Chapter 5 CALIBRATION AND VERIFICATION

This chapter contains the calibration procedure and data used for the LSC existing conditions model. The goal of the calibration effort was to develop a hydraulic model that reflects observed conditions in the watershed which can be used to predict system performance for future events and to evaluate alternative projects in the watershed.

5.1 Boundary Conditions

The Lower Sweetwater Creek project area has two outfalls to Old Tampa Bay and one boundary near the north of Johns Road and Benjamin Center (Thompson Center Lateral). The boundary condition used for all design event model simulations for both outfalls to the Bay was a constant water surface elevation of 2.5 feet NGVD. This elevation represents the expected mean high tide for this region of Old Tampa Bay. An initial water surface elevation of 2.5 feet was used for tidally influenced junctions. A fixed elevation boundary is used for John Road outfall.

5.2 Hydrologic and Hydraulic Model Check

Based on the watershed features and methodology described in Chapter 2 and 3 with available topographical data, the watershed was subdivided into 272 sub-basins. These sub-basins are further connected into a drainage network by junctions and conduits (pipe, channel, control structure and boundary) as shown in Exhibit 5-1. Following the assembly of the hydrologic and hydraulic components of the LSC model, several checks were performed on the model hydrology and hydraulic components to confirm compliance with collected data.

5.2.1 Hydrologic Model Check

Three fundamental hydrologic reviews were performed to ensure that runoff contributions from all areas of the LSC watershed were being considered in the hydrologic model. Basin area summations were performed to ensure that the entire watershed area was included in the hydrologic model. An overall watershed area was compared to the summation of the individual basin areas. The results of the comparison revealed an approximate area of 6688 acres for the LSC watershed. The exact watershed boundaries are indeterminate because there are known interconnections between the Sweetwater Creek Watershed and the Lower Sweetwater Creek Watershed, especially at flood stage. This condition will be examined in the future study when all watersheds within Northwest of County are combined. Comparison of runoff and computed flows was also performed. Runoff depth for the 25-year design event was computed by the SCS runoff formula for all sub-basins draining to the Lower Sweetwater Creek Outfall. Runoff volume was then computed by multiplying runoff depth by sub-basin area. Total runoff volume was computed by summing runoff for all sub-basins draining to the Lower Sweetwater Creek Outfall. An "average" SCS Runoff depth over the entire basin was then computed by dividing the runoff volume by the watershed area. Next, the total volume computed by the modified EXTRAN model through LSC outfall was divided by the same contributing basin area to obtain the "average" depth of runoff over the basin for design storm event. These general hydrologic checks suggest that runoffs contributing to the Lower Sweetwater Creek Outfall is properly connected at a macroscopic level.

5.2.2 Hydraulic Model Check

The hydraulic model review consisted of connectivity diagram checking and an evaluation of the computed water surface elevations and flows at each junction and reach, respectively, for the most severe storm event (100-year 24-hour event). Software has been developed to plot the connectivity diagram through input file to detect man-made error during the editing processes. The 100-year storm event's discharge/stage analysis was to assess the reasonableness and consistency of the variations and magnitudes of flows and elevations throughout the hydraulic network. Discharge continuity checks were performed at junctions to ensure that continuity of flow was maintained. Water surface elevations at specific junctions were compared to nearby or adjacent sub-basin boundary elevations to determine if additional reaches were needed to further distribute flows, and to determine if additional stormwater storage areas were necessary.

5.3 Model Calibration

After the fundamental hydrologic and hydraulic checks were completed, a calibration process was conducted to evaluate the general reliability of the model for producing reasonable results. The calibration process includes simulating a measured event by adjusting the hydrologic input parameters according to the measured rainfall depth and distribution and comparing computed water surface elevations and flows to the measured values. The hydrologic and/or hydraulic model is then adjusted so that computed and measured values more closely match.

5.3.1 Gage Information

Calibration data, including measured rainfall depths and distributions, corresponding high water marks, measured water surface elevations and corresponding measured flows, was collected for several rainfall events. Collected flow data includes measurements from the Henry Street Canal near Tampa stream flow gage (USGS #02306654) located on the right upstream wingwall of the Golden Drive bridge on the Henry Street Canal approximately 2500' upstream of the confluence with Lower Sweetwater Creek and is shown in Figure 5-1. The initial period of record for this stage gage spans from October 1985 to September 1990. The gage was reestablished in April 1992 and is currently in operation. Rainfall records were collected for two gages in or near the watershed, including the Tampa International Airport (TIA) rainfall gage and the SWFWMD rainfall gage located at Channel A, just west of the LSC basin boundary. Both gages are continuous rainfall gages.

5.3.2 Selection of Calibration Event

The September 26-27 1997 rainfall event was selected for model calibration event. This storm event occurred near the beginning of a weather pattern known as El Nino that brought heavier than normal rainfall for the 1997-1998 winter. High water marks collected immediately following the event as well as flooding complaints reported during El Nino period are shown in Figure 5-2. This event was selected due to the availability of gage records and high water mark data and the magnitude of the storm. The Tampa International Airport measured 7.59 inches of rainfall during the first 24-hour period (September 26) and 2.23 inches during the second 24-hour period (September 27). The 25-year, 24-hour design event for this area has a total of 8.0 inches which is closely approximated to the rainfall occurring on September 26, 1997. Since the TIA gage is located within

the watershed, a rainfall depth of 9.82 inches was used for model calibration. Rainfall depth and distribution for the September 26, 27, 1997 event was obtained from Tampa International Airport records for a 48-hour period. Hourly discharge and stage records obtained from USGS gage #02306654, Henry Street Canal near Tampa (upstream of Golden Drive cross-drain) are contained in Table 5.1. Hourly rainfall depths for the TIA gage are contained in Table 5.2. The calibration event hydrologic input file was developed using the TIA rainfall distribution and depth. The moisture condition of the soil is unknown at the time of the event, but is oftentimes estimated by the accumulated rainfall depth in the five-day period prior to the event. The TIA rainfall gage reported approximately 1.5 inches of rainfall in the five-day period preceding the calibration event, which corresponds to AMC II conditions. Therefore, the calibration event hydrology was formulated with AMC II curve numbers. The 25-year, 24-hour design event for this area has a depth of 8.0 inches. Although the September 26, 1997 event has a smaller rainfall depth than the 25-year design event, it most closely approximates the depth, duration, and antecedent moisture condition of the design event for the storms under consideration. The data for calibration is summarized in Table 5.3 and the results of this calibration storm event are shown in Figures 5-3 and 5-4.

Table 5.3
Summary of Data for Calibration

Date	Maximum Discharge * (cfs)	Maximum Stage * (ft)	Rainfall Depth @ Channel "A" -SWFWMD	Rainfall Depth @ Tampa International Airport (inch) NOAA
September 26-27, 1997 **	1210	12.60	--	9.82/9.79***

* Represents maximum instantaneous discharge measured at USGS gage #02306654 (measured in unit –15 minutes interval)

** 48-hour simulation

*** TIA 2 days Data (amount) / 48 Hourly Data (Rainfall Distribution)

5.3.3 High Water Marks and Field Investigation

High water marks were collected at locations along Lower Sweetwater Creek and the Henry Street Canal immediately following the September 26-27, 1997 rainfall event. Locations where high water marks were collected are shown in Table 5.4.

Table 5.4

High Water Marks (HWM) for September 26-27, 2002 Storm Event

System	Location Description	Comments	HWM Elevation (ngvd)	Model Simulated Results	Model Junction Number
LSC North System	West bank @ confluence	HWM on west bank	7.7	7.67	402100
LSC North System	Sawyer Road	HWM on upstream	9.1	9.04	402930
LSC North System	Clifton in yard	Average along Clifton Avenue	11.6	N/A	N/A
LSC North System	Golden Drive	Average along Golden Drive	11.5	N/A	N/A
LSC North System	USGS Golden Drive	USGS gage # 02306654	12.6	12.81	402950
HSC West System	Benjamin Road	Upstream side	16.9	16.11	430350
HSC West System	5802 Occident Road Driveway	HWM on driveway on north side of HSC	23.7	22.59	403810
HSC West System	Hesperides	Upstream side of bridge	25.2	22.84	403900

Computed and measured stages were compared. The measured and computed maximum stage at the USGS gage at Golden Drive and all downstream HWM agreed well (gage measured 12.6 feet NGVD, computed value 12.81 feet NGVD) as show in Table 5.4. However, the maximum stages computed along Henry Street Canal, east of gage station # 02306654 (junction 403810 and 403900), are lower than the HWM recorded. The Manning n and homogenous rainfall distribution for entire watershed may play a factor for this storm event at upstream area.

5.4 Model Verification

Model verification is an important measure to be undertaken to ensure that adjustments made to the model during calibration are appropriate and to ensure that the model will produce reliable results. The September 13-15 2001 storm event was selected for model verification event. This storm event occurred during tropical depression Gabrielle covering entire Tampa Bay area. This event was selected due to the availability of gage and the magnitude of the storm. The SWFWMD Channel A measured 6.16 inches of rainfall during the 43-hour period (17:50 9/13/2001 to 13:00 9/15/2001). Hourly discharge and stage records obtained from USGS gage #02306654, Henry Street Canal near Tampa are contained in Table 5.5. Recorded rainfall depths from SWFWMD Channel A gage are contained in Table 5.6. The moisture condition of the soil is estimated from the accumulated rainfall depth in the five-day period prior to the event. The Channel rainfall gage reported approximately 0.41 inches of rainfall in the five-day period preceding the verification event, which corresponds to AMC-I conditions. The simulated results are shown in Figure 5-5 and 5-6. The model is under estimated in both stage and discharge. However, a sensitivity study has been conducted with AMC-II soil condition during this storm event and the results of this storm event sensitivity are shown in Figures 5-7 and 5-8. It is recommended the soil condition for this storm event may be within AMC-I and AMC-II. The second peak appeared in recorded data may coincidentally occur with tidal surge which was not included in the boundary condition. A further investigation may be required to justify this event. The data used for verification is summarized in Table 5.7

Table 5.7
Summary of Data for Verification

Date	Maximum Hourly Discharge * (cfs)	Maximum Hourly Stage * (ft)	Rainfall Depth @ Channel "A" -SWFWMD	Rainfall Depth @ TIA (in.) NOAA/USGS
September 13-15, 2001 **	510/538 ***	10.62/10.79***	6.16	----

* Represents maximum instantaneous discharge measured at USGS gage #02306654
** 72-hour simulation
*** First peak /Second peak