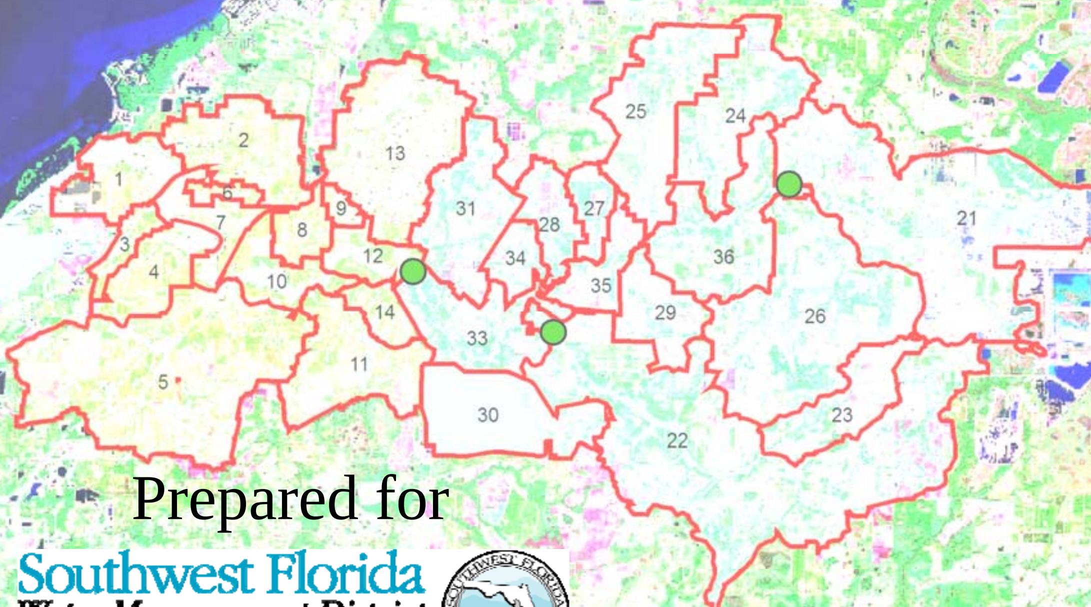
Appendix P

Estimating the Un-Gaged Inflows In the Little Manatee River Basin, Florida



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Project Objectives

The objective of this project was to determine the un-gaged inflows to the Little Manatee River (see Figure 1) in response to rainfall events. These flows are needed to evaluate the salinity interface in conjunction with determining minimum flows and levels (MFL) in the river. The un-gaged inflows to the river can significantly affect the location and distribution of the salinity wedge. Currently the U.S. Geological Survey (USGS) gages the upper two thirds of the basin (see blue shaded basin in Figure 1). The lower third of the basin remains un-gaged (shown in yellow). The ability to continuously gage the lower portion of any river basin is reduced due to the impacts of the tidal fluxes. The surface water model HSPF (Hydrological Simulation Program - FORTRAN) was used to estimate the storm water response of the Little Manatee basin. The HSPF model was calibrated utilizing the rainfall response from the gaged portion of the basin. The calibrated parameters were then extrapolated to the un-gaged basins utilizing the available landuse distribution.

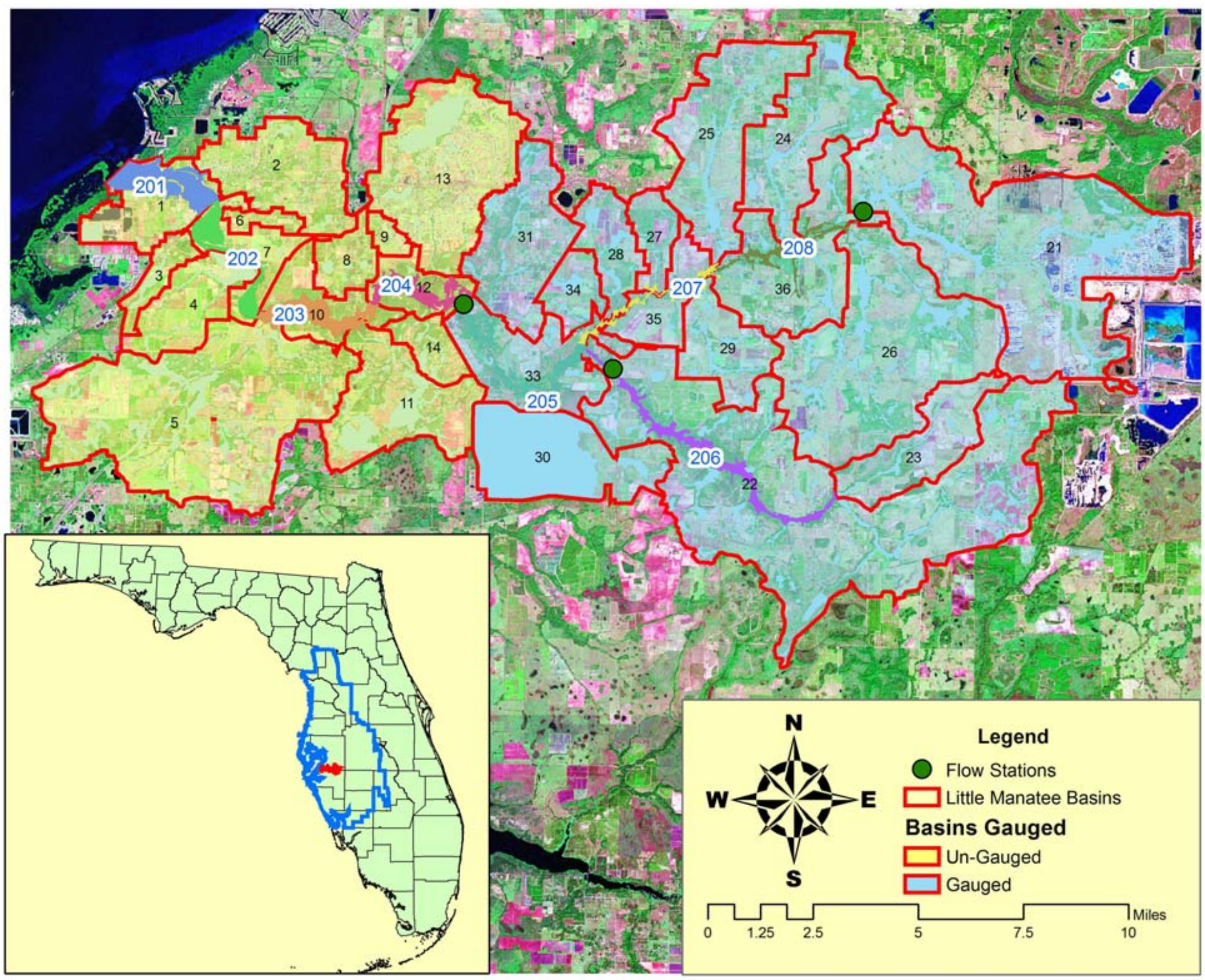

Figure 1 Little Manatee River Basin with Gaged and Un-Gaged Areas Highlighted

Data Collection and Analysis

Before applying the HSPF model, specific data were required for boundary condition fluxes and to provide calibration targets (observed internal/external fluxes). In addition spatial data (from GIS (Geographical Information System) analysis) is required to help develop model parameters. In this case many groups of external fluxes and thematic spatial data were used to drive the model. The data developed for this effort is described below.

Surface Water Basins

Several basin boundaries were collected from a number of sources including Southwest Florida Water Management District (SWFWMD or District), USGS, Tampa Bay Water (TBW), and Hillsborough County. The basins used in this project were derived from the extremely detailed basin delineation performed by Hillsborough County. The resolution of the county basins was far too detailed (2000 basins) for the requirements of this work so the basins were aggregated into 29 sub-basins (see Figure 2). The USGS quadrangles, 100,000 scale hydrography, USGS drainage basins, and even the Digital Orthophoto Quarter Quadrangle (DOQQ)'s were all used to aid in the aggregation process. The final basin delineation is shown in Figure 2.

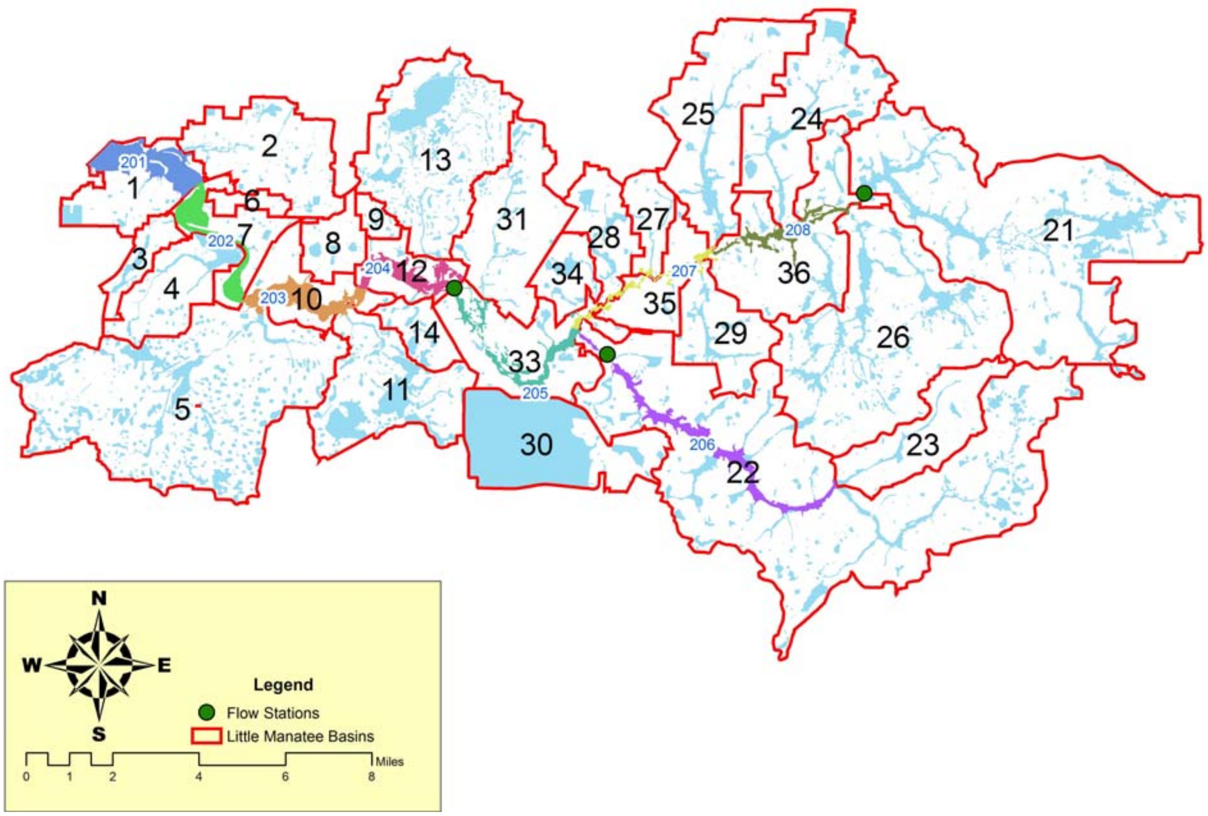

Figure 2 Little Manatee River Basins with Model Subbasins

Basin Land Use

The land use and land cover map (dated 2000) was obtained from the District's online GIS data. The landuse data was used as the best estimate for the spatial coverage of wetlands and lakes which produced the hydrography area used in the model. This area was assumed to act as a storage reservoir and was simulated as such in HSPF (see Model Preparation section below). Prior efforts made an attempt at estimating the wetlands that acted like closed basins. Using a thorough review of the available data it was determined that the amount of closed or conditionally connected reaches was fairly insignificant due to the considerable ditching in the area. The land use map was also utilized to determine the irrigated agricultural areas. The irrigated portion for each basin was simulated as a separate land segment. Separating each basin into multiple land segments allows for better definition of model parameters and boundary conditions (i.e., irrigation inflows are not averaged over the entire basin only over the irrigated agricultural lands). The generalized landuse map is shown in Figure 3. See Appendix A.1 for a table showing the Florida Land Use, Cover and Forms Classification System (FLUCCS) codes and the generalized land use conditions for each code. Each generalized land use condition was represented in the model as a separate computational element to eliminate gross parameter lumping. Appendix E shows a table of the basin areas (in acres) as simulated in the model.

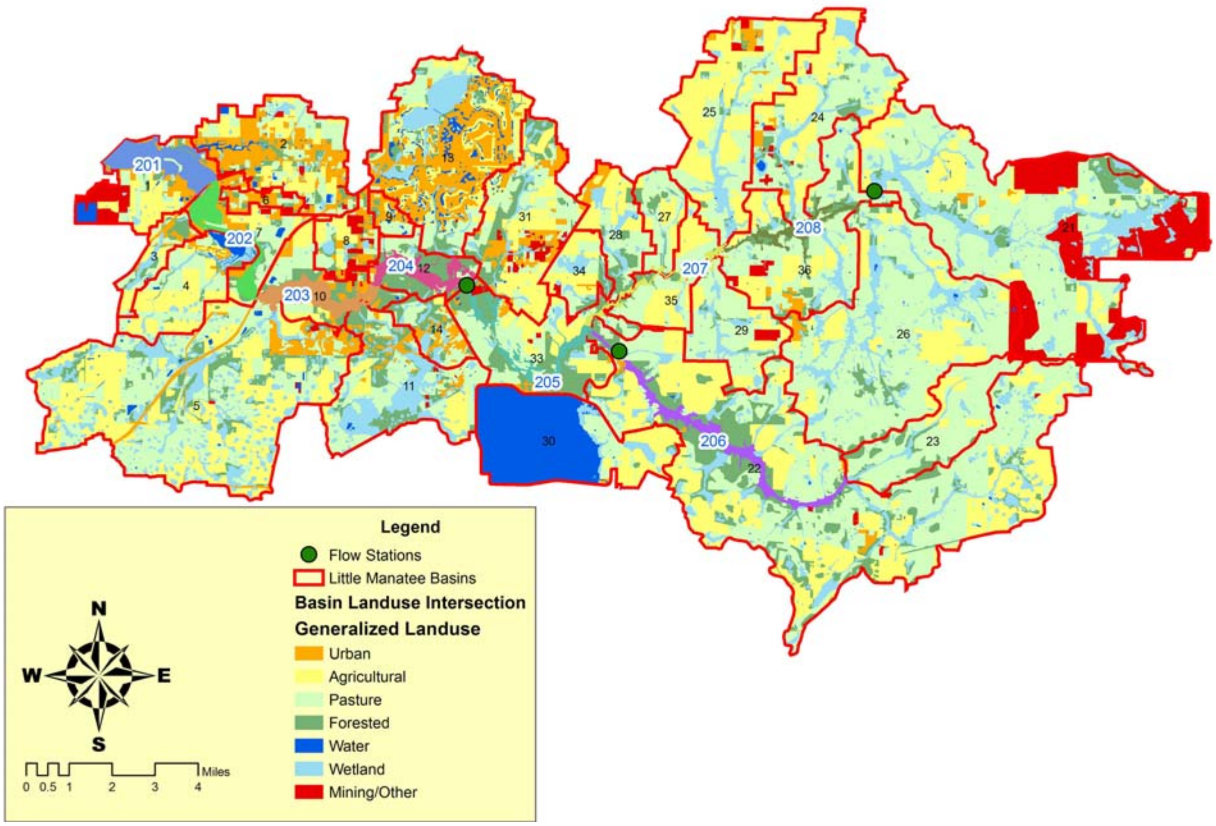

Figure 3 Little Manatee River Basin and Generalized Landuse Map

Basin Slope

The seamless Digital Elevation Model (DEM) data was obtained for the Little Manatee River Basin from USGS. The DEM data was converted to a slope grid in ArcMap. The zonal statistics for each basin was computed using the slope surface. The computed average slope determined from the zonal statistics was used to develop the HSPF data set.

Rainfall

Rainfall data was obtained at various time scales from various agencies including: TBW, SWFWMD, National Oceanic and Atmospheric Association (NOAA), as well as local municipalities (see Figure 4 for a map of station locations and resulting Thiessen polygons; see

Appendix A.2 for a table of rain stations utilized). The daily data was utilized to capture the best definition of the spatial distribution of rainfall. The NOAA 15-minute data were obtained to provide the best temporal distribution. The daily rainfall data, obtained from the SWFWMD, are predominately volunteer data collectors that read standard volumetric rain gages. This data is prone to errors for many reasons (not read, not read on time, zero data mistaken for missing records, etc.). However, the 16 SWFWMD daily rainfall stations represent the best spatial resolution available. Only 3 stations were available from the NOAA 15 Minute data, 1 from the NOAA Summary of the Day data. By averaging all available rain data on a daily basis the best daily volume or basin average is obtained for modeling. This averaging was performed using the area of the Thiessen polygons as a weighting factor (if no data was available the area was excluded from the averaging). The daily volume was then disaggregated into a fifteen-minute time-series for use by the hydrologic model. The disaggregation was performed using the temporal distribution found at the nearest fifteen-minute station (86880 Parrish station, 84797 Lakeland, 84802 Lakeland 2, and 87886 St. Petersburg) that had a similar (+/- 50%) daily total rainfall. If no NOAA 15 minute station fit these criteria, standardized distributions were used (Table 1, Hernandez, 2001). The standard distribution was developed from high frequency rain data collected at USF (Hernandez, 2001). The daily rainfall value for a basin was disaggregated into a 15-minute time series by scaling the precipitation record of the nearest 15-minute station by the proportionate difference in rainfall at the basin. For example, if 1 inch of precipitation was estimated for a basin and the closest 15-minute station recorded 2 inches, each 15-minute record would be scaled by ½ for that basin. The developed rainfall time-series for the Little Manatee River Basin was stored in a model binary data format (WDM) for use by HSPF.

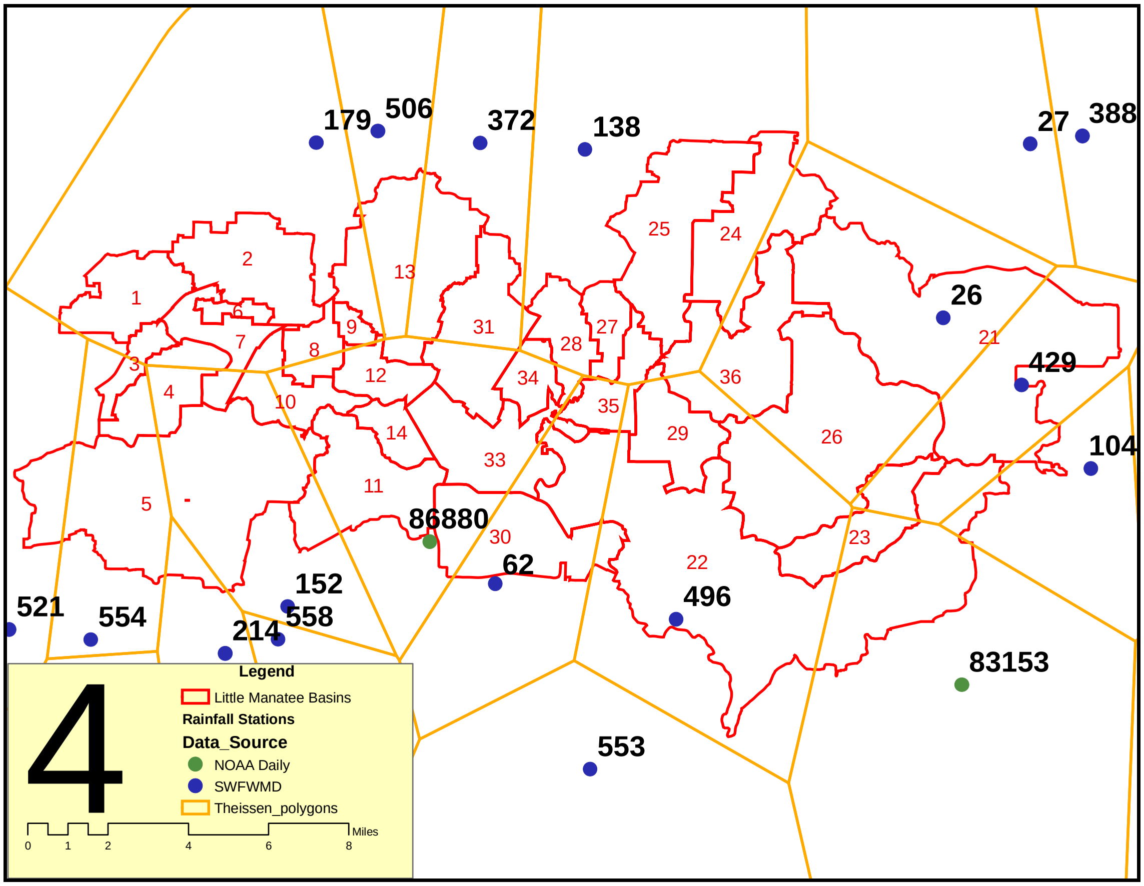

Figure 4 Rain Gage Locations

Table 1 Statistically Defined Rainfall Distributions

		Daily Rainfall Total (inches)			
	Time of Day	< 0.2	0.2 to 0.4	0.4 to 0.7	> 0.7
Rainfall Distribution Fractions	5:15 PM	1	0.15	0.11	0.07
	5:30 PM		0.7	0.11	0.07
	5:45 PM		0.15	0.56	0.07
	6:00 PM			0.11	0.07
	6:15 PM			0.11	0.43
	6:30 PM				0.07
	6:45 PM				0.07
	7:00 PM				0.07
	7:15 PM				0.07

Evaporation

The potential evaporation time-series (daily) was developed from the available pan evaporation data from the Lake Alfred, Moore Haven, and Lisbon NOAA ET stations (see Figure 5 for station locations). Other sources of pan evaporation data were investigated (SWFWMD, TBW, and Manatee Water Supply) but only NOAA data was used in this project. The other sources were too problematic to successfully apply to this study. A hierarchy was set up for the data source for the model. Lake Alfred pan data was the first choice. When Lake Alfred was not available, the missing data was replaced using one of two methods. For short periods of missing data, simple linear interpolation was employed. For longer periods, for example the month of October 1997, the average of two simulated Lake Alfred data (simulated using linear regressions from Lisbon and Moore Haven gage data) was employed. Lake Alfred pan data collection ceased in May 2000, this period was also filled using the average of the two simulated time series. The pan evaporation data was then scaled during the model simulation (HSPF multiplication factor) by a factor of 0.7 to estimate the potential ET of the region. The corrected pan data was stored in WDM binary file format for use by HSPF.

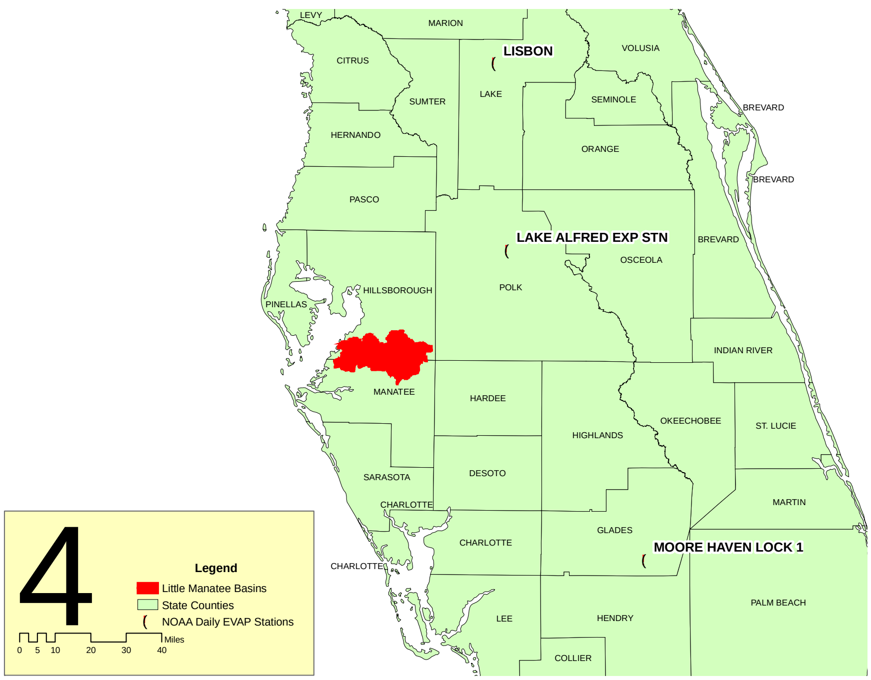

Figure 5 Pan Evaporation Station Locations

Agricultural Irrigation

For detailed water budget analysis of basins heavily impacted by groundwater pumping it is necessary to return groundwater pumping used for irrigation to the surface water system. The groundwater to surface water exchange can have a significant effect on the overall water budget in agricultural areas especially the low flow conditions. The metered and estimated monthly groundwater-pumping rates were obtained from the District. Agricultural and recreational wells identified by USETYPE codes 'A' and 'R' (respectively) in the SWFWMD well permit database were used to develop the irrigation time series. Irrigated land was identified by selecting areas with a FLUCCS code between 2100 and 2600 as well as 1800. This selection criterion included all irrigated land uses including agriculture and recreation. Recreation was included to account for irrigation on golf courses. Figure 6 shows the irrigation land use polygons with the associated water use points. The water pumped from agricultural wells was then applied to the irrigated land areas within the basins identified as agricultural land use conditions. All agricultural pumping for the month was distributed to all days without significant rainfall (<.5 inches). The developed daily time-series assumed the irrigation volume for the day is applied to the land surface and to interception storage (HSPF Lateral surface inflow [SURLI] and Initial Interception Storage [CEPS] variables) within a four hour application interval from 5:00AM to 9:00AM. The fraction of irrigation delivered to CEPS and SURLI was obtained from the INTB model application. The fraction of drip irrigation and spray irrigation was determined from available data on crop types. The estimated irrigation data was not available for the years 2003 for the calibration period and both 2004 and 2005 for the verification/predictive simulations. These missing years were estimated using representative years. The selection of the representative years were based on a simple analysis using the precipitation time series both annual rainfall totals as well as seasonal totals (using the assumption that irrigation practices would be similar for similar rainfall). The developed time series for each basin is stored in the WDM binary format for use by HSPF.

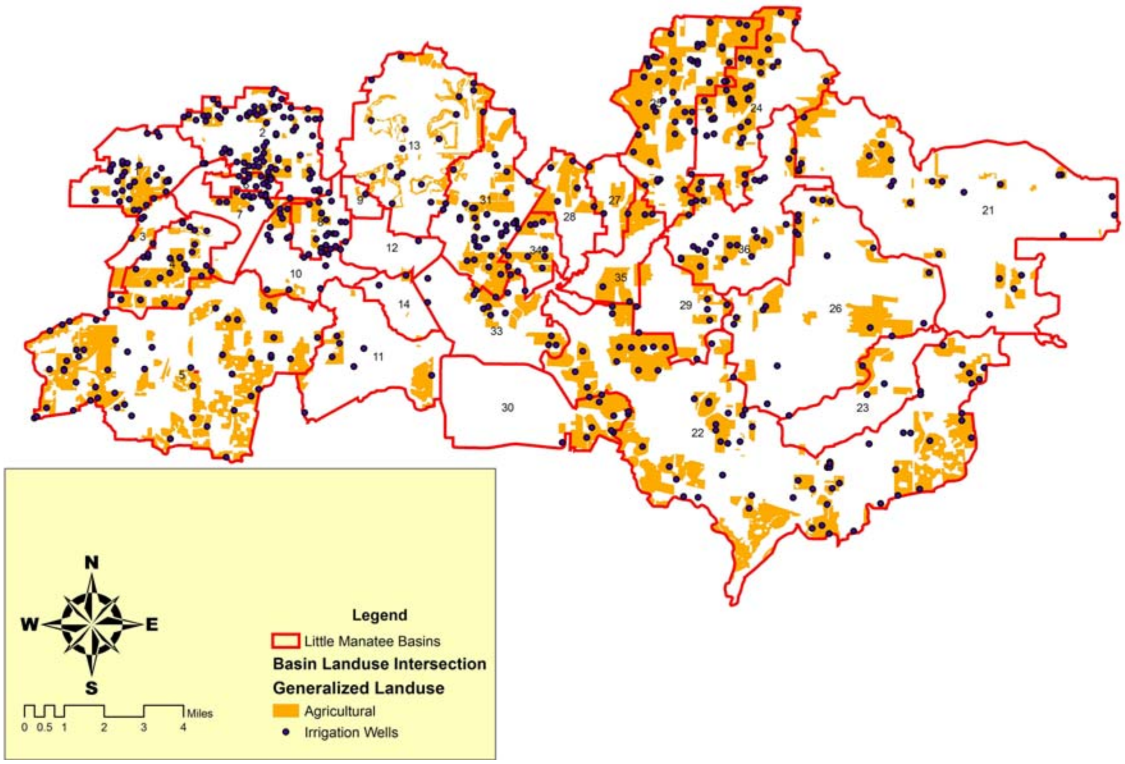

Figure 6 Agricultural Irrigation Land Segments and Water Use Points

Stream Flow

Observed stream flows were obtained from the USGS for three stations: Little Manatee River at Wimauma (USGS station ID 02300100), Little Manatee River at Fort Lonesome (USGS station ID 02300100), and South Fork Little Manatee River near Wimauma (USGS station ID 02300300). The data represents the observed average daily flow. This data was converted to an estimate for runoff and baseflow for calibration and verification comparisons (see following sections). The South Fork Little Manatee River gage was not used for calibration comparison. The time series for this gage started on 10/1/2000. Originally this gage was not included in the calibration due to the short record available. This gage, however, was included in the verification comparisons (see results). Figure 7 shows the Little Manatee River Basin and subbasins with the locations of the USGS gaging stations.

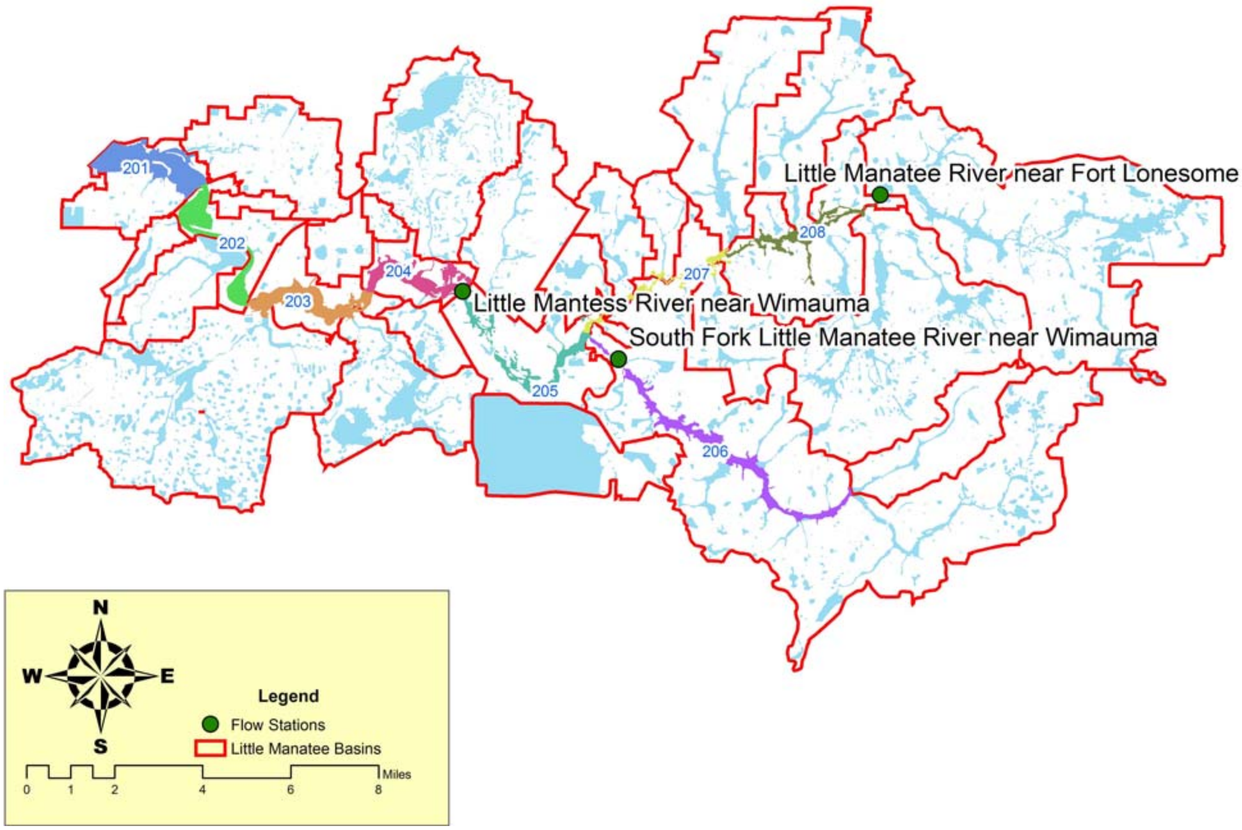

Figure 7 Calibration and Verification Streamflow Gage Locations

Baseflow

Baseflow at each observed streamflow station was estimated using a numerical baseflow separation technique. The technique is described in detail in the Southern District Modeling study (Geurink *et al.* 2001). The method is basically a low pass filter time series filter. This technique was used for both the observed and simulated hydrographs. A separation method was necessary for the observed hydrographs because only total streamflow can be measured. As it is impossible to fully differentiate groundwater flow from surface water flow in a stream flow record, it was desirable to utilize the same procedures on the simulated results so as to make an assessment of the low flow model performance (see results section below).

Florida Progress Water Use

Florida Progress uses a large surface water use permit to supply make up water for their reservoir. The metered water use was obtained from the District. These water use rates were available only in monthly accumulated totals (million gallons). These monthly rates were converted into a WDM data set and applied as a withdrawal time series to the routing reach 205.

Model Preparation

The HSPF model for the Little Manatee River basin was developed using the spatial data and temporal data collected and processed as described above. The basins were divided into the land segments to preserve the correct parameters and avoid parameter lumping (for example averaging impervious with pervious). The reaches were developed from the land use mapping and the USGS rating tables. This allowed correct representation of the reach storage potential and therefore reach water budget. Details on the model development, calibration, and predictions are included in the sections below.

Integrated Northern Tampa Bay Model

The model developed in this study was built from the existing model parameters that were developed for the Integrated Northern Tampa Bay (INTB) model application (Ruskauff *et al.* 2001). In the INTB model, the Little Manatee basin was represented with 5 basins (see Figure 8). Since the INTB application used the same landuse based calibration the INTB model parameters were used as a starting point for this calibration exercise. Other non landuse based parameters (for example soils based data) were extrapolated from the INTB calibration based on an overlay of the basins.

The Integrated Northern Tampa Bay (INTB) Model was calibrated from 1/1/1989 to 12/31/2000 (Ruskauff *et al.* 2003). This period represented a significant dry period as well as two significant wet periods (1992-1993 and 1997-1998). This large variation in the calibration period is useful to help build confidence in the model's predictive capability for a wide variety of conditions. The INTB model was shown to predict cumulative hydrographs as well as hydrograph peaks and basin annual targets of estimated ET to within acceptable differences for the scale of the problem. The INTB model parameters for the basins that comprised the Little Manatee River (specifically 157, 158, 159, 160, and 161) were used as a starting point for this model. The parameters were further calibrated (see calibration section below).

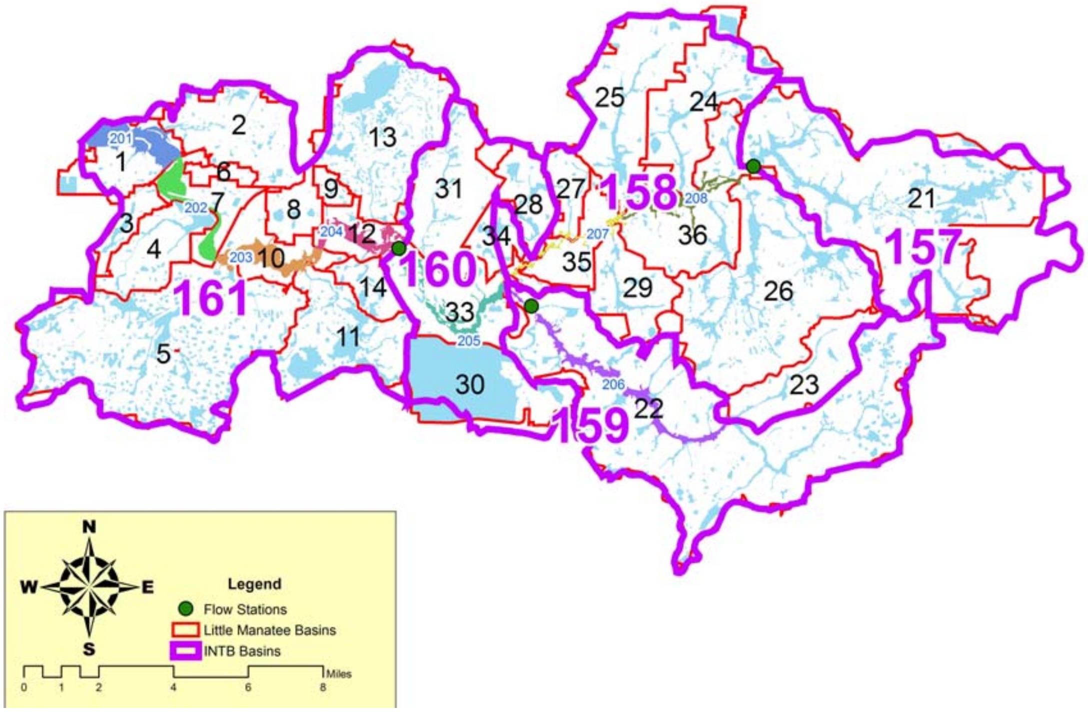

Figure 8 Little Manatee River Subbasins and INTB Basin Overlay

Gaged/Un-Gaged Little Manatee River Basin

As stated previously, the Little Manatee basin for this project was sub-divided into 29 sub-basins (see Figure 2). The 29 subbasins defined the entire Little Manatee basin. The un-gaged portion of the Little Manatee River is represented by 14 of those subbasins while the gaged portion was represented with 15 subbasins. The 29 subbasins were divided into 137 pervious land segments and 28 impervious land segments. Dividing the basins into land segments practically eliminates the parameter lumping typically found in hydrologic models. The resulting operation number in the HSPF data set was set to BasinID*10 + generalized land use code. The generalized land use codes used in the model are listed in Table 2. The landuse and soils parameters for the un-gaged basins were extrapolated from the calibrated parameters from the gaged basins. This extrapolation assumes that the landforms within the basins upstream of the gages are hydraulically similar to the basins downstream of the gages. Unfortunately this is an assumption that is problematic. Moving westward towards Tampa Bay, the amount of development or impervious area, mining effects, and drainage all change dramatically. Nevertheless, it is still the best available information given the lack of measurements and difficulty in making those measurements. Also the downstream basins have generally shallower depth to water table and the water budget may be affected by groundwater discharge zones. Model parameters were adjusted to help account for this but no information or calibration data is available.

The 14 basins that represent the un-gaged portion of the Little Manatee River include: 1) “Lower Little Manatee”, 2) Marsh Branch, 3) “Sun City”, 4) Wildcat Creek, 5) Curiosity Creek, 6) “Fish Hatcheries 1”, 7) Mill Bayou, 8) “Fish Hatcheries 2”, 9) “No Name 1”, 10) Upper “Middle Little Manatee River”, 11) “No Name 2”, 12) “Upper Little Manatee River”, 13) Cypress Creek, and 14) “No Name 3”.

Table 2 Generalized Landuse Codes

Land Use Code	Land Use Description
1	Urban
2	Agricultural
3	Pasture
4	Forested
7	Other/Mining

Model Basin Parameters

Appendix B tabulates model parameters and the entire HSPF model data set used in both the calibration as well as the predictive hydrologic simulations.

Model Reach Parameters

The hydrography or reaches (wetlands, lakes, and streams) play a very significant role in the hydrologic response of the basins in West-Central Florida. The reaches have considerable impact on modifying the basin runoff response to given rainfall events. The storage in these water features attenuates or even completely captures the runoff hydrograph from upland portions of the basin. The available storage capacity before a storm is a function of the antecedent moisture condition. The best way to represent this storage in HSPF is through the Free Flowing Reach or Reservoir (RCHRES) module. In the Little Manatee River Model two types of reaches were utilized to represent the hydrography in the basin: storage attenuation reaches and routing reaches. The storage attenuation reaches were defined as an aggregate of all wetlands and lakes within each of the sub-basin boundaries (one for each sub-basin). The storage attenuation reaches were classified with the basin ID in which they resided therefore the RCHRES operation ID used the same number. The routing reaches were defined as the rivers and associated riparian wetlands that convey the runoff hydrographs from each basin (technically each storage attenuation reach) to the final outfall, Tampa Bay. The routing reaches RCHRES operations were number from 201 to 208 (see figure 2). An additional RCHRES operation was utilized to simplify post-processing. This additional RCHRES (operation ID 300, not shown on any map) is used to accumulate flows from reaches 205 and 31.

In HSPF's RCHRES operations, the non-linear relationship between reach stage, storage volume, and discharge is defined with a table called an F-TABLE. The 2000 land-use map was used as the best available data for defining the spatial extent or the area of the reaches. The area for each reach was defined as a constant for all stages based on the land use mapping. This assumes the mapping represents normal pool extents. The constant area was used to eliminate the possibility of mass balance errors caused by double accounting for areas that may or may not be inundated. If the reach area were allowed to change at different stages, then the basin areas would have to change as well to conserve mass (precipitation times area and ET times area). Standard HSPF does not allow the basin areas to change with time (the reach area would not be available until after the reaches are simulated thus making it an iterative problem). Maintaining constant reach areas does introduce errors. The constant area forces the model to remove potential evaporation and add rainfall over the defined area at all times. When the reach is dry the area that should be represented with full open water potential evaporation should be something less than the defined constant area. This will over-estimate the reach evaporation rates. In turn the inflow volume will be over-estimated for rain event during times of low wetland stage. The high water table (even during dry periods) and the dense vegetation in wetlands will cause the actual ET to approach that of open water evaporation rates. The over-estimation of precipitation inflows will be reduced because the storage volume can include (below the invert of discharge) vadose zone soil storage. The most representative USGS rating or stage-discharge relationship of each observed gage was scaled for each reach based on the ratio between the contributing area to the reach and the contributing area of the gage. The nearest downstream rating was used to define this relationship for each reach. The volumes were then defined as the reach area times the stage (defined again by the scaling the USGS rating condition) times a volume adjustment factor. The volume adjustment factor allowed for a diminishing volume stored at lower stages while exponentially increasing at the higher stages to allow for the extreme volumes stored at high stages. The volume adjustment factors were adjusted to improve the match between observed and simulated stream discharges. This methodology dramatically simplifies the reach calibration while remaining true to the available data.

Model Simulation and Results

The simulation results include a complete water budget for all basins and reaches included in the simulation. For the gaged portion of the basin the simulation results were compared to the observed measurements. After the calibration and extrapolation of the basin and reach parameters, the un-gaged results were generated into time series inflows to the Little Manatee River.

Calibration and Verification Results

Model calibration and verification are necessary and critical steps in any model application. For HSPF, as with any numerical model, calibration is an iterative procedure of parameter evaluation and refinement, as a result of comparing simulated and observed values of interest. It is required for parameters that cannot be deterministically, and uniquely, evaluated from topographic, climatic, edaphic, or physical/chemical characteristics of the watershed and compounds of interest. Ideally, calibration is based on several years of simulation in order to evaluate parameters under a variety of climatic, soil moisture, and water quality conditions. Calibration should result in parameter values that produce the best overall agreement between simulated and observed values throughout the calibration period while remaining within the bounds of published literature ranges.

Calibration includes the comparison of both monthly and annual values, and individual storm events, whenever sufficient data are available for these comparisons. In addition, when a continuous observed record is available, such as for streamflow, simulated and observed values should be analyzed on a frequency basis and their resulting cumulative distributions compared to assess the model behavior and agreement over the full range of observations. In addition, other calibration targets can include estimates for baseflow, ET, and reach stage or storage.

Model verification is an extension of the calibration process. Its purpose is to assure that the calibrated model properly assesses all the variables and conditions which can affect model results. While there are several approaches to validating a model, perhaps the most effective procedure is to use only a portion of the available record of observed values for calibration; once the final parameter values are developed through calibration, simulation is performed for the remaining period of observed values and goodness-of-fit between recorded and simulated values is reassessed (Donigian, 2002).

The Little Manatee model was calibrated for the period from January 1, 1992 to December 31, 2003. Two long term flow gages (Little Manatee near Wimauma and Little Manatee near Fort Lonesome) were available for this period. The calibration comparisons were made using a variety of graphical and statistical analyses. Graphical plots included cumulative volume as well as arithmetic and logarithmic hydrographs. The cumulative graphs show the running volume comparisons over the calibration period. The arithmetic hydrographs provide an effective comparison of peak flows while the logarithmic hydrographs provide an effective comparison of low flows. Scatter plots of simulated versus observed average daily flows, for the period from January 1, 1992 to September 30, 2005, were also generated giving both a visual and statistical (R^2) measure of model performance. The calibration process also included the use of the HSPF Expert System (HSPEXP). This valuable tool provides statistical analysis of a wide range of model components (peak flows, low flows, recession rates, seasonal variations, etc.).

For model verification (as well as the predictive simulations, see below), the simulation period was extended until September 30, 2005. These additional years were required to predict the inflows to the Little Manatee River during which river salinities were collected. Using this period for verification also provided an additional observed flow record (South Fork Little Manatee near Ft Lonesome) for model comparison (there was not enough useful data at this station for use in calibration).

The calibration and verification results were considered reasonable estimates of total streamflow for all the gaging stations considering the scale of the application and the uncertainty of hydrologic input and hydrologic processes. The calibration comparisons for each flow gage are shown in Appendix C.

Predictive Simulation Results

Predictive simulations were performed on the basins that were not gaged. The un-gaged portion of the Little Manatee River is represented by 14 individual time series. These time series of flow enter the Little Manatee River as either a point source or non-point source. The un-gaged basins are shown in Figure 9. The hydro-dynamic model domain is required in order to determine the locations for the application of the time series.

The time series of streamflow discharges for the 14 basins were generated for the period 1989-2005 and were transmitted in electronic file format to the District for use in the salinity model. Running hydrographs for each ungaged basin are shown in Appendix D.

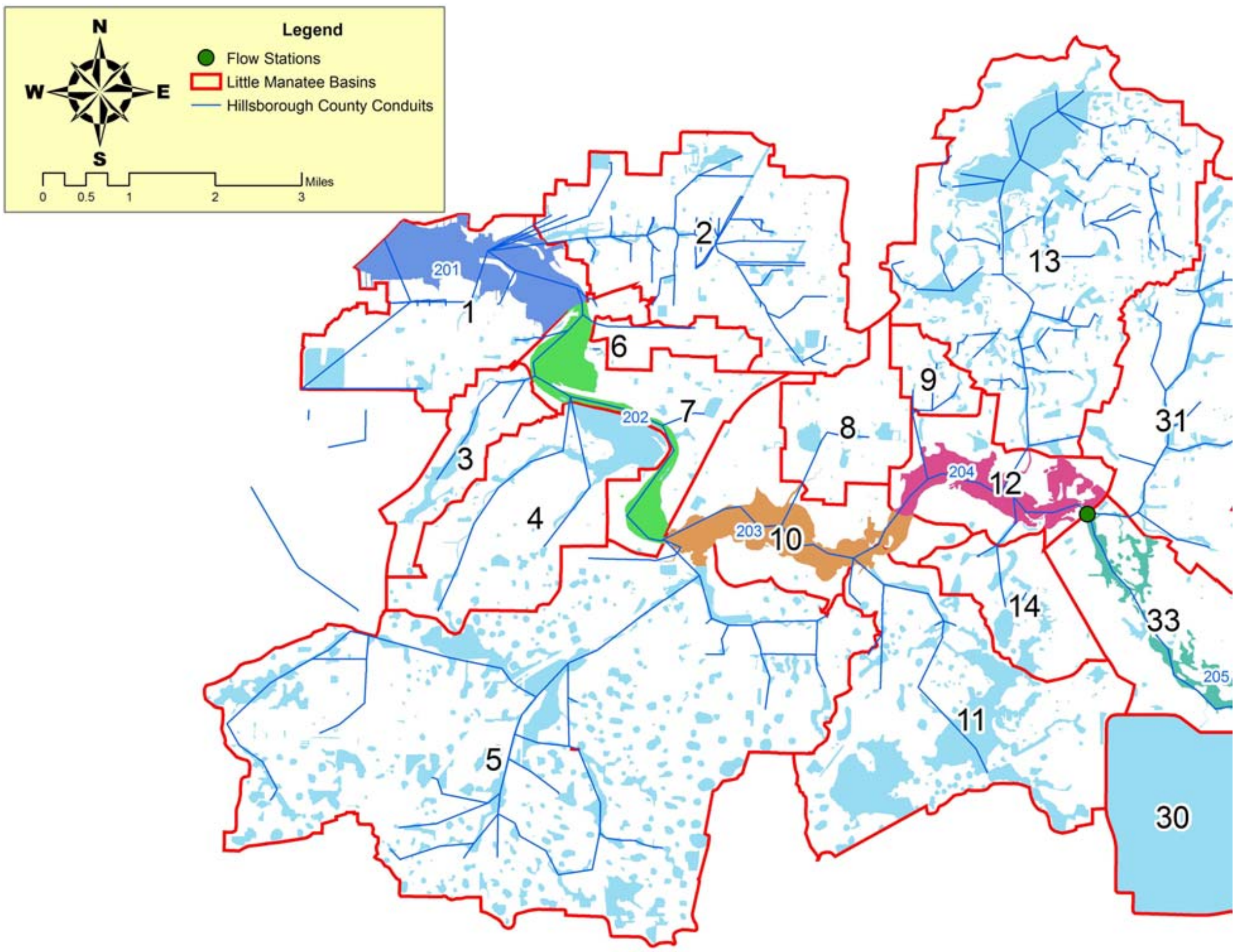

Figure 9 Ungaged Subbasins of the Little Manatee River Watershed

Recommendations

This project estimated the un-gaged flows into the Little Manatee River. Confidence in the estimate is modest given limitations in rainfall measurement, lack of regional groundwater discharges, and inadequacies in calibration extrapolation. However, to date it is the best available estimate given these data inadequacies and the limited scope of this effort. Short-comings in the results include (in no particular order of significance):

1. Observed stream flow estimates. Confidence in the model performance would greatly increase if more observations were available for tributaries of the un-gaged portion of the basin. Ideally gages would record hydrologic response from basins with a single predominant landform. This would isolate the processes and improve model calibration.
2. Rainfall estimates. Rainfall is the most important component of the water budget. It is also the easiest to measure at a point. To best observe the spatial distribution of the storm many rain gages are necessary. Also, for surface water modeling, finer temporal distribution is required. Model performance can be significantly increased by a more thorough review of the single most significant component of the water budget: rain fall. Suspected data gaps and accumulation errors plague the daily rainfall dataset (e.g., cooperator either does not read the rain gage or accumulated the past several days together). These errors can usually be identified, but it is a time consuming task. Also, a new source of rain data has been recently been made available. The radar rain or raster rain utilizes Doppler radar to detect rainfall quantities on a 2km x 2km grid. The district has recently purchased the data. The radar rain can be readily processed into input for the HSPF surface water model of the Little Manatee River.
3. Integrated surface/ groundwater modeling. Considerable thought should be given towards using an integrated surface / groundwater model to better estimate the ungaged flows. Given the coastal proximity of this part of the basin it is, understandably, heavily influenced by regional groundwater discharges which impact the surface water budget through maintaining higher water table heads thereby generating more runoff, baseflow and ET. These regional groundwater discharges can be at times (especially during dry periods) a significant inflow to the Manatee River.

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APPENDICES

APPENDIX A.1 Land Use Codes within the Little Manatee River Basin

FLUCCSCODE	FLUCSDESC	Generalized Land Use Code
1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	1
1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	1
1300	RESIDENTIAL HIGH DENSITY	1
1400	COMMERCIAL AND SERVICES	1
1500	INDUSTRIAL	1
1600	EXTRACTIVE	7
1700	INSTITUTIONAL	1
1800	RECREATIONAL	2
1900	OPEN LAND	3
2100	CROPLAND AND PASTURELAND	3
2140	ROW CROPS	2
2200	TREE CROPS	2
2300	FEEDING OPERATIONS	2
2400	NURSERIES AND VINEYARDS	2
2440	VINEYARDS	2
2500	SPECIALTY FARMS	7
2550	TROPICAL FISH FARMS	7

FLUCCSCODE	FLUCSDESC	Generalized Land Use Code
2600	OTHER OPEN LANDS	3
3100	HERBACEOUS	3
3200	SHRUB AND BRUSHLAND	3
3300	MIXED RANGELAND	3
4100	UPLAND CONIFEROUS FOREST	4
4110	PINE FLATWOODS	4
4200	UPLAND HARDWOOD FORESTS - PART 1	4
4340	HARDWOOD CONIFER MIXED	4
4400	TREE PLANTATIONS	4
5100	STREAMS AND WATERWAYS	5
5200	LAKES	5
5300	RESERVOIRS	5
5400	BAYS AND ESTUARIES	5
6110	BAY SWAMPS	6
6120	MANGROVE SWAMPS	6
6150	STREAM AND LAKE SWAMPS (BOTTOMLAND)	6
6200	WETLAND CONIFEROUS FORESTS	6
6210	CYPRESS	6
6300	WETLAND FORESTED MIXED	6
6400	VEGETATED NON-FORESTED WETLANDS	6

FLUCCSCODE	FLUCSDESC	Generalized Land Use Code
6410	FRESHWATER MARSHES	6
6420	SALTWATER MARSHES	6
6430	WET PRAIRIES	6
6440	EMERGENT AQUATIC VEGETATION	6
6500	NON-VEGETATED	6
6510	TIDAL FLATS/SUBMERGED SHALLOW PLATFORM	6
6520	SHORELINES	6
6530	INTERMITTENT PONDS	6
7400	DISTURBED LAND	7
8100	TRANSPORTATION	1
8200	COMMUNICATIONS	1
8300	UTILITIES	1

APPENDIX A.2 Rain Stations Used to Develop Model Data Time Series

Site	UIDSITENAM	Type	LAT	LONG	Data Source	Min Date	Max Date
5	KINGSFORD	RAIN	27.7975	-82.0019	SWFWMD	1/1/1990	5/31/2003
26	HERRING	RAIN	27.6998	-82.1421	SWFWMD	1/1/1982	2/28/1999
27	ROMP 49 BALM PARK	RAIN	27.7631	-82.1074	SWFWMD	8/1/1989	9/3/2005
62	FP & L	RAIN	27.6017	-82.3232	SWFWMD	1/1/1988	4/30/2000
104	FOUR CORNERS MINE	RAIN	27.6456	-82.0816	SWFWMD	9/1/1978	5/31/2003
138	WIMAUMA	RAIN	27.7595	-82.2885	SWFWMD	1/1/1981	7/31/1993
152	BLISS TOWER	RAIN	27.5925	-82.4074	SWFWMD	10/1/1975	7/31/1996
172	FORT GREEN	RAIN	27.6731	-81.9883	SWFWMD	10/1/1975	5/31/2003
179	RUSKIN	RAIN	27.7609	-82.3980	SWFWMD	5/1/1976	9/30/2000
214	PARRISH NWS	RAIN	27.5753	-82.4327	SWFWMD	1/1/1958	12/31/2004
254	RG-3 C & F INDUSTRIES	RAIN	27.5628	-81.9938	SWFWMD	1/1/1976	4/30/2005
372	BROWN TOWER	RAIN	27.7614	-82.3313	SWFWMD	7/1/1970	4/30/1998
388	WIMAUMA AIRPORT	RAIN	27.7661	-82.0863	SWFWMD	8/1/1993	10/2/2005
427	ROMP 40 FOUR CORNERS	RAIN	27.6478	-82.0460	SWFWMD	6/27/1992	7/17/2005
429	ROMP 123 STARLING	RAIN	27.6756	-82.1102	SWFWMD	1/2/1992	7/17/2005
496	ROMP 39 OAK KNOLL	RAIN	27.5895	-82.2496	SWFWMD	8/15/1999	7/17/2005
506	ROMP TR 9-2 APOLLO BEACH	RAIN	27.7653	-82.3730	SWFWMD	8/6/1999	7/17/2005
521	ROMP TR 8-1 RUBONIA	RAIN	27.5831	-82.5205	SWFWMD	4/11/2000	7/17/2005
553	GAMBLE CREEK	RAIN	27.5348	-82.2839	SWFWMD	3/6/2001	7/17/2005
554	FROG CREEK	RAIN	27.5797	-82.4872	SWFWMD	8/16/2000	7/16/2005
555	GOVERNMENT HAMMOCK	RAIN	27.5347	-82.4968	SWFWMD	4/4/2001	7/17/2005
558	PARRISH CEMETERY	RAIN	27.5806	-82.4111	SWFWMD	1/1/2001	5/31/2005

83153	FORT GREEN 12 WSW	RAIN	27.5667	-82.1333	NOAA daily	1/1/1989	7/31/2005
86880	PARRISH	RAIN	27.6167	-82.3500	NOAA daily	1/1/1989	7/31/2005
86880	PARRISH	RAIN	27.6167	-82.3500	NOAA 15-minute	1/1/1989	6/1/2005
84797	LAKELAND	RAIN	28.0167	-81.9167	NOAA 15-minute	1/1/1980	5/1/2003
84802	LAKELAND 2	RAIN	27.9833	-82.0167	NOAA 15-minute	11/1/2001	6/1/2005
87886	ST PETERSBURG WHITTD	RAIN	27.7667	-82.6333	NOAA 15-minute	1/1/1989	6/1/2005

APPENDIX B Model Dataset

```
RUN

GLOBAL
  LittleManatee, Base5 scen, dec. LZETP, inc. INFILT
  START       1992/ 1/01 00:00  END    2005/ 9/30 24:00
  RUN INTERP OUTPT LEVELS    5    0
  RESUME     0 RUN     1                          UNITS    1
END GLOBAL

FILES
<FILE>  <UN#>***<----FILE NAME------------------------------------------------>
MESSU      24   Base6.ech
           91   Base6.out
WDM1       25   Base6.wdm
WDM2       26   LManPred.wdm
BINO       92   Final.hbn
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      PERLND      12
      PERLND      13
      PERLND      14
      PERLND      17
      IMPLND      11
      PERLND      21
      PERLND      22
      PERLND      23
      PERLND      24
      PERLND      27
      IMPLND      21
      PERLND      31
      PERLND      32
      PERLND      33
      PERLND      34
      PERLND      37
      IMPLND      31
      PERLND      41
      PERLND      42
      PERLND      43
      PERLND      44
      IMPLND      41
      PERLND      51
      PERLND      52
      PERLND      53
      PERLND      54
      PERLND      57
      IMPLND      51
      PERLND      61
      PERLND      62
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      PERLND      64
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      PERLND      72
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      PERLND     111
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      PERLND     234
      PERLND     237
      IMPLND     231
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      PERLND     242
      PERLND     243
      PERLND     244
      PERLND     247
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      IMPLND     241
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      PERLND     257
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      PERLND     282
      PERLND     283
      PERLND     284
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      PERLND     364
      PERLND     367
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      RCHRES       3
      RCHRES       4
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      RCHRES       7
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      RCHRES      27
      RCHRES      28
      RCHRES      29
      RCHRES      30
      RCHRES      31
      RCHRES      33
      RCHRES      34
      RCHRES      35
      RCHRES      36
      RCHRES     206
      RCHRES     208
      RCHRES     207
      RCHRES     205
      RCHRES     300
      RCHRES     204
      RCHRES     203
      RCHRES     202
      RCHRES     201
      COPY         1
      COPY         2
    END INGRP
END OPN SEQUENCE

PERLND
  ACTIVITY
*** <PLS >               Active Sections                                     ***
*** x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11  367    0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
*** < PLS>                       Print-flags                              PIVL  PYR
*** x   - x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC
   11  367    4    4    5    4    4    4    4    4    4    4    4    4    1   12
  END PRINT-INFO

  BINARY-INFO
*** < PLS>               Binary Output Flags                              PIVL  PYR
*** x   - x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC
   11  367    4    4    4    4    4    4    4    4    4    4    4    4    1   12
  END BINARY-INFO

  GEN-INFO
***             Name                     Unit-systems   Printer BinaryOut
*** <PLS >                                   t-series Engl Metr Engl Metr
*** x -  x                                    in  out
   11     Urban                                1    1   91    0   92    0
   12     Irrigated Land                       1    1   91    0   92    0
   13     Grass/Pasture                        1    1   91    0   92    0
   14     Forested                             1    1   91    0   92    0
   17     Mining/Other                         1    1   91    0   92    0
   21     Urban                                1    1   91    0   92    0
   22     Irrigated Land                       1    1   91    0   92    0
   23     Grass/Pasture                        1    1   91    0   92    0
   24     Forested                             1    1   91    0   92    0
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  27     Mining/Other                 1    1   91    0   92    0
  31     Urban                        1    1   91    0   92    0
  32     Irrigated Land               1    1   91    0   92    0
  33     Grass/Pasture                1    1   91    0   92    0
  34     Forested                     1    1   91    0   92    0
  37     Mining/Other                 1    1   91    0   92    0
  41     Urban                        1    1   91    0   92    0
  42     Irrigated Land               1    1   91    0   92    0
  43     Grass/Pasture                1    1   91    0   92    0
  44     Forested                     1    1   91    0   92    0
  51     Urban                        1    1   91    0   92    0
  52     Irrigated Land               1    1   91    0   92    0
  53     Grass/Pasture                1    1   91    0   92    0
  54     Forested                     1    1   91    0   92    0
  57     Mining/Other                 1    1   91    0   92    0
  61     Urban                        1    1   91    0   92    0
  62     Irrigated Land               1    1   91    0   92    0
  63     Grass/Pasture                1    1   91    0   92    0
  64     Forested                     1    1   91    0   92    0
  67     Mining/Other                 1    1   91    0   92    0
  71     Urban                        1    1   91    0   92    0
  72     Irrigated Land               1    1   91    0   92    0
  73     Grass/Pasture                1    1   91    0   92    0
  74     Forested                     1    1   91    0   92    0
  77     Mining/Other                 1    1   91    0   92    0
  81     Urban                        1    1   91    0   92    0
  82     Irrigated Land               1    1   91    0   92    0
  83     Grass/Pasture                1    1   91    0   92    0
  84     Forested                     1    1   91    0   92    0
  87     Mining/Other                 1    1   91    0   92    0
  91     Urban                        1    1   91    0   92    0
  92     Irrigated Land               1    1   91    0   92    0
  93     Grass/Pasture                1    1   91    0   92    0
  94     Forested                     1    1   91    0   92    0
 101     Urban                        1    1   91    0   92    0
 102     Irrigated Land               1    1   91    0   92    0
 103     Grass/Pasture                1    1   91    0   92    0
 104     Forested                     1    1   91    0   92    0
 107     Mining/Other                 1    1   91    0   92    0
 111     Urban                        1    1   91    0   92    0
 112     Irrigated Land               1    1   91    0   92    0
 113     Grass/Pasture                1    1   91    0   92    0
 114     Forested                     1    1   91    0   92    0
 117     Mining/Other                 1    1   91    0   92    0
 121     Urban                        1    1   91    0   92    0
 122     Irrigated Land               1    1   91    0   92    0
 123     Grass/Pasture                1    1   91    0   92    0
 124     Forested                     1    1   91    0   92    0
 127     Mining/Other                 1    1   91    0   92    0
 131     Urban                        1    1   91    0   92    0
 132     Irrigated Land               1    1   91    0   92    0
 133     Grass/Pasture                1    1   91    0   92    0
 134     Forested                     1    1   91    0   92    0
 137     Mining/Other                 1    1   91    0   92    0
 141     Urban                        1    1   91    0   92    0
 142     Irrigated Land               1    1   91    0   92    0
 143     Grass/Pasture                1    1   91    0   92    0
 144     Forested                     1    1   91    0   92    0
 211     Urban                        1    1   91    0   92    0
 212     Irrigated Land               1    1   91    0   92    0
 213     Grass/Pasture                1    1   91    0   92    0
 214     Forested                     1    1   91    0   92    0
 217     Mining/Other                 1    1   91    0   92    0
 221     Urban                        1    1   91    0   92    0
 222     Irrigated Land               1    1   91    0   92    0
 223     Grass/Pasture                1    1   91    0   92    0
 224     Forested                     1    1   91    0   92    0
 227     Mining/Other                 1    1   91    0   92    0
 231     Urban                        1    1   91    0   92    0
 232     Irrigated Land               1    1   91    0   92    0
 233     Grass/Pasture                1    1   91    0   92    0
 234     Forested                     1    1   91    0   92    0
 237     Mining/Other                 1    1   91    0   92    0
 241     Urban                        1    1   91    0   92    0
 242     Irrigated Land               1    1   91    0   92    0
 243     Grass/Pasture                1    1   91    0   92    0
 244     Forested                     1    1   91    0   92    0
 247     Mining/Other                 1    1   91    0   92    0
 251     Urban                        1    1   91    0   92    0
 252     Irrigated Land               1    1   91    0   92    0
 253     Grass/Pasture                1    1   91    0   92    0
 254     Forested                     1    1   91    0   92    0
 257     Mining/Other                 1    1   91    0   92    0
 261     Urban                        1    1   91    0   92    0
 262     Irrigated Land               1    1   91    0   92    0
 263     Grass/Pasture                1    1   91    0   92    0
 264     Forested                     1    1   91    0   92    0
 267     Mining/Other                 1    1   91    0   92    0
 271     Urban                        1    1   91    0   92    0
 272     Irrigated Land               1    1   91    0   92    0
 273     Grass/Pasture                1    1   91    0   92    0
 274     Forested                     1    1   91    0   92    0
 281     Urban                        1    1   91    0   92    0
 282     Irrigated Land               1    1   91    0   92    0
 283     Grass/Pasture                1    1   91    0   92    0
 284     Forested                     1    1   91    0   92    0
 292     Irrigated Land               1    1   91    0   92    0
 293     Grass/Pasture                1    1   91    0   92    0
 294     Forested                     1    1   91    0   92    0
 297     Mining/Other                 1    1   91    0   92    0
 301     Urban                        1    1   91    0   92    0
 302     Irrigated Land               1    1   91    0   92    0
 303     Grass/Pasture                1    1   91    0   92    0
 304     Forested                     1    1   91    0   92    0
 311     Urban                        1    1   91    0   92    0
 312     Irrigated Land               1    1   91    0   92    0
 313     Grass/Pasture                1    1   91    0   92    0
 314     Forested                     1    1   91    0   92    0
 317     Mining/Other                 1    1   91    0   92    0
 331     Urban                        1    1   91    0   92    0
 332     Irrigated Land               1    1   91    0   92    0
 333     Grass/Pasture                1    1   91    0   92    0
 334     Forested                     1    1   91    0   92    0
 337     Mining/Other                 1    1   91    0   92    0
 341     Urban                        1    1   91    0   92    0
 342     Irrigated Land               1    1   91    0   92    0
 343     Grass/Pasture                1    1   91    0   92    0
 344     Forested                     1    1   91    0   92    0
 347     Mining/Other                 1    1   91    0   92    0
 351     Urban                        1    1   91    0   92    0
 352     Irrigated Land               1    1   91    0   92    0
 353     Grass/Pasture                1    1   91    0   92    0
 354     Forested                     1    1   91    0   92    0
 361     Urban                        1    1   91    0   92    0
 362     Irrigated Land               1    1   91    0   92    0
 363     Grass/Pasture                1    1   91    0   92    0
 364     Forested                     1    1   91    0   92    0
 367     Mining/Other                 1    1   91    0   92    0
 END GEN-INFO

 PWAT-PARM1
*** <PLS >               Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE IFFC  HWT IRRG IFRD
  11          0    1    1    1    0    0    0    0    1    1    0    0    0
  12          0    1    1    1    0    0    0    0    1    1    0    1    0
  13   17     0    1    1    1    0    0    0    0    1    1    0    0    0
```

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  21        0    1    1    1    0    0    0    0    1    1    0    0    0
  22        0    1    1    1    0    0    0    0    1    1    0    1    0
  23   27   0    1    1    1    0    0    0    0    1    1    0    0    0
  31        0    1    1    1    0    0    0    0    1    1    0    0    0
  32        0    1    1    1    0    0    0    0    1    1    0    1    0
  33   37   0    1    1    1    0    0    0    0    1    1    0    0    0
  41        0    1    1    1    0    0    0    0    1    1    0    0    0
  42        0    1    1    1    0    0    0    0    1    1    0    1    0
  43   47   0    1    1    1    0    0    0    0    1    1    0    0    0
  51        0    1    1    1    0    0    0    0    1    1    0    0    0
  52        0    1    1    1    0    0    0    0    1    1    0    1    0
  53   57   0    1    1    1    0    0    0    0    1    1    0    0    0
  61        0    1    1    1    0    0    0    0    1    1    0    0    0
  62        0    1    1    1    0    0    0    0    1    1    0    1    0
  63   67   0    1    1    1    0    0    0    0    1    1    0    0    0
  71        0    1    1    1    0    0    0    0    1    1    0    0    0
  72        0    1    1    1    0    0    0    0    1    1    0    1    0
  73   77   0    1    1    1    0    0    0    0    1    1    0    0    0
  81        0    1    1    1    0    0    0    0    1    1    0    0    0
  82        0    1    1    1    0    0    0    0    1    1    0    1    0
  83   87   0    1    1    1    0    0    0    0    1    1    0    0    0
  91        0    1    1    1    0    0    0    0    1    1    0    0    0
  92        0    1    1    1    0    0    0    0    1    1    0    1    0
  93   97   0    1    1    1    0    0    0    0    1    1    0    0    0
 101        0    1    1    1    0    0    0    0    1    1    0    0    0
 102        0    1    1    1    0    0    0    0    1    1    0    1    0
 103  107   0    1    1    1    0    0    0    0    1    1    0    0    0
 111        0    1    1    1    0    0    0    0    1    1    0    0    0
 112        0    1    1    1    0    0    0    0    1    1    0    1    0
 113  117   0    1    1    1    0    0    0    0    1    1    0    0    0
 121        0    1    1    1    0    0    0    0    1    1    0    0    0
 122        0    1    1    1    0    0    0    0    1    1    0    1    0
 123  127   0    1    1    1    0    0    0    0    1    1    0    0    0
 131        0    1    1    1    0    0    0    0    1    1    0    0    0
 132        0    1    1    1    0    0    0    0    1    1    0    1    0
 133  137   0    1    1    1    0    0    0    0    1    1    0    0    0
 141        0    1    1    1    0    0    0    0    1    1    0    0    0
 142        0    1    1    1    0    0    0    0    1    1    0    1    0
 143  147   0    1    1    1    0    0    0    0    1    1    0    0    0
 211        0    1    1    1    0    0    0    0    1    1    0    0    0
 212        0    1    1    1    0    0    0    0    1    1    0    1    0
 213  217   0    1    1    1    0    0    0    0    1    1    0    0    0
 221        0    1    1    1    0    0    0    0    1    1    0    0    0
 222        0    1    1    1    0    0    0    0    1    1    0    1    0
 223  227   0    1    1    1    0    0    0    0    1    1    0    0    0
 231        0    1    1    1    0    0    0    0    1    1    0    0    0
 232        0    1    1    1    0    0    0    0    1    1    0    1    0
 233  237   0    1    1    1    0    0    0    0    1    1    0    0    0
 241        0    1    1    1    0    0    0    0    1    1    0    0    0
 242        0    1    1    1    0    0    0    0    1    1    0    1    0
 243  247   0    1    1    1    0    0    0    0    1    1    0    0    0
 251        0    1    1    1    0    0    0    0    1    1    0    0    0
 252        0    1    1    1    0    0    0    0    1    1    0    1    0
 253  257   0    1    1    1    0    0    0    0    1    1    0    0    0
 261        0    1    1    1    0    0    0    0    1    1    0    0    0
 262        0    1    1    1    0    0    0    0    1    1    0    1    0
 263  267   0    1    1    1    0    0    0    0    1    1    0    0    0
 271        0    1    1    1    0    0    0    0    1    1    0    0    0
 272        0    1    1    1    0    0    0    0    1    1    0    1    0
 273  277   0    1    1    1    0    0    0    0    1    1    0    0    0
 281        0    1    1    1    0    0    0    0    1    1    0    0    0
 282        0    1    1    1    0    0    0    0    1    1    0    1    0
 283  287   0    1    1    1    0    0    0    0    1    1    0    0    0
 291        0    1    1    1    0    0    0    0    1    1    0    0    0
 292        0    1    1    1    0    0    0    0    1    1    0    1    0
 293  297   0    1    1    1    0    0    0    0    1    1    0    0    0
 301        0    1    1    1    0    0    0    0    1    1    0    0    0
 302        0    1    1    1    0    0    0    0    1    1    0    1    0
 303  307   0    1    1    1    0    0    0    0    1    1    0    0    0
 311        0    1    1    1    0    0    0    0    1    1    0    0    0
 312        0    1    1    1    0    0    0    0    1    1    0    1    0
 313  317   0    1    1    1    0    0    0    0    1    1    0    0    0
 331        0    1    1    1    0    0    0    0    1    1    0    0    0
 332        0    1    1    1    0    0    0    0    1    1    0    1    0
 333  337   0    1    1    1    0    0    0    0    1    1    0    0    0
 341        0    1    1    1    0    0    0    0    1    1    0    0    0
 342        0    1    1    1    0    0    0    0    1    1    0    1    0
 343  347   0    1    1    1    0    0    0    0    1    1    0    0    0
 351        0    1    1    1    0    0    0    0    1    1    0    0    0
 352        0    1    1    1    0    0    0    0    1    1    0    1    0
 353  357   0    1    1    1    0    0    0    0    1    1    0    0    0
 361        0    1    1    1    0    0    0    0    1    1    0    0    0
 362        0    1    1    1    0    0    0    0    1    1    0    1    0
 363  367   0    1    1    1    0    0    0    0    1    1    0    0    0
  END PWAT-PARM1

*** Use same assumptions as INTB model for irrigation (comments below from INTB)

*** All spray irrigation is considered as coming from an external source
*** and all is applied as additional precip, i.e. subject to interception.
*** It is applied using the irrigation function instead of additional
*** precip so that the amounts can be tracked separately by the program.

*** Drip irrigation is handled separately as lateral inflow.  It is not
*** handled as part of the single irrigation demand timeseries so that it
*** can be given a different daily schedule (6 hrs in the morning) than
*** the spray (3 hrs in the morning).

  IRRIG-SOURCE
*** < PLS><-----External-----><---Groundwater----><-----------RCHRES----------->
*** x  - x    XPRIOR     XFRAC    GPRIOR     GFRAC    RPRIOR     RFRAC    IRCHNO
   12  362         1       1.0
  END IRRIG-SOURCE

  IRRIG-TARGET
*** < PLS>   Irrigation Application Target Fractions
*** x  - x  Intercep   Surface     Upper     Lower Active GW
   12  362       1.0
  END IRRIG-TARGET

*** initial LSUR values from Intera geodatabase, all others from corresponding
INTB land use
*** Adjusted INFILT values down by 75% from INTB
  PWAT-PARM2
*** < PLS>    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
*** x  - x                (in)   (in/hr)      (ft)               (1/in)   (1/day)
   11              0.     3.60     0.250      143.    0.0068        0.     0.999
   12              1.     4.20     0.250      273.    0.0043        0.     0.999
   13              1.     4.20     0.250      311.    0.0042        0.     0.999
   14              1.     4.40     0.220      500.    0.0061        0.     0.999
   17              1.     3.80     0.150      300.    0.0039        0.     0.999
   21              0.     3.60     0.250      151.    0.0046        0.     0.999
   22              1.     4.20     0.250      245.    0.0041        0.     0.999
   23              1.     4.20     0.250      302.    0.0051        0.     0.999
   24              1.     4.40     0.220      500.    0.0049        0.     0.999
   27              1.     3.80     0.150       50.    0.0033        0.     0.999
   31              0.     3.60     0.250      159.    0.0068        0.     0.999
   32              1.     4.20     0.250      228.     0.003        0.     0.999
   33              1.     4.20     0.250      322.    0.0043        0.     0.999
   34              1.     4.40     0.220      500.    0.0089        0.     0.999
   37              1.     3.80     0.150      300.     0.001        0.     0.999
   41              0.     3.60     0.250      152.    0.0136        0.     0.999
   42              1.     4.20     0.250      271.    0.0053        0.     0.999
   43              1.     4.20     0.250      322.     0.007        0.     0.999
   44              1.     4.40     0.220      500.    0.0184        0.     0.999
   51              0.     3.60     0.250      182.    0.0056        0.     0.999
```

52	1.	4.20	0.250	190.	0.0041	0.	0.999
53	1.	4.20	0.250	315.	0.0048	0.	0.999
54	1.	4.40	0.220	500.	0.0071	0.	0.999
57	1.	3.80	0.150	300.	0.0016	0.	0.999
61	0.	3.60	0.250	159.	0.0054	0.	0.999
62	1.	4.20	0.250	218.	0.0073	0.	0.999
63	1.	4.20	0.250	301.	0.0048	0.	0.999
64	1.	4.40	0.220	500.	0.0077	0.	0.999
67	1.	3.80	0.150	50.	0.0025	0.	0.999
71	0.	3.60	0.250	147.	0.0097	0.	0.999
72	1.	4.20	0.250	198.	0.0048	0.	0.999
73	1.	4.20	0.250	302.	0.0076	0.	0.999
74	1.	4.40	0.220	500.	0.0186	0.	0.999
77	1.	3.80	0.150	50.	0.0028	0.	0.999
81	0.	3.60	0.250	187.	0.0055	0.	0.999
82	1.	4.20	0.250	228.	0.0076	0.	0.999
83	1.	4.20	0.250	304.	0.006	0.	0.999
84	1.	4.40	0.220	500.	0.0055	0.	0.999
87	1.	3.80	0.150	50.	0.0067	0.	0.999
91	0.	3.60	0.250	126.	0.004	0.	0.999
92	1.	4.20	0.250	200.	0.003	0.	0.999
93	1.	4.20	0.250	304.	0.0069	0.	0.999
94	1.	4.40	0.220	500.	0.0046	0.	0.999
101	0.	3.60	0.250	181.	0.0076	0.	0.999
102	1.	4.20	0.250	250.	0.0058	0.	0.999
103	1.	4.20	0.250	309.	0.0064	0.	0.999
104	1.	4.40	0.220	500.	0.0109	0.	0.999
107	1.	3.80	0.150	50.	0.0047	0.	0.999
111	0.	3.60	0.250	188.	0.0063	0.	0.999
112	1.	4.20	0.250	196.	0.0082	0.	0.999
113	1.	4.20	0.250	337.	0.0049	0.	0.999
114	1.	4.40	0.220	500.	0.0072	0.	0.999
117	1.	3.80	0.150	96.	0.0041	0.	0.999
121	0.	3.60	0.250	179.	0.0078	0.	0.999
122	1.	4.20	0.250	300.	0.0268	0.	0.999
123	1.	4.20	0.250	325.	0.0124	0.	0.999
124	1.	4.40	0.220	500.	0.0135	0.	0.999
127	1.	3.80	0.150	50.	0.005	0.	0.999
131	0.	3.60	0.250	109.	0.0059	0.	0.999
132	1.	4.20	0.250	188.	0.0058	0.	0.999
133	1.	4.20	0.250	318.	0.0065	0.	0.999
134	1.	4.40	0.220	500.	0.0105	0.	0.999
137	1.	3.80	0.150	300.	0.0096	0.	0.999
141	0.	3.60	0.250	194.	0.0063	0.	0.999
142	1.	4.20	0.250	269.	0.0118	0.	0.999
143	1.	4.20	0.250	368.	0.0061	0.	0.999
144	1.	4.40	0.220	500.	0.0046	0.	0.999
211	0.	3.70	0.250	160.	0.0104	0.	0.999
212	1.	5.10	0.250	222.	0.0091	0.	0.999
213	1.	4.50	0.250	309.	0.0084	0.	0.999
214	1.	5.0	0.220	500.	0.0075	0.	0.999
217	1.	3.8	0.150	300.	0.0068	0.	0.999
221	0.	3.40	0.250	186.	0.012	0.	0.999
222	1.	5.70	0.250	221.	0.0069	0.	0.999
223	1.	4.70	0.250	322.	0.0078	0.	0.999
224	1.	6.2	0.220	500.	0.0153	0.	0.999
227	1.	3.4	0.150	223.	0.0059	0.	0.999
231	0.	3.70	0.250	200.	0.0076	0.	0.999
232	1.	5.10	0.250	155.	0.0062	0.	0.999
233	1.	4.60	0.250	320.	0.0062	0.	0.999
234	1.	5.40	0.220	500.	0.0058	0.	0.999
237	1.	3.70	0.150	300.	0.0025	0.	0.999
241	0.	3.70	0.250	200.	0.0078	0.	0.999
242	1.	5.10	0.250	273.	0.0062	0.	0.999
243	1.	4.60	0.250	321.	0.0074	0.	0.999
244	1.	5.40	0.220	500.	0.0093	0.	0.999
247	1.	3.70	0.150	50.	0.0116	0.	0.999
251	0.	3.70	0.250	189.	0.0109	0.	0.999
252	1.	5.10	0.250	267.	0.0082	0.	0.999
253	1.	4.60	0.250	300.	0.0107	0.	0.999
254	1.	5.40	0.220	500.	0.0128	0.	0.999
257	1.	3.70	0.150	235.	0.0178	0.	0.999
261	0.	3.70	0.250	200.	0.0111	0.	0.999
262	1.	5.10	0.250	182.	0.0078	0.	0.999
263	1.	4.60	0.250	330.	0.0072	0.	0.999
264	1.	5.40	0.220	500.	0.0068	0.	0.999
267	1.	3.70	0.150	300.	0.0051	0.	0.999
271	0.	3.70	0.250	150.	0.0033	0.	0.999
272	1.	5.10	0.250	165.	0.009	0.	0.999
273	1.	4.60	0.250	328.	0.0127	0.	0.999
274	1.	5.40	0.220	500.	0.0139	0.	0.999
281	0.	3.70	0.250	144.	0.0079	0.	0.999
282	1.	5.10	0.250	225.	0.0082	0.	0.999
283	1.	4.60	0.250	344.	0.0092	0.	0.999
284	1.	5.40	0.220	500.	0.0111	0.	0.999
292	1.	5.10	0.250	185.	0.0072	0.	0.999
293	1.	4.60	0.250	309.	0.0092	0.	0.999
294	1.	5.40	0.220	500.	0.0095	0.	0.999
297	1.	3.70	0.150	50.	0.0053	0.	0.999
301	0.	3.70	0.250	150.	0.046	0.	0.999
302	1.	5.10	0.250	268.	0.0092	0.	0.999
303	1.	4.60	0.250	314.	0.0106	0.	0.999
304	1.	5.40	0.220	500.	0.0058	0.	0.999
311	0.	3.70	0.250	175.	0.0104	0.	0.999
312	1.	5.10	0.250	195.	0.0082	0.	0.999
313	1.	4.60	0.250	338.	0.008	0.	0.999
314	1.	5.40	0.220	500.	0.0122	0.	0.999
317	1.	3.70	0.150	50.	0.0081	0.	0.999
331	0.	3.70	0.250	165.	0.0176	0.	0.999
332	1.	5.10	0.250	198.	0.01	0.	0.999
333	1.	4.60	0.250	331.	0.0127	0.	0.999
334	1.	5.40	0.220	500.	0.0171	0.	0.999
337	1.	3.70	0.150	256.	0.0178	0.	0.999
341	0.	3.70	0.250	109.	0.0039	0.	0.999
342	1.	5.10	0.250	165.	0.0039	0.	0.999
343	1.	4.60	0.250	312.	0.0035	0.	0.999
344	1.	5.40	0.220	500.	0.0095	0.	0.999
347	1.	3.70	0.150	50.	0.0034	0.	0.999
351	0.	3.70	0.250	200.	0.0214	0.	0.999
352	1.	5.10	0.250	156.	0.0073	0.	0.999
353	1.	4.60	0.250	317.	0.013	0.	0.999
354	1.	5.40	0.220	500.	0.0222	0.	0.999
361	0.	3.70	0.250	191.	0.0081	0.	0.999
362	1.	5.10	0.250	272.	0.0115	0.	0.999
363	1.	4.60	0.250	313.	0.0103	0.	0.999
364	1.	5.40	0.220	500.	0.0131	0.	0.999
367	1.	3.70	0.150	50.	0.0096	0.	0.999

END PWAT-PARM2

*** All initial values from INTB
*** Adjusted INFILD from 1.0 to 2.0
*** Adjusted DEEPFR values from 1.0 to 0.1
*** Adjusted AGWETP values down by 50% or more

PWAT-PARM3

*** < PLS>	PETMAX	PETMIN	INFEXP	INFILD	DEEPFR	BASETP	AGWETP
*** x - x	(deg F)	(deg F)					
11	40	35	2	2.0	0.1	0	0.1
12	40	35	2	2.0	0.1	0	0.15
13	40	35	2	2.0	0.1	0	0.11
14	40	35	2	2.0	0.1	0	0.12
17	40	35	2	2.0	0.1	0	0.14
21	40	35	2	2.0	0.1	0	0.1
22	40	35	2	2.0	0.1	0	0.15
23	40	35	2	2.0	0.1	0	0.11
24	40	35	2	2.0	0.1	0	0.12
27	40	35	2	2.0	0.1	0	0.14

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   31        40     35     2     2.0     0.1     0     0.1
   32        40     35     2     2.0     0.1     0     0.15
   33        40     35     2     2.0     0.1     0     0.11
   34        40     35     2     2.0     0.1     0     0.12
   37        40     35     2     2.0     0.1     0     0.14
   41        40     35     2     2.0     0.1     0     0.1
   42        40     35     2     2.0     0.1     0     0.15
   43        40     35     2     2.0     0.1     0     0.11
   44        40     35     2     2.0     0.1     0     0.12
   51        40     35     2     2.0     0.1     0     0.1
   52        40     35     2     2.0     0.1     0     0.15
   53        40     35     2     2.0     0.1     0     0.11
   54        40     35     2     2.0     0.1     0     0.12
   57        40     35     2     2.0     0.1     0     0.14
   61        40     35     2     2.0     0.1     0     0.1
   62        40     35     2     2.0     0.1     0     0.15
   63        40     35     2     2.0     0.1     0     0.11
   64        40     35     2     2.0     0.1     0     0.12
   67        40     35     2     2.0     0.1     0     0.14
   71        40     35     2     2.0     0.1     0     0.1
   72        40     35     2     2.0     0.1     0     0.15
   73        40     35     2     2.0     0.1     0     0.11
   74        40     35     2     2.0     0.1     0     0.12
   77        40     35     2     2.0     0.1     0     0.14
   81        40     35     2     2.0     0.1     0     0.1
   82        40     35     2     2.0     0.1     0     0.15
   83        40     35     2     2.0     0.1     0     0.11
   84        40     35     2     2.0     0.1     0     0.12
   87        40     35     2     2.0     0.1     0     0.14
   91        40     35     2     2.0     0.1     0     0.1
   92        40     35     2     2.0     0.1     0     0.15
   93        40     35     2     2.0     0.1     0     0.11
   94        40     35     2     2.0     0.1     0     0.12
  101        40     35     2     2.0     0.1     0     0.1
  102        40     35     2     2.0     0.1     0     0.15
  103        40     35     2     2.0     0.1     0     0.11
  104        40     35     2     2.0     0.1     0     0.12
  107        40     35     2     2.0     0.1     0     0.14
  111        40     35     2     2.0     0.1     0     0.1
  112        40     35     2     2.0     0.1     0     0.15
  113        40     35     2     2.0     0.1     0     0.11
  114        40     35     2     2.0     0.1     0     0.12
  117        40     35     2     2.0     0.1     0     0.14
  121        40     35     2     2.0     0.1     0     0.1
  122        40     35     2     2.0     0.1     0     0.15
  123        40     35     2     2.0     0.1     0     0.11
  124        40     35     2     2.0     0.1     0     0.12
  127        40     35     2     2.0     0.1     0     0.14
  131        40     35     2     2.0     0.1     0     0.1
  132        40     35     2     2.0     0.1     0     0.15
  133        40     35     2     2.0     0.1     0     0.11
  134        40     35     2     2.0     0.1     0     0.12
  137        40     35     2     2.0     0.1     0     0.14
  141        40     35     2     2.0     0.1     0     0.1
  142        40     35     2     2.0     0.1     0     0.15
  143        40     35     2     2.0     0.1     0     0.11
  144        40     35     2     2.0     0.1     0     0.12
  211        40     35     2     2.0     0.1     0     0.1
  212        40     35     2     2.0     0.1     0     0.15
  213        40     35     2     2.0     0.1     0     0.11
  214        40     35     2     2.0     0.1     0     0.12
  217        40     35     2     2.0     0.1     0     0.14
  221        40     35     2     2.0     0.1     0     0.1
  222        40     35     2     2.0     0.1     0     0.15
  223        40     35     2     2.0     0.1     0     0.11
  224        40     35     2     2.0     0.1     0     0.12
  227        40     35     2     2.0     0.1     0     0.14
  231        40     35     2     2.0     0.1     0     0.1
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  232        40     35     2     2.0     0.1     0     0.15
  233        40     35     2     2.0     0.1     0     0.11
  234        40     35     2     2.0     0.1     0     0.12
  237        40     35     2     2.0     0.1     0     0.14
  241        40     35     2     2.0     0.1     0     0.1
  242        40     35     2     2.0     0.1     0     0.15
  243        40     35     2     2.0     0.1     0     0.11
  244        40     35     2     2.0     0.1     0     0.12
  247        40     35     2     2.0     0.1     0     0.14
  251        40     35     2     2.0     0.1     0     0.1
  252        40     35     2     2.0     0.1     0     0.15
  253        40     35     2     2.0     0.1     0     0.11
  254        40     35     2     2.0     0.1     0     0.12
  257        40     35     2     2.0     0.1     0     0.14
  261        40     35     2     2.0     0.1     0     0.1
  262        40     35     2     2.0     0.1     0     0.15
  263        40     35     2     2.0     0.1     0     0.11
  264        40     35     2     2.0     0.1     0     0.12
  267        40     35     2     2.0     0.1     0     0.14
  271        40     35     2     2.0     0.1     0     0.1
  272        40     35     2     2.0     0.1     0     0.15
  273        40     35     2     2.0     0.1     0     0.11
  274        40     35     2     2.0     0.1     0     0.12
  281        40     35     2     2.0     0.1     0     0.1
  282        40     35     2     2.0     0.1     0     0.15
  283        40     35     2     2.0     0.1     0     0.11
  284        40     35     2     2.0     0.1     0     0.12
  292        40     35     2     2.0     0.1     0     0.15
  293        40     35     2     2.0     0.1     0     0.11
  294        40     35     2     2.0     0.1     0     0.12
  297        40     35     2     2.0     0.1     0     0.14
  301        40     35     2     2.0     0.1     0     0.1
  302        40     35     2     2.0     0.1     0     0.15
  303        40     35     2     2.0     0.1     0     0.11
  304        40     35     2     2.0     0.1     0     0.12
  311        40     35     2     2.0     0.1     0     0.1
  312        40     35     2     2.0     0.1     0     0.15
  313        40     35     2     2.0     0.1     0     0.11
  314        40     35     2     2.0     0.1     0     0.12
  317        40     35     2     2.0     0.1     0     0.14
  331        40     35     2     2.0     0.1     0     0.1
  332        40     35     2     2.0     0.1     0     0.15
  333        40     35     2     2.0     0.1     0     0.11
  334        40     35     2     2.0     0.1     0     0.12
  337        40     35     2     2.0     0.1     0     0.14
  341        40     35     2     2.0     0.1     0     0.1
  342        40     35     2     2.0     0.1     0     0.15
  343        40     35     2     2.0     0.1     0     0.11
  344        40     35     2     2.0     0.1     0     0.12
  347        40     35     2     2.0     0.1     0     0.14
  351        40     35     2     2.0     0.1     0     0.1
  352        40     35     2     2.0     0.1     0     0.15
  353        40     35     2     2.0     0.1     0     0.11
  354        40     35     2     2.0     0.1     0     0.12
  361        40     35     2     2.0     0.1     0     0.1
  362        40     35     2     2.0     0.1     0     0.15
  363        40     35     2     2.0     0.1     0     0.11
  364        40     35     2     2.0     0.1     0     0.12
  367        40     35     2     2.0     0.1     0     0.14
  END PWAT-PARM3

*** initial UZSN and NSUR values from Intera geodatabase, all others from INTB
*** Adjusted INTFW values up by 2X
  PWAT-PARM4
*** <PLS >    CEPSC     UZSN     NSUR     INTFW      IRC     LZETP
*** x -  x     (in)     (in)                       (1/day)
    11         0.05    0.118    0.239     1.20      0.2      0.22
    12        0.090    0.113    0.298     1.20      0.2      0.35
```

13	0.061	0.078	0.300	1.15	0.2	0.2
14	0.16	0.15	0.450	1.10	0.2	0.4
17	0.050	0.1	0.2	1.10	0.2	0.44
21	0.05	0.117	0.229	1.20	0.2	0.22
22	0.079	0.105	0.288	1.20	0.2	0.35
23	0.060	0.076	0.303	1.15	0.2	0.2
24	0.16	0.15	0.450	1.10	0.2	0.4
27	0.030	0.107	0.2	1.10	0.2	0.44
31	0.05	0.112	0.240	1.20	0.2	0.22
32	0.075	0.101	0.295	1.20	0.2	0.35
33	0.064	0.074	0.301	1.15	0.2	0.2
34	0.16	0.15	0.450	1.10	0.2	0.4
37	0.030	0.05	0.2	1.10	0.2	0.44
41	0.05	0.122	0.247	1.20	0.2	0.22
42	0.090	0.113	0.300	1.20	0.2	0.35
43	0.066	0.085	0.292	1.15	0.2	0.2
44	0.16	0.15	0.450	1.10	0.2	0.4
51	0.05	0.127	0.264	1.20	0.2	0.22
52	0.064	0.091	0.299	1.20	0.2	0.35
53	0.064	0.084	0.294	1.15	0.2	0.2
54	0.16	0.15	0.449	1.10	0.2	0.4
57	0.050	0.1	0.2	1.10	0.2	0.44
61	0.05	0.127	0.253	1.20	0.2	0.22
62	0.067	0.098	0.270	1.20	0.2	0.35
63	0.058	0.069	0.309	1.15	0.2	0.2
64	0.16	0.15	0.450	1.10	0.2	0.4
67	0.030	0.1	0.2	1.10	0.2	0.44
71	0.05	0.113	0.225	1.20	0.2	0.22
72	0.065	0.093	0.294	1.20	0.2	0.35
73	0.059	0.070	0.308	1.15	0.2	0.2
74	0.16	0.15	0.450	1.10	0.2	0.4
77	0.030	0.1	0.2	1.10	0.2	0.44
81	0.05	0.142	0.283	1.20	0.2	0.22
82	0.076	0.101	0.300	1.20	0.2	0.35
83	0.061	0.078	0.301	1.15	0.2	0.2
84	0.16	0.15	0.450	1.10	0.2	0.4
87	0.030	0.1	0.2	1.10	0.2	0.44
91	0.05	0.108	0.222	1.20	0.2	0.22
92	0.070	0.100	0.300	1.20	0.2	0.35
93	0.061	0.078	0.301	1.15	0.2	0.2
94	0.16	0.15	0.450	1.10	0.2	0.4
101	0.05	0.124	0.263	1.20	0.2	0.22
102	0.083	0.107	0.300	1.20	0.2	0.35
103	0.062	0.083	0.296	1.15	0.2	0.2
104	0.16	0.15	0.438	1.10	0.2	0.4
107	0.030	0.1	0.2	1.10	0.2	0.44
111	0.05	0.139	0.275	1.20	0.2	0.22
112	0.064	0.093	0.295	1.20	0.2	0.35
113	0.071	0.093	0.283	1.15	0.2	0.2
114	0.16	0.15	0.450	1.10	0.2	0.4
117	0.030	0.084	0.2	1.10	0.2	0.44
121	0.05	0.125	0.263	1.20	0.2	0.22
122	0.100	0.120	0.300	1.20	0.2	0.35
123	0.067	0.087	0.290	1.15	0.2	0.2
124	0.16	0.15	0.443	1.10	0.2	0.4
127	0.030	0.1	0.2	1.10	0.2	0.44
131	0.05	0.100	0.193	1.20	0.2	0.22
132	0.065	0.095	0.300	1.20	0.2	0.35
133	0.063	0.071	0.305	1.15	0.2	0.2
134	0.16	0.15	0.450	1.10	0.2	0.4
137	0.030	0.1	0.2	1.10	0.2	0.44
141	0.05	0.147	0.289	1.20	0.2	0.22
142	0.089	0.112	0.295	1.20	0.2	0.35
143	0.079	0.098	0.274	1.15	0.2	0.2
144	0.16	0.15	0.434	1.10	0.2	0.4
211	0.05	0.126	0.246	1.20	0.2	0.22
212	0.074	0.099	0.299	1.20	0.2	0.35
213	0.062	0.084	0.296	1.15	0.2	0.2
214	0.16	0.15	0.430	1.10	0.2	0.4
217	0.050	0.1	0.2	1.10	0.2	0.44
221	0.05	0.137	0.273	1.20	0.2	0.22
222	0.074	0.100	0.300	1.20	0.2	0.35
223	0.067	0.089	0.289	1.15	0.2	0.2
224	0.16	0.15	0.450	1.10	0.2	0.4
227	0.037	0.119	0.2	1.10	0.2	0.44
231	0.05	0.150	0.300	1.20	0.2	0.22
232	0.052	0.081	0.300	1.20	0.2	0.35
233	0.066	0.088	0.290	1.15	0.2	0.2
234	0.16	0.15	0.450	1.10	0.2	0.4
237	0.047	0.107	0.2	1.10	0.2	0.44
241	0.05	0.150	0.300	1.20	0.2	0.22
242	0.091	0.113	0.297	1.20	0.2	0.35
243	0.066	0.088	0.290	1.15	0.2	0.2
244	0.16	0.15	0.450	1.10	0.2	0.4
247	0.030	0.1	0.2	1.10	0.2	0.44
251	0.05	0.143	0.279	1.20	0.2	0.22
252	0.089	0.111	0.298	1.20	0.2	0.35
253	0.060	0.080	0.300	1.15	0.2	0.2
254	0.16	0.15	0.450	1.10	0.2	0.4
257	0.030	0.099	0.2	1.10	0.2	0.44
261	0.05	0.150	0.300	1.20	0.2	0.22
262	0.059	0.089	0.292	1.20	0.2	0.35
263	0.069	0.092	0.285	1.15	0.2	0.2
264	0.16	0.15	0.450	1.10	0.2	0.4
267	0.050	0.1	0.2	1.10	0.2	0.44
271	0.05	0.080	0.200	1.20	0.2	0.22
272	0.055	0.084	0.300	1.20	0.2	0.35
273	0.068	0.091	0.286	1.15	0.2	0.2
274	0.16	0.15	0.450	1.10	0.2	0.4
281	0.05	0.116	0.216	1.20	0.2	0.22
282	0.075	0.100	0.300	1.20	0.2	0.35
283	0.071	0.098	0.278	1.15	0.2	0.2
284	0.16	0.15	0.450	1.10	0.2	0.4
292	0.061	0.089	0.300	1.20	0.2	0.35
293	0.063	0.084	0.296	1.15	0.2	0.2
294	0.16	0.15	0.450	1.10	0.2	0.4
297	0.030	0.1	0.2	1.10	0.2	0.44
301	0.05	0.096	0.200	1.20	0.2	0.22
302	0.089	0.112	0.300	1.20	0.2	0.35
303	0.064	0.086	0.293	1.15	0.2	0.2
304	0.16	0.15	0.450	1.10	0.2	0.4
311	0.05	0.136	0.264	1.20	0.2	0.22
312	0.065	0.092	0.297	1.20	0.2	0.35
313	0.071	0.095	0.282	1.15	0.2	0.2
314	0.16	0.15	0.449	1.10	0.2	0.4
317	0.030	0.1	0.2	1.10	0.2	0.44
331	0.05	0.115	0.237	1.20	0.2	0.22
332	0.066	0.093	0.300	1.20	0.2	0.35
333	0.069	0.092	0.285	1.15	0.2	0.2
334	0.16	0.15	0.450	1.10	0.2	0.4
337	0.030	0.068	0.2	1.10	0.2	0.44
341	0.05	0.104	0.117	1.20	0.2	0.22
342	0.055	0.084	0.300	1.20	0.2	0.35
343	0.063	0.085	0.294	1.15	0.2	0.2
344	0.16	0.15	0.450	1.10	0.2	0.4
347	0.030	0.1	0.2	1.10	0.2	0.44
351	0.05	0.150	0.300	1.20	0.2	0.22
352	0.052	0.082	0.300	1.20	0.2	0.35
353	0.064	0.087	0.292	1.15	0.2	0.2
354	0.16	0.15	0.450	1.10	0.2	0.4
361	0.05	0.146	0.282	1.20	0.2	0.22
362	0.091	0.112	0.300	1.20	0.2	0.35
363	0.064	0.085	0.294	1.15	0.2	0.2
364	0.16	0.15	0.450	1.10	0.2	0.4
367	0.030	0.1	0.2	1.10	0.2	0.44

END PWAT-PARM4

```
  PWAT-STATE1
*** < PLS>  PWATER state variables (in)
*** x  - x       CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11  367       0.01      0.01       0.1      0.02       5.0     20.00      0.01
  END PWAT-STATE1

*** max CEPSC values from Intera geodatabase, used INTB for variation
  MON-INTERCEP
*** <PLS >  Interception storage capacity at start of each month (in)
*** x -  x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
   11     11 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   12     12 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   13     13 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   14     14 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   17     17 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   21     21 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   22     22 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   23     23 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   24     24 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   27     27 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   31     31 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   32     32 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   33     33 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   34     34 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   37     37 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   41     41 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   42     42 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   43     43 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   44     44 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   47     47 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   51     51 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   52     52 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   53     53 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   54     54 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   57     57 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   61     61 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   62     62 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   63     63 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   64     64 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   67     67 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   71     71 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   72     72 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   73     73 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   74     74 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   77     77 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   81     81 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   82     82 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   83     83 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   84     84 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   87     87 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   91     91 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
   92     92 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
   93     93 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
   94     94 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
   97     97 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  101    101 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  102    102 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  103    103 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  104    104 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  107    107 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  111    111 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  112    112 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  113    113 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  114    114 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  117    117 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  121    121 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  122    122 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  123    123 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  124    124 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  127    127 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  131    131 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  132    132 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  133    133 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  134    134 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  137    137 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  141    141 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  142    142 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  143    143 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  144    144 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  147    147 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  211    211 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  212    212 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  213    213 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  214    214 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  217    217 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  221    221 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  222    222 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  223    223 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  224    224 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  227    227 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  231    231 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  232    232 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  233    233 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  234    234 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  237    237 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  241    241 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  242    242 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  243    243 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  244    244 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  247    247 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  251    251 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  252    252 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  253    253 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  254    254 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  257    257 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  261    261 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  262    262 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  263    263 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  264    264 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  267    267 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  271    271 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  272    272 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  273    273 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  274    274 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  277    277 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  281    281 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  282    282 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  283    283 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  284    284 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  287    287 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  291    291 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  292    292 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  293    293 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  294    294 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  297    297 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  301    301 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  302    302 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  303    303 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  304    304 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  307    307 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  311    311 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
  312    312 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
  313    313 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
  314    314 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
  317    317 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
```

```
 331  331 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 332  332 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
 333  333 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
 334  334 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
 337  337 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 341  341 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 342  342 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
 343  343 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
 344  344 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
 347  347 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 351  351 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 352  352 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
 353  353 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
 354  354 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
 357  357 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 361  361 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 362  362 0.02 0.03 0.04 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.04 0.03
 363  363 0.01 0.02 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 0.04 0.02
 364  364 0.03 0.06 0.09 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.09 0.06
 367  367 0.01 0.02 0.03 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.03 0.02
 END MON-INTERCEP

*** INTB values lowered 25 to 50 percent
 MON-LZETPARM
*** <PLS >  Lower zone evapotransp   parm at start of each month
*** x -  x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
  11    11 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  12    12 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  13    13 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  14    14 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  17    17 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  21    21 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  22    22 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  23    23 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  24    24 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  27    27 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  31    31 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  32    32 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  33    33 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  34    34 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  37    37 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  41    41 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  42    42 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  43    43 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  44    44 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  47    47 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  51    51 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  52    52 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  53    53 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  54    54 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  57    57 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  61    61 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  62    62 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  63    63 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  64    64 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  67    67 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  71    71 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  72    72 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  73    73 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  74    74 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  77    77 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  81    81 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  82    82 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  83    83 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  84    84 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  87    87 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  91    91 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  92    92 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  93    93 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  94    94 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  97    97 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 101   101 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 102   102 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 103   103 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 104   104 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 107   107 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 111   111 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 112   112 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 113   113 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 114   114 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 117   117 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 121   121 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 122   122 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 123   123 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 124   124 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 127   127 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 131   131 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 132   132 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 133   133 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 134   134 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 137   137 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 141   141 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 142   142 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 143   143 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 144   144 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 147   147 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 211   211 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 212   212 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 213   213 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 214   214 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 217   217 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 221   221 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 222   222 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 223   223 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 224   224 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 227   227 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 231   231 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 232   232 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 233   233 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 234   234 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 237   237 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 241   241 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 242   242 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 243   243 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 244   244 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 247   247 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 251   251 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 252   252 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 253   253 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 254   254 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 257   257 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 261   261 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 262   262 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 263   263 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 264   264 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 267   267 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 271   271 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 272   272 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 273   273 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 274   274 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 277   277 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
 281   281 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
 282   282 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
 283   283 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
 284   284 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
 287   287 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
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  291  291 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  292  292 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  293  293 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  294  294 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  297  297 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  301  301 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  302  302 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  303  303 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  304  304 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  307  307 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  311  311 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  312  312 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  313  313 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  314  314 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  317  317 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  331  331 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  332  332 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  333  333 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  334  334 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  337  337 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  341  341 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  342  342 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  343  343 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  344  344 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  347  347 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  351  351 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  352  352 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  353  353 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  354  354 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  357  357 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  361  361 .180 .200  .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
  362  362 .260 .280 .300 .320 .340 .480 .500 .500 .480 .400 .300 .280
  363  363 .200 .230  .26 .280 .300 .400 .420 .420  .40 .310  .23 .210
  364  364 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
  367  367 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
  END MON-LZETPARM

END PERLND

IMPLND
  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   11  361    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
*** <ILS > ******** Print-flags ******** PIVL  PYR
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   11  361    4    4    4    4    4    4    1   12
  END PRINT-INFO

  BINARY-INFO
*** <ILS > **** Binary-Output-flags **** PIVL  PYR
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   11  361    4    4    5    4    4    4    1   12
  END BINARY-INFO

  GEN-INFO
***              Name             Unit-systems   Printer BinaryOut
*** <ILS >                            t-series Engl Metr Engl Metr
*** x -  x                             in  out
   11  361Urban                         1    1    0    0   92    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   11  361    0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (in)
   11           100.    0.0068      0.05       0.1
   21           100.    0.0046      0.05       0.1
   31           100.    0.0068      0.05       0.1
   41           100.    0.0136      0.05       0.1
   51           100.    0.0056      0.05       0.1
   61           100.    0.0054      0.05       0.1
   71           100.    0.0097      0.05       0.1
   81           100.    0.0055      0.05       0.1
   91           100.  2.38E-06      0.05       0.1
  101           100.    0.0076      0.05       0.1
  111           100.    0.0063      0.05       0.1
  121           100.    0.0078      0.05       0.1
  131           100.    0.0059      0.05       0.1
  141           100.    0.0063      0.05       0.1
  211           100.    0.0104      0.05       0.1
  221           100.     0.012      0.05       0.1
  231           100.    0.0006      0.05       0.1
  241           100.    0.0078      0.05       0.1
  251           100.    0.0109      0.05       0.1
  261           100.    0.0111      0.05       0.1
  271           100.    0.0003      0.05       0.1
  281           100.    0.0079      0.05       0.1
  301           100.     0.046      0.05       0.1
  311           100.    0.0104      0.05       0.1
  331           100.    0.0176      0.05       0.1
  341           100.    0.0039      0.05       0.1
  351           100.    0.0214      0.05       0.1
  361           100.    0.0081      0.05       0.1
  END IWAT-PARM2

  IWAT-PARM3
*** <ILS >    PETMAX    PETMIN
*** x -  x   (deg F)   (deg F)
   11  361       40.       35.
  END IWAT-PARM3

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   11  361      0.01      0.01
  END IWAT-STATE1

END IMPLND

RCHRES
  ACTIVITY
*** RCHRES  Active sections
*** x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG
    1  300    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
*** RCHRES  Printout level flags
*** x -  x HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR
    1  300    4    4    4    4    4    4    4    4    4    4    1   12
  END PRINT-INFO

  BINARY-INFO
*** RCHRES  Binary Output level flags
*** x -  x HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR
    1  300    3    4    4    4    4    4    4    4    4    4    1   12
  END BINARY-INFO
```

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  GEN-INFO
***             Name        Nexits   Unit Systems   Printer
*** RCHRES                              t-series  Engl Metr LKFG
*** x -  x                                in  out
    1     Reach 1                  1         1    1   91    0    1   92    0
    2     Reach 2                  1         1    1   91    0    1   92    0
    3     Reach 3                  1         1    1   91    0    1   92    0
    4     Reach 4                  1         1    1   91    0    1   92    0
    5     Reach 5                  1         1    1   91    0    1   92    0
    6     Reach 6                  1         1    1   91    0    1   92    0
    7     Reach 7                  1         1    1   91    0    1   92    0
    8     Reach 8                  1         1    1   91    0    1   92    0
    9     Reach 9                  1         1    1   91    0    1   92    0
   10     Reach 10                 1         1    1   91    0    1   92    0
   11     Reach 11                 1         1    1   91    0    1   92    0
   12     Reach 12                 1         1    1   91    0    1   92    0
   13     Reach 13                 1         1    1   91    0    1   92    0
   14     Reach 14                 1         1    1   91    0    1   92    0
   21     Reach 21                 1         1    1   91    0    1   92    0
   22     Reach 22                 1         1    1   91    0    1   92    0
   23     Reach 23                 1         1    1   91    0    1   92    0
   24     Reach 24                 1         1    1   91    0    1   92    0
   25     Reach 25                 1         1    1   91    0    1   92    0
   26     Reach 26                 1         1    1   91    0    1   92    0
   27     Reach 27                 1         1    1   91    0    1   92    0
   28     Reach 28                 1         1    1   91    0    1   92    0
   29     Reach 29                 1         1    1   91    0    1   92    0
   30     Reach 30                 1         1    1   91    0    1   92    0
   31     Reach 31                 1         1    1   91    0    1   92    0
   33     Reach 33                 1         1    1   91    0    1   92    0
   34     Reach 34                 1         1    1   91    0    1   92    0
   35     Reach 35                 1         1    1   91    0    1   92    0
   36     Reach 36                 1         1    1   91    0    1   92    0
  201     Reach 201                1         1    1   91    0    0   92    0
  202     Reach 202                1         1    1   91    0    0   92    0
  203     Reach 203                1         1    1   91    0    0   92    0
  204     Reach 204                1         1    1   91    0    0   92    0
  205     Reach 205                2         1    1   91    0    0   92    0
  206     Reach 206                1         1    1   91    0    0   92    0
  207     Reach 207                1         1    1   91    0    0   92    0
  208     Reach 208                1         1    1   91    0    0   92    0
  300     Reach 300                1         1    1   91    0    0   92    0
  END GEN-INFO

  HYDR-PARM1
***         Flags for HYDR section
*** RCHRES  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
*** x  - x  FG FG FG FG  possible   exit *** possible   exit     possible   exit
    1  204   0  1  1  1    4  0  0  0  0       0  0  0  0  0       1  1  1  1  1
  205  205   0  1  1  1    4  0  0  0  0       0  2  0  0  0       1  1  1  1  1
  206  300   0  1  1  1    4  0  0  0  0       0  0  0  0  0       1  1  1  1  1
  END HYDR-PARM1

  HYDR-PARM2
*** RCHRES FTBW FTBU       LEN     DELTH     STCOR        KS       DB50
*** x -  x              (miles)     (ft)      (ft)                  (in)
    1         0.   1.        1.        3.       3.2       0.5      0.01
    2         0.   2.        1.        3.       3.2       0.5      0.01
    3         0.   3.        1.        3.       3.2       0.5      0.01
    4         0.   4.        1.        3.       3.2       0.5      0.01
    5         0.   5.        1.        3.       3.2       0.5      0.01
    6         0.   6.        1.        3.       3.2       0.5      0.01
    7         0.   7.        1.        3.       3.2       0.5      0.01
    8         0.   8.        1.        3.       3.2       0.5      0.01
    9         0.   9.        1.        3.       3.2       0.5      0.01
   10         0.  10.        1.        3.       3.2       0.5      0.01
   11         0.  11.        1.        3.       3.2       0.5      0.01
   12         0.  12.        1.        3.       3.2       0.5      0.01
   13         0.  13.        1.        3.       3.2       0.5      0.01
   14         0.  14.        1.        3.       3.2       0.5      0.01
   21         0.  21.        1.        3.       3.2       0.5      0.01
   22         0.  22.        1.        3.       3.2       0.5      0.01
   23         0.  23.        1.        3.       3.2       0.5      0.01
   24         0.  24.        1.        3.       3.2       0.5      0.01
   25         0.  25.        1.        3.       3.2       0.5      0.01
   26         0.  26.        1.        3.       3.2       0.5      0.01
   27         0.  27.        1.        3.       3.2       0.5      0.01
   28         0.  28.        1.        3.       3.2       0.5      0.01
   29         0.  29.        1.        3.       3.2       0.5      0.01
   30         0.  30.        1.        3.       3.2       0.5      0.01
   31         0.  31.        1.        3.       3.2       0.5      0.01
   33         0.  33.        1.        3.       3.2       0.5      0.01
   34         0.  34.        1.        3.       3.2       0.5      0.01
   35         0.  35.        1.        3.       3.2       0.5      0.01
   36         0.  36.        1.        3.       3.2       0.5      0.01
  201         0. 201.        1.        3.       3.2       0.5      0.01
  202         0. 202.        1.        3.       3.2       0.5      0.01
  203         0. 203.        1.        3.       3.2       0.5      0.01
  204         0. 204.        1.        3.       3.2       0.5      0.01
  205         0. 205.        1.        3.       3.2       0.5      0.01
  206         0. 206.        1.        3.       3.2       0.5      0.01
  207         0. 207.        1.        3.       3.2       0.5      0.01
  208         0. 208.        1.        3.       3.2       0.5      0.01
  300         0. 300.        1.        3.       3.2       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
***          Initial conditions for HYDR section
***RC HRES       VOL  CAT Initial value  of COLIND     initial  value  of OUTDGT
*** x  - x     ac-ft      for each possible   exit  for each possible exit,ft3
    1   20     20.00       4.2  4.5  4.5  4.5  4.2        2.1  1.2  0.5  1.2  1.8
   21   21    200.00       4.2  4.5  4.5  4.5  4.2        2.1  1.2  0.5  1.2  1.8
   22  300     20.00       4.2  4.5  4.5  4.5  4.2        2.1  1.2  0.5  1.2  1.8
  END HYDR-INIT

END RCHRES

FTABLES
  ******
  FTABLE      1
 ROWS COLS***
   13    4
***  DEPTH      AREA    VOLUME      DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)      (CFS)     (MIN) ***
          0 1.932E+02         0         0
 6.437E-01 1.932E+02 3.731E+01 5.429E-01
 1.287E+00 1.932E+02 7.463E+01 7.030E+00
 1.931E+00 1.932E+02 1.119E+02 2.600E+01
 2.575E+00 1.932E+02 1.493E+02 4.246E+01
 3.218E+00 1.932E+02 1.866E+02 6.243E+01
 3.862E+00 1.932E+02 2.239E+02 8.584E+01
 4.506E+00 1.932E+02 2.799E+02 1.188E+02
 5.150E+00 1.932E+02 3.545E+02 1.614E+02
 5.793E+00 1.932E+02 4.478E+02 2.114E+02
 6.437E+00 1.932E+02 5.659E+02 2.691E+02
 7.081E+00 1.932E+02 6.903E+02 2.961E+02
 9.081E+00 1.932E+02 4.555E+03 5.921E+02
  END FTABLE  1
  ******
  FTABLE      2
 ROWS COLS***
   13    4
***  DEPTH      AREA    VOLUME      DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)      (CFS)     (MIN) ***
          0 3.494E+02         0         0
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 1.019E+00 3.494E+02 1.068E+02 1.167E+00
 2.037E+00 3.494E+02 2.136E+02 1.511E+01
 3.056E+00 3.494E+02 3.203E+02 5.587E+01
 4.074E+00 3.494E+02 4.271E+02 9.124E+01
 5.093E+00 3.494E+02 5.339E+02 1.342E+02
 6.112E+00 3.494E+02 6.407E+02 1.845E+02
 7.130E+00 3.494E+02 8.008E+02 2.553E+02
 8.149E+00 3.494E+02 1.014E+03 3.468E+02
 9.167E+00 3.494E+02 1.281E+03 4.542E+02
 1.019E+01 3.494E+02 1.619E+03 5.783E+02
 1.120E+01 3.494E+02 1.975E+03 6.362E+02
 1.320E+01 3.494E+02 8.964E+03 1.272E+03
  END FTABLE  2
  ******
  FTABLE      3
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 1.522E+02         0         0
 4.127E-01 1.522E+02 1.884E+01 2.589E-01
 8.255E-01 1.522E+02 3.769E+01 3.352E+00
 1.238E+00 1.522E+02 5.653E+01 1.240E+01
 1.651E+00 1.522E+02 7.537E+01 2.025E+01
 2.064E+00 1.522E+02 9.422E+01 2.977E+01
 2.476E+00 1.522E+02 1.131E+02 4.093E+01
 2.889E+00 1.522E+02 1.413E+02 5.665E+01
 3.302E+00 1.522E+02 1.790E+02 7.695E+01
 3.715E+00 1.522E+02 2.261E+02 1.008E+02
 4.127E+00 1.522E+02 2.858E+02 1.283E+02
 4.540E+00 1.522E+02 3.486E+02 1.412E+02
 6.540E+00 1.522E+02 3.392E+03 2.823E+02
  END FTABLE  3
  ******
  FTABLE      4
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 5.174E+02         0         0
 7.272E-01 5.174E+02 1.129E+02 6.652E-01
 1.454E+00 5.174E+02 2.258E+02 8.614E+00
 2.182E+00 5.174E+02 3.386E+02 3.186E+01
 2.909E+00 5.174E+02 4.515E+02 5.203E+01
 3.636E+00 5.174E+02 5.644E+02 7.650E+01
 4.363E+00 5.174E+02 6.773E+02 1.052E+02
 5.090E+00 5.174E+02 8.466E+02 1.456E+02
 5.817E+00 5.174E+02 1.072E+03 1.977E+02
 6.545E+00 5.174E+02 1.355E+03 2.590E+02
 7.272E+00 5.174E+02 1.712E+03 3.298E+02
 7.999E+00 5.174E+02 2.088E+03 3.628E+02
 9.999E+00 5.174E+02 1.244E+04 7.256E+02
  END FTABLE  4
  ******
  FTABLE      5
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 2.600E+03         0         0
 1.025E+00 2.600E+03 7.991E+02 6.746E-01
 2.049E+00 2.600E+03 1.598E+03 1.081E+01
 3.074E+00 2.600E+03 2.397E+03 4.347E+01
 4.098E+00 2.600E+03 3.196E+03 7.142E+01
 5.123E+00 2.600E+03 3.995E+03 1.102E+02
 6.148E+00 2.600E+03 4.794E+03 2.192E+02
 7.172E+00 2.600E+03 5.993E+03 4.918E+02
 8.197E+00 2.600E+03 7.591E+03 9.919E+02
 9.221E+00 2.600E+03 9.589E+03 1.841E+03
 1.025E+01 2.600E+03 1.212E+04 3.198E+03
 1.127E+01 2.600E+03 1.478E+04 3.518E+03
 1.327E+01 2.600E+03 6.677E+04 7.036E+03
  END FTABLE  5
  ******
  FTABLE      6
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 5.575E+00         0         0
 3.046E-01 5.575E+00 5.094E-01 1.560E-01
 6.092E-01 5.575E+00 1.019E+00 2.020E+00
 9.137E-01 5.575E+00 1.528E+00 7.470E+00
 1.218E+00 5.575E+00 2.038E+00 1.220E+01
 1.523E+00 5.575E+00 2.547E+00 1.794E+01
 1.827E+00 5.575E+00 3.057E+00 2.466E+01
 2.132E+00 5.575E+00 3.821E+00 3.414E+01
 2.437E+00 5.575E+00 4.840E+00 4.637E+01
 2.741E+00 5.575E+00 6.113E+00 6.073E+01
 3.046E+00 5.575E+00 7.726E+00 7.733E+01
 3.350E+00 5.575E+00 9.425E+00 8.506E+01
 5.350E+00 5.575E+00 1.125E+03 1.701E+02
  END FTABLE  6
  ******
  FTABLE      7
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 8.950E+01         0         0
 5.444E-01 8.950E+01 1.462E+01 4.107E-01
 1.089E+00 8.950E+01 2.924E+01 5.318E+00
 1.633E+00 8.950E+01 4.386E+01 1.967E+01
 2.178E+00 8.950E+01 5.848E+01 3.212E+01
 2.722E+00 8.950E+01 7.310E+01 4.723E+01
 3.267E+00 8.950E+01 8.771E+01 6.494E+01
 3.811E+00 8.950E+01 1.096E+02 8.988E+01
 4.356E+00 8.950E+01 1.389E+02 1.221E+02
 4.900E+00 8.950E+01 1.754E+02 1.599E+02
 5.444E+00 8.950E+01 2.217E+02 2.036E+02
 5.989E+00 8.950E+01 2.705E+02 2.240E+02
 7.989E+00 8.950E+01 2.061E+03 4.479E+02
  END FTABLE  7
  ******
  FTABLE      8
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 1.079E+02         0         0
 5.056E-01 1.079E+02 1.636E+01 3.630E-01
 1.011E+00 1.079E+02 3.273E+01 4.700E+00
 1.517E+00 1.079E+02 4.909E+01 1.739E+01
 2.022E+00 1.079E+02 6.546E+01 2.839E+01
 2.528E+00 1.079E+02 8.182E+01 4.175E+01
 3.034E+00 1.079E+02 9.819E+01 5.740E+01
 3.539E+00 1.079E+02 1.227E+02 7.944E+01
 4.045E+00 1.079E+02 1.555E+02 1.079E+02
 4.550E+00 1.079E+02 1.964E+02 1.413E+02
 5.056E+00 1.079E+02 2.482E+02 1.800E+02
 5.561E+00 1.079E+02 3.027E+02 1.980E+02
 7.561E+00 1.079E+02 2.461E+03 3.959E+02
  END FTABLE  8
  ******
  FTABLE      9
 ROWS COLS***
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```
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 3.447E+01         0         0
 2.721E-01 3.447E+01 2.814E+00 1.293E-01
 5.443E-01 3.447E+01 5.628E+00 1.674E+00
 8.164E-01 3.447E+01 8.442E+00 6.192E+00
 1.089E+00 3.447E+01 1.126E+01 1.011E+01
 1.361E+00 3.447E+01 1.407E+01 1.487E+01
 1.633E+00 3.447E+01 1.688E+01 2.044E+01
 1.905E+00 3.447E+01 2.110E+01 2.829E+01
 2.177E+00 3.447E+01 2.673E+01 3.843E+01
 2.449E+00 3.447E+01 3.377E+01 5.034E+01
 2.721E+00 3.447E+01 4.268E+01 6.409E+01
 2.993E+00 3.447E+01 5.206E+01 7.050E+01
 4.993E+00 3.447E+01 7.414E+02 1.410E+02
  END FTABLE  9
  ******
  FTABLE     10
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 2.769E+01         0         0
 6.021E-01 2.769E+01 5.001E+00 4.857E-01
 1.204E+00 2.769E+01 1.000E+01 6.289E+00
 1.806E+00 2.769E+01 1.500E+01 2.326E+01
 2.408E+00 2.769E+01 2.000E+01 3.799E+01
 3.010E+00 2.769E+01 2.500E+01 5.586E+01
 3.613E+00 2.769E+01 3.001E+01 7.680E+01
 4.215E+00 2.769E+01 3.751E+01 1.063E+02
 4.817E+00 2.769E+01 4.751E+01 1.444E+02
 5.419E+00 2.769E+01 6.001E+01 1.891E+02
 6.021E+00 2.769E+01 7.585E+01 2.408E+02
 6.623E+00 2.769E+01 9.252E+01 2.649E+02
 8.623E+00 2.769E+01 5.630E+03 5.297E+02
  END FTABLE 10
  ******
  FTABLE     11
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 1.409E+03         0         0
 9.301E-01 1.409E+03 3.931E+02 1.003E+00
 1.860E+00 1.409E+03 7.863E+02 1.298E+01
 2.790E+00 1.409E+03 1.179E+03 4.801E+01
 3.720E+00 1.409E+03 1.573E+03 7.841E+01
 4.650E+00 1.409E+03 1.966E+03 1.153E+02
 5.580E+00 1.409E+03 2.359E+03 1.585E+02
 6.510E+00 1.409E+03 2.949E+03 2.194E+02
 7.440E+00 1.409E+03 3.735E+03 2.980E+02
 8.371E+00 1.409E+03 4.718E+03 3.903E+02
 9.301E+00 1.409E+03 5.963E+03 4.970E+02
 1.023E+01 1.409E+03 7.273E+03 5.467E+02
 1.223E+01 1.409E+03 3.545E+04 1.093E+03
  END FTABLE 11
  ******
  FTABLE     12
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 4.154E+01         0         0
 4.547E-01 4.154E+01 5.666E+00 3.041E-01
 9.093E-01 4.154E+01 1.133E+01 3.938E+00
 1.364E+00 4.154E+01 1.700E+01 1.457E+01
 1.819E+00 4.154E+01 2.267E+01 2.379E+01
 2.273E+00 4.154E+01 2.833E+01 3.498E+01
 2.728E+00 4.154E+01 3.400E+01 4.809E+01
 3.183E+00 4.154E+01 4.250E+01 6.656E+01
 3.637E+00 4.154E+01 5.383E+01 9.041E+01
 4.092E+00 4.154E+01 6.800E+01 1.184E+02
 4.547E+00 4.154E+01 8.594E+01 1.508E+02
 5.001E+00 4.154E+01 1.048E+02 1.659E+02
 7.001E+00 4.154E+01 9.357E+02 3.317E+02
  END FTABLE 12
  ******
  FTABLE     13
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 1.512E+03         0         0
 1.277E+00 1.512E+03 5.794E+02 1.701E+00
 2.554E+00 1.512E+03 1.159E+03 2.202E+01
 3.832E+00 1.512E+03 1.738E+03 8.146E+01
 5.109E+00 1.512E+03 2.317E+03 1.330E+02
 6.386E+00 1.512E+03 2.897E+03 1.956E+02
 7.663E+00 1.512E+03 3.476E+03 2.689E+02
 8.940E+00 1.512E+03 4.345E+03 3.722E+02
 1.022E+01 1.512E+03 5.504E+03 5.056E+02
 1.149E+01 1.512E+03 6.952E+03 6.623E+02
 1.277E+01 1.512E+03 8.787E+03 8.432E+02
 1.405E+01 1.512E+03 1.072E+04 9.276E+02
 1.605E+01 1.512E+03 4.096E+04 1.855E+03
  END FTABLE 13
  ******
  FTABLE     14
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 2.274E+02         0         0
 4.481E-01 2.274E+02 3.057E+01 2.969E-01
 8.962E-01 2.274E+02 6.113E+01 3.844E+00
 1.344E+00 2.274E+02 9.170E+01 1.422E+01
 1.792E+00 2.274E+02 1.223E+02 2.322E+01
 2.241E+00 2.274E+02 1.528E+02 3.414E+01
 2.689E+00 2.274E+02 1.834E+02 4.694E+01
 3.137E+00 2.274E+02 2.292E+02 6.497E+01
 3.585E+00 2.274E+02 2.904E+02 8.824E+01
 4.033E+00 2.274E+02 3.668E+02 1.156E+02
 4.481E+00 2.274E+02 4.636E+02 1.472E+02
 4.929E+00 2.274E+02 5.655E+02 1.619E+02
 6.929E+00 2.274E+02 5.113E+03 3.238E+02
  END FTABLE 14
  ******
  FTABLE     21
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 2.532E+03         0         0
 1.140E+00 2.532E+03 8.659E+02 8.059E-01
 2.280E+00 2.532E+03 1.732E+03 1.291E+01
 3.420E+00 2.532E+03 2.598E+03 5.193E+01
 4.560E+00 2.532E+03 3.464E+03 8.532E+01
 5.700E+00 2.532E+03 4.329E+03 1.316E+02
 6.840E+00 2.532E+03 5.195E+03 2.618E+02
 7.980E+00 2.532E+03 6.494E+03 5.876E+02
 9.120E+00 2.532E+03 8.226E+03 1.185E+03
 1.026E+01 2.532E+03 1.039E+04 2.199E+03
 1.140E+01 2.532E+03 1.313E+04 3.821E+03
 1.254E+01 2.532E+03 1.602E+04 4.203E+03
 1.454E+01 2.532E+03 6.666E+04 8.406E+03
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  END FTABLE 21
  ******
  FTABLE     22
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 2.096E+03         0         0
 1.392E+00 2.096E+03 8.750E+02 1.124E+00
 2.783E+00 2.096E+03 1.750E+03 1.800E+01
 4.175E+00 2.096E+03 2.625E+03 7.242E+01
 5.567E+00 2.096E+03 3.500E+03 1.190E+02
 6.959E+00 2.096E+03 4.375E+03 1.835E+02
 8.350E+00 2.096E+03 5.250E+03 3.651E+02
 9.742E+00 2.096E+03 6.563E+03 8.194E+02
 1.113E+01 2.096E+03 8.313E+03 1.652E+03
 1.253E+01 2.096E+03 1.050E+04 3.067E+03
 1.392E+01 2.096E+03 1.327E+04 5.328E+03
 1.531E+01 2.096E+03 1.619E+04 5.861E+03
 1.731E+01 2.096E+03 5.810E+04 1.172E+04
  END FTABLE 22
  ******
  FTABLE     23
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 2.009E+02         0         0
 4.757E-01 2.009E+02 2.868E+01 1.878E-01
 9.515E-01 2.009E+02 5.735E+01 3.009E+00
 1.427E+00 2.009E+02 8.603E+01 1.210E+01
 1.903E+00 2.009E+02 1.147E+02 1.988E+01
 2.379E+00 2.009E+02 1.434E+02 3.067E+01
 2.854E+00 2.009E+02 1.721E+02 6.101E+01
 3.330E+00 2.009E+02 2.151E+02 1.369E+02
 3.806E+00 2.009E+02 2.724E+02 2.762E+02
 4.282E+00 2.009E+02 3.441E+02 5.125E+02
 4.757E+00 2.009E+02 4.349E+02 8.904E+02
 5.233E+00 2.009E+02 5.305E+02 9.795E+02
 7.233E+00 2.009E+02 4.549E+03 1.959E+03
  END FTABLE 23
  ******
  FTABLE     24
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 7.921E+02         0         0
 5.933E-01 7.921E+02 1.410E+02 2.713E-01
 1.187E+00 7.921E+02 2.820E+02 4.347E+00
 1.780E+00 7.921E+02 4.230E+02 1.749E+01
 2.373E+00 7.921E+02 5.639E+02 2.873E+01
 2.966E+00 7.921E+02 7.049E+02 4.431E+01
 3.560E+00 7.921E+02 8.459E+02 8.816E+01
 4.153E+00 7.921E+02 1.057E+03 1.978E+02
 4.746E+00 7.921E+02 1.339E+03 3.990E+02
 5.339E+00 7.921E+02 1.692E+03 7.405E+02
 5.933E+00 7.921E+02 2.138E+03 1.287E+03
 6.526E+00 7.921E+02 2.608E+03 1.415E+03
 8.526E+00 7.921E+02 1.845E+04 2.830E+03
  END FTABLE 24
  ******
  FTABLE     25
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 6.219E+02         0         0
 6.590E-01 6.219E+02 1.229E+02 3.232E-01
 1.318E+00 6.219E+02 2.459E+02 5.179E+00
 1.977E+00 6.219E+02 3.688E+02 2.083E+01
 2.636E+00 6.219E+02 4.918E+02 3.422E+01
 3.295E+00 6.219E+02 6.147E+02 5.279E+01
 3.954E+00 6.219E+02 7.377E+02 1.050E+02
 4.613E+00 6.219E+02 9.221E+02 2.357E+02
 5.272E+00 6.219E+02 1.168E+03 4.753E+02
 5.931E+00 6.219E+02 1.475E+03 8.822E+02
 6.590E+00 6.219E+02 1.865E+03 1.533E+03
 7.249E+00 6.219E+02 2.274E+03 1.686E+03
 9.249E+00 6.219E+02 1.471E+04 3.372E+03
  END FTABLE 25
  ******
  FTABLE     26
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 1.676E+03         0         0
 9.455E-01 1.676E+03 4.754E+02 5.901E-01
 1.891E+00 1.676E+03 9.508E+02 9.453E+00
 2.837E+00 1.676E+03 1.426E+03 3.803E+01
 3.782E+00 1.676E+03 1.902E+03 6.247E+01
 4.728E+00 1.676E+03 2.377E+03 9.636E+01
 5.673E+00 1.676E+03 2.852E+03 1.917E+02
 6.619E+00 1.676E+03 3.566E+03 4.302E+02
 7.564E+00 1.676E+03 4.516E+03 8.676E+02
 8.510E+00 1.676E+03 5.705E+03 1.610E+03
 9.455E+00 1.676E+03 7.210E+03 2.798E+03
 1.040E+01 1.676E+03 8.795E+03 3.077E+03
 1.240E+01 1.676E+03 4.231E+04 6.155E+03
  END FTABLE 26
  ******
  FTABLE     27
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 7.884E+01         0         0
 2.688E-01 7.884E+01 6.357E+00 7.250E-02
 5.375E-01 7.884E+01 1.271E+01 1.162E+00
 8.063E-01 7.884E+01 1.907E+01 4.672E+00
 1.075E+00 7.884E+01 2.543E+01 7.676E+00
 1.344E+00 7.884E+01 3.178E+01 1.184E+01
 1.613E+00 7.884E+01 3.814E+01 2.355E+01
 1.881E+00 7.884E+01 4.767E+01 5.286E+01
 2.150E+00 7.884E+01 6.039E+01 1.066E+02
 2.419E+00 7.884E+01 7.628E+01 1.979E+02
 2.688E+00 7.884E+01 9.641E+01 3.438E+02
 2.956E+00 7.884E+01 1.176E+02 3.781E+02
 4.956E+00 7.884E+01 1.694E+03 7.563E+02
  END FTABLE 27
  ******
  FTABLE     28
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)  (AC-FT)     (CFS)     (MIN) ***
         0 2.914E+02         0         0
 3.290E-01 2.914E+02 2.876E+01 1.016E-01
 6.580E-01 2.914E+02 5.752E+01 1.627E+00
 9.870E-01 2.914E+02 8.628E+01 6.545E+00
 1.316E+00 2.914E+02 1.150E+02 1.075E+01
 1.645E+00 2.914E+02 1.438E+02 1.659E+01
 1.974E+00 2.914E+02 1.726E+02 3.300E+01
 2.303E+00 2.914E+02 2.157E+02 7.406E+01
 2.632E+00 2.914E+02 2.732E+02 1.494E+02
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 2.961E+00 2.914E+02 3.451E+02 2.772E+02
 3.290E+00 2.914E+02 4.362E+02 4.816E+02
 3.619E+00 2.914E+02 5.321E+02 5.297E+02
 5.619E+00 2.914E+02 6.360E+03 1.059E+03
  END FTABLE 28
  ******
  FTABLE     29
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 3.498E+02         0         0
 4.022E-01 3.498E+02 4.221E+01 1.420E-01
 8.045E-01 3.498E+02 8.441E+01 2.275E+00
 1.207E+00 3.498E+02 1.266E+02 9.150E+00
 1.609E+00 3.498E+02 1.688E+02 1.503E+01
 2.011E+00 3.498E+02 2.110E+02 2.319E+01
 2.413E+00 3.498E+02 2.532E+02 4.613E+01
 2.816E+00 3.498E+02 3.166E+02 1.035E+02
 3.218E+00 3.498E+02 4.010E+02 2.088E+02
 3.620E+00 3.498E+02 5.065E+02 3.875E+02
 4.022E+00 3.498E+02 6.401E+02 6.732E+02
 4.425E+00 3.498E+02 7.808E+02 7.405E+02
 6.425E+00 3.498E+02 7.776E+03 1.481E+03
  END FTABLE 29
  ******
  FTABLE     30
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 3.858E+03         0         0
 2.790E-01 3.858E+03 3.228E+02 7.715E-02
 5.579E-01 3.858E+03 6.457E+02 1.236E+00
 8.369E-01 3.858E+03 9.685E+02 4.972E+00
 1.116E+00 3.858E+03 1.291E+03 8.168E+00
 1.395E+00 3.858E+03 1.614E+03 1.260E+01
 1.674E+00 3.858E+03 1.937E+03 2.506E+01
 1.953E+00 3.858E+03 2.421E+03 5.625E+01
 2.232E+00 3.858E+03 3.067E+03 1.134E+02
 2.511E+00 3.858E+03 3.874E+03 2.106E+02
 2.790E+00 3.858E+03 4.896E+03 3.658E+02
 3.069E+00 3.858E+03 5.972E+03 4.024E+02
 5.069E+00 3.858E+03 8.313E+04 8.047E+02
  END FTABLE 30
  ******
  FTABLE     31
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 3.663E+02         0         0
 5.726E-01 3.663E+02 6.292E+01 2.558E-01
 1.145E+00 3.663E+02 1.258E+02 4.098E+00
 1.718E+00 3.663E+02 1.887E+02 1.648E+01
 2.290E+00 3.663E+02 2.517E+02 2.708E+01
 2.863E+00 3.663E+02 3.146E+02 4.177E+01
 3.436E+00 3.663E+02 3.775E+02 8.310E+01
 4.008E+00 3.663E+02 4.719E+02 1.865E+02
 4.581E+00 3.663E+02 5.977E+02 3.761E+02
 5.153E+00 3.663E+02 7.550E+02 6.980E+02
 5.726E+00 3.663E+02 9.542E+02 1.213E+03
 6.299E+00 3.663E+02 1.164E+03 1.334E+03
 8.299E+00 3.663E+02 8.489E+03 2.668E+03
  END FTABLE 31
  ******
  FTABLE     33
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 1.727E+02         0         0
 5.135E-01 1.727E+02 2.661E+01 2.133E-01
 1.027E+00 1.727E+02 5.322E+01 3.417E+00
 1.540E+00 1.727E+02 7.983E+01 1.374E+01
 2.054E+00 1.727E+02 1.064E+02 2.258E+01
 2.567E+00 1.727E+02 1.331E+02 3.483E+01
 3.081E+00 1.727E+02 1.597E+02 6.929E+01
 3.594E+00 1.727E+02 1.996E+02 1.555E+02
 4.108E+00 1.727E+02 2.528E+02 3.136E+02
 4.621E+00 1.727E+02 3.193E+02 5.821E+02
 5.135E+00 1.727E+02 4.036E+02 1.011E+03
 5.648E+00 1.727E+02 4.923E+02 1.112E+03
 7.648E+00 1.727E+02 3.947E+03 2.225E+03
  END FTABLE 33
  ******
  FTABLE     34
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 2.317E+02         0         0
 2.554E-01 2.317E+02 1.775E+01 6.658E-02
 5.107E-01 2.317E+02 3.551E+01 1.067E+00
 7.661E-01 2.317E+02 5.326E+01 4.290E+00
 1.021E+00 2.317E+02 7.101E+01 7.049E+00
 1.277E+00 2.317E+02 8.877E+01 1.087E+01
 1.532E+00 2.317E+02 1.065E+02 2.163E+01
 1.787E+00 2.317E+02 1.332E+02 4.854E+01
 2.043E+00 2.317E+02 1.687E+02 9.790E+01
 2.298E+00 2.317E+02 2.130E+02 1.817E+02
 2.554E+00 2.317E+02 2.693E+02 3.157E+02
 2.809E+00 2.317E+02 3.284E+02 3.472E+02
 4.809E+00 2.317E+02 4.963E+03 6.945E+02
  END FTABLE 34
  ******
  FTABLE     35
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 5.386E+01         0         0
 3.448E-01 5.386E+01 5.571E+00 1.098E-01
 6.895E-01 5.386E+01 1.114E+01 1.759E+00
 1.034E+00 5.386E+01 1.671E+01 7.076E+00
 1.379E+00 5.386E+01 2.228E+01 1.163E+01
 1.724E+00 5.386E+01 2.785E+01 1.793E+01
 2.069E+00 5.386E+01 3.342E+01 3.567E+01
 2.413E+00 5.386E+01 4.178E+01 8.006E+01
 2.758E+00 5.386E+01 5.292E+01 1.615E+02
 3.103E+00 5.386E+01 6.685E+01 2.997E+02
 3.448E+00 5.386E+01 8.449E+01 5.206E+02
 3.792E+00 5.386E+01 1.031E+02 5.727E+02
 5.792E+00 5.386E+01 1.088E+04 1.145E+03
  END FTABLE 35
  ******
  FTABLE     36
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***   (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 4.779E+02         0         0
 6.149E-01 4.779E+02 8.815E+01 2.880E-01
 1.230E+00 4.779E+02 1.763E+02 4.614E+00
 1.845E+00 4.779E+02 2.644E+02 1.856E+01
 2.459E+00 4.779E+02 3.526E+02 3.049E+01
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 3.074E+00 4.779E+02 4.407E+02 4.703E+01
 3.689E+00 4.779E+02 5.289E+02 9.357E+01
 4.304E+00 4.779E+02 6.611E+02 2.100E+02
 4.919E+00 4.779E+02 8.374E+02 4.235E+02
 5.534E+00 4.779E+02 1.058E+03 7.860E+02
 6.149E+00 4.779E+02 1.337E+03 1.366E+03
 6.764E+00 4.779E+02 1.631E+03 1.502E+03
 8.764E+00 4.779E+02 1.119E+04 3.004E+03
  END FTABLE 36
  ******
  FTABLE    201
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 9.878E+02         0         0
 2.148E+00 9.878E+02 2.122E+01 7.893E+01
 4.296E+00 9.878E+02 2.334E+02 2.566E+02
 6.444E+00 9.878E+02 4.880E+02 4.772E+02
 8.592E+00 9.878E+02 8.062E+02 7.588E+02
 1.074E+01 9.878E+02 1.231E+03 1.099E+03
 1.289E+01 9.878E+02 1.867E+03 1.561E+03
 1.504E+01 9.878E+02 2.822E+03 2.830E+03
 1.718E+01 9.878E+02 4.095E+03 5.432E+03
 1.933E+01 9.878E+02 5.686E+03 9.695E+03
 2.148E+01 9.878E+02 7.702E+03 1.633E+04
 2.363E+01 9.878E+02 9.823E+03 1.796E+04
 2.563E+01 9.878E+02 2.958E+04 3.593E+04
  END FTABLE201
  ******
  FTABLE    202
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 6.014E+02         0         0
 1.938E+00 6.014E+02 1.166E+01 6.651E+01
 3.876E+00 6.014E+02 1.282E+02 2.162E+02
 5.815E+00 6.014E+02 2.681E+02 4.021E+02
 7.753E+00 6.014E+02 4.429E+02 6.394E+02
 9.691E+00 6.014E+02 6.760E+02 9.262E+02
 1.163E+01 6.014E+02 1.026E+03 1.316E+03
 1.357E+01 6.014E+02 1.550E+03 2.385E+03
 1.551E+01 6.014E+02 2.250E+03 4.577E+03
 1.744E+01 6.014E+02 3.124E+03 8.169E+03
 1.938E+01 6.014E+02 4.231E+03 1.376E+04
 2.132E+01 6.014E+02 5.397E+03 1.514E+04
 2.332E+01 6.014E+02 1.742E+04 3.027E+04
  END FTABLE202
  ******
  FTABLE    203
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 7.754E+02         0         0
 1.887E+00 7.754E+02 1.463E+01 6.363E+01
 3.775E+00 7.754E+02 1.610E+02 2.068E+02
 5.662E+00 7.754E+02 3.366E+02 3.847E+02
 7.549E+00 7.754E+02 5.561E+02 6.117E+02
 9.437E+00 7.754E+02 8.487E+02 8.860E+02
 1.132E+01 7.754E+02 1.288E+03 1.259E+03
 1.321E+01 7.754E+02 1.946E+03 2.281E+03
 1.510E+01 7.754E+02 2.824E+03 4.378E+03
 1.699E+01 7.754E+02 3.922E+03 7.815E+03
 1.887E+01 7.754E+02 5.312E+03 1.316E+04
 2.076E+01 7.754E+02 6.775E+03 1.448E+04
 2.276E+01 7.754E+02 2.228E+04 2.896E+04
  END FTABLE203
  ******
  FTABLE    204
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 5.999E+02         0         0
 1.804E+00 5.999E+02 1.082E+01 5.899E+01
 3.607E+00 5.999E+02 1.190E+02 1.917E+02
 5.411E+00 5.999E+02 2.488E+02 3.567E+02
 7.214E+00 5.999E+02 4.111E+02 5.671E+02
 9.018E+00 5.999E+02 6.275E+02 8.214E+02
 1.082E+01 5.999E+02 9.521E+02 1.167E+03
 1.262E+01 5.999E+02 1.439E+03 2.115E+03
 1.443E+01 5.999E+02 2.088E+03 4.059E+03
 1.623E+01 5.999E+02 2.900E+03 7.245E+03
 1.804E+01 5.999E+02 3.927E+03 1.220E+04
 1.984E+01 5.999E+02 5.009E+03 1.342E+04
 2.184E+01 5.999E+02 1.701E+04 2.685E+04
  END FTABLE204
  ******
  FTABLE    205
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 5.685E+02         0         0
 1.646E+00 5.685E+02 9.356E+00 5.064E+01
 3.291E+00 5.685E+02 1.029E+02 1.646E+02
 4.937E+00 5.685E+02 2.152E+02 3.062E+02
 6.583E+00 5.685E+02 3.555E+02 4.868E+02
 8.228E+00 5.685E+02 5.426E+02 7.051E+02
 9.874E+00 5.685E+02 8.233E+02 1.002E+03
 1.152E+01 5.685E+02 1.244E+03 1.815E+03
 1.317E+01 5.685E+02 1.806E+03 3.485E+03
 1.481E+01 5.685E+02 2.507E+03 6.220E+03
 1.646E+01 5.685E+02 3.396E+03 1.048E+04
 1.810E+01 5.685E+02 4.332E+03 1.152E+04
 2.010E+01 5.685E+02 1.570E+04 2.305E+04
  END FTABLE205
  ******
  FTABLE    206
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 9.011E+02         0         0
 1.527E+00 9.011E+02 1.376E+01 1.312E+01
 3.054E+00 9.011E+02 1.514E+02 4.203E+01
 4.581E+00 9.011E+02 3.165E+02 8.452E+01
 6.108E+00 9.011E+02 5.229E+02 1.389E+02
 7.635E+00 9.011E+02 7.981E+02 2.142E+02
 9.162E+00 9.011E+02 1.211E+03 4.261E+02
 1.069E+01 9.011E+02 1.830E+03 9.563E+02
 1.222E+01 9.011E+02 2.656E+03 1.929E+03
 1.374E+01 9.011E+02 3.688E+03 3.580E+03
 1.527E+01 9.011E+02 4.995E+03 6.219E+03
 1.680E+01 9.011E+02 6.371E+03 6.841E+03
 1.880E+01 9.011E+02 2.439E+04 1.368E+04
  END FTABLE206
  ******
  FTABLE    207
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 2.917E+02         0         0
```

```
 2.304E+00 2.917E+02 6.720E+00 2.603E+01
 4.607E+00 2.917E+02 7.392E+01 8.340E+01
 6.911E+00 2.917E+02 1.546E+02 1.677E+02
 9.214E+00 2.917E+02 2.554E+02 2.756E+02
 1.152E+01 2.917E+02 3.898E+02 4.250E+02
 1.382E+01 2.917E+02 5.914E+02 8.456E+02
 1.613E+01 2.917E+02 8.938E+02 1.898E+03
 1.843E+01 2.917E+02 1.297E+03 3.827E+03
 2.073E+01 2.917E+02 1.801E+03 7.104E+03
 2.304E+01 2.917E+02 2.439E+03 1.234E+04
 2.534E+01 2.917E+02 3.111E+03 1.358E+04
 2.734E+01 2.917E+02 8.946E+03 2.715E+04
  END FTABLE207
  ******
  FTABLE    208
 ROWS COLS***
   13    4
***  DEPTH     AREA    VOLUME     DISCH  FLO-THRU ***
***    (FT)  (ACRES)   (AC-FT)     (CFS)     (MIN) ***
         0 4.908E+02         0         0
 1.940E+00 4.908E+02 9.524E+00 1.955E+01
 3.881E+00 4.908E+02 1.048E+02 6.265E+01
 5.821E+00 4.908E+02 2.190E+02 1.260E+02
 7.761E+00 4.908E+02 3.619E+02 2.070E+02
 9.702E+00 4.908E+02 5.524E+02 3.193E+02
 1.164E+01 4.908E+02 8.381E+02 6.352E+02
 1.358E+01 4.908E+02 1.267E+03 1.426E+03
 1.552E+01 4.908E+02 1.838E+03 2.875E+03
 1.746E+01 4.908E+02 2.552E+03 5.336E+03
 1.940E+01 4.908E+02 3.457E+03 9.271E+03
 2.134E+01 4.908E+02 4.410E+03 1.020E+04
 2.334E+01 4.908E+02 1.423E+04 2.040E+04
  END FTABLE208
  ******



  FTABLE    300
 rows cols                               ***
   13    4
     depth      area    volume  outflow1 ***
        0.       10.        0.        0.
      1.65       10.      1.60       58.
      3.29       10.      1.81      189.
      4.94       10.      3.79      352.
      6.58       10.      6.25      561.
      8.23       10.      9.54      813.
      9.87       10.     14.48     1155.
     11.52       10.     21.89     2093.
     13.17       10.     31.76     4020.
     14.81       10.      44.1     7175.
     16.46       10.     59.74    12080.
      18.1       10.     76.19    13290.
      20.1       10.    276.19    26580.
  END FTABLE300
END FTABLES

COPY
  TIMESERIES
  Copy-opn***
*** x -  x  NPT  NMN
    1    2    0    7
  END TIMESERIES

END COPY

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name>   x <Name> x tem strg<-factor->strg <Name>   x   x        <Name> x x ***
*** Met Seg LITTLE,PI:PETINP=0.7
WDM2   106 PREC     ENGL            SAME PERLND  11 367 EXTNL  PREC
WDM2   113 PEVT     ENGL         0.7DIV  PERLND  11 367 EXTNL  PETINP
*** Met Seg LITTLE,PI:PETINP=0.7
WDM2   106 PREC     ENGL            SAME IMPLND  11 361 EXTNL  PREC
WDM2   113 PEVT     ENGL         0.7DIV  IMPLND  11 361 EXTNL  PETINP
*** Met Seg LITTLE,PI:PETINP=0.7
WDM2   106 PREC     ENGL            SAME RCHRES   1 300 EXTNL  PREC
WDM2   113 PEVT     ENGL         0.7DIV  RCHRES   1 300 EXTNL  POTEV

*** Irrigation (using fractions from INTB PERLNDs 573 - 613)
*** INTB PERLND 613 --> PERLNDs 12-142
WDM2     1 IRRIG    ENGL       0.90506DIV  PERLND  12     EXTNL  SURLI
WDM2     1 IRRIG    ENGL       0.09494DIV  PERLND  12     EXTNL  IRRINP
WDM2     2 IRRIG    ENGL       0.90506DIV  PERLND  22     EXTNL  SURLI
WDM2     2 IRRIG    ENGL       0.09494DIV  PERLND  22     EXTNL  IRRINP
WDM2     3 IRRIG    ENGL       0.90506DIV  PERLND  32     EXTNL  SURLI
WDM2     3 IRRIG    ENGL       0.09494DIV  PERLND  32     EXTNL  IRRINP
WDM2     4 IRRIG    ENGL       0.90506DIV  PERLND  42     EXTNL  SURLI
WDM2     4 IRRIG    ENGL       0.09494DIV  PERLND  42     EXTNL  IRRINP
WDM2     5 IRRIG    ENGL       0.90506DIV  PERLND  52     EXTNL  SURLI
WDM2     5 IRRIG    ENGL       0.09494DIV  PERLND  52     EXTNL  IRRINP
WDM2     6 IRRIG    ENGL       0.90506DIV  PERLND  62     EXTNL  SURLI
WDM2     6 IRRIG    ENGL       0.09494DIV  PERLND  62     EXTNL  IRRINP
WDM2     7 IRRIG    ENGL       0.90506DIV  PERLND  72     EXTNL  SURLI
WDM2     7 IRRIG    ENGL       0.09494DIV  PERLND  72     EXTNL  IRRINP
WDM2     8 IRRIG    ENGL       0.90506DIV  PERLND  82     EXTNL  SURLI
WDM2     8 IRRIG    ENGL       0.09494DIV  PERLND  82     EXTNL  IRRINP
***WDM2     9 IRRIG    ENGL       0.90506DIV  PERLND  92     EXTNL  SURLI
***WDM2     9 IRRIG    ENGL       0.09494DIV  PERLND  92     EXTNL  IRRINP
WDM2    10 IRRIG    ENGL       0.90506DIV  PERLND 102     EXTNL  SURLI
WDM2    10 IRRIG    ENGL       0.09494DIV  PERLND 102     EXTNL  IRRINP
WDM2    11 IRRIG    ENGL       0.90506DIV  PERLND 112     EXTNL  SURLI
WDM2    11 IRRIG    ENGL       0.09494DIV  PERLND 112     EXTNL  IRRINP
***WDM2    12 IRRIG    ENGL       0.90506DIV  PERLND 122     EXTNL  SURLI
***WDM2    12 IRRIG    ENGL       0.09494DIV  PERLND 122     EXTNL  IRRINP
WDM2    13 IRRIG    ENGL       0.90506DIV  PERLND 132     EXTNL  SURLI
WDM2    13 IRRIG    ENGL       0.09494DIV  PERLND 132     EXTNL  IRRINP
WDM2    14 IRRIG    ENGL       0.90506DIV  PERLND 142     EXTNL  SURLI
WDM2    14 IRRIG    ENGL       0.09494DIV  PERLND 142     EXTNL  IRRINP
*** INTB PERLND 573 --> PERLND 212
WDM2    21 IRRIG    ENGL       0.95455DIV  PERLND 212     EXTNL  SURLI
WDM2    21 IRRIG    ENGL       0.04545DIV  PERLND 212     EXTNL  IRRINP
*** INTB PERLND 593 --> PERLND 222
WDM2    22 IRRIG    ENGL       0.81609DIV  PERLND 222     EXTNL  SURLI
WDM2    22 IRRIG    ENGL       0.18391DIV  PERLND 222     EXTNL  IRRINP
*** INTB PERLND 583 --> PERLNDs 232-272,292,352,362
WDM2    23 IRRIG    ENGL       0.82353DIV  PERLND 232     EXTNL  SURLI
WDM2    23 IRRIG    ENGL       0.17647DIV  PERLND 232     EXTNL  IRRINP
WDM2    24 IRRIG    ENGL       0.82353DIV  PERLND 242     EXTNL  SURLI
WDM2    24 IRRIG    ENGL       0.17647DIV  PERLND 242     EXTNL  IRRINP
WDM2    25 IRRIG    ENGL       0.82353DIV  PERLND 252     EXTNL  SURLI
WDM2    25 IRRIG    ENGL       0.17647DIV  PERLND 252     EXTNL  IRRINP
WDM2    26 IRRIG    ENGL       0.82353DIV  PERLND 262     EXTNL  SURLI
WDM2    26 IRRIG    ENGL       0.17647DIV  PERLND 262     EXTNL  IRRINP
WDM2    27 IRRIG    ENGL       0.82353DIV  PERLND 272     EXTNL  SURLI
WDM2    27 IRRIG    ENGL       0.17647DIV  PERLND 272     EXTNL  IRRINP
WDM2    29 IRRIG    ENGL       0.82353DIV  PERLND 292     EXTNL  SURLI
WDM2    29 IRRIG    ENGL       0.17647DIV  PERLND 292     EXTNL  IRRINP
WDM2    35 IRRIG    ENGL       0.82353DIV  PERLND 352     EXTNL  SURLI
WDM2    35 IRRIG    ENGL       0.17647DIV  PERLND 352     EXTNL  IRRINP
WDM2    36 IRRIG    ENGL       0.82353DIV  PERLND 362     EXTNL  SURLI
WDM2    36 IRRIG    ENGL       0.17647DIV  PERLND 362     EXTNL  IRRINP
*** INTB PERLND 603 --> PERLNDs 282,302-332
WDM2    28 IRRIG    ENGL       1.00000DIV  PERLND 282     EXTNL  SURLI
WDM2    28 IRRIG    ENGL       0.00000DIV  PERLND 282     EXTNL  IRRINP
WDM2    30 IRRIG    ENGL       1.00000DIV  PERLND 302     EXTNL  SURLI
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WDM2    30 IRRIG    ENGL       0.00000DIV  PERLND 302      EXTNL  IRRINP
WDM2    31 IRRIG    ENGL       1.00000DIV  PERLND 312      EXTNL  SURLI
WDM2    31 IRRIG    ENGL       0.00000DIV  PERLND 312      EXTNL  IRRINP
WDM2    32 IRRIG    ENGL       1.00000DIV  PERLND 322      EXTNL  SURLI
WDM2    32 IRRIG    ENGL       0.00000DIV  PERLND 322      EXTNL  IRRINP
WDM2    33 IRRIG    ENGL       1.00000DIV  PERLND 332      EXTNL  SURLI
WDM2    33 IRRIG    ENGL       0.00000DIV  PERLND 332      EXTNL  IRRINP

*** Withdrawal from RCH205 for nearby reservoir - mfact converts MGD to cfs
WDM2   206 OFLOW    ENGL       1.5477 SAME RCHRES 205      EXTNL  OUTDGT 2

END EXT SOURCES

SCHEMATIC
<-Volume->                  <--Area-->     <-Volume->  <ML#> ***       <sb>
<Name>   x                  <-factor->     <Name>   x        ***        x x
PERLND  11                      307.21     RCHRES   1      2
PERLND  12                      594.55     RCHRES   1      2
PERLND  13                      329.72     RCHRES   1      2
PERLND  14                       115.1     RCHRES   1      2
PERLND  17                      437.16     RCHRES   1      2
IMPLND  11                        52.1     RCHRES   1      1
PERLND  21                     1249.92     RCHRES   2      2
PERLND  22                      847.81     RCHRES   2      2
PERLND  23                     1147.33     RCHRES   2      2
PERLND  24                       293.8     RCHRES   2      2
PERLND  27                      107.03     RCHRES   2      2
IMPLND  21                      298.93     RCHRES   2      1
PERLND  31                       135.2     RCHRES   3      2
PERLND  32                      248.48     RCHRES   3      2
PERLND  33                      284.22     RCHRES   3      2
PERLND  34                      172.81     RCHRES   3      2
PERLND  37                        3.32     RCHRES   3      2
IMPLND  31                        31.3     RCHRES   3      1
PERLND  41                      105.46     RCHRES   4      2
PERLND  42                     1091.75     RCHRES   4      2
PERLND  43                      925.41     RCHRES   4      2
PERLND  44                      112.31     RCHRES   4      2
IMPLND  41                       14.65     RCHRES   4      1
PERLND  51                      742.91     RCHRES   5      2
PERLND  52                     4638.65     RCHRES   5      2
PERLND  53                     4587.15     RCHRES   5      2
PERLND  54                     1149.41     RCHRES   5      2
PERLND  57                       26.04     RCHRES   5      2
IMPLND  51                      135.24     RCHRES   5      1
PERLND  61                      220.74     RCHRES   6      2
PERLND  62                       37.75     RCHRES   6      2
PERLND  63                      109.08     RCHRES   6      2
PERLND  64                       65.46     RCHRES   6      2
PERLND  67                       63.75     RCHRES   6      2
IMPLND  61                       30.67     RCHRES   6      1
PERLND  71                      364.54     RCHRES   7      2
PERLND  72                      273.96     RCHRES   7      2
PERLND  73                      477.61     RCHRES   7      2
PERLND  74                      162.46     RCHRES   7      2
PERLND  77                       20.19     RCHRES   7      2
IMPLND  71                          90     RCHRES   7      1
PERLND  81                       257.9     RCHRES   8      2
PERLND  82                      274.73     RCHRES   8      2
PERLND  83                      311.94     RCHRES   8      2
PERLND  84                      135.22     RCHRES   8      2
PERLND  87                      224.69     RCHRES   8      2
IMPLND  81                       23.04     RCHRES   8      1
PERLND  91                      193.09     RCHRES   9      2
PERLND  92                       26.79     RCHRES   9      2
PERLND  93                      142.81     RCHRES   9      2
PERLND  94                       33.25     RCHRES   9      2
IMPLND  91                       41.24     RCHRES   9      1
PERLND 101                      236.96     RCHRES  10      2
PERLND 102                      316.84     RCHRES  10      2
PERLND 103                      505.05     RCHRES  10      2
PERLND 104                      486.54     RCHRES  10      2
PERLND 107                       51.54     RCHRES  10      2
IMPLND 101                       45.47     RCHRES  10      1
PERLND 111                      324.36     RCHRES  11      2
PERLND 112                      554.98     RCHRES  11      2
PERLND 113                     1604.02     RCHRES  11      2
PERLND 114                      847.66     RCHRES  11      2
PERLND 117                       19.83     RCHRES  11      2
IMPLND 111                       39.27     RCHRES  11      1
PERLND 121                       52.38     RCHRES  12      2
PERLND 122                       14.67     RCHRES  12      2
PERLND 123                      276.49     RCHRES  12      2
PERLND 124                      662.84     RCHRES  12      2
PERLND 127                       12.67     RCHRES  12      2
IMPLND 121                        9.39     RCHRES  12      1
PERLND 131                     2056.83     RCHRES  13      2
PERLND 132                     1261.84     RCHRES  13      2
PERLND 133                     1256.77     RCHRES  13      2
PERLND 134                       484.5     RCHRES  13      2
PERLND 137                         2.5     RCHRES  13      2
IMPLND 131                      689.27     RCHRES  13      1
PERLND 141                      264.14     RCHRES  14      2
PERLND 142                       51.21     RCHRES  14      2
PERLND 143                      358.73     RCHRES  14      2
PERLND 144                      307.11     RCHRES  14      2
IMPLND 141                       22.66     RCHRES  14      1
PERLND 211                       60.49     RCHRES  21      2
PERLND 212                     1533.54     RCHRES  21      2
PERLND 213                     7314.26     RCHRES  21      2
PERLND 214                      827.74     RCHRES  21      2
PERLND 217                     3728.16     RCHRES  21      2
IMPLND 211                       10.93     RCHRES  21      1
PERLND 221                      137.01     RCHRES  22      2
PERLND 222                     6574.59     RCHRES  22      2
PERLND 223                     8549.38     RCHRES  22      2
PERLND 224                     3410.99     RCHRES  22      2
PERLND 227                       99.39     RCHRES  22      2
IMPLND 221                       19.57     RCHRES  22      1
PERLND 231                       13.77     RCHRES  23      2
PERLND 232                      332.61     RCHRES  23      2
PERLND 233                     2411.68     RCHRES  23      2
PERLND 234                      361.14     RCHRES  23      2
PERLND 237                       20.31     RCHRES  23      2
IMPLND 231                        0.72     RCHRES  23      1
PERLND 241                      110.07     RCHRES  24      2
PERLND 242                     1895.11     RCHRES  24      2
PERLND 243                     2126.64     RCHRES  24      2
PERLND 244                      313.55     RCHRES  24      2
PERLND 247                       85.97     RCHRES  24      2
IMPLND 241                        5.79     RCHRES  24      1
PERLND 251                      182.83     RCHRES  25      2
PERLND 252                     3213.86     RCHRES  25      2
PERLND 253                     1795.68     RCHRES  25      2
PERLND 254                      112.37     RCHRES  25      2
PERLND 257                       77.87     RCHRES  25      2
IMPLND 251                       22.37     RCHRES  25      1
PERLND 261                       86.54     RCHRES  26      2
PERLND 262                     1651.06     RCHRES  26      2
PERLND 263                     7410.22     RCHRES  26      2
PERLND 264                      527.96     RCHRES  26      2
PERLND 267                      186.06     RCHRES  26      2
IMPLND 261                        4.55     RCHRES  26      1
PERLND 271                        0.28     RCHRES  27      2
PERLND 272                      301.99     RCHRES  27      2
PERLND 273                      735.53     RCHRES  27      2
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PERLND 274	174.34	RCHRES 27	2
IMPLND 271	0.15	RCHRES 27	1
PERLND 281	130.17	RCHRES 28	2
PERLND 282	611.28	RCHRES 28	2
PERLND 283	621.45	RCHRES 28	2
PERLND 284	309.7	RCHRES 28	2
IMPLND 281	25.72	RCHRES 28	1
PERLND 292	490.68	RCHRES 29	2
PERLND 293	1633.75	RCHRES 29	2
PERLND 294	154.42	RCHRES 29	2
PERLND 297	95.33	RCHRES 29	2
PERLND 301	28.88	RCHRES 30	2
PERLND 302	780.39	RCHRES 30	2
PERLND 303	439.38	RCHRES 30	2
PERLND 304	28.32	RCHRES 30	2
IMPLND 301	13.04	RCHRES 30	1
PERLND 311	636.28	RCHRES 31	2
PERLND 312	1442.12	RCHRES 31	2
PERLND 313	1200.95	RCHRES 31	2
PERLND 314	713.6	RCHRES 31	2
PERLND 317	194.5	RCHRES 31	2
IMPLND 311	89.24	RCHRES 31	1
PERLND 331	171.67	RCHRES 33	2
PERLND 332	712.74	RCHRES 33	2
PERLND 333	1453.77	RCHRES 33	2
PERLND 334	1121.97	RCHRES 33	2
PERLND 337	59.99	RCHRES 33	2
IMPLND 331	46.18	RCHRES 33	1
PERLND 341	9.21	RCHRES 34	2
PERLND 342	528.48	RCHRES 34	2
PERLND 343	376.21	RCHRES 34	2
PERLND 344	151.12	RCHRES 34	2
PERLND 347	36.85	RCHRES 34	2
IMPLND 341	11.4	RCHRES 34	1
PERLND 351	2.99	RCHRES 35	2
PERLND 352	796.26	RCHRES 35	2
PERLND 353	904.95	RCHRES 35	2
PERLND 354	131.73	RCHRES 35	2
IMPLND 351	0.16	RCHRES 35	1
PERLND 361	124.83	RCHRES 36	2
PERLND 362	1115.47	RCHRES 36	2
PERLND 363	2960.7	RCHRES 36	2
PERLND 364	476.33	RCHRES 36	2
PERLND 367	124.72	RCHRES 36	2
IMPLND 361	13.72	RCHRES 36	1
RCHRES 22		RCHRES 206	3
RCHRES 23		RCHRES 206	3
RCHRES 21		RCHRES 208	3
RCHRES 24		RCHRES 208	3
RCHRES 26		RCHRES 208	3
RCHRES 36		RCHRES 208	3
RCHRES 25		RCHRES 207	3
RCHRES 27		RCHRES 207	3
RCHRES 29		RCHRES 207	3
RCHRES 35		RCHRES 207	3
RCHRES 208		RCHRES 207	3
RCHRES 28		RCHRES 205	3
RCHRES 30		RCHRES 205	3
RCHRES 33		RCHRES 205	3
RCHRES 34		RCHRES 205	3
RCHRES 206		RCHRES 205	3
RCHRES 207		RCHRES 205	3
RCHRES 31		RCHRES 300	3
RCHRES 205		RCHRES 300	4
RCHRES 12		RCHRES 204	3
RCHRES 13		RCHRES 204	3
RCHRES 14		RCHRES 204	3
RCHRES 300		RCHRES 204	3

RCHRES 8		RCHRES 203	3
RCHRES 9		RCHRES 203	3
RCHRES 10		RCHRES 203	3
RCHRES 11		RCHRES 203	3
RCHRES 204		RCHRES 203	3
RCHRES 4		RCHRES 202	3
RCHRES 6		RCHRES 202	3
RCHRES 7		RCHRES 202	3
RCHRES 203		RCHRES 202	3
RCHRES 1		RCHRES 201	3
RCHRES 2		RCHRES 201	3
RCHRES 3		RCHRES 201	3
RCHRES 5		RCHRES 201	3
RCHRES 202		RCHRES 201	3
PERLND 211	60.49	COPY 1	90
PERLND 212	1533.54	COPY 1	90
PERLND 213	7314.26	COPY 1	90
PERLND 214	827.74	COPY 1	90
PERLND 217	3728.16	COPY 1	90
IMPLND 211	10.93	COPY 1	91
PERLND 311	636.28	COPY 2	90
PERLND 312	1442.12	COPY 2	90
PERLND 313	1200.95	COPY 2	90
PERLND 314	713.6	COPY 2	90
PERLND 317	194.5	COPY 2	90
IMPLND 311	89.24	COPY 2	91
PERLND 281	130.17	COPY 2	90
PERLND 282	611.28	COPY 2	90
PERLND 283	621.45	COPY 2	90
PERLND 284	309.7	COPY 2	90
IMPLND 281	25.72	COPY 2	91
PERLND 301	28.88	COPY 2	90
PERLND 302	780.39	COPY 2	90
PERLND 303	439.38	COPY 2	90
PERLND 304	28.32	COPY 2	90
IMPLND 301	13.04	COPY 2	91
PERLND 331	171.67	COPY 2	90
PERLND 332	712.74	COPY 2	90
PERLND 333	1453.77	COPY 2	90
PERLND 334	1121.97	COPY 2	90
PERLND 337	59.99	COPY 2	90
IMPLND 331	46.18	COPY 2	91
PERLND 341	9.21	COPY 2	90
PERLND 342	528.48	COPY 2	90
PERLND 343	376.21	COPY 2	90
PERLND 344	151.12	COPY 2	90
PERLND 347	36.85	COPY 2	90
IMPLND 341	11.4	COPY 2	91
PERLND 221	137.01	COPY 2	90
PERLND 222	6574.59	COPY 2	90
PERLND 223	8549.38	COPY 2	90
PERLND 224	3410.99	COPY 2	90
PERLND 227	99.39	COPY 2	90
IMPLND 221	19.57	COPY 2	91
PERLND 231	13.77	COPY 2	90
PERLND 232	332.61	COPY 2	90
PERLND 233	2411.68	COPY 2	90
PERLND 234	361.14	COPY 2	90
PERLND 237	20.31	COPY 2	90
IMPLND 231	0.72	COPY 2	91
PERLND 251	182.83	COPY 2	90
PERLND 252	3213.86	COPY 2	90
PERLND 253	1795.68	COPY 2	90
PERLND 254	112.37	COPY 2	90
PERLND 257	77.87	COPY 2	90
IMPLND 251	22.37	COPY 2	91
PERLND 271	0.28	COPY 2	90
PERLND 272	301.99	COPY 2	90

```
PERLND 273                        735.53     COPY     2      90
PERLND 274                        174.34     COPY     2      90
IMPLND 271                          0.15     COPY     2      91
PERLND 292                        490.68     COPY     2      90
PERLND 293                       1633.75     COPY     2      90
PERLND 294                        154.42     COPY     2      90
PERLND 297                         95.33     COPY     2      90
PERLND 351                          2.99     COPY     2      90
PERLND 352                        796.26     COPY     2      90
PERLND 353                        904.95     COPY     2      90
PERLND 354                        131.73     COPY     2      90
IMPLND 351                          0.16     COPY     2      91
PERLND 211                         60.49     COPY     2      90
PERLND 212                       1533.54     COPY     2      90
PERLND 213                       7314.26     COPY     2      90
PERLND 214                        827.74     COPY     2      90
PERLND 217                       3728.16     COPY     2      90
IMPLND 211                         10.93     COPY     2      91
PERLND 241                        110.07     COPY     2      90
PERLND 242                       1895.11     COPY     2      90
PERLND 243                       2126.64     COPY     2      90
PERLND 244                        313.55     COPY     2      90
PERLND 247                         85.97     COPY     2      90
IMPLND 241                          5.79     COPY     2      91
PERLND 261                         86.54     COPY     2      90
PERLND 262                       1651.06     COPY     2      90
PERLND 263                       7410.22     COPY     2      90
PERLND 264                        527.96     COPY     2      90
PERLND 267                        186.06     COPY     2      90
IMPLND 261                          4.55     COPY     2      91
PERLND 361                        124.83     COPY     2      90
PERLND 362                       1115.47     COPY     2      90
PERLND 363                        2960.7     COPY     2      90
PERLND 364                        476.33     COPY     2      90
PERLND 367                        124.72     COPY     2      90
IMPLND 361                         13.72     COPY     2      91
END SCHEMATIC

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd ***
<Name>   x        <Name> x x<-factor->strg <Name>   x <Name>qf  tem strg strg***
RCHRES   1 HYDR   RO     1 1          AVER WDM1  2001 FLOW   1 ENGL AGGR REPL
RCHRES   2 HYDR   RO     1 1          AVER WDM1  2002 FLOW   1 ENGL AGGR REPL
RCHRES   3 HYDR   RO     1 1          AVER WDM1  2003 FLOW   1 ENGL AGGR REPL
RCHRES   4 HYDR   RO     1 1          AVER WDM1  2004 FLOW   1 ENGL AGGR REPL
RCHRES   5 HYDR   RO     1 1          AVER WDM1  2005 FLOW   1 ENGL AGGR REPL
RCHRES   6 HYDR   RO     1 1          AVER WDM1  2006 FLOW   1 ENGL AGGR REPL
RCHRES   7 HYDR   RO     1 1          AVER WDM1  2007 FLOW   1 ENGL AGGR REPL
RCHRES   8 HYDR   RO     1 1          AVER WDM1  2008 FLOW   1 ENGL AGGR REPL
RCHRES   9 HYDR   RO     1 1          AVER WDM1  2009 FLOW   1 ENGL AGGR REPL
RCHRES  10 HYDR   RO     1 1          AVER WDM1  2010 FLOW   1 ENGL AGGR REPL
RCHRES  11 HYDR   RO     1 1          AVER WDM1  2011 FLOW   1 ENGL AGGR REPL
RCHRES  12 HYDR   RO     1 1          AVER WDM1  2012 FLOW   1 ENGL AGGR REPL
RCHRES  13 HYDR   RO     1 1          AVER WDM1  2013 FLOW   1 ENGL AGGR REPL
RCHRES  14 HYDR   RO     1 1          AVER WDM1  2014 FLOW   1 ENGL AGGR REPL
RCHRES  21 HYDR   RO     1 1          AVER WDM1  2021 FLOW   1 ENGL AGGR REPL
*** commented out area term is sum of PERLND,IMPLND,RCHRES areas (16006 ac)
*** RCHRES  21 ROFLOW ROVOL  1 1 7.4967e-4     WDM    501 SIMQ   1 ENGL AGGR REPL
*** this area term is reported by the USGS gage as 20096 ac
RCHRES  21 ROFLOW ROVOL  1 1 5.9713e-4     WDM    2501 SIMQ   1 ENGL AGGR REPL
RCHRES  22 HYDR   RO     1 1          AVER WDM1  2022 FLOW   1 ENGL AGGR REPL
RCHRES  23 HYDR   RO     1 1          AVER WDM1  2023 FLOW   1 ENGL AGGR REPL
RCHRES  24 HYDR   RO     1 1          AVER WDM1  2024 FLOW   1 ENGL AGGR REPL
RCHRES  25 HYDR   RO     1 1          AVER WDM1  2025 FLOW   1 ENGL AGGR REPL
RCHRES  26 HYDR   RO     1 1          AVER WDM1  2026 FLOW   1 ENGL AGGR REPL
RCHRES  27 HYDR   RO     1 1          AVER WDM1  2027 FLOW   1 ENGL AGGR REPL
RCHRES  28 HYDR   RO     1 1          AVER WDM1  2028 FLOW   1 ENGL AGGR REPL
RCHRES  29 HYDR   RO     1 1          AVER WDM1  2029 FLOW   1 ENGL AGGR REPL
```

```
RCHRES  30 HYDR   RO     1 1          AVER WDM1  2030 FLOW   1 ENGL AGGR REPL
RCHRES  31 HYDR   RO     1 1          AVER WDM1  2031 FLOW   1 ENGL AGGR REPL
RCHRES  33 HYDR   RO     1 1          AVER WDM1  2033 FLOW   1 ENGL AGGR REPL
RCHRES  34 HYDR   RO     1 1          AVER WDM1  2034 FLOW   1 ENGL AGGR REPL
RCHRES  35 HYDR   RO     1 1          AVER WDM1  2035 FLOW   1 ENGL AGGR REPL
RCHRES  36 HYDR   RO     1 1          AVER WDM1  2036 FLOW   1 ENGL AGGR REPL
RCHRES 206 HYDR   RO     1 1          AVER WDM1  2206 FLOW   1 ENGL AGGR REPL
RCHRES 208 HYDR   RO     1 1          AVER WDM1  2208 FLOW   1 ENGL AGGR REPL
RCHRES 207 HYDR   RO     1 1          AVER WDM1  2207 FLOW   1 ENGL AGGR REPL
RCHRES 205 HYDR   RO     1 1          AVER WDM1  2205 FLOW   1 ENGL AGGR REPL
*** commented out area term is sum of PERLND,IMPLND,RCHRES areas (93448.6 ac)
*** RCHRES 300 ROFLOW ROVOL  1 1 1.2841e-4     WDM   2511 SIMQ   1 ENGL AGGR REPL
*** this area term is reported by the USGS gage as 95360 ac
RCHRES 300 ROFLOW ROVOL  1 1 1.2584e-4     WDM   2511 SIMQ   1 ENGL AGGR REPL
RCHRES 300 HYDR   RO     1 1          AVER WDM1  2300 FLOW   1 ENGL AGGR REPL
RCHRES 204 HYDR   RO     1 1          AVER WDM1  2204 FLOW   1 ENGL AGGR REPL
RCHRES 203 HYDR   RO     1 1          AVER WDM1  2203 FLOW   1 ENGL AGGR REPL
RCHRES 202 HYDR   RO     1 1          AVER WDM1  2202 FLOW   1 ENGL AGGR REPL
RCHRES 201 HYDR   RO     1 1          AVER WDM1  2201 FLOW   1 ENGL AGGR REPL
*** these area terms are based on the sum of the PERLND and IMPLND areas (13475
ac)
COPY     1 OUTPUT MEAN   1 1 7.4211e-5     WDM   2502 SURO   1 ENGL AGGR REPL
COPY     1 OUTPUT MEAN   2 1 7.4211e-5     WDM   2503 IFWO   1 ENGL AGGR REPL
COPY     1 OUTPUT MEAN   3 1 7.4211e-5     WDM   2504 AGWO   1 ENGL AGGR REPL
COPY     1 OUTPUT MEAN   4 1 7.4211e-5     WDM   2505 PETX   1 ENGL AGGR REPL
COPY     1 OUTPUT MEAN   5 1 7.4211e-5     WDM   2506 SAET   1 ENGL AGGR REPL
COPY     1 OUTPUT MEAN   6 1 7.4211e-5AVER WDM   2507 UZSX   1 ENGL AGGR REPL
COPY     1 OUTPUT MEAN   7 1 7.4211e-5AVER WDM   2508 LZSX   1 ENGL AGGR REPL
*** these area terms are based on the sum of the PERLND and IMPLND areas (77397.7
ac)
COPY     2 OUTPUT MEAN   1 1 1.292E-05     WDM   2512 SURO   1 ENGL AGGR REPL
COPY     2 OUTPUT MEAN   2 1 1.292E-05     WDM   2513 IFWO   1 ENGL AGGR REPL
COPY     2 OUTPUT MEAN   3 1 1.292E-05     WDM   2514 AGWO   1 ENGL AGGR REPL
COPY     2 OUTPUT MEAN   4 1 1.292E-05     WDM   2515 PETX   1 ENGL AGGR REPL
COPY     2 OUTPUT MEAN   5 1 1.292E-05     WDM   2516 SAET   1 ENGL AGGR REPL
COPY     2 OUTPUT MEAN   6 1 1.292E-05AVER WDM   2517 UZSX   1 ENGL AGGR REPL
COPY     2 OUTPUT MEAN   7 1 1.292E-05AVER WDM   2518 LZSX   1 ENGL AGGR REPL
RCHRES 206 HYDR   AVVEL  1 1          AVER WDM1  2306 AVEL   1 ENGL AGGR REPL
RCHRES 208 HYDR   AVVEL  1 1          AVER WDM1  2308 AVEL   1 ENGL AGGR REPL
RCHRES 207 HYDR   AVVEL  1 1          AVER WDM1  2307 AVEL   1 ENGL AGGR REPL
RCHRES 205 HYDR   AVVEL  1 1          AVER WDM1  2305 AVEL   1 ENGL AGGR REPL
RCHRES 300 HYDR   AVVEL  1 1          AVER WDM1  2400 AVEL   1 ENGL AGGR REPL
RCHRES  21 HYDR   AVVEL  1 1          AVER WDM1  2121 AVEL   1 ENGL AGGR REPL
RCHRES  22 HYDR   AVVEL  1 1          AVER WDM1  2122 AVEL   1 ENGL AGGR REPL
END EXT TARGETS

MASS-LINK

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->     <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->     <Name>                <Name> x x  ***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
PERLND     PWTGAS PODOXM                   RCHRES         INFLOW OXIF   1
PERLND     PWTGAS POHT                     RCHRES         INFLOW IHEAT  1
PERLND     PQUAL  POQUAL 1                 RCHRES         INFLOW IDQAL  1
PERLND     PEST   POPST  1                 RCHRES         INFLOW IDQAL  1
PERLND     PEST   SOSDPS 1                 RCHRES         INFLOW ISQAL  1 1
PERLND     PEST   SOSDPS 1                 RCHRES         INFLOW ISQAL  2 1
PERLND     PEST   SOSDPS 1                 RCHRES         INFLOW ISQAL  3 1
PERLND     SEDMNT SOSED  1        0.05     RCHRES         INFLOW ISED   1
PERLND     SEDMNT SOSED  1        0.55     RCHRES         INFLOW ISED   2
PERLND     SEDMNT SOSED  1         0.4     RCHRES         INFLOW ISED   3
  END MASS-LINK    2

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->     <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->     <Name>                <Name> x x  ***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
```

```
IMPLND     IWTGAS SODOXM                  RCHRES         INFLOW OXIF   1
IMPLND     IWTGAS SOHT                    RCHRES         INFLOW IHEAT  1
IMPLND     IQUAL  SOQUAL 1                RCHRES         INFLOW IDQAL  1
IMPLND     SOLIDS SOSLD  1         0.05   RCHRES         INFLOW ISED   1
IMPLND     SOLIDS SOSLD  1         0.55   RCHRES         INFLOW ISED   2
IMPLND     SOLIDS SOSLD  1          0.4   RCHRES         INFLOW ISED   3
  END MASS-LINK    1

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->    <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->    <Name>                <Name> x x  ***
RCHRES     ROFLOW                         RCHRES         INFLOW
  END MASS-LINK    3

  MASS-LINK        4
<-Volume-> <-Grp> <-Member-><--Mult-->    <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->    <Name>                <Name> x x  ***
RCHRES     OFLOW  OVOL   1                RCHRES         INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK       90
<-Volume-> <-Grp> <-Member-><--Mult-->    <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->    <Name>                <Name> x x  ***
PERLND     PWATER SURO                    COPY           INPUT  MEAN   1
PERLND     PWATER IFWO                    COPY           INPUT  MEAN   2
PERLND     PWATER AGWO                    COPY           INPUT  MEAN   3
PERLND     PWATER PET                     COPY           INPUT  MEAN   4
PERLND     PWATER TAET                    COPY           INPUT  MEAN   5
PERLND     PWATER UZS                     COPY           INPUT  MEAN   6
PERLND     PWATER LZS                     COPY           INPUT  MEAN   7
  END MASS-LINK   90

  MASS-LINK       91
<-Volume-> <-Grp> <-Member-><--Mult-->    <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->    <Name>                <Name> x x  ***
IMPLND     IWATER SURO                    COPY           INPUT  MEAN   1
IMPLND     IWATER PET                     COPY           INPUT  MEAN   4
IMPLND     IWATER IMPEV                   COPY           INPUT  MEAN   5
  END MASS-LINK   91
END MASS-LINK

END RUN
```

APPENDIX C Calibration/Verification Simulation Results

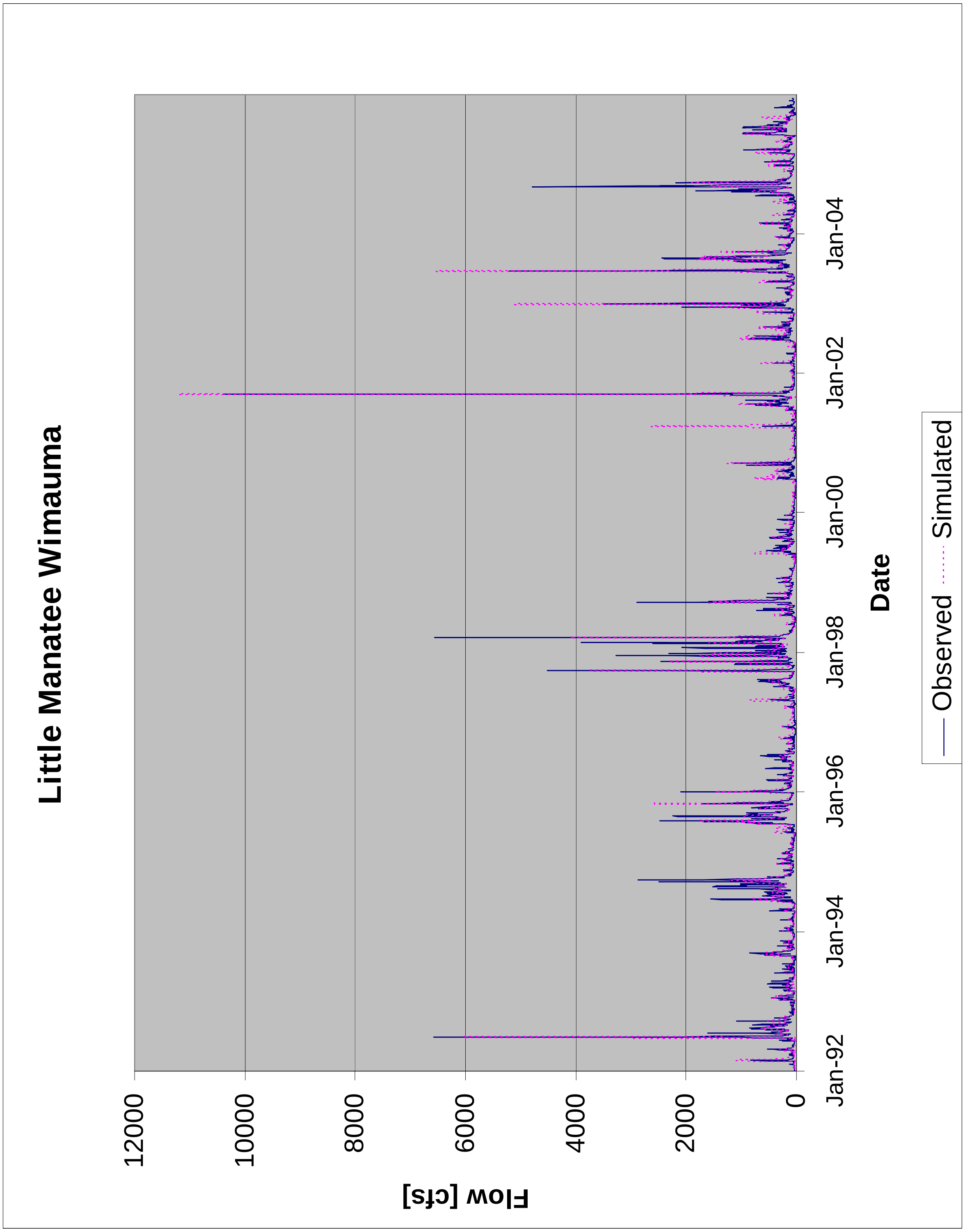


Figure 10 Little Manatee Wimauma Hydrograph

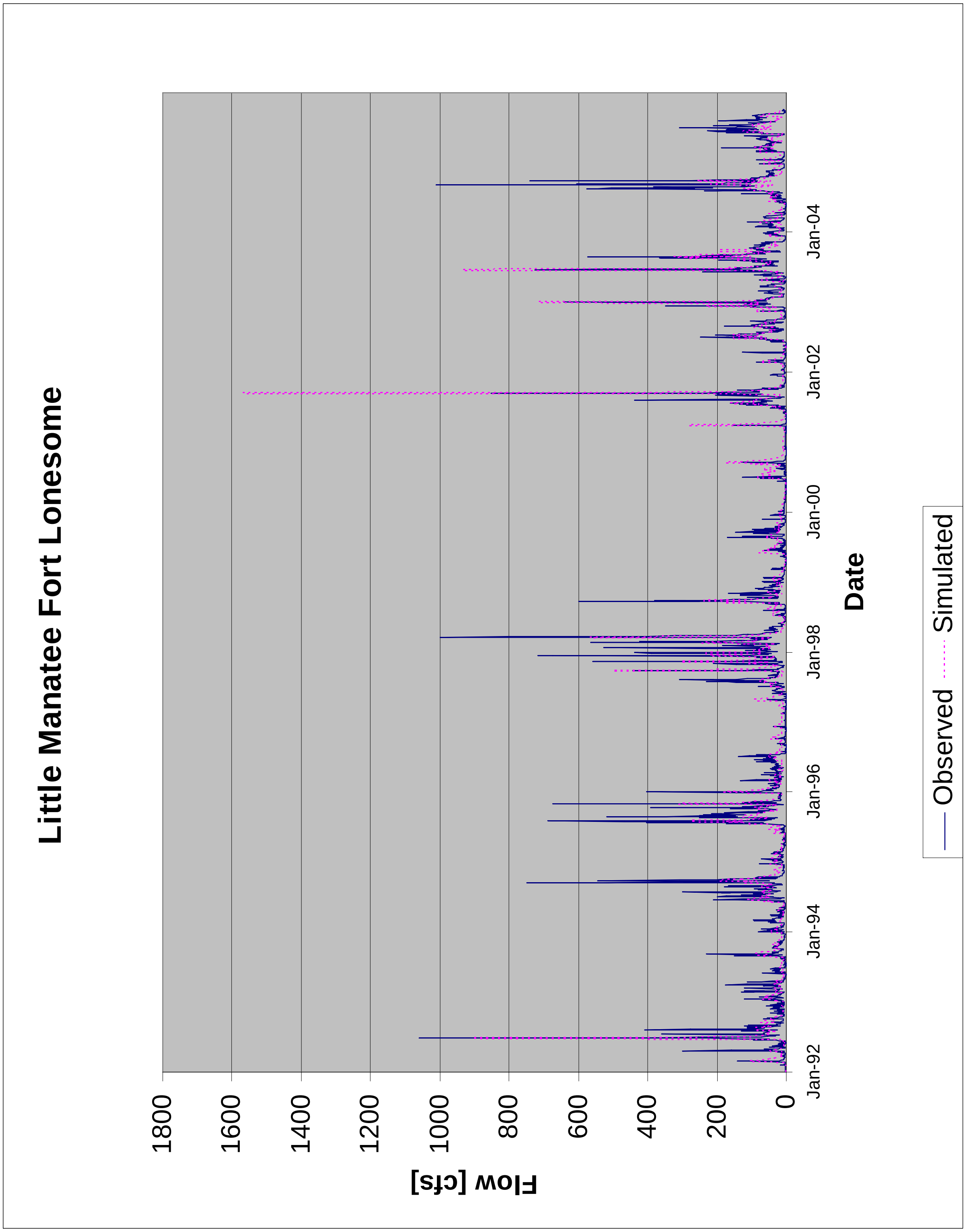


Figure 11 Little Manatee Fort Lonesome Hydrograph

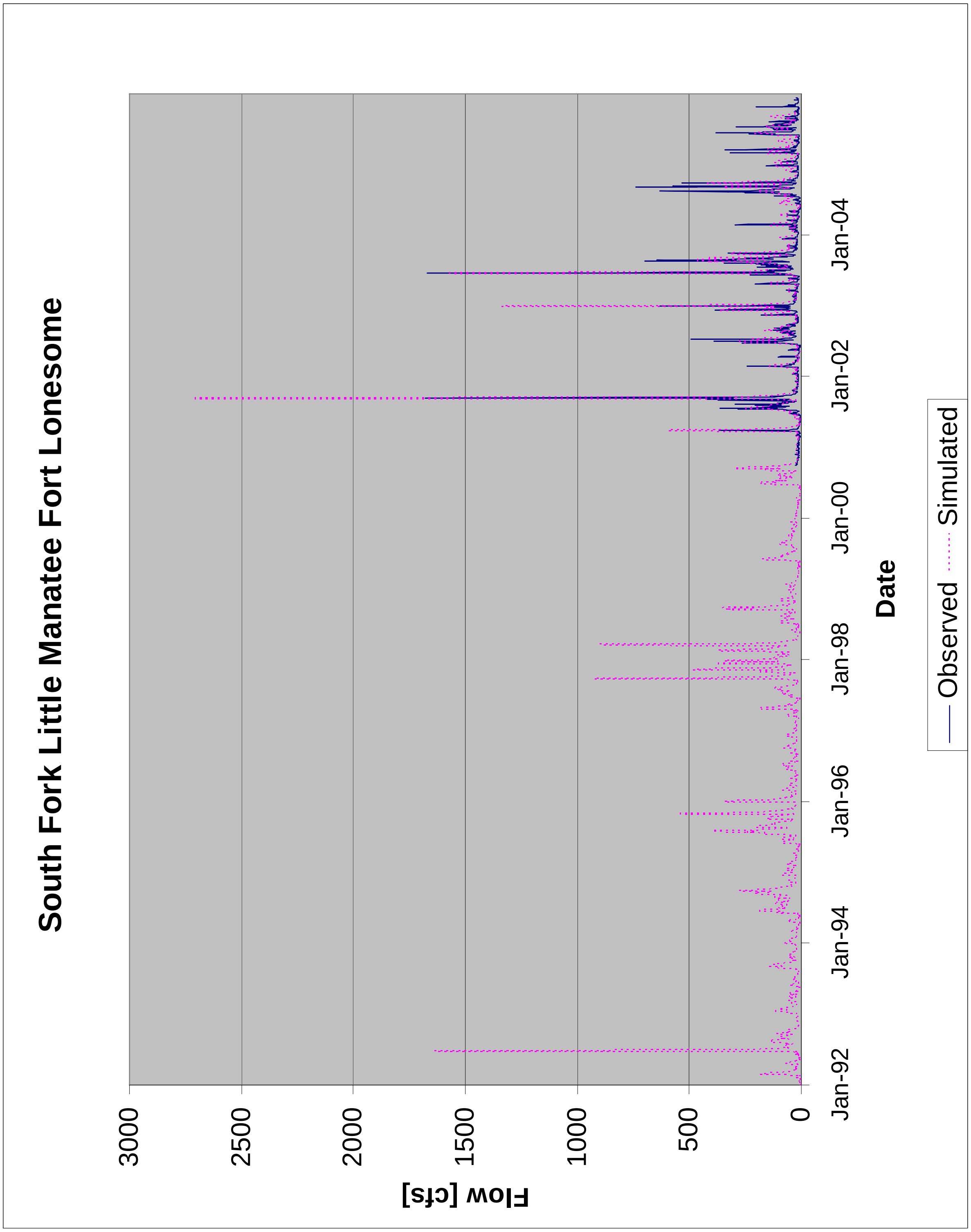


Figure 12 South Fork Little Manatee Fort Lonesome Hydrograph

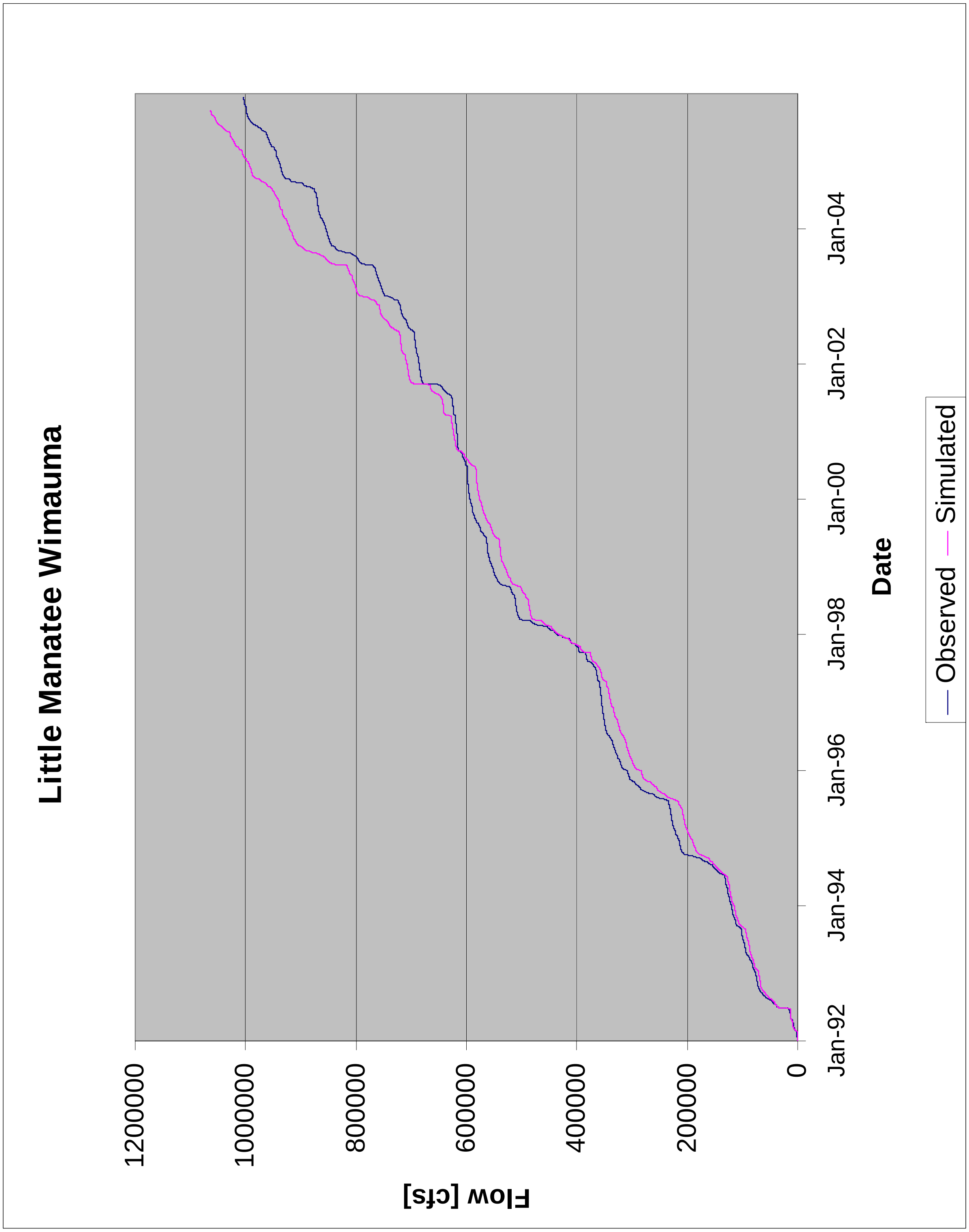


Figure 13 Little Manatee Wimauma Cumulative Hydrograph

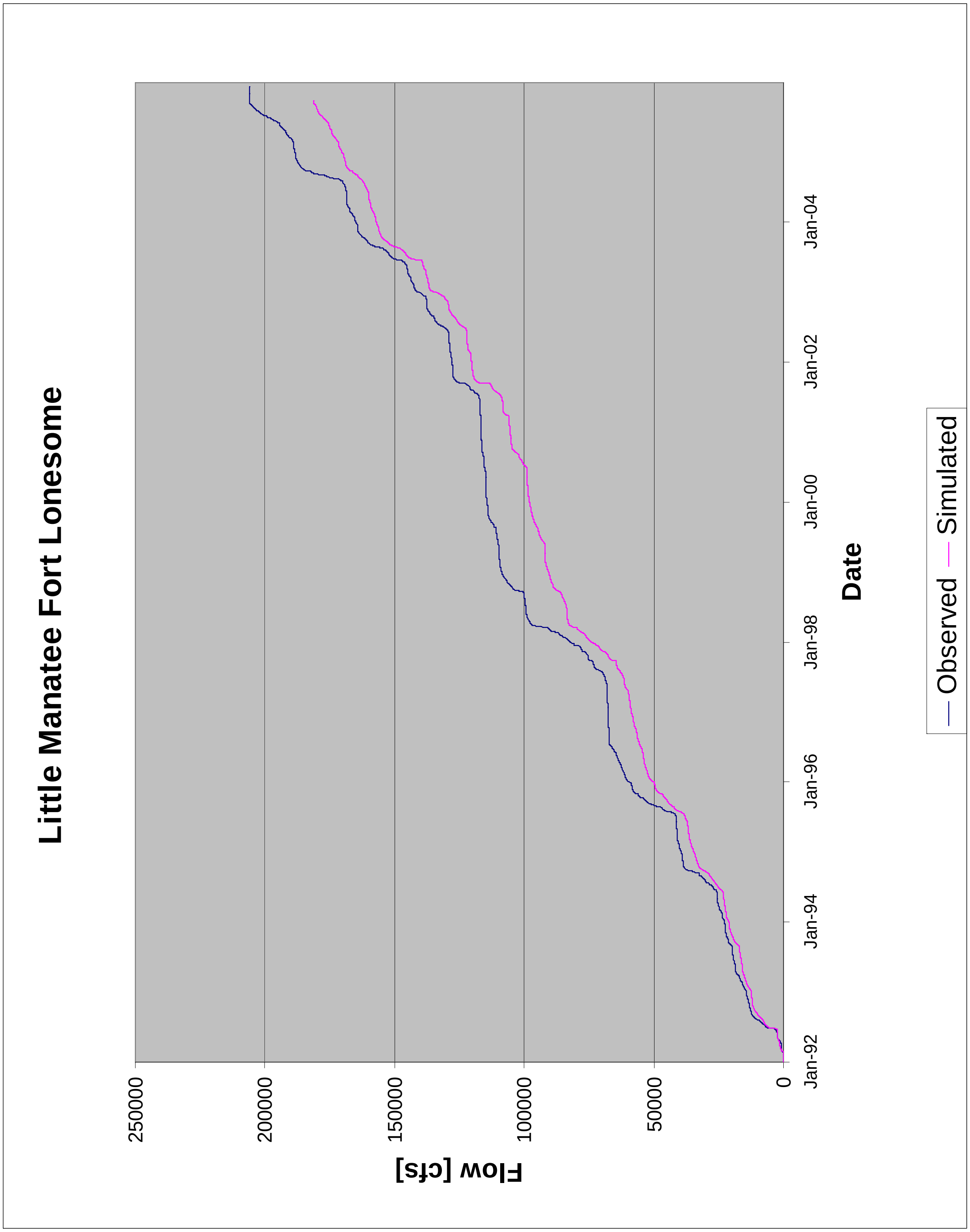


Figure 14 Little Manatee Fort Lonesome Cumulative Hydrograph

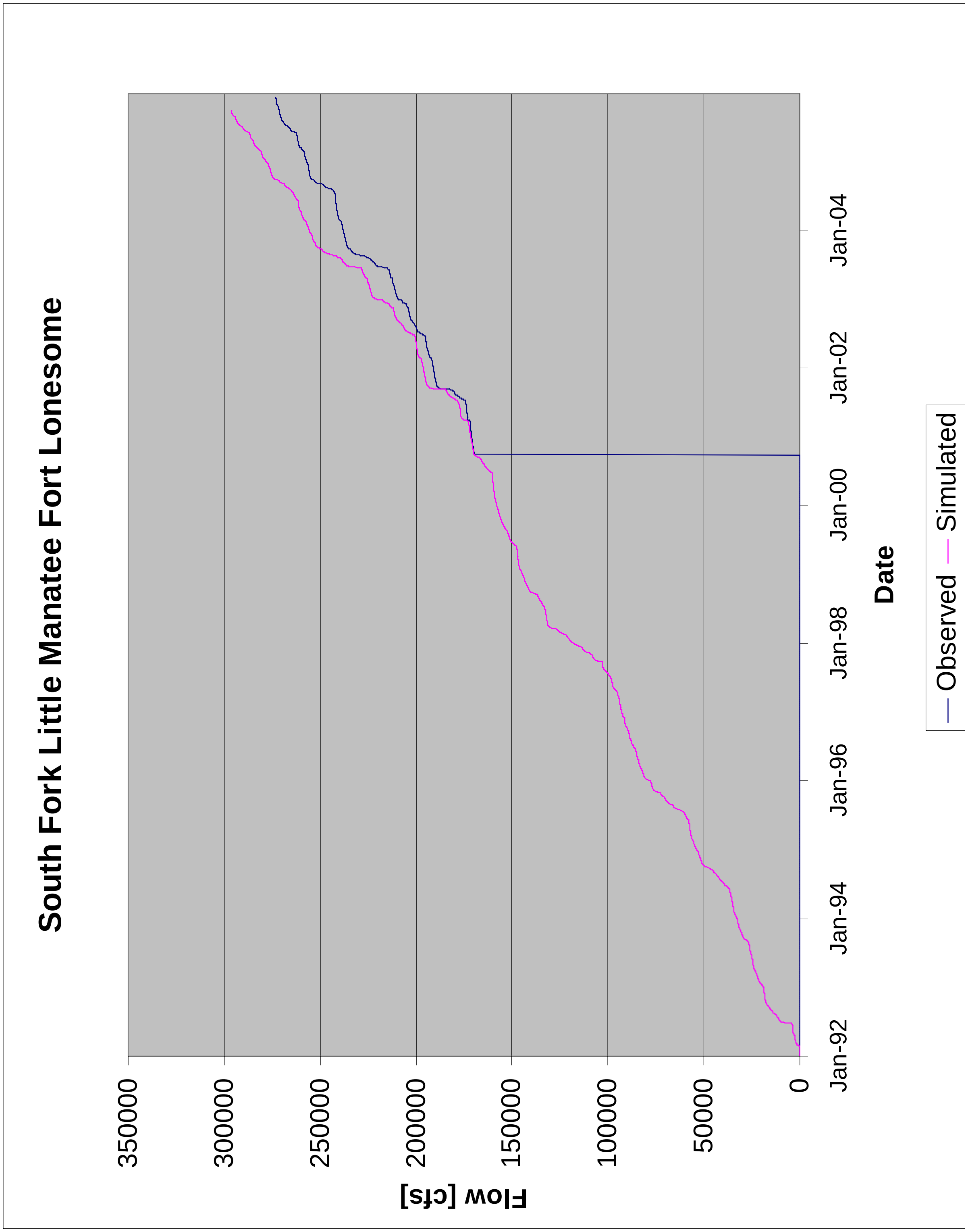


Figure 15 South Fork Little Manatee Fort Lonesome Cumulative Hydrograph

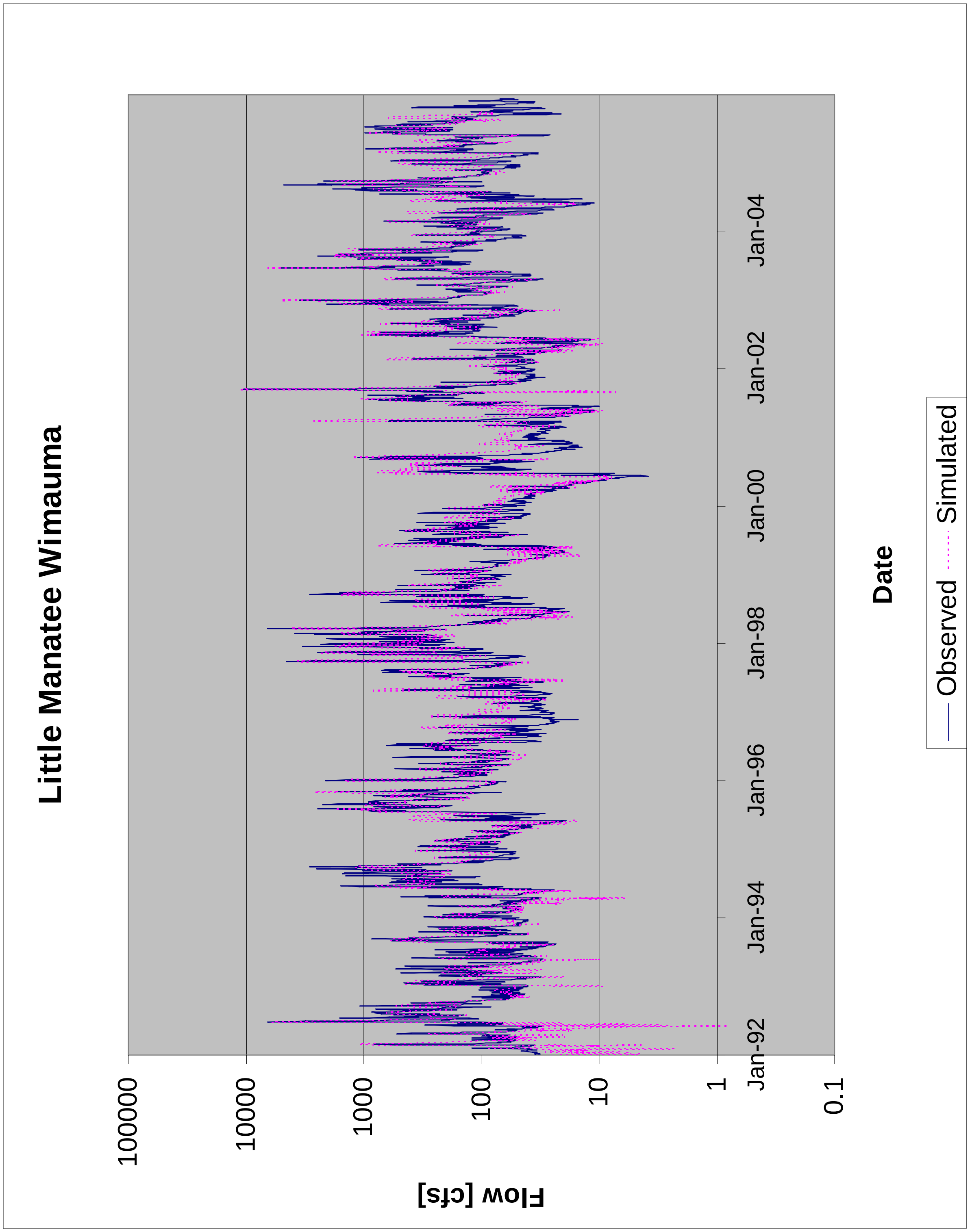


Figure 16 Little Manatee Wimauma Log Hydrograph

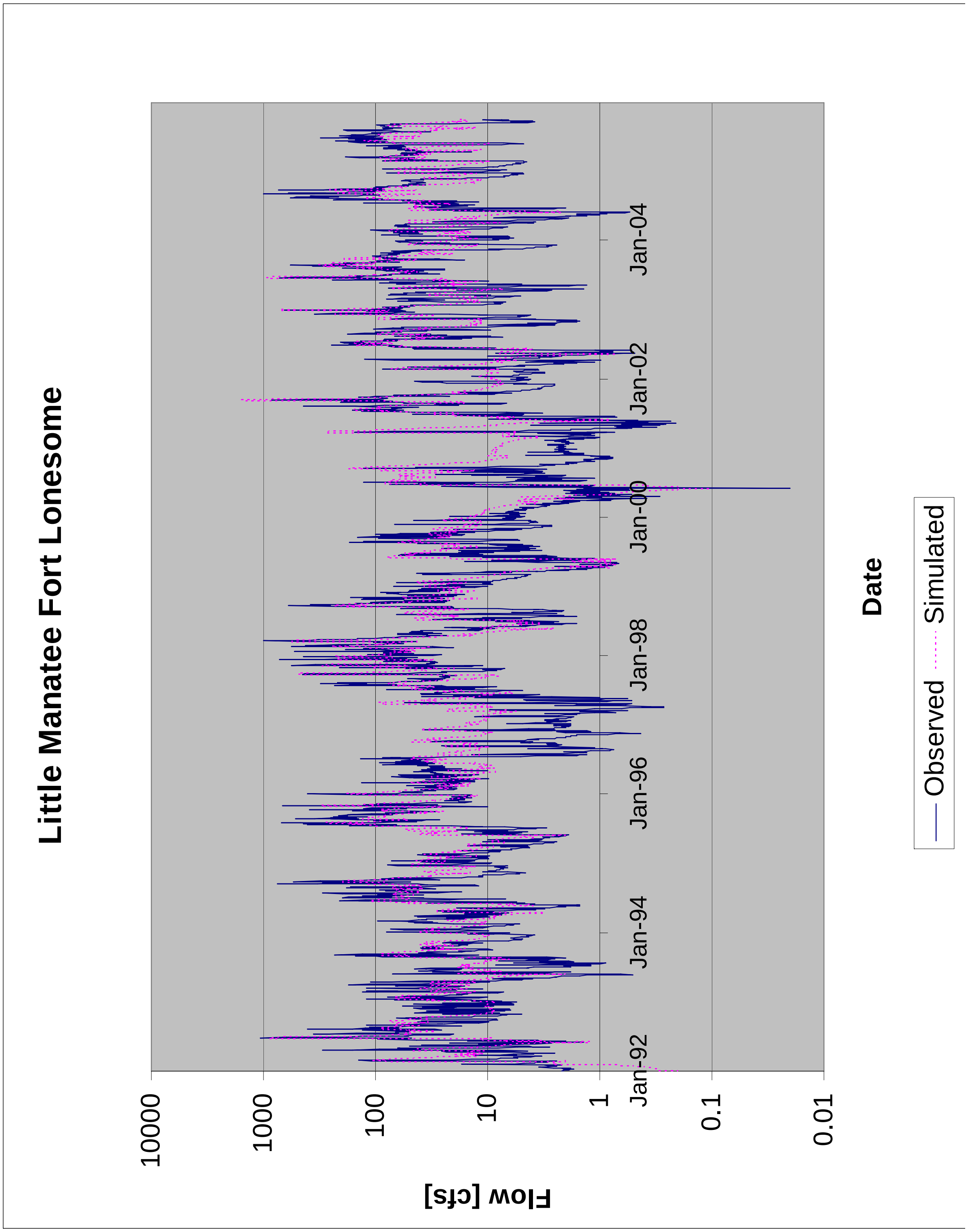


Figure 17 Little Manatee Fort Lonesome Log Hydrograph

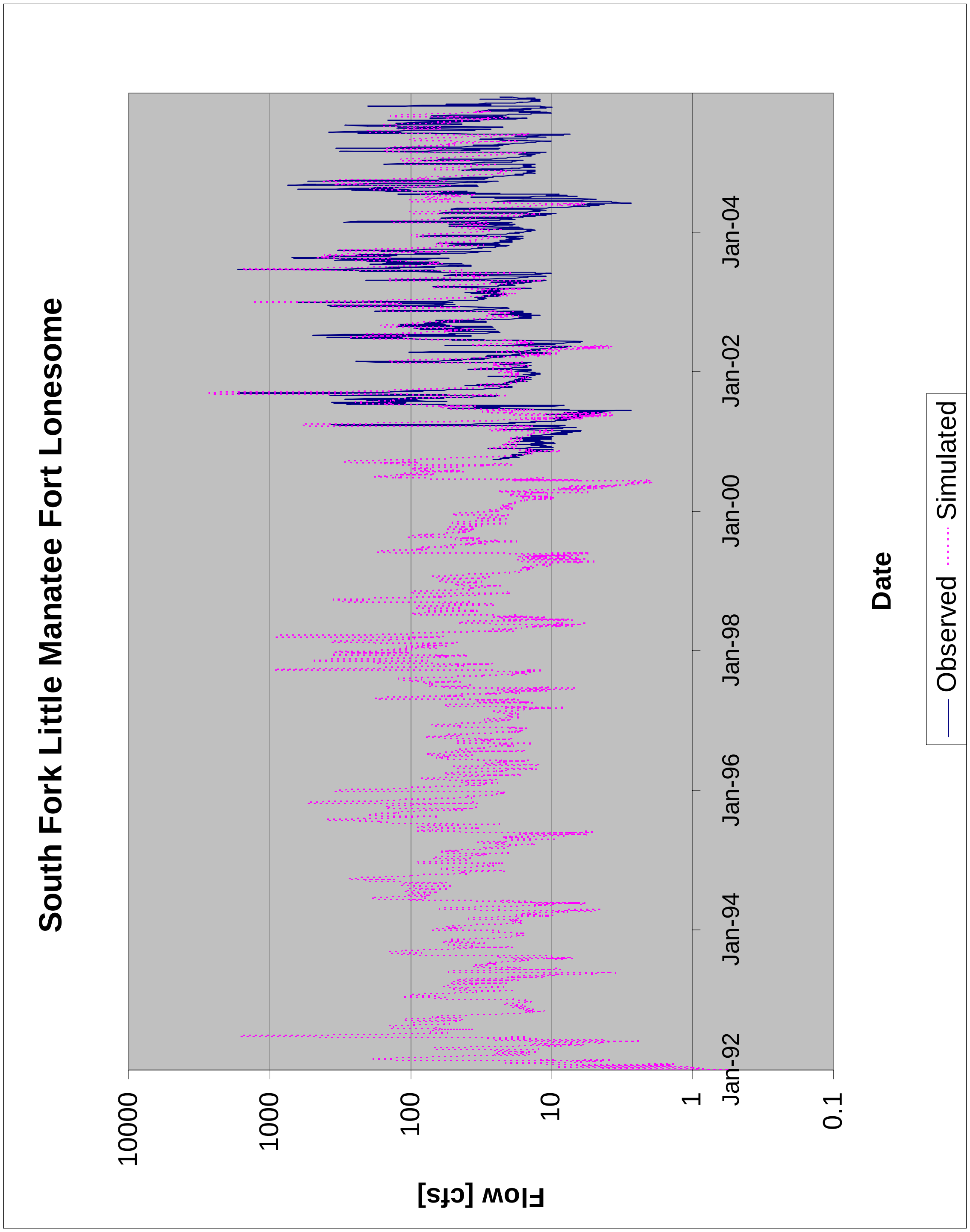


Figure 18 South Fork Little Manatee Fort Lonesome Log Hydrograph

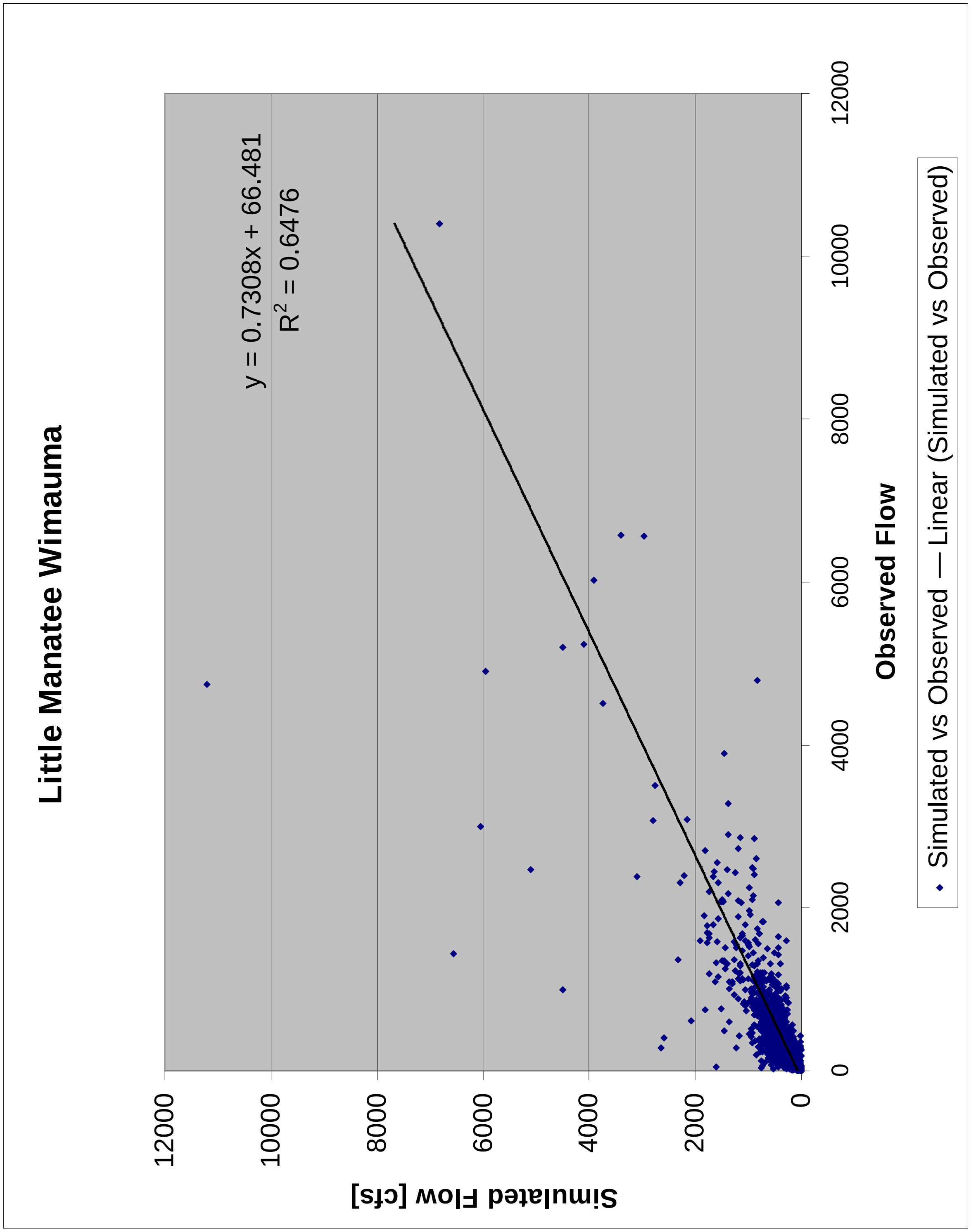


Figure 19 Little Manatee Wimauma Simulated vs Observed Flows

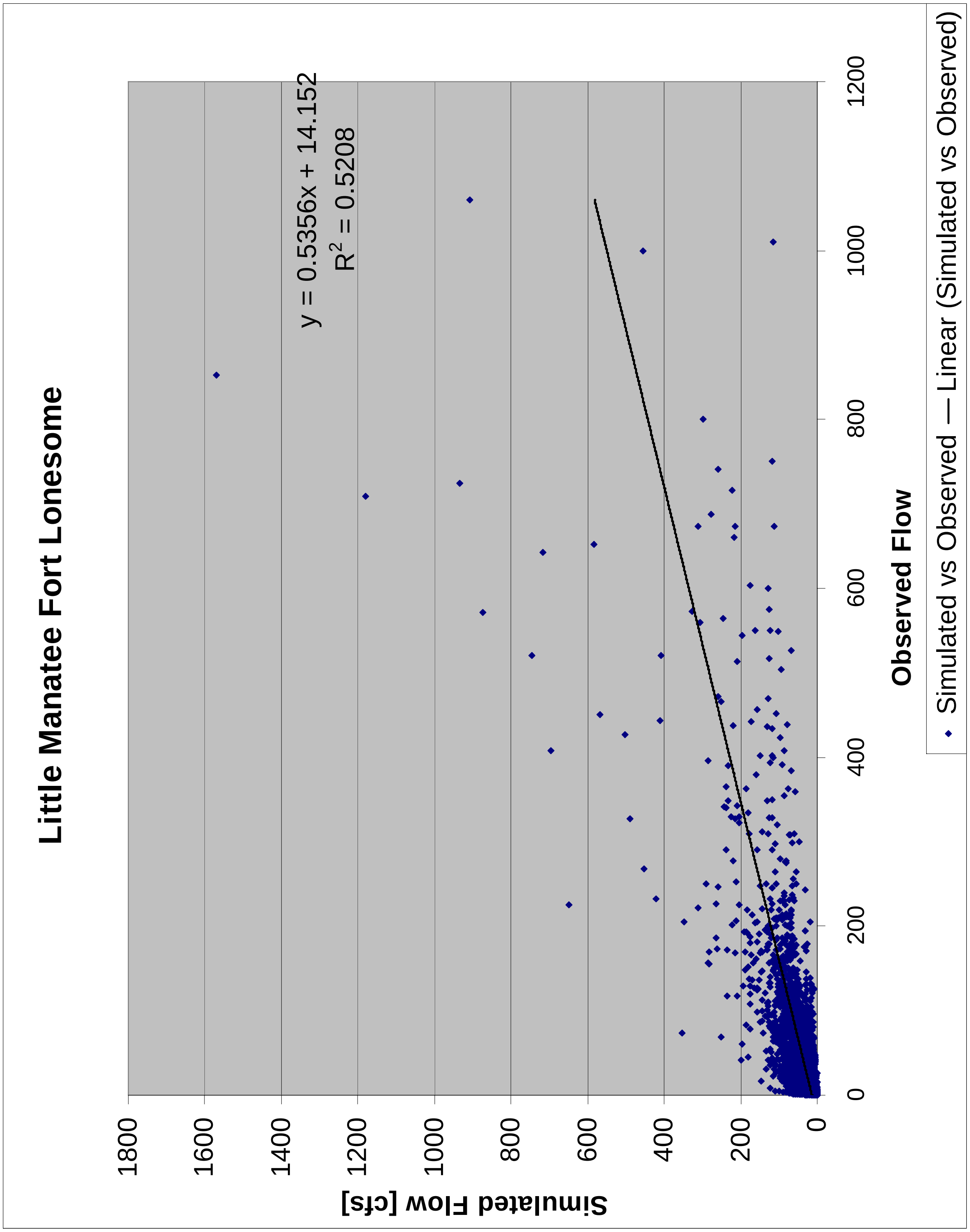


Figure 20 Little ManateeFort Lonesome Simulated vs Observed Flows

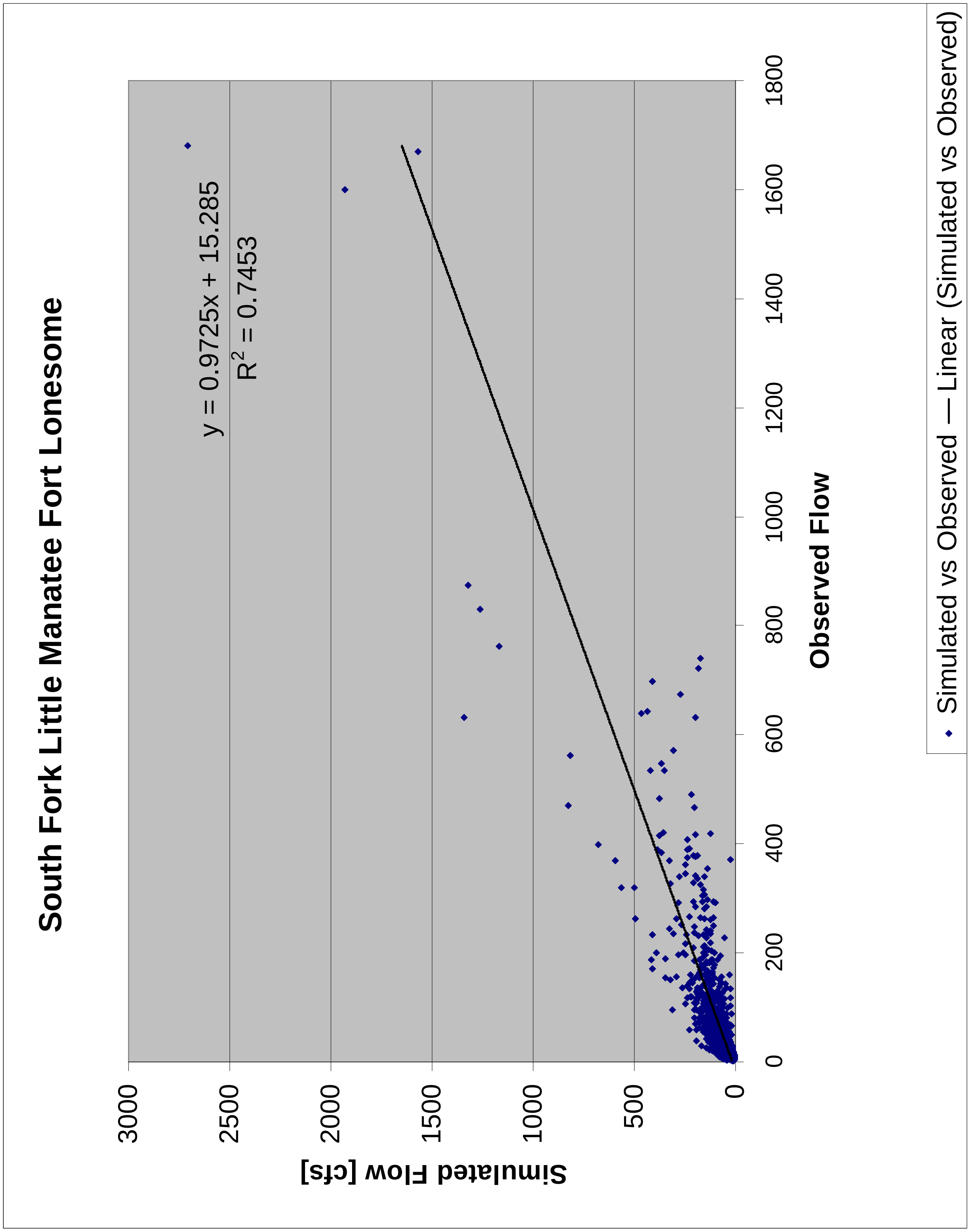
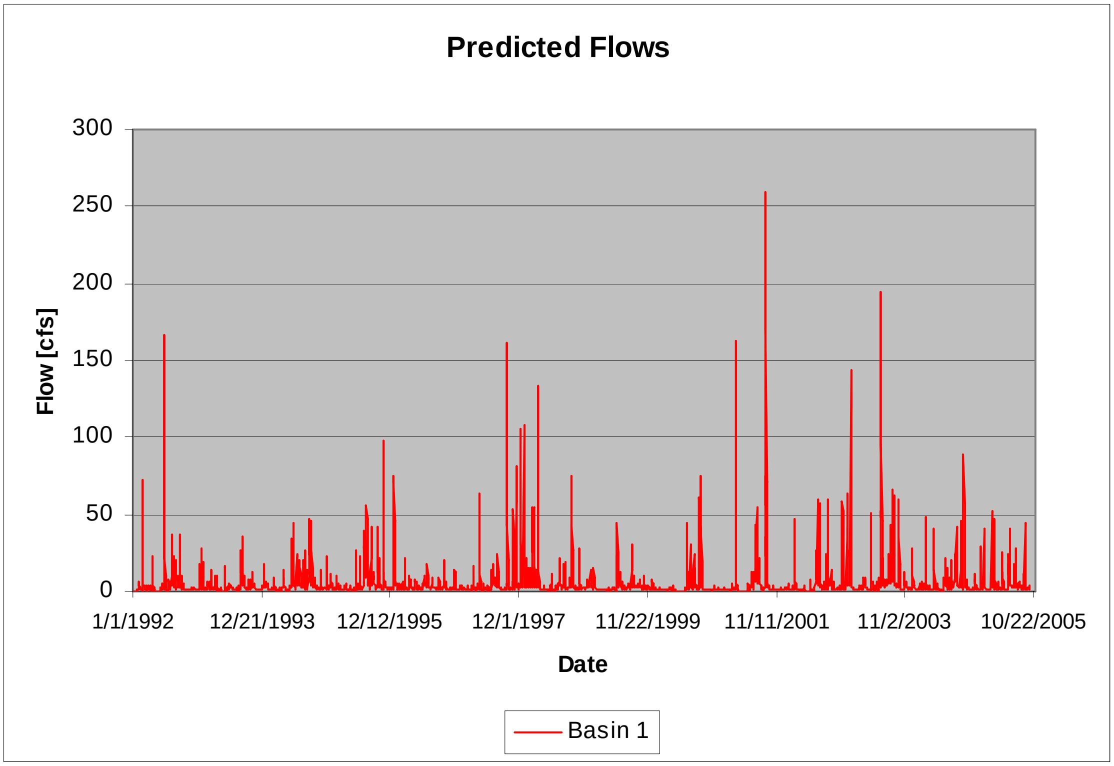
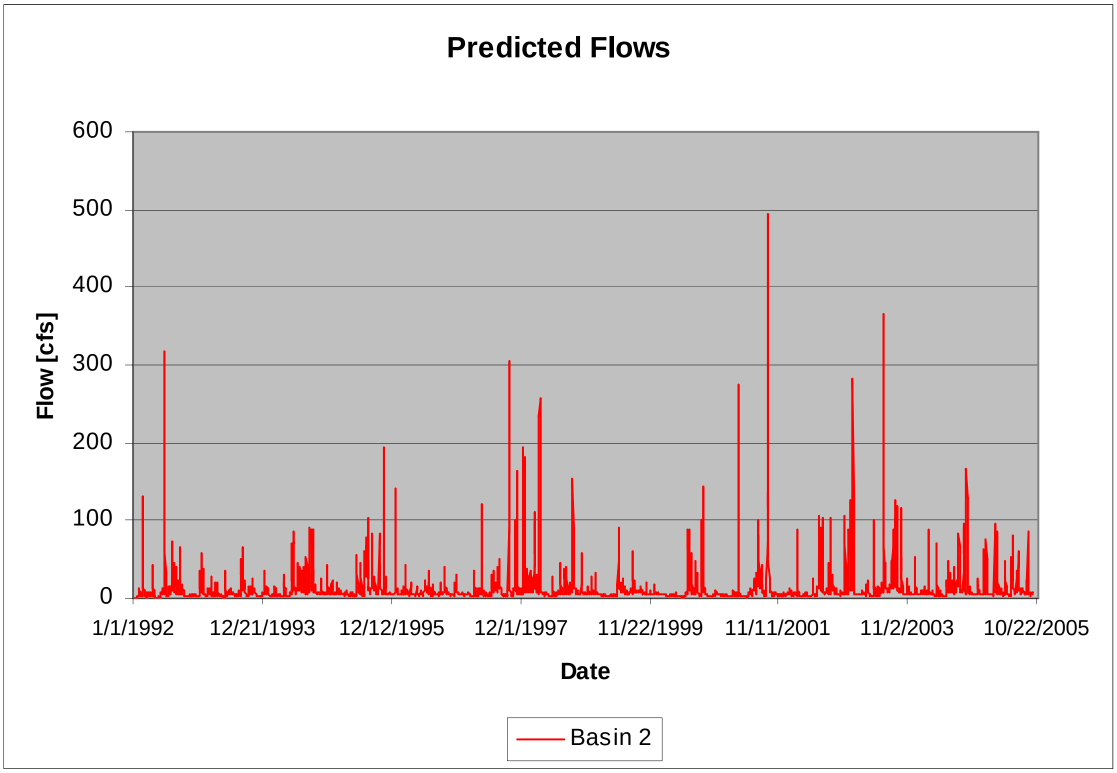
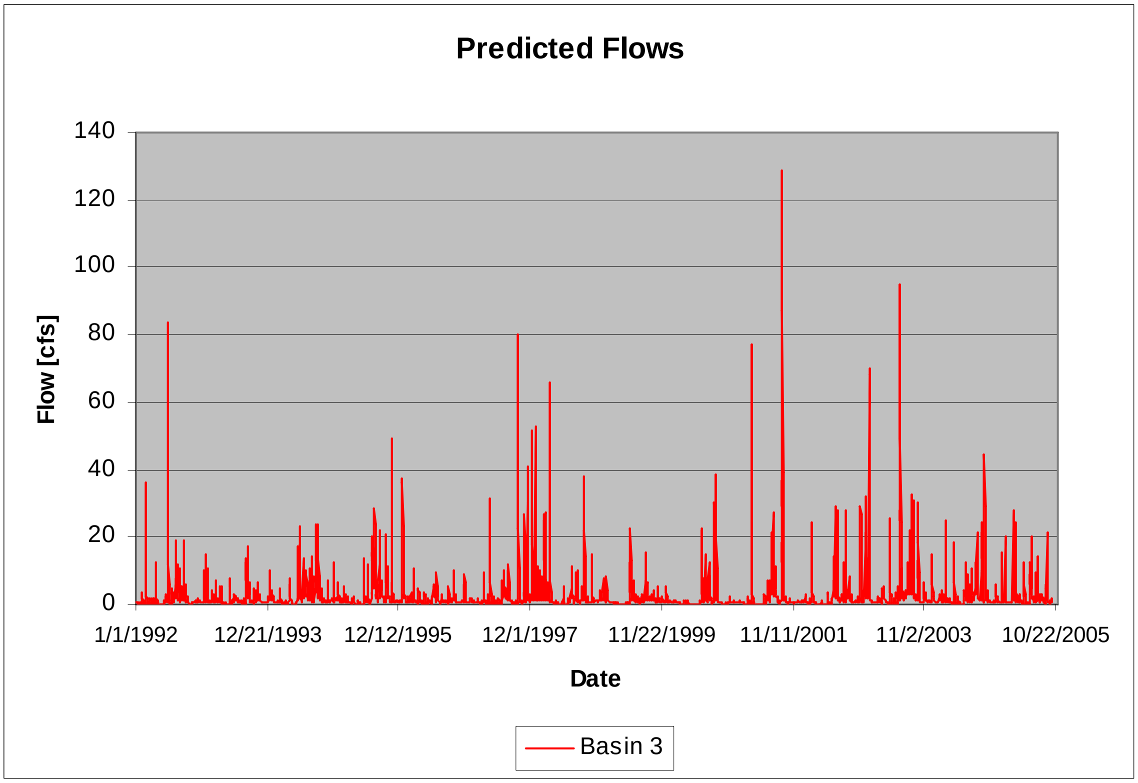


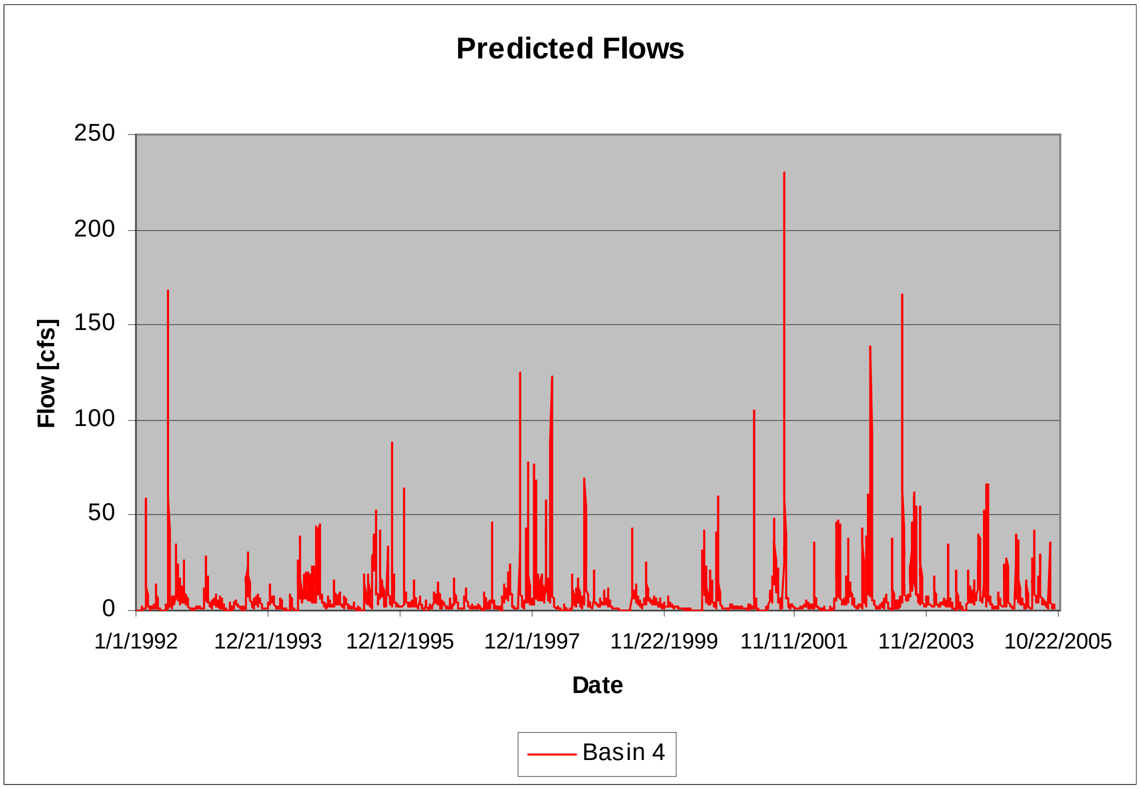
Figure 21 South Fork Little Manatee Fort Lonesome Simulated vs Observed Flows

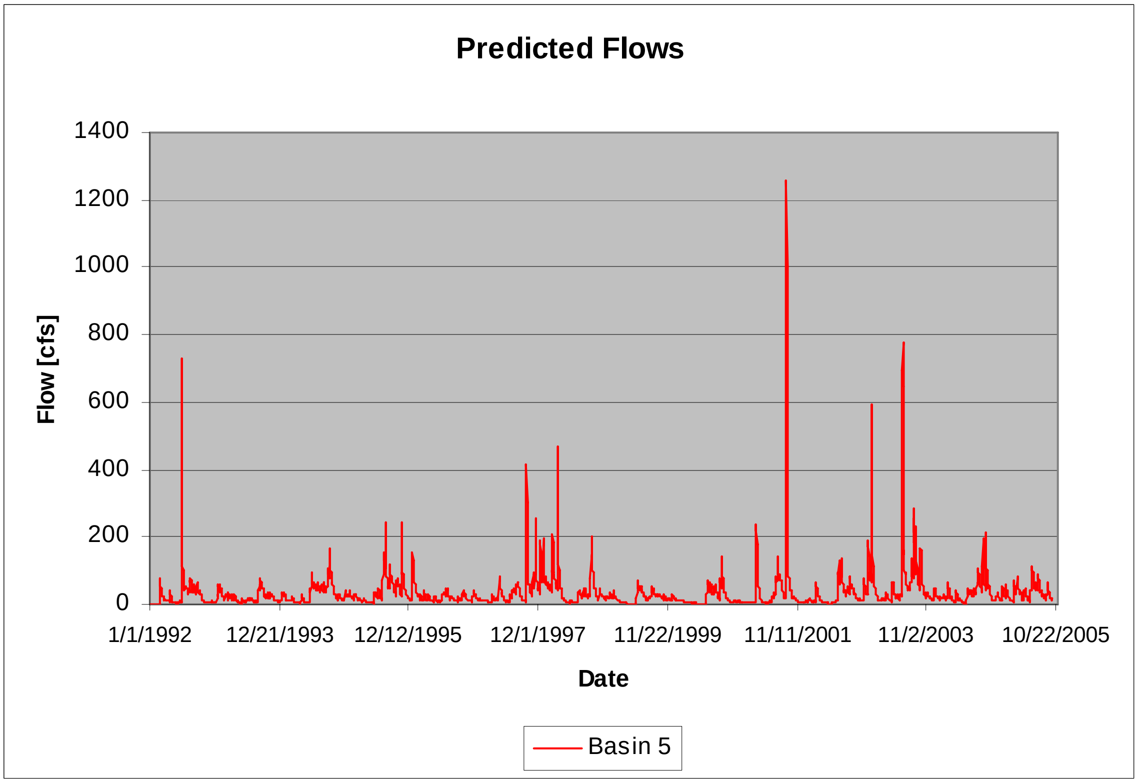
APPENDIX D Predictive Simulation Results

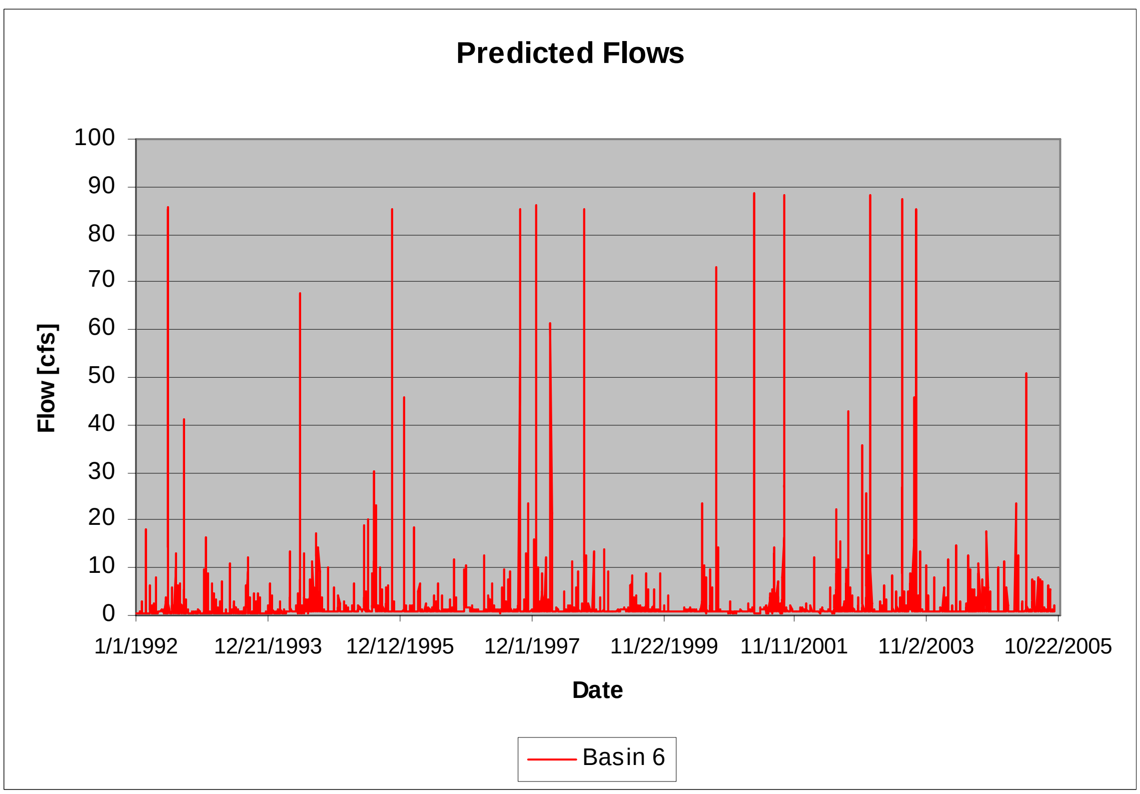


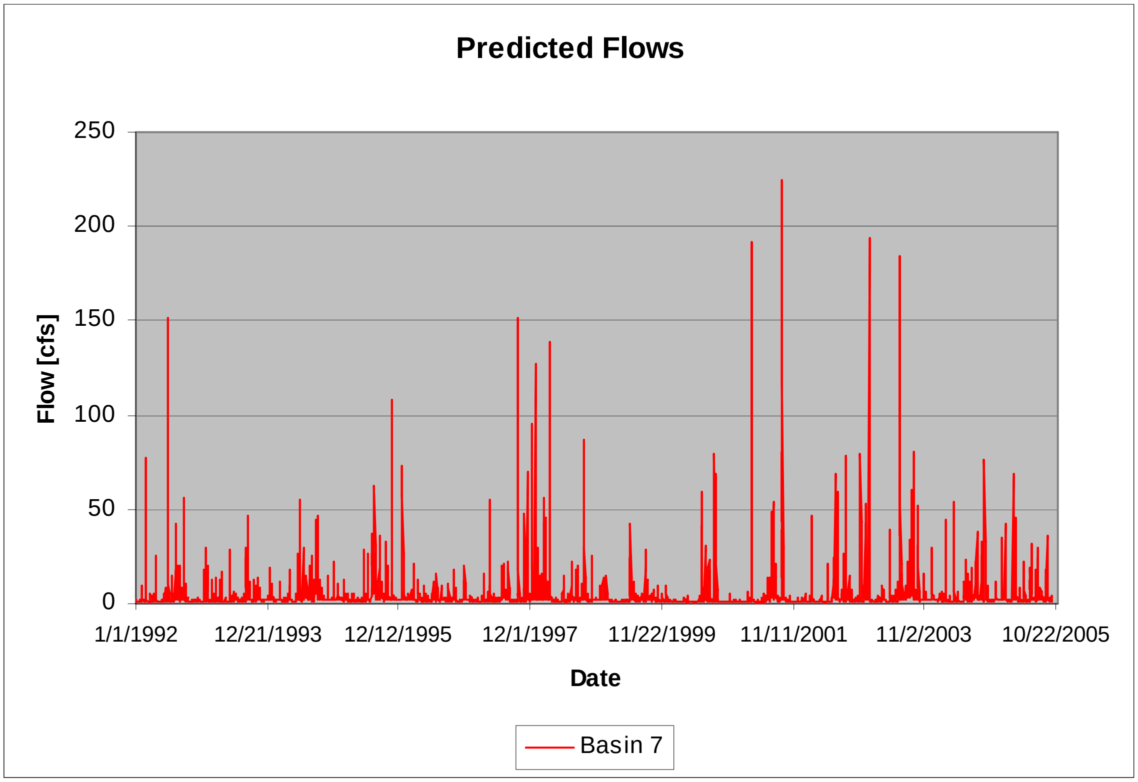


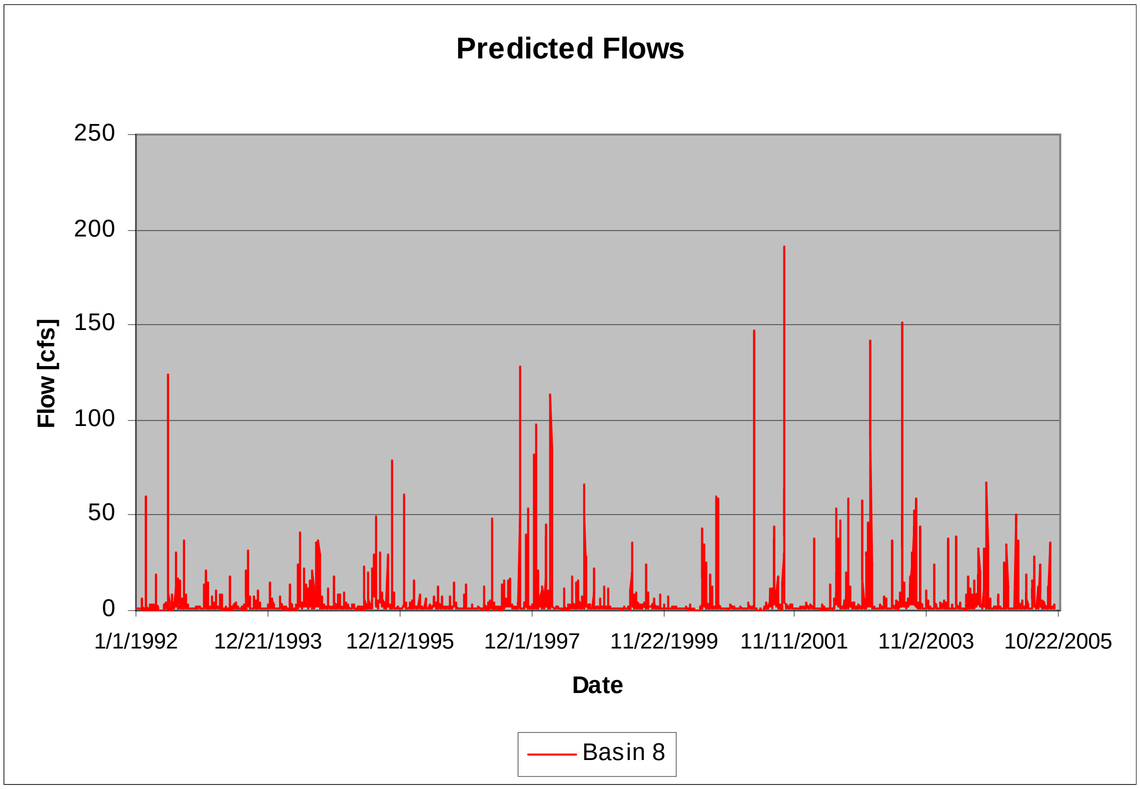

Predicted Flows
140
120
100
80
60
40
20
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 3

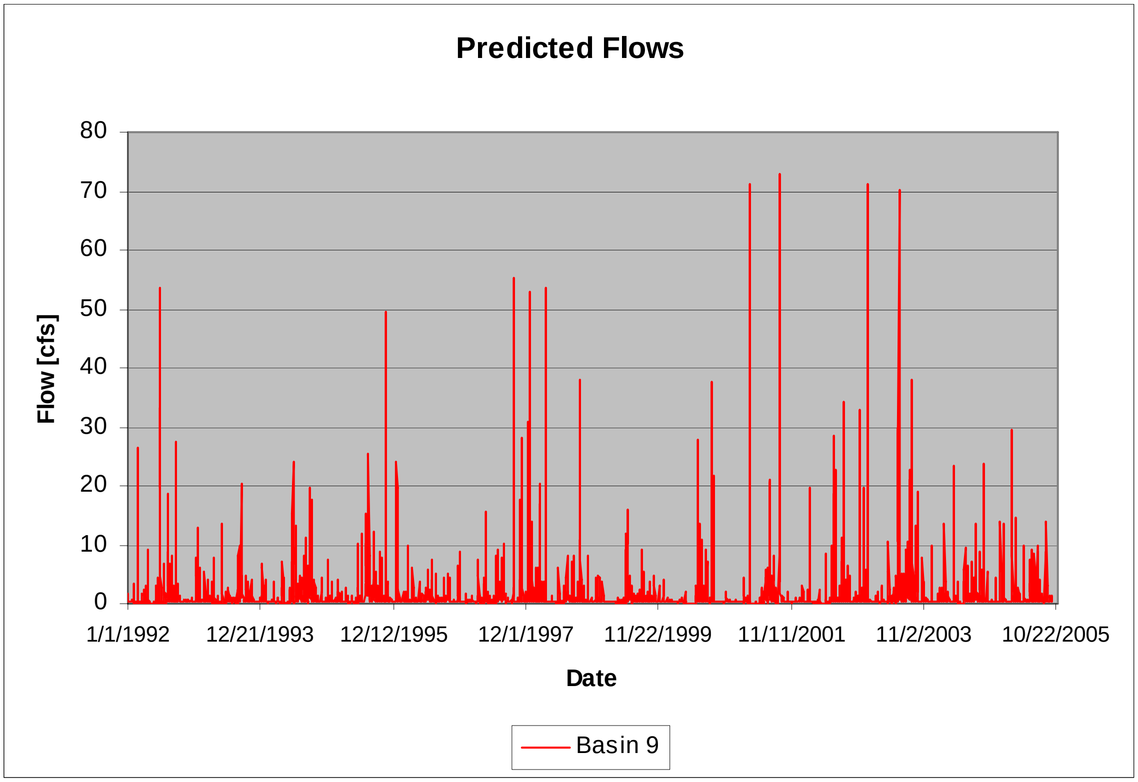

Predicted Flows
250
200
150
100
50
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 4

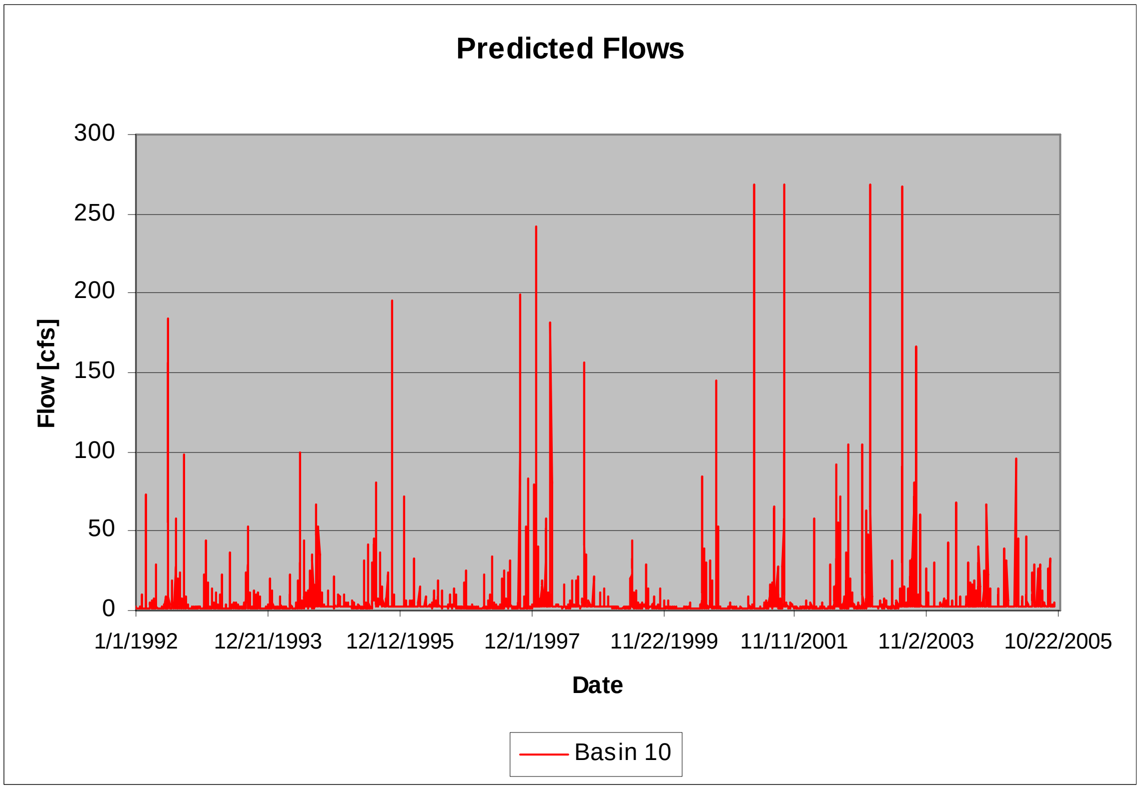

Predicted Flows
1400
1200
1000
800
600
400
200
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 5

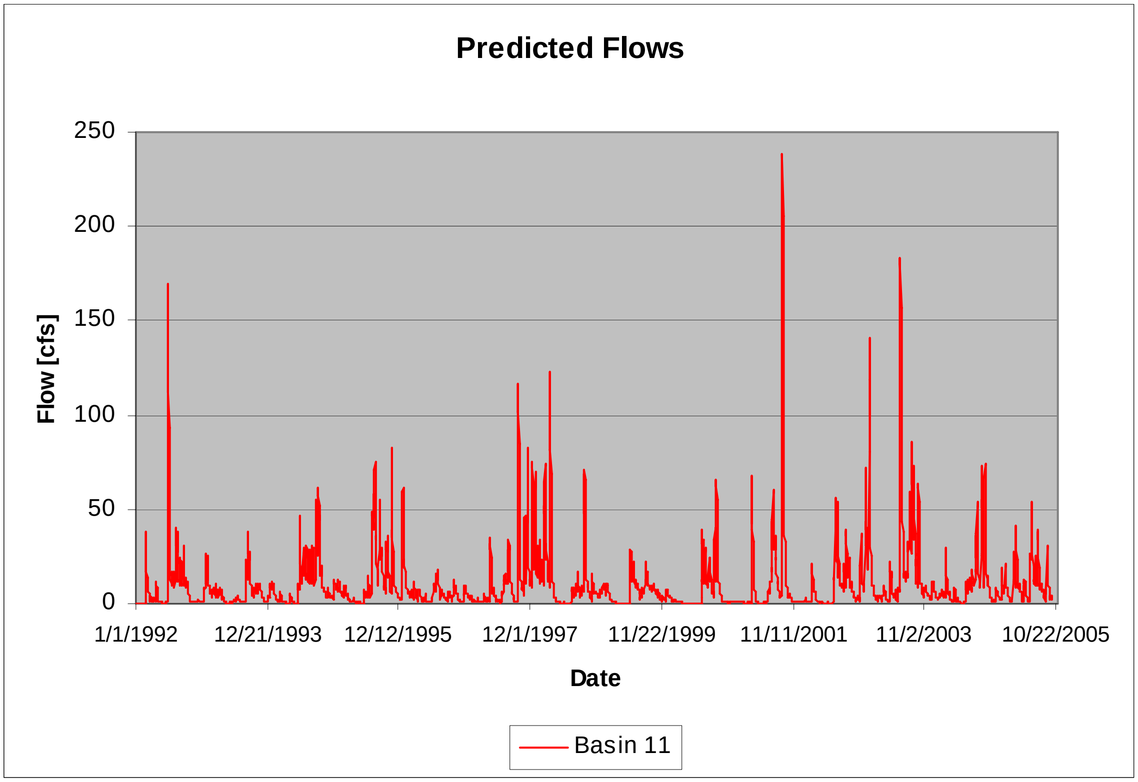

Predicted Flows
100
90
80
70
60
50
40
30
20
10
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 6


Predicted Flows
250
200
150
100
50
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 7

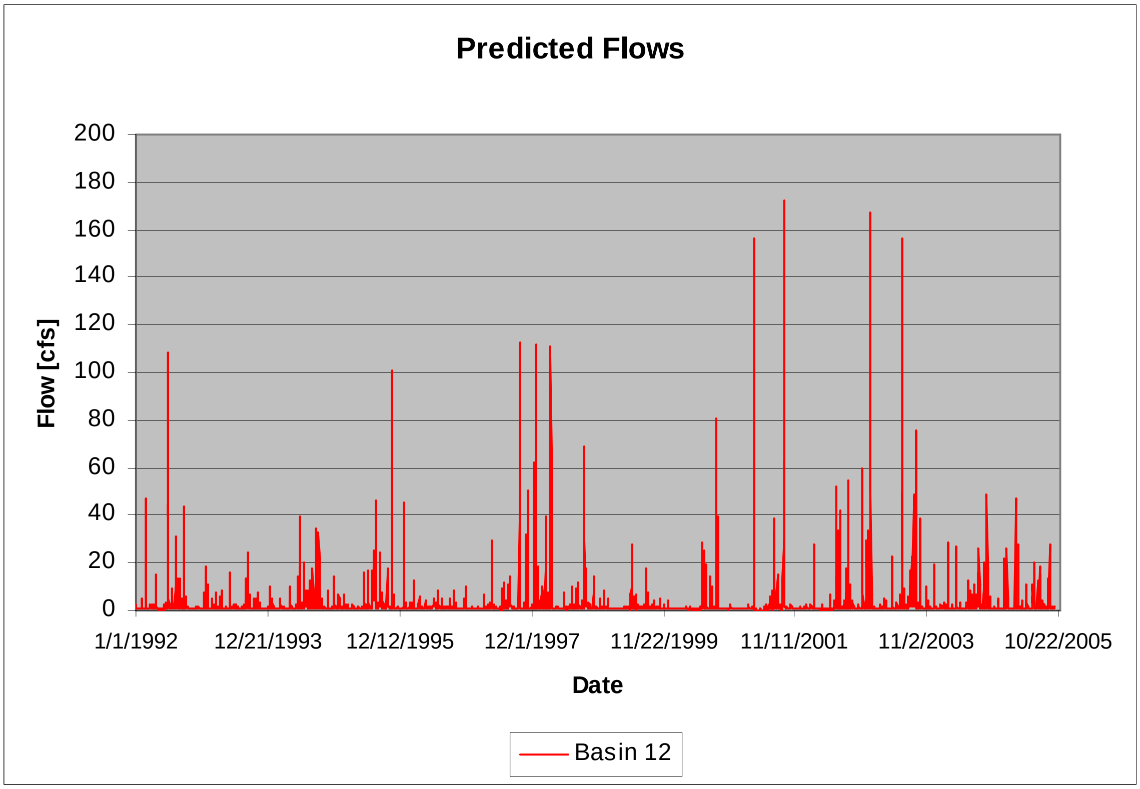

Predicted Flows
250
200
150
100
50
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 8


Predicted Flows
80
70
60
50
40
30
20
10
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 9

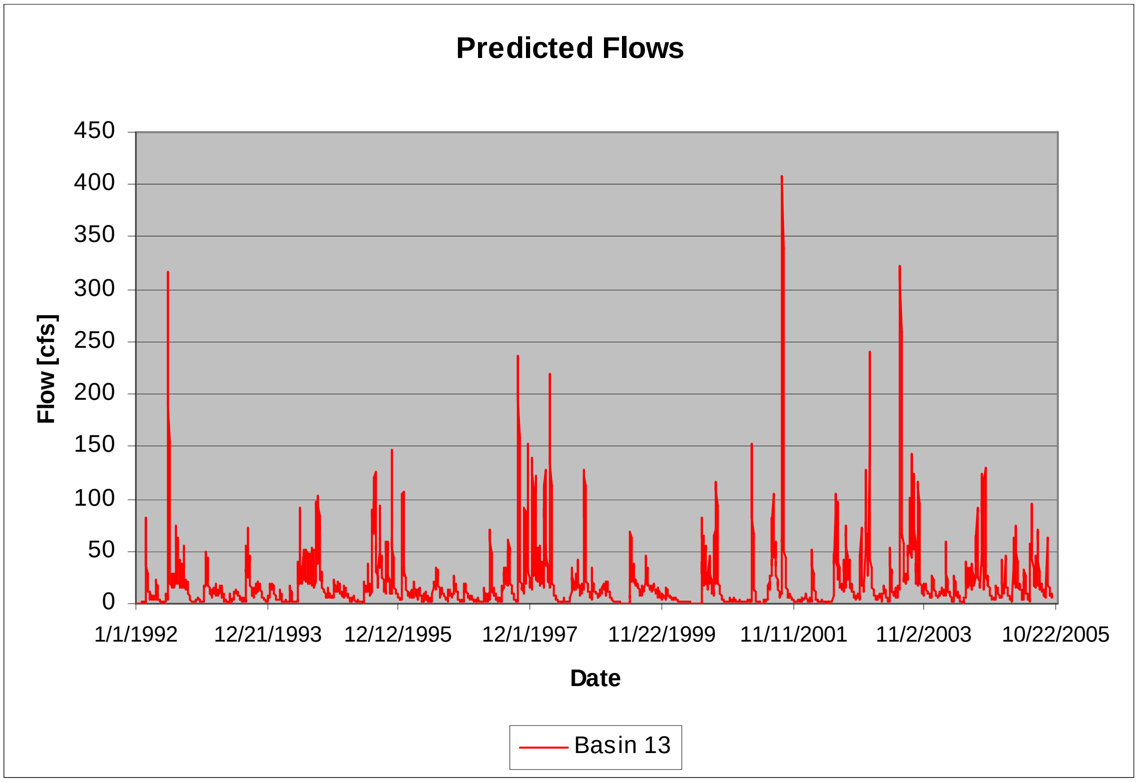

Predicted Flows
300
250
200
150
100
50
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 10

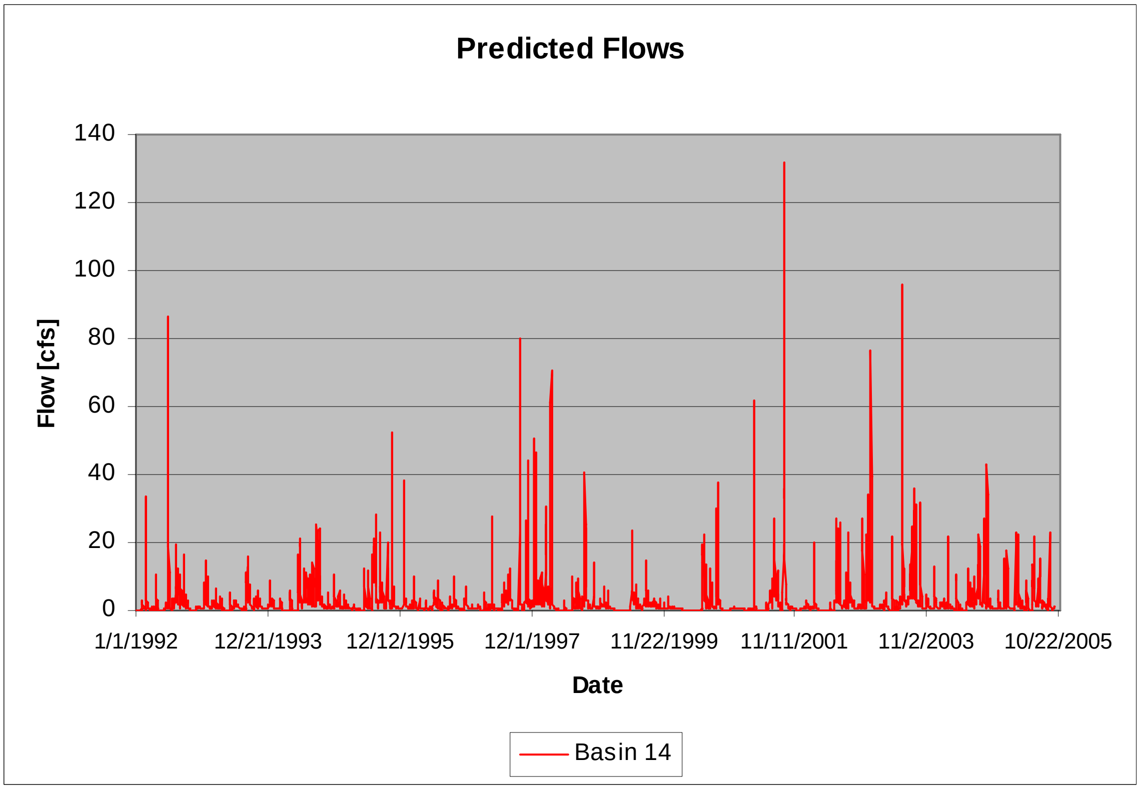


Predicted Flows
250
200
150
100
50
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 11



Predicted Flows
200
180
160
140
120
100
80
60
40
20
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 12


Predicted Flows
450
400
350
300
250
200
150
100
50
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 13


Predicted Flows
140
120
100
80
60
40
20
0
Flow [cfs]
1/1/1992
12/21/1993
12/12/1995
12/1/1997
11/22/1999
11/11/2001
11/2/2003
10/22/2005
Date
Basin 14

APPENDIX E Land Segment Area in Acres by Landuse

	Land Segment Area in Acres by Land Use				
BasinID	1 - Urban	2 - Irrigated	3 - Pasture	4 - Forested	7 - Other
1	359.3	594.6	329.7	115.1	437.2
2	1548.9	847.8	1147.3	293.8	107.0
3	166.5	248.5	284.2	172.8	3.3
4	120.1	1091.7	925.4	112.3	
5	878.1	4638.6	4587.1	1149.4	26.0
6	251.4	37.7	109.1	65.5	63.8
7	454.5	274.0	477.6	162.5	20.2
8	280.9	274.7	311.9	135.2	224.7
9	234.3	26.8	142.8	33.2	
10	282.4	316.8	505.0	486.5	51.5
11	363.6	555.0	1604.0	847.7	19.8
12	61.8	14.7	276.5	662.8	12.7
13	2746.1	1261.8	1256.8	484.5	2.5
14	286.8	51.2	358.7	307.1	
21	71.4	1533.5	7314.3	827.7	3728.2
22	156.6	6574.6	8549.4	3411.0	99.4
23	14.5	332.6	2411.7	361.1	20.3
24	115.9	1895.1	2126.6	313.6	86.0
25	205.2	3213.9	1795.7	112.4	77.9
26	91.1	1651.1	7410.2	528.0	186.1
27	0.4	302.0	735.5	174.3	
28	155.9	611.3	621.5	309.7	
29		490.7	1633.7	154.4	95.3
30	41.9	780.4	439.4	28.3	
31	725.5	1442.1	1200.9	713.6	194.5
33	217.9	712.7	1453.8	1122.0	60.0
34	20.6	528.5	376.2	151.1	36.8
35	3.1	796.3	905.0	131.7	
36	138.5	1115.5	2960.7	476.3	124.7

Appendix F Response to Comments from the District

INTERA Incorporated
1541 North Dale Mabry Highway, Suite202
Lutz, Florida 33548
ph: 813 600 5737 fax: 813 600 3761
Fax: 813 354 4698

Mike Heyl

Southwest Florida Water Management District

7601 Highway 301 North

Tampa, Florida 33637

Mike,

Below is a compiled list of the report comments that I received from District. In some cases the reviewer asked a simple question and therefore it was easier to compile this reply. In other cases the reviewer asked for specific report modifications. A revised final copy of the report will be submitted to the District. The page numbers listed below referred to the original text. This letter will be included as an addition appendix to the final report.

Sincerely,

Patrick Tara

Senior Engineer

INTERA Incorporated

Sid Flannery's comments:

page 4. What does DEM stand for? In this and other instances, please spell out the complete term when an acronym is first introduced.

The report was modified explaining the many acronyms.

page 5 and 6. The term potential evaporation is used on page 5, while page 6 states that pan evaporation were multiplied by 0.7 to yield potential ET (evapotranspiration) of the region. It is my understanding that pan evaporation * 0.7 is the evaporation from an open water surface, so I suppose this could be potential ET since water is not limiting. However, how was this term applied to different land covers? Was pan evap * 0.7 applied to the entire watershed area - that is what the sentence implies, or was it modified for different land covers in the watershed.

The model requires potential ET as an external time series. One potential ET time series was generated and applied to all land uses and water bodies within the model. The pan ET rate is elevated above natural systems ET for a number of reasons (local effect of wind caused by the pan itself, heat transfer through the pan material, etc). For these reasons potential ET is assumed to be pan factored by a pan ET coefficient. For the Little Manatee River application .7 was used to scale pan ET to open water ET. Open water ET was assumed as potential ET from the natural system. It is up to the model and the model conceptualization to limit the available water that satisfies that potential. Open water obviously would easily satisfy the potential (therefore actual ET is equal to the potential) On the other hand pasture would limit the available water and other model parameters (as determined from the land use calibration) and would therefore have a simulated actual ET which is much less than the potential.

P 13 and pages 55-56. From what time periods are the data shown in the scatter plots on pages 55 - 56. Is this for the entire period of simulation for each gage, including 2004 and 2005, or for some sub-set of the simulation period? Also, over what time steps are the flow data shown in these figures aggregated - are these average daily flows? Please specify in the text.

The total simulation period is from 1/1/1992 to 9/30/2005. This period was mainly dictated by the Districts estimated water use database. At the time the model was completed 2003, 2004, and 2005 were not available. These years were populated using representative years based on similar precipitation records.

P 13. In the calibration procedure and the plots of simulated vs observed flows for the Little Manatee River at Wimauma, did you add withdrawals from the river by Florida Power and Light back into the flow record?

Yes. Monthly data was obtained for the FPL water use. These records were utilized in the calibration as a withdrawal evenly distributed across the month.

P 13. In general, there should be some more write-up of the calibration and verification results. Are there any likely reasons that certain outliers occurred (such as variability in rain coverage). Of all the gages, the agreement of observed and simulated flows was the best for the South Fork. Is there any likely reason for that?

Outliers will always be present in any model whether statistical or numerical. There are many reasons that can be blamed for their presence. As you suggested the variability in rainfall is probably the number one reason (since it is the most significant water balance term). The good agreement for the South Fork is purely happenstance. The South Fork data was not even used for calibration. The period of record was too short for utility in the calibration process. It was used in the model verification task. The reasons for this are varied as well but rainfall, landuse, ditching, soils, depth to water, regional discharge all play a role in introducing variability from subbasin to subbasin.

P 13. What was the exact ending date of the simulation period in 2005. The graphs make it look like it was near Oct 22, 2005 - can the exact date be stated in the text.

The total simulation period is from 1/1/1992 to 9/30/2005. The ending dates for all graphs is 9/30/2005.

Importantly, we would like to know the areas for the 14 ungaged sub-basins. Also, could you provide a table of the area-normalized runoff in inches for these 14 ungaged basins and the three gaged sub-basins for the period of simulation, which should be 1989 -2005 for LMR at Wimauma and Ft. Lonesome, and October 2000 - 2005 for the South Fork.

This data was included with the transmittal of the ungaged basin flows. They are again included here for completeness.

Basin	Area Sq Miles
1	2.87
2	6.16
3	1.37
4	3.51
5	17.62
6	0.82
7	2.17
8	1.92
9	0.68
10	2.57
11	5.30
12	1.61
13	8.99
14	1.57
21	21.05

Mike Heyl's comments:

Page 1 - Patrick - The "Un-Gaged" legend washes out on the printed copy. Can you put an outline on it please?

The GIS graphic was updated.

Page 3 - A table in the appendix with acres of land use by sub-basin would be useful.

A table will be added with this information.

Page 4 – Where did you get the DEM data? Can you elaborate?

The DEM data is readily available from the USGS (http://seamless.usgs.gov).

Page 5 – Two formatting issues here. The Table spans the page and the outer boundaries of the theissen polygons are missing.

The table will be corrected. As for the Theissen polygons the outer boundaries were truncated, they actually extend much further. A frame was placed around the graphic.

Page 5 - Can you elaborate? What were the problems with the other data sets? Can you specify by source ?

The hydrologic model requires a clean and continuous time series. Data gaps need to be filled. If the gap is small a simple interpolation will suffice. Large gaps must be filled using more complicated techniques. If the data gaps are large and numerous, the data can be deemed too problematic for useful application to a numerical model.

Page 6 - What is the basis for this number ? Mark Ross used it too, but he ignored my review comment asking for justification. I think it is the correction from pan to lake evaporation. I gotta believe that when you add transpiration to the evaporation this value will change. Do you have any peer-review citations for this.

The adjustment factor of .7 modifies the pan ET rate to a potential ET rate for natural systems. The Class A pans are small in size, shallow, wind effects induced pan, thermal heat transfer through pan material, etc. These effects cause the pan ET rate to exceed the natural systems and therefore a coefficient is used to adjust the measurements. The Class A pan, the most commonly used pan in the US, has ranges in the coefficient from .64-.82. An average coefficient of .7 is well adopted in literature to represent average conditions (Bras 1990).

Page 6 - Figure 6 shows A LOT of wells that are not surrounded by Ag or Rec land uses. How/ where these assigned?

Many of the wells Ag and Rec wells are associated with an Ag or Rec polygon. A small number are not directly associated with the appropriate land use. These can be caused by changing landuse conditions, or poor location of wells in the original database. These wells that are not directly associated with the appropriate irrigated landuse were lumped with into the other irrigation and applied to the irrigated land segment within the model.

Page 8 - Need to mention adjustments for FPL.

Agreed. A section will be added for the FPL data.

Page 10 - I don't follow these comments. Are you saying that the impervious area of a residential neighborhood is greater downstream than the impervious area of a residential area upstream? I thought the whole concept of this project was to characterize the landuses in the gaged watershed and then apply those parameters to the SAME landuses in the ungaged area. Granted the characteristics of the undeveloped areas may change, but I don't follow the comment to developed areas.

The report was stating the fact that the relative areas of development change as you move closer to the bay (for example 10% of the basin is developed in eastern half of the basin yet 30% of the basin is developed close to Tampa Bay). This changing landuse condition forces to use of landuse based calibration (which is what was performed for the Little Manatee Application). Expanding on this is the changes in the density of the development. The density of the development to the east of the basin is much less than the density of the development to the west. The change in the densities of the development is the uncertainty that the report was alluding to. The model was calibrated to the less dense eastern half yet the predictions were made using the same model parameters on the western denser half of the basin. Since there is no data to calibrate the denser land use conditions the uncertainty in the predictions is the best available data.

Page 12 - How significant are these areas to contributing area? I understand the significance in terms of storage and the timing of runoff, but what percentage of the contributing area are the wetlands? Perhaps a table of F-table area compared to the sub-basin area?

The wetlands in West Central Florida are a significant component of the landscape. In this particular Little Manatee River domain the wetlands and lakes represent about 20 percent of the basin. The uplands sum to 156 thousand acres and water bodies sum to 30 thousand acres.

Page 12 - I think this should exceed lake evaporation rates since you have both unlimited evaporation coupled with unlimited transpiration.

Potential ET is the limit due to the atmosphere inability of removing more water.

Page 12 - I'm not following any of this. A dry reach will: a) over estimate evaporation b) over estimate inflow but the over-estimation will be reduced the excess rainfall will go into vadose zone soil storage. Doesn't that always happen - up to the capacity and infiltration rate? What is different?

In the physical landscape the wetland areas change dramatically. In the model the area of the reaches are held constant. Holding the reach areas constant for all stages cause the model to produce errors. At high stage the model should be representing the large area with potential ET. Since the model is using the fixed area it will under estimate the ET when the wetland is under high stage conditions. Conversely, when the physical system is extremely dry the area should be small. Again the model area is held constant at the wetland area as represented with normal pool stages. During dry conditions the model will over estimate the wetland ET. The report was stating the deficiency in the model's ability to represent the physical hydrologic cycle during extreme shifts in the wetland areas. These statements describe reasons for the scatter as mentioned in Sid Flannery's comments above.

Page 13 - Do the scatter plots really contain 4,328 points or are they a subset of the calibration /verification period.

They actually have 5022 points. Daily data from 1/1/1992 to 9/30/2005 inclusive.

XinJian Chen's comments

Page 4 - Not very clear on what was exactly done here. An equation or a figure may be helpful.

This averaging was performed using the area weighted approach. The areas were determined from the Thiessen polygons (if no data was available for the particular rain gage the area was excluded from the weighting). This averaging was performed for each day for the simulations period.

Page 4 - Not found in References. Did you mean (Hernandez, 2001)?

Yes

Page 5 - NOAA daily or 15-minute rain?

NOAA daily

Page 7 – Any references on this number? I would think 0.5" rain is not very tiny. If you get 0.49" everyday for many days, you don't need to turn on your irrigation system at all during these days.

This number has been used before in other studies (i.e., Southern District Model, Alafia model, INTB model). There is no scientific reason or determination for the threshold. The distribution of the monthly irrigation is prone to errors. Some farmers even irrigate during rain due to the nature of automatic irrigation systems. Some have automatic shut off there is a wide spectrum of irrigation practices.

Page 9 – small changes

Fixed

Page 11 - I don't see Reach 209 in Figure 2.

Typo supposed to be 208

Page 11 - Did you mean Sub-Basin (Storage) 31?

Each basin has an associated storage attenuation reach. The storage attenuation reaches are numbered the same as the basin. The text is correct in referring to reach 31.

Page 12 - Please reword. The term "low wetland stage rain event" makes no sense.

Reworded: In turn the inflow volume will be over-estimated for rain event during times of low wetland stage.

Page 12 - Is vadose zone soil storage included in the model?

In the reach conceptual model the vadose zone storage is included. The vadose zone storage allows the reaches to ET during extended dry periods. Obviously there is no accurate way to measure this storage as well as the above ground storage of wetlands. The storage becomes a calibration factor. The storage is adjusted to capture the small events that do not discharge as well as the attenuation of the large events that do discharge.

Page 12 - I don't understand this. You are not scaling the stage, do you? How do you determine this volume adjustment factor which is time-dependent as the stage is time-dependent?

The Ftable defines the stage storage discharge and area nonlinear relationship for each reach. The Ftable was developed from each reach from the GIS data as well as the USGS ratings. These ratings were scaled and extrapolated to better define the conditions for the water bodies. As the text states the areas for each reach were held constant for all stages. The stages and flows for the USGS rating were scaled based on the relative contributing area. The volumes were calculated from the area and the scaled stages. An adjustment factor was also implemented in the conceptual model to allow calibration. The scale factor accounted for vadose zone storage as well as storage below the invert. The adjustment factor is stage dependant (allowing the modeler to adjust storage below the invert as well as above the invert). There is not temporal variability to the volume adjustment.

Page 13 - Please add figure numbers and captions to the figures in Appendix C.

Figure captions will be added.

Page 13 - Please add some discussions on comparing model results with measured data. Also, please provide a table showing the starting and ending River Kilometers of each un-gaged sub-basins.

We would need the coverage of the river miles. The location of river mile 0.0 is fairly ambiguous (where does the bay stop and the river start). We can provide the District with the basins and hydrography coverages. From the GIS coverages the river miles can be determined.

Page 15 – minor changes

Corrected