Chapter 4 METHODOLOGY

4.1 General Methodology and Data Base Development

This report project utilized several computer software models and analysis techniques to create the numeric data on which decisions for this report could be made. This chapter provides a general description of these methods and approaches as they pertain to this report's project.

The U.S. Soil Conservation Service (SCS) Runoff Curve Number (CN) method has been used to convert storm rainfall into runoff. This method estimates the expected stormwater runoff on the basis of soil and land cover characteristics. Runoff hydrographs have been developed by the U.S. Soil Conservation Service Dimensionless Unit Hydrograph method.

The locations for inflow hydrograph generation have been determined by the development of a link/node or reach/junction relationship for the stormwater conveyance system or network. The distribution of these inflows within the conveyance system has been accomplished by routing the inflows through the system using a hydrodynamic routing technique. The projections of the rise and fall of water surface elevations with time have also been accomplished with this routing technique.

4.2 Hydrology

A computer model has been utilized to generate SCS-type inflow hydrographs for input to the hydrodynamic model. The U.S. EPA Stormwater Management Model (SWMM) EXTRAN block was modified to include the SCS synthetic unit hydrograph method to generate subbasin runoff. SCS unit hydrograph methodology requires input of subbasin areas, times of concentration, runoff curve numbers, initial rainfall abstraction ratios, and unit hydrograph shape factors. The Hillsborough County Stormwater Management Technical Manual indicates that a value of 256 with a corresponding dimensionless unit hydrograph, is more appropriate for the County. Therefore the program was altered to accept the 256 factor and the SCS Type II Florida Modified unit hydrograph. An initial abstraction coefficient of 0.2 was used throughout this study as recommended in the County Technical Manual. The SWMM Combine Block was then utilized to interface the runoff hydrograhs to the hydrodynamic model.

Rainfall depths are estimated from the SWFWMD isohyetographs contained in the Hillsborough County Stormwater Technical Manual. The specific rainfall depths for the LSC WMMP project were determined to be as shown in Table 4.1

Table 4.1 Storm Event and Rainfall Depth Relationship

STORM EVENT	RAINFALL DEPTH (in)
Mean Annual	4.5
5 - year	5.5
10 - year	7.0
25 - year	8.0
50 - year	10.0
100 - year	11.5

4.2.1 Land Use

The SWFWMD GIS Land Use Coverage (1999) was used to represent existing conditions land use. The SWFWMD land use coverage is based on 1999 aerial infrared photography. Each land use polygon in the GIS coverage is associated with an attribute that designates a classification from the Florida Land Use Classification System (FLUCS) – also known as the Florida Land Use, Cover and Forms Classification System (FLUCFCS). There has been some minor development in the LSC watershed since 1999 that is not represented in the SWFWMD coverage. As impervious area increases, runoff usually increases. However, SWFWMD has been regulating the quantity of stormwater runoff since 1984. The objective of this regulation is to prevent peak runoff rates under developed conditions from exceeding peak runoff rates associated with predevelopment conditions. The Land Use/Land Cover data used in the analysis are shown in Figure 2-6. SWFWMD uses the ARC/INFO GIS in Unix System, which is compatible to Hillsborough County ARC/INFO GIS performed in Windows NT Workstation version GIS system.

4.2.2 Soils

Hydrologic soil polygons were developed from the SCS Soil Survey of Hillsborough County, Florida, 1989. Each soil with identification numbers contained in the Soil Survey can be associated with its corresponding hydrologic soil group. Hydrologic soil groups in the LSC watershed consist of six designations- A, B, C, D, B/D and Water. The "A" soil has a high infiltration rate and low runoff potential. Class "B" soil is moderately well drained soils and have a moderate infiltration rate. Class "C" soils have slow infiltration rates and may contain a layer of fine texture soil impedes the downward movement of water. Class "D" soils include poorly drained, very silty/clayey/organic

soils or soils with high groundwater tables. The dual hydrologic classification (B/D) includes soils have a seasonal high water table but can be drained. The first hydrologic soil group designates the drained condition and the second hydrologic soil group designates the undrained condition of the soil. For soils classified with dual hydrologic soil groups, a representative hydrologic soil group was determined by the corresponding land cover; areas with developed or urban land cover were assigned hydrologic soil group "B" and areas with undeveloped or rural land cover were assigned hydrologic soil group "D". Contiguous soil types with the same hydrologic soil group designation were aggregated into one polygon.

4.2.3 Curve Numbers

Curve number calculations were based on a GIS intersection of the SWFWMD land use coverage with the SWFWMD soil coverage and with the County subbasin map. The subbasin map was prepared in AutoCAD and exported in DXF format. It was then imported to the County GIS system for overlay with the soil and land use coverages. The resulting GIS polygons are associated with attributes of soil type and FLUCS code. Each soil type was then associated with a hydrologic soil group (A, B, C, or D) as discussed in previous sections, and each FLUCS code was associated with an SCS land use category. A CN value was then assigned to each polygon based on the specific hydrologic soil group and land cover classification. The average CN value for a sub-basin was finally computed by area weighted method which dividing the product of each polygon area times CN by the sub-basin area. The program generated an ASCII output file containing the subbasin identification number and area, the average CN value, and sub-basin area for input to the hydrologic model.

4.2.4 Time-of-Concentration

Time-of-concentration were estimated by adding the travel time for segments of appropriate flow paths. The methods for calculating the travel times is reflective of that documented in the Hillsborough County Stormwater Management Technical Manual. The following methods were used to establish travel times.

FLOW REGIME	METHOD
Overland Flow	Kinematic Wave Equation
Shallow Concentrated Paved	SCS Equations relating velocity to watercourse slope
Shallow Concentrated Unpaved	SCS Equations relating velocity to watercourse slope

Channel Flow	Assumed Velocity 2 ft/sec
Pipe Flow	Assumed Velocity 3 ft/sec

4.3 Hydraulics

The hydrodynamic routing model used in the WMMP was a modification of the U.S. EPA EXTRAN model version 4.31. Several modifications to the software were necessary. The first of these is addition of the SCS method of runoff hydrograph generation described in the Hydrology section. In addition to increasing the dimensions of a number of key parameters, other modifications were made to the EXTRAN model. Most of the changes have been enhancements to the inputs and the outputs. Input/output enhancements included:

Specifying reach numbers for orifices and weirs;
Using elevations, rather than depths above invert, for data;
Adding standard horizontal elliptical and arch pipe shapes;
Including the entrance/exit and other minor headloss and pipe stretch factor into internal calculation;
An output summary of Froude number for each conduit which can be used to indicate the instability problem area; and
The hydrograph output for each sub-basin.

4.4 Data Sources

4.4.1 Survey

Survey data for the structure crossings and channel cross sections was obtained in 1992 by County survey crews for the majority of the hydraulic elements in the model. Updated survey information was obtained by County survey crews for portions of the basin in 1995 and was incorporated in the model. Some survey information was utilized from previous efforts. The majority of the cross section and structure crossing data for the Henry Street Canal was obtained from previous survey collected for the Henry Street Ditch Drainage Study by Florida Land Design and Engineering, Inc., 1985.

4.4.2 Literature Review

Previous reports for the area that were consulted for this SWMMP were:

Henry Street Ditch Drainage Study, Florida Land Design and Engineering, 1985.

Hillsborough County National Pollutant Discharge Elimination System Program, Application for Discharges from Municipal Separate Storm Sewer Systems, Part 2, Discharge Characterization Final Results, March, 1994.

Drew Park Drainage Study, City of Tampa, Post, Buckley, Schuh, and Jernigan, Inc., October 1991.

Southwest Florida Water Management District Surface Water Management Conceptual Permit for Tampa International Airport, South System Drainage Calculations, Griener, Inc., September 1990.

Southwest Florida Water Management District Surface Water Management Conceptual Permit for Tampa International Airport, North System Drainage Calculations, Griener, Inc., September 1990.

Spruce Street Canal Surface Water Management Master Plan and Conceptual Permit Application, Final Study Design Task Document, Hillsborough County Aviation Authority, Griener, March 1990.

Design Computations for George Road over Henry Street Ditch, State Project No. 97102-3302 WPI No. 7153105, Hillsborough County, BHR of Tampa, Inc., and E.C. Driver and Associates, Inc., December 1991.

4.4.3 Construction Plans and As-Built

FDOT construction plans, County construction plans, and private development construction plans were used to supplement survey information.

4.4.4 Field Reconnaissance

Field observations were made within the watershed area on several occasions. They were as follows:

March 7, 1990 - Initiation of the Lower Sweetwater Creek Photograph Log by County personnel. This notebook contains color photographs of most crossing structures and cross sections contained in the hydrodynamic model. Manning 'n' values used in the model were determined for cross sections from the information contained in this photograph log. Typical Manning 'n' values used in the model are documented in the photograph log.

June 27, 1995 - A windshield damage assessment was conducted by the Hillsborough County Emergency Planning Department on June 27, 1995 following the June 24, 1995 storm event. The windshield assessment identified nineteen (19) residential dwelling units damaged by the resulting flooding. Several streets in the Town N' Country area west of Hanley Road, east of Webb Road, south of Clifton Street, and north of Hillsborough Avenue were also inundated by this event, including portions of Gateway Drive, Halifax Drive, Larimer Drive, Santa Monica Drive, Ambassador Drive, Paula Drive, Comanche Avenue West, Powhattan Avenue, Town N' Country Boulevard and Hanley Road. Rainfall records for this event were measured by the USGS Gage # 2306647 (Channel "G" and Hanley Road) at 6.65 inches and by the Tampa International Airport Gage at 5.29 inches (24-hour duration). No rainfall was measured on June 23, 1995.

August 3, 1995 - High water marks for portions of Town N' Country Canal A, Henry Street Canal, and Lower Sweetwater Creek were identified by County personnel with orange paint following Tropical Storm Erin, occurring August 2, 1995. Rainfall records for this event were measured by the USGS rainfall gage# 2306647 (Channel "G" and Hanley Road) at 2.29 inches and by the Tampa International Airport rainfall gage at 2.72 inches (24-hour duration). No rainfall was measured August 2, 1995.

August 8, 1995 - Elevations of high water marks identified on August 3, 1995 were collected by County personnel. High water mark elevations were computed by adding or subtracting a measured distance of the high water mark above or below a known elevation (taken mostly from crossing structure survey data).

August 26, 1995 - A field measurement of the water surface elevation was taken at the

Hesperides Street crossing of the Henry Street Canal by County personnel.

Sept. 30, 1997 - High water marks for portions of the Henry Street Canal and Lower Sweetwater Creek were identified by County personnel with orange paint following a two-day rainfall event occurring on September 26 and 27, 1997. The southwestern portion of Hillsborough County experienced less rainfall than the southern and central portions of Hillsborough County. Rainfall records for this event were measured by the SWFWMD Channel A rainfall gage at 4.22 inches and by the Tampa International Airport rainfall gage at 9.82 inches (48-hour duration) with the majority of the rainfall occurring on September 26, 1997.