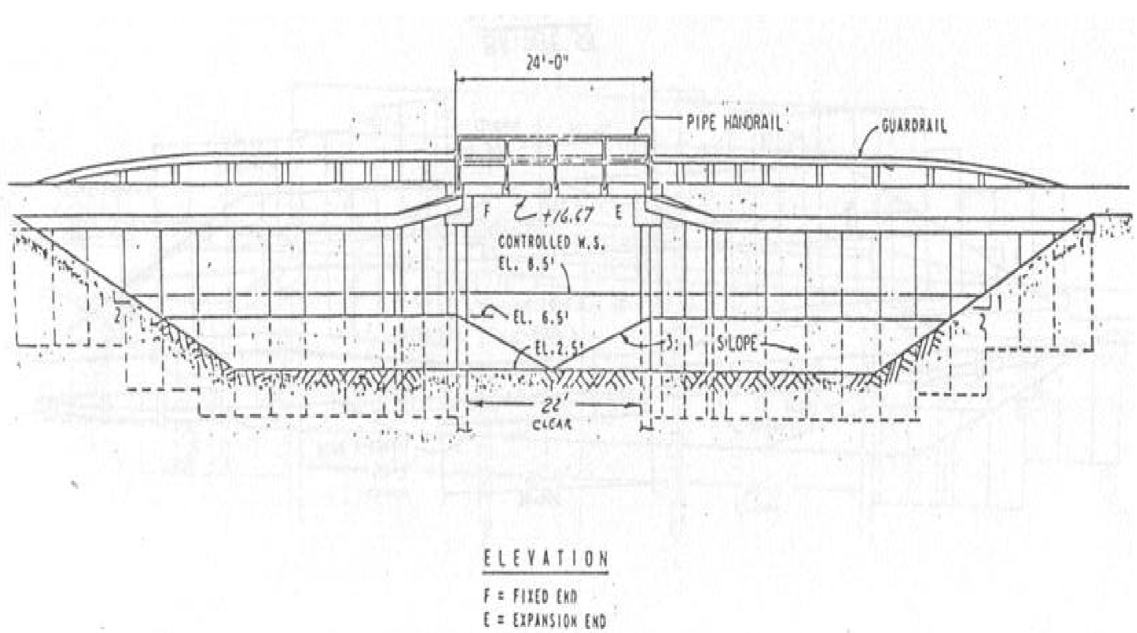

Figure D10. Bridge #62.

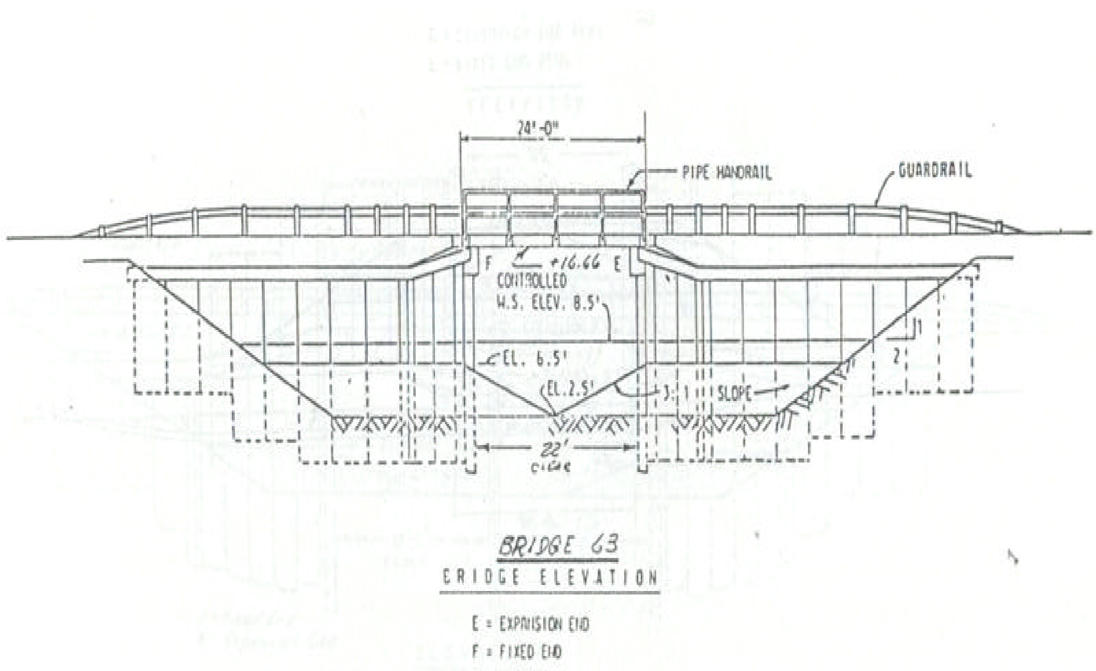

Figure D11. Bridge #63.

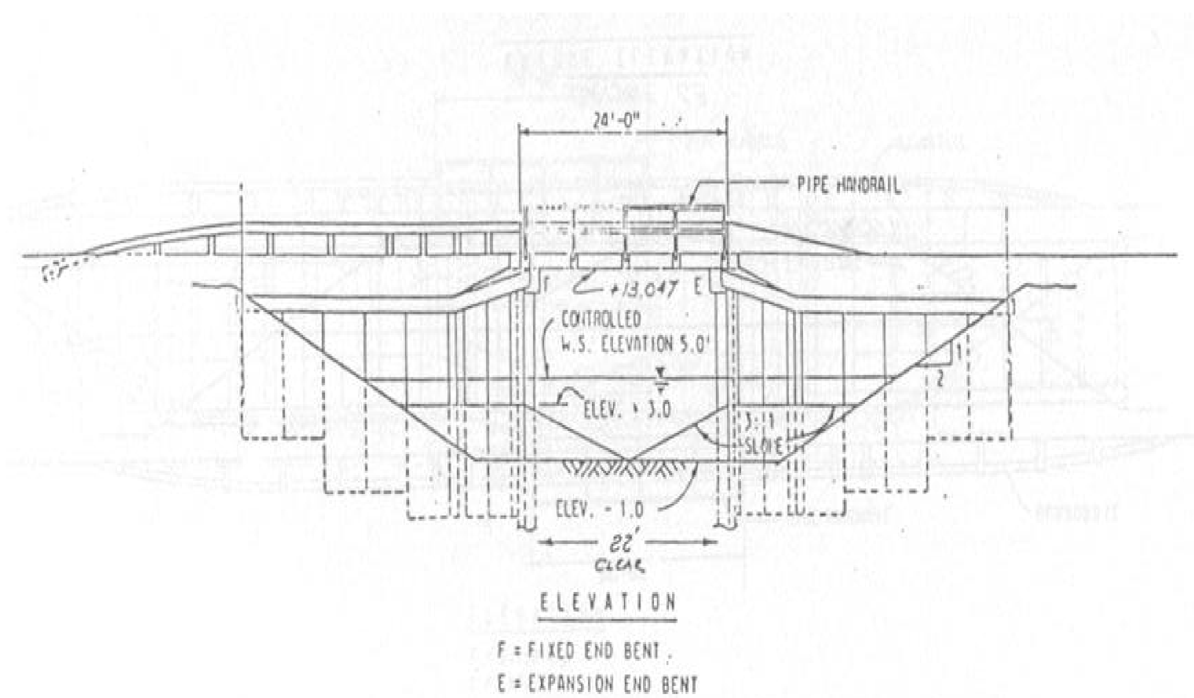

Figure D12. Bridge #64.

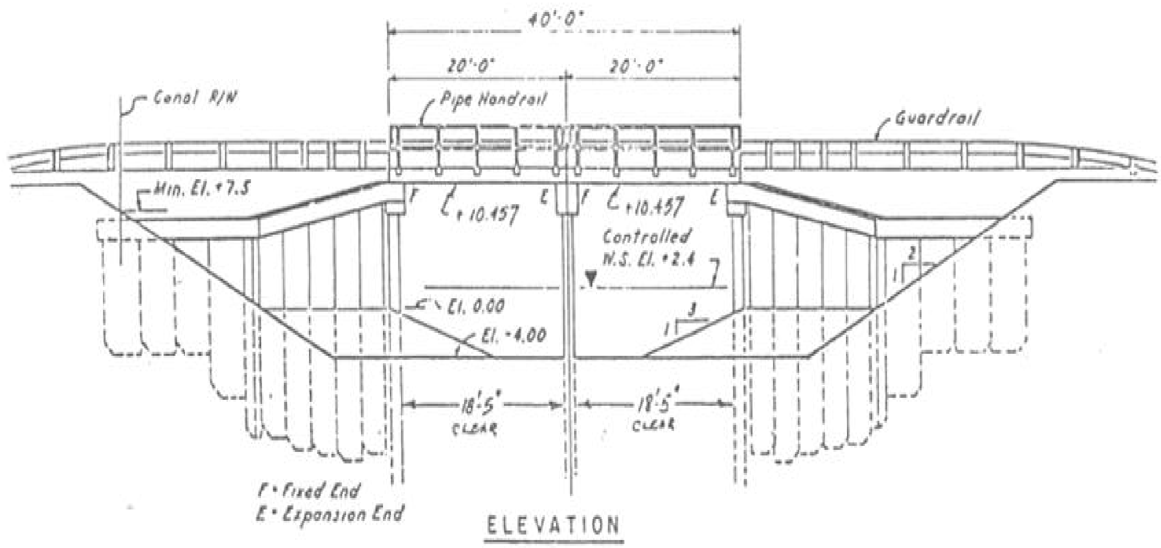

Figure D13. Bridge #65.

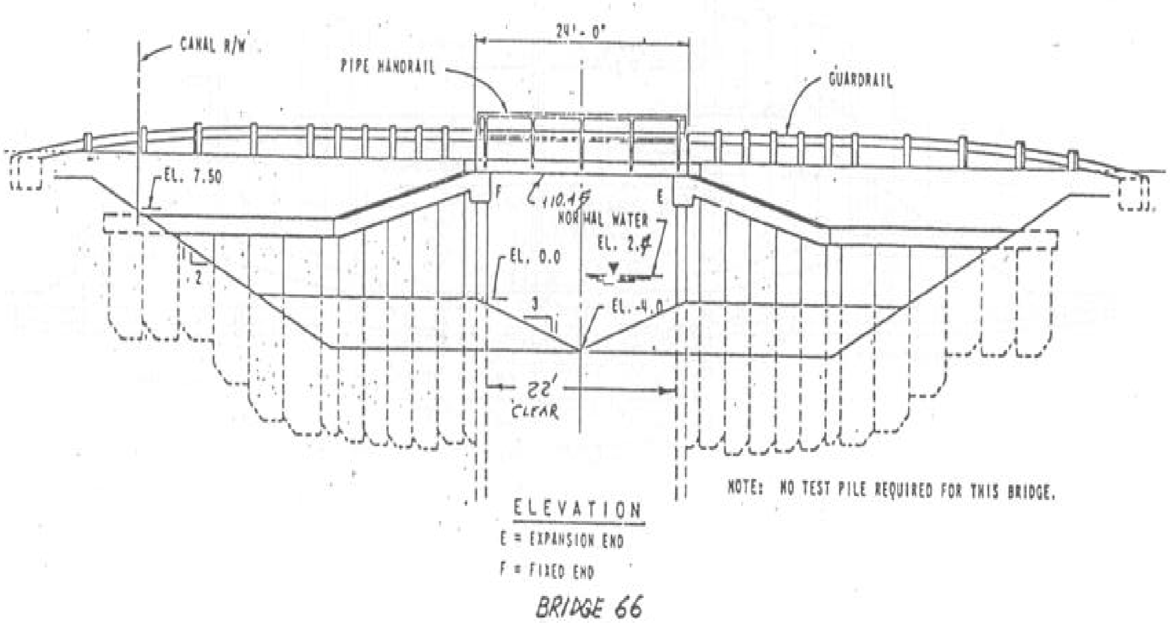

Figure D14. Bridge #66.

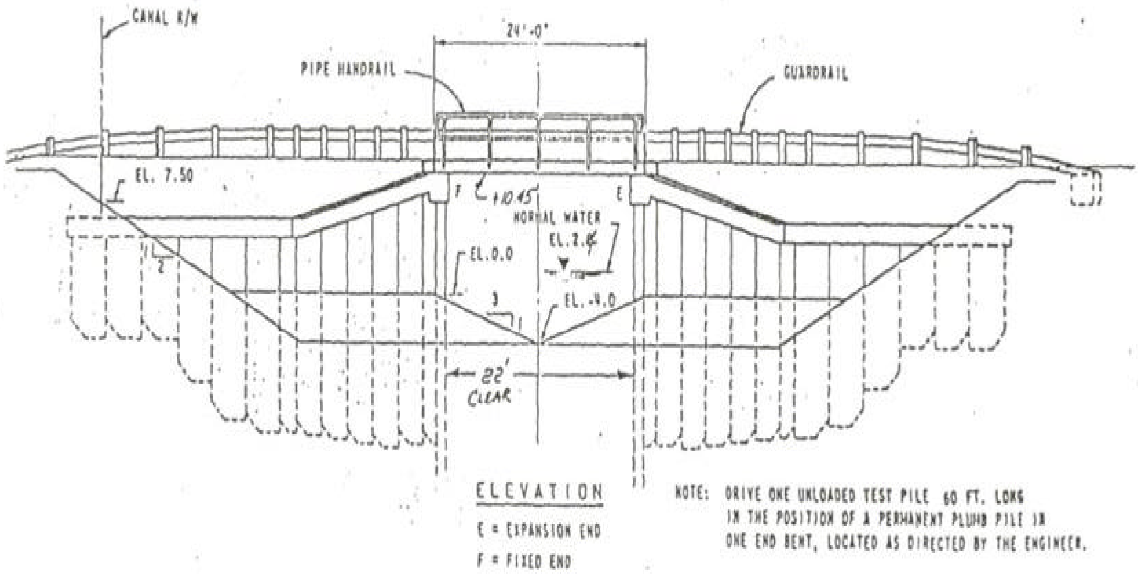

Figure D15. Bridge #67.

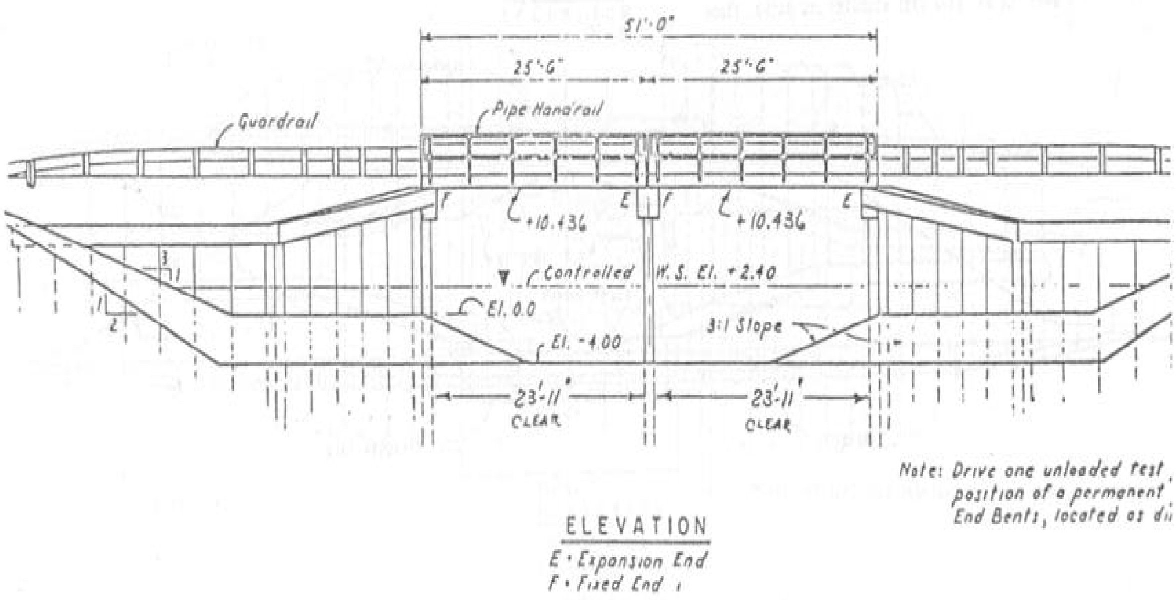

Figure D16. Bridge #68.

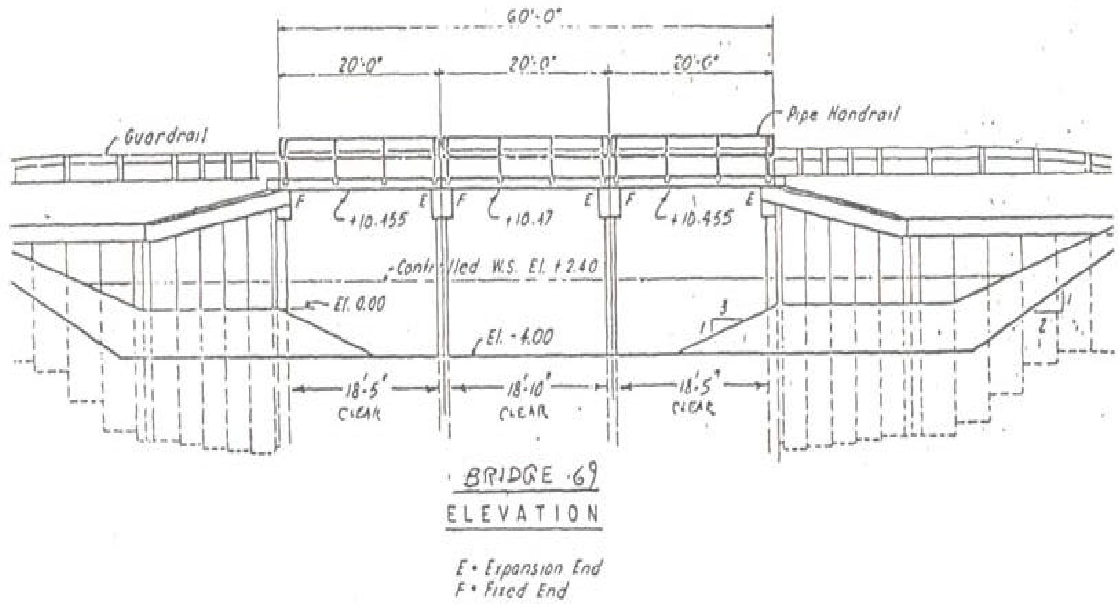

Figure D17. Bridge #69.

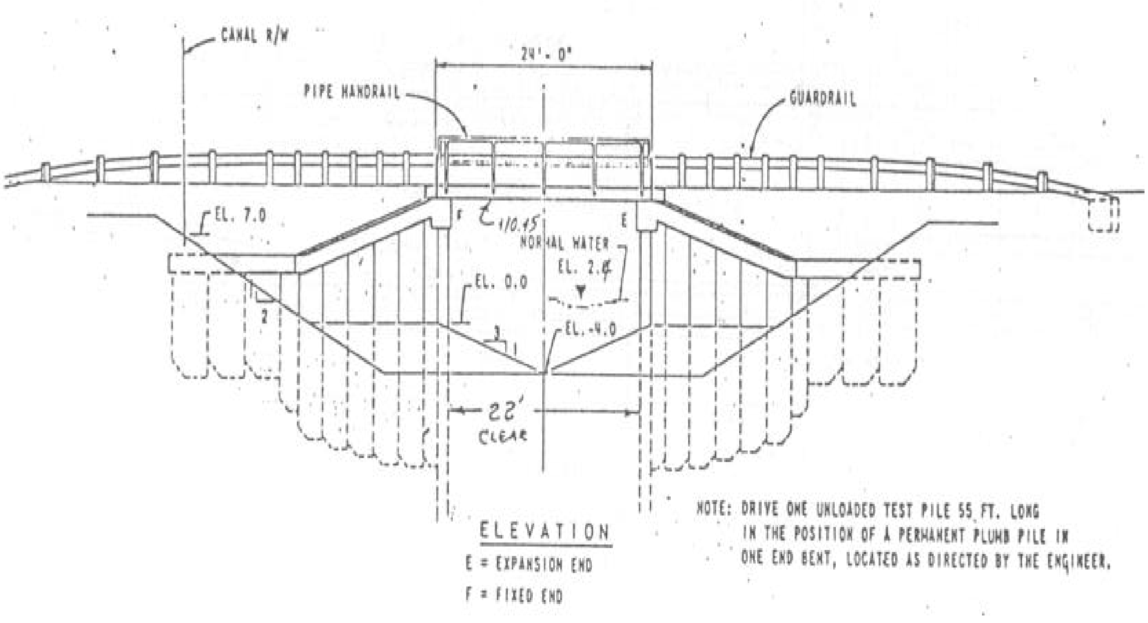

Figure D18. Bridge #71.

Gator Slough Structures Summary

Canal System	Structure	Road Crossing
Gator Slough	Bridge 58	Douglas Parkway
Gator Slough	Bridge 74	Old Burnt Store Road
Gator Slough	Bridge 94	El Dorado Boulevard
Gator Slough	Bridge BS	Burnt Store Road
Gator Slough	Bridge BC-GC1	West Gator Circle
Gator Slough	Bridge BC-GC2	East Gator Circle
Gator Slough	Bridge BC-US41	Garden Boulevard
Gator Slough	Weir 4	Chiquita Boulevard
Gator Slough	Weir 9	None-adjacent to Nelson Rd.
Gator Slough	Weir 11	Burnt Store Road
Gator Slough	Weir 19	Andalusia Boulevard
Horseshoe	Bridge 16	Chiquita Boulevard
Horseshoe	Bridge 19	Andalusia Boulevard
Horseshoe	Bridge 20	Del Prado Boulevard
Horseshoe	Bridge 21	Kismet Parkway
Horseshoe	Bridge 22	NE 28TH Street
Horseshoe	Bridge 54	Diplomat Parkway
Horseshoe	Bridge 55	Nelson Road
Horseshoe	Bridge 56	Kismet Parkway
Horseshoe	Bridge 57	Kismet Parkway
Horseshoe	Bridge 60	NE 3RD Avenue
Horseshoe	Bridge 61	Kismet Parkway
Horseshoe	Bridge 62	NE 27TH Terrace
Horseshoe	Bridge 63	NE 4TH Place
Horseshoe	Bridge 69	El Dorado Boulevard
Horseshoe	Bridge 70	NW 14TH Terrace
Horseshoe	Bridge 72	NW 15TH Terrace
Horseshoe	Bridge 75	Old Burnt Store Road
Horseshoe	Weir 13	Burnt Store Road
Horseshoe	Weir 16	Chiquita Boulevard
Horseshoe	Weir 21	Juanita Boulevard
Hermosa	Bridge 16A	Del Prado Boulevard
Hermosa	Bridge 18	NE 13TH Avenue
Hermosa	Bridge 17A	Chiquita Boulevard
Hermosa	Bridge 17	Andalusia Boulevard
Hermosa	Bridge 46	NE 2ND Place
Hermosa	Bridge 47	Tropicana Parkway
Hermosa	Bridge 48	NE 10TH Street
Hermosa	Bridge 49	Juanita Boulevard
Hermosa	Bridge 50	Tropicana Parkway
Hermosa	Bridge 51	NW 10TH Terrace
Hermosa	Bridge 52	Nelson Road
Hermosa	Bridge 53	NW 11TH Terrace
Hermosa	Bridge 59	NE 4TH Place
Hermosa	Bridge 68	El Dorado Boulevard

Canal System	Structure	Road Crossing
Hermosa	Bridge 76	Old Burnt Store Road
Hermosa	Weir 14	Burnt Store Road
Hermosa	Weir 17	Chiquita Boulevard
Shadroe	Bridge 65	El Dorado Boulevard
Shadroe	Bridge 66	Embers Parkway
Shadroe	Bridge 67	El Dorado Boulevard
Shadroe	Weir 15	Burnt Store Road
Shadroe	Weir 18	Chiquita Boulevard

Appendix E1. Sample Model Input File.

Verification Data (Summer 2001)

Cumulative Rainfall: Lake Fairways (July 12 to August 4 2001)

Time interval: 15 minutes
Total time:24 days (576 hours – **2304** values)
(Start) import from row **2**

DATA	R_REIN		""	**2**	**2304**
0	0.001	0.002	0.004	0.005	0.006
0.007	0.008	0.009	0.01	0.012	0.013
0.014	0.016	0.017	0.019	0.02	0.022
0.024	0.026	0.028	0.03	0.032	0.035
0.037	0.04	0.043	0.046	0.049	0.052
0.055	0.059	0.062	0.065	0.069	0.073
0.077	0.081	0.086	0.091	0.096	0.101
0.107	0.114	0.121	0.132	0.144	0.22
0.295	0.311	0.328	0.337	0.345	0.351
0.358	0.363	0.368	0.372	0.376	0.379
0.383	0.386	0.389	0.393	0.396	0.398
0.4	0.402	0.404	0.406	0.408	0.41
0.412	0.414	0.416	0.418	0.42	0.423
0.424	0.426	0.428	0.43	0.431	0.432
0.434	0.435	0.437	0.438	0.439	0.441
0.442	0.443	0.445	0.446	0.447	0.449
0.45	0.45	0.45	0.451	0.451	0.451
0.451	0.452	0.452	0.452	0.452	0.453
0.453	0.453	0.453	0.454	0.454	0.454
0.455	0.455	0.456	0.456	0.456	0.457
0.457	0.458	0.459	0.459	0.46	0.46
0.461	0.462	0.462	0.463	0.464	0.465
0.465	0.466	0.467	0.468	0.469	0.47
0.471	0.473	0.474	0.476	0.479	0.494
0.509	0.512	0.516	0.517	0.519	0.52
0.522	0.523	0.524	0.524	0.525	0.526
0.527	0.527	0.528	0.529	0.529	0.53
0.53	0.53	0.531	0.531	0.532	0.532
0.532	0.533	0.533	0.534	0.534	0.535
0.535	0.535	0.536	0.536	0.536	0.536
0.537	0.537	0.537	0.538	0.538	0.538
0.538	0.539	0.539	0.539	0.539	0.54
0.54	0.541	0.543	0.545	0.546	0.547
0.549	0.55	0.551	0.553	0.555	0.557
0.558	0.56	0.562	0.564	0.566	0.568
0.57	0.573	0.575	0.578	0.581	0.584
0.587	0.591	0.594	0.598	0.602	0.606
0.61	0.614	0.618	0.623	0.627	0.632
0.637	0.643	0.649	0.655	0.661	0.668
0.675	0.684	0.693	0.708	0.722	0.818
0.914	0.934	0.956	0.966	0.977	0.985
0.993	0.999	1.006	1.011	1.016	1.021
1.025	1.029	1.033	1.038	1.042	1.044
1.047	1.05	1.052	1.055	1.057	1.059

1.062	1.065	1.067	1.070	1.072	1.075
1.078	1.08	1.083	1.084	1.086	1.088
1.089	1.091	1.093	1.095	1.096	1.098
1.1	1.101	1.103	1.105	1.107	1.108
1.11	1.119	1.133	1.147	1.156	1.17
1.179	1.193	1.202	1.216	1.23	1.244
1.258	1.272	1.286	1.304	1.318	1.336
1.355	1.378	1.396	1.42	1.443	1.47
1.493	1.521	1.549	1.581	1.609	1.641
1.674	1.711	1.743	1.78	1.817	1.858
1.9	1.946	1.992	2.043	2.094	2.15
2.205	2.279	2.353	2.468	2.584	3.365
4.141	4.307	4.478	4.566	4.654	4.718
4.783	4.834	4.889	4.931	4.968	5.005
5.037	5.074	5.106	5.143	5.176	5.199
5.217	5.24	5.259	5.282	5.3	5.319
5.342	5.365	5.384	5.402	5.425	5.448
5.467	5.485	5.508	5.522	5.536	5.55
5.564	5.578	5.591	5.605	5.619	5.633
5.647	5.661	5.675	5.688	5.702	5.716
5.73	5.73	5.73	5.73	5.73	5.73
5.73	5.73	5.73	5.73	5.73	5.73
5.73	5.73	5.73	5.73	5.73	5.73
5.731	5.731	5.731	5.731	5.731	5.731
5.731	5.731	5.731	5.731	5.731	5.731
5.731	5.731	5.731	5.731	5.732	5.732
5.732	5.732	5.732	5.732	5.732	5.732
5.732	5.733	5.733	5.733	5.733	5.735
5.737	5.737	5.737	5.737	5.738	5.738
5.738	5.738	5.738	5.738	5.738	5.738
5.739	5.739	5.739	5.739	5.739	5.739
5.739	5.739	5.739	5.739	5.739	5.739
5.739	5.739	5.739	5.739	5.739	5.739
5.739	5.739	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.74	5.74	5.74	5.74	5.74
5.74	5.741	5.742	5.742	5.743	5.744
5.745	5.746	5.746	5.747	5.748	5.749
5.75	5.751	5.752	5.753	5.754	5.755
5.756	5.758	5.759	5.761	5.762	5.764
5.766	5.768	5.769	5.772	5.773	5.776

5.778	5.78	5.782	5.785	5.79	5.793
5.796	5.799	5.803	5.806	5.81	5.813
5.818	5.823	5.831	5.839	5.891	5.943
5.955	5.966	5.972	5.978	5.982	5.986
5.99	5.994	5.996	5.999	6.001	6.004
6.006	6.008	6.011	6.013	6.014	6.016
6.017	6.018	6.02	6.021	6.022	6.024
6.026	6.027	6.028	6.03	6.031	6.032
6.034	6.035	6.036	6.037	6.038	6.039
6.04	6.041	6.042	6.043	6.043	6.044
6.045	6.046	6.047	6.048	6.049	6.05
6.05	6.05	6.05	6.05	6.05	6.05
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6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.05	6.05	6.05	6.05	6.05	6.05
6.052	6.055	6.059	6.061	6.064	6.066
6.069	6.072	6.075	6.078	6.081	6.085
6.088	6.091	6.095	6.099	6.103	6.107
6.113	6.117	6.122	6.128	6.134	6.14
6.146	6.153	6.16	6.167	6.174	6.182
6.19	6.198	6.207	6.215	6.225	6.235
6.245	6.256	6.268	6.28	6.293	6.306
6.323	6.341	6.368	6.395	6.577	6.758
6.797	6.837	6.858	6.878	6.893	6.909
6.92	6.933	6.943	6.952	6.96	6.968
6.977	6.984	6.993	7	7.006	7.01
7.016	7.02	7.025	7.03	7.034	7.039
7.045	7.049	7.053	7.059	7.064	7.068
7.073	7.078	7.081	7.085	7.088	7.091
7.094	7.098	7.101	7.104	7.107	7.111
7.114	7.117	7.12	7.124	7.127	7.13
7.131	7.132	7.134	7.134	7.136	7.137
7.138	7.139	7.14	7.141	7.143	7.144
7.145	7.147	7.148	7.15	7.152	7.153
7.156	7.157	7.159	7.162	7.164	7.167
7.169	7.172	7.175	7.178	7.181	7.184
7.187	7.19	7.194	7.197	7.201	7.205
7.21	7.214	7.219	7.224	7.229	7.234
7.241	7.248	7.259	7.27	7.345	7.419
7.434	7.451	7.459	7.467	7.474	7.48
7.485	7.49	7.494	7.497	7.501	7.504
7.508	7.511	7.514	7.517	7.519	7.521
7.523	7.525	7.527	7.529	7.531	7.533
7.535	7.537	7.539	7.541	7.543	7.545
7.547	7.549	7.55	7.552	7.553	7.554

7.555	7.557	7.558	7.559	7.561	7.562
7.563	7.565	7.566	7.567	7.569	7.57
7.574	7.581	7.587	7.591	7.598	7.602
7.608	7.612	7.619	7.625	7.631	7.638
7.644	7.651	7.659	7.665	7.674	7.682
7.693	7.701	7.712	7.723	7.735	7.746
7.759	7.771	7.786	7.799	7.814	7.829
7.846	7.86	7.877	7.894	7.913	7.933
7.954	7.975	7.998	8.022	8.047	8.072
8.106	8.14	8.193	8.246	8.605	8.961
9.037	9.115	9.156	9.196	9.226	9.255
9.279	9.304	9.323	9.34	9.357	9.372
9.389	9.404	9.421	9.436	9.446	9.455
9.465	9.474	9.484	9.493	9.501	9.512
9.523	9.531	9.539	9.55	9.561	9.569
9.578	9.588	9.595	9.601	9.607	9.614
9.62	9.626	9.633	9.639	9.645	9.652
9.658	9.665	9.671	9.677	9.684	9.69
9.706	9.731	9.756	9.772	9.797	9.814
9.838	9.855	9.88	9.904	9.929	9.954
9.978	10	10.04	10.06	10.09	10.13
10.17	10.2	10.24	10.28	10.33	10.37
10.42	10.47	10.53	10.58	10.64	10.7
10.76	10.82	10.88	10.95	11.02	11.1
11.18	11.26	11.35	11.45	11.54	11.64
11.77	11.91	12.11	12.32	13.71	15.1
15.39	15.7	15.85	16.01	16.13	16.24
16.33	16.43	16.5	16.57	16.64	16.69
16.76	16.82	16.88	16.94	16.98	17.02
17.06	17.09	17.13	17.16	17.2	17.24
17.28	17.31	17.34	17.39	17.43	17.46
17.49	17.53	17.56	17.58	17.61	17.63
17.66	17.68	17.71	17.73	17.76	17.78
17.81	17.83	17.86	17.88	17.91	17.93
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17.98	17.98	17.98	17.98	17.98	17.98
17.98	17.99	17.99	18	18	18.01
18.01	18.01	18.02	18.02	18.03	18.03
18.04	18.04	18.05	18.06	18.06	18.07
18.08	18.09	18.09	18.1	18.11	18.12
18.13	18.14	18.15	18.16	18.18	18.19
18.2	18.21	18.23	18.24	18.26	18.27
18.29	18.31	18.33	18.34	18.36	18.39

18.41	18.44	18.48	18.53	18.81	19.1
19.16	19.23	19.26	19.29	19.32	19.34
19.36	19.38	19.39	19.41	19.42	19.43
19.45	19.46	19.47	19.48	19.49	19.5
19.51	19.52	19.52	19.53	19.54	19.55
19.55	19.56	19.57	19.58	19.59	19.59
19.6	19.61	19.61	19.62	19.62	19.63
19.63	19.64	19.64	19.65	19.65	19.66
19.66	19.67	19.67	19.68	19.68	19.69
19.69	19.7	19.71	19.71	19.72	19.72
19.73	19.73	19.74	19.75	19.75	19.76
19.77	19.77	19.78	19.79	19.8	19.81
19.82	19.83	19.84	19.85	19.86	19.87
19.88	19.9	19.91	19.93	19.94	19.96
19.97	19.99	20.01	20.02	20.04	20.06
20.08	20.11	20.13	20.15	20.18	20.21
20.24	20.28	20.33	20.39	20.75	21.12
21.2	21.28	21.32	21.36	21.39	21.42
21.45	21.47	21.49	21.51	21.53	21.54
21.56	21.58	21.59	21.61	21.62	21.63
21.64	21.65	21.66	21.67	21.68	21.69
21.7	21.71	21.72	21.73	21.74	21.75
21.75	21.77	21.77	21.78	21.78	21.79
21.8	21.8	21.81	21.82	21.82	21.83
21.84	21.84	21.85	21.86	21.86	21.87
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21.88	21.88	21.89	21.89	21.89	21.89
21.89	21.89	21.89	21.9	21.9	21.9
21.9	21.9	21.91	21.91	21.91	21.91
21.92	21.92	21.92	21.93	21.93	21.93
21.94	21.94	21.95	21.95	21.95	21.96
21.96	21.97	21.97	21.98	21.99	21.99
22	22	22.01	22.02	22.03	22.03
22.04	22.05	22.07	22.09	22.2	22.31
22.33	22.35	22.37	22.38	22.39	22.4
22.4	22.41	22.42	22.42	22.43	22.43
22.44	22.44	22.45	22.45	22.46	22.46
22.46	22.46	22.47	22.47	22.47	22.48
22.48	22.48	22.48	22.49	22.49	22.49
22.5	22.5	22.5	22.5	22.5	22.51
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22.55	22.55	22.55	22.56	22.56	22.56
22.56	22.56	22.57	22.57	22.59	22.61
22.61	22.62	22.62	22.62	22.62	22.63

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22.65	22.65	22.65	22.65	22.65	22.65
22.65	22.66	22.67	22.67	22.68	22.69
22.69	22.7	22.71	22.71	22.72	22.73
22.74	22.74	22.75	22.76	22.77	22.78
22.79	22.8	22.82	22.83	22.84	22.86
22.87	22.89	22.9	22.92	22.94	22.95
22.97	22.99	23.01	23.03	23.05	23.08
23.1	23.13	23.15	23.18	23.21	23.24
23.28	23.32	23.38	23.44	23.87	24.28
24.37	24.47	24.51	24.56	24.59	24.63
24.66	24.69	24.71	24.73	24.75	24.77
24.79	24.8	24.82	24.84	24.85	24.86
24.88	24.89	24.9	24.91	24.92	24.93
24.94	24.95	24.96	24.98	24.99	25
25.01	25.02	25.03	25.04	25.04	25.05
25.06	25.07	25.07	25.08	25.09	25.1
25.1	25.11	25.12	25.13	25.13	25.14
25.14	25.15	25.15	25.15	25.16	25.16
25.16	25.17	25.17	25.17	25.18	25.18
25.19	25.19	25.2	25.2	25.21	25.21
25.22	25.22	25.23	25.24	25.24	25.25
25.26	25.27	25.28	25.28	25.29	25.3
25.31	25.32	25.33	25.34	25.36	25.37
25.38	25.39	25.41	25.42	25.44	25.46
25.48	25.5	25.53	25.56	25.79	26.01
26.06	26.11	26.13	26.16	26.18	26.2
26.21	26.23	26.24	26.25	26.26	26.27
26.28	26.29	26.3	26.31	26.32	26.32
26.33	26.33	26.34	26.35	26.35	26.36
26.36	26.37	26.38	26.38	26.39	26.39
26.4	26.41	26.41	26.41	26.42	26.42
26.43	26.43	26.43	26.44	26.44	26.45
26.45	26.45	26.46	26.46	26.47	26.47
26.47	26.47	26.47	26.47	26.47	26.47
26.48	26.48	26.48	26.48	26.48	26.48
26.48	26.48	26.48	26.48	26.48	26.49
26.49	26.49	26.49	26.49	26.49	26.49
26.5	26.5	26.5	26.5	26.5	26.51
26.51	26.51	26.51	26.51	26.52	26.52
26.52	26.53	26.53	26.53	26.54	26.54
26.54	26.55	26.56	26.56	26.61	26.66
26.67	26.68	26.69	26.69	26.7	26.7
26.7	26.71	26.71	26.71	26.71	26.72
26.72	26.72	26.72	26.73	26.73	26.73
26.73	26.73	26.73	26.73	26.73	26.74
26.74	26.74	26.74	26.74	26.74	26.74
26.74	26.75	26.75	26.75	26.75	26.75
26.75	26.75	26.75	26.75	26.75	26.75
26.76	26.76	26.76	26.76	26.76	26.76

Inflow – USGS (User defined – U.S. Hwy 41)

Date	Max GH	Min GH	Avg GH	Max Q	Min Q	Avg Q
7/1/01	15.38	15.37	15.37	0.39	0.35	0.37
7/2/01	15.37	15.37	15.37	0.35	0.35	0.35
7/3/01	15.37	15.31	15.36	0.35	0.17	0.33
7/4/01	15.37	15.36	15.36	0.35	0.32	0.33
7/5/01	15.36	15.35	15.36	0.32	0.28	0.3
7/6/01	15.36	15.35	15.35	0.32	0.28	0.29
7/7/01	15.36	15.34	15.35	0.32	0.25	0.28
7/8/01	15.49	15.36	15.45	0.98	0.32	0.74
7/9/01	15.47	15.39	15.42	0.85	0.43	0.55
7/10/01	15.4	15.38	15.39	0.47	0.39	0.42
7/11/01	15.54	15.39	15.45	1.4	0.43	0.76
7/12/01	15.72	15.54	15.63	3.2	1.4	2.2
7/13/01	15.74	15.72	15.73	3.4	3.2	3.3
7/14/01	15.82	15.73	15.76	4.5	3.3	3.6
7/15/01	16.35	15.82	15.98	17	4.5	8.1
7/16/01	16.55	16.35	16.51	25	17	23
7/17/01	16.49	16.31	16.39	22	16	19
7/18/01	16.31	16.15	16.22	16	11	13
7/19/01	16.15	16.04	16.09	11	8.6	9.8
7/20/01	16.28	15.99	16.13	15	7.5	11
7/21/01	16.47	16.28	16.38	22	15	18
7/22/01	16.98	16.47	16.73	47	22	34
7/23/01	18.63	16.98	18.16	179	47	137
7/24/01	18.63	17.82	18.26	179	105	144
7/25/01	17.82	17.7	17.71	105	96	97
7/26/01	17.61	17.44	17.56	89	77	86
7/27/01	17.53	17.18	17.35	84	59	71
7/28/01	17.18	16.92	17.04	59	44	51
7/29/01	16.92	16.77	16.84	44	35	39
7/30/01	17.12	16.7	16.83	55	32	39
7/31/01	17.12	16.87	17.01	55	41	49
8/1/01	16.87	16.75	16.79	41	34	36
8/2/01	17.16	16.71	16.83	58	32	39
8/3/01	17.32	17.16	17.28	68	58	66
8/4/01	17.26	17.1	17.17	65	54	59

GH-Gage Height (ft); Q-Flow (cfs)

Appendix E2. Sample Model Output File.

Verification Results (July 12 to August 4, 2001)

The detailed output file generated by XP-SWMM is large (12.2 MB, 2199 pages-font 8) and hence impractical to print. It is available in the attached CD. However a summary of the file is given below. This summary gives the various tables in both Runoff and Extran modes and continuity error.

```
Input File : C:\Cla_Andre\TempRunning\Gator-VerificRun-12-OCT.XP
 Current Directory:   C:\XPS\XP-SWMM2000
 Executable Name:     C:\XPS\XP-SWM~1\SWMMENGW.EXE
 Read      4 line(s) and found    1 items(s) from your cfg file.
          *================================================*
          |                  XP-SWMM2000                   |
          |           Storm Water Management Model         |
          |                  Version 7.51                  |
          |================================================|
          |                 Developed by                   |
          |================================================|
          |                                                |
          |           XP Software Inc. and Pty. Ltd.       |
          |                                                |
          |              Based on the U.S. EPA             |
          |   Storm Water Management Model Version 4.40    |
          |                                                |
          |            Originally Developed by             |
          |             Metcalf & Eddy, Inc.               |
          |            University of Florida               |
          |          Camp Dresser & McKee Inc.             |
          |              September 1970                    |
          |                                                |
          |            EPA-SWMM is maintained by           |
          |            Oregon State University             |
          |            Camp Dresser & McKee Inc.           |
          |================================================|
          |      XP Software      October, 2000            |
          |        Data File Version --->     9.0          |
          *================================================*


*==========================================================*
|       Input and Output file names by SWMM Layer          |
*==========================================================*

 Input File  to Layer #     1 JIN.US
 Output File to Layer #     1 C:\Cla_Andre\XPSWMM\Gator25.int
 Input File  to Layer #     2 C:\Cla_Andre\XPSWMM\Gator25.int
 Output File to Layer #     2 JOT.US

*============================================================*
|   Special command line arguments in XP-SWMM2000. This      |
|   now includes program defaults. $Keywords are the program|
|   defaults.  Other Keywords are from the SWMMCOM.CFG file.|
|   or the command line or any cfg file on the command line.|
|   Examples include these in the file xpswm.bat under the  |
```

```
|   section :solve or in the windows version XPSWMM32 in the|
|   file solve.bat                                           |
|                                                            |
|   Note: the cfg file should be in the subdirectory swmxp   |
|         or defined by the set variable in the xpswm.bat    |
|         file.  Some examples of the command lines possible|
|         are shown below:                                   |
|                                                            |
|   swmmd swmmcom.cfg                                        |
|   swmmd my.cfg                                             |
|   swmmd nokeys nconv5 perv extranwq                        |
*============================================================*

 $powerstation        0.0000        1        2
 $perv                0.0000        0        4
 $oldegg              0.0000        0        7
 $as                  0.0000        0       11
 $noflat              0.0000        0       21
 $oldomega            0.0000        0       24
 $oldvol              0.0000        1       28
 $implicit            0.0000        1       29
 $oldhot              0.0000        1       31
 $oldscs              0.0000        0       33
 $flood               0.0000        1       40
 $nokeys              0.0000        0       42
 $pzero               0.0000        0       55
 $oldvol2             0.0000        2       59
 $oldhot1             0.0000        1       63
 $pumpwt              0.0000        1       70
 $ecloss              0.0000        1       77
 $exout               0.0000        0       97
 MAXPTS=5000          0.0000     5000      136
 $oldbnd              0.0000        1      154
 $nogrelev            0.0000        1      161
 $ncmid               0.0000        0      164
 $new_nl_97           0.0000        2      290
 $best97              0.0000        1      294
 $newbound            0.0000        1      295

 *===========================================================*
 | Parameter Values on the Tapes Common Block.These are the |
 | values read from the data file and dynamically allocated |
 | by the model for this simulation.                         |
 *===========================================================*

  Number of Subcatchments in the Runoff Block (NW)....   295
  Number of Channel/Pipes in the Runoff Block (NG)....     0
  Runoff Water quality constituents (NRQ).............     0
  Runoff Land Uses per Subcatchment (NLU).............     0
  Number of Elements in the Transport Block (NET).....     0
  Number of Storage Junctions in Transport (NTSE).....     0
  Number of Input Hydrographs in Transport (NTH)......     0
  Number of Elements in the Extran Block (NEE)........   409
  Number of Groundwater Subcatchments in Runoff (NGW).   295
  Number of Interface locations for all Blocks (NIE)..   409
  Number of Pumps in Extran (NEP).....................     0
  Number of Orifices in Extran (NEO)..................     0
  Number of Tide Gates/Free Outfalls in Extran (NTG)..     1
  Number of Extran Weirs (NEW)........................     7
  Number of scs hydrograph points..................... 20833
  Number of Extran printout locations (NPO)...........     4
  Number of Tide elements in Extran (NTE).............     1
  Number of Natural channels (NNC)....................   331
```

```
 Number of Storage junctions in Extran (NVSE)........   323
 Number of Time history data points in Extran(NTVAL).     7
 Number of Variable storage elements in Extran (NVST)    17
 Number of Input Hydrographs in Extran (NEH).........     1
 Number of Particle sizes in Transport Block (NPS)...     0
 Number of User defined conduits (NHW)..............   325
 Number of Connecting conduits in Extran (NECC)......    20
 Number of Upstream elements in Transport (NTCC).....    10
 Number of Storage/treatment plants (NSTU)...........     0
 Number of Values for R1 lines in Transport (NR1)....     0
 Number of Nodes to be allowed for (NNOD)............   409
 Number of Plugs in a Storage Treatment Unit.........     1


 #######################################################
 #    Entry made to the Runoff Layer(Block) of SWMM    #
 #    Last Updated October, 2000 by XP Software        #
 #    and is CURRENTLY under development.              #

 *===========================================================*
 |         RUNOFF TABLES IN THE OUTPUT FILE.                 |
 |  These are the more important tables in the output file. |
 |  You can use your editor to find the table numbers,      |
 |  for example: search for Table R3 to check continuity.   |
 |  This output file can be imported into a Word Processor  |
 |  and printed on US letter or A4 paper using portrait     |
 |  mode, courier font, a size of 8 pt. and margins of 0.75 |
 |                                                          |
 | Table R1  - Physical Hydrology Data                      |
 | Table R2  - Infiltration data                            |
 | Table R3  - Raingage and Infiltration Database Names     |
 | Table R4  - Groundwater Data                             |
 | Table R5  - Continuity Check for Surface Water           |
 | Table R6  - Continuity Check for Channels/Pipes          |
 | Table R7  - Continuity Check for Subsurface Water        |
 | Table R8  - Infiltration/Inflow Continuity Check         |
 | Table R9  - Summary Statistics for Subcatchments         |
 | Table R10 - Sensitivity analysis for Subcatchments        |
 *===========================================================*

                   Gator Slough

###########################################
#             RUNOFF JOB CONTROL          #
###########################################

 Snowmelt parameter - ISNOW......................            0
 Number of rain gages - NRGAG....................            1
 Quality is not simulated - KWALTY...............            0
 Read evaporation data on line(s) F1 (F2) - IVAP..           2
 Hour of day at start of storm - NHR.............            0
 Minute of hour at start of storm - NMN..........            0
 Time TZERO at start of storm (hours)............        0.000
 Use U.S. Customary units for most I/O - METRIC...           0
 Runoff input print control...                               0
 Runoff graph plot control....                               0
 Runoff output print control..                               0
 Limit number of groundwater convergence messages to     10000
 Month, day, year of start of storm is:              7/12/2001
 Wet time step length (seconds).......                    30.0
 Dry time step length (seconds).......                 86400.0
 Wet/Dry time step length (seconds)...                    30.0
 Simulation length is......                              576.0 Hours
```

```
 If Horton infiltration model is being used
 A mixture of infiltration options may be used in
 XP-SWMM2000 as a watershed specific option.
 Rate for regeneration of infiltration = REGEN * DECAY
 Decay is read in for each subcatchment
 REGEN = ............................................  0.01000



#########################################################
# Rainfall input summary from Runoff Continuity Check   #
#########################################################

 Total rainfall read for gage #     1 is      26.7590 in
 Total rainfall read for gage #     1 is     22440.00 minutes

 ************************************************************
 * Table R5. CONTINUITY CHECK FOR SURFACE WATER             *
 *       Any continuity error can be fixed by lowering the  *
 *       wet and transition time step. The transition time  *
 *       should not be much greater than the wet time step. *
 ************************************************************

                                                    cubic feet    Total inches
                                                                  over Basin
 Total Precipitation (Rain plus Snow)                3.238805E+09     26.760
 Total Infiltration                                  4.625262E+08      3.822
 Total Evaporation                                   4.804629E+08      3.970
 Surface Runoff from Watersheds                      2.193716E+09     18.125
 Total Water remaining in Surface Storage            1.021056E+08      0.844
 Infiltration over the Pervious Area...              4.625262E+08      4.076
                       --------
 Infiltration + Evaporation +
 Surface Runoff + Snow removal +
 Water remaining in Surface Storage +
 Water remaining in Snow Cover.........              3.238811E+09     26.760
 Total Precipitation + Initial Storage.              3.238805E+09     26.760


 The error in continuity is calculated as
 ***************************************
 * Precipitation + Initial Snow Cover  *
 *      - Infiltration -               *
 *Evaporation - Snow removal -         *
 *Surface Runoff from Watersheds -     *
 *Water in Surface Storage -           *
 *Water remaining in Snow Cover        *
 *-------------------------------------*
 * Precipitation + Initial Snow Cover  *
 ***************************************
 Percent Continuity Error...............                             0.000


 ****************************************************
 * Table R6. Continuity Check for Channel/Pipes     *
 *           You should have zero continuity error  *
 *           if you are not using runoff hydraulics *
 ****************************************************

                                                    cubic feet    Total inches
                                                                  over Basin
 Initial Channel/Pipe Storage................        0.000000E+00      0.000
```

```
Final Channel/Pipe Storage.................          0.000000E+00      0.000
Surface Runoff from Watersheds.............          2.193716E+09     18.125
Groundwater Subsurface Inflow..............          6.311514E+08      5.215
Evaporation Loss from Channels.............          0.000000E+00      0.000
Channel/Pipe/Inlet Outflow.................          2.471194E+09     20.418
Initial Storage + Inflow...................          2.824867E+09     23.340
Final Storage + Outflow....................          2.471194E+09     20.418
********************************************
* Final Storage + Outflow + Evaporation  - *
* Watershed Runoff - Groundwater Inflow  - *
*     Initial Channel/Pipe Storage         *
*     ---------------------------------    *
*  Final Storage + Outflow  + Evaporation  *
********************************************
Percent Continuity Error...................                          -14.312


****************************************************
* Table R7. Continuity Check for Subsurface Water  *
****************************************************

                                                   cubic feet    Total inches
                                                                 over Basin

Total Infiltration                                   4.625262E+08      3.822
Total Upper Zone ET                                  2.486851E+07      0.205
Total Lower Zone ET                                  2.653109E+08      2.192
Total Groundwater flow                               6.311514E+08      5.215
Total Deep percolation                               0.000000E+00      0.000
Initial Subsurface Storage                           8.692487E+09     71.820
Final Subsurface Storage                             8.714240E+09     72.000
Upper Zone ET over Pervious Area                     2.486851E+07      0.219
Lower Zone ET over Pervious Area                     2.653109E+08      2.338
Infiltration + Initial Storage                                        75.642
Final Storage, Upper and Lower                                        79.612
Zone ET, Groundwater Flow, Deep Percolation

******************************************
* Infiltration + Initial Storage - Final *
* Storage - Upper and Lower Zone ET -    *
* Groundwater Flow - Deep Percolation    *
* -------------------------------------- *
*     Infiltration + Initial Storage     *
******************************************
Percent Continuity Error.................                             -5.249


   Outflow      Outflow          Average
   Junction  Volume,ft^3    Outflow, cfs
-----------  ------------   ------------
148         10.309855E+06         4.9720
158         43.382557E+06        20.9214
AtkinsonLk   1.937453E+09       934.3425
Valmora Lk 133.530724E+06        64.3956
1323        96.972973E+06        46.7655
1756       395.973665E+06       190.9595
```

```
*=====================================================*
| Initial system volume        =     3.0596E+08 Cu Ft |
| Total system inflow volume   =     2.5837E+09 Cu Ft |
| Inflow + Initial volume      =     2.8897E+09 Cu Ft |
|=====================================================|
| Total system outflow         =     2.6176E+09 Cu ft |
| Volume left in system        =     6.5785E+08 Cu ft |
| Evaporation                  =     0.0000E+00 Cu ft |
| Outflow + Final Volume       =     3.2755E+09 Cu ft |
*=====================================================*

*===============================================*
| Total Model Continuity Error                  |
| Error in Continuity, Percent =        0.43385 |
| Error in Continuity, ft^3    =   12537064.936 |
| + Error means a continuity loss, - a gain     |
*===============================================*

###################################################
# Table E22. Numerical Model judgment section    #
###################################################

Your overall error was                              0.4339 percent
Worst nodal error was in node 797        with     0.0671 percent
Of the total inflow this loss was                 0.0975 percent
Your overall continuity error was                  Excellent
                                                  Excellent Efficiency
Efficiency of the simulation                        1.64
Most Number of Non Convergences at one Node      316.
Total Number Non Convergences at all Nodes       358.
Total Number of Nodes with Non Convergences        4.

===> Hydraulic model simulation ended normally.
 ===> SWMM Simulation ended normally.
===> your input file was named  : C:\Cla_Andre\TempRunning\Gator-VerificRun-
12-OCT.DAT
===> Your output file was named : C:\Cla_Andre\TempRunning\Gator-VerificRun-
12-OCT.out

*===============================================================*
|             SWMM Simulation Date and Time Summary             |
*===============================================================*
| Starting Date... October    13, 2001  Time...    5:26:50:76  |
|   Ending Date... October    13, 2001  Time...   22:15: 9:60  |
|  Elapsed Time... 1008.31400 minutes or  60498.84000 seconds  |
*===============================================================*
```