Hydrological Simulation Program – Fortran (HSPF) Hydrologic Model Calibration for Streams in the Sinclair–Dyes Inlet Watershed

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1. INTRODUCTION

Purpose. The objective of this document is to provide a description of ongoing activities related to Hydrological Simulation Program–Fortran (HSPF) model development, and associated model determination and application, for several streams in the Sinclair–Dyes Inlet watershed in Kitsap County, Washington. These efforts support the Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) Environmental Investment (ENVVEST) Project (Navy, Ecology, and USEPA 2000).

This report describes HSPF model development and hydrologic calibration results for several gaged streams in the Sinclair–Dyes Inlet watershed. This effort serves as a first step in the development of water quality models that will be used to estimate diffuse contaminant loading into Sinclair Inlet and Dyes Inlet. This document identifies and describes the watershed characteristics and types of data utilized for each model, and presents the general approach that was followed for constructing and calibrating the HSPF hydrologic models.

The three major steps in the HSPF simulation process consist of:

1. collection and development of time series data,
2. characterization and segmentation of the watershed, and
3. calibration and validation of the model.

These three steps will be discussed to some level of detail in the following sections of this report. Section 2 describes the hydrological, meteorological, and other types of data that were collected, processed, and utilized for the hydrologic simulations; Section 3 presents the general approach that was utilized for developing the HSPF hydrologic models; Section 4 presents the calibration methods and results; Section 5 addresses comments that were provided to the first draft of this document, and

Appendix A provides a fairly comprehensive overview of the HSPF model, including its history, model structure, and data requirements, among other items.

Background. The Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) project ENVVEST was initiated, under a final project agreement among PSNS & IMF, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (WDOE) on September 25th 2000 (Navy, Ecology, and USEPA, 2000), to develop better ways to protect and improve environmental quality than can be accomplished under the current regulatory framework. One goal of the effort is to develop an integrated watershed modeling system for the Sinclair–Dyes Inlet watershed in Kitsap County, Washington (Figure 1). Selected watershed and receiving water models will be capable of simulating water quantity and water quality for both existing and future conditions. These model simulations will be used to address system–wide issues related to ecological risk assessment and environmental resource management for the Sinclair–Dyes Inlet watershed. The watershed model is an application of the Hydrological Simulation Program – FORTRAN (HSPF) model. Hydrology and non–point source contaminant loads, computed using a number of HSPF models, will serve as input to the Curvilinear Hydrodynamics in 3 Dimensions (CH3D) and WASP receiving water models.

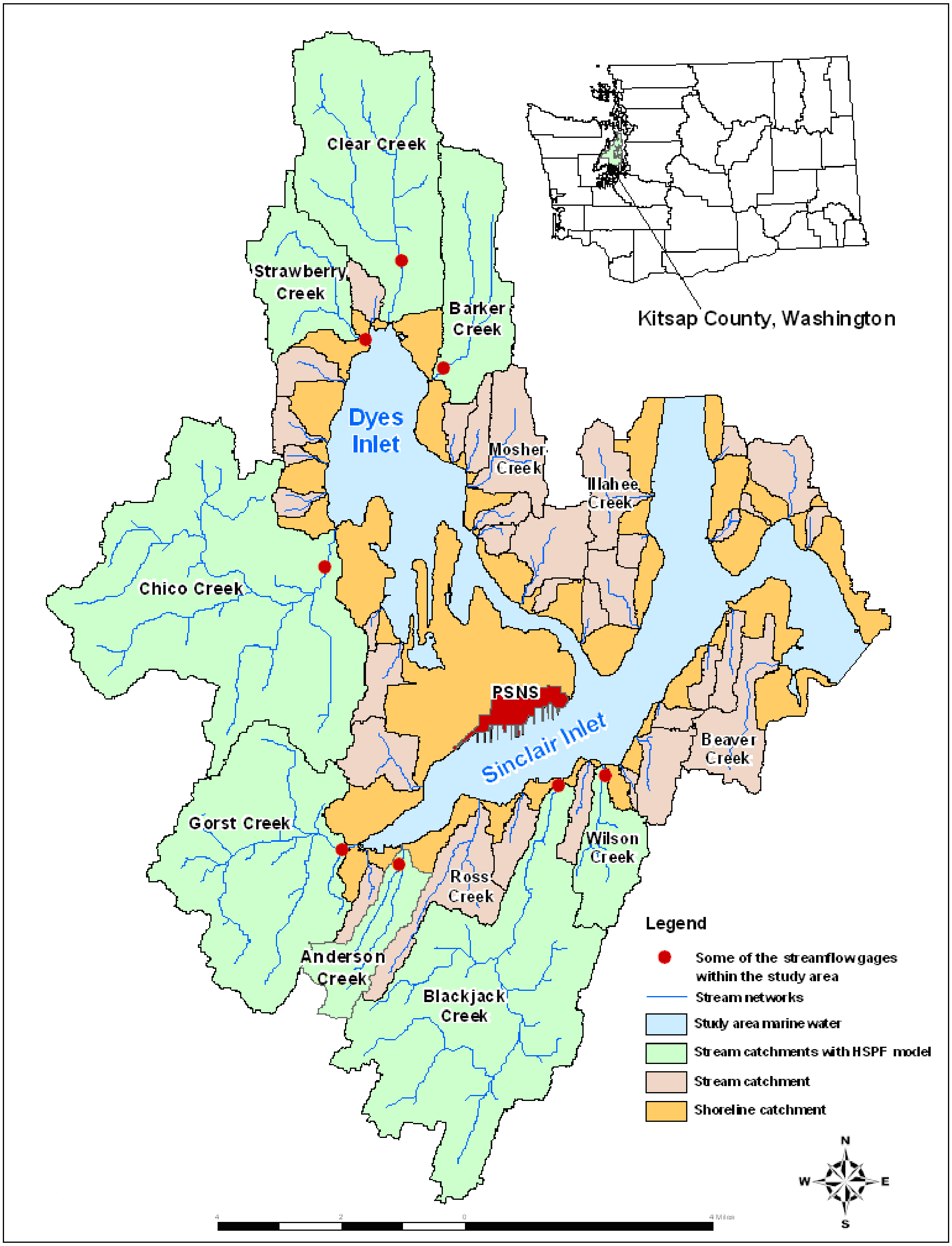


Figure 1. PSNS & IMF Project ENVVEST Study Area.

2. HSPF DATA DEVELOPMENT

The Sinclair and Dyes Inlet watershed covers an area of approximately 62,000 acres. It is entirely within Kitsap County, Washington and includes all or portions of the cities of Bremerton, Port Orchard, and Bainbridge Island as well as land under the jurisdiction of the Washington State Department of Natural Resources and the U.S. Navy. Figure 1 in Section 1 of this report identified the significant watersheds and marine water bodies within the project study area. Figure 2 below identifies the locations of the streamflow gaging stations and their associated watershed systems, within the project study area, for which there is data available to calibrate and verify an HSPF hydrologic model.

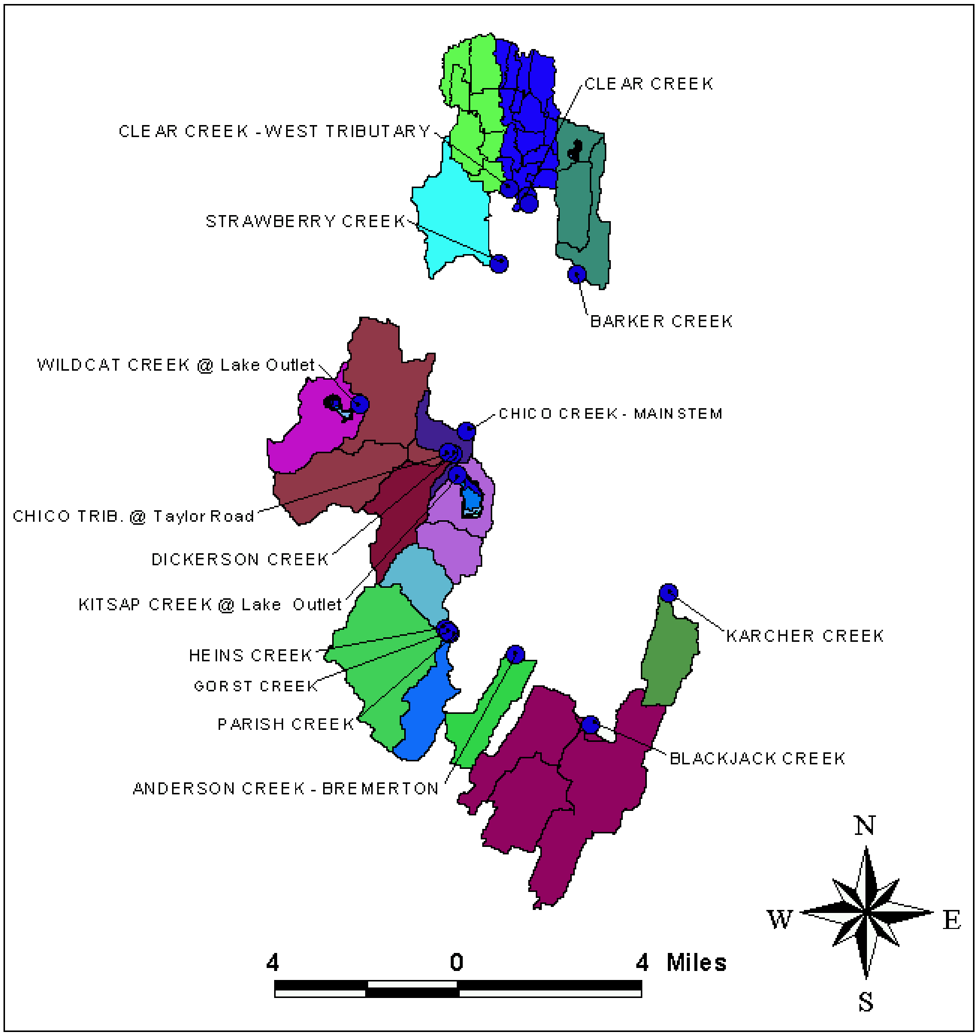
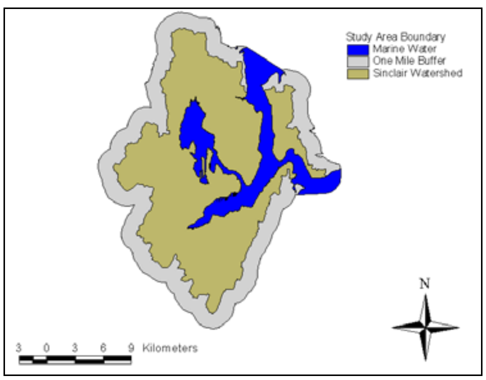


Figure 2. Streamflow gaging stations and their associated watershed systems, within the project study area, for which there is data available to calibrate an HSPF model.

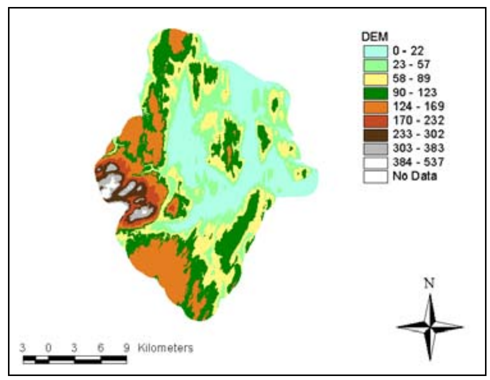
Physical watershed–specific data relevant to HSPF model development and calibration (e.g., elevation, channel geometry, soils, vegetation, and land use and land cover (LULC), among others) were obtained from GIS databases maintained by the PSNS & IMF and field observations. GIS software packages were utilized for mapping and evaluation at multiple scales. Meteorological data were collected from weather stations maintained by the National Weather Service, the City of

Bremerton and the Kitsap Public Utility District (KPUD). Data associated with the streamflow gaging stations maintained by the Kitsap Public Utility District were collected to develop and determine the HSPF models. The ANNIE (Flynn et al. 1995) and WDMUtil (USEPA 1999) utility software packages were used to input and subsequently manage the meteorological and calibration time series data in a Watershed Data Management (WDM) file.

Physical Watershed–Specific Data. Physical watershed–specific data, in a GIS format, were obtained from a map of the project study area, United States Geologic Survey (USGS) ten meter Digital Elevation Models (DEMs), LULC and percent impervious data, for 1999, that were derived from Landsat 7 Thematic Mapper satellite imagery using standard image processing techniques, and the Soil Survey Geographic (SSURGO) database for the Kitsap County Area, Washington (Figure 3). The percent impervious cover data for the ENVVEST project study area, shown in Figure 3 (d), is a reclassification of the urban or built-up land denoted in the land use and land cover data for the project study area shown in Figure 3 (c). These GIS data (DEM, LULC, percent impervious, soils, study area boundary) were provided by the PSNS & IMF in support of the watershed modeling effort. Channel cross sections were approximated based on field visits and best professional judgment. The Washington State Department of Fish and Wildlife provided bathymetry data, and other ancillary information, for Kitsap Lake, Island Lake and Wildcat Lake.



(a)



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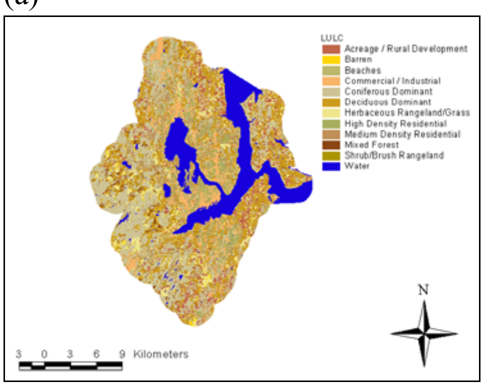

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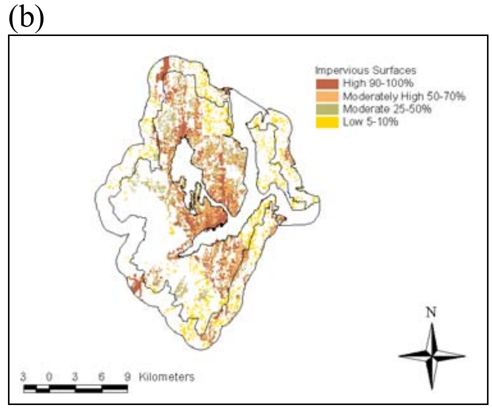

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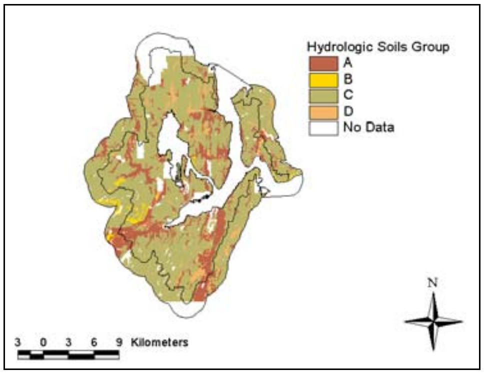

(e)

Figure 3. (a) Map, (b) DEM, (c) LULC, (d) percent impervious cover, and (e) representative soils data for the ENVVEST project study area.

Meteorological Data. A climate summary of mean monthly temperatures for Bremerton, Washington, obtained from the Western Regional Climate Center (http://www.wrcc.dri.edu/index.html), indicated that it would not be necessary to model snow accumulation and melt for the watersheds to be modeled in the project study area. As a result, the meteorological time series data requirements for an HSPF hydrologic model included precipitation and potential evapotranspiration.

Precipitation. A precipitation gage network was established to support the watershed modeling effort. Since October 2000, four gages have been continuously recording precipitation data with a temporal resolution of fifteen minutes. The locations of the four precipitation gages maintained by the Kitsap Public Utilities District are identified in Figure 4. To date, the Kitsap Public Utilities District has supplied data associated with each gage from this network for the period January 01, 2001 – September 30, 2003. Table 1 specifies the periods of missing precipitation data for each of the four gages. For each gage, missing precipitation data were filled in using functional relationships that were established with neighboring stations for periods of coincident data. Figure 5 is a plot of monthly precipitation totals, in inches, at each of the four gages.

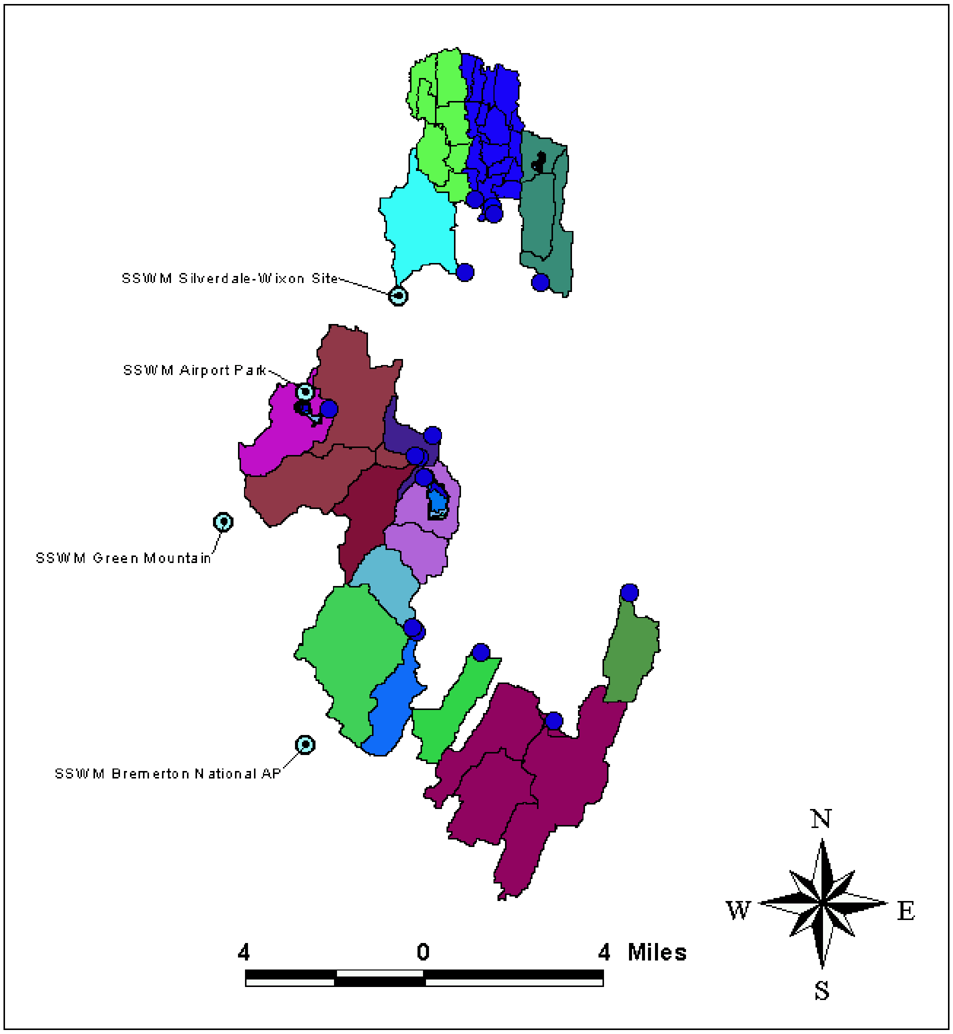

Figure 4. Location of the four precipitation gages established in October 2000.

Precipitation Gage	Missing Data
SSWM Green Mountain (60)	02/01/2001 07:00 – 02/28/2001 23:45 04/17/2002 00:00 – 05/01/2002 23:45 03/03/2003 22:15 – 04/07/2003 10:00
SSWM Bremerton National AP (61)	02/01/2001 07:00 – 02/28/2001 23:45
SSWM Silverdale – Wixon (62)	02/01/2001 00:00 – 02/28/2001 23:45 05/13/2002 00:00 – 06/07/2002 23:45 08/13/2002 00:00 – 09/11/2002 23:45
SSWM Airport Park (63)	02/01/2001 07:00 – 02/28/2001 23:45 08/01/2002 00:00 – 09/09/2002 23:45

Table 1. Record of missing data for the four precipitation gages established as part of the monitoring program in support of the PSNS & IMF Project ENVVEST.

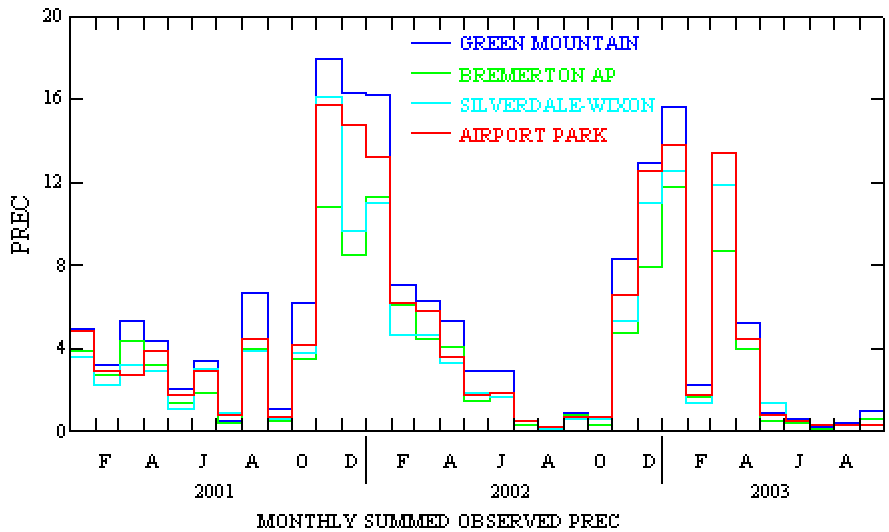

Figure 5. Plot of monthly precipitation totals, in inches, at the four precipitation gages established as part of the monitoring program in support of the PSNS & IMF Project ENVVEST.

Precipitation data at a fifteen-minute time interval were also provided for four precipitation gages maintained by the City of Bremerton, Washington. The locations of the four gages, numbered 1 – 4, are shown in Figure 6. Table 2 specifies the periods of record and periods of missing precipitation data, for the period January 01, 2001 – September 30, 2003, for each of the four gages. For each gage, missing precipitation data were filled in using functional relationships that were established with neighboring stations for periods of coincident data. Figure 7 is a plot of monthly precipitation totals, in inches, at each of the four gages for the period January 01, 2001 – September 30, 2003.

Precipitation Gage	Period of Record	Missing Data for Jan. 01, 2001 – Sep. 30, 2003
City of Bremerton Gage 1 (1)	01/01/1992 – 12/02/2003	10/2001 – 11/2001 12/2001 04/02/2003 00:45 – 04/02/2003 15:30 04/24/2003 18:45 – 05/01/2003 01:00 05/30/2003 16:00 – 06/13/2003 02:15 06/30/2003 06:30 – 07/01/2003 00:30 08/09/2003 21:45 – 10/01/2003 14:45 10/21/2003 15:00 – 10/22/2003 13:15 11/05/2003 16:00 – 11/07/2003 16:00
City of Bremerton Gage 2 (2)	01/01/1992 – 12/02/2003	12/2001 04/2002 – 08/2002 05/01/2003 12:15 – 05/04/2003 02:15 06/04/2003 14:30 – 06/13/2003 01:30 06/30/2003 08:00 – 07/01/2003 00:30 08/06/2003 14:30 – 08/09/2003 05:45 10/21/2003 07:00 – 10/22/2003 01:30
City of Bremerton Gage 3 (3)	01/01/1997 – 12/02/2003	12/2001 04/24/2003 19:15 – 05/04/2003 02:15 07/01/2003 12:30 09/03/2003 12:30 – 12/02/2003 11:30
City of Bremerton Gage 4 (4)	10/21/1999 – 12/03/2003	12/2001 06/03/2003 00:15 – 07/12/2003 23:00 09/03/2003 13:15 – 09/06/2003 23:00 10/01/2003 13:45 – 10/04/2003 06:00 10/21/2003 14:00 – 10/22/2003 13:00

Table 2. Periods of record and periods of missing data for the precipitation data provided by the City of Bremerton.

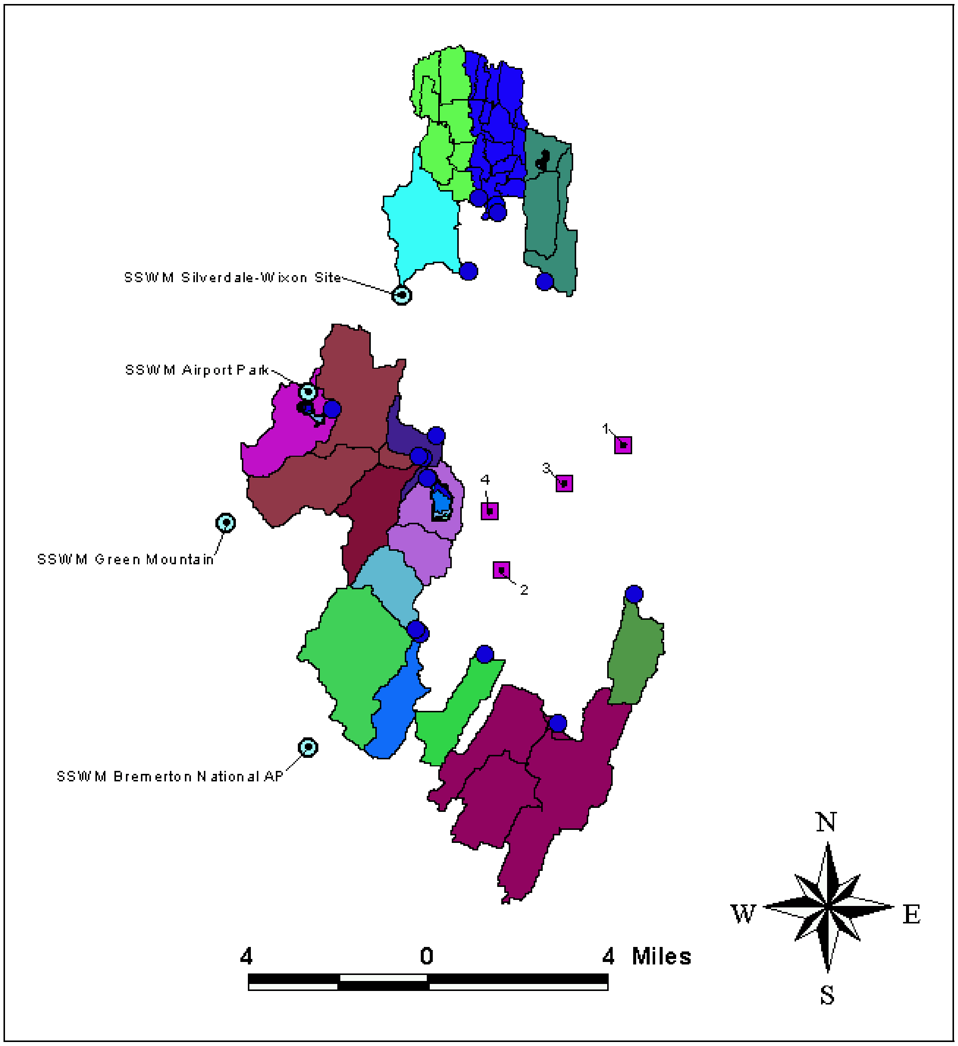

Figure 6. Gage locations for precipitation data provided by the City of Bremerton are numbered 1-4.

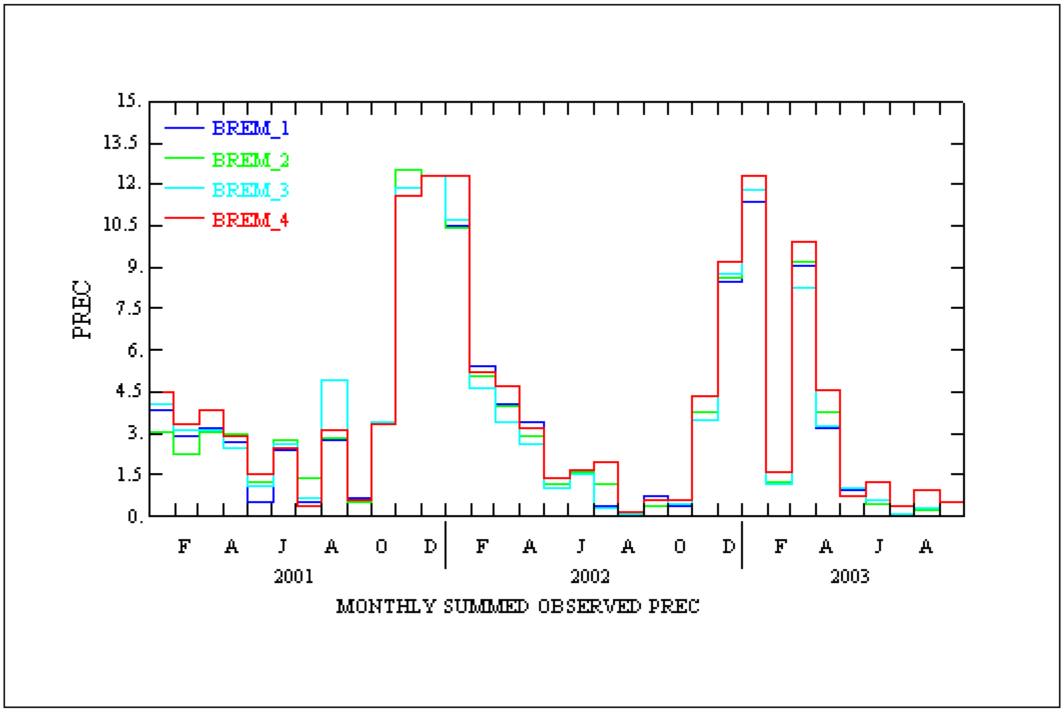

Figure 7. Plot of observed monthly precipitation totals, in inches, for the precipitation data provided by the City of Bremerton, WA in support of the PSNS & IMF Project ENVVEST.

Precipitation data were assigned, with equal weighting, to each modeled sub–watershed as prescribed in Table 3.

Watershed	**Precipitation Gages Used to Support Simulation**
ANDERSON CREEK – BREMERTON	City of Bremerton Gage 2 SSWM Bremerton National AP (61)
BARKER CREEK	SSWM Silverdale – Wixon (62)
BLACKJACK CREEK	City of Bremerton Gage 2 SSWM Bremerton National AP (61)
CHICO CREEK MAINSTEM	City of Bremerton Gage 4 SSWM Green Mountain (60) SSWM Airport Park (63)
CHICO TRIB. @ Taylor Road	SSWM Green Mountain (60) SSWM Airport Park (63)
CLEAR CREEK	SSWM Silverdale – Wixon (62)
CLEAR CREEK – WEST TRIBUTARY	SSWM Silverdale – Wixon (62)
DICKERSON CREEK	City of Bremerton Gage 4 SSWM Green Mountain (60) SSWM Airport Park (63)
GORST CREEK	City of Bremerton Gage 2 SSWM Bremerton National AP (61)
HEINS CREEK	City of Bremerton Gage 2
KARCHER CREEK	City of Bremerton Gage 2
KITSAP CREEK @ Lake Outlet	City of Bremerton Gage 4 SSWM Green Mountain (60)
PARISH CREEK	SSWM Bremerton National AP (61)
STRAWBERRY CREEK	SSWM Silverdale – Wixon (62)
WILDCAT CREEK @ Lake Outlet	SSWM Green Mountain (60) SSWM Airport Park (63)

Table 3. Assignment of precipitation data to modeled watershed systems.

Evaporation. Potential evapotranspiration is typically prescribed by multiplying pan evaporation data by a pan coefficient. Actual evapotranspiration is subsequently simulated based on the input potential evapotranspiration data, model algorithms, and evapotranspiration parameters. Pan evaporation data was obtained for the SeaTac Airport meteorological station from the WDM data file for the state of Washington that is packaged with the BASINS system from the EPA (http://www.epa.gov/OST/BASINS/download.htm). These data, together with potential evapotranspiration data computed using temperature data for Bremerton, WA were used to support HSPF hydrologic simulation.

Calibration Data. A streamflow monitoring plan was established to support the watershed modeling effort for the PSNS & IMF Project ENVVEST. The Kitsap Public Utilities District maintains the streamflow gaging stations. Streamflow data, collected at a fifteen minute time step, was provided by the Kitsap Public Utilities District for the streamflow gaging stations depicted in Figure 2. Appendix B provides the periods of record and periods of missing data for the streamflow gaging stations.

Observed Streamflow/Precipitation Volume Ratios. Appendix C lists tables that specify the ratio of observed stream discharge to observed precipitation (precipitation data were assigned, with equal weighting, to each sub–watershed as prescribed in Table 3), both collected at a fifteen minute time step, for specified periods, for the watershed systems associated with the streamflow gaging stations identified in Figure 2. The observed streamflow volume/precipitation volume ratios that are listed in Tables C.1 – C.15 not only underscore the need to treat each watershed system individually, but also they suggest that one may experience difficulty attempting to determine an HSPF hydrologic model for several of the gaged systems within the Sinclair–Dyes Inlet watershed; for example, Karcher Creek, Anderson Creek, Parish Creek, and Gorst Creek, among possible others.

3. HSPF HYDROLOGIC MODEL DEVELOPMENT

Sub–watersheds (e.g., Barker Creek, Clear Creek, Chico Creek, …) of the Sinclair–Dyes Inlet watershed were delineated using

1. the DEM for the project study area and industry standard DEM processing algorithms,
2. information pertaining to the urban drainage systems, and
3. pre–existing watershed delineation efforts.

This data was manually translated into the appropriate blocks within the Users Control Input (UCI) file, the main HSPF model input file. Table 4 specifies the approximate upstream drainage area associated with each streamflow gaging station that is identified in Figure 2. Figure 8 is a plot depicting the current basin delineation for the PSNS & IMF project ENVVEST.

Watershed	Contributing Drainage Area (acres)
ANDERSON CREEK – BREMERTON	1607
BARKER CREEK	1506
BLACKJACK CREEK	5933
CHICO CREEK MAINSTEM	1474
CHICO TRIB. @ Taylor Road	9686
CLEAR CREEK	1914
CLEAR CREEK – WEST TRIBUTARY	2247
DICKERSON CREEK	4603
GORST CREEK	2069
HEINS CREEK	1225
KARCHER CREEK	6996
KITSAP CREEK @ Lake Outlet	1220
PARISH CREEK	1005
STRAWBERRY CREEK	1092
WILDCAT CREEK @ Lake Outlet	3197

Table 4. Drainage area associated with the streamflow gaging stations identified in Figure 2.

Based on guidance provided by the PSNS & IMF project ENVVEST Technical Working Group, the land uses reflected in the HSPF models that were developed included

1. Medium Density Residential
2. High Density Residential
3. Commercial / Industrial
4. Acreages / Rural Development
5. Herbaceous Rangeland
6. Shrub & Brush Rangeland
7. Deciduous Forest
8. Coniferous Forest
9. Mixed Forest
10. Beaches
11. Other Barren Land

Directly connected impervious surface was treated as a calibration parameter and it was associated with the Medium Density Residential, High Density Residential, Commercial / Industrial, and Acreages / Rural Development pervious land areas. The land use distribution within each modeled sub–watershed was determined using GIS analysis. This information was subsequently manually mapped into the SCHEMATIC block of the UCI file. The land segmentation for the modeled watershed systems in the Sinclair–Dyes Inlet watershed is depicted in Figure 2. That is, the model for the drainage area above each streamflow gaging station was developed with its own unique set of parameters.

Initial parameter estimates were based on guidance provided by USEPA (2000), Munson (1998), Dinicola (1990), and USACE and USEPA (2000), among others, and GIS–based analysis. Stage–discharge relationships for each reach within each sub-watershed were specified based on either application of Manning's equation and information obtained from field observations or stream gaging station information obtained from KPUD. FTABLES for Island Lake, Kitsap Lake, and Wildcat Lake were specified based on available bathymetry data and an assumed outflow relation.

The simulation time step was fifteen minutes, which equaled the temporal resolution of the input precipitation data. A WDM file was prepared to receive and store, at a fifteen–minute time step, the simulated flow and volume data for each modeled RCHRES. The model was interfaced with GenScn (Kittle et al. 1998). GenScn is a public domain graphically–based modeling environment that supports scenario analysis, BMP analysis, and time series data analysis for the HSPF model, among others.

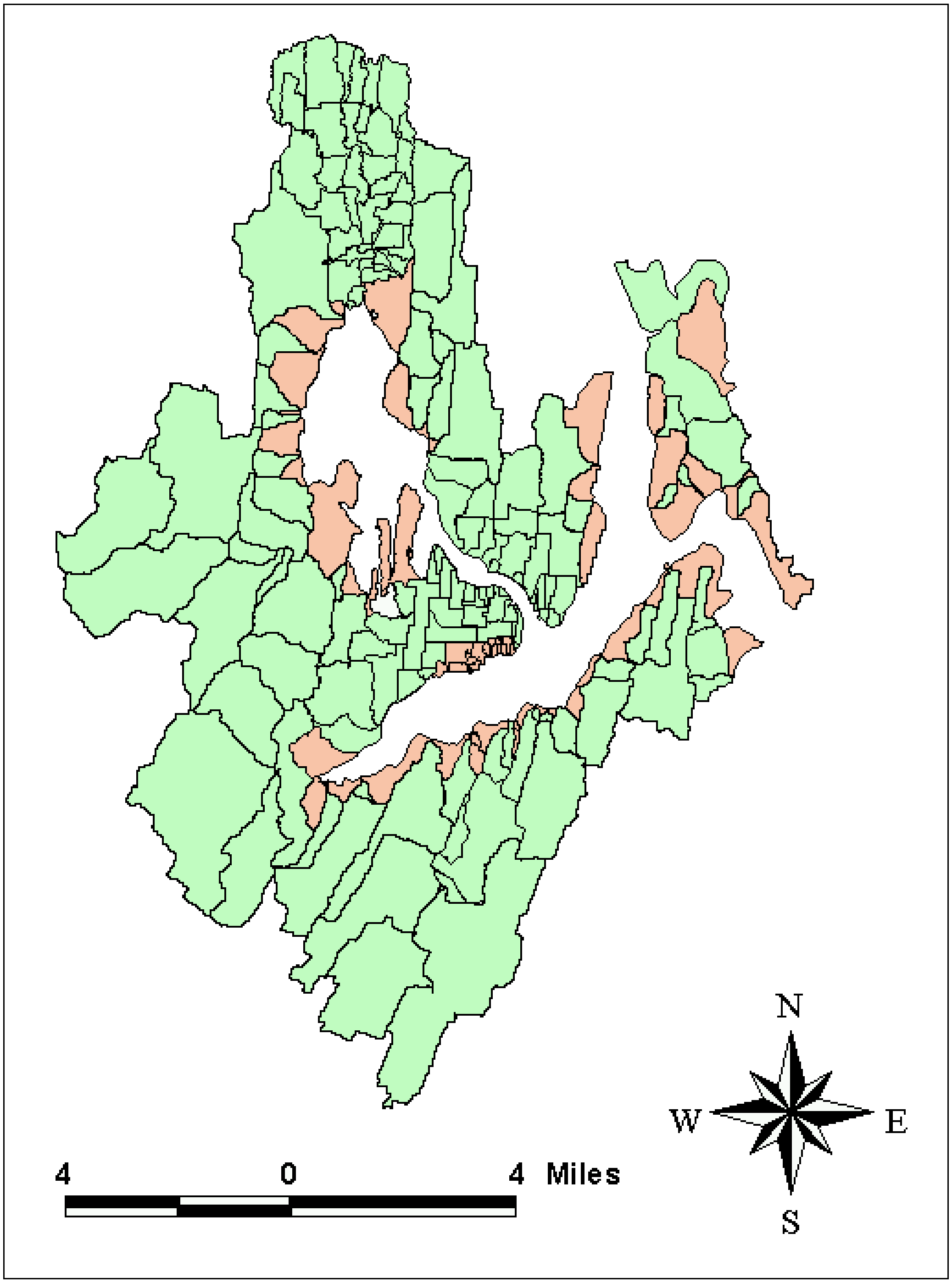

Figure 8. Current delineation for Sinclair–Dyes Inlet watershed.

4. HSPF HYDROLOGIC MODEL CALIBRATION AND VERIFICATION

Background. Figure D.1 in Appendix D depicts the water budget compartment, which is based on the Stanford watershed model, of the PERLND application module of the HSPF model. Examining Figure D.1, it is apparent that, for this conceptual rainfall-runoff (CRR) model, there are on the order of a dozen parameters that must be estimated during the hydrologic model determination process. One of the notable strengths of the HSPF model is its ability to account for a multiplicity of areally associated factors relevant to the hydrologic and water quality response within a given modeled watershed system. Hence, for a mixed land use system, there could be up to $12 \times x$ parameters to estimate, where x is the number of unique hydrologic response units within the given modeled watershed system, just to "calibrate" the water budget component of the model. This is weighed against the fact that only 4-5 adjustable parameters are all that is needed to calibrate a well designed rainfall-runoff model against a streamflow hydrograph (Jakeman and Hornberger 1993; Beven 2001). Hence, the HSPF hydrologic model complexity that was specified in the previous section suggests a high propensity for redundancy in the parameterization, which may very well involve parameter correlation (a form of parameter insensitivity), of the HSPF models. Given the desired HSPF hydrologic model complexity, parameter non–uniqueness needs to be examined, and further, one would possibly also need to subsequently examine the impacts of identified parameter insensitivity on model predictions (i.e., model outcomes would possibly need to be specified within the context of model predictive uncertainty). Computationally tractable and reliable methods are readily available to support parameter estimation, identification of parameter non–uniqueness, and quantitative assessment of its impacts on model predictions.

The PEST software is comprehensively described in Doherty (2002) and the advantages of a PEST/HSPF model linkage are briefly described in Appendix A. The PEST software is based on a robust implementation of the Gauss–Marquardt–Levenburg method, and it will adjust model parameters and/or excitations until the fit between model outputs and laboratory or field observations is optimized in the weighted least squares sense. Doherty and Johnston (2003) noted that the Gauss–Marquardt–Levenburg method will normally find the objective function minimum in fewer models runs than any other parameter estimation method, and, clearly, that this characteristic is important when model run times are lengthy or even moderate.

Local search methods such as the gradient-based Gauss–Marquardt–Levenburg method have been suggested to be inappropriate to support the calibration of CRR models. This is due mostly to the multiple optima problem identified by Duan et al. (1992) with the research CRR model SIXPAR. The author would not object to the observation that the objective function surface associated with a CRR model may exhibit multiple optima. Figure E.1 is a plot of a part of the objective function surface, in effect, a partial slice of the objective function surface, versus the normalized distance between two parameter sets that were obtained using the parameter estimation mode of PEST, starting at two different points in feasible parameter space. The results presented in Figure E.1 are associated with an HSPF model for the approximate fourteen acre drainage area above gaging site ten in the Goodwin Creek Experimental Watershed. The Goodwin Creek Experimental Watershed is located in Northern Mississippi approximately sixty miles south of Memphis, Tennessee. It is operated by the National Sedimentation Laboratory of the United States Department of Agriculture Agricultural Research Service. The results presented in Figure E.1 were easily obtained using PEST's sensitivity analysis tool SENSAN, and they provide comparable information to that presented by Duan et al. (1992) which relied upon computationally intensive exhaustive gridding.

Two multi-start drivers were developed to support the application of the PEST software in the surface hydrology domain. One, named PD_MS2, consists of pre-inversion random sample runs followed by a set of PEST optimization runs which use some of the pre-inversion randomly-generated parameter sets as starting values. During the execution of PD_MS2, subsequent PEST optimization runs "learn from previous mistakes" by selecting initial parameter sets, from the pre-inversion randomly-generated parameter sets, which are as far as possible from all previous PEST optimization run parameter trajectories (Doherty 2003). Application of PD_MS2 to date has indicated that it is able to find the global optimum for the CRR Stanford Watershed Model, as implemented in HSPF, in less than or equal to the number of model runs required to find the global optimum using the Shuffled Complex Evolution (SCE) global search method (Duan et al. 1992). The SCE method could be viewed as the benchmark for effective and efficient automated parameter estimation for CRR models. Moreover, upon examination of the dotty plots presented in Appendix F, which are related to an HSPF hydrologic model for the approximate fourteen acre drainage area above gaging site ten in the Goodwin Creek Experimental Watershed, PD_MS2 is able to provide one with more information about the objective function surface. Dotty plots are projections of the objective function surface onto individual parameter spaces.

Calibration and Verification. Almost all of the HSPF model parameters related to the water budget computations are not available from field data and must be determined through model calibration. The HSPF hydrologic models that were developed for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed were subsequently interfaced with the model–independent parameter estimation tool PEST (Doherty 2002) to support parameter estimation and eventual model predictive uncertainty analysis. From a practical HSPF model deployment perspective, the PEST/HSPF model linkage is better suited, relative to the conventional use of HSPEXP (Lumb et al. 1994), to support HSPF hydrologic model calibration in situations where system observation data contains periods of missing record, which is the case for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed. For example, with the PEST/HSPF model linkage, there is no need to manufacture artificial observation data to support a model parameter estimation and predictive analysis effort.

Tables G.1 – G.15 in Appendix G list the calibration and verification periods for each of the HSPF hydrologic models that were developed for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed. In each case, the parameter estimation process was conducted by comparing simulated results against observed streamflow data. In particular, the specified multi-component objective function consisted of aggregation of the fifteen minute streamflow data to daily, monthly, and annual (or the entire simulation period if it was less than one year) time steps, exceedence times for various flow thresholds, and also the slow flow and quick flow system response which were each determined using a digital baseflow separation filter (Doherty 2003). Weights to each of these groups of data were specified in a pragmatic manner such that the parameter estimation engine saw each of them as of equal importance. Hence, there was no specific HSPF hydrologic model calibration objective for any one of the systems; for example, to focus on simulating peak flows well at the possible expense of modeled low flows. Possibly a more appropriate and efficient approach could have been to assign weights to each of the models in a manner consistent with their intended predictions.

Table 5 presents a list of the adjustable parameters that were estimated for each of the HSPF hydrologic models that were developed for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed. HSPF model parameterization attempted to meet the established project objective to simulate the landscape that was reflected in each of the models.

Parameter	Parameter	Parameter	Parameter	Parameter	Parameter
x	agwrc_rat	basetp	nsura	ircrat_1	retsc
imp1	agwrctrnsa	cepsca	nsurb	ircrat_2	
imp2	lzsn	cepscb	nsurc	lzetpa	
imp3	infilt	uzsn_1rat	intfwrat1	lzetpb	
imp4	deepfr	uzsn_2rat	intfwrat2	insur	

Table 5. List of the adjustable parameters that were estimated for each of the HSPF hydrologic models that were developed for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed.

The parameter x listed in Table 5 was only used for Karcher Creek and Anderson Creek. Its purpose was to artificially introduce a constant supply of water into the stream to aid in establishing an acceptable water balance. The parameters imp1, imp2, imp3, and imp4 listed in Table 5 were set to range from 0.20 to 0.35, 0.35 to 0.60, 0.60 to 0.90, and 0.00 to 0.20, respectively. They partitioned the total Medium Density Residential, High Density Residential, Commercial / Industrial, and Acreages / Rural Development urban land use area within each given modeled sub-watershed between pervious land area and directly connected impervious land area, as specified in Equations 1-8. The adjustable parameters agwrc_rat and agwrctrnsa listed in Table 5 were set to range from 0 to 1, and 5 to 999, respectively. The adjustable parameters agwrc_rat and agwrctrnsa listed in Table 5 are related to the HSPF model parameter agwrc as specified in Equations 9 - 11. In particular, agwrca and agwrcb, as defined in Equation 10 and Equation 11, were the agwrc parameter values specified for the High Density Residential, Commercial / Industrial and the remaining land uses that were reflected in the HSPF models, respectively. The adjustable parameters cepsca and cepscb listed in Table 5 were set to range from 0.15 to 0.40 and 0.00 to 0.15, respectively. The adjustable parameters cepsca and cepscb listed in Table 5 were the cepsc parameter values specified for the forested land and remaining land uses that were reflected in the HSPF models, respectively. The adjustable parameters uzsn_1rat and uzsn_2rat listed in Table 5 were set to range from 0 to 1, respectively. The adjustable parameters uzsn_1rat and uzsn_2rat listed in Table 5 are related to the HSPF model parameter uzsn as specified in Equations 12 - 13. In particular, uzsna and uzsnb, as defined in Equation 12 and Equation 13, were the uzsn parameter values specified for the High Density Residential, Commercial / Industrial and the remaining land uses that were reflected in the HSPF models, respectively. The adjustable parameters nsura, nsurb, and nsurc listed in Table 5 were set to range from 0.05 to 0.15, 0.15 to 0.30, and 0.30 to 0.45, respectively. The adjustable parameters nsura, nsurc, and nsurb listed in Table 5 were the nsur parameter values specified for the High Density Residential and Commercial / Industrial, forested land, and remaining land uses that were reflected in the HSPF models, respectively. The adjustable parameters intfwrat1, intfwrat2, ircrat_1, and ircrat_2 listed in Table 5 were all set to range from 0 to 1, respectively. The adjustable parameters intfwrat1 and intfwrat2, and ircrat_1 and ircrat_2 listed in Table 5 are related to the HSPF model parameters intfw and irc as specified in Equations 14 – 15 and Equations 16 – 17, respectively. In particular, intfwa and irca, and intfwb and ircb as defined in Equations 14 and 16, and Equations 15 and 17, respectively, were the intfw and irc parameter values specified for the High Density Residential, Commercial / Industrial and the remaining land uses that were reflected in the HSPF models, respectively. The adjustable parameters lzetpa and lzetpb listed in Table 5 were the lzetp parameter values specified for the forested land and remaining land uses that were reflected in the HSPF models, respectively. The HSPF model parameters agwrc, lzsn, infilt, deepfr, basetp, cepsc, uzsn, nsur, intfw, irc, lzetp, insur, and retsc are comprehensively described in USEPA (2000) and Bicknell et al. (1996), among others.

Medium Density Residential Pervious Land Area	= (1.0 – imp1) * Medium Density Residential Total Land Area	(1)
High Density Residential Pervious Land Area	= (1.0 – imp2) * High Density Residential Total Land Area	(2)
Commercial / Industrial Pervious Land Area	= (1.0 – imp3) * Commercial / Industrial Total Land Area	(3)
Acreages / Rural Development Pervious Land Area	= (1.0 – imp4) * Acreages / Rural Development Total Land Area	(4)

Medium Density Residential Impervious Land Area	= imp1 * Medium Density Residential Total Land Area	(5)
High Density Residential Impervious Land Area	= imp2 * High Density Residential Total Land Area	(6)
Commercial / Industrial Impervious Land Area	= imp3 * Commercial / Industrial Total Land Area	(7)
Acreages / Rural Development Impervious Land Area	= imp4 * Acreages / Rural Development Total Land Area	(8)

agwrctrnsb = agwrctrnsa + agwrc_rat * (999 - agwrctrnsa) (9)

agwrca = agwrctrnsa / (1.0 + agwrctrnsa) (10)
agwrcb = agwrctrnsb / (1.0 + agwrctrnsb) (11)

uzsna = (.06 + uzsn_1rat * (.14 - .06)) * lzsn1 (12)
uzsnb = ((.06 + uzsn_1rat * (.14 - .06)) + uzsn_2rat * (.14 - (.06 + uzsn_1rat * (.14 - .06)))) * lzsn1 (13)

intfwa = 1.0 + intfwrat1 * (10.0 - 1.0) (14)
intfwb = (1.0 + intfwrat1 * (10.0 - 1.0)) + intfwrat2 * (10.0 - (1.0 + intfwrat1 * (10.0 - 1.0))) (15)

irca = 0.3 + ircrat_1 * (0.85 - 0.3) (16)
ircb = (0.3 + ircrat_1 * (0.85 - 0.3)) + ircrat_2 * (0.85 - (0.3 + ircrat_1 * (0.85 - 0.3))) (17)

Tables H.1 – H.15 in Appendix H list the optimized parameter sets that resulted from application of PD_MS2 to the HSPF hydrologic models that were developed for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed. The optimized parameter sets that are listed in Appendix H were, in each case, based on thousands of model calls, a fairly exhaustive effort well beyond that which would be capable if one conducted an iterative manual model calibration.

Tables I.1 – I.15 in Appendix I summarize computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination that were calculated based on a comparison of the computed flows, obtained from the optimized models, obtained using PD_MS2, with the observed flows at the fifteen minute, daily, and monthly timescales, respectively. The Nash and Sutcliffe efficiency score, *ES*, correlation coefficient, *R*, and coefficient of determination, R^2, are defined in Equations 18 – 21.

$$M_f = \frac{1}{n}\sum_{i=1}^{n} Q_f(i) \tag{18}$$

$$M_o = \frac{1}{n}\sum_{i=1}^{n} Q_o(i) \tag{19}$$

$$ES = \left[\frac{\Sigma_{i=1}^{n}(Q_o - M_o)^2 - \Sigma_{i=1}^{n}(Q_o - Q_f)^2}{\Sigma_{i=1}^{n}(Q_o - M_o)^2}\right] \tag{20}$$

$$R^2 = \left[\frac{\frac{1}{n}\sum_{i=1}^{n} Q_o Q_f - M_o M_f}{\left(\frac{1}{n}\sum_{i=1}^{n} Q_o^2 - M_o^2\right)\left(\frac{1}{n}\sum_{i=1}^{n} Q_f^2 - M_f^2\right)}\right]^2 \tag{21}$$

where Q_f and Q_o are the simulated and observed streamflow, respectively.

Values of the Nash and Sutcliffe efficiency score, *ES*, range from 1 to $-\infty$. When model predictions equal observed values, *ES* equals 1. Negative values of *ES* imply that the model's predictive power is worse than simply using the mean of the observed values. Donigian (2002), based on more than twenty years of experience with the HSPF model, provided correlation coefficient and coefficient of determination value ranges for assessing (HSPF) hydrologic model performance at the daily and monthly timescales. "Very Good", "Good", "Fair", and "Poor" HSPF hydrologic model simulations would have R^2 value ranges of approximately 0.85–1.00, 0.75–0.85, 0.65–0.75, and 0.00–0.65, respectively, at the monthly timescale and 0.80–1.00, 0.70–0.80, 0.60–0.70, and 0.00–0.60, respectively, at the daily timescale. Table 6 incorporates the conventional wisdom provided by Donigian (2002) with the summary statistics presented in Tables I.1 – I.15 in Appendix I to present a qualitative assessment of HSPF hydrologic model performance for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed.

Watershed	Calibration	Verification
ANDERSON CREEK – BREMERTON	NA	NA
BARKER CREEK	"Good" to "Very Good"	"Poor" to "Very Good"
BLACKJACK CREEK	"Fair"	"Poor" to "Good"
CHICO CREEK MAINSTEM	NA	NA
CHICO TRIB. @ Taylor Road	"Fair" to "Very Good"	"Very Good"
CLEAR CREEK	"Poor" to "Very Good"	"Poor" to "Very Good"
CLEAR CREEK – WEST TRIBUTARY	"Poor" to "Very Good"	"Poor" to "Very Good"
DICKERSON CREEK	"Fair" to "Very Good"	"Poor" to "Very Good"
GORST CREEK	NA	NA
HEINS CREEK	"Very Good"	"Very Good"
KARCHER CREEK	NA	NA
KITSAP CREEK @ Lake Outlet	"Very Good"	"Very Good"
PARISH CREEK	NA	NA
STRAWBERRY CREEK	"Good" to "Very Good"	"Poor" to "Very Good"
WILDCAT CREEK @ Lake Outlet	"Good" to "Very Good"	"Good" to "Very Good"

Table 6. Qualitative assessment of HSPF hydrologic model performance, at the daily timescale, for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed.

Figures I.1 – I.15 in Appendix I present graphical results of the HSPF hydrologic model calibration and verification exercise for the gaged sub-watersheds of the Sinclair-Dyes Inlet watershed at the fifteen minute, monthly mean, and monthly mean for the period of interest timescales.

Anderson Creek. The observed streamflow volume/precipitation volume ratios that are listed in Table C.12 in Appendix C for Anderson Creek deviate far from that of the "typical" watershed in Kitsap County, Washington wherein approximately 42 percent of the input precipitation is lost to evapotranspiration (Kitsap County 2002). Evaluation of Anderson Creek's groundwater resources and/or the rating curve for Anderson Creek's streamflow gaging station are necessary before the HSPF hydrologic model that has been developed for Anderson Creek can be calibrated to available streamflow discharge data.

Barker Creek. Despite the acceptable R^2 values for the periods through 06/03/2003, the simulation bias to under-predict streamflow discharge for 01/06/2001 – 10/31/2001 and 10/01/2002 – 11/20/2002 (see Figure I.9.A and Figure I.9.C) clearly explains the low Nash and Sutcliffe efficiency scores that were calculated for these two periods. The poor model volume to measurement volume misfit for these two periods suggests, among possible others, that either a system dynamic may not be reflected in the model and/or a poor rating curve for the Barker Creek streamflow gaging station. The poor model to measurement misfit for the period 07/12/2003 – 09/30/2003 is attributed to poor discharge observation data (see Figure I.9.G). The observed streamflow volume/precipitation volume ratios that are listed in Table C.9 in Appendix C for Barker Creek are, possibly, somewhat high, at least relative to the figures and discussion provided by Kitsap County (2002).

Blackjack Creek. With the exception of the periods 06/14/2003 – 07/15/2003 and 07/17/2003 – 09/30/2003, calculated R^2 values suggested "Fair" to "Good" HSPF hydrologic model performance. However, the computed Nash and Sutcliffe efficiency scores were all relatively low. The divergence is attributed to under-prediction and over-prediction of flow volumes (see Figures I.11). Although the model to measurement misfit would quantitatively suffer in terms of an increase in the value of the specified multi-component objective function, adjustment of the interflow and baseflow recession rates could possibly provide for a more visual pleasing model to measurement misfit, particularly for the descending limb of the storm hydrographs.

Chico Creek Tributary at Taylor Road. Although the HSPF hydrologic model calibration and verification was assessed, based on calculated R^2 values, to be "Fair" to "Very Good" and "Very Good", respectively, the computed Nash and Sutcliffe efficiency scores indicated model performance could range anywhere from "Poor" (for example, the period 05/21/2002 – 09/30/2002) to "Very Good"(for example, the period 11/14/2002 – 12/13/2002). The results depicted in Figure I.3.D and Figure I.3.G indicate model bias to under-predict streamflow discharge for these two periods.

Clear Creek. The calculated R^2 values and Nash and Sutcliffe efficiency scores both indicated that model performance could range anywhere from "Poor" (for example, the period 10/01/2001 – 10/31/2001) to "Very Good" (for example, the period 12/21/2002 – 04/08/2003). The results depicted in Figure I.8.A, Figure I.8.F, and Figure I.8.G indicate model bias to under-predict streamflow discharge for these three periods.

Clear Creek – West Tributary. The calculated R^2 values and Nash and Sutcliffe efficiency scores both indicated that model performance could range anywhere from "Poor" (for example, the period 01/01/2001 – 04/28/2001) to "Very Good" (for example, the period 03/01/2003 – 05/04/2003). The results depicted in Figure I.7.A and Figure I.7.B indicate model bias to under-predict streamflow discharge for these two periods. The results depicted in Figure I.7.F indicate model bias to over-predict streamflow discharge for the associated model verification period.

Dickerson Creek. The "Poor" model performance for the rainy two week period 03/12/2003 – 03/24/2003 is principally attributed to the under-prediction of observed flow volumes, which seemed to be high, based on the precipitation/runoff value specified in Table C.4 in Appendix C. Although the model to measurement misfit would quantitatively suffer in terms of an increase in the value of the specified multi-component objective function, adjustment of the interflow and baseflow recession rates could possibly be adjusted to produce a more visually pleasing model to measurement misfit for some of the periods, particularly for the descending limb of the storm hydrographs. The observed streamflow volume/precipitation volume ratios that are listed in Table C.4 in Appendix C for Dickerson Creek are, possibly, somewhat high (particularly for a relatively non-urbanized watershed), at least relative to the figures and discussion provided by Kitsap County (2002).

Gorst Creek. The observed streamflow volume/precipitation volume ratios that are listed in Table C.15 in Appendix C for Gorst Creek deviate far from that of the "typical" watershed in Kitsap County, Washington wherein approximately 42 percent of the input precipitation is lost to evapotranspiration (Kitsap County 2002). Evaluation of Gorst Creek's groundwater resources and/or the rating curve for Gorst Creek's streamflow gaging station are necessary before the HSPF hydrologic model that has been developed for Gorst Creek can be calibrated to available streamflow discharge data.

Heins Creek. While based on brief periods of record, the results presented in TableI.13 and Figure I.13 indicate a "Very Good" model to measurement misfit. The observed streamflow volume/precipitation volume ratios that are listed in Table C.13 in Appendix C for Heins Creek are, possibly, somewhat high, at least relative to the figures and discussion provided by Kitsap County (2002).

Karcher Creek. The observed streamflow volume/precipitation volume ratios that are listed in Table C.10 in Appendix C for Karcher Creek deviate from that of the "typical" watershed in Kitsap County, Washington wherein approximately 42 percent of the input precipitation is lost to evapotranspiration (Kitsap County 2002). Evaluation of Karcher Creek's groundwater resources and/or the rating curve for Karcher Creek's streamflow gaging station are necessary before the HSPF hydrologic model that has been developed for Karcher Creek can be calibrated to available streamflow discharge data.

Kitsap Creek at Lake Outlet. The results that are presented in TableI.1 and Figure I.1 indicate a "Very Good" model to measurement misfit. The observed streamflow volume/precipitation volume ratios that are listed in Table C.1 in Appendix C for the drainiage area above the Kitsap Creek at Lake Outlet streamflow gaging station are, possibly, somewhat high, at least relative to the figures and discussion provided by Kitsap County (2002).

Parish Creek. The observed streamflow volume/precipitation volume ratios that are listed in Table C.14 in Appendix C for Parish Creek deviate far from that of the "typical" watershed in Kitsap County, Washington wherein approximately 42 percent of the input precipitation is lost to evapotranspiration (Kitsap County 2002). Evaluation of Parish Creek's groundwater resources and/or the rating curve for Parish Creek's streamflow gaging station are necessary before the HSPF hydrologic model that has been developed for Parish Creek can be calibrated to available streamflow discharge data.

Strawberry Creek. With the exception of the period 06/05/2003 – 07/14/2003, for which the observed streamflow discharge data is presumably of low quality (see Figure I.6.H.1), the computed Nash and Sutcliffe efficiency scores indicated that the model had predictive value; albeit, a low efficiency for some periods. The results depicted in Figure I.6.A indicate model bias to under-predict streamflow discharge for the associated model calibration period.

Wildcat Creek at Lake Outlet. The results that are presented in TableI.2 and Figure I.2 indicate a "Good" to "Very Good" model to measurement misfit.

The PEST template files for the main HSPF model Users Control and Supplementary input files are presented in Appendix J for each model. The reader is referred to the EPA's Center for Exposure Assessment Modeling (CEAM) web page for obtaining the PEST software and related documentation (http://www.epa.gov/ceampubl/tools/pest/).

Parameter Non-uniqueness and Model Predictive Uncertainty Analysis.

For each of the models, information associated with the optimized parameter sets strongly suggested that desired model complexity was too high relative to the information content of the data available to determine each of the models. For example, the "normal matrix" (which is calculated from the Jacobian matrix, the matrix of partial derivatives of the observations with respect to the parameters) that must be inverted to compute the parameter upgrade vector, was ill-conditioned and the parameter estimation process was experiencing difficulties as a result of parameter insensitivity. For each of the models, the results from the PEST parameter estimation runs indicated that if one wants to include all of the desired model complexity to support simulation, then one must examine the impacts of parameter insensitivity on model predictions. That is, key model outcomes must be specified within the context of model predictive uncertainty. It is poor modeling practice not to impart to the decision making process identified non–uniqueness and its impacts on key model predictions.

The predictive analysis mode of PEST is capable of assessing the range of model predictions for key model outcomes, all the while keeping the model in a calibrated state. Although model parameter values are typically not the predictions of interest; for example, the hydrologic parameter LZSN was identified, using PEST, to be able to vary between 5.7 and 9.0, and all the while the HSPF model for Blackjack Creek maintained desired complexity and remained in a calibrated state. Figure 9 is a plot presenting the predictive range, obtained using PEST, for the simulated maximum discharge for Wildcat Creek for the month of January 2002.

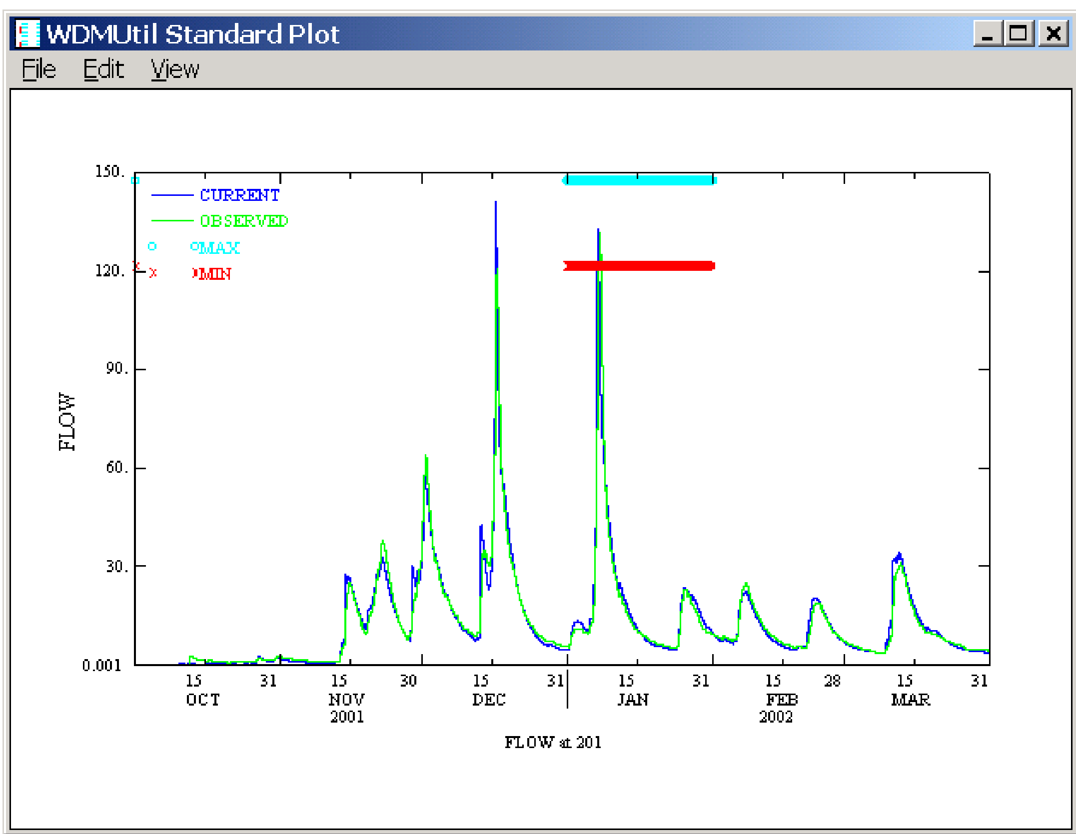

Figure 9. Results of the predictive range for the simulated maximum discharge for Wildcat Creek for January 2002.

5. RESPONSE TO WDOE COMMENTS

Number	Comments on September 30, 2003 Draft Report	Response
1	Background is useful for this specific report, but this will overwhelm the average reader of future, widely released reports. I suggest the details of the software and capabilities be included in an appendix to future reports.	The contents of Section 2 of the September 30, 2003 draft report are now in Appendix A
2	Minor comment on page 4, second paragraph-- the interflow and lower zone storage parameters can be varied monthly to reflect seasonal patterns. The report says the values can vary seasonally.	The text in the report was modified as suggested
3	On page 6, third paragraph-- should point out that no western Washington projects are included in the HSPFParm database.	The following text was placed at the end of the noted paragraph: "For example, not a single western Washington HSPF application is included in the HSPFParm database."
4	On a related note, there is no mention of the Dinicola values here, which I believe are included in KCRTS (King County Runoff Time Series). This was the best source of regionally applicable parameters as pointed out earlier. Still, you should include a blurb on why these weren't considered for this application, given that so many in the region are familiar with the Dinicola/KCRTS source of starting points for HSPF applications.	Section 3 of this document references Dinicola as a source for initital parameter estimates. A reference to Duan et al. (1992) should be more than sufficient for a response to the last comment.
5	On page 14, last paragraph, you state that missing precipitation records were filled in using the average from neighboring stations. A better way is to develop a relationship between stations with overlapping information, then apply the relationship to estimate missing data. So, develop y = f(x), where x is the neighboring station. The f(x) might be an exponential, linear, or power function that gives the best R2 value. Using averages will underestimate precipitation from usually high precip stations, and overestimate precip for stations that are lowest for the region. Since the missing data for a station tends to be weeks or longer at a time and not a matter of a few hours, this could have a significant impact on the hydrology.	The noted guidance was incorporated into the input precipitation time series which supported the hydrologic simulation reported herein.
6	On page 16, you describe using the same averaging for the Bremerton-area records. This is reasonable here, given that precipitation varies less over the area covered by these four gaging stations. But, for the highland gages, I'd expect the high variability to make the use of average values more uncertain (and a likely source of error).	The noted guidance was incorporated into the input precipitation time series which supported the hydrologic simulation reported herein.
7	On page 17, you state that you extended the precipitation records using SeaTac data. Again, I would encourage you to develop a relationship between SeaTac and the records you wish to extend for the overlapping data, then apply that relationship.	For the work reported in this document, precipitation data records were not extended based on SeaTac data
8	The last sentence on page 17 is unclear-- Is there no spatial variation in the available processed precipitation data because you used the SeaTac data for each site?	The sentence was removed from the text. Table 3 in the text specifies the assignment of input precipitation to the respective watershed systems.
9	Table 3 is very useful. I suggest not only using the precipitation gage numbers but the names by sub-watershed. And, it seems odd to me that you would use 63 (Airport Park) for precipitation on the Chico Trib and Wildcat Creek instead of 60 (Green Mountain). Are you sure about that?	The text in the report was modified as suggested. Both gages were used to support the hydrologic simulation on Chico Trib. and Wildcat Creek.
10	On page 20 you indicate that you use IMPLND to describe medium- and high-density residential, commercial/industrial, and rural development. Did you use a %impervious cover for each of these categories to determine the land area simulated by IMPLND (and PERLND for the inverse of that amount)? If so, please present these numbers explicitly.	Please see Section 3 and Appendix H
11	Explicitly state the period of calibration. It appears to vary by sub-watershed, I suppose based on data availability. No need to include those details-- "data available for the period x to y" would suffice.	Please see Appendix G
12	The first bulleted items on page 22 are confusing. Looks like extra line breaks in there?	
13	And, I don't understand what you mean by "communication with the Kitsap Public Utilities District indicated that separate models would be needed..." because of the reliability of the historical data. Looks to me like you didn't use the historical data at all, right? State that clearly.	The noted text was removed from the document. Please see Appendix G for the periods of simulation for the respective watershed systems

Number	Comments on September 30, 2003 Draft Report	Response
14	At the bottom of page 22, you explain your code for identifying the tables that follow, but it's still difficult to follow. Does "X" refer to time series? Overall, a better way to present all of this information is in summary tables, rather than in the text format used currently. The terms in the text shots need to be defined at a minimum (I have no idea what the Nash-Sutcliffe coefficient is). Even the basics like standard error. And, the units for volume are not specified, but I suspect are something like cubic feet or gallons (per year or per period of simulation). Yes, we can compare the simulated volume to the observed volume in these units, but a more approachable and understandable way of presenting the same information takes it one step further. Convert the volumes into the equivalent cfs or in/year. Not only can we compare the predicted and observed, but the units themselves will be more meaningful. I have no idea what 10^7 gal/simulation period is, but I do have an intuitive understanding of 8 cfs. This will provide context for understanding the results. I suggest two to four tables with the following information: Table X-1. Annual discharge Columns: Station ID, period of comparison, observed Q (cfs), simulated Q (cfs), and maybe terms like standard error or bias Table X-2. Monthly (or seasonal?) discharge Same columns, but need 12x the rows to list the monthly values	Suggestions noted and implemented into the text of this document. Please see Appendix I.
15	The other summaries you provide are summed daily comparisons and comparisons of predicted and observed 15-minute values. These don't lend themselves to a tabular summary in the form I've described. If you think of a simple way to do it, include it in the text. If not, I would include this information in an appendix; you can still characterize your findings in text form, but in qualitative terms.	Please see Appendix I

Number	Comments on September 30, 2003 Draft Report	Response
16	The WDMUtil screenshots are very useful for high-level review of calibration success. Some specific comments by station, based solely on visual interpretation (I will need to look at the calibrated parameter values, such as LZSN, etc., especially since your early results from the PEST application seemed to include some unrealistic values, at least for Clear Creek): Kitsap-- consistently underpredict the peak flows. In fact, it looks like you probably underpredict the total amount of water coming out of that basin. (I know it's buried in the text shots, but I can't follow it.) Going back to Table 3, I see you used Bremerton precip gage 4. I'd guess Kitsap is still influenced by the mountains, even though its headwaters are low. You might consider rethinking the associated precipitation record. Another option, which might not work, is to adjust your f-table to reduce the lake storage during storms-- lower the outlet level or check the volume/elevation curve. Wildcat-- great. But, I think the AP precip record might underestimate the amount of water falling on the basin. Green Mountain site probably better. Chico Trib at Taylor Rd-- missing the WDMUtil screenshot. Can't offer comments yet, except the precip might be closer to Green Mountain. Dickerson-- good (and used Green Mountain) Strawberry-- OK. Peak flows look off, but this won't change the annual balance much. Peak flows in observed record are the most uncertain anyway. Still, this could overpredict the storm contributions from Strawberry when we put the fecal coliform concentration relationship together with the flows to get loads. Something to be aware of for now. Clear Creek West-- good Clear Creek main tem-- looks like there's not quite enough recession here. If you vary parameters by basin, you might adjust here. If you use the same values across all sub-watersheds, you should look through your geology. Clear Creek has lots of wetlands, and I suspect the underlying geology contributes to the storm recession shape. I recall you had some unlikely values for LZSN or UZSN from the earlier presentation. Barker-- good Karcher-- good Blackjack-- good Anderson-- you are underestimating storms consistently. Again, if you vary values by sub-watershed, I would spend some more time on LZS and UZS. In the end, this will underestimate Anderson's contribution. Heins Creek-- storms don't even show up in the simulation, probably since there's essentially no IMPLND in the basin. I would re-evaluate LZS and UZS here. Fairly low priority, given the low flows from this basin. Parish-- good	Suggestions noted and implemented into the analysis and text of this document.
17	The final product must append the UCI files.	Please see Appendix J
18	You should also include the final calibrated values of the primary hydrologic parameters, like LZSN, IRC, etc., either in the body of the report or an appendix.	Please see Appendix H

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APPENDIX A

Overview. HSPF is a robust, highly complex mathematically based computer code developed under EPA sponsorship to simulate water quantity and quality processes on a continuous basis in natural and man–made water systems. HSPF uses input meteorological forcing data and parameters that are related to system geometry, land use patterns, soil characteristics, and land use activities (e.g., agricultural practices) to simulate the water quantity and quality processes that occur within a watershed. HSPF can simulate at temporal scales ranging from minutes to days. Due to its flexible modular design, HSPF can model systems of varying size and complexity; for example, "from a parking lot to a three acre farm to the Chesapeake Bay" (Munson 1998). Depending upon available resources, an HSPF modeler has access to a number of different simulation algorithms at different levels of detail and sophistication. The simulation algorithms available within HSPF are a mixture of physically–based and empirical approaches. The HSPF model is generally classified as a lumped parameter model; however, the spatial variability in a watershed can be simulated if the watershed is appropriately subdivided into land segments that are perceived to exhibit a homogeneous hydrologic and water quality response. Donigian et al. (1997) noted that HSPF "is the only available model that can simulate the continuous, dynamic event, or steady–state behavior of both hydrologic/hydraulic and water quality processes in a watershed, with an integrated linkage of surface, soil, and stream processes."

General Description. For an HSPF model, the watershed is subdivided into individual land segments that are assumed to produce a homogeneous hydrologic and water quality response. The purpose of the land segmentation within the watershed is to construct a conceptual model with the minimum number of land segments needed to simulate the hydrologic processes (Dinicola 1990). Factors that influence land segmentation for a typical HSPF model application include the meteorological forcing terms, characteristics of the watershed system itself (e.g., topography, geology, soils, land use, channel properties, etc.), and calibration endpoints, among others. A given land segment may contain one or many modeled sub–watersheds. A set of pervious land areas, directly connected impervious land areas, and reaches that may be open or closed channels, or completely mixed impoundments constitute the land area and hydrography for a given land segment. A drainage area, or a sub–watershed, is associated with each specified reach.

The HSPF model code consists of three application modules (PERLND, IMPLND, RCHRES) and five utility modules (COPY, PLTGEN, DISPLY, DURANL, GENER, MUTSIN). The PERLND and IMPLND application modules simulate runoff and water quality constituents from pervious and directly connected impervious land areas in the watershed, respectively. Within a given drainage area or sub–watershed, the RCHRES module is used to route runoff and water quality constituents simulated by the PERLND and IMPLND modules through a single reach of open or closed channel or a completely mixed impoundment. Bicknell et al. (1996) and Donigian et al. (1995) provide graphical summaries that describe the structure and contents of the PERLND, IMPLND, and RCHRES application modules. Bicknell et al. (1996) and Donigian et al. (1995) provide detailed descriptions of the individual compartments within the PERLND, IMPLND, and RCHRES application modules.

The five utility modules are used to manage model input and model generated time series data that are typically stored by an HSPF model user in one or more Watershed Data Management (WDM) files. A WDM file is a binary, direct–access file format that supports efficient storage and retrieval of time series data. Bicknell et al. (1996) and Donigian et al. (1995) provide descriptions of the five utility modules in HSPF.

The HSPF application modules contain compartments that completely account for the land–side components of the hydrologic cycle, and these compartments descend from the Stanford Watershed Model. The ATEMP compartment of the PERLND application module adjusts the input air temperature time series assigned to a given pervious land area based on the elevation difference between the station and the pervious land area. The SNOW compartment of the PERLND application module may simulate snow accumulation and melt by either an energy balance approach or a temperature index/degree–day method.

The PWATER compartment of the PERLND application module models the complete land–side water budget for a pervious land area, and it is the key compartment in the PERLND module in that it is the basis for all subsequent water quality simulation. Precipitation falling on the land surface is first intercepted by vegetation. Interception storage in HSPF is modeled as a reservoir that must first be filled before any precipitation can reach the ground. The modeler specifies the interception storage capacity, and it can vary monthly to reflect seasonal patterns. Excess precipitation reaching the land surface is temporarily placed in surface detention storage, from where it will either enter the upper zone as potential direct runoff or it will infiltrate into the subsurface. The partitioning between these two pathways is a function of the soil moisture and the infiltration rate. Potential direct runoff is further partitioned as either direct surface runoff, interflow runoff, or upper zone storage. The amount of direct surface runoff within a particular time step is a function of slope, roughness (which can vary monthly to reflect seasonal patterns), and distance to a first order stream. Interflow runoff is stored in a reservoir that empties based on a specified decay rate. Both the inflow and decay rate for interflow can vary monthly to reflect seasonal patterns. Upper zone storage represents ditches, swales, or depressions in the watershed surface, and it can vary monthly to reflect seasonal patterns. Water in the upper zone storage can either evaporate, percolate to the subsurface, or become direct runoff or interflow during the next time step. The partition between upper zone storage and direct surface runoff is a function of upper zone storage and its nominal value. Infiltrated water is routed to either lower zone storage, active groundwater storage, or deep inactive groundwater. Water is first put in the lower zone storage. Once the lower zone storage is satisfied, the remaining water is partitioned between deep/inactive groundwater and active groundwater storage. Active groundwater is stored in a reservoir and released as baseflow based on a specified groundwater recession parameter. The input evapotranspiration demand is attempted to be met by evaporating water from five possible storages in the following sequence: baseflow, interception storage, upper zone storage, active groundwater, and lower zone storage. Each storage has a user–specified resistance to evaporation. The resistance to evaporation for the lower zone storage can vary monthly to reflect seasonal patterns.

For a pervious land area, HSPF attempts to account for both the temporal and spatial dimensions of the infiltration process. The infiltration process is modeled based on Philip's equation, with cumulative infiltration represented as the ratio of the lower zone storage to its nominal storage value. The spatial distribution of infiltration over a pervious land area is modeled by specifying a linear probability density function for the infiltration capacity. Inflow to the interflow reservoir is modeled in a manner quite similar to the approach utilized to model infiltration. In particular, what constitutes interflow is assumed to be proportional to the local infiltration capacity. The fraction of the remaining subsurface water goes to either lower zone storage or groundwater (active and/or inactive) based on the ratio of lower zone storage and its nominal value.

The SEDMNT compartment of the PERLND application module models sediment production and removal for pervious land areas in the watershed. The processes of detachment, washoff of the detached sediment, and scour of the soil matrix are all modeled using simple two parameter relationships of the form

$$e = aq^b$$

where e represents detachment, washoff, or scour, a and b are parameters, and q is either a model input or a model generated quantity. For detachment, q is the rainfall rate; whereas, for washoff and scour, q is the model computed overland flow rate. The sediment load calculated from the land surface is a total load (i.e., there is no division into sand, silt, and clay classes). Detached sediment storage may be modified by two additional fluxes, lateral inflow from an upslope land area and/or net vertical sediment input resulting from wind and/or human activities. The soil matrix is assumed to have infinite storage.

The PQUAL compartment of the PERLND application module simulates water quality constituents in the outflows from a pervious land area (i.e., overland flow, interflow, baseflow, washoff of detached sediment, and scour of the soil matrix) using straightforward relationships based on water and/or sediment yield. Constituents assumed to be transported with sediment may be modeled by specification of potency factors that relate constituent strength proportionally to the sediment removal computed in the SEDMNT compartment of the PERLND application module. General pollutant accumulation and washoff equations, which relate constituent washoff to constituent storage and computed surface runoff, are another mechanism for modeling generalized water quality constituents. A user–specified parameter in the second approach allows for modeling a “first flush” effect. PQUAL allows for the specification of monthly concentrations for the subsurface outflows (i.e., interflow and baseflow).

The MSTLAY, PEST, NITR, PHOS, and TRACER compartments of the PERLND application module support the detailed simulation of solute transport, pesticides, nitrogen, phosphorous, and conservatives, respectively. Together, these compartments constitute what is referred to as the AGCHEM section of the HSPF model due to their principal use in modeling agricultural chemicals. The PERLND application module contains two additional compartments, PSTEMP and PWTGAS, which simulate soil temperature and surface runoff water temperature and gas concentrations, respectively.

The IMPLND application module is used for impervious land areas where little or no infiltration occurs, principally urban land categories. The ATEMP, SNOW, IWATER, SOLIDS, IWTGAS, and IQUAL compartments within the IMPLND module are very similar in function and structure to the ATEMP, SNOW, PWATER, SEDMNT, PWTGAS, and PQUAL compartments in the PERLND module, respectively.

The RCHRES application module contains compartments that simulate hydraulics, water temperature, noncohesive and cohesive sediment, pesticides, nutrients, biochemical oxygen demand, phytoplankton, zooplankton, dissolved oxygen, and pH, among others. HSPF provides the user with the capability to simulate any water quality constituent by specifying its sources, sinks, decay properties, and advective behavior. Flow through a RCHRES is assumed to be unidirectional. All inputs to a reach are assumed to enter at a single upstream point. The outflow from a reach, or from a completely mixed lake, may be distributed across several targets to represent normal outflow, diversions, and multiple gates on a lake or reservoir.

Support Software. The EPA, USGS, and others, have developed several software programs to support HSPF model development and application. Among others, these include IOWDM (http://water.usgs.gov/software/iowdm.html), ANNIE (Flynn et al. 1995), METCMP (Flynn and Lumb 1991), WDMUtil (USEPA 1999a), HSPFParm (Donigian et al. 1999), HSPEXP (Lumb et al. 1994), WinHSPF, GenScn (Kittle et al. 1998), the HSPF interface within the Watershed Modeling System (WMS) developed jointly by the USACE Waterways Experiment Station and Brigham Young University (Brigham Young University – Environmental Modeling Research Laboratory 1999), and the model–independent parameter estimation tool PEST (Doherty 2002; Doherty and Johnston 2003). With the exception of the WMS, all of the above noted software is in the public domain. In addition, HSPF is the nonpoint source model interfaced within the public domain Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) system developed and freely distributed by the EPA Office of Water to support Total Maximum Daily Load (TMDL) analysis nationwide.

The IOWDM, ANNIE, and WDMUtil utility software packages are typically used to input and subsequently manage HSPF model input, calibration, and model generated output time series data in a Watershed Data Management (WDM) file. The METCMP software system is typically used to fill in missing precipitation data and/or disaggregate meteorological data. Much of the functionality of the DOS–based programs IOWDM, ANNIE, and METCMP is now contained within the, possibly more usable, windows based utility software WDMUtil. However, there are still some time series data management tasks that are more easily performed, or that are only possible, using the predecessor DOS–based tools.

The HSPF Parameter Database (HSPFParm) is a windows based software package that was designed to be a source for identifying reasonable initial values, and possibly also expected parameter ranges, for model parameters prior to initiating the calibration process. It provides an HSPF modeler interactive access to calibrated parameter values from previous applications of HSPF across North America. Although Donigian et al. (1999) noted that "the parameter values, contained in the database, characterize a broad variety of physical settings, land use practices, and water quality constituents", examination of Figure A.1, a screenshot of HSPFParm depicting all locations contained in its database, clearly indicates that the current database may be of limited utility to support practical HSPF application for many areas of the United States. For example, not a single western Washington HSPF application is included in the HSPFParm database.

Hydrologic calibration is typically performed manually, often utilizing the expert system calibration tool HSPEXP. HSPEXP produces a standard set of mass balance, statistical, and hydrograph comparisons that greatly facilitate manual HSPF hydrologic model calibration. The HSPEXP system also provides advice on parameter adjustments related to various user specified error criteria for deciding whether each phase of calibration is satisfactory. HSPEXP is only designed to support iterative manual HSPF calibration for the hydrologic simulations and does not deal with water quality processes.

GenScn is a public domain graphically–based management modeling environment that supports scenario analysis (assessing the hydrologic and water quality impacts of land use change, for example), best management practice (BMP) analysis, and time series data analysis for the HSPF model, among others. With GenScn, for a given HSPF model, one may graphically select a single sub–basin/reach/outlet or multiple sub–basins/reaches/outlets, one or multiple modeled scenarios, and desired constituents, and subsequently retrieve all of the time series data that have been stored for the selected modeled location(s), scenarios, and constituents. Thereafter, one may graphically compare the selected time series data, perform statistical comparisons, and/or export the data for further analysis, in a spreadsheet, for example. GenScn also possesses animation capabilities, allowing one to visualize the spatial and temporal character of various HSPF model output. In addition, GenScn provides the user full access to the capabilities of the HSPF model. For example, the GenScn graphical user interface allows one to easily select a pre–existing HSPF model scenario (e.g., maybe the "calibrated" scenario related to the HSPF model under consideration), activate it, and perform a new modeling scenario on the fly, with new time series data set numbers in the associated model output WDM file automatically generated.

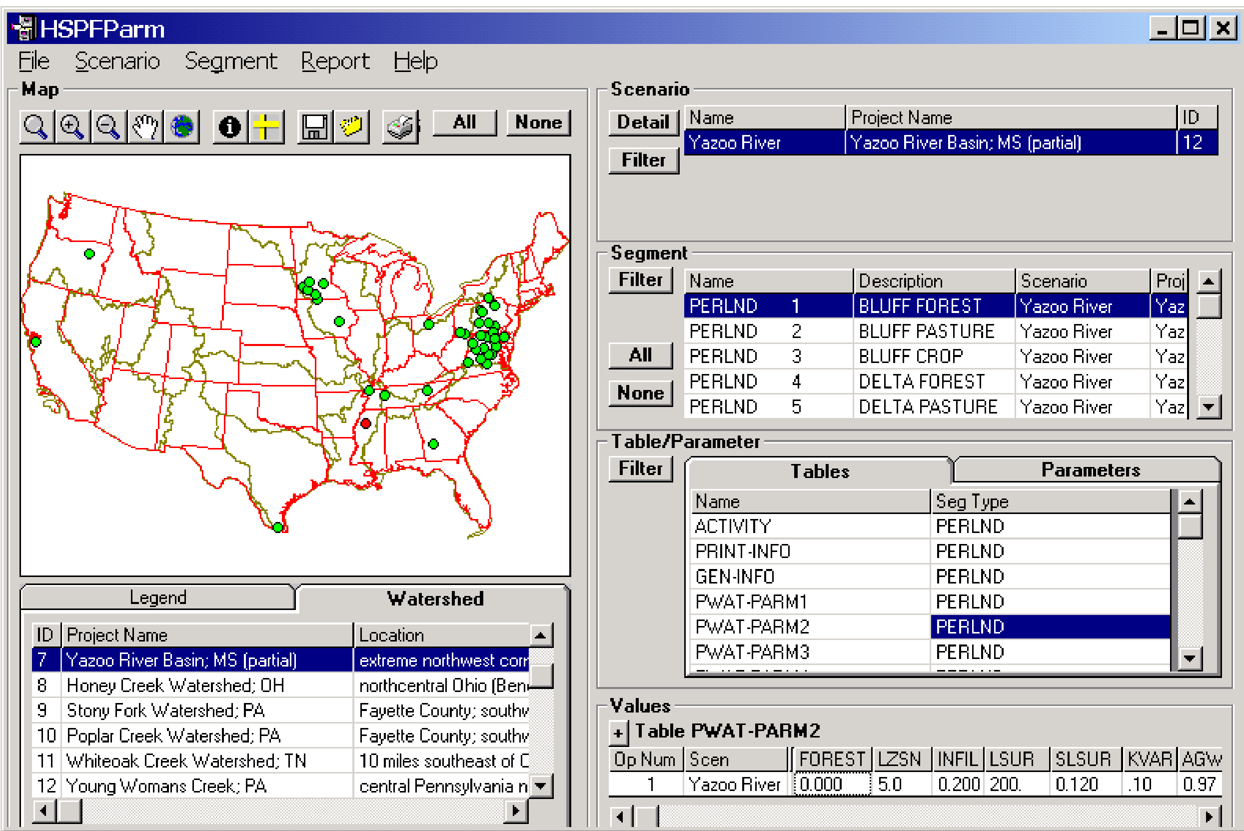


Figure A.1. Screenshot graphically depicting all of the locations that constitute the HSPFParm database.

The ability to efficiently construct and initially parameterize the Users Control Input (UCI) file, the main HSPF model input file, using readily available and/or project specific Geographic Information System (GIS) data coverages is the principal strength of the HSPF model interface in WMS. In particular, watershed delineation (if not already performed), or easy incorporation of a pre–existing watershed delineation, land segmentation, computation of the areal distribution of land use within each modeled sub–watershed, determination of the model topology, and graphical/conceptual model support for construction of a complete HSPF model UCI file are some of the current notable strengths of the HSPF model interface in the WMS.

PEST is a public domain model–independent parameter estimator with advanced predictive analysis and regularisation features. It implements a robust implementation of the Gauss–Marquardt–Levenburg method. PEST will adjust model parameters and/or excitations until the fit between model outputs and laboratory or field observations is optimized in the weighted least squares sense. A suite of PEST model utility software is available to be used as part of the calibration and predictive analysis process, some specific to HSPF/PEST linkage and application. PEST, together with its utility software, allows one to incorporate into the parameter estimation process, among others,

1. known/perceived parameter bounds,
2. known/perceived parameter relationships,
3. "volumetric observations" (e.g., over the entire simulation time period, monthly volumetric readings, and/or one or a number of discrete events),
4. one's intuition or indirect knowledge (for example, to determine the relative magnitudes of different flow components (interflow, baseflow, surface runoff)),
5. exceedence–time characteristics, and
6. (prior) information available from outside of the parameter estimation process about what value a parameter should take.

Hence, "reality" and "plausibility" checks can, and should, be implicitly incorporated into the PEST/HSPF parameter estimation process; thus, allowing such an endeavor to remain within the bounds of historical/conventional HSPF model practice.

In addition to some of the above noted capabilities, PEST with HSPF also allows one to assess, the clearly needed (National Research Council 2001), implications of parameter uncertainty (Whittemore and Beebe 2000) on HSPF model predictive uncertainty. In particular, PEST's predictive analysis mode allows one to examine the range of uncertainty of a key HSPF model prediction (e.g., a maximum daily constituent loading, peak discharge, minimum flow, maximum water temperature, minimum DO, …) while maintaining the model in a calibrated (or almost calibrated) state. At present, the PEST/HSPF linkage is a DOS–based command line driven process.

There are also HSPF model application specific software support tools available; for example, the Bacterial Indicator Tool (USEPA 2000a) and the spreadsheet tool, TMDLUSLE (USEPA 2001), both of which are freely available from the EPA web pages.

Capabilities and Limitations. Donigian et al. (1995) listed several potential applications and uses of the HSPF model:

1. Flood control planning and operations
2. Hydropower studies
3. River basin and watershed planning
4. Storm drainage analyses
5. Water quality planning and management
6. Point and nonpoint source pollution analyses
7. Soil erosion and sediment transport studies
8. Evaluation of urban and agricultural best management practices (BMPs)
9. Fate, transport, exposure assessment, and control of pesticides, nutrients, and toxic substances
10. Time–series data storage, analysis, and display

USACE and USEPA (2000) list documented strengths and weaknesses of the HSPF model. Strengths listed include, among others, its comprehensive treatment of watershed scale hydrologic and water quality processes, flexible design, wide spread applicability, sustained support by both the EPA and USGS, and its companion WDM file and utility software. Weaknesses listed include, among others, its lumped parameter approach, unidirectional treatment of flow hydraulics, limited treatment of the urban drainage system, lack of comprehensive parameter guidance, extensive data requirements, and the user training that is typically required to operate the model.

One of the notable strengths of the HSPF model is its ability to account for the land use distribution within a given modeled watershed. This information, or a blending of this information with other data describing the watershed, serves as a basis for part of the model parameterization process. However, the available guidance information and tools do not support a comprehensive model parameterization effort for a watershed with mixed land uses. For example, the expert system tool HSPEXP does not provide expert advice related to the discernment of parameter differences across land uses. As a result, current practice with HSPF for parameterizing across land uses is a fairly heuristic exercise. Furthermore, the expert system tool HSPEXP does not provide any water quality model parameter estimation support. Clearly, HSPF model parameterization for a typical model deployment is a difficult task alone, despite the availability of support utilities such as HSPFParm (Donigian et al. 1999). The comments provided below, from Munson (1998), clearly underscore this point.

> It quickly became apparent that little data exists to distinguish the hydrologic characteristics among land uses. Indeed, this has always been problematic in HSPF [18]. When setting parameters such as lower zone storage, for example, there is no empirical data to support different LZSN values for different land uses. It makes intuitive sense that wetlands should be able to store more water than forest, which stores more than residential land. However, the magnitudes of these differences can only be guessed at. If the average calibrated value of LZSN is about 15 inches, then any combination of LZSN values should give the same results if they average to fifteen.

Munson’s (1998) comments above are consistent with Whittemore and Beebe (2000) and (Whittemore 2001), who both also noted the issue of HSPF model parameter nonuniqueness, and they dovetail well with the National Research Council’s (2001) recent recommendation that “guidance/software needs to be developed to support uncertainty analysis” as part of the TMDL modeling process.

Model Development and Calibration. USACE and USEPA (2000) list the major steps in the HSPF model simulation process:

4. problem definition,
5. modeling strategy,
6. operational aspects,
7. collection and development of time series data,
8. characterization and segmentation of the watershed, and
9. calibration and validation of the model.

These major model simulation steps require approximately 5, 10, 10, 30, 15, and 30 percent of the total project effort, respectively.

Data Requirements. Data requirements for an HSPF model application can be grouped into three broad categories (Munson 1998):

1. physical watershed–specific data,
2. meteorologic data, and
3. calibration data.

Physical watershed–specific data are necessary to adequately describe the watershed. Physical watershed–specific data include elevation, channel geometry, soils, vegetation, and land use and land cover (LULC), among others. These data can be obtained from GIS databases, topographical maps, field observations, regulatory agencies, and historical records. A GIS allows for mapping and evaluation at multiple scales. Meteorologic time series data requirements for the HSPF model vary depending upon which processes are modeled. USACE and USEPA (2000) list the meteorologic time series data requirements for various individual compartments within the PERLND, IMPLND, and RCHRES application modules. In general, HSPF requires six meteorologic time series to model streamflow. These include precipitation, potential evapotranspiration, air temperature, dewpoint temperature, wind speed, and solar radiation. However, if snow accumulation and melt are not simulated, the meteorologic time series data requirements include precipitation and potential evapotranspiration. Water quality simulations also require time series of cloud cover. Empirical data is required to calibrate and validate processes simulated by HSPF. These data are not input to HSPF, but are used to evaluate model performance.

Development. The IOWDM, ANNIE, and WDMUtil utility software packages are typically used to input and subsequently manage HSPF model input, calibration, and model generated output time series data in a Watershed Data Management (WDM) file.

For a given modeled watershed, the channel network must be divided into reaches based on the HSPF constraint that there is a minimum length which keeps the Courant number smaller than one (Lohani et al. 2000; Munson 1998). Reach boundaries are also placed at physical structures such as dams, tributaries, and lake inlets and outlets. The required rating table for a reach can be obtained from stream cross–section data and utilization of Manning's equation or specification of an outflow demand which may be a function of volume and/or time. USEPA (1999b) provides guidance on the generation of a rating table for a reservoir. The watershed contributing to each reach can subsequently be delineated using readily available digital elevation models (DEMs) and GIS or GIS compatible processing techniques; for example, the tools within the Watershed Modeling System (Brigham Young University – Environmental Modeling Research Laboratory 1999).

Land segmentation is specified to divide the watershed into individual land segments that are assumed to produce a homogeneous hydrologic and water quality response. Land segmentation, together with the specification of hydrologic response units to model, dictates how an HSPF model will ultimately be parameterized. Land Use and Land Cover (LULC) data are typically used to define pervious and directly connected impervious land areas within each land segment, which may contain one or many modeled sub–watersheds. Typical HSPF model applications define approximately five to six distinct land use classes within each modeled land segment (Northwest Hydraulic Consultants Inc. 1993a; Northwest Hydraulic Consultants Inc. 1993b; Munson 1998; HydroGeoLogic, Inc. and AQUA TERRA Consultants 1999; Lohani et al. 2000; Bergman and Donnangelo 2000).

Calibration. A reliable water quality model depends upon a prior satisfactory hydrologic model calibration and validation. For HSPF, there is a fair amount of guidance material and support software that is available, in the public domain, to support a hydrologic model calibration and validation exercise. These include, among others,

1. US EPA BASINS Technical Notes (http://www.epa.gov/ost/basins/bsnsdoc.html#tech),
2. web–based hydrologic calibration guides (http://www.epa.gov/waterscience/ftp/basins/training/tutorial/di.htm, http://www.hydrocomp.com/jour4b.htm),
3. the expert system tool HSPEXP (Lumb et al. 1994),
4. the windows–based HSPF Parameter Database tool HSPFParm (Donigian et al. 1999),
5. past documented HSPF studies, and
6. research articles; for example, Donigian (2002).

Donigian (2002) provided a fairly comprehensive summary of issues related to watershed model calibration and validation based on more than twenty years of experience with the HSPF model.

Several HSPF model parameters are not available from field data, and must be determined through model calibration. HSPF hydrologic model calibration is typically performed manually by comparing simulated and observed flow volumes for various runoff categories: total runoff, fifty percent lowest flows, ten percent highest flows, storm flows, and seasonal runoff. Other criteria that are also used to support the manual calibration of an HSPF model include

1. visually inspecting the match of simulated and observed flows, and
2. validation of the calibration results.

The expert system calibration tool HSPEXP (Lumb et al. 1994) is a tool that is often used to support the manual hydrologic model calibration for an HSPF model. HSPEXP produces a standard set of mass balance, statistical, and hydrograph comparisons that facilitate manual HSPF hydrologic model calibration. The HSPEXP system also provides advice on parameter adjustments related to various user specified error criteria for deciding whether each phase of calibration is satisfactory. Accuracy of the simulations is measured as the volume error percentage for the various runoff categories. Volume error is defined as the ratio of the difference between simulated and observed flows, expressed as a percentage of observed volumes. The default error criteria within the HSPEXP system can be adopted, or modified, to quantify the simulation errors. The default error criteria for HSPEXP are ten percent error allowed in total volume, volume of fifty percent lowest flows, and seasonal error, and fifteen percent error allowed in ten percent highest flows and storm volumes. A model calibration would be assumed to be complete when simulated volumes for each runoff category fall within the specified error limits. The HSPF Application Guide states that "calibration should be based on several years of simulation (3 to 5 years is optimal) in order to evaluate parameters under a variety of climatic, soil moisture, and water quality conditions." Donigian (2002) provided correlation coefficient and coefficient of determination value ranges for assessing hydrologic model performance for daily and monthly flows. A "good" HSPF hydrologic model calibration would have r–squared value ranges at monthly and daily timescales of approximately 0.75–0.85, and 0.70–0.80, respectively.

A standard HSPF hydrologic model calibration is divided into four phases (HydroGeoLogic, Inc. and AQUA TERRA Consultants 1999):

1. Establish the annual water balance
2. Adjust low flow / high flow distribution
3. Adjust storm flow / hydrograph shape
4. Make seasonal adjustments

Four parameters significantly influence the annual water balance: INFILT, LZSN, UZSN, and LZETP (Munson 1998; HydroGeoLogic, Inc. and AQUA TERRA Consultants 1999; Bergman and Donnangelo 2000). The parameters INFILT, AGWRC, and BASETP significantly influence the low flow / high flow distribution (HydroGeoLogic, Inc. and AQUA TERRA Consultants 1999). The parameters UZSN, INTFW, and IRC significantly influence stormflow volumes and hydrograph shape (Munson 1998; HydroGeoLogic, Inc. and AQUA TERRA Consultants 1999). Seasonal adjustments are generally accomplished by using time varying values for the parameters CEPSC, LZETP, and UZSN. Adjustments to KVARY and BASETP may also be used (Munson 1998; HydroGeoLogic, Inc. and AQUA TERRA Consultants 1999). Munson (1998), HydroGeoLogic, Inc. and AQUA TERRA Consultants (1999), Bergman and Donnangelo (2000), and USEPA (2000b), among others, all provide excellent descriptions of these HSPF water budget parameters, and others, and their impact on the various phases of an HSPF hydrologic model calibration.

APPENDIX B

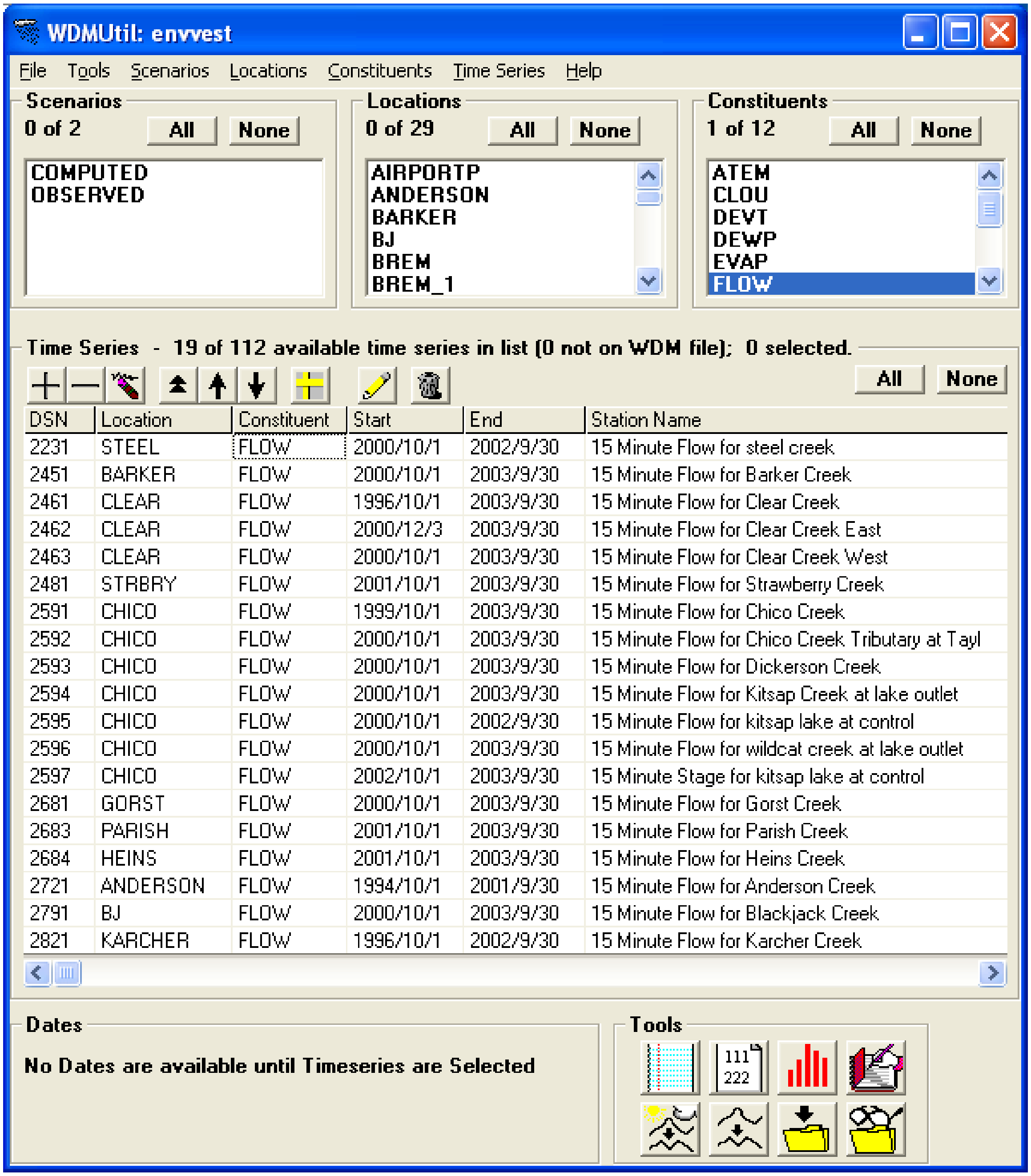


Figure B.1. Plot depicting periods of record for collected observed fifteen-minute streamflow data.

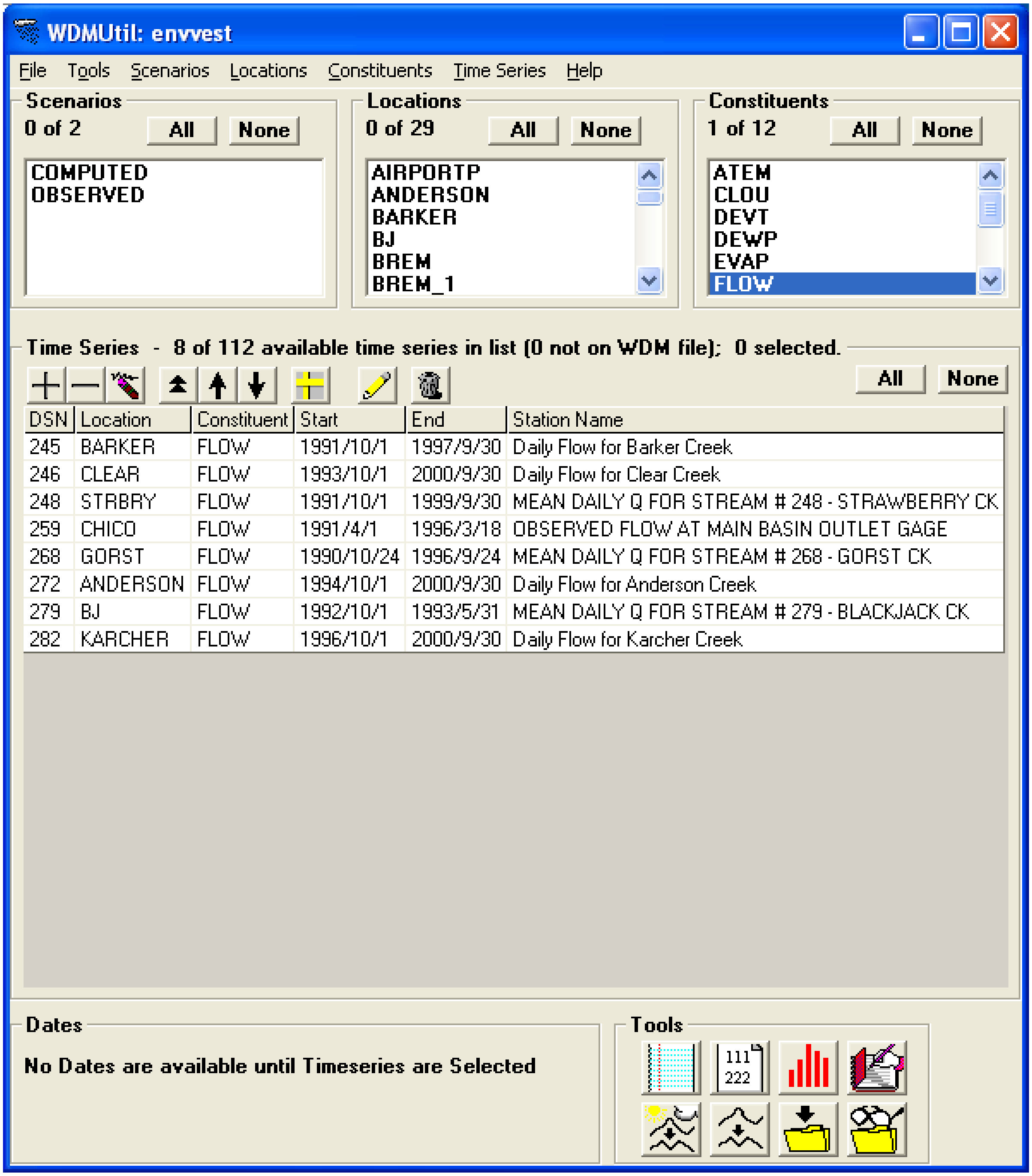


Figure B.2. Plot depicting periods of record for collected observed mean daily streamflow data.

WDMUtil: envvest	
DSN	Date Range for Missing Data
245	Oct 1/1991 Oct 8-10/1994 Dec 19/1994-Feb 1/1995 Dec 7-31/1995 Feb 14-26/1996 Jun 3-27/1996 Nov 7/1996 Dec 31/1996-Jan 1/1997 Jan 8/1997-Sep 30/1997
246	Dec 9-10/1993 Mar 3/1995 Jan 16-27/1998 Jul 23/1998-Sept 10/1998 May 6-21/1999 Jul 29/1999-Aug 19/1999 Sept 21-30/1999 Nov 29/1999-Dec 14/1999 Feb 21/2000-Mar 7/2000 May 16/2000-Jun 20/2000
248	10/01/1993-09/30/1995 10/01/1996-09/30/1997 11/13/1997 12/13/1998 12/30/1998 01/18/1999 01/29/1999-01/30/1999 02/05/1999 02/24/1999

WDMUtil: envvest	
DSN	Date Range for Missing Data
259	04/01/1991 00:00 - 04/01/1991 09:00 04/08/1991 08:00 - 05/01/1991 11:00 09/30/1991 23:00 01/28/1992 14:00 – 02/01/1992 22:00 05/01/1992 12:00 - 05/01/1992 13:00 04/27/1993 04:00 – 09/30/1993 22:00 08/18/1994 10:00 – 08/27/1994 22:00 09/22/1994 09:00 - 09/22/1994 22:00 11/30/1994 07:00 - 11/30/1994 22:00 12/17/1994 06:00 - 12/18/1994 22:00 12/19/1994 11:00 - 12/21/1994 22:00 12/27/1994 04:00 - 12/28/1994 22:00 02/18/1995 16:00 - 02/19/1995 22:00 02/25/1995 10:00 - 03/02/1995 12:00 04/22/1995 11:00 - 09/30/1995 22:00 10/12/1995 16:00 - 10/13/1995 22:00 10/23/1995 23:00 - 12/05/1995 12:00
268	9/8/1993-9/29/1995 12/19/1995-2/26/1996
272	10/01/1994-09/27/1995 01/05/1996-03/11/1996 06/27/1996-06/28/1996 09/05/1996-09/06/1996 12/19/1996 02/12/1997-02/19/1997 09/09/1997-09/30/1997
279	
282	Oct 1/1996-Apr 10/1997 Oct 30/1997-Dec 16/1997 Jan 29/1998 Apr 23/1998 Aug 28-31/1998 Sept 29-30/1998 Mar 1/1999 Jun 2/1999 Aug 17/1999-Sept 8/1999 Oct 4/1999-Dec 1/1999 Feb 18/2000-Mar 31/2000 Apr 29/2000-May 22/2000 Aug 6/2000-Sept 30/2000

WDMUtil: envvest	
DSN	Date Range for Missing Data
2231	Oct 01/2000 00:00-Feb 25/2001 08:45 Jun 5/2002 10:00-Sept 30/2002 23:45
2451	Oct 01/2000 00:00-Jan 5/2001 14:00 11/21/2002 13:45-12/04/2002 12:15 04/02/2003 09:00 06/04/2003 12:45 07/11/2003 09:15
2461	12/31/1996 18:15-12/31/1996 23:45 01/16/1998 12:45-01/27/1998 11:45 07/23/1998 10:15-09/10/1998 13:30 05/06/1999 10:00-05/21/1999 09:00 07/29/1999 05:30-08/19/1999 10:15 09/21/1999 09:30-09/30/1999 23:45 11/29/1999 05:45-12/14/1999 13:30 02/21/2000 10:00-03/07/2000 14:00 05/16/2000 12:30-06/28/2000 10:45 12/05/2001 19:15-01/17/2002 12:30 02/08/2002 10:00-02/08/2002 10:45 04/10/2002 12:00-05/03/2002 09:45 06/03/2002 01:00-06/07/2002 09:45 07/19/2002 23:45-08/08/2002 09:00 08/28/2002 01:15-09/30/2002 23:45 10/01/2002 00:00-11/25/2002 10:45 12/20/2002 10:30 04/09/2003 08:45 06/04/2003 12:00 07/28/2003 10:00 09/08/2003 01:00-09/08/2003 23:45 09/09/2003 01:00-09/09/2003 23:45 09/10/2003 01:00-09/10/2003 23:45 09/11/2003 01:00-09/11/2003 23:45 09/12/2003 01:00-09/12/2003 23:45 09/13/2003 01:00-09/13/2003 23:45 … 09/30/2003 01:00-09/30/2003 23:45

WDMUtil: envvest	
DSN	Date Range for Missing Data
2462	Dec 3/2000 00:00-Dec 30/2000 14:15 Jun 6/2002 09:00-Jul 29/2002 09:45 10/02/2002 13:30-10/02/2002 13:45 11/07/2002 11:15 11/16/2002 19:45 12/03/2002 16:45-12/05/2002 10:00 01/06/2003 11:00 02/07/2003 11:30 03/22/2003 08:30 04/02/2003 09:45 06/04/2003 11:45 07/11/2003 09:00
2463	Oct 01/2000 00:00-Dec 30/2000 12:15 Apr 29/2001 09:15-May 8/2001 10:30 Feb 4/2002 15:15-Mar 6/2002 14:45 10/01/2002 00:00-10/01/2002 13:30 02/28/2003 14:15 05/05/2003 08:30 06/18/2003 09:15-08/21/2003 09:00
2481	Oct 1/2001 00:00-Oct 4/2001 12:45 10/04/2002 11:30 11/07/2002 11:45-12/04/2002 12:00 01/06/2003 11:30 01/24/2003 14:30 02/07/2003 11:15 04/02/2003 09:15-04/02/2003 09:30 06/04/2003 12:30 07/15/2003 11:15

WDMUtil: envvest	
DSN	Date Range for Missing Data
2591	Oct 1/1999 00:00-Oct 6/1999 10:00 Jan 13/2000 09:00-Jan 24/2000 13:15 Apr 19/2000 04:00-Apr 26/2000 12:45 May 16/2000 10:00-May 16/2000 10:30 Jun 26/2000 12:00 Oct 8/2000 07:45-Oct 18/2000 12:00 Aug 20/2001 10:45-Sept 20/2001 12:45 Nov 6/2001 00:00-Nov 14/2001 12:15 Jan 2/2002 12:00-Jan 14/2002 14:45 10/04/2002 10:00 11/12/2002 10:45 12/20/2002 11:00 12/20/2002 11:15 01/06/2003 12:00 01/24/2003 15:00 02/07/2003 12:00 06/09/2003 10:45 06/09/2003 11:00 07/14/2003 12:00 08/28/2003 11:15
2592	Jan 7/2002 17:45-May 20/2002 13:15 10/01/2002 00:00-10/01/2002 11:30 11/05/2002 19:15-11/13/2002 15:15 12/14/2002 05:45-12/14/2002 17:30 01/02/2003 13:15 02/10/2003 15:00-02/10/2003 15:15 04/09/2003 09:15 06/09/2003 11:00
2593	Jan 10/2002 04:00-Jan 24/2002 22:30 12/30/2002 06:30-01/03/2003 11:30 02/05/2003 12:00-03/03/2003 11:30 05/08/2003 10:00 06/02/2003 11:15 07/07/2003 10:15
2594	Oct 1/2000 00:00-Oct 17/2000 23:45 Jul 8/2001 00:00-Aug 2/2001 09:30 Jan 9/2002 13:15-Feb 4/2002 11:00 Apr 8/2002 10:30 06/02/2003 11:00 07/06/2003 00:15-07/07/2003 10:00 08/12/2003 10:30 09/30/2003 11:30

WDMUtil: envvest	
DSN	Date Range for Missing Data
2595	Oct 1/2000 00:00-Oct 15/2000 23:45 Nov 1/2000 14:45-Nov 15/2000 13:15 Nov 15/2000 14:00-Dec 1/2000 11:00 Jan 17/2001 16:45-Feb 1/2001 10:30
2596	Oct 1/2000 00:00-Oct 5/2000 13:30 Oct 5/2000 14:00-Oct 11/2000 10:45 May 27/2001 20:30-Jun 7/2001 10:00 Jul 10/2001 03:00-Aug 2/2001 10:00 Sept 5/2001 09:45-Sept 30/2001 23:45 Apr 8/2002 11:00 Apr 13/2002 01:30-Jun 6/2002 09:15 Sept 10/2002 10:00-Sept 30/2002 23:45 12/09/2002 02:30-01/02/2003 11:45 01/06/2003 09:45 02/04/2003 14:00 07/07/2003 10:30 09/05/2003 11:30-09/30/2003 23:45
2597	06/02/2003 11:00 07/06/2003 00:15-07/07/2003 09:45 08/12/2003 10:15
2681	Oct 1/2000 00:00-Dec 30/2000 11:15 Jan 3/2002 12:30-Sept 30/2002 23:45 10/01/2002 00:00-10/01/2002 11:00 2/04/2003 13:15-2/04/2003 13:30 05/01/2003 11:15-06/13/2003 10:00 07/11/2003 09:45-07/11/2003 10:00
2683	Oct 1/2001 00:00-Feb 28/2002 11:15 10/01/2002 00:00-10/01/2002 10:45 02/04/2003 13:15 02/28/2003 12:30-04/15/2003 12:00 05/01/2003 10:30 06/09/2003 11:30 07/11/2003 09:45

WDMUtil: envvest	
DSN	Date Range for Missing Data
2684	Oct 1/2001 00:00-Jun 14/2002 11:30 10/01/2002 11:15 02/03/2003 19:15-02/03/2003 20:30 02/03/2003 23:45-02/04/2003 00:30 02/04/2003 01:15-02/04/2003 12:00 02/04/2003 13:45-02/04/2003 15:00 02/04/2003 16:30-02/05/2003 13:00 02/05/2003 14:15-02/06/2003 14:45 05/01/2003 11:15 06/09/2003 11:45 07/11/2003 10:00
2721	Oct 1/1994 00:00-Jan 12/1995 11:15 Mar 20/1995 14:15 Jun 20/1995 10:45 Jul 25/1995 09:45-Sept 27/1995 12:00 Jan 5/1996 00:00-Mar 3/1996 10:30 Sept 5/1996 17:30-Sept 6/1996 11:45 Dec 19/1996 12:45 Feb 12/1997 13:00-Feb 19/1997 11:15 Sept 9/1997 10:15-Sept 30/1997 23:45 Mar 19/1998 11:00
2791	Oct 1/2000 00:00-Dec 30/2000 10:30 Feb 27/2001 15:45 10/01/2002 00:00-10/01/2002 10:15 11/04/2002 11:30 12/11/2002 13:00 02/28/2003 12:15 05/05/2003 11:00 06/13/2003 10:45 07/16/2003 08:00-07/16/2003 08:15

WDMUtil: envvest	
DSN	Date Range for Missing Data
2821	Oct 1/1996 00:00-Apr 10/1997 13:00 Oct 30/1997 10:15-Dec 16/1997 10:30 Jan 29/1998 11:30 Apr 23/1998 11:15 Aug 28/1998 15:15-Aug 31/1998 11:15 Sept 29/1998 13:15-Sept 30/1998 23:45 Mar 1/1999 10:30 Jun 2/1999 11:15 Aug 17/1999 10:45-Sept 8/1999 13:30 Oct 4/1999 14:00-Dec 1/1999 12:30 Feb 18/2000 14:00-Mar 31/2000 13:00 Apr 29/2000 14:00-May 17/2000 14:00 May 17/2000 14:30-May 22/2000 13:00 Jan 2/2001 13:15-Jan 29/2001 16:45 Sept 19/2001 12:45-Sept 25/2001 12:15 01/09/2002 12:00-01/23/2002 10:45 01/23/2002 11:15-02/01/2002 13:30 02/01/2002 14:00-02/04/2002 12:00 05/06/2002 11:15-05/09/2002 11:00 05/09/2002 11:30-07/31/2002 11:00

APPENDIX C

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	07/07/2001 23:45	18048	2789.54	1748.62	62.68
08/03/2001 00:00	01/08/2002 23:45	15264	6582.57	3982.43	60.50
02/05/2002 00:00	04/07/2002 23:45	5952	1539.15	1766.65	114.78
04/09/2002 00:00	06/01/2003 23:45	40224	8319.72	5239.28	62.97
06/03/2003 00:00	07/05/2003 23:45	3168	77.66	90.36	116.35
07/08/2003 00:00	08/11/2003 23:45	3360	64.94	43.63	67.18
08/13/2003 00:00	09/30/2003 23:30	4703	151.30	11.68	7.72
		90719	19524.89	12882.64	65.98

Table C.1. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	05/26/2001 23:45	14016	2237.17	997.17	44.57
08/03/2001 00:00	09/04/2001 23:45	3168	708.53	53.92	7.61
10/01/2001 00:00	04/07/2002 23:45	18144	8187.91	4655.62	56.86
06/07/2002 00:00	09/09/2002 23:45	9120	419.84	62.72	14.94
01/07/2003 00:00	02/03/2003 23:45	2688	1140.29	727.12	63.77
02/05/2003 00:00	07/06/2003 23:45	14592	2707.96	1836.21	67.81
		61728	16464.81	8434.23	51.23

Table C.2. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	12/31/2001 23:45	35040	32536.72	6876.94	21.14
05/21/2002 00:00	09/30/2002 23:45	12768	2546.41	397.75	15.62
11/14/2002 00:00	12/13/2002 23:45	2880	3693.53	526.51	14.25
12/15/2002 00:00	01/01/2003 23:45	1728	3834.45	2132.39	55.61
01/03/2003 00:00	02/09/2003 23:45	3648	5194.18	2848.75	54.84
02/11/2003 00:00	04/08/2003 23:45	5472	8598.46	3570.82	41.53
04/10/2003 00:00	06/08/2003 23:45	5760	1698.43	1564.87	92.14
		67296	58102.18	17918.03	30.84

Table C.3. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Chico Tributary at Taylor Road streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	12/31/2001 23:45	35040	7432.00	3948.81	53.13
01/26/2002 00:00	12/29/2002 23:45	32448	4998.04	3224.15	64.51
01/11/2003 00:00	01/28/2003 23:45	1728	893.74	538.74	60.28
03/12/2003 00:00	03/24/2003 23:45	1248	1202.43	1012.57	84.21
05/09/2003 00:00	06/01/2003 23:45	2304	49.13	124.78	253.98
06/03/2003 00:00	07/06/2003 23:45	3264	79.02	88.59	112.11
07/08/2003 00:00	09/29/2003 23:45	8064	156.80	123.50	78.76
		84096	14811.15	9061.13	61.18

Table C.4. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Dickerson Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
10/05/2001 00:00	10/31/2001 23:45	2592	596.60	89.65	15.03
12/10/2001 00:00	10/03/2002 23:45	28608	5977.12	3798.20	63.55
12/05/2002 00:00	01/05/2003 23:45	3072	2595.35	513.91	19.80
01/07/2003 00:00	01/23/2003 23:45	1632	669.97	200.93	29.99
01/25/2003 00:00	02/06/2003 23:45	1248	392.41	168.53	42.95
02/08/2003 00:00	04/01/2003 23:45	5088	2142.32	807.38	37.69
04/03/2003 00:00	06/03/2003 23:45	5952	826.30	475.18	57.51
06/05/2003 00:00	07/14/2003 23:45	3840	78.16	100.49	128.56
		52032	13278.24	6154.27	46.35

Table C.6. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Strawberry Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	04/28/2001 23:45	11328	1986.44	762.07	38.36
05/09/2001 00:00	11/05/2001 23:45	17376	2464.21	1141.29	46.31
03/07/2002 00:00	09/30/2002 23:45	19968	2364.97	1401.03	59.24
10/02/2002 00:00	02/27/2003 23:45	14304	5756.08	1677.07	29.14
03/01/2003 00:00	05/04/2003 23:45	6240	3160.79	849.95	26.89
05/06/2003 00:00	06/17/2003 23:45	4128	116.10	314.19	270.63
08/22/2003 00:00	09/30/2003 23:30	3839	58.05	169.25	291.58
12/05/2001 00:00	02/03/2002 23:45	5856	3840.50	1572.33	40.94
		83039	19747.14	7887.19	39.94

Table C.7. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Clear Creek – West Tributary streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
10/01/2001 00:00	10/31/2001 23:45	2976	1434.52	213.85	14.91
01/18/2002 00:00	02/07/2002 23:45	2016	1645.47	484.41	29.44
02/09/2002 00:00	04/09/2002 23:45	5760	3076.15	1147.93	37.32
05/04/2002 00:00	06/02/2002 23:45	2880	709.59	285.90	40.29
06/08/2002 00:00	07/18/2002 23:45	3936	629.04	380.89	60.55
08/09/2002 00:00	08/27/2002 23:45	1824	7.67	177.72	2316.73
11/26/2002 00:00	12/19/2002 23:45	2304	2811.50	778.51	27.69
12/21/2002 00:00	04/08/2003 23:45	10464	12116.67	3964.06	32.72
04/10/2003 00:00	06/03/2003 23:45	5280	1388.49	772.20	55.61
06/05/2003 00:00	07/27/2003 23:45	5088	187.94	653.98	347.96
		42528	24007.05	8859.46	36.90

Table C.8. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Clear Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/06/2001 00:00	10/31/2001 23:45	28704	4108.61	2263.48	55.09
03/01/2002 00:00	11/20/2002 23:45	25440	3182.95	2588.87	81.34
12/05/2002 00:00	04/01/2003 23:45	11328	6367.63	2483.89	39.01
04/03/2003 00:00	06/03/2003 23:45	5952	893.16	637.19	71.34
06/05/2003 00:00	07/10/2003 23:45	3456	82.76	218.07	263.49
07/12/2003 00:00	09/30/2003 23:30	7775	101.73	441.36	433.85
		82655	14736.84	8632.87	58.58

Table C.9. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Barker Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
02/01/2001 00:00	09/18/2001 23:45	22080	1761.41	1333.32	75.70
09/26/2001 00:00	11/10/2001 23:45	4416	931.33	412.73	44.32
02/05/2002 00:00	05/05/2002 23:45	8640	1264.24	939.25	74.29
08/01/2002 00:00	09/30/2002 23:30	5855	65.36	332.12	508.16
		40991	4022.35	3017.42	75.02

Table C.10. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Karcher Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	02/26/2001 23:45	5472	3464.39	1411.84	40.75
03/01/2001 00:00	09/30/2002 23:45	55584	40335.75	18080.42	44.82
10/02/2002 00:00	11/03/2002 23:45	3168	206.96	288.46	139.38
11/05/2002 00:00	12/10/2002 23:45	3456	3078.14	453.51	14.73
12/12/2002 00:00	02/27/2003 23:45	7488	11338.99	3531.24	31.14
03/01/2003 00:00	05/04/2003 23:45	6240	7581.67	2847.95	37.56
05/06/2003 00:00	06/12/2003 23:45	3648	256.51	551.94	215.17
06/14/2003 00:00	07/15/2003 23:45	3072	218.62	256.11	117.15
07/17/2003 00:00	09/30/2003 23:30	7295	437.24	573.83	131.24
		95423	66918.27	27995.30	41.84

Table C.11. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Blackjack Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
10/01/1997 00:00	03/18/1998 23:45	16224	3552.35	3350.54	94.32
03/20/1998 00:00	09/30/2001 23:30	123935	14007.77	13637.70	97.36
		140159	17560.12	16988.25	96.74

Table C.12. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Anderson Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
06/15/2002 00:00	09/30/2002 23:45	10368	196.88	281.65	143.06
10/02/2002 00:00	02/02/2003 23:45	11904	2474.84	910.27	36.78
02/07/2003 00:00	04/30/2003 23:45	7968	1462.78	1204.24	82.32
05/02/2003 00:00	06/08/2003 23:45	3648	109.75	196.12	178.69
06/10/2003 00:00	07/10/2003 23:45	2976	40.21	87.71	218.11
07/12/2003 00:00	09/30/2003 23:30	7775	49.43	163.89	331.57
		44639	4333.90	2843.89	65.62

Table C.13. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Heins Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
03/01/2002 00:00	09/30/2002 23:45	20544	1168.28	1028.18	88.01
10/02/2002 00:00	02/03/2003 23:45	12000	2271.95	1477.29	65.02
02/05/2003 00:00	02/27/2003 23:45	2208	128.29	140.23	109.31
04/16/2003 00:00	04/30/2003 23:45	1440	104.64	78.01	74.55
05/02/2003 00:00	06/08/2003 23:45	3648	48.22	90.98	188.67
06/10/2003 00:00	07/10/2003 23:45	2976	40.94	68.98	168.47
07/12/2003 00:00	09/30/2003 23:30	7775	76.43	137.98	180.53
		50591	3797.81	2952.67	77.75

Table C.14. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Parish Creek streamflow gaging station.

			P	Q	Q/P
Begin Date & Time	End Date & Time	Number of Series	acre-ft	acre-ft	
01/01/2001 00:00	12/10/2001 23:45	33024	10310.23	11616.75	112.67
10/02/2002 00:00	02/03/2003 23:45	12000	6611.06	4817.89	72.88
02/05/2003 00:00	04/30/2003 23:45	8160	3776.42	7959.48	210.77
		53184	20697.71	24394.13	117.86

Table C.15. Ratio of observed stream discharge to observed precipitation for specified periods for the drainage area above the Gorst Creek streamflow gaging station.

APPENDIX D

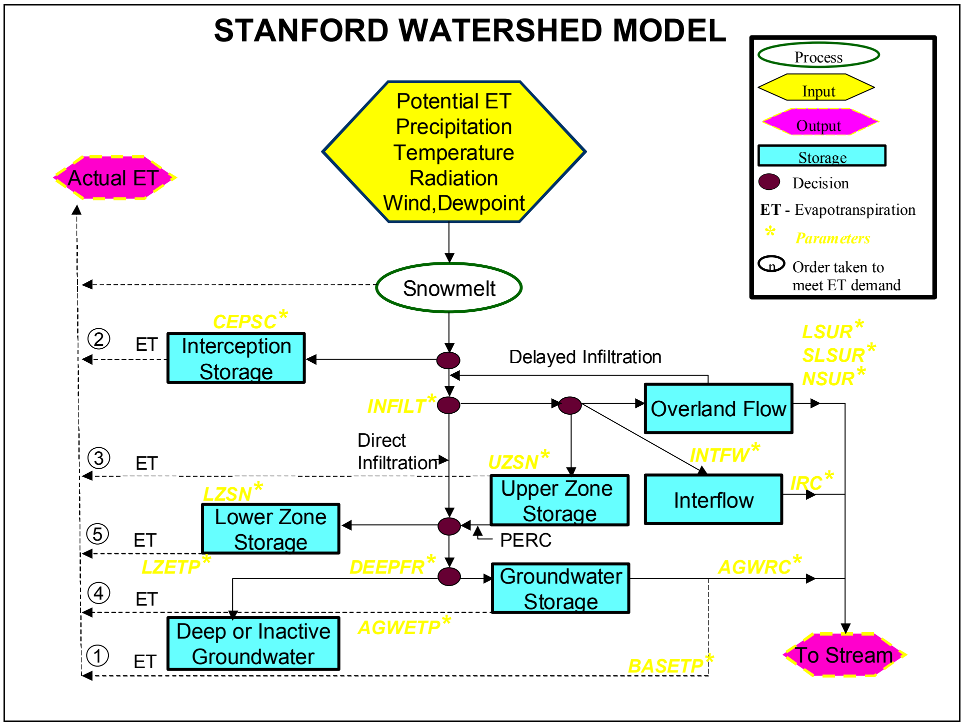


Figure D.1. Schematic of the water budget compartment of the HSPF model (USACE and USEPA 2000).

APPENDIX E

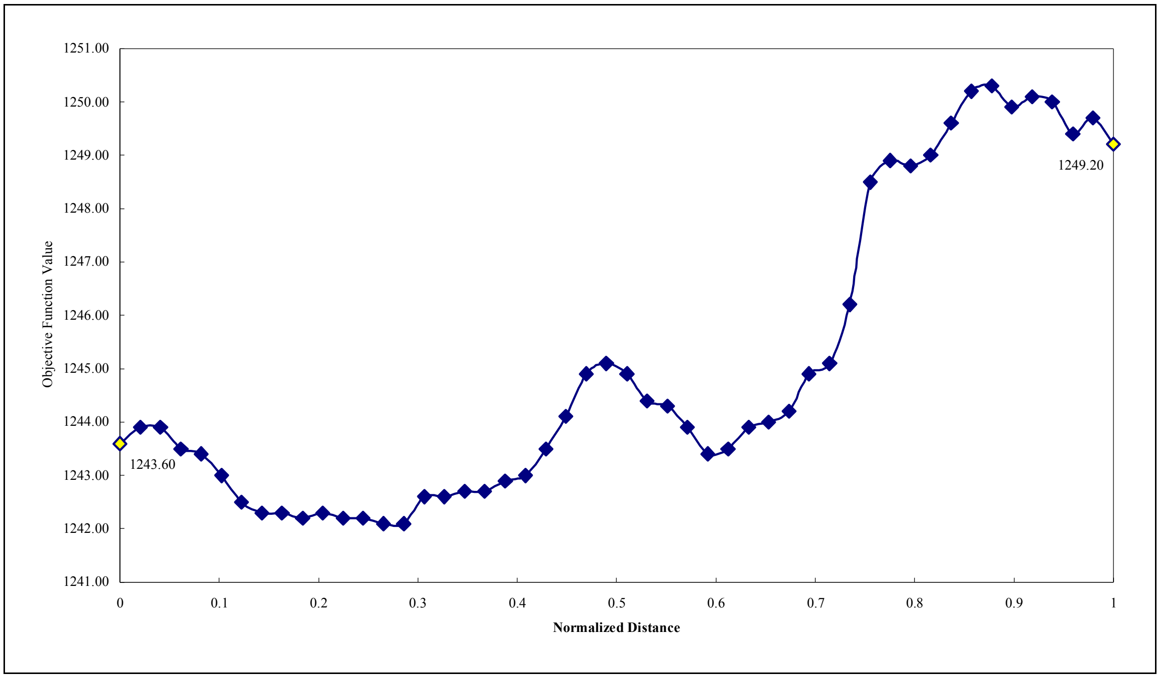
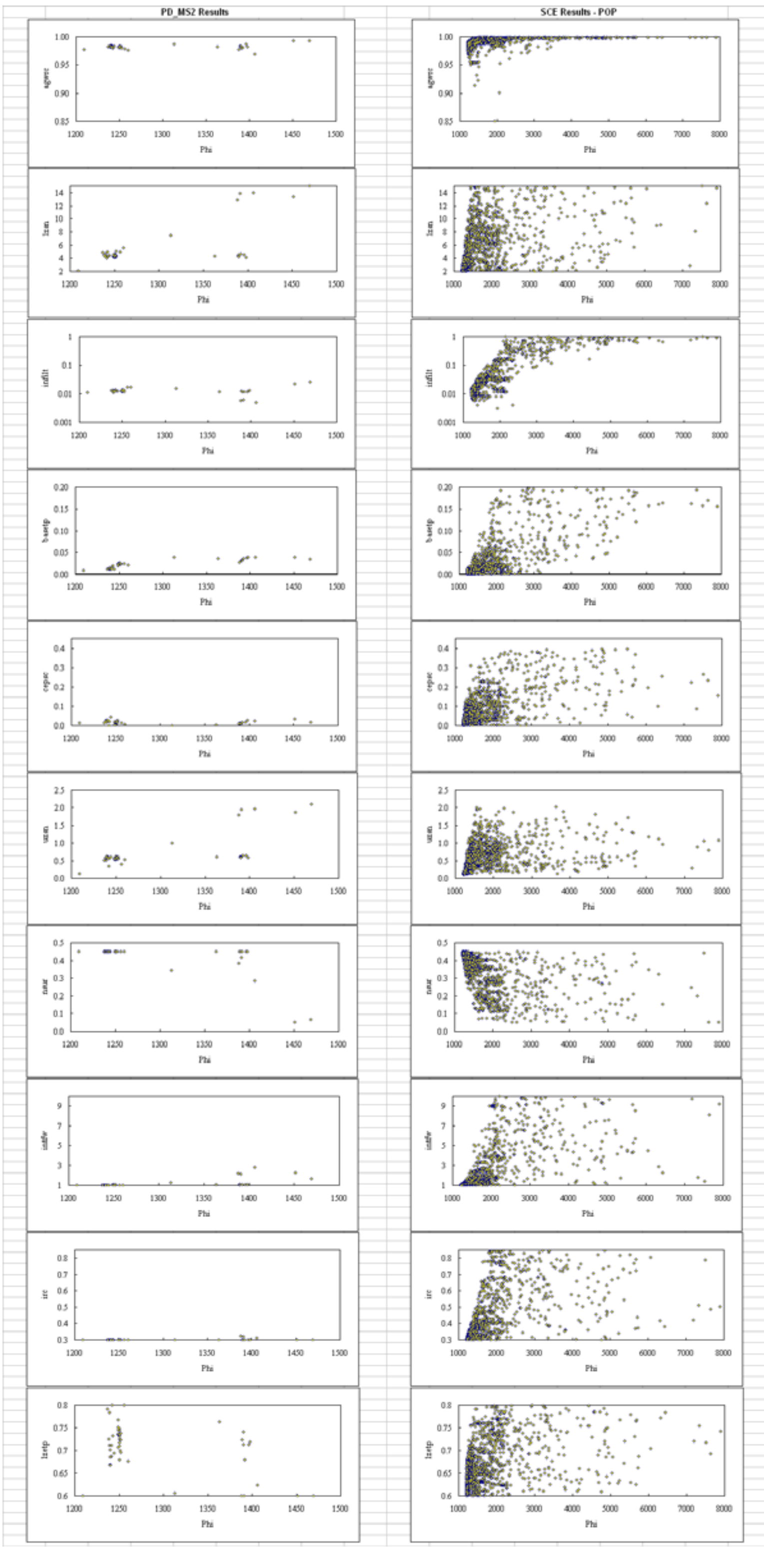


Figure E.1. A partial slice of the objective function surface between two parameter sets obtained using PEST, starting at two different points in feasible parameter space.

APPENDIX F



APPENDIX G

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/01/2001 00:00	07/07/2001 23:45	X	
08/03/2001 00:00	01/08/2002 23:45	X	
02/05/2002 00:00	04/07/2002 23:45	X	
04/09/2002 00:00	06/01/2003 23:45		X

Table G.1. Calibration and Verification periods for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/01/2001 00:00	05/26/2001 23:45	X	
08/03/2001 00:00	09/04/2001 23:45	X	
10/01/2001 00:00	04/07/2002 23:45	X	
06/07/2002 00:00	09/09/2002 23:45	X	
10/01/2002 00:00	12/08/2002 23:45		X
01/07/2003 00:00	02/03/2003 23:45		X
02/05/2003 00:00	07/06/2003 23:45		X

Table G.2. Calibration and Verification periods for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/01/2001 00:00	12/31/2001 23:45	X	
05/21/2002 00:00	09/30/2002 23:45	X	
11/14/2002 00:00	12/13/2002 23:45		X
12/15/2002 00:00	01/01/2003 23:45		X
01/03/2003 00:00	02/09/2003 23:45		X
02/11/2003 00:00	04/08/2003 23:45		X
04/10/2003 00:00	06/08/2003 23:45		X

Table G.3. Calibration and Verification periods for the drainage area above the Chico Tributary at Taylor Road streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/01/2001 00:00	12/31/2001 23:45	X	
01/26/2002 00:00	09/30/2002 23:45	X	
10/01/2002 00:00	12/29/2002 23:45		X
01/11/2003 00:00	01/28/2003 23:45		X
03/12/2003 00:00	03/24/2003 23:45		X
05/09/2003 00:00	06/01/2003 23:45		X
06/03/2003 00:00	07/06/2003 23:45		X
07/08/2003 00:00	09/29/2003 23:45		X

Table G.4. Calibration and Verification periods for the drainage area above the Dickerson Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
10/05/2001 00:00	10/31/2001 23:45	X	
12/10/2001 00:00	09/30/2002 23:45	X	
12/05/2002 00:00	01/05/2003 23:45		X
01/07/2003 00:00	01/23/2003 23:45		X
01/25/2003 00:00	02/06/2003 23:45		X
02/08/2003 00:00	04/01/2003 23:45		X
04/03/2003 00:00	06/03/2003 23:45		X
06/05/2003 00:00	07/14/2003 23:45		X

Table G.6. Calibration and Verification periods for the drainage area above the Strawberry Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/01/2001 00:00	04/28/2001 23:45	X	
05/09/2001 00:00	11/05/2001 23:45	X	
12/05/2001 00:00	02/03/2002 23:45	X	
03/07/2002 00:00	09/30/2002 23:45	X	
10/02/2002 00:00	02/27/2003 23:45		X
03/01/2003 00:00	05/04/2003 23:45		X
05/06/2003 00:00	06/17/2003 23:45		X
08/22/2003 00:00	09/30/2003 23:30		X

Table G.7. Calibration and Verification periods for the drainage area above the Clear Creek – West Tributary streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
10/01/2001 00:00	10/31/2001 23:45	X	
01/18/2002 00:00	02/07/2002 23:45	X	
02/09/2002 00:00	04/09/2002 23:45	X	
05/04/2002 00:00	06/02/2002 23:45	X	
06/08/2002 00:00	07/18/2002 23:45	X	
08/09/2002 00:00	08/27/2002 23:45	X	
11/26/2002 00:00	12/19/2002 23:45		X
12/21/2002 00:00	04/08/2003 23:45		X
04/10/2003 00:00	06/03/2003 23:45		X
06/05/2003 00:00	07/27/2003 23:45		X

Table G.8. Calibration and Verification periods for the drainage area above the Clear Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/06/2001 00:00	10/31/2001 23:45	X	
03/01/2002 00:00	09/30/2002 23:30	X	
10/01/2002 23:45	11/20/2002 23:45		X
12/05/2002 00:00	04/01/2003 23:45		X
04/03/2003 00:00	06/03/2003 23:45		X
06/05/2003 00:00	07/10/2003 23:45		X
07/12/2003 00:00	09/30/2003 23:30		X

Table G.9. Calibration and Verification periods for the drainage area above the Barker Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification

Table G.10. Calibration and Verification periods for the drainage area above the Karcher Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
01/01/2001 00:00	02/26/2001 23:45	X	
03/01/2001 00:00	09/30/2002 23:45	X	
10/02/2002 00:00	11/03/2002 23:45		X
11/05/2002 00:00	12/10/2002 23:45		X
12/12/2002 00:00	02/27/2003 23:45		X
03/01/2003 00:00	05/04/2003 23:45		X
05/06/2003 00:00	06/12/2003 23:45		X
06/14/2003 00:00	07/15/2003 23:45		X
07/17/2003 00:00	09/30/2003 23:30		X

Table G.11. Calibration and Verification periods for the drainage area above the Blackjack Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification

Table G.12. Calibration and Verification periods for the drainage area above the Anderson Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification
10/02/2002 00:00	02/02/2003 23:45	X	
02/07/2003 00:00	04/30/2003 23:45		X

Table G.13. Calibration and Verification periods for the drainage area above the Heins Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification

Table G.14. Calibration and Verification periods for the drainage area above the Parish Creek streamflow gaging station.

Period			
Begin Date & Time	End Date & Time	Calibration	Verification

Table G.15. Calibration and Verification periods for the drainage area above the Gorst Creek streamflow gaging station.

APPENDIX H

parameter	value
imp1	0.350000
imp2	0.351000
imp3	0.601000
imp4	0.100000
agwrc_rat	3.864535E-02
agwrctrns1a	15.1499
lzsn1	2.00000
infilt1	0.754283
lsur1	429.000
slsur1	4.321800E-02
deepfr1	2.285148E-03
basetp1	6.157369E-03
cepsc1a	0.201605
cepsc1b	0.149000
uzsn1_1rat	0.243204
uzsn1_2rat	0.135805
nsur1a	0.148000
nsur1b	0.152491
nsur1c	0.320650
intfw1rat1	3.131357E-02
intfw1rat2	0.194652
ircrat1_1	0.532899
ircrat1_2	0.404586
lzetp1a	0.600000
lzetp1b	0.268328
ilsur1	100.000
islsur1	3.380000E-02
insur1	0.111730
retsc1	0.300000

Table H.1. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station.

parameter	value
imp1	0.24636
imp2	0.47500
imp3	0.75000
imp4	0.10000
agwrc_rat	8.90744E-03
agwrctrns2a	5.0370
lzsn2	5.6260
infilt2	0.29142
lsur2	427.00
slsur2	4.39500E-02
deepfr2	0.37335
basetp2	3.66895E-03
cepsc2a	0.15000
cepsc2b	0.14900
uzsn2_1rat	2.75617E-02
uzsn2_2rat	9.56669E-04
nsur2a	5.00000E-02
nsur2b	0.15000
nsur2c	0.30000
intfw2rat1	1.40771E-02
intfw2rat2	8.18672E-03
ircrat2_1	8.46442E-02
ircrat2_2	0.27562
lzetp2a	0.80000
lzetp2b	0.60000
ilsur2	100.00
islsur2	2.12000E-02
insur2	6.65685E-02
retsc2	0.24283

Table H.2. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station.

parameter	value
imp1	0.267426
imp2	0.546087
imp3	0.900000
imp4	0.10000
agwrc_rat	0.9990
agwrctrns3a	5.0370
lzsn3	5.6260
infilt3	0.29142
lsur3	427.00
slsur3	4.39500E-02
deepfr3	0.37335
basetp3	3.66895E-03
cepsc3a	0.15000
cepsc3b	0.14900
uzsn3_1rat	2.75617E-02
uzsn3_2rat	9.56669E-04
nsur3a	5.00000E-02
nsur3b	0.15000
nsur3c	0.30000
intfw3rat1	1.40771E-02
intfw3rat2	8.18672E-03
ircrat3_1	8.46442E-02
ircrat3_2	0.27562
lzetp3a	0.80000
lzetp3b	0.60000
ilsur3	100.00
islsur3	2.12000E-02
insur3	6.65685E-02
retsc3	0.24283

Table H.3. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Chico Tributary at Taylor Road streamflow gaging station.

parameter	value
imp1	0.28788
imp2	0.35492
imp3	0.75000
imp4	0.10000
agwrc_rat	8.31182E-03
agwrctrns4a	27.016
lzsn4	7.5986
infilt4	5.26439E-02
lsur4	422.00
slsur4	4.66000E-02
deepfr4	8.06190E-03
basetp4	1.00000E-10
cepsc4a	0.15000
cepsc4b	3.15406E-02
uzsn4_1rat	0.37188
uzsn4_2rat	0.99000
nsur4a	9.00938E-02
nsur4b	0.15103
nsur4c	0.44271
intfw4rat1	0.42389
intfw4rat2	0.99000
ircrat4_1	0.99000
ircrat4_2	0.99000
lzetp4a	0.60000
lzetp4b	0.22081
ilsur4	100.00
islsur4	2.45000E-02
insur4	0.14847
retsc4	0.24759

Table H.4. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Dickerson Creek streamflow gaging station.

parameter	value
imp1	0.29532
imp2	0.35587
imp3	0.60100
imp4	0.10000
agwrc_rat	5.30411E-02
agwrctrns6a	20.404
lzsn6	2.0000
infilt6	0.50663
lsur6	459.00
slsur6	2.91000E-02
deepfr6	0.49507
basetp6	1.00000E-10
cepsc6a	0.38844
cepsc6b	1.00437E-02
uzsn6_1rat	0.49720
uzsn6_2rat	7.96340E-02
nsur6a	5.00000E-02
nsur6b	0.15000
nsur6c	0.30000
intfw6rat1	1.97902E-03
intfw6rat2	3.35677E-03
ircrat6_1	1.01978E-02
ircrat6_2	0.39515
lzetp6a	0.60000
lzetp6b	0.10000
ilsur6	100.00
islsur6	2.29000E-02
insur6	1.00000E-02
retsc6	0.13032

Table H.6. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Strawberry Creek streamflow gaging station.

parameter	value
imp1	0.20100
imp2	0.35100
imp3	0.70141
imp4	0.10000
agwrc_rat	0.14252
agwrctrns7a	6.8877
lzsn7	4.1427
infilt7	0.38523
lsur7	477.00
slsur7	2.08000E-02
deepfr7	0.15295
basetp7	1.00000E-10
cepsc7a	0.15000
cepsc7b	3.45260E-02
uzsn7_1rat	0.22838
uzsn7_2rat	0.41539
nsur7a	9.43878E-02
nsur7b	0.23259
nsur7c	0.45000
intfw7rat1	4.85795E-04
intfw7rat2	3.06035E-03
ircrat7_1	3.33951E-02
ircrat7_2	0.45185
lzetp7a	0.60000
lzetp7b	0.10000
ilsur7	100.00
islsur7	1.64000E-02
insur7	0.15000
retsc7	5.53118E-02

Table H.7. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Clear Creek – West Tributary streamflow gaging station.

parameter	value
imp1	0.20100
imp2	0.57163
imp3	0.75986
imp4	0.10000
agwrc_rat	6.64321E-04
agwrctrns8a	94.306
lzsn8	4.0000
infilt8	0.22161
lsur8	471.00
slsur8	2.35000E-02
deepfr8	0.50000
basetp8	1.00000E-10
cepsc8a	0.40000
cepsc8b	1.00000E-02
uzsn8_1rat	8.55133E-04
uzsn8_2rat	8.23294E-04
nsur8a	6.16543E-02
nsur8b	0.15000
nsur8c	0.30000
intfw8rat1	0.99000
intfw8rat2	0.99000
ircrat8_1	6.56618E-03
ircrat8_2	0.25482
lzetp8a	0.60000
lzetp8b	0.17451
ilsur8	100.00
islsur8	2.00300E-02
insur8	0.13692
retsc8	0.30000

Table H.8. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Clear Creek streamflow gaging station.

parameter	value
imp1	0.33671
imp2	0.39948
imp3	0.90000
imp4	0.10000
agwrc_rat	9.90897E-02
agwrctrns9a	17.488
lzsn9	4.0000
infilt9	0.25541
lsur9	471.00
slsur9	2.34700E-02
deepfr9	1.67417E-03
basetp9	4.02829E-03
cepsc9a	0.15000
cepsc9b	0.14900
uzsn9_1rat	5.04616E-02
uzsn9_2rat	4.95293E-02
nsur9a	0.12823
nsur9b	0.15000
nsur9c	0.33901
intfw9rat1	0.99000
intfw9rat2	0.30900
ircrat9_1	0.10579
ircrat9_2	0.99000
lzetp9a	0.60000
lzetp9b	0.10000
ilsur9	100.00
islsur9	2.03800E-02
insur9	0.15000
retsc9	0.30000

Table H.9. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Barker Creek streamflow gaging station.

parameter	value
imp1	
imp2	
imp3	
imp4	
agwrc_rat	
agwrctrns1a	
lzsn1	
infilt1	
lsur1	
slsur1	
deepfr1	
basetp1	
cepsc1a	
cepsc1b	
uzsn1_1rat	
uzsn1_2rat	
nsur1a	
nsur1b	
nsur1c	
intfw1rat1	
intfw1rat2	
ircrat1_1	
ircrat1_2	
lzetp1a	
lzetp1b	
ilsur1	
islsur1	
insur1	
retsc1	

Table H.10. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Karcher Creek streamflow gaging station.

parameter	value
imp1	0.20100
imp2	0.35100
imp3	0.75000
imp4	0.10000
agwrc_rat	6.46728E-02
agwrctrns11a	16.670
lzsn11	7.8636
infilt11	8.57340E-03
lsur11	477.00
slsur11	2.09000E-02
deepfr11	7.36658E-03
basetp11	1.00000E-10
cepsc11a	0.15000
cepsc11b	1.00000E-02
uzsn11_1rat	0.99000
uzsn11_2rat	0.84459
nsur11a	7.47973E-02
nsur11b	0.15000
nsur11c	0.44968
intfw11rat1	0.49135
intfw11rat2	0.39197
ircrat11_1	7.47972E-02
ircrat11_2	0.99000
lzetp11a	0.60000
lzetp11b	0.10000
ilsur11	100.00
islsur11	1.78000E-02
insur11	0.15000
retsc11	0.14743

Table H.11. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Blackjack Creek streamflow gaging station.

parameter	value
imp1	
imp2	
imp3	
imp4	
agwrc_rat	
agwrctrns1a	
lzsn1	
infilt1	
lsur1	
slsur1	
deepfr1	
basetp1	
cepsc1a	
cepsc1b	
uzsn1_1rat	
uzsn1_2rat	
nsur1a	
nsur1b	
nsur1c	
intfw1rat1	
intfw1rat2	
ircrat1_1	
ircrat1_2	
lzetp1a	
lzetp1b	
ilsur1	
islsur1	
insur1	
retsc1	

Table H.12. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Anderson Creek streamflow gaging station.

parameter	value
imp1	
imp2	
imp3	
imp4	
agwrc_rat	3.98923E-03
agwrctrns13a	14.220
lzsn13	4.1697
infilt13	0.32856
lsur13	401.00
slsur13	5.61600E-02
deepfr13	1.07913E-02
basetp13	2.15952E-04
cepsc13a	0.40000
cepsc13b	9.51030E-02
uzsn13_1rat	0.10591
uzsn13_2rat	4.51341E-02
nsur13a	0.12500
nsur13b	0.20878
nsur13c	0.34487
intfw13rat1	0.23482
intfw13rat2	0.36024
ircrat13_1	0.23502
ircrat13_2	0.21749
lzetp13a	0.80000
lzetp13b	0.35787
ilsur13	100.00
islsur13	0.00722933
insur13	7.50000E-02
retsc13	0.10000

Table H.13. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Heins Creek streamflow gaging station.

parameter	value
imp1	
imp2	
imp3	
imp4	
agwrc_rat	
agwrctrns1a	
lzsn1	
infilt1	
lsur1	
slsur1	
deepfr1	
basetp1	
cepsc1a	
cepsc1b	
uzsn1_1rat	
uzsn1_2rat	
nsur1a	
nsur1b	
nsur1c	
intfw1rat1	
intfw1rat2	
ircrat1_1	
ircrat1_2	
lzetp1a	
lzetp1b	
ilsur1	
islsur1	
insur1	
retsc1	

Table H.14. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Parish Creek streamflow gaging station.

parameter	value
imp1	
imp2	
imp3	
imp4	
agwrc_rat	
agwrctrns1a	
lzsn1	
infilt1	
lsur1	
slsur1	
deepfr1	
basetp1	
cepsc1a	
cepsc1b	
uzsn1_1rat	
uzsn1_2rat	
nsur1a	
nsur1b	
nsur1c	
intfw1rat1	
intfw1rat2	
ircrat1_1	
ircrat1_2	
lzetp1a	
lzetp1b	
ilsur1	
islsur1	
insur1	
retsc1	

Table H.15. Optimized parameter set obtained for the HSPF hydrologic model for the drainage area above the Gorst Creek streamflow gaging station.

APPENDIX I

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/01/2001 00:00	07/07/2001 23:45	0.82	0.93	0.86	0.82	0.93	0.86	0.91	0.98	0.96
08/03/2001 00:00	01/08/2002 23:45	0.69	0.95	0.90	0.70	0.95	0.90	0.81	1	1
02/05/2002 00:00	04/07/2002 23:45	0.79	0.95	0.90	0.79	0.95	0.90			
04/09/2002 00:00	06/01/2003 23:45	0.89	0.95	0.89	0.89	0.95	090	0.95	0.97	0.95

Table I.1. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/01/2001 00:00	05/26/2001 23:45	0.61	0.86	0.73	0.63	0.86	0.74	0.84	0.99	0.97
08/03/2001 00:00	09/04/2001 23:45	0.93	0.96	0.93	0.93	0.97	0.93			
10/01/2001 00:00	04/07/2002 23:45	0.94	0.97	0.95	0.95	0.98	0.96	0.99	1	0.99
06/07/2002 00:00	09/09/2002 23:45	0.50	0.86	0.74	0.52	0.87	0.75			
10/01/2002 00:00	12/08/2002 23:45	0.64	0.82	0.67	0.64	0.82	0.67			
01/07/2003 00:00	02/03/2003 23:45	0.79	0.93	0.87	0.79	0.94	0.88			
02/05/2003 00:00	07/06/2003 23:45	0.88	0.97	0.93	0.90	0.98	0.95	0.95	0.99	0.98

Table I.2. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/01/2001 00:00	12/31/2001 23:45	0.67	0.94	0.82	0.68	0.94	0.88	0.66	0.97	0.93
05/21/2002 00:00	09/30/2002 23:45	-3.85	0.77	0.59	-4.37	0.78	0.61	-29.69	0.95	0.90
11/14/2002 00:00	12/13/2002 23:45	0.95	0.98	0.95	0.96	0.98	0.97			
12/15/2002 00:00	01/01/2003 23:45	-1.68	0.94	0.89	-1.74	0.95	0.90			
01/03/2003 00:00	02/09/2003 23:45	0.54	0.90	0.82	0.59	0.92	0.84			
02/11/2003 00:00	04/08/2003 23:45	0.86	0.93	0.87	0.89	0.95	0.89			
04/10/2003 00:00	06/08/2003 23:45	-0.20	0.93	0.87	-0.12	0.96	0.91			

Table I.3. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Chico Tributary at Taylor Road streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/01/2001 00:00	12/31/2001 23:45	0.59	0.79	0.62	0.61	0.81	0.65	0.74	0.92	0.84
01/26/2002 00:00	09/30/2002 23:45	0.87	0.94	0.88	0.90	0.95	0.90	0.98	0.99	0.99
10/01/2002 00:00	12/29/2002 23:45	0.65	0.89	0.80	0.67	0.91	0.82			
01/11/2003 00:00	01/28/2003 23:45	0.54	0.89	0.78	0.55	0.89	0.79			
03/12/2003 00:00	03/24/2003 23:45	-0.04	0.71	0.50	-0.12	0.69	0.48			
05/09/2003 00:00	06/01/2003 23:45	0.96	0.98	0.97	0.98	0.99	0.98			
06/03/2003 00:00	07/06/2003 23:45	-0.56	0.96	0.93	-0.58	0.97	0.94			
07/08/2003 00:00	09/29/2003 23:45	-15.71	0.94	0.89	-15.88	0.95	0.90			

Table I.4. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Dickerson Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
10/05/2001 00:00	10/31/2001 23:45	0.29	0.82	0.68	0.08	0.97	0.95			
12/10/2001 00:00	09/30/2002 23:45	0.25	0.78	0.61	0.32	0.85	0.73	0.45	0.93	0.86
12/05/2002 00:00	01/05/2003 23:45	0.55	0.82	0.67	0.64	0.88	0.78			
01/07/2003 00:00	01/23/2003 23:45	0.74	0.89	0.80	0.89	0.99	0.99			
01/25/2003 00:00	02/06/2003 23:45	0.69	0.89	0.79	0.76	0.97	0.94			
02/08/2003 00:00	04/01/2003 23:45	0.68	0.93	0.87	0.72	0.97	0.94			
04/03/2003 00:00	06/03/2003 23:45	0.24	0.57	0.33	0.30	0.61	0.37			
06/05/2003 00:00	07/14/2003 23:45	-1.47	0.03	0	-5.38	0.08	0.01			

Table I.6. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Strawberry Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/01/2001 00:00	04/28/2001 23:45	-1.21	0.43	0.18	-1.31	0.54	0.29			
05/09/2001 00:00	11/05/2001 23:45	-2.17	0.58	0.33	-3.07	0.69	0.47			
12/05/2001 00:00	02/03/2002 23:45	0.63	0.89	0.78	0.76	0.96	0.92			
03/07/2002 00:00	09/30/2002 23:45	0.39	0.88	0.78	0.40	0.90	0.82	-1.22	0.96	0.92
10/02/2002 00:00	02/27/2003 23:45	0.53	0.79	0.63	0.56	0.82	0.68			
03/01/2003 00:00	05/04/2003 23:45	0.84	0.96	0.92	0.86	0.98	0.96			
05/06/2003 00:00	06/17/2003 23:45	-5.99	-0.07	0	-8.46	-0.13	0.02			
08/22/2003 00:00	09/30/2003 23:30	-2.03	0.08	0.01	-4.33	0.12	0.01			

Table I.7. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Clear Creek – West Tributary streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
10/01/2001 00:00	10/31/2001 23:45	-1.72	0.42	0.18	-1.23	0.68	0.47			
01/18/2002 00:00	02/07/2002 23:45	0.73	0.88	0.77	0.84	0.94	0.88			
02/09/2002 00:00	04/09/2002 23:45	0.8	0.92	0.84	0.84	0.95	0.91			
05/04/2002 00:00	06/02/2002 23:45	-0.37	0.36	0.13	-0.31	0.42	0.17			
06/08/2002 00:00	07/18/2002 23:45	-1.06	0.68	0.46	-3.21	0.49	0.24			
08/09/2002 00:00	08/27/2002 23:45	-46.51	-0.22	0.05						
11/26/2002 00:00	12/19/2002 23:45	0.30	0.90	0.81	0.30	0.98	0.96			
12/21/2002 00:00	04/08/2003 23:45	0.82	0.94	0.88	0.85	0.96	0.92			
04/10/2003 00:00	06/03/2003 23:45	0.59	0.78	0.61	0.69	0.84	0.71			
06/05/2003 00:00	07/27/2003 23:45	-3.87	0.56	0.32	-5.18	0.65	0.42			

Table I.8. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Clear Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/06/2001 00:00	10/31/2001 23:45	-1.32	0.78	0.62	-1.30	0.88	0.77	-2.01	0.98	0.96
03/01/2002 00:00	09/30/2002 23:30	0.53	0.88	0.78	0.57	0.93	0.86	0.57	0.98	0.95
10/01/2002 23:45	11/20/2002 23:45	-2.25	0.76	0.58	-4.22	0.94	0.88			
12/05/2002 00:00	04/01/2003 23:45	0.68	0.85	0.72	0.76	0.90	0.81			
04/03/2003 00:00	06/03/2003 23:45	0.83	0.91	0.83	0.96	0.98	0.96			
06/05/2003 00:00	07/10/2003 23:45	-0.41	-0.10	0.01	-1.04	-0.17	0.03			
07/12/2003 00:00	09/30/2003 23:30	-18.92	-0.02	0.00	-46.52	-0.08	0.01			

Table I.9. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Barker Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2

Table I.10. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Karcher Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
01/01/2001 00:00	02/26/2001 23:45	0.42	0.74	0.55	0.49	0.80	0.64			
03/01/2001 00:00	09/30/2002 23:45	0.53	0.73	0.53	0.63	0.80	0.64	0.91	0.97	0.95
10/02/2002 00:00	11/03/2002 23:45	-67.41	-0.76	0.58	-80	-0.84	0.70			
11/05/2002 00:00	12/10/2002 23:45	-1.80	0.64	0.42	-2.29	0.83	0.70			
12/12/2002 00:00	02/27/2003 23:45	-0.46	0.79	0.62	-0.10	0.88	0.78			
03/01/2003 00:00	05/04/2003 23:45	0.28	0.83	0.69	0.47	0.89	0.79			
05/06/2003 00:00	06/12/2003 23:45	-1.11	0.83	0.70	-1.17	0.86	0.74			
06/14/2003 00:00	07/15/2003 23:45	-25.24	0.55	0.30	-34.19	0.64	0.41			
07/17/2003 00:00	09/30/2003 23:30	-3532	0.21	0.04	-14000	0.41	0.17			

Table I.11. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Blackjack Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2

Table I.12. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Anderson Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2
10/02/2002 00:00	02/02/2003 23:45	0.93	0.97	0.93	0.94	0.97	0.94			
02/07/2003 00:00	04/30/2003 23:45	0.79	0.95	0.91	0.80	0.96	0.92			

Table I.13. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Heins Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2

Table I.14. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Parish Creek streamflow gaging station.

Period		15 Minute			Daily			Monthly		
Begin Date & Time	End Date & Time	ES	R	R^2	ES	R	R^2	ES	R	R^2

Table I.15. Computed Nash and Sutcliffe efficiency scores, correlation coefficients, and coefficients of determination for the optimized HSPF hydrologic model for the drainage area above the Gorst Creek streamflow gaging station.

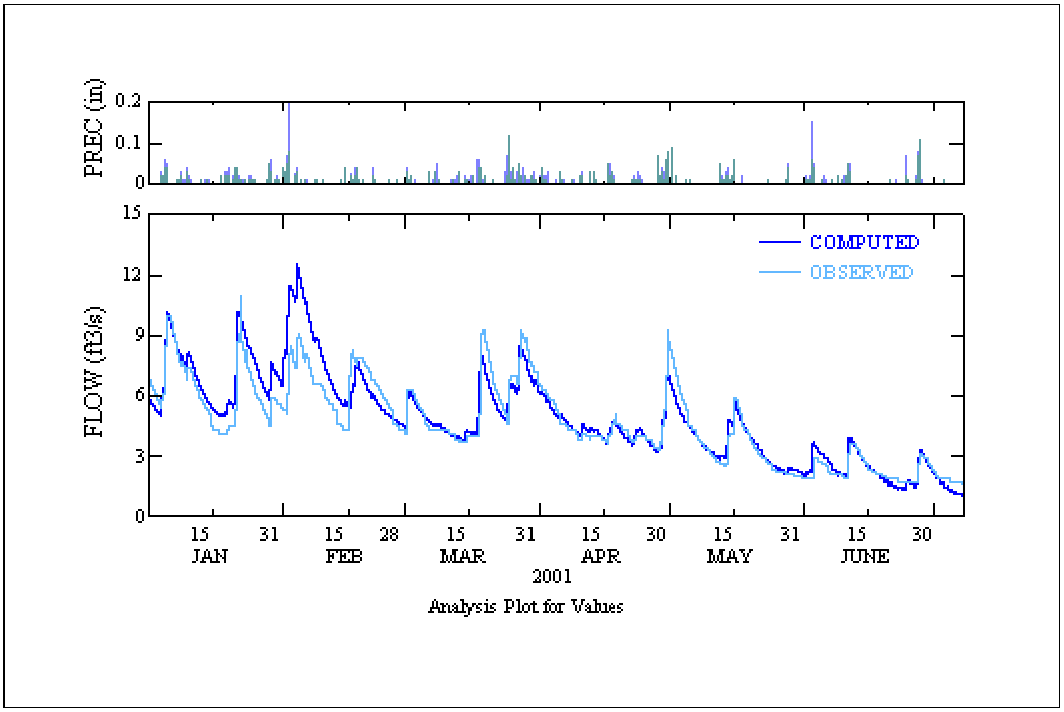


Figure I.1.A.1. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

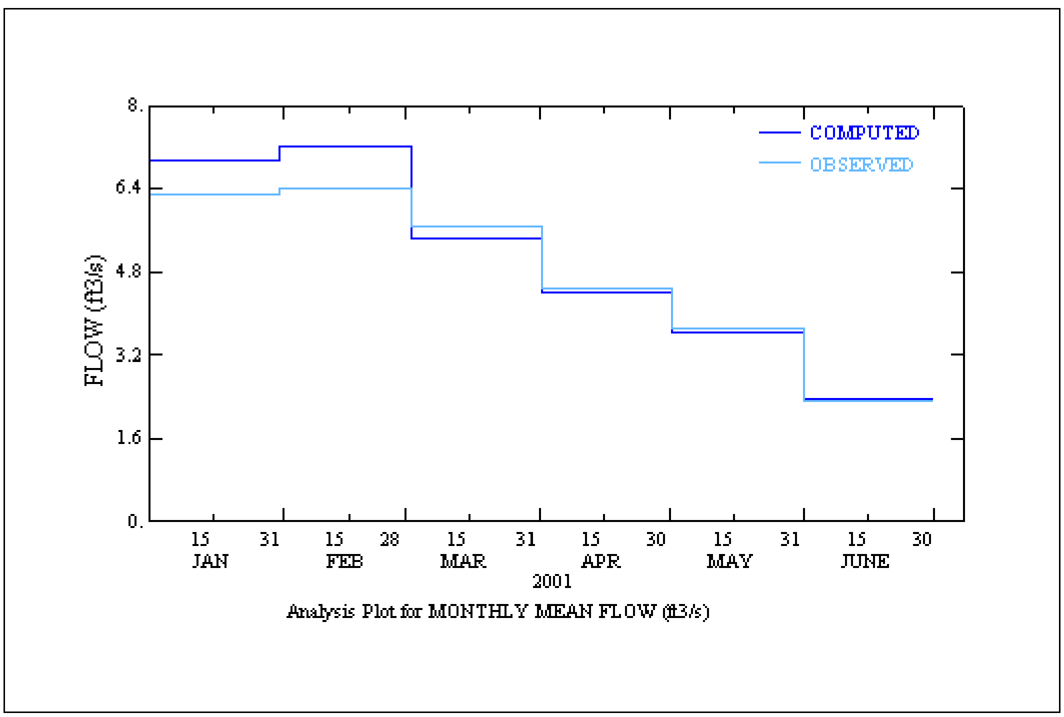


Figure I.1.A.2. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

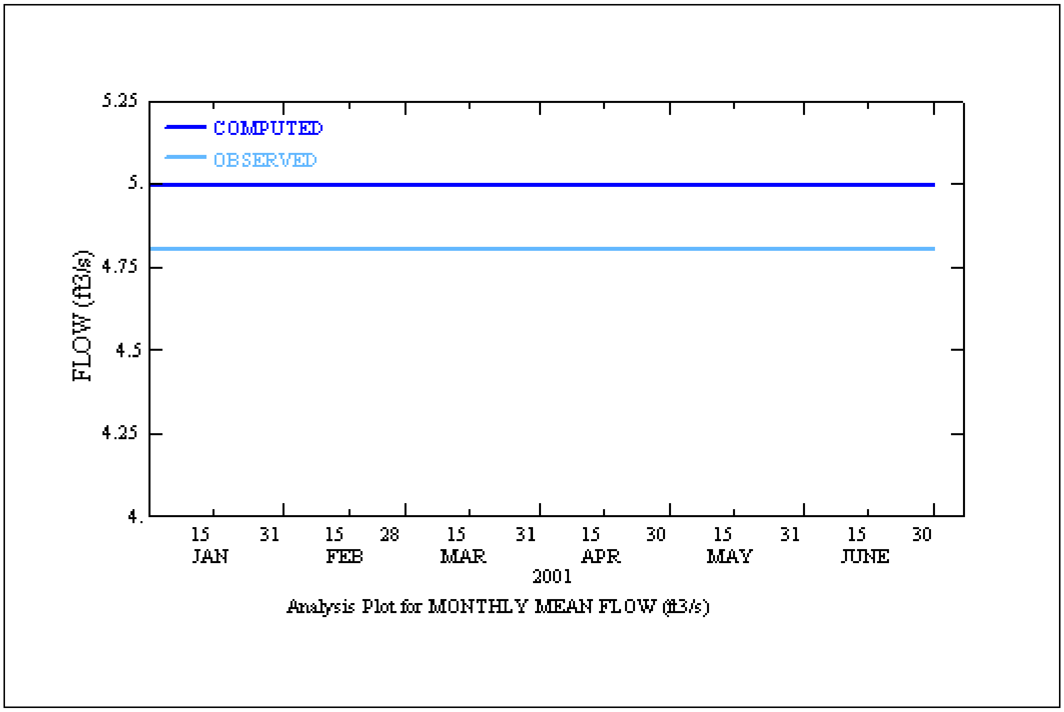


Figure I.1.A.3. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 01/01/2001 – 06/30/2001.

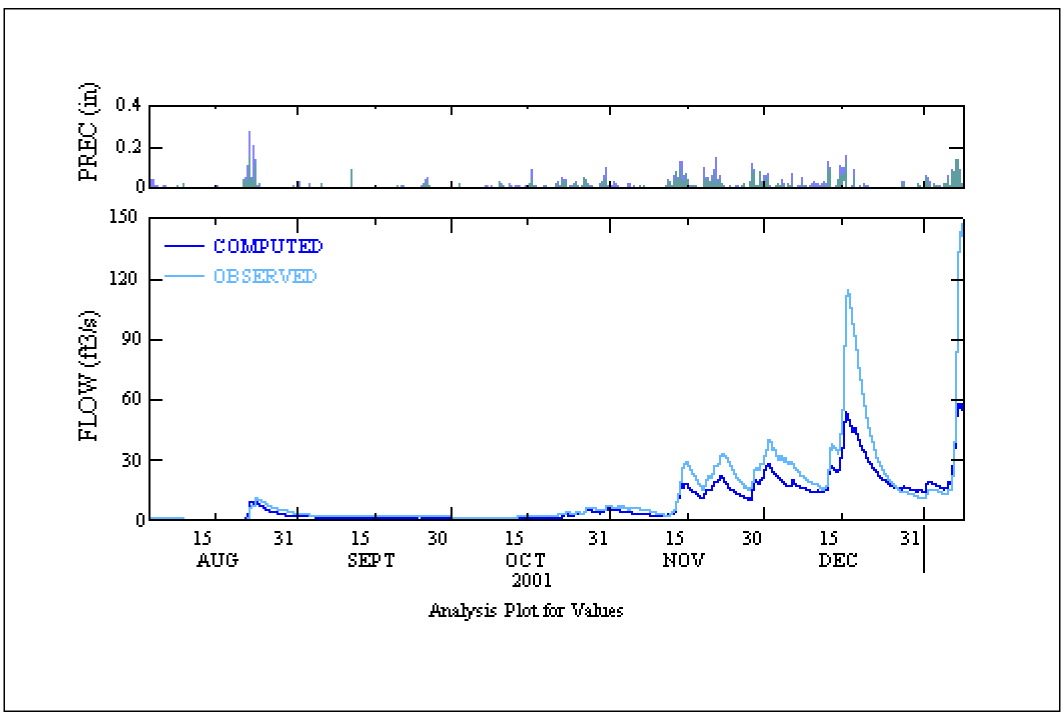


Figure I.1.B.1. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

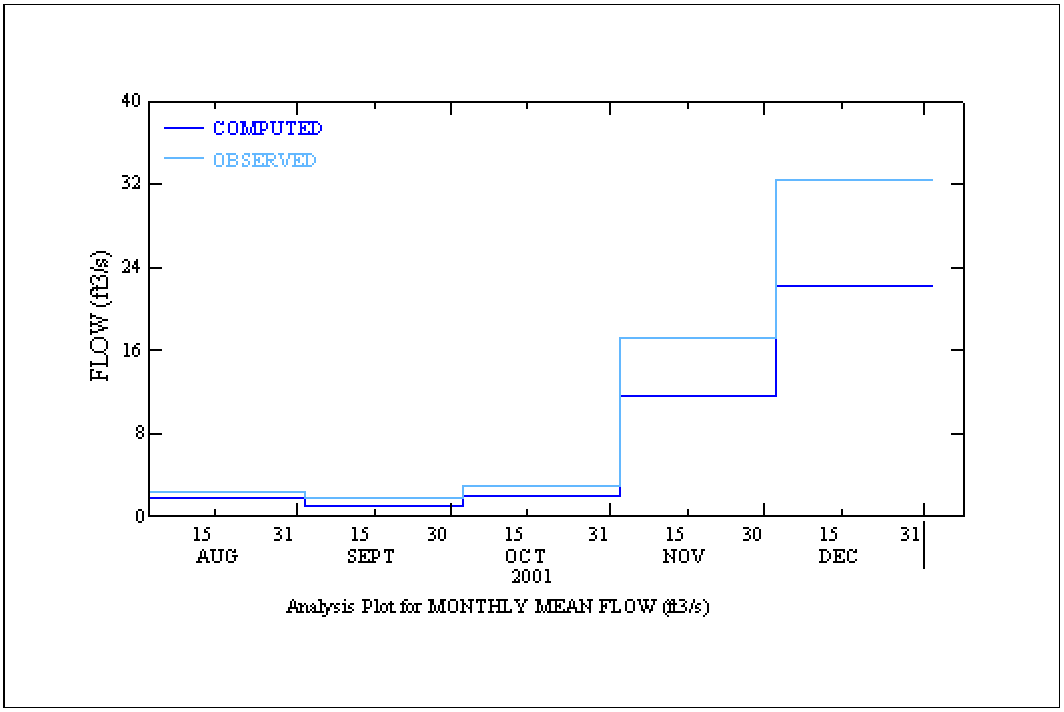


Figure I.1.B.2. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

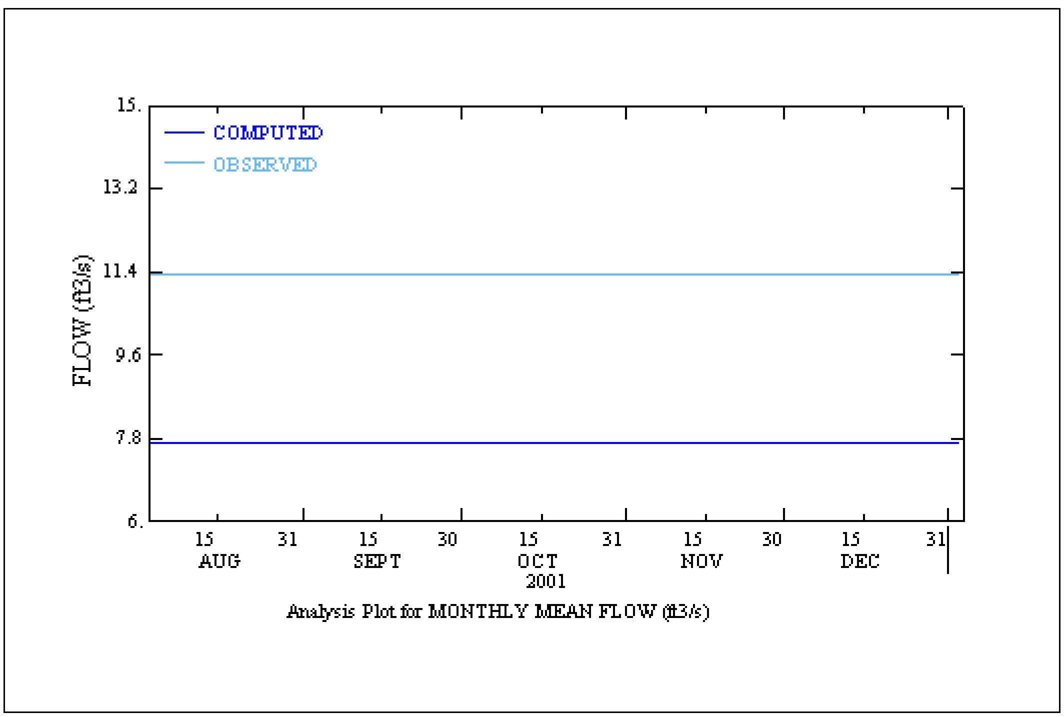


Figure I.1.B.3. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 08/03/2001 – 01/03/2002.

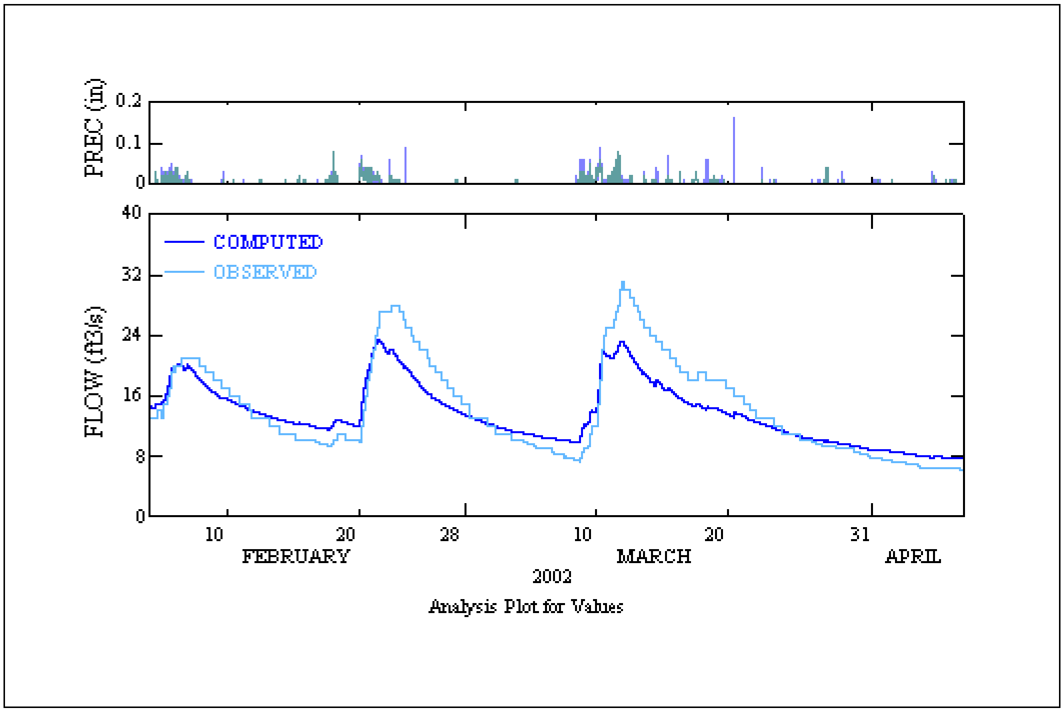


Figure I.1.C.1. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

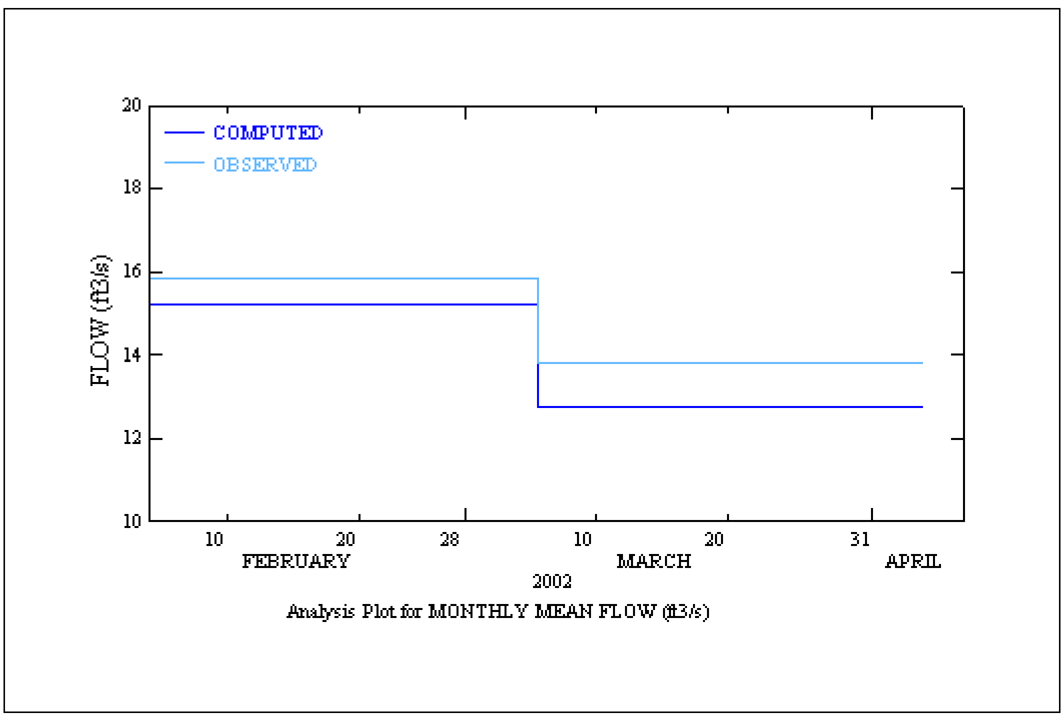


Figure I.1.C.2. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

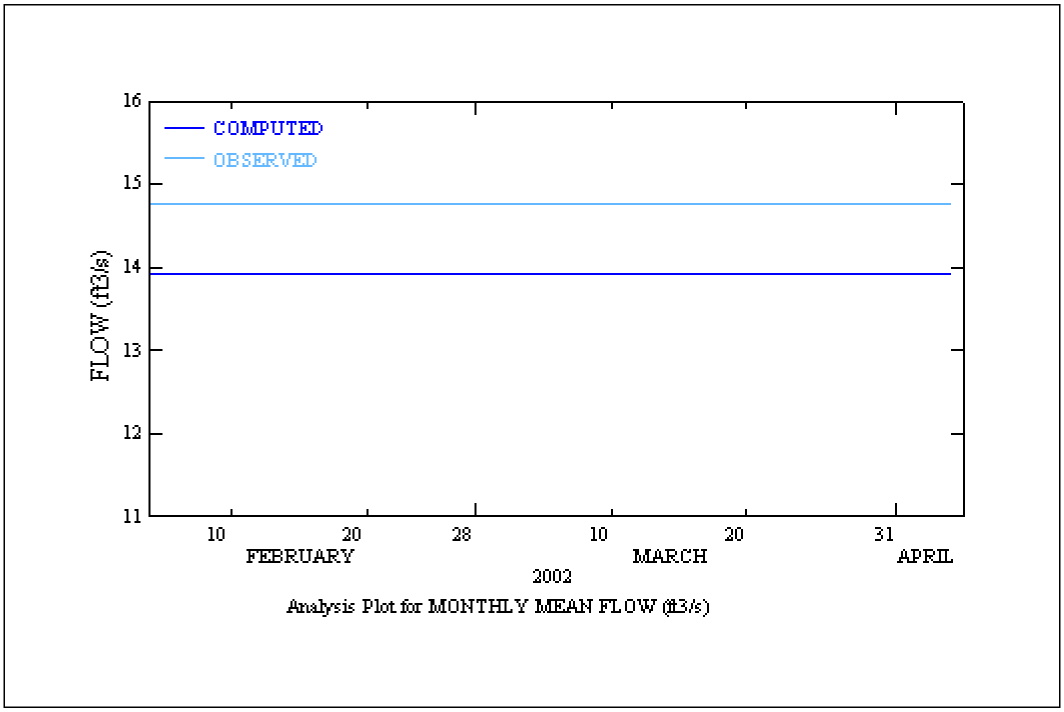


Figure I.1.C.3. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 02/05/2002 – 04/05/2002.

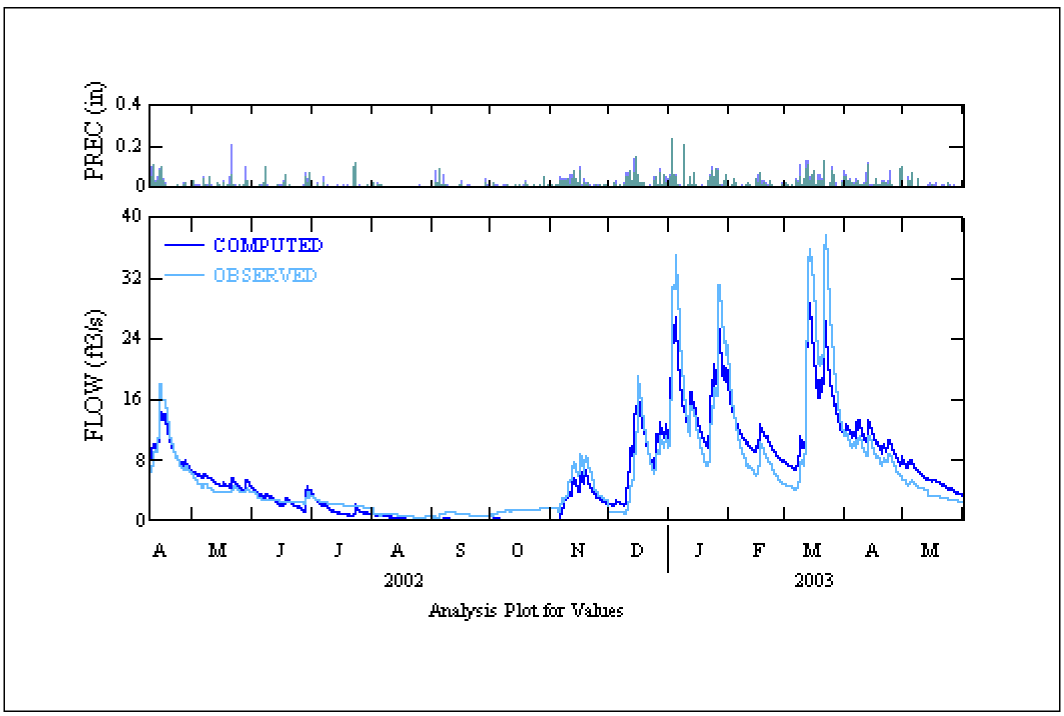


Figure I.1.D.1. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

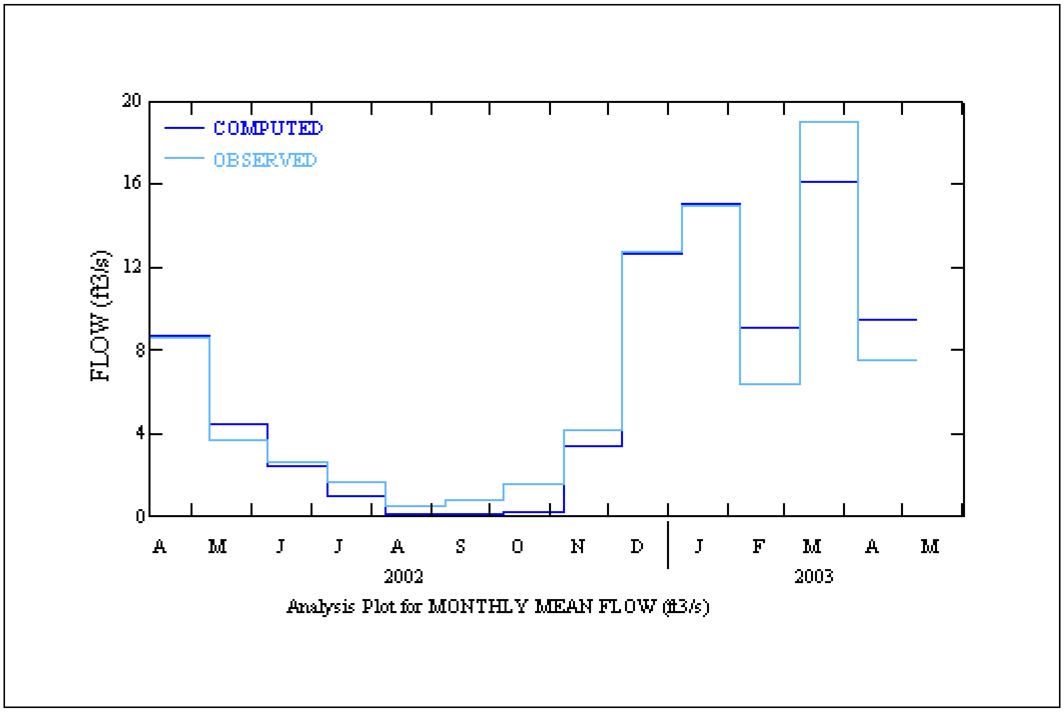


Figure I.1.D.2. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

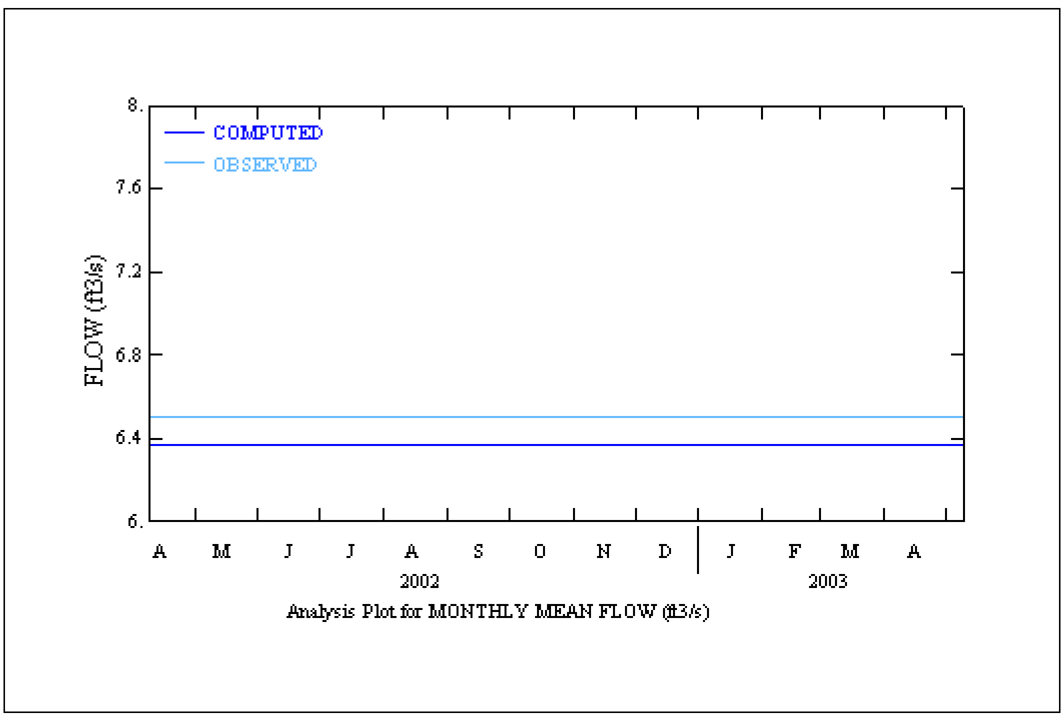


Figure I.1.D.3. Final parameter estimation results for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 04/09/2002 – 05/09/2003.

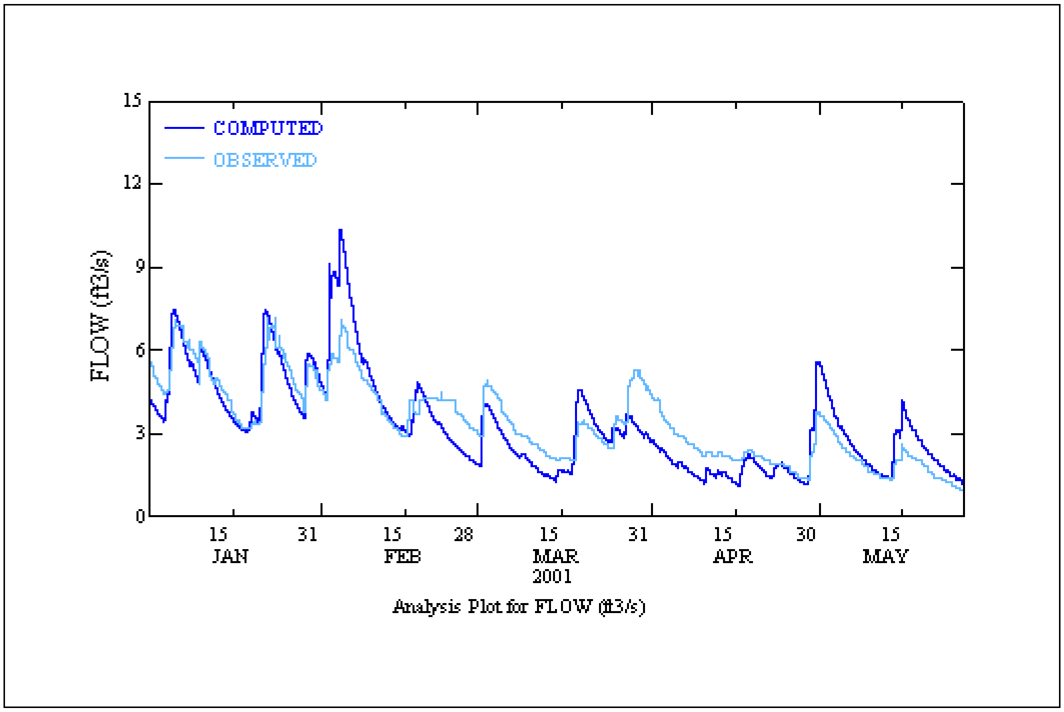


Figure I.2.A.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

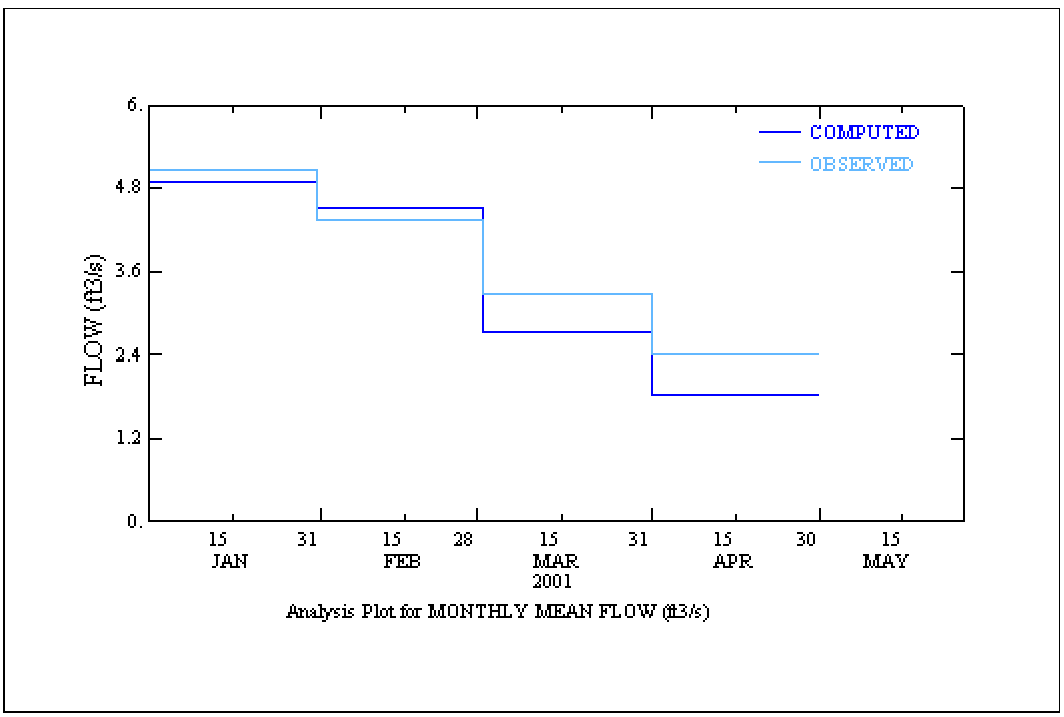


Figure I.2.A.2 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

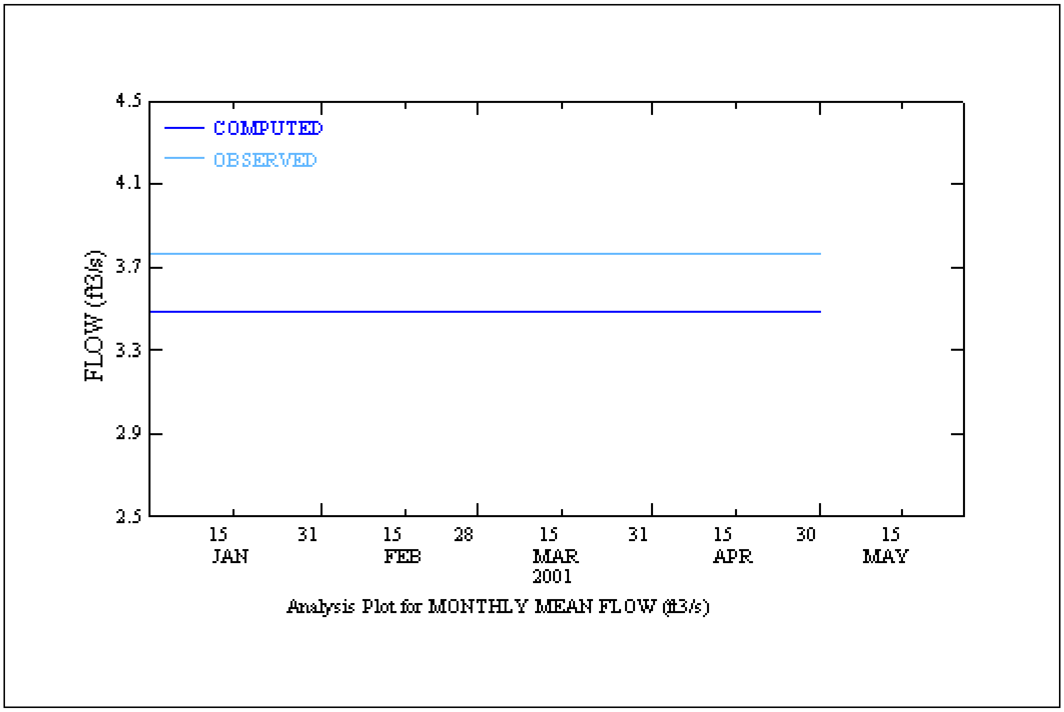


Figure I.2.A.3 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 01/01/2001 – 05/26/2001.

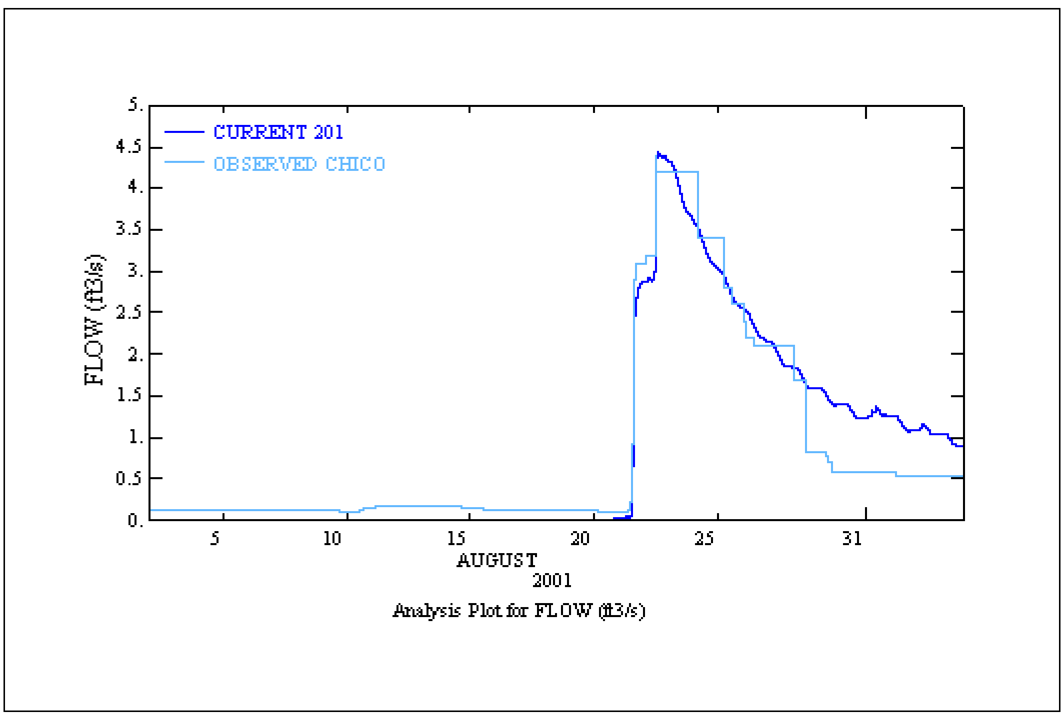


Figure I.2.B.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

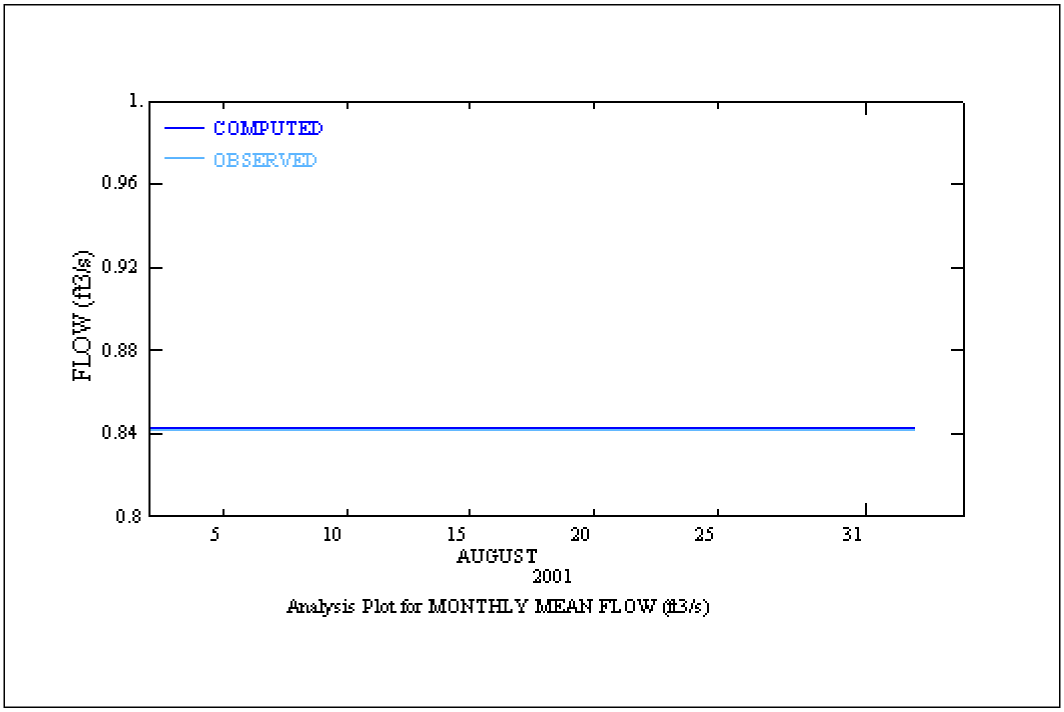


Figure I.2.B.2 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

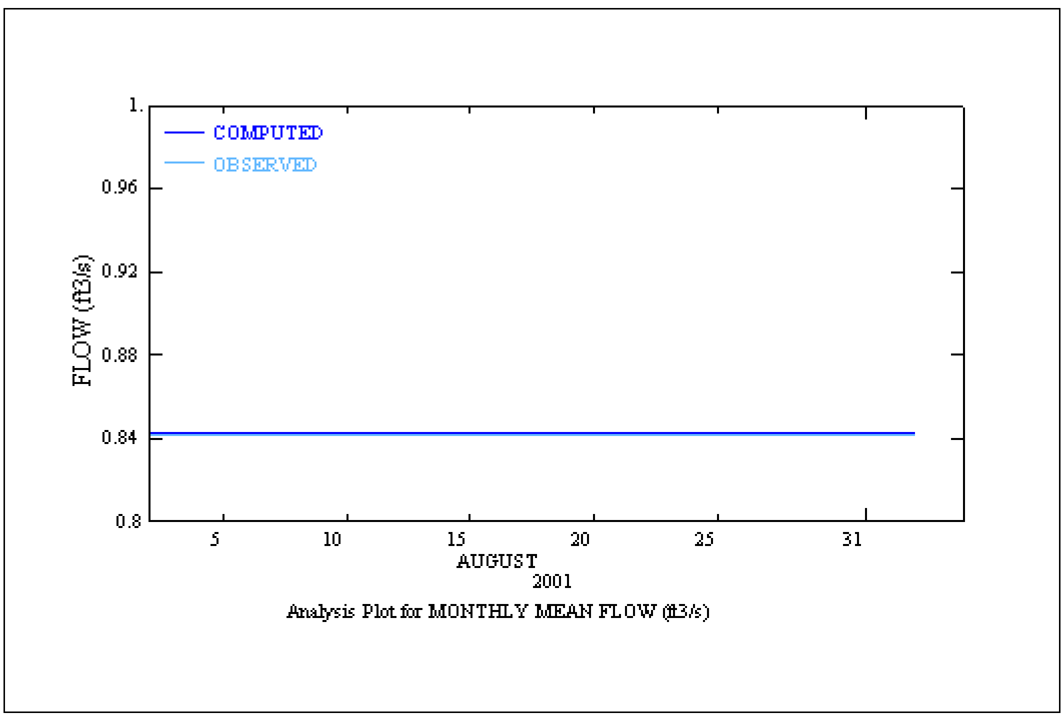


Figure I.2.B.3 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 08/03/2001 – 09/04/2001.

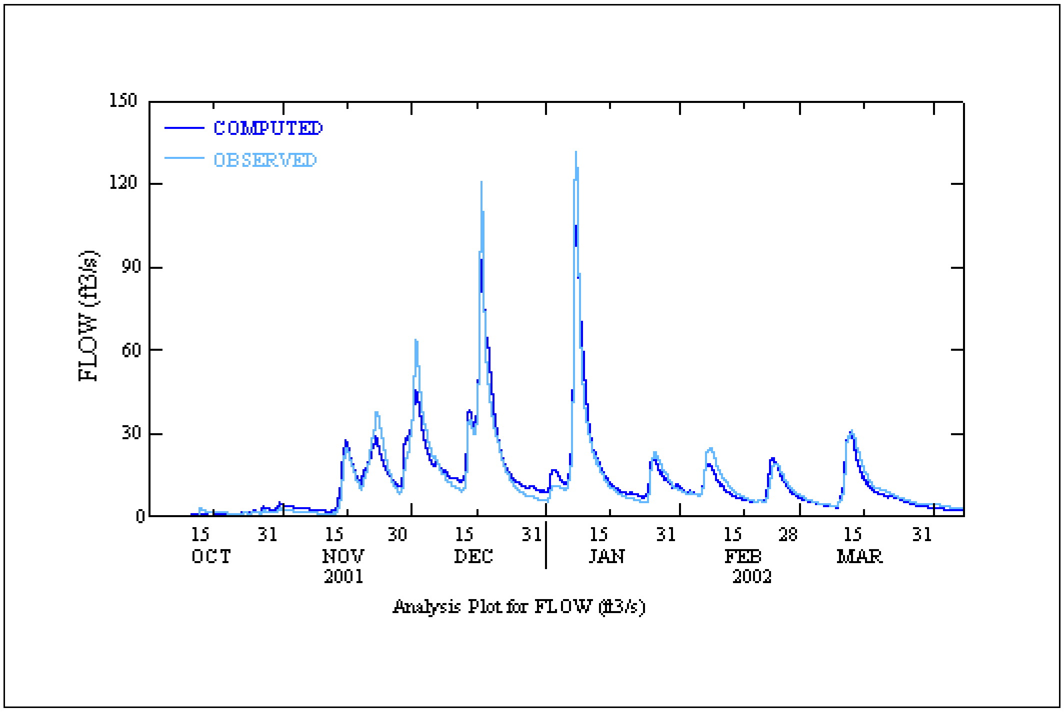


Figure I.2.C.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

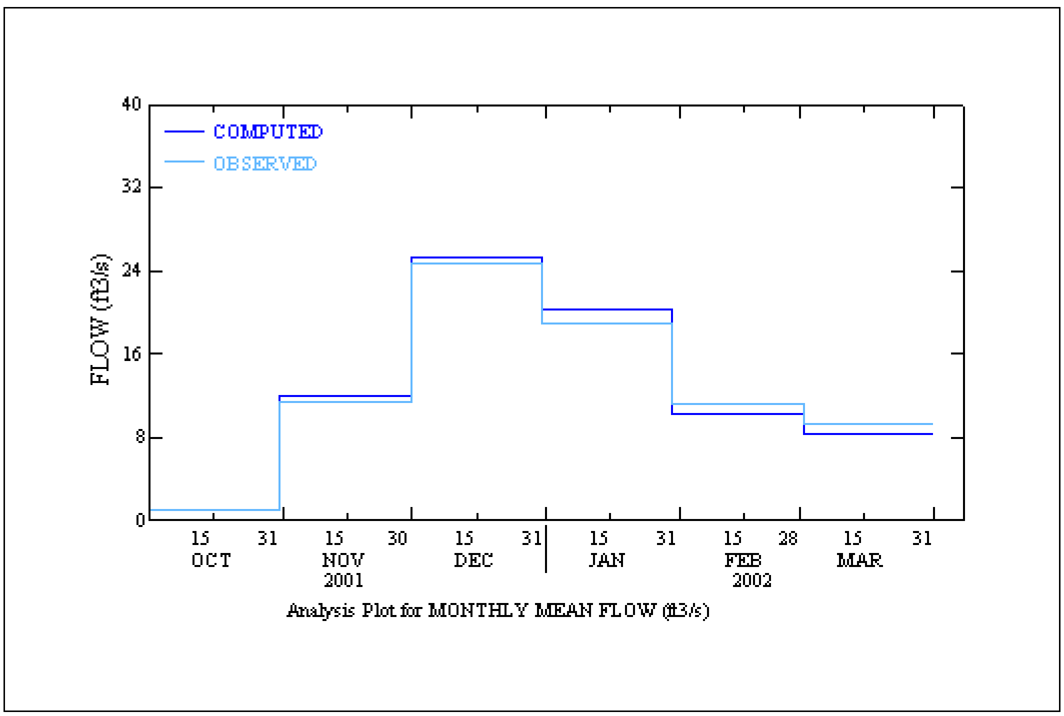


Figure I.2.C.2 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

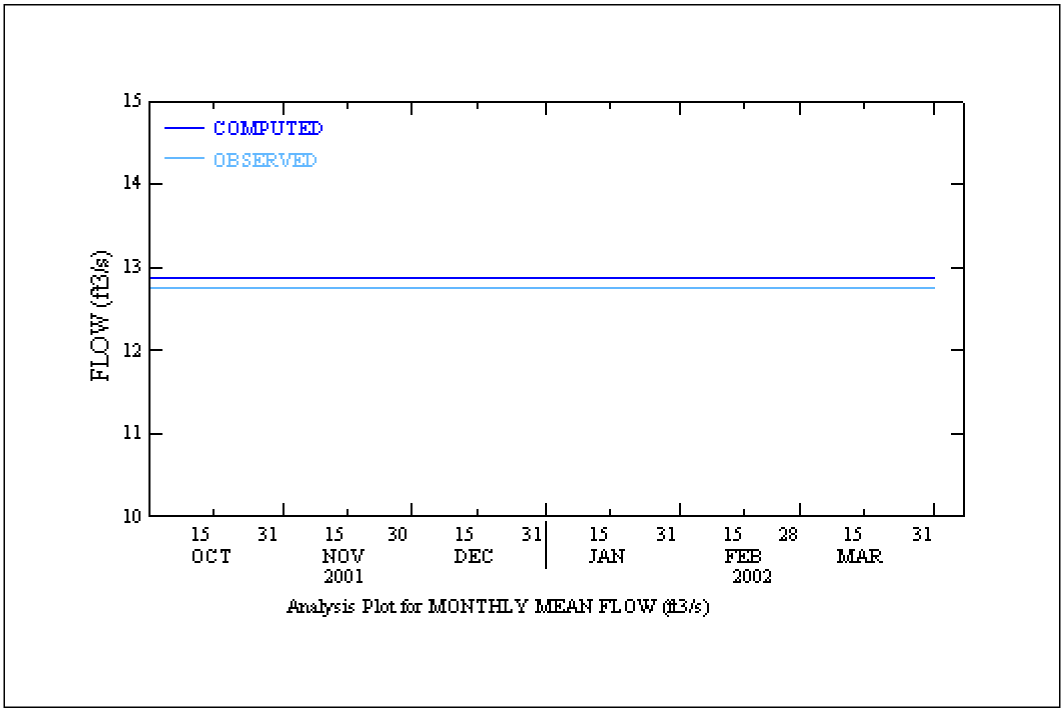


Figure I.2.C.3 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 10/01/2001 – 04/07/2002.

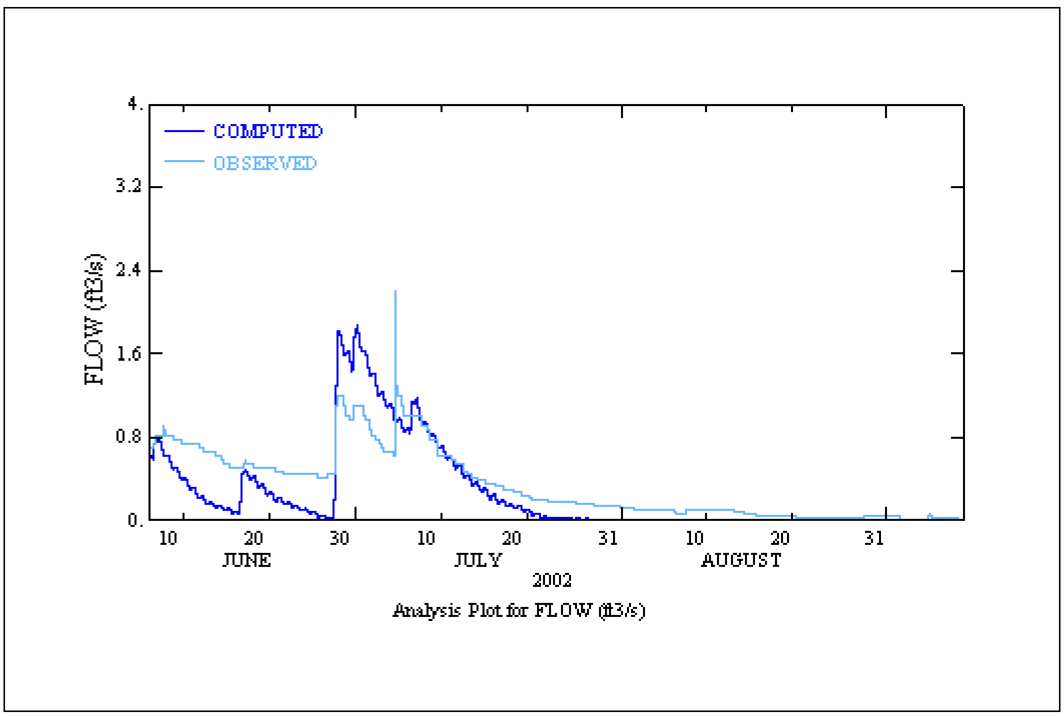


Figure I.2.D.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

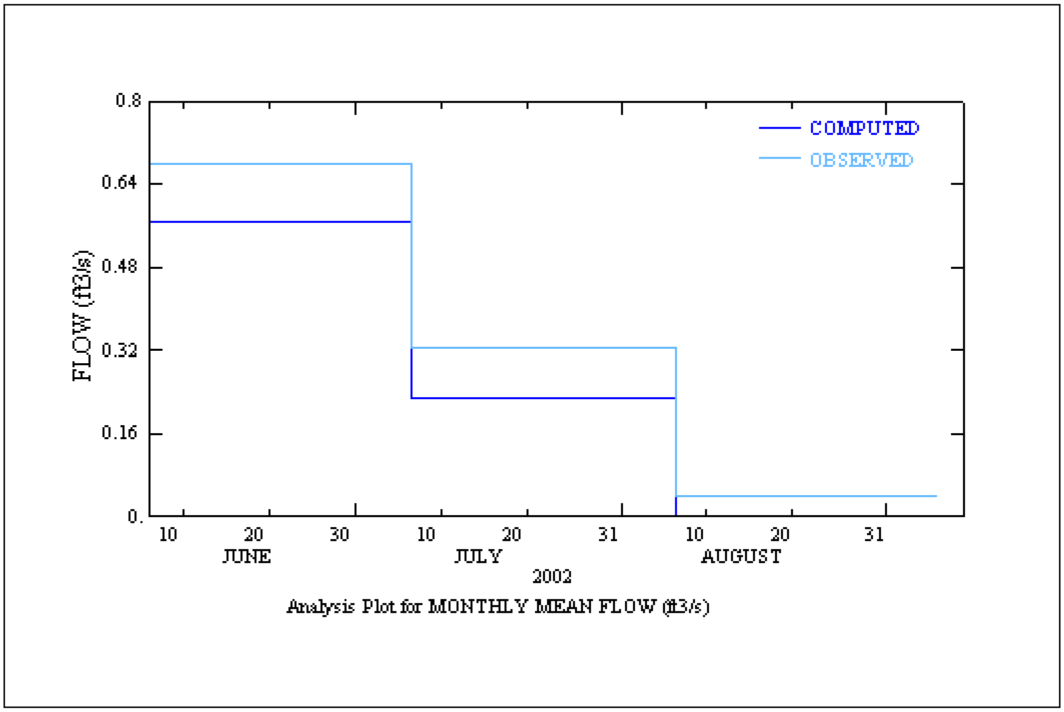


Figure I.2.D.2 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

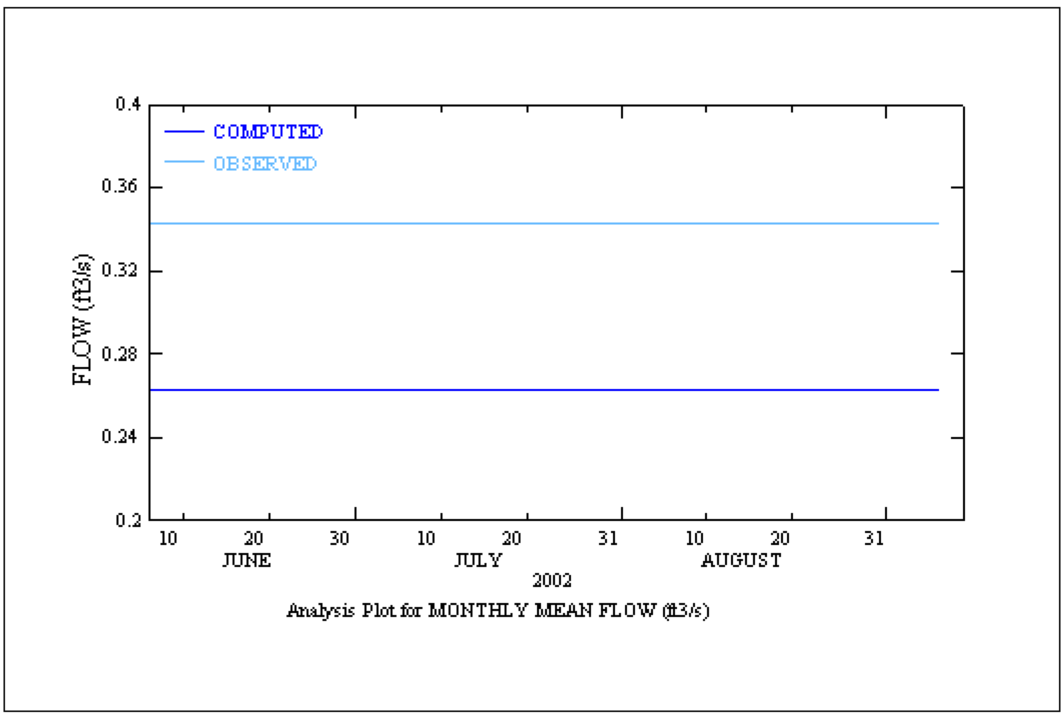


Figure I.2.D.3 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 06/07/2002 – 09/09/2002.

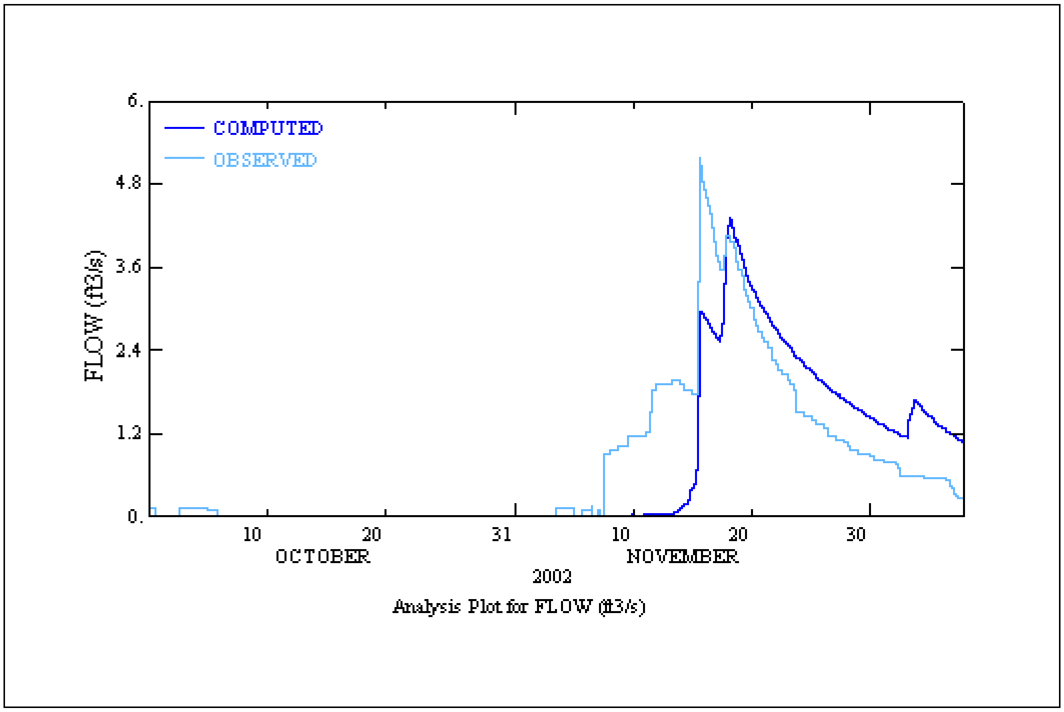


Figure I.2.E.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

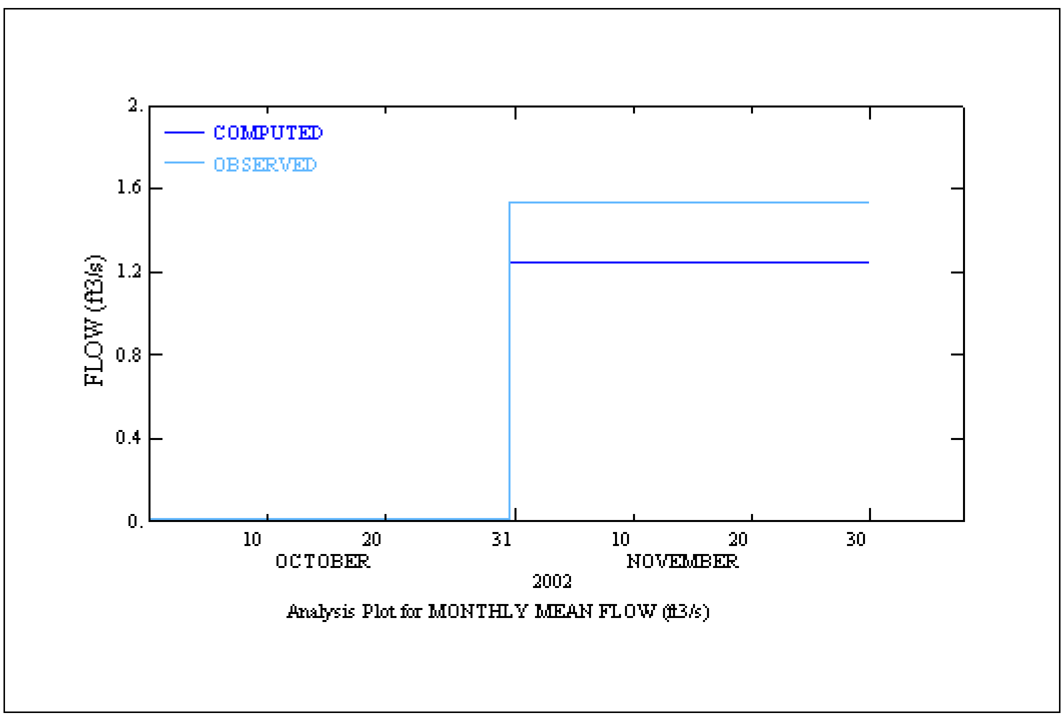


Figure I.2.E.2 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

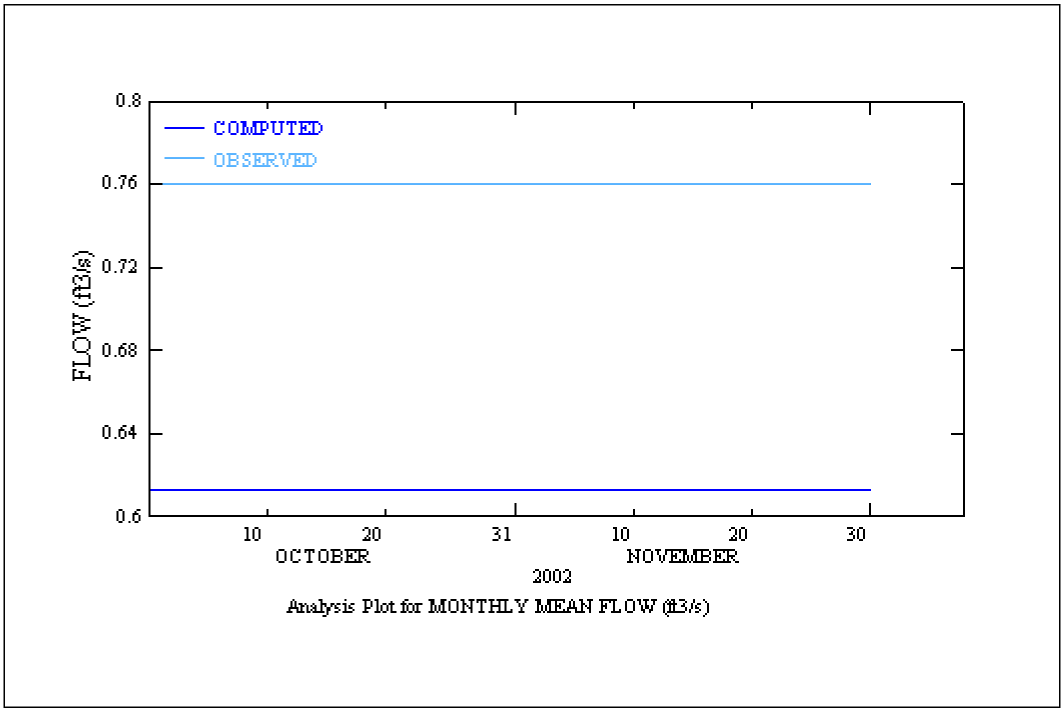


Figure I.2.E.3 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 10/01/2002 – 12/08/2002.

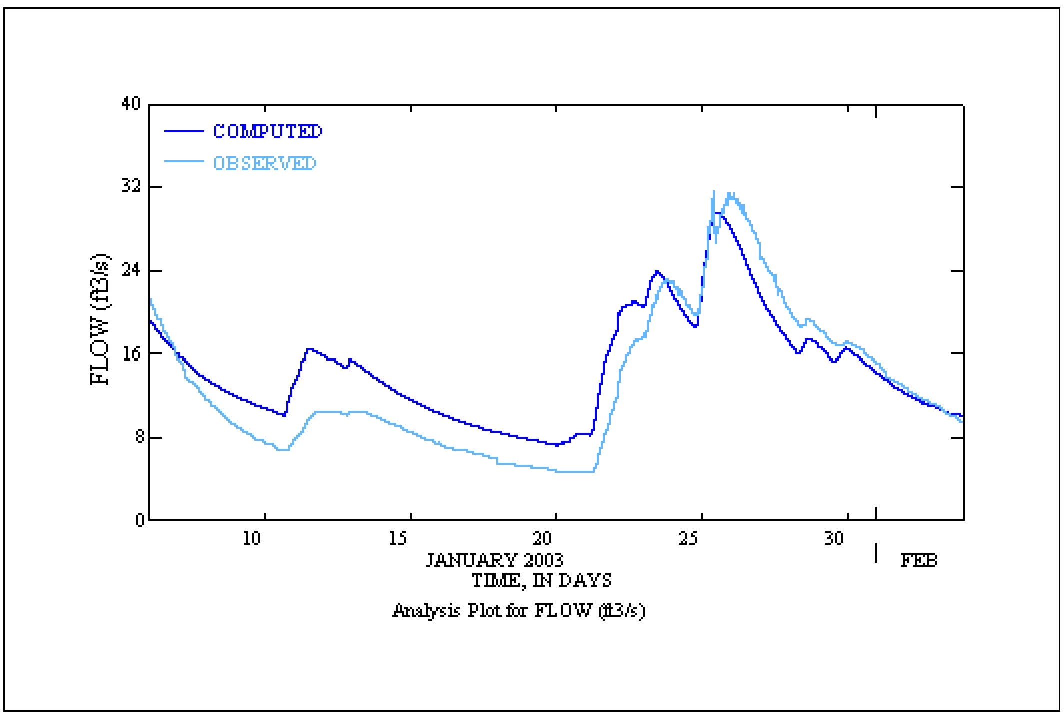


Figure I.2.F.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

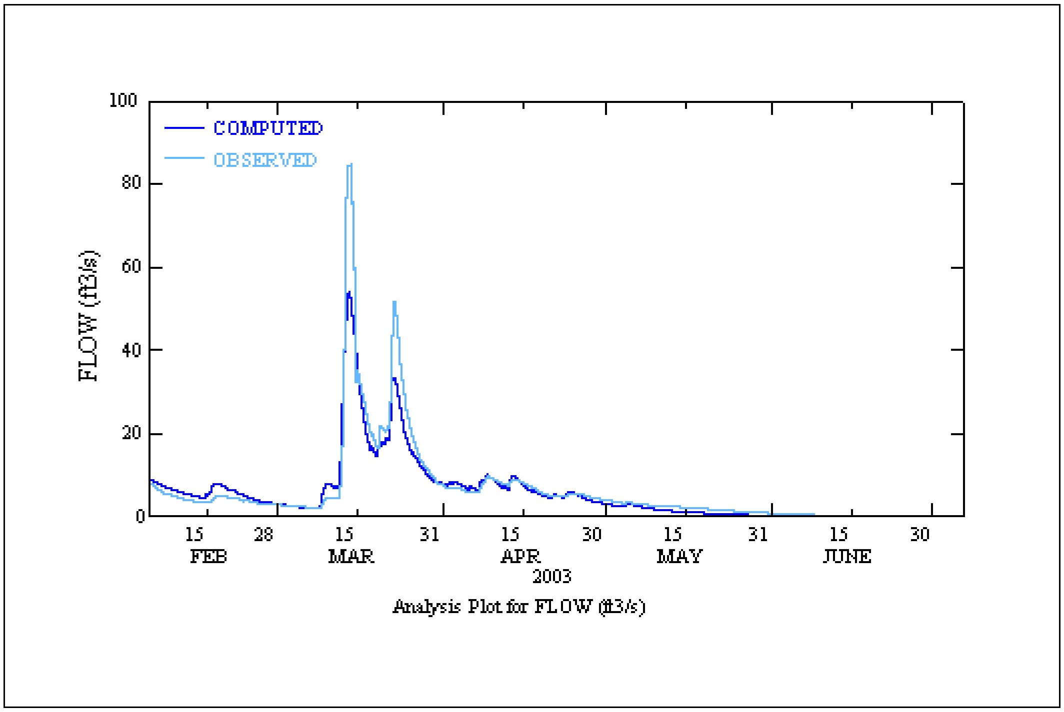


Figure I.2.G.1 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed fifteen minute flows.

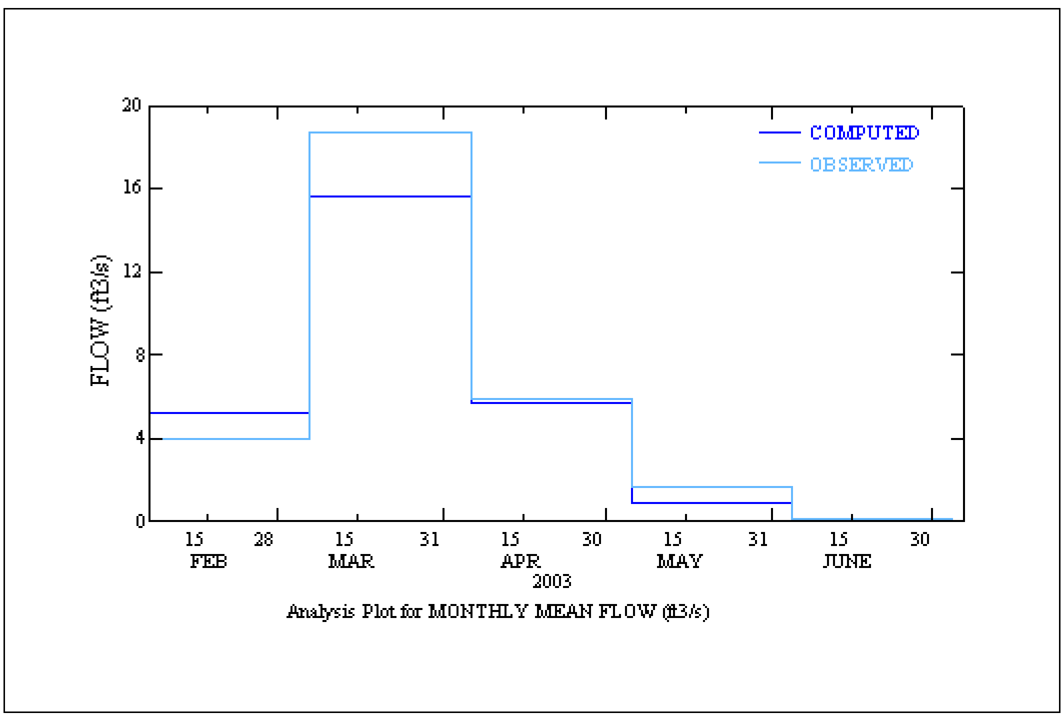


Figure I.2.G.2 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed monthly mean flows.

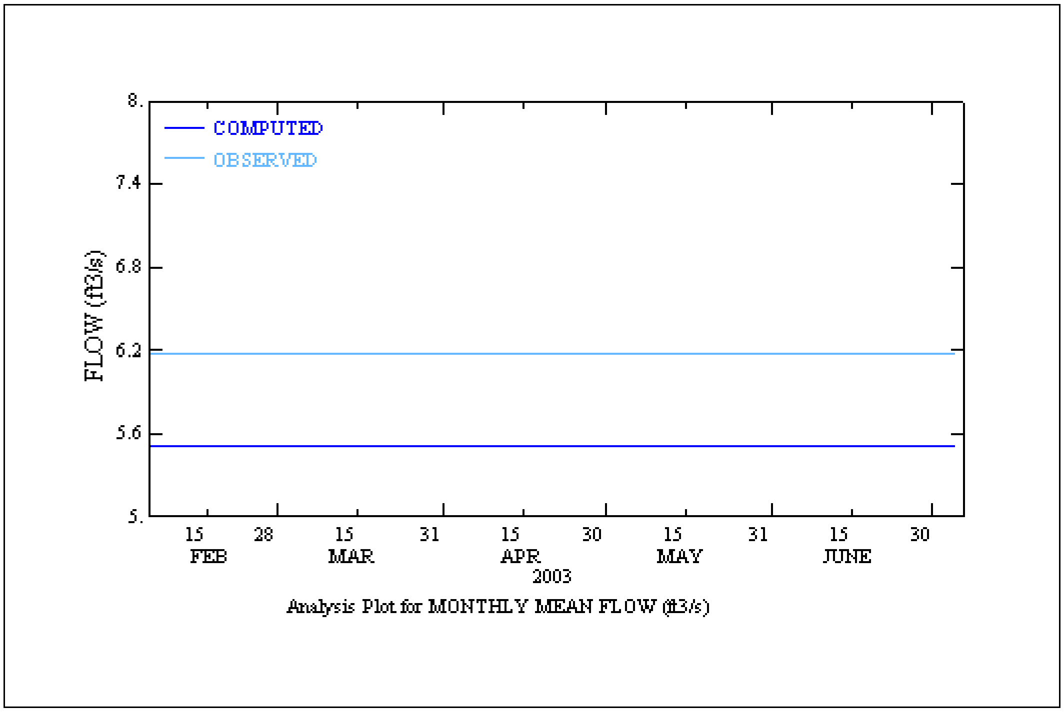


Figure I.2.G.3 Final parameter estimation results for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station, comparing simulated and observed flows for the period 02/05/2003 – 07/06/2003.

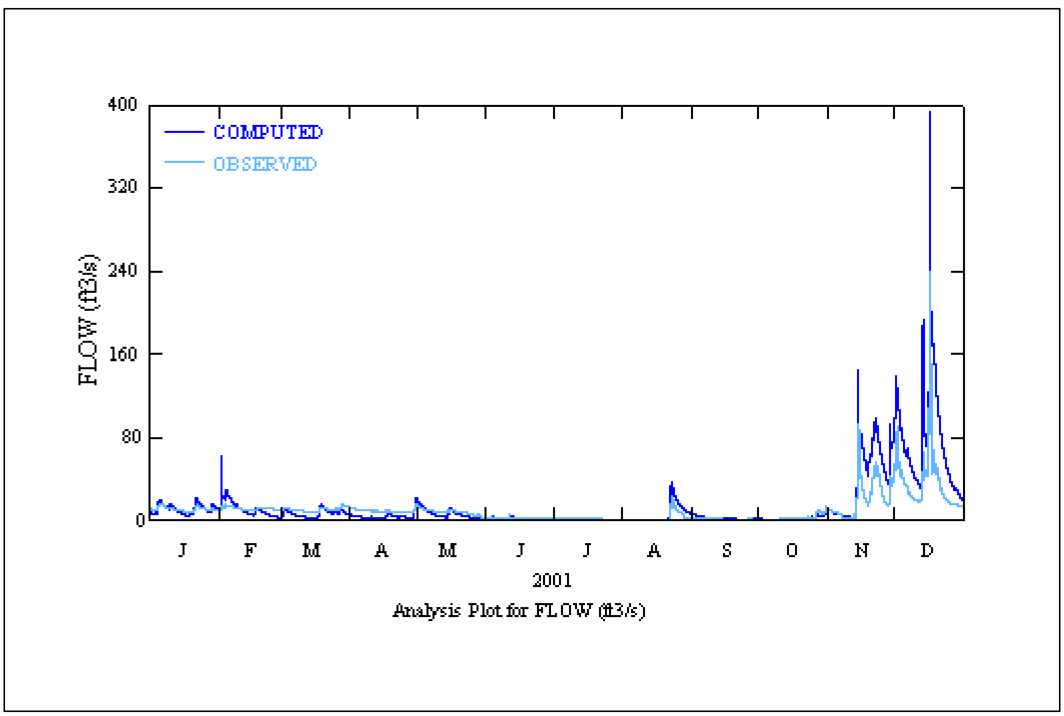


Figure I.3.A.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

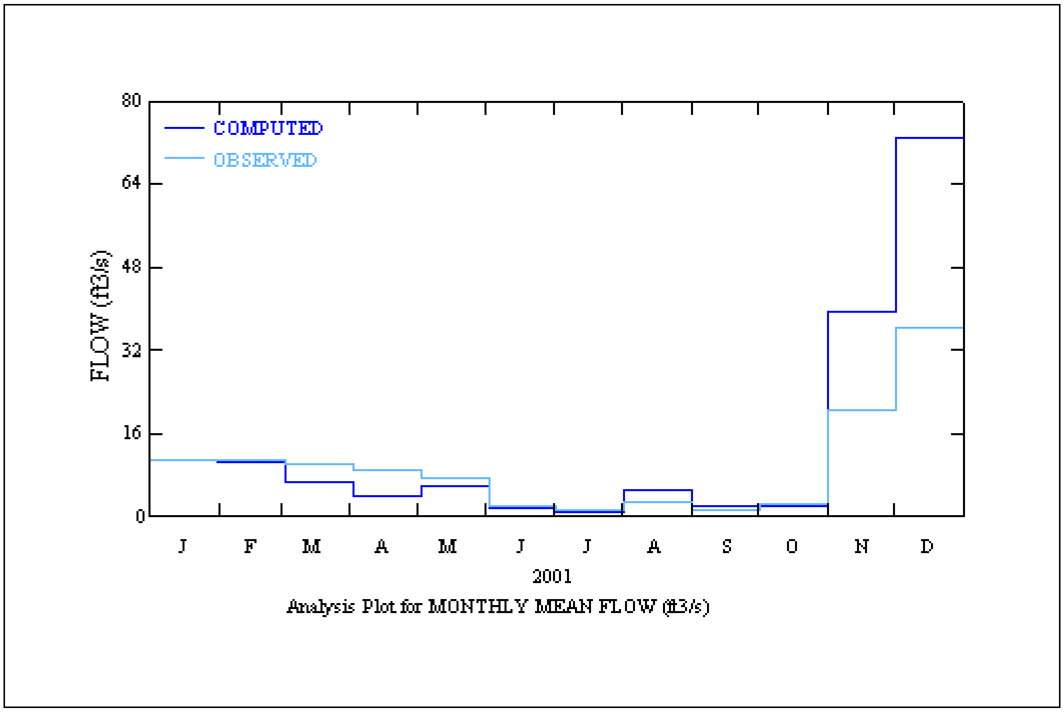


Figure I.3.A.2. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed monthly mean flows.

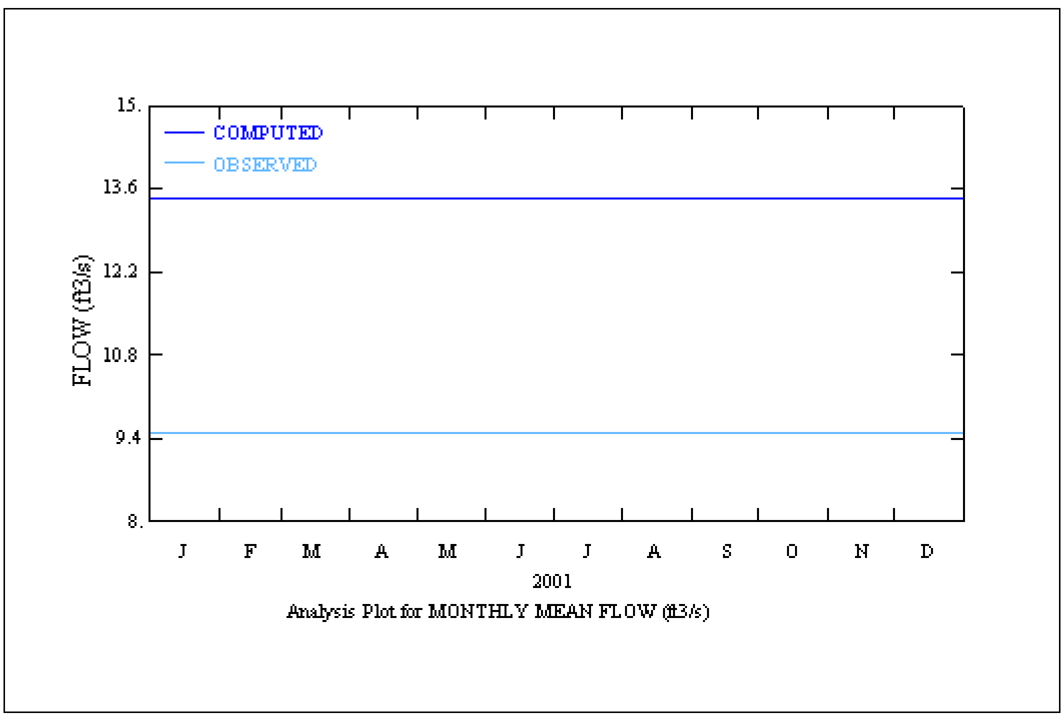


Figure I.3.A.3. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed flows for the period 01/01/2001 – 12/31/2001.

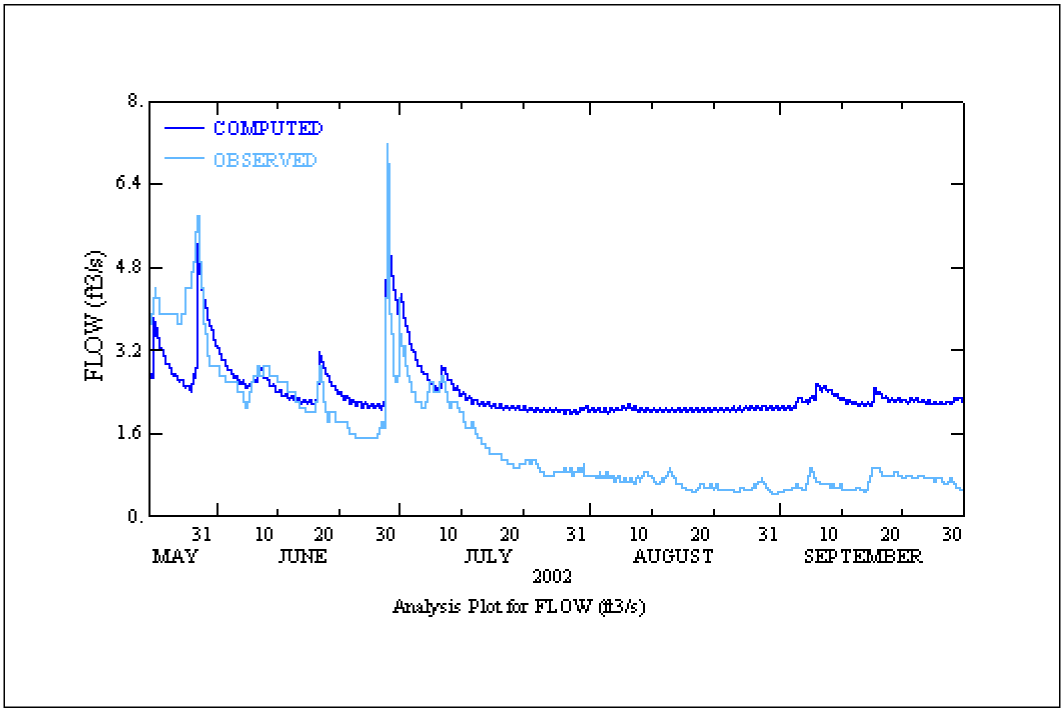


Figure I.3.B.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

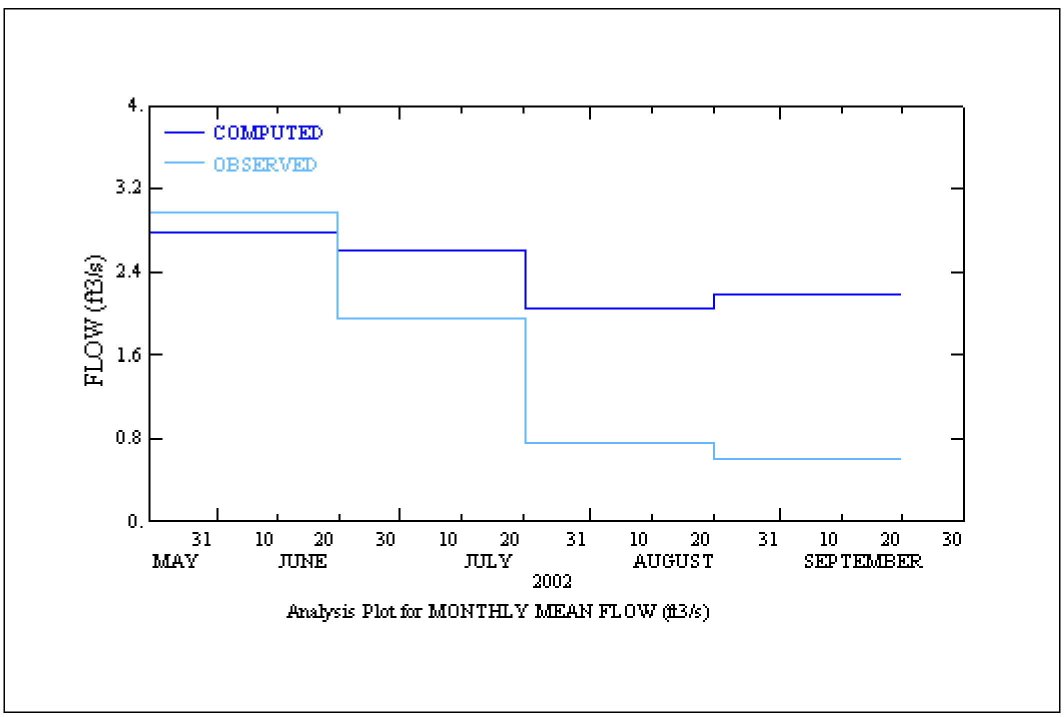


Figure I.3.B.2. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed monthly mean flows.

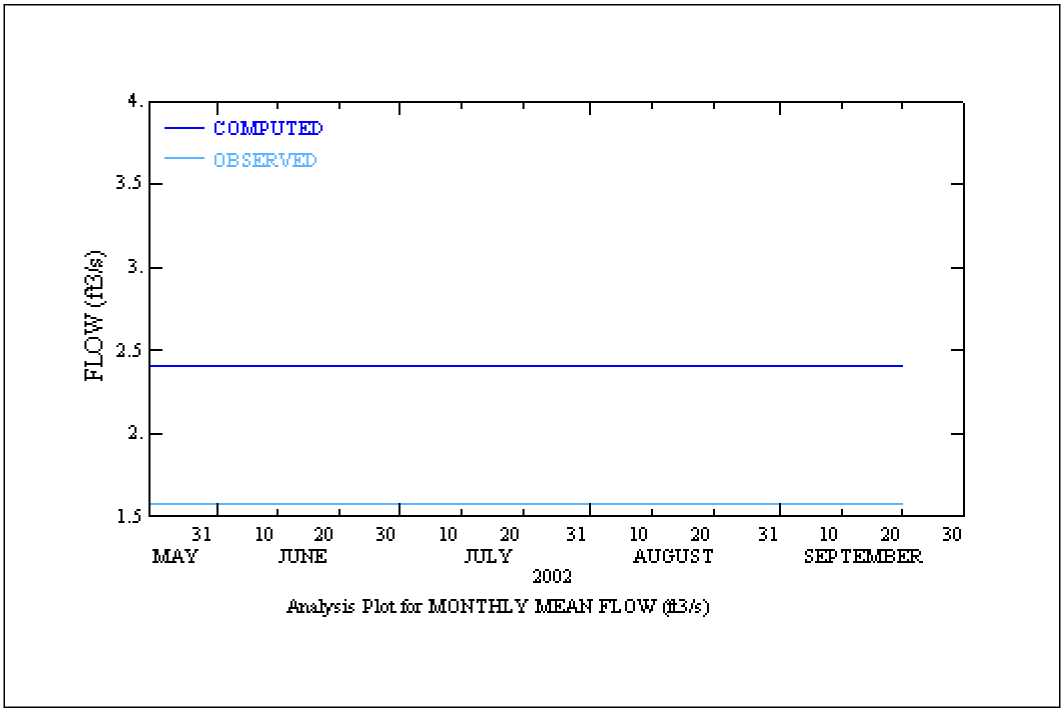


Figure I.3.B.3. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed flows for the period 05/21/2002 – 09/30/2002.

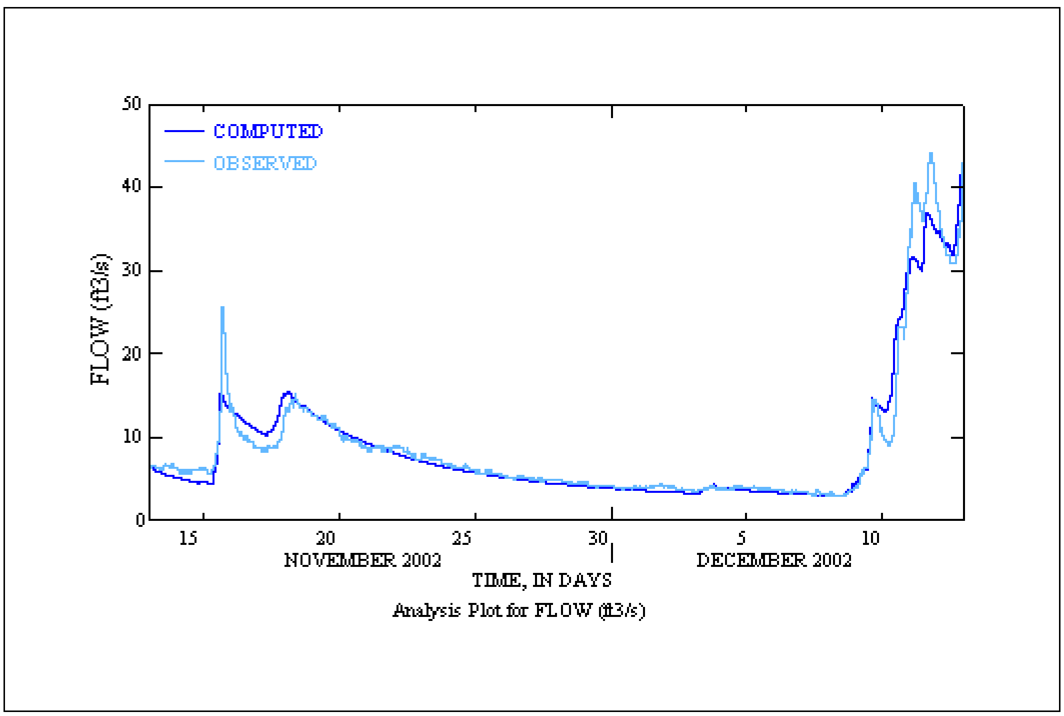


Figure I.3.C.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

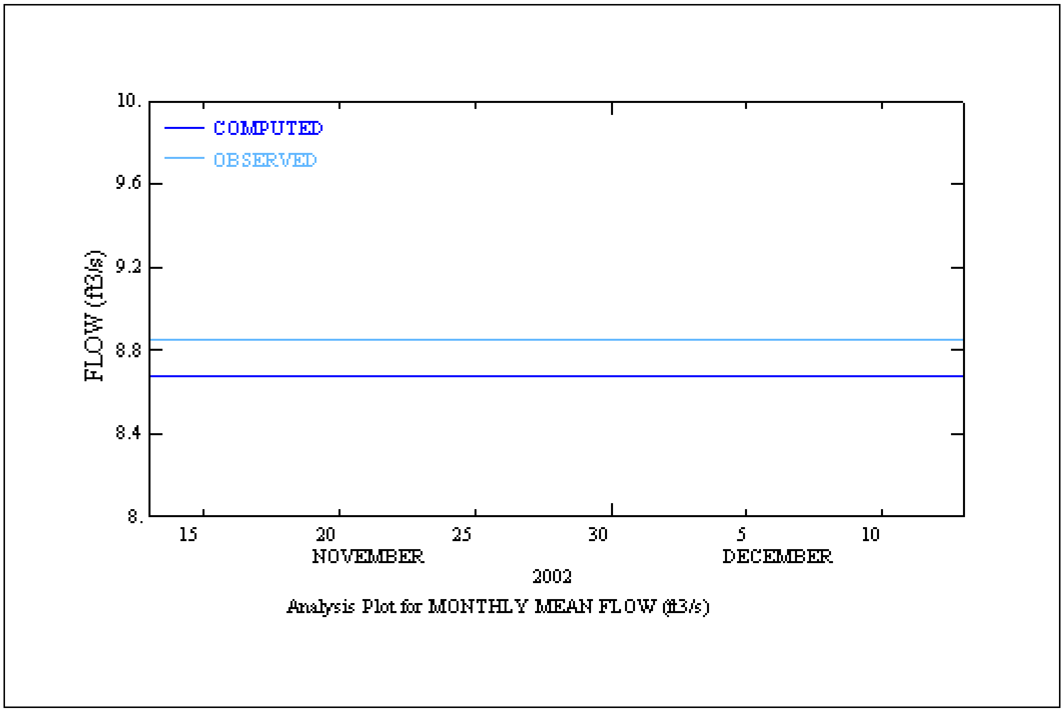


Figure I.3.C.2. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed monthly mean flows.

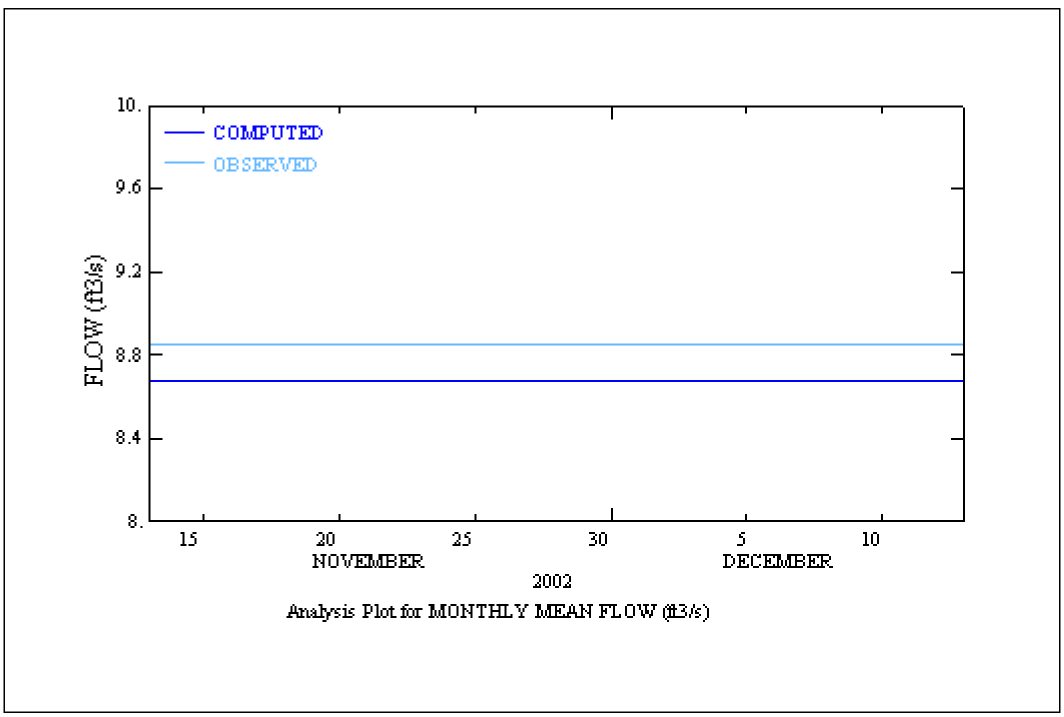


Figure I.3.C.3. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed flows for the period 11/14/2002 – 12/13/2002.

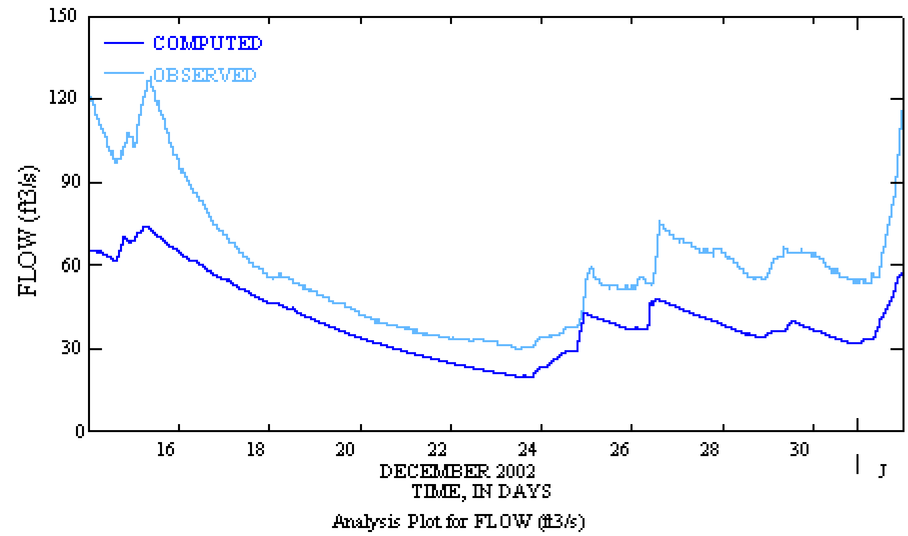


Figure I.3.D.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

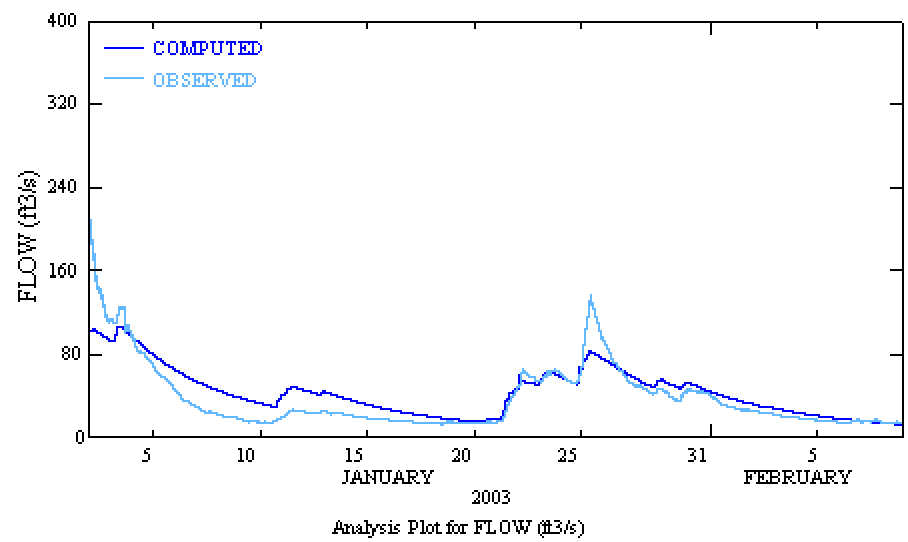


Figure I.3.E.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

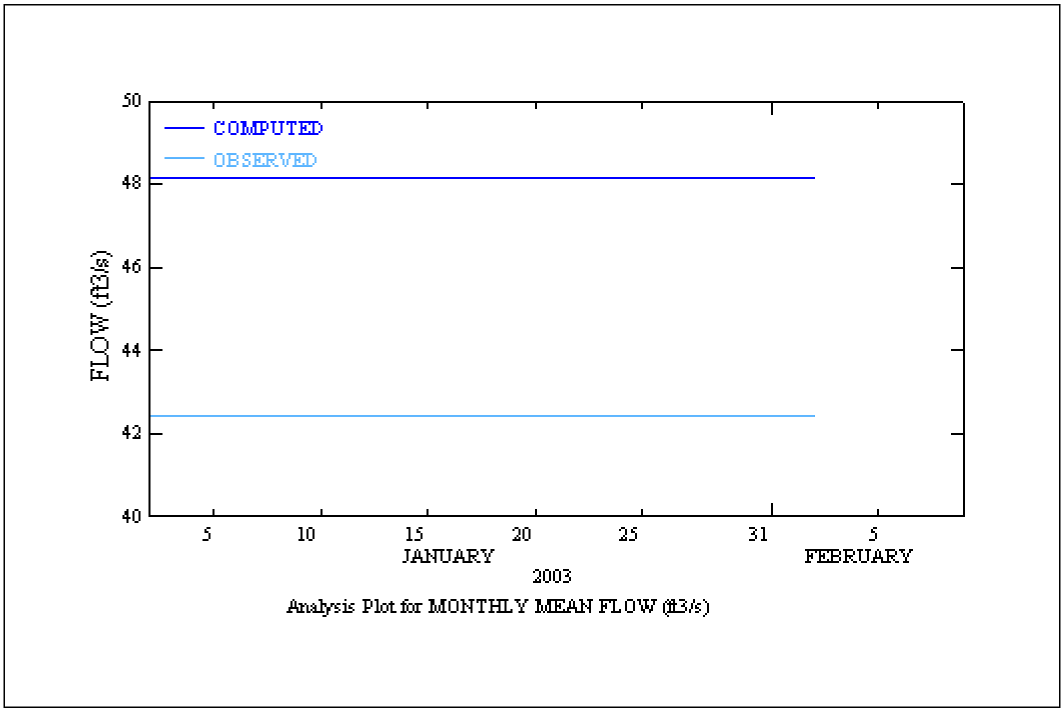


Figure I.3.E.2. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed monthly mean flows.

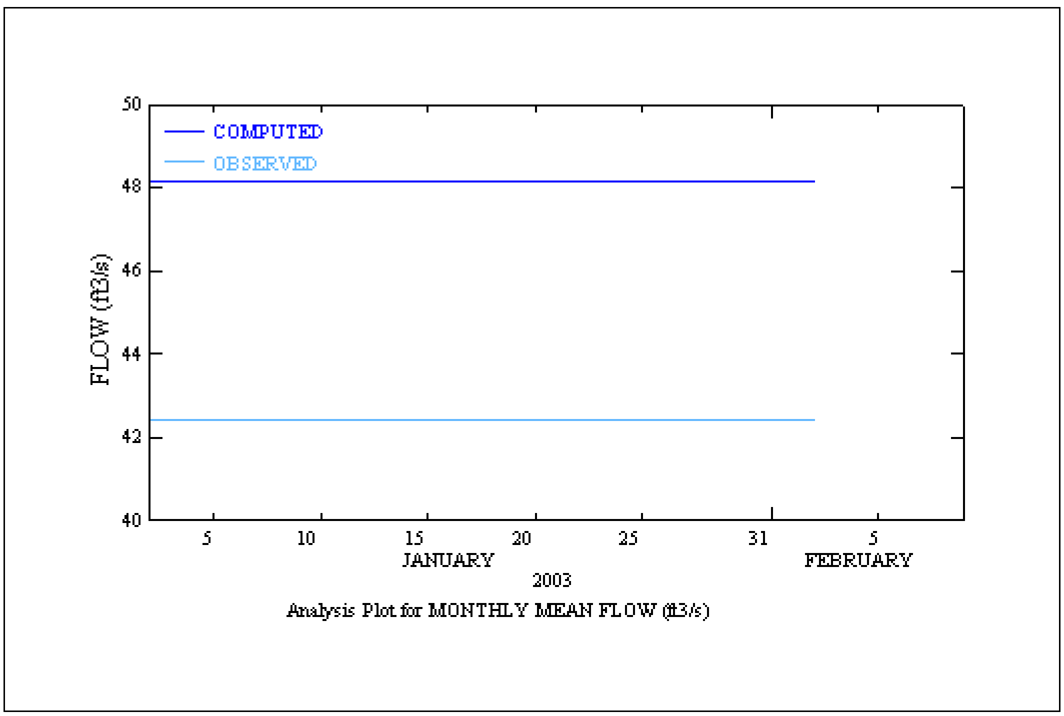


Figure I.3.E.3. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed flows for the period 01/03/2003 – 02/09/2003.

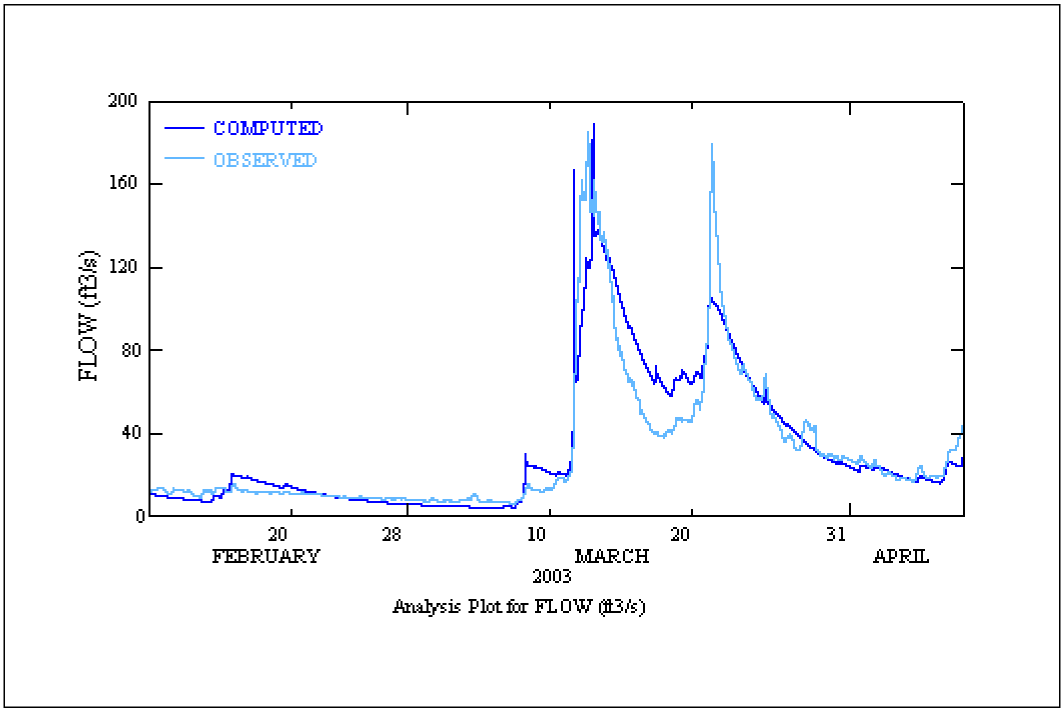


Figure I.3.F.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

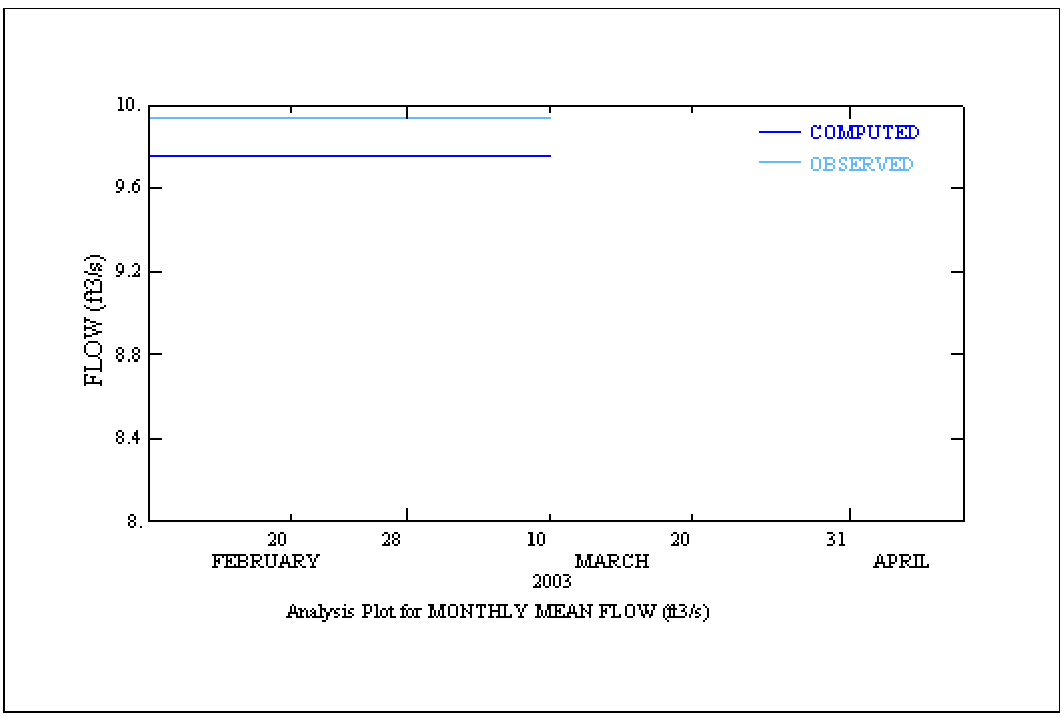


Figure I.3.F.2. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed monthly mean flows.

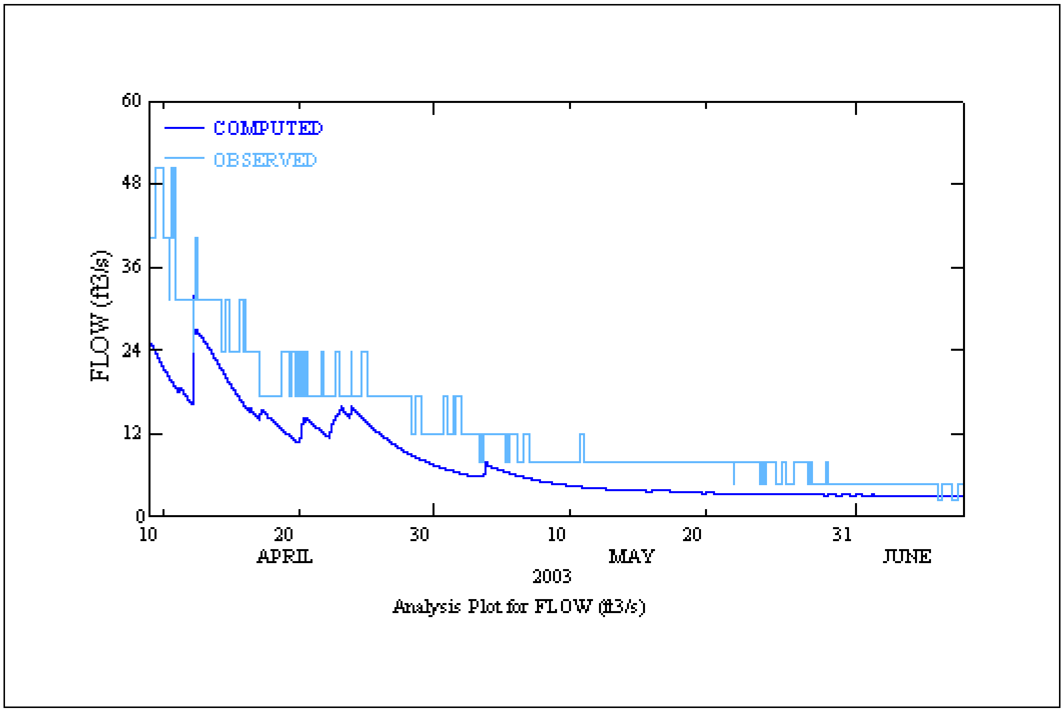


Figure I.3.G.1. Final parameter estimation results for the drainage area above the Chico Tributary at Taylor Road streamflow gaging, comparing simulated and observed fifteen minute flows.

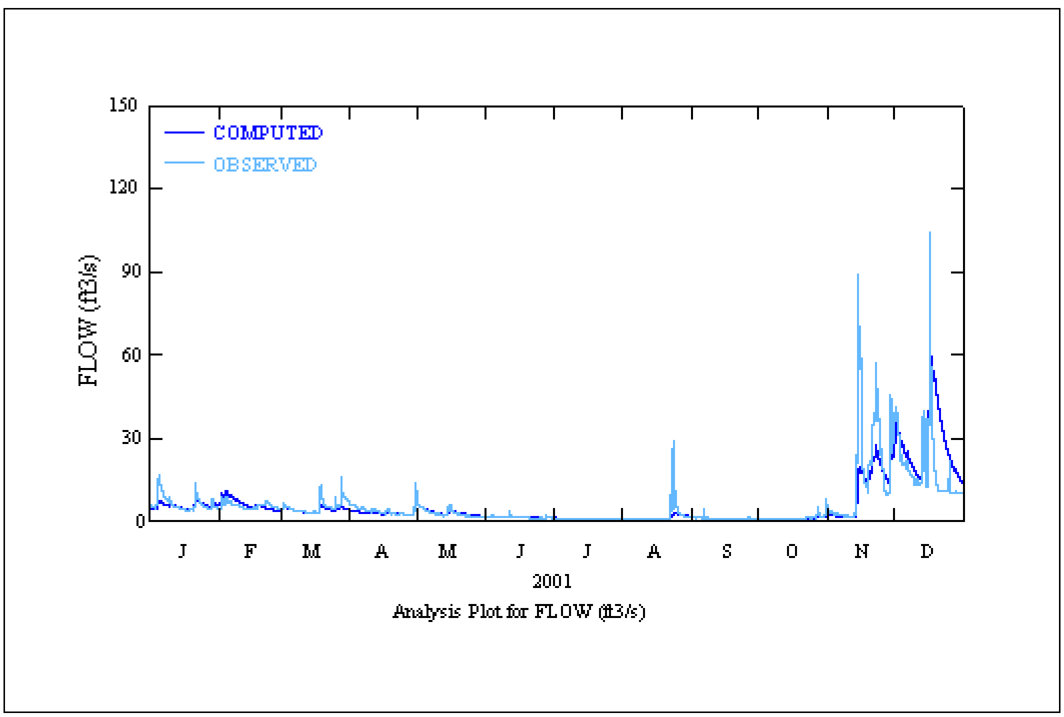


Figure I.4.A.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

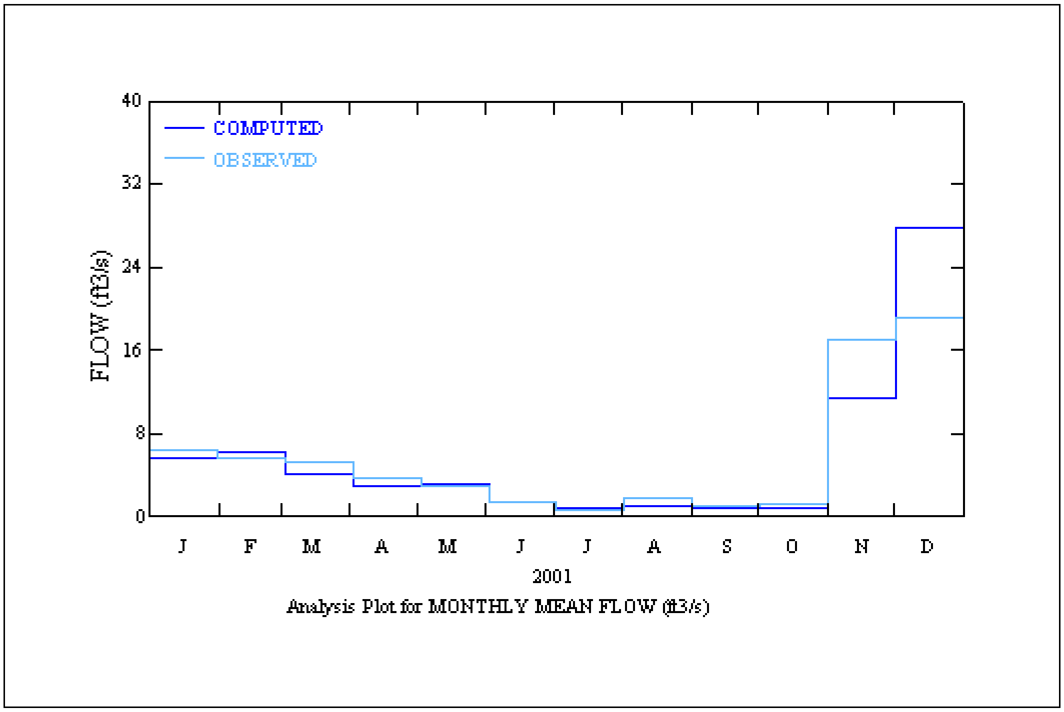


Figure I.4.A.2. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed monthly mean flows.

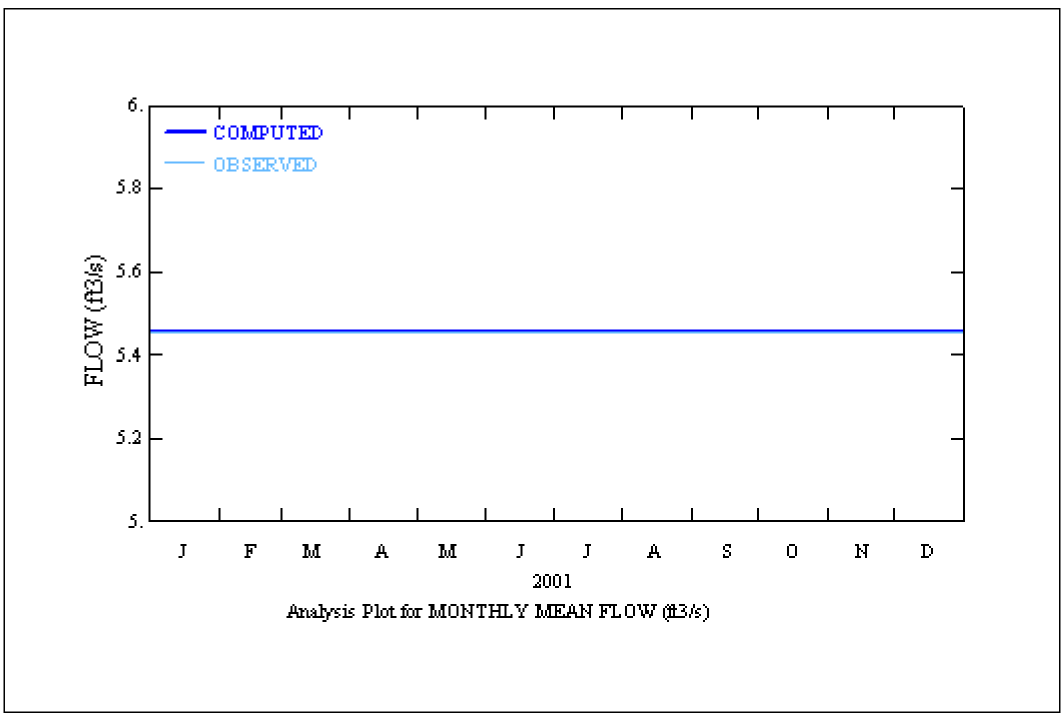


Figure I.4.A.3. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed flows for the period 01/01/2001 – 12/31/2001.

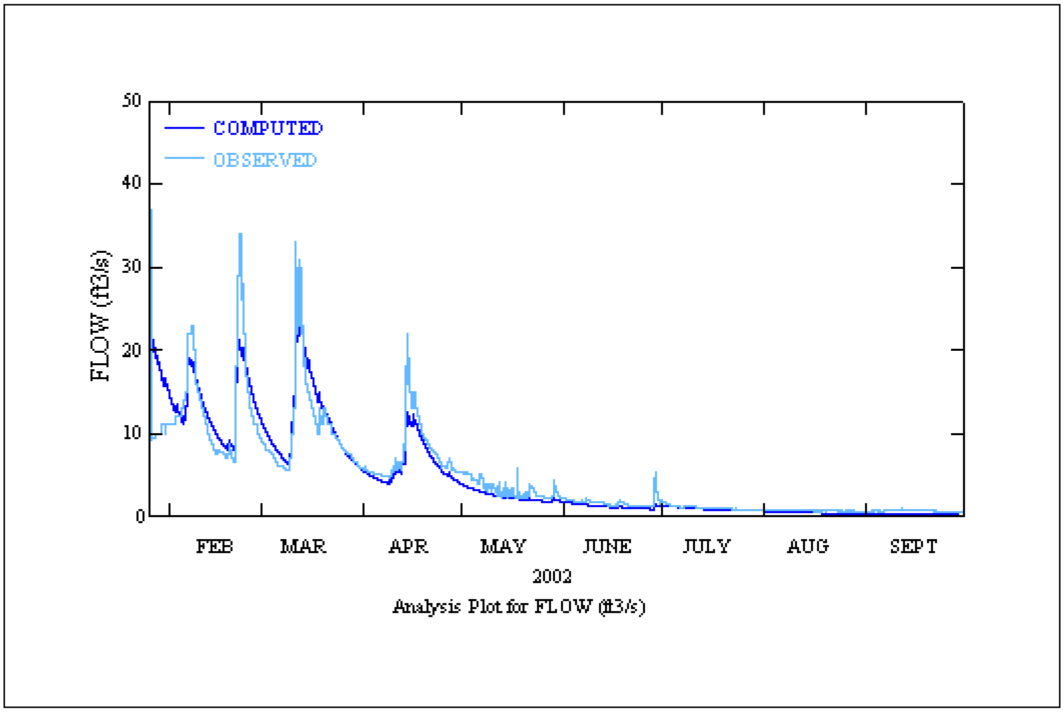


Figure I.4.B.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

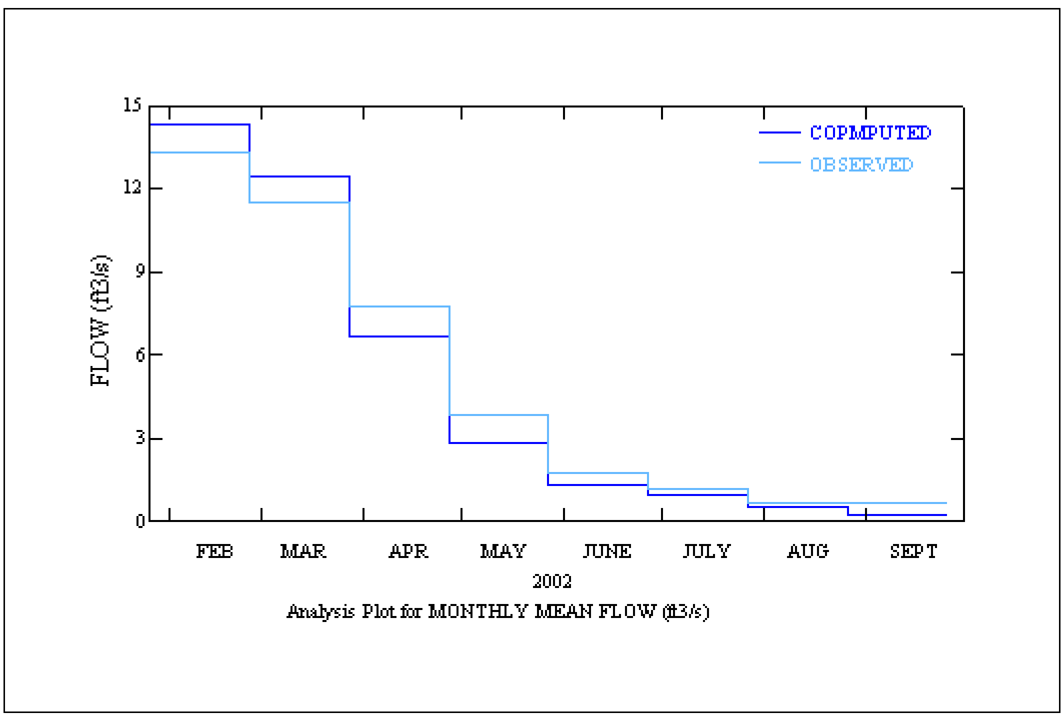


Figure I.4.B.2. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed monthly mean flows.

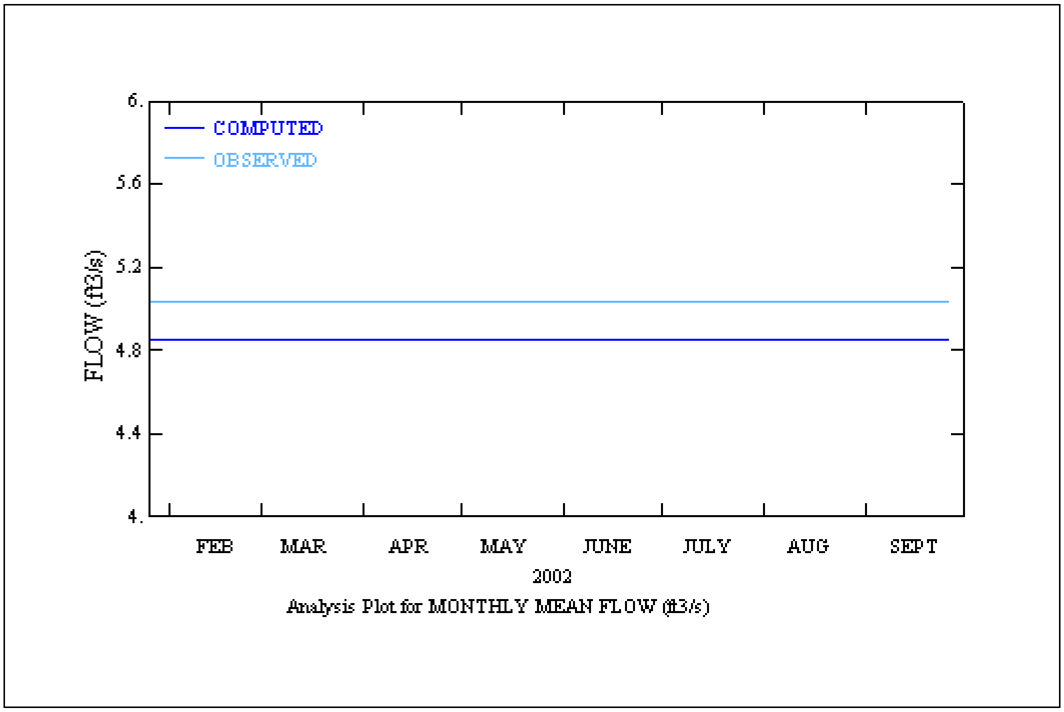


Figure I.4.B.3. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed flows for the period 01/26/2002 – 09/30/2002.

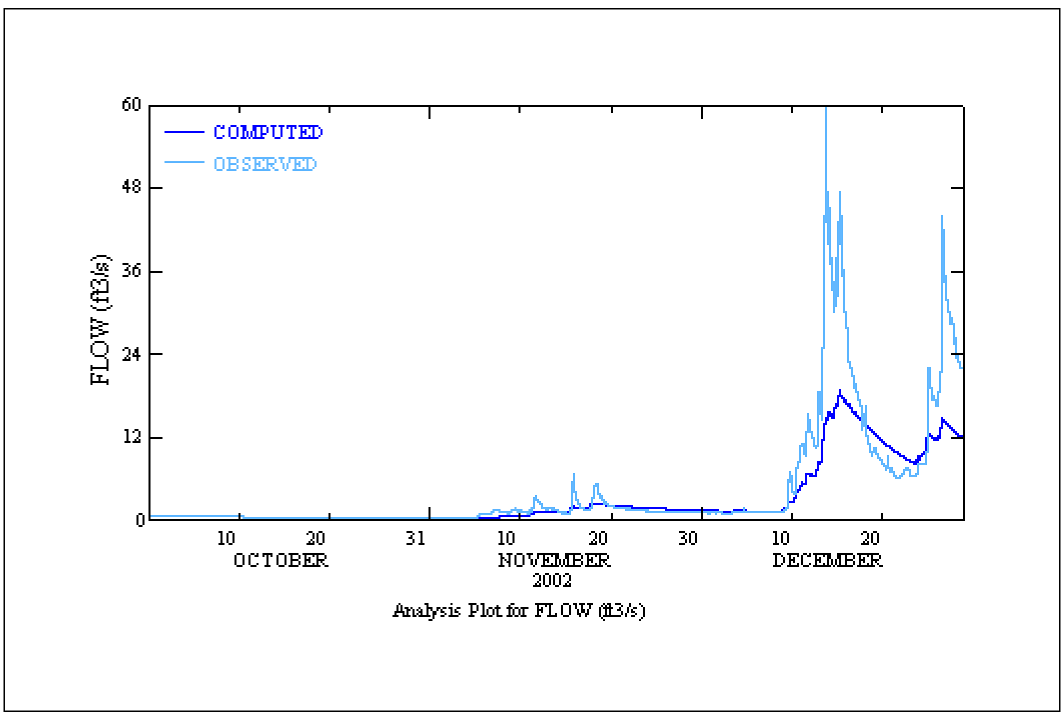


Figure I.4.C.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

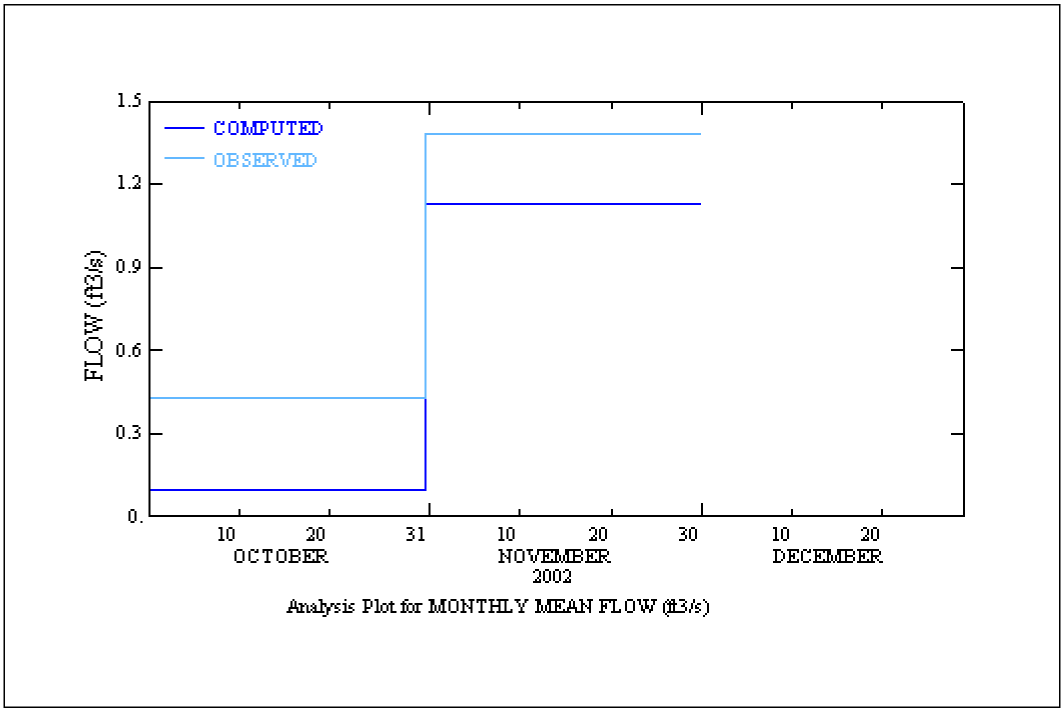


Figure I.4.C.2. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed monthly mean flows.

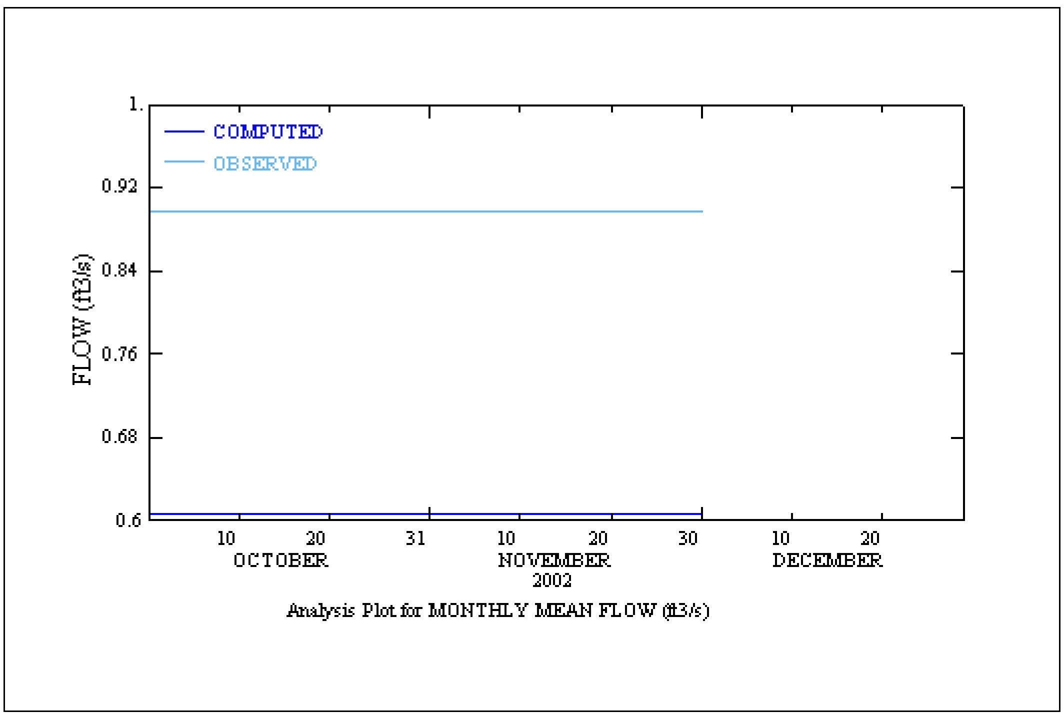


Figure I.4.C.3. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed flows for the period 10/01/2002 – 12/29/2002.

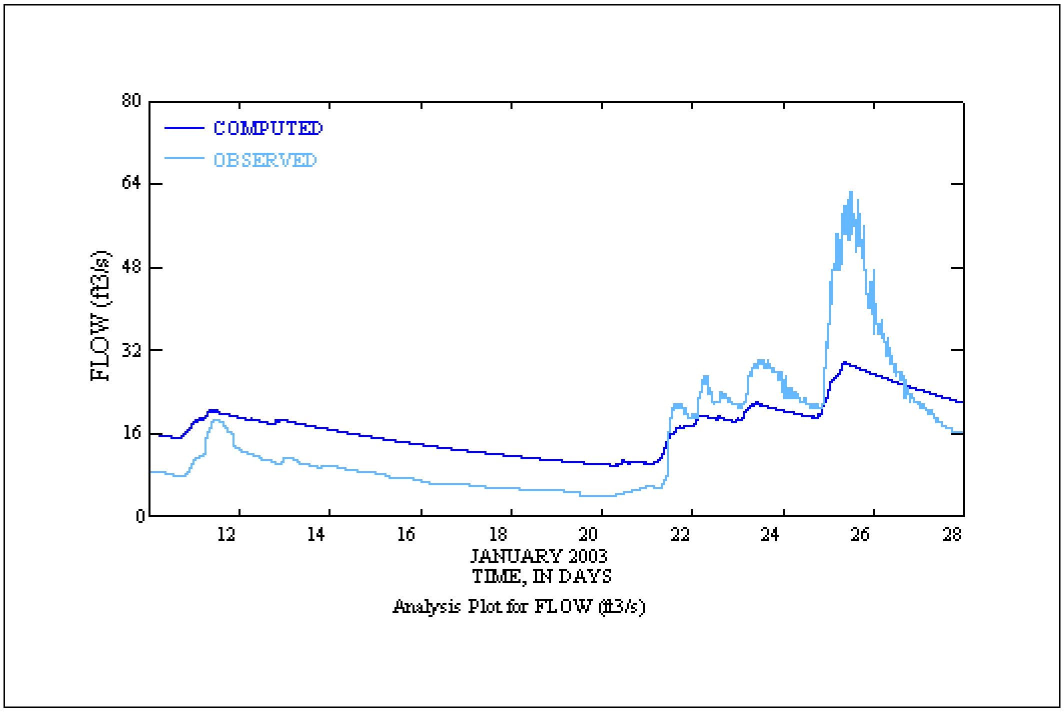


Figure I.4.D.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

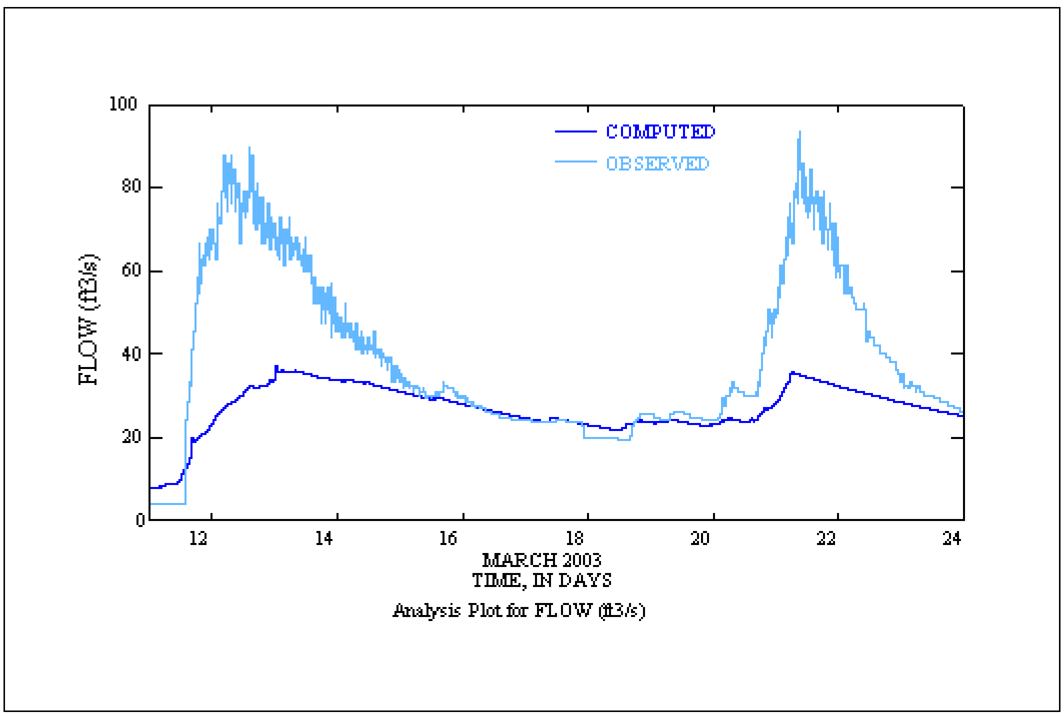


Figure I.4.E.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

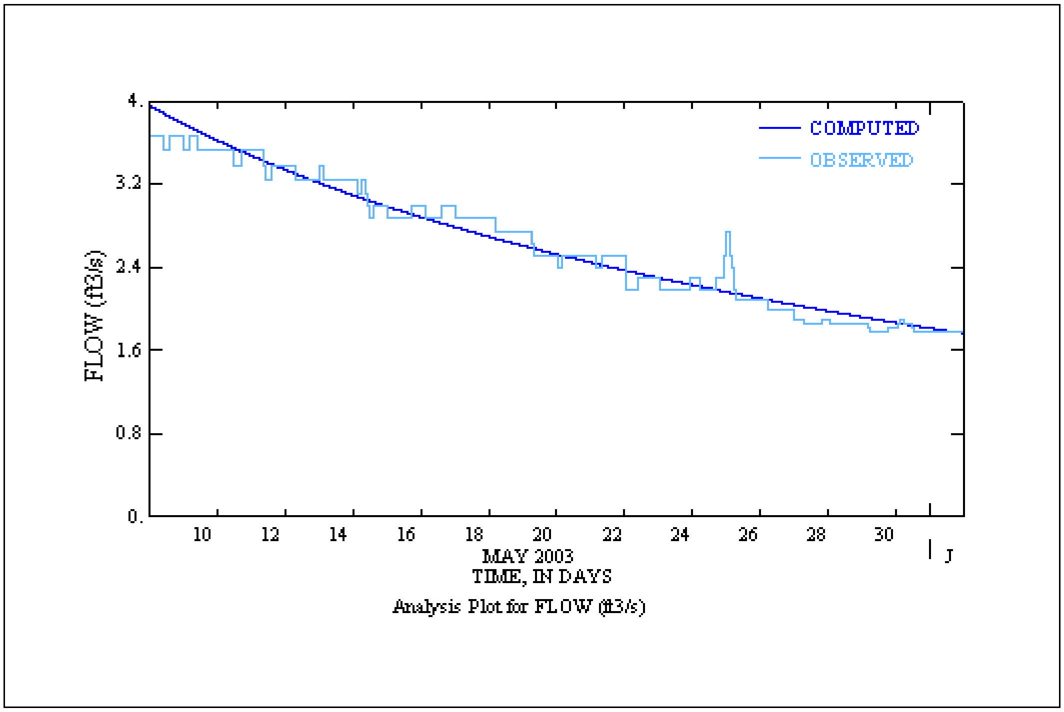


Figure I.4.F.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

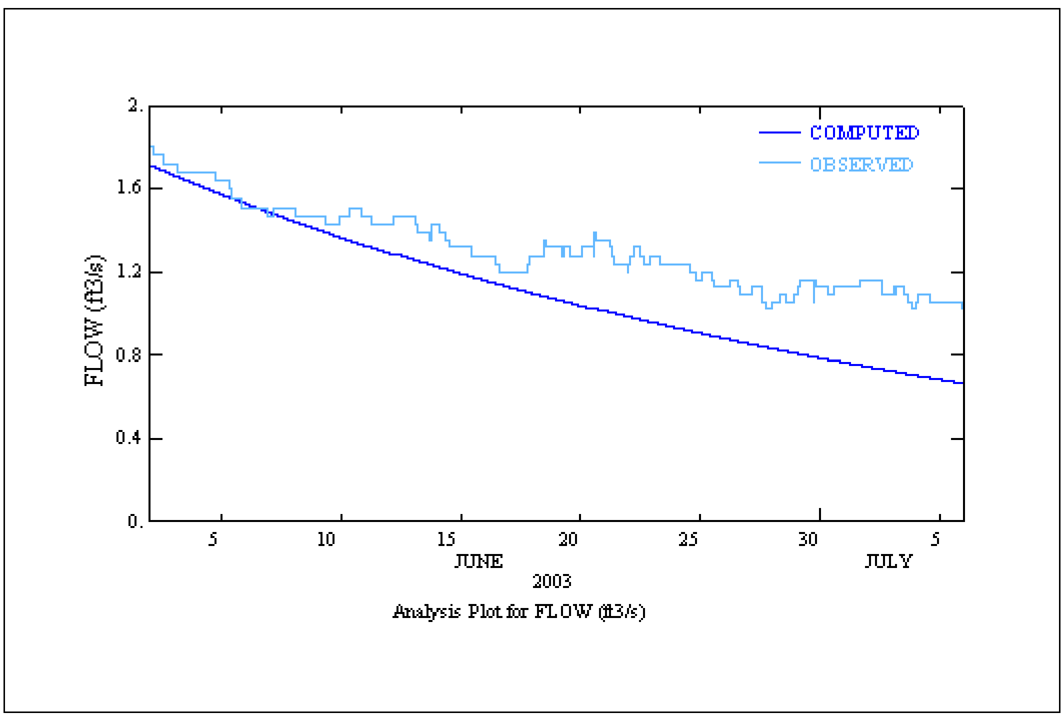


Figure I.4.G.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

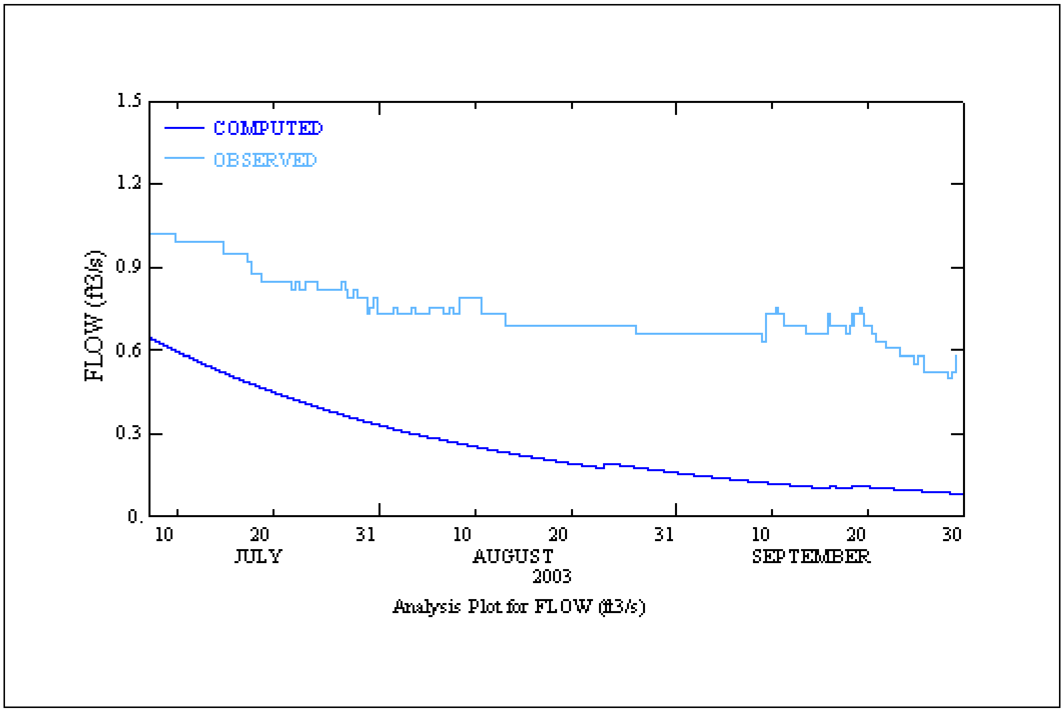


Figure I.4.H.1. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

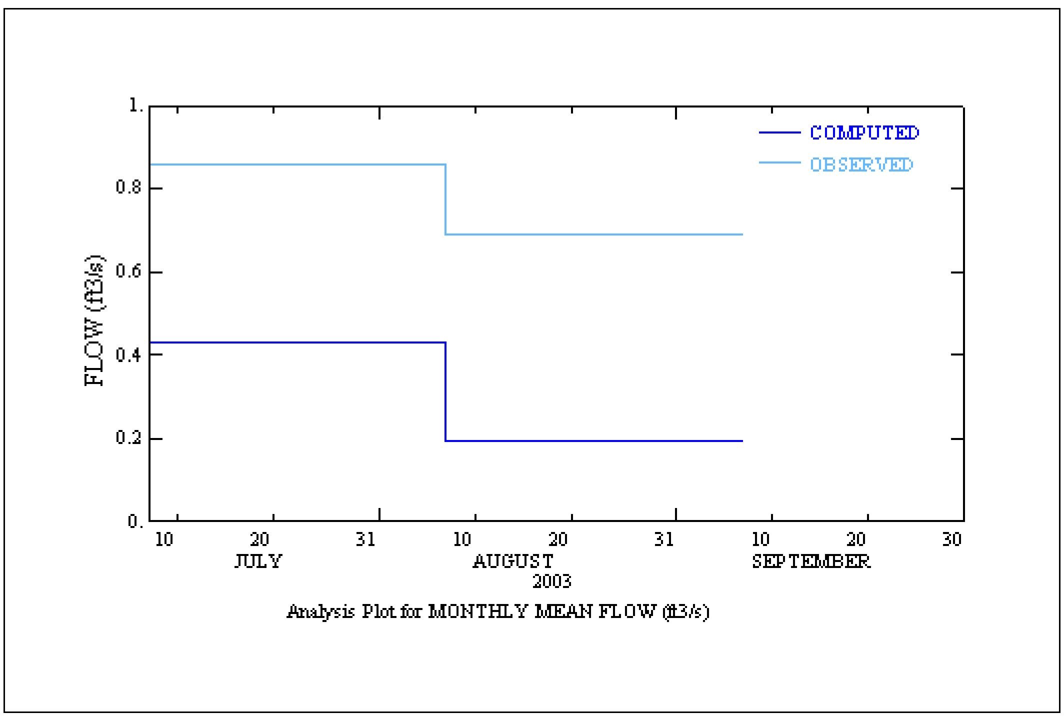


Figure I.4.H.2. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed monthly mean flows.

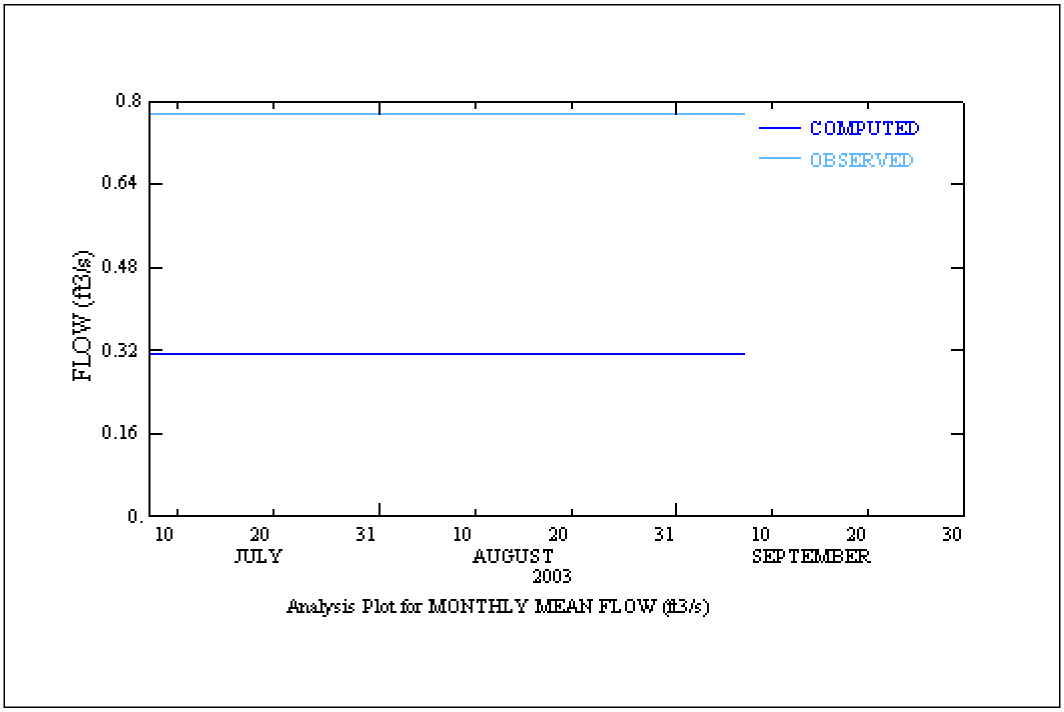


Figure I.4.H.3. Final parameter estimation results for the drainage area above the Dickerson Creek streamflow gaging, comparing simulated and observed flows for the period 07/08/2003 – 09/30/2003.

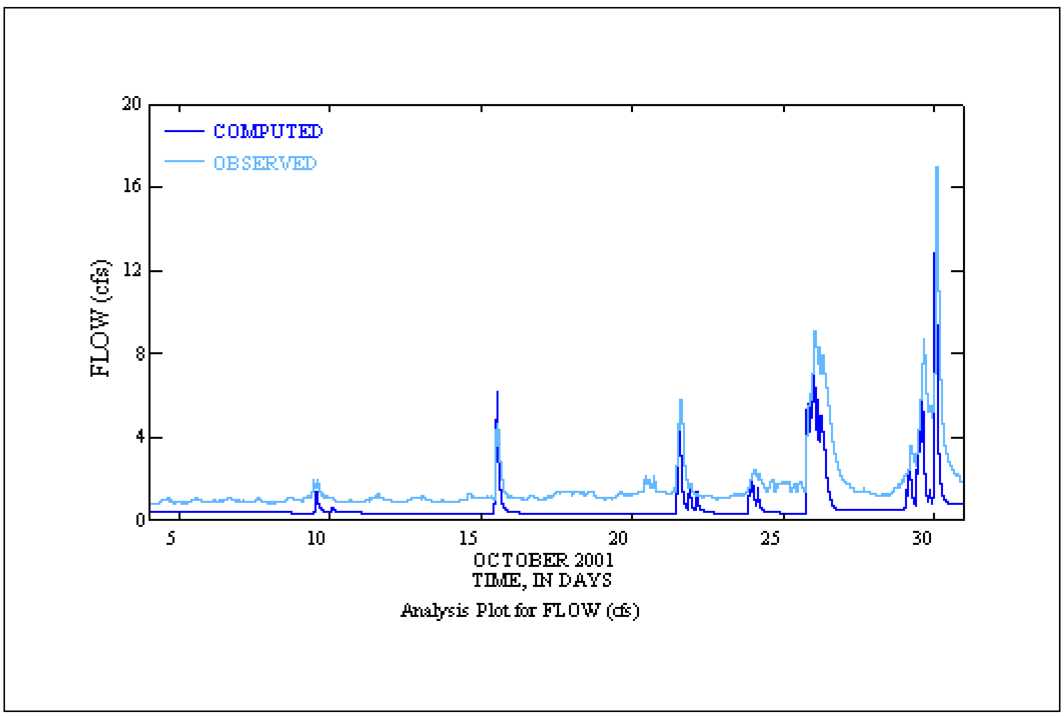


Figure I.6.A.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

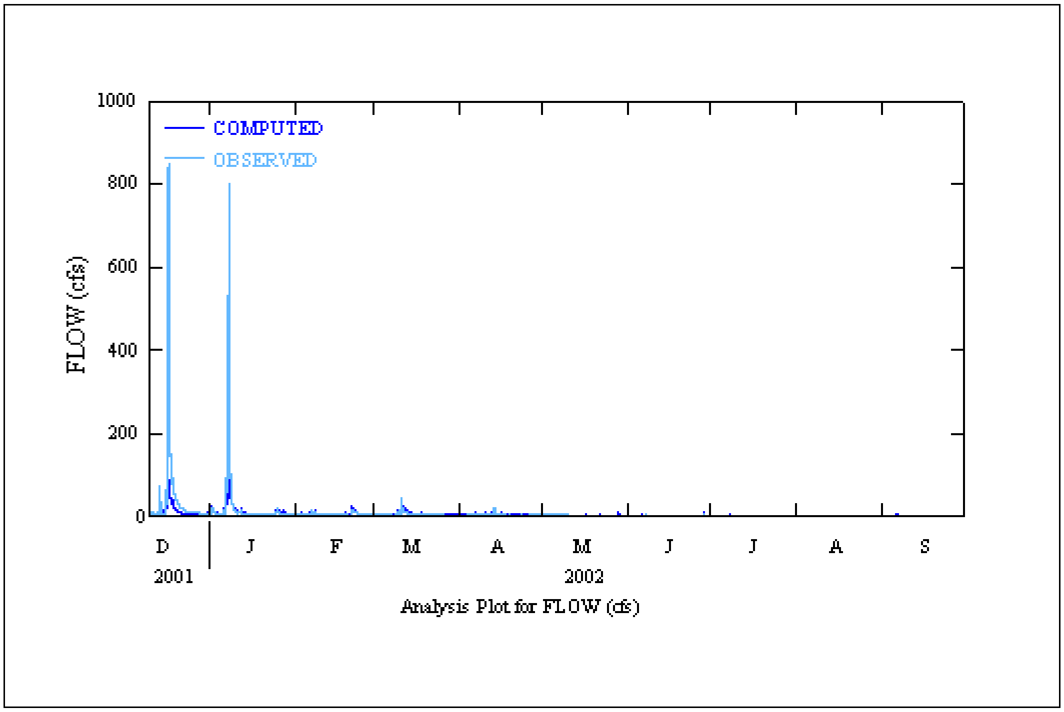


Figure I.6.B.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

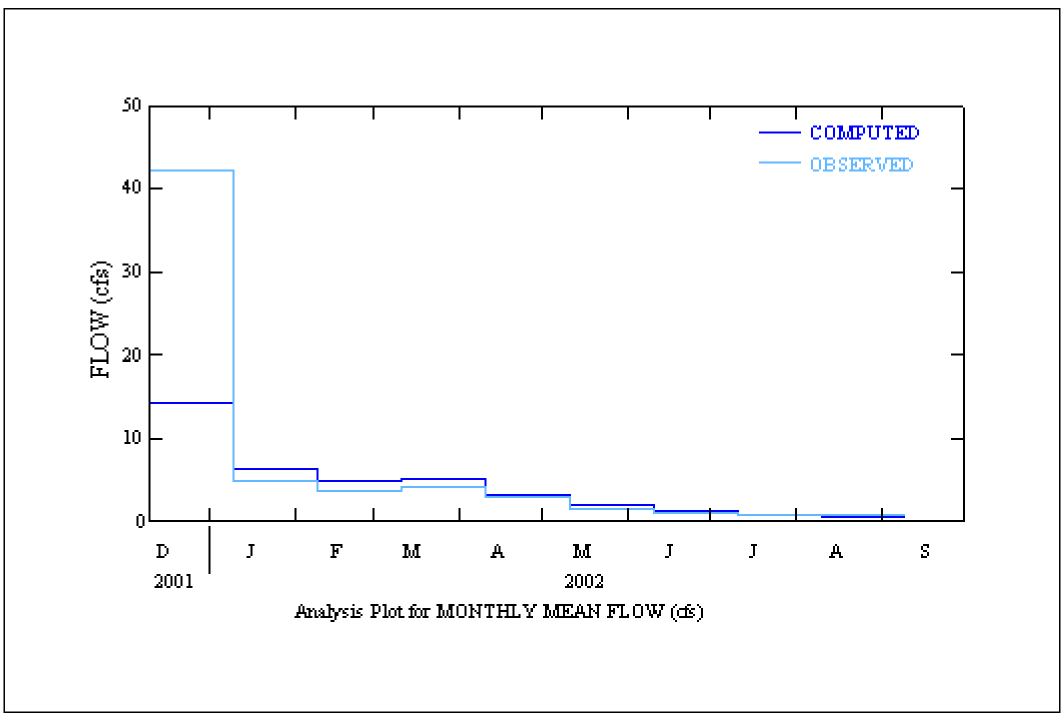


Figure I.6.B.2. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed monthly mean flows.

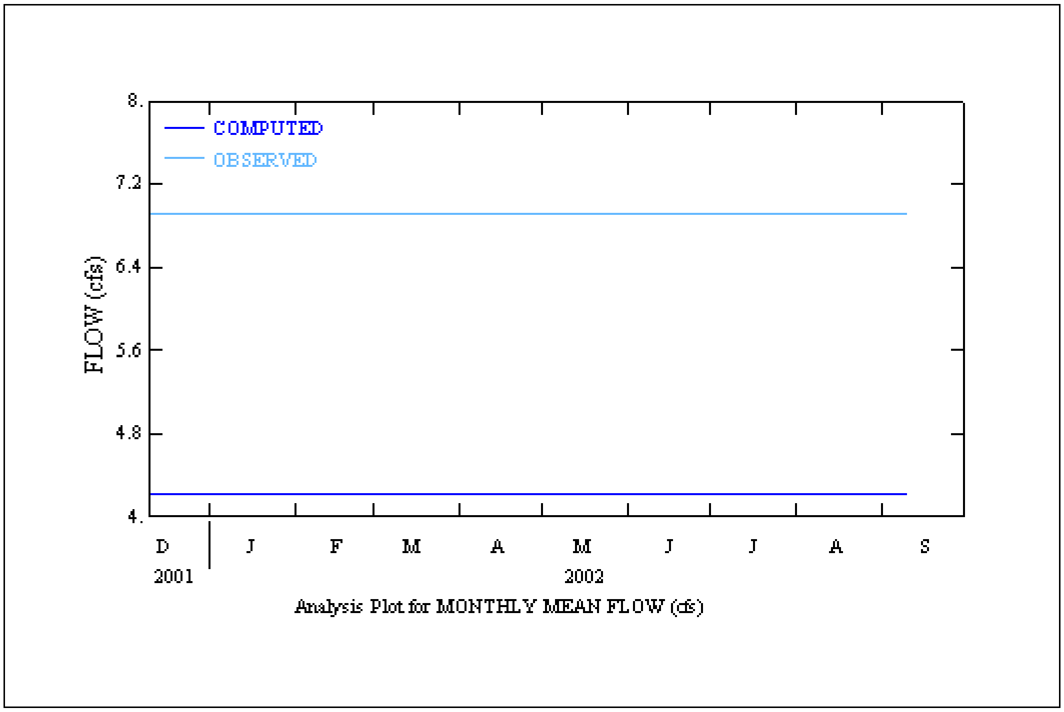


Figure I.6.B.3. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed flows for the period 12/10/2001 – 09/30/2002.

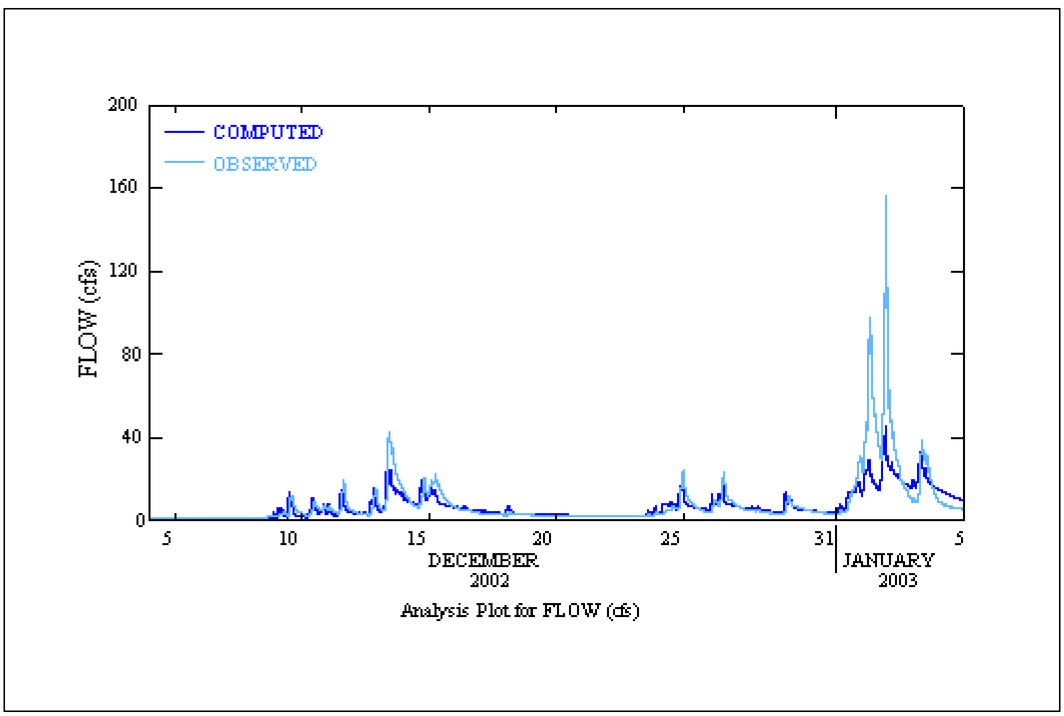


Figure I.6.C.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

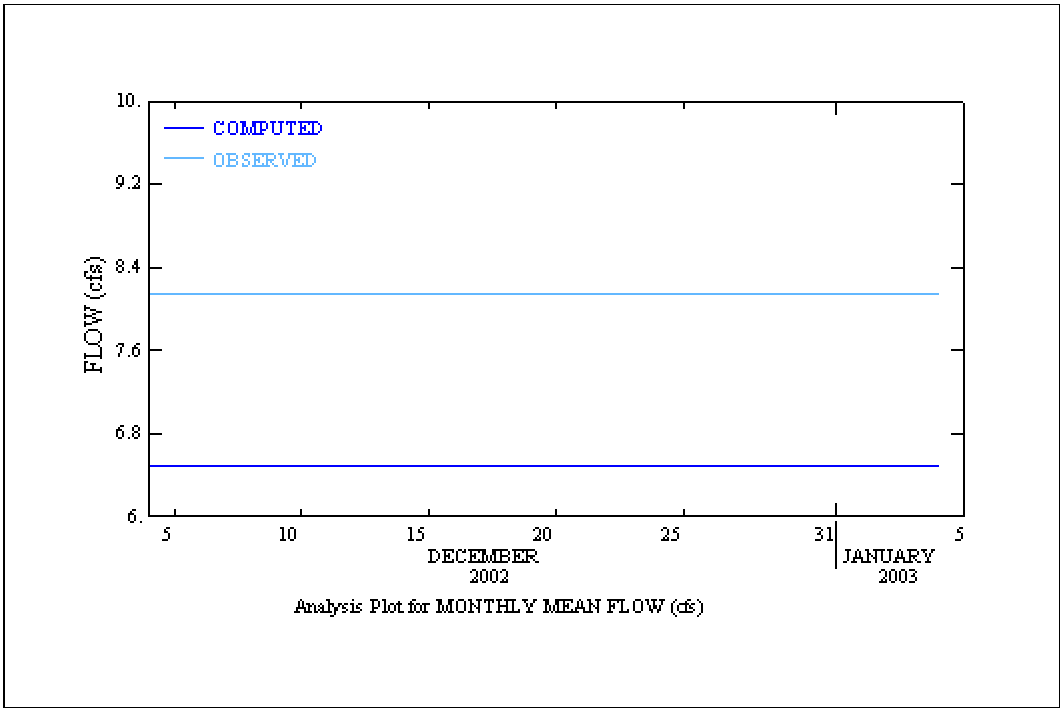


Figure I.6.C.2. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed monthly mean flows.

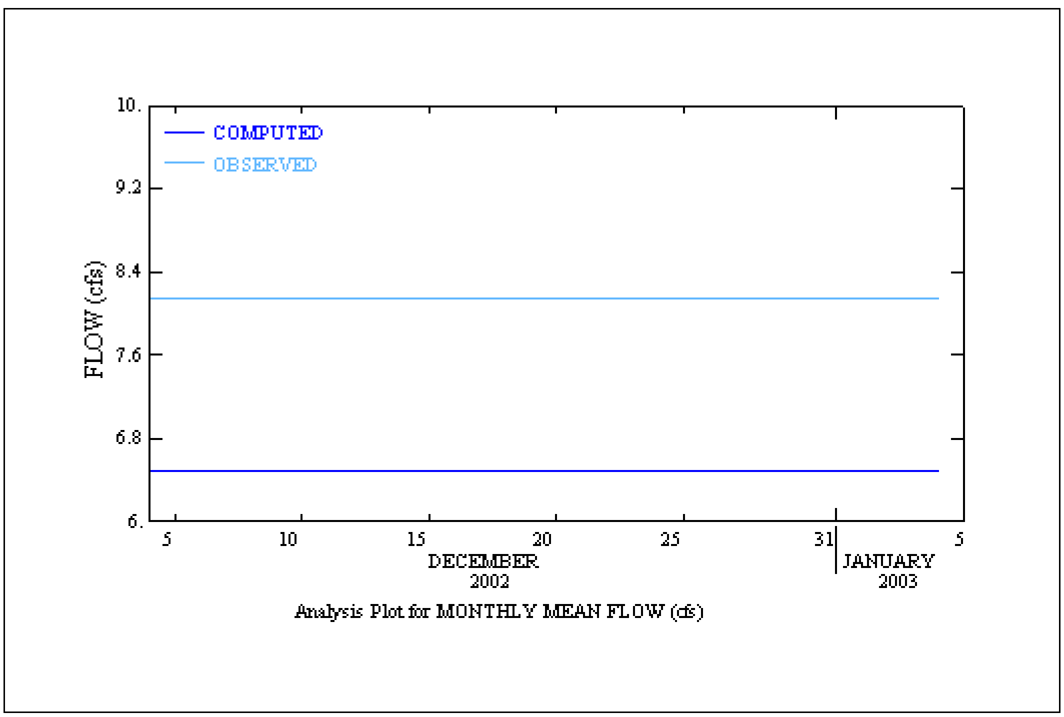


Figure I.6.C.3. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed flows for the period 12/05/2002 – 01/05/2003.

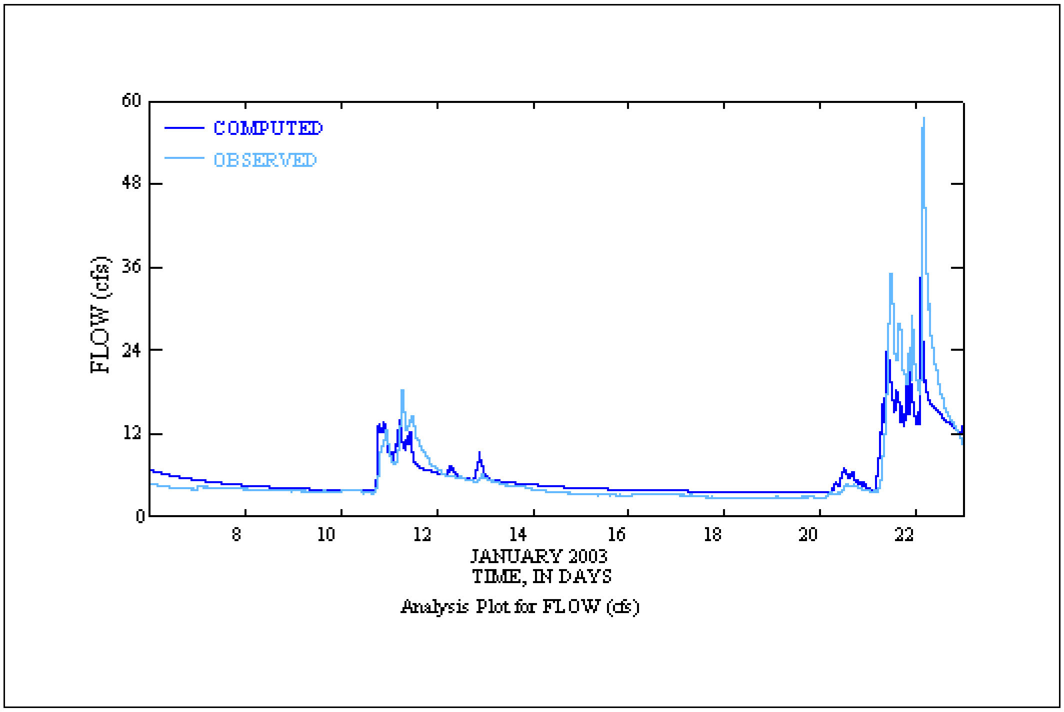


Figure I.6.D.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

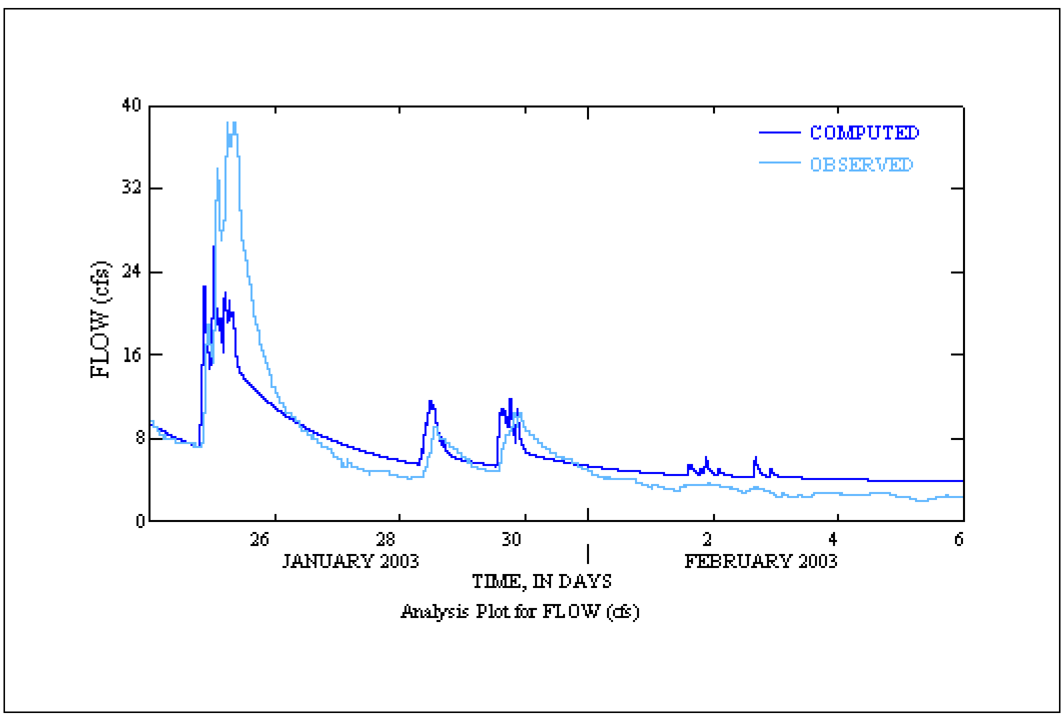


Figure I.6.E.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

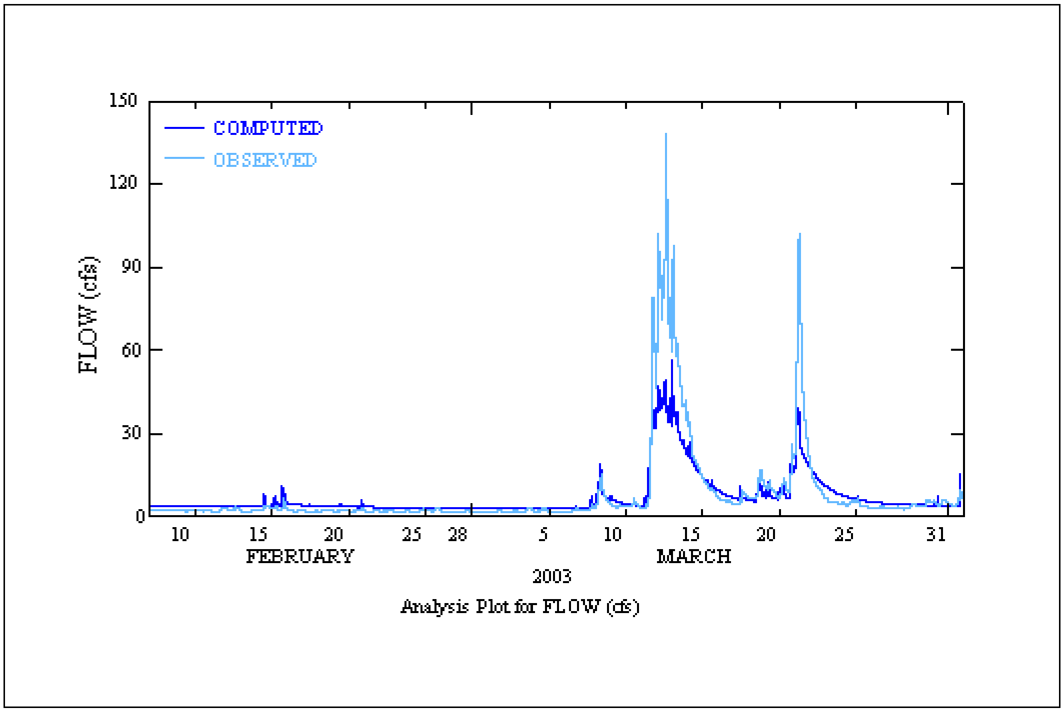


Figure I.6.F.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

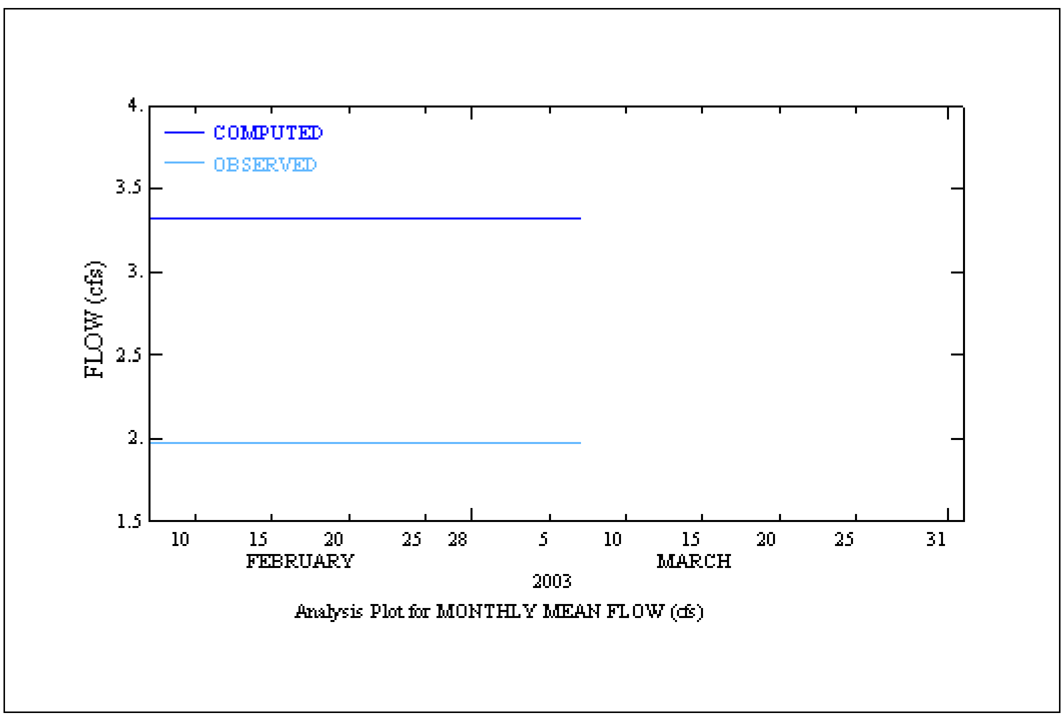


Figure I.6.F.2. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed monthly mean flows.

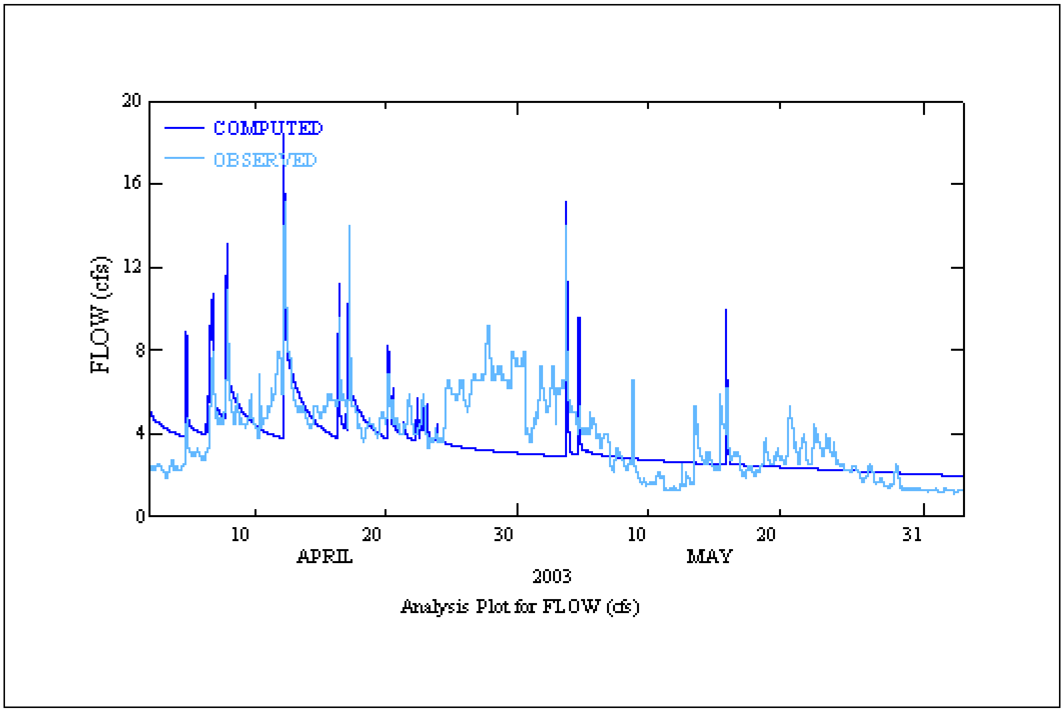


Figure I.6.G.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

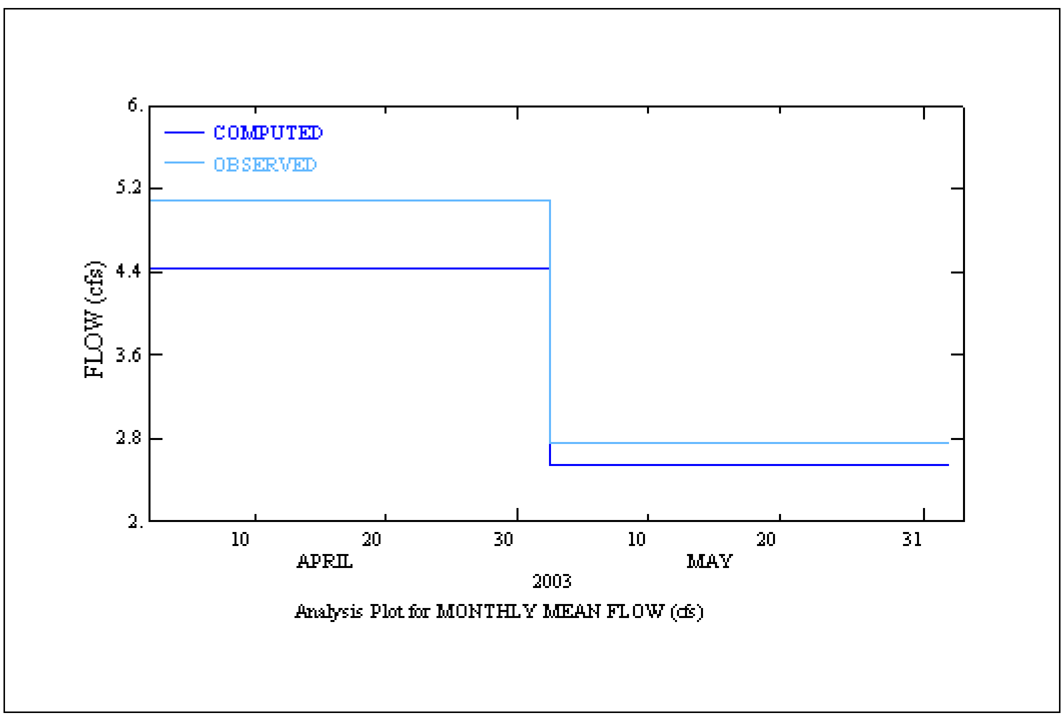


Figure I.6.G.2. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed monthly mean flows.

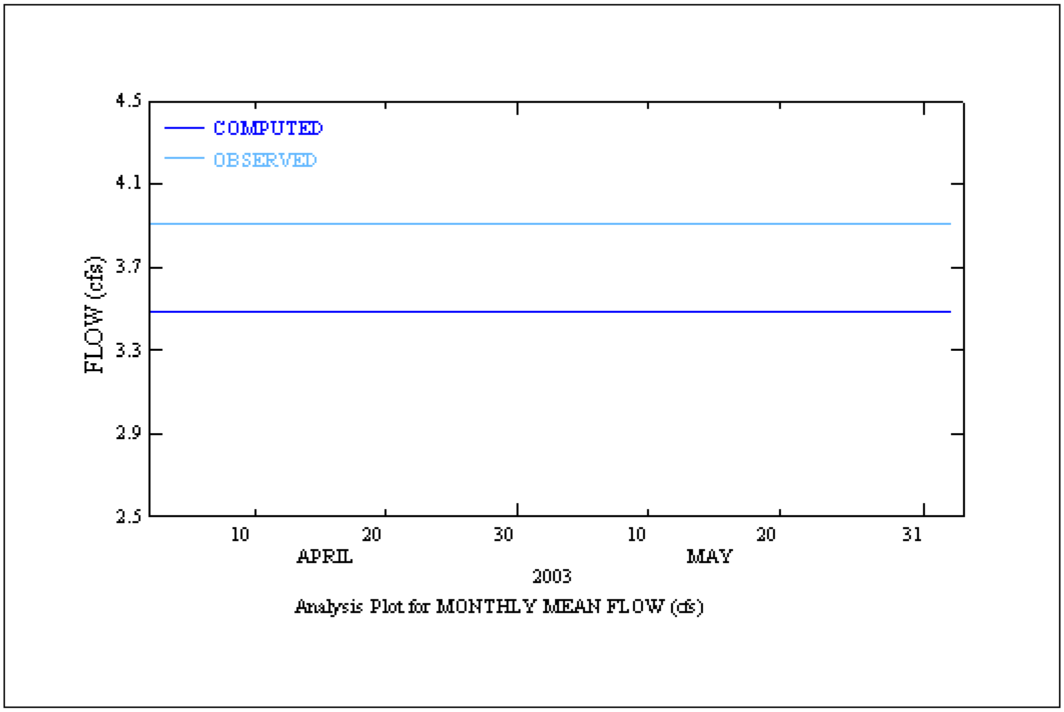


Figure I.6.G.3. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed flows for the period 04/03/2003 – 06/03/2003.

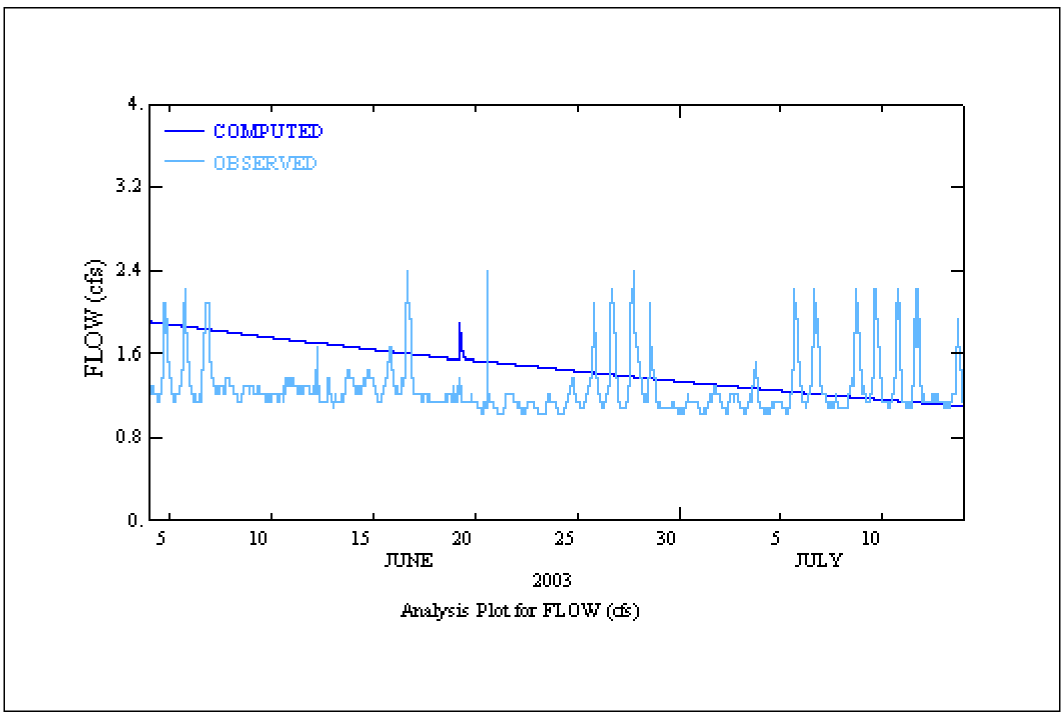


Figure I.6.H.1. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

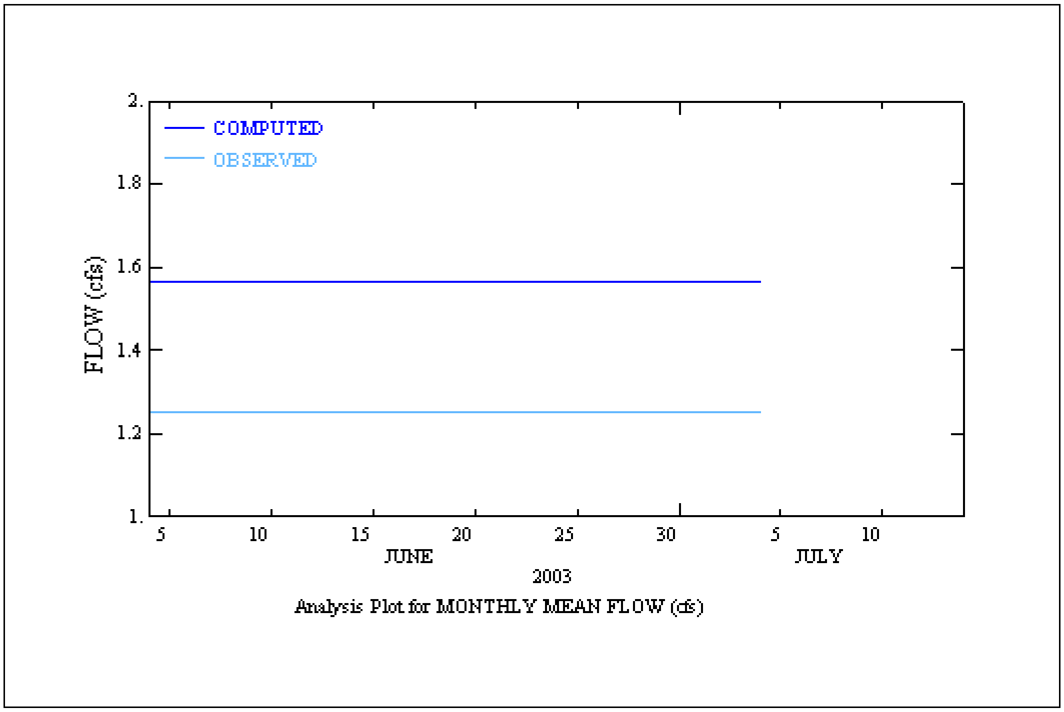


Figure I.6.H.2. Final parameter estimation results for the drainage area above the Strawberry Creek streamflow gaging, comparing simulated and observed monthly mean flows.

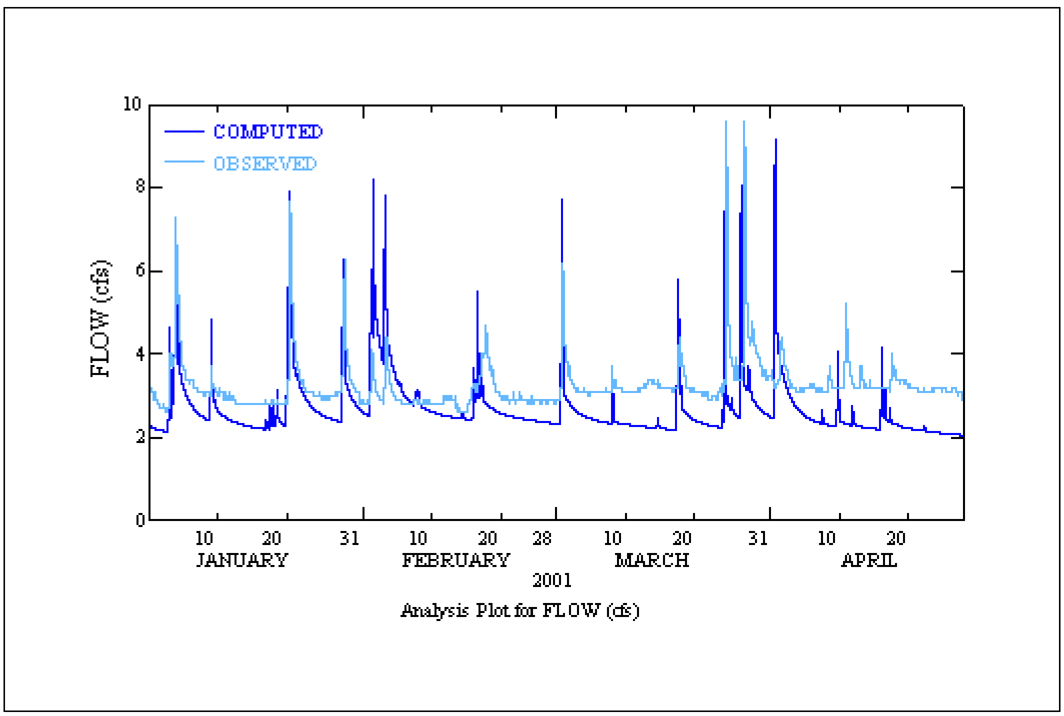


Figure I.7.A.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

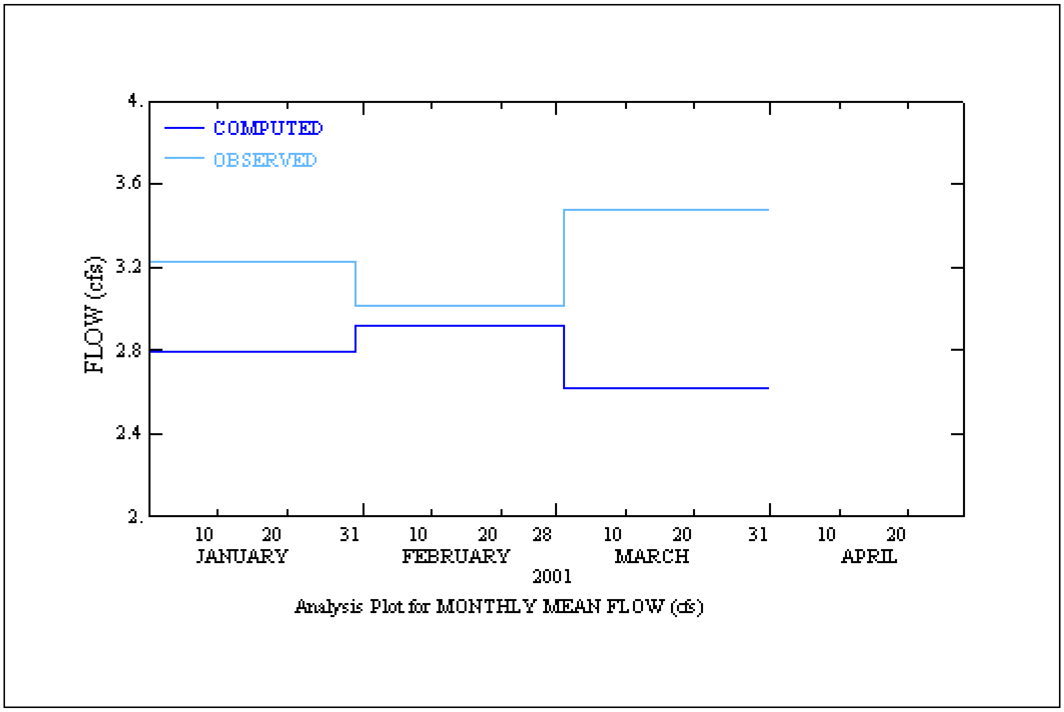


Figure I.7.A.2. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed monthly mean flows.

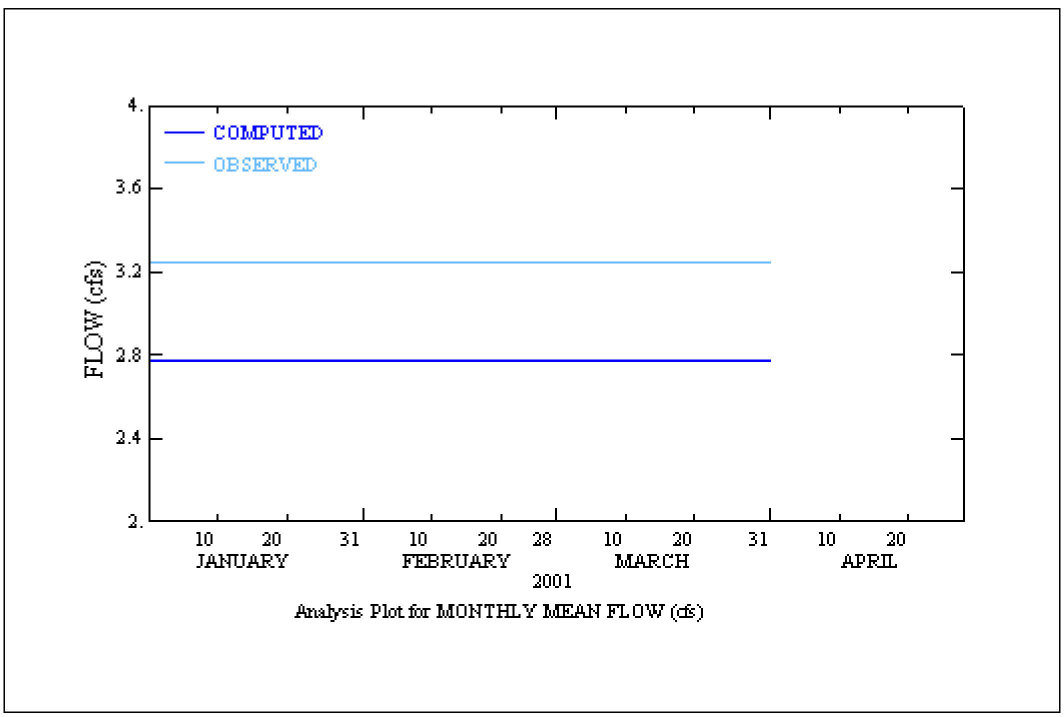


Figure I.7.A.3. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed flows for the period 01/01/2001 – 04/28/2001.

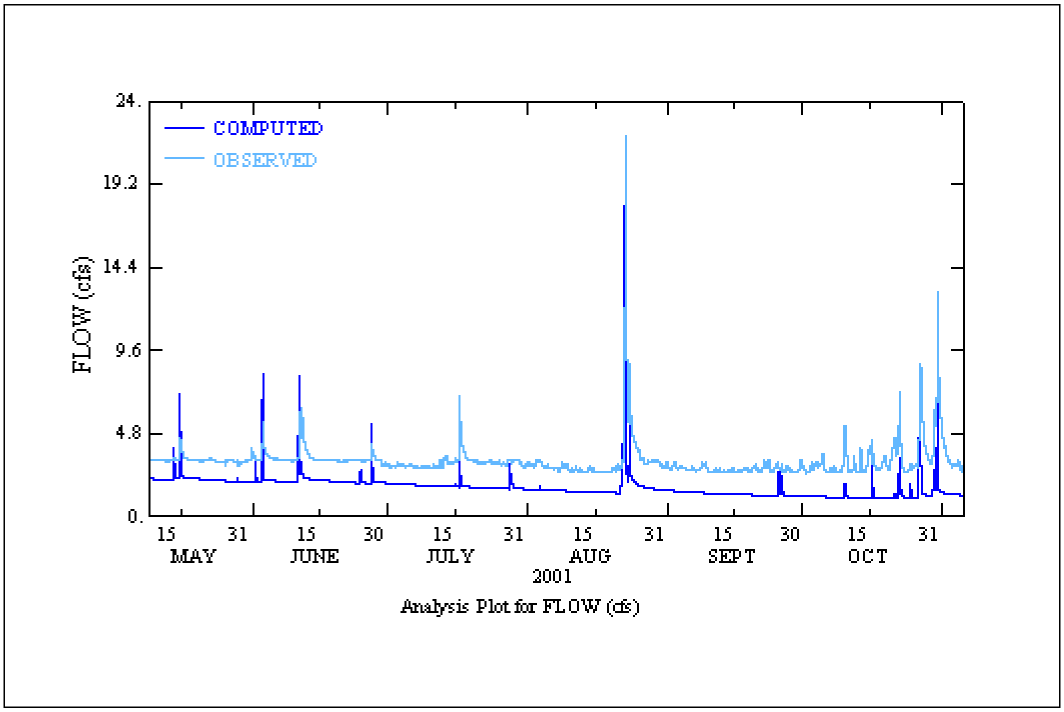


Figure I.7.B.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

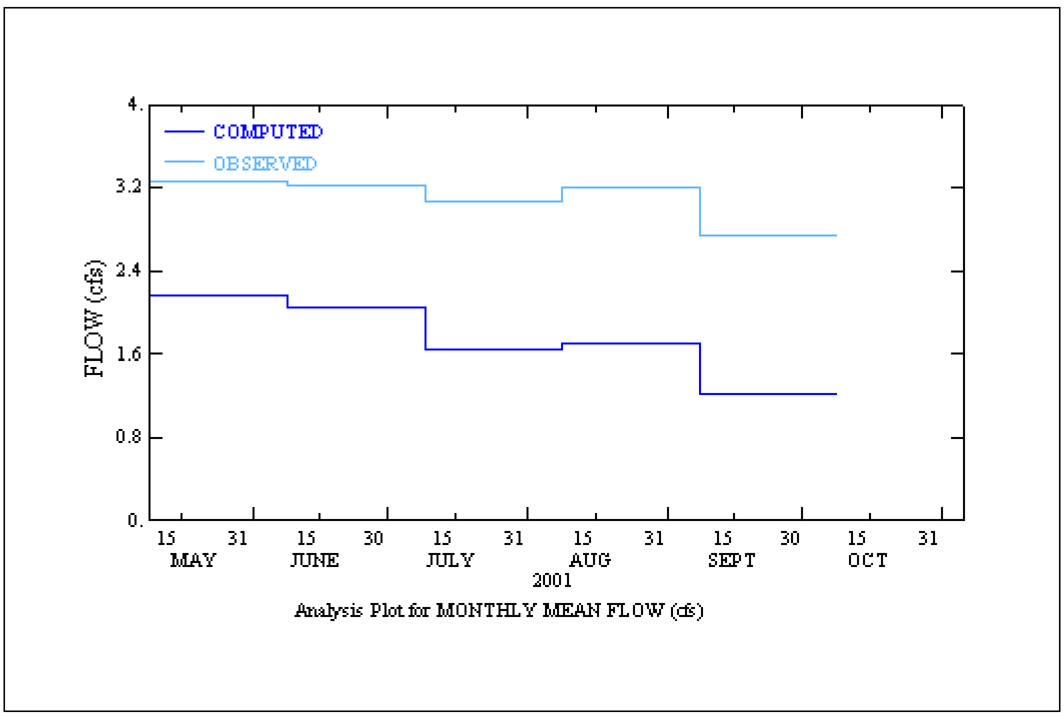


Figure I.7.B.2. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed monthly mean flows.

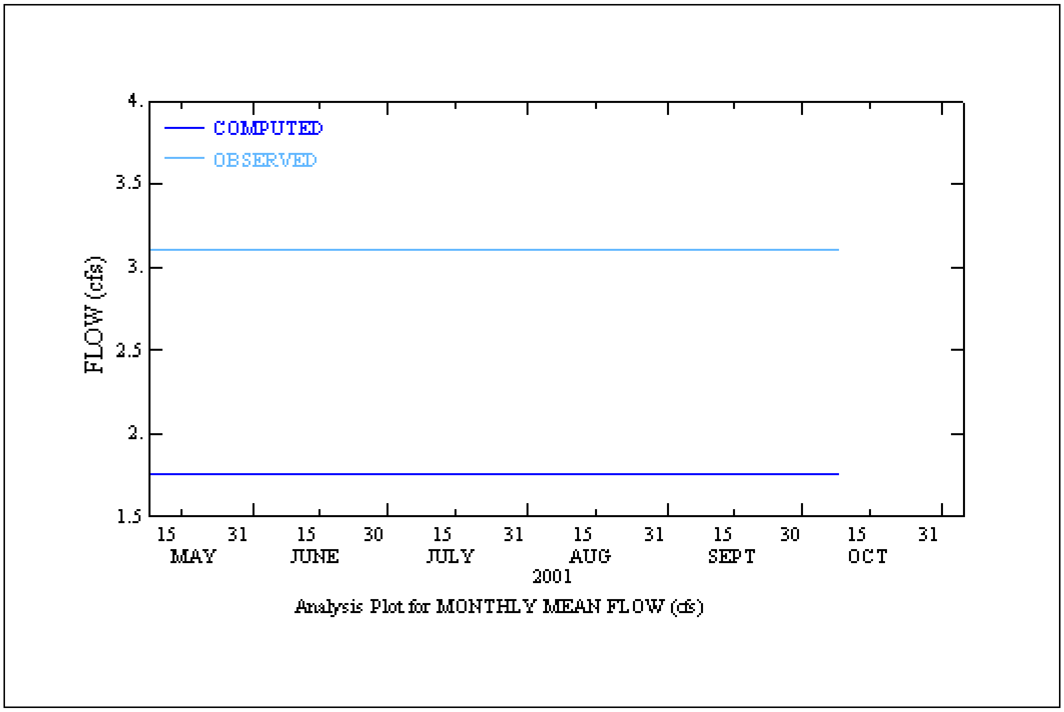


Figure I.7.B.3. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed flows for the period 05/09/2001 – 11/05/2001.

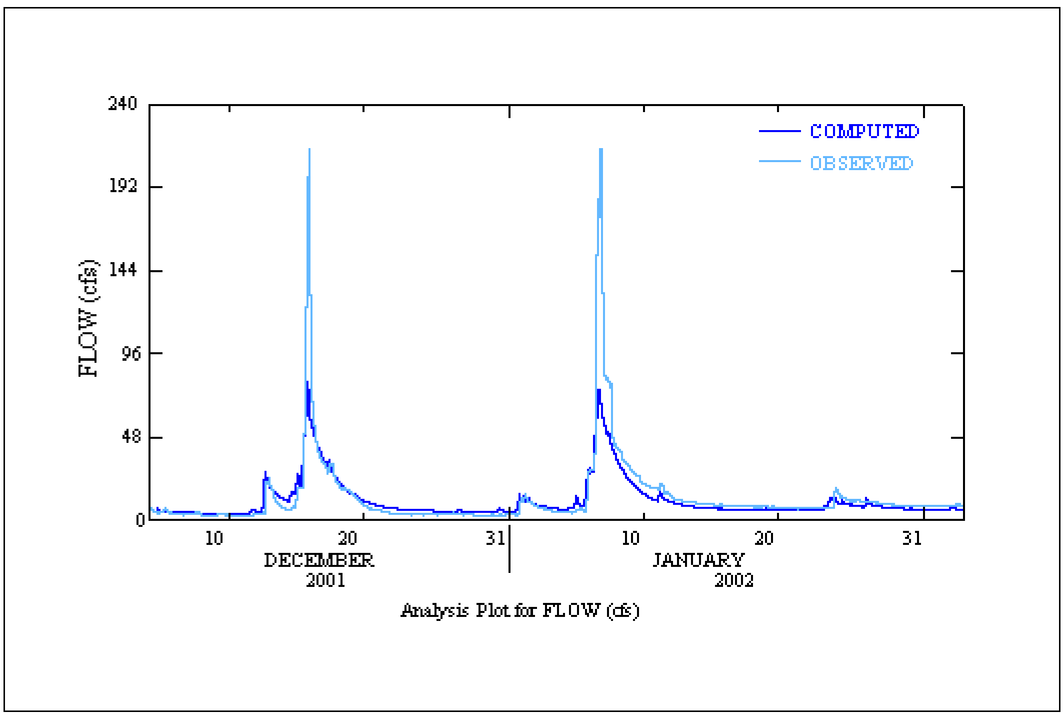


Figure I.7.C.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

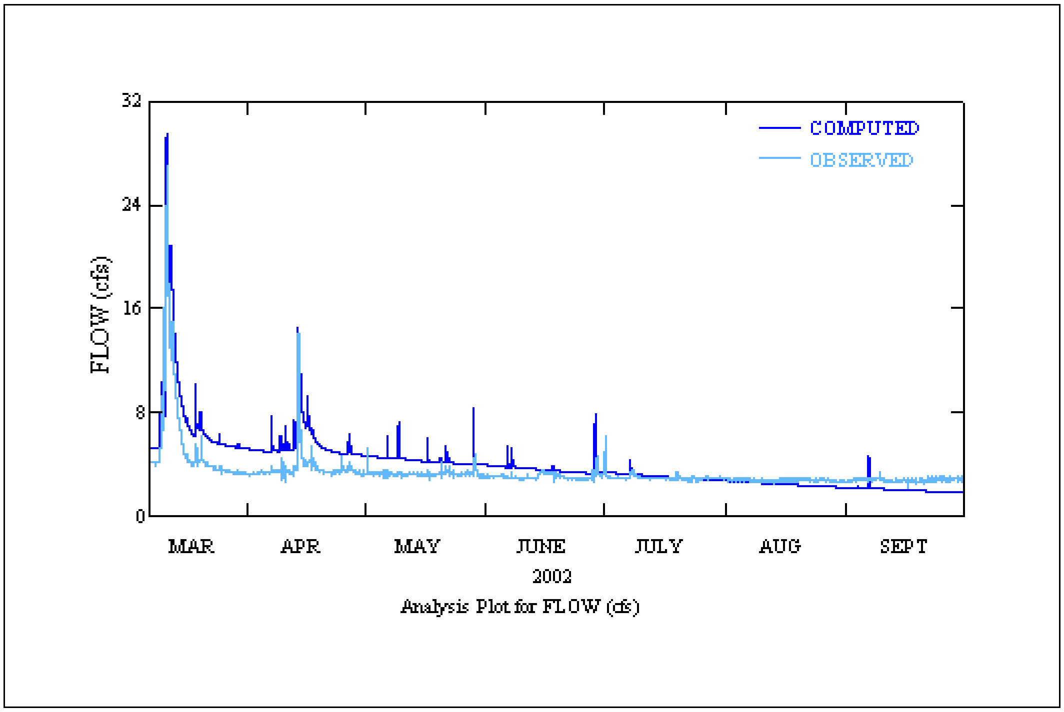


Figure I.7.D.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

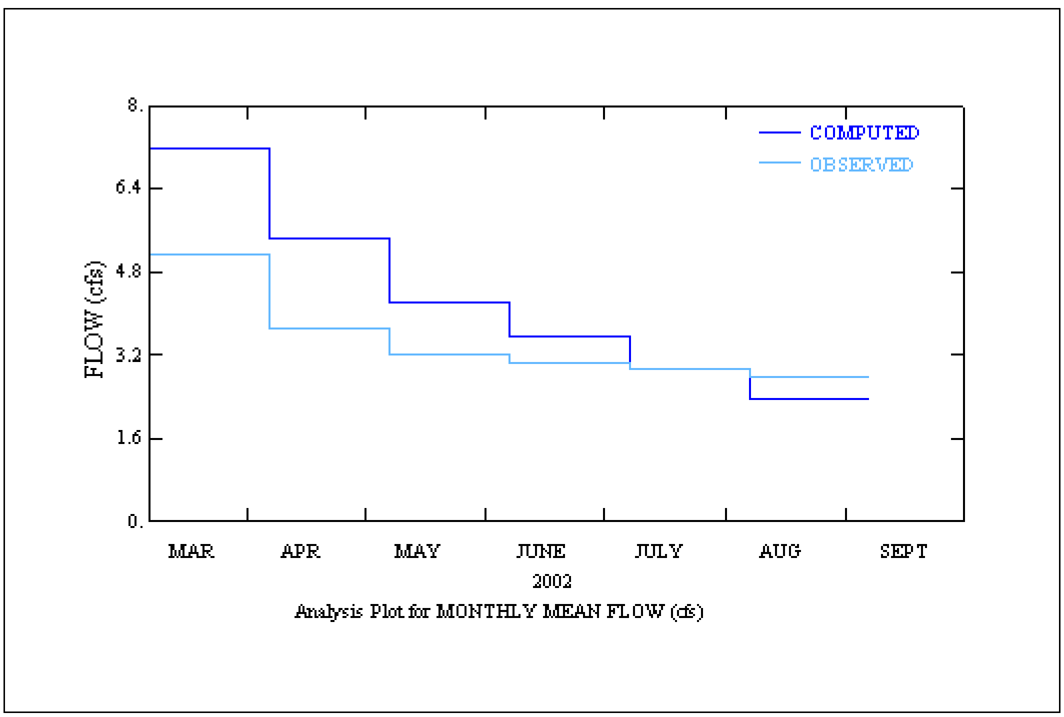


Figure I.7.D.2. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed monthly mean flows.

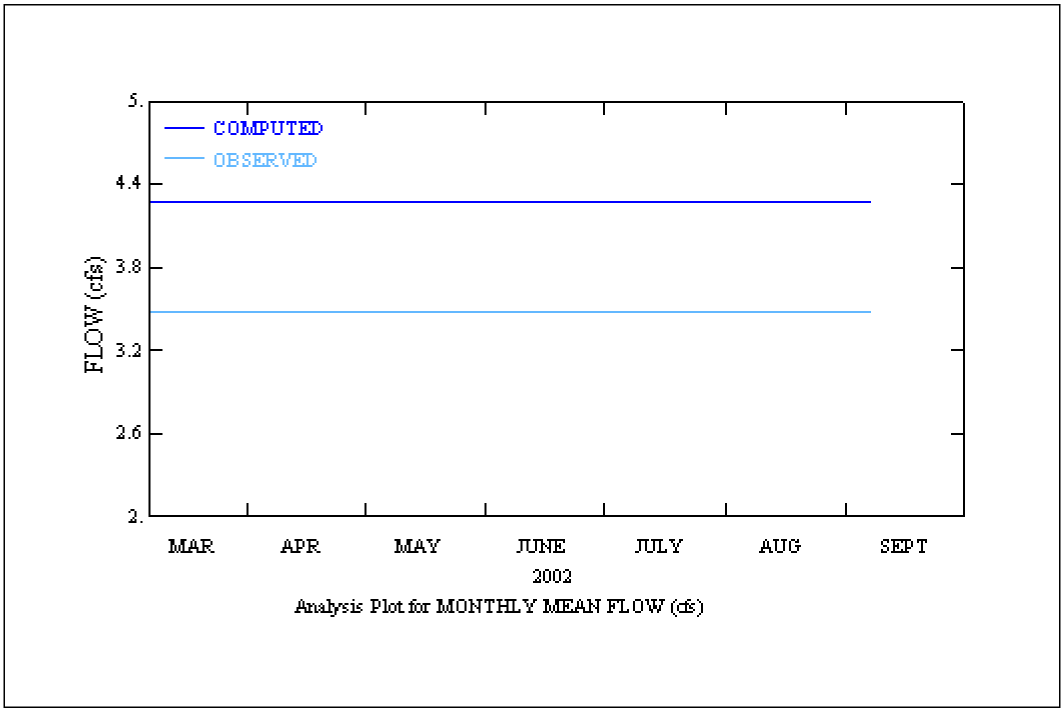


Figure I.7.D.3. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed flows for the period 03/07/2002 – 09/30/2002.

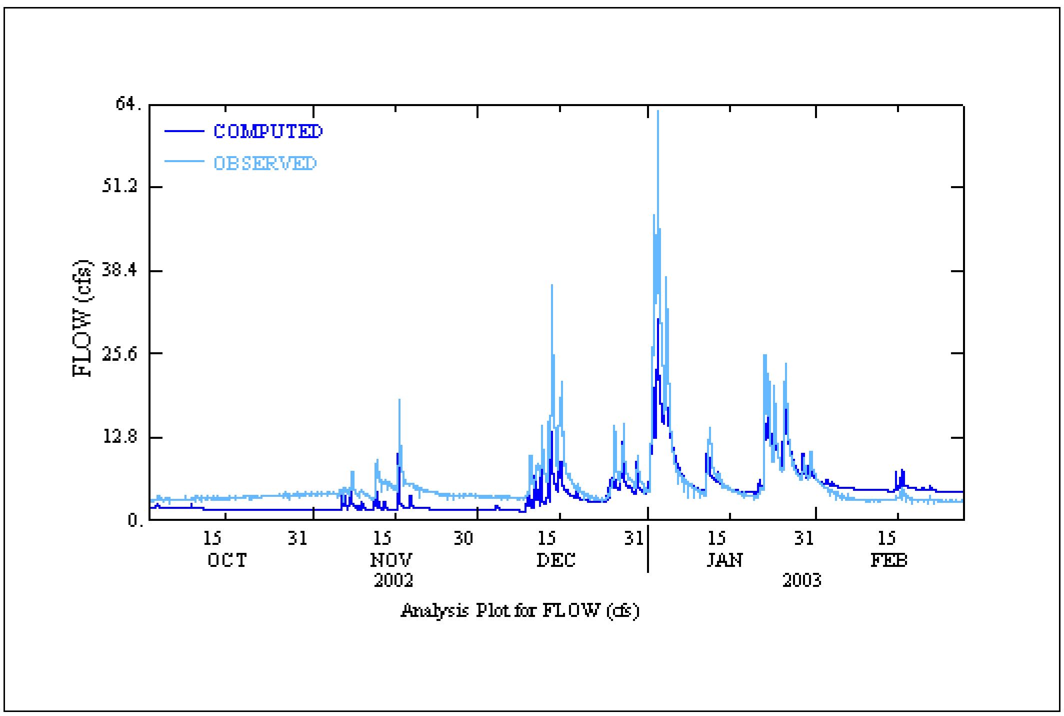


Figure I.7.E.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

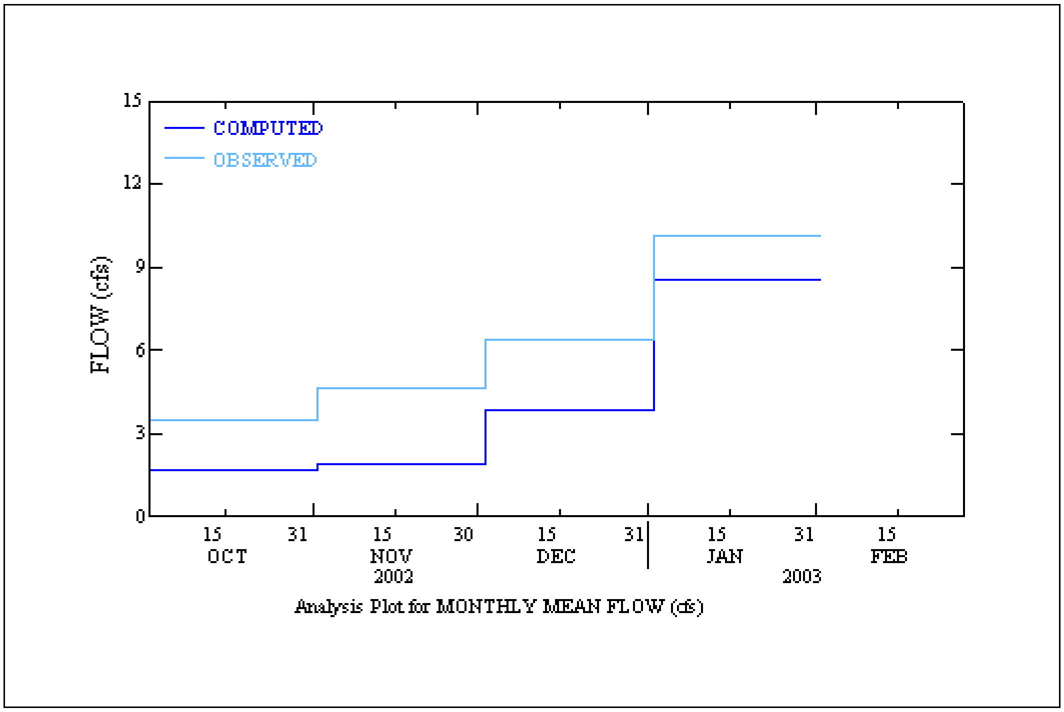


Figure I.7.E.2. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed monthly mean flows.

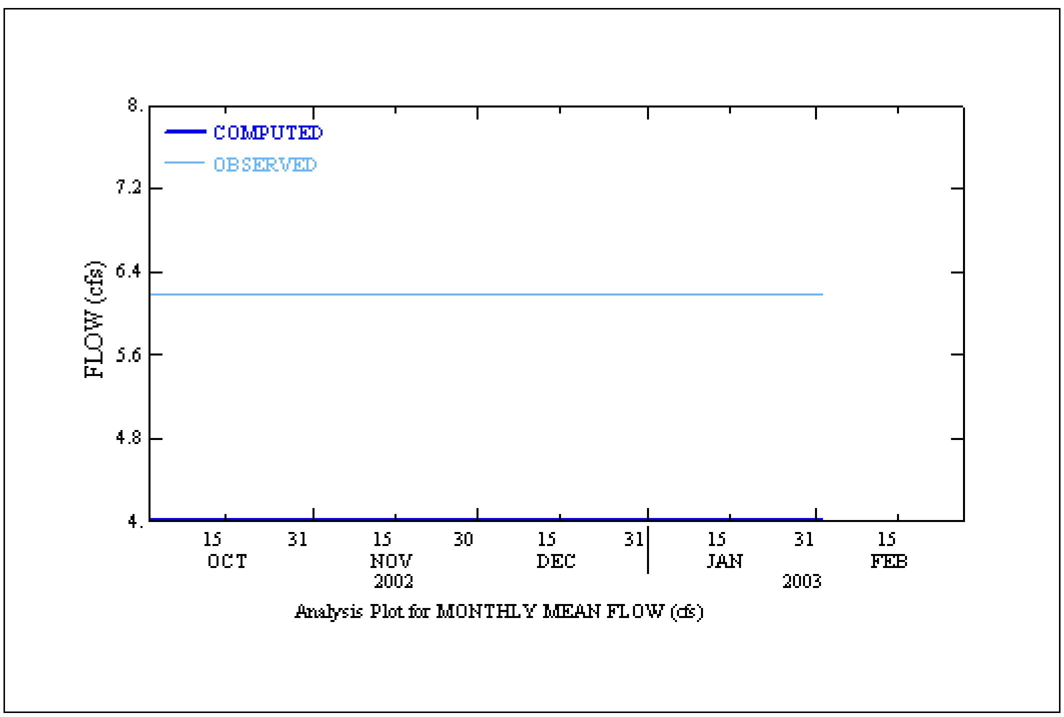


Figure I.7.E.3. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed flows for the period 10/02/2002 – 02/27/2003.

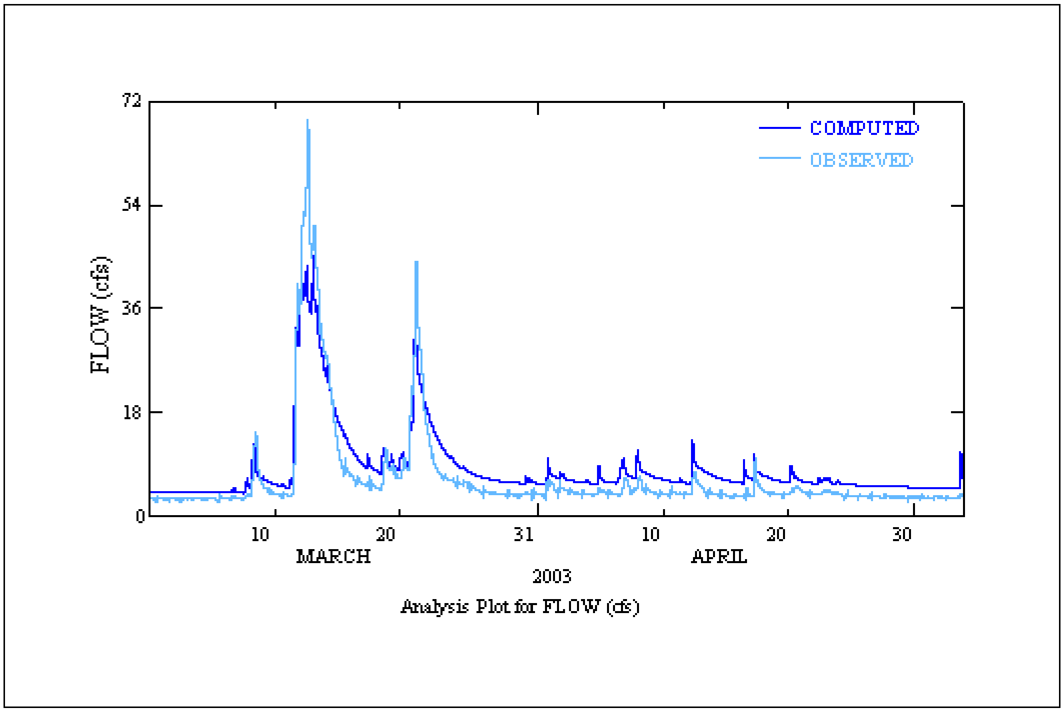


Figure I.7.F.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

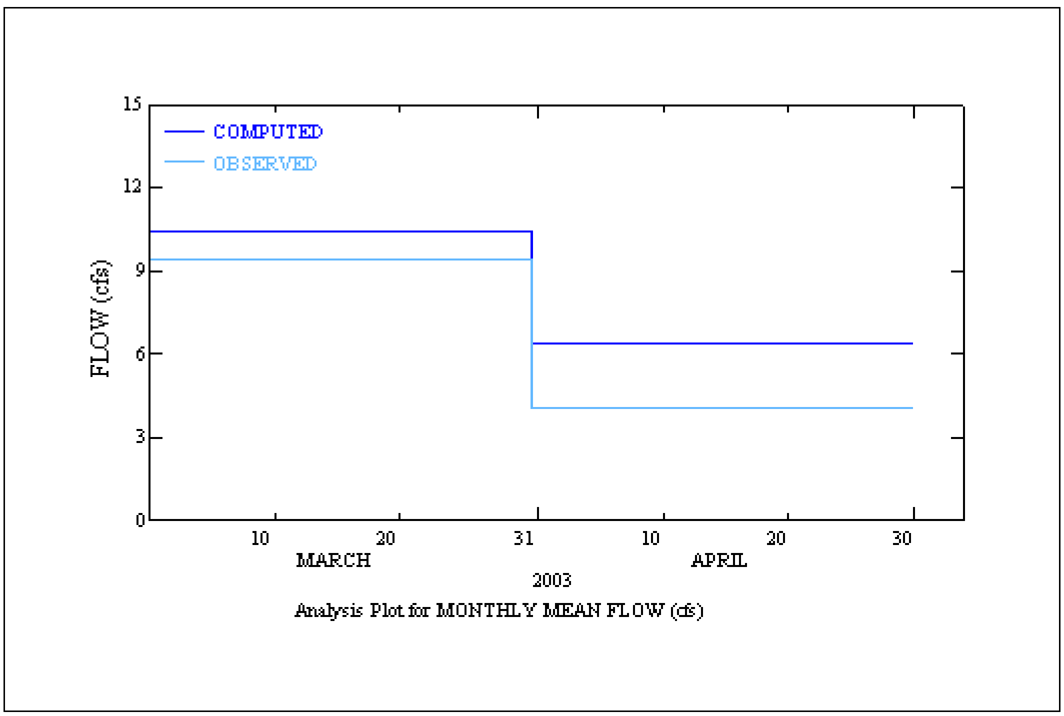


Figure I.7.F.2. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed monthly mean flows.

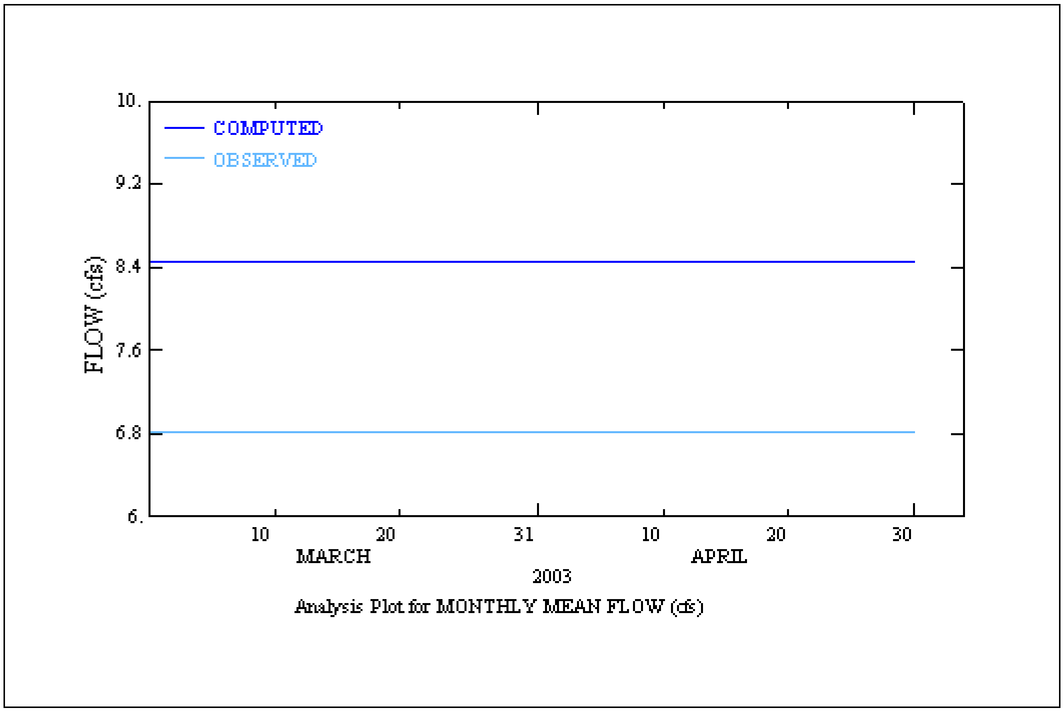


Figure I.7.F.3. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed flows for the period 03/01/2003 – 05/04/2003.

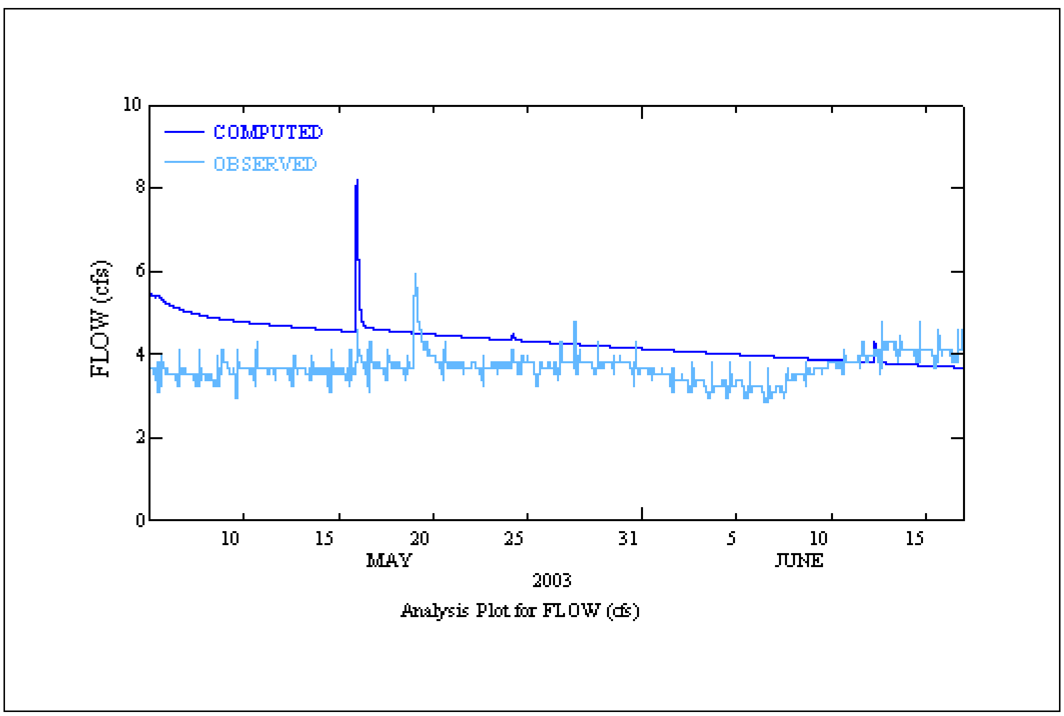


Figure I.7.G.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

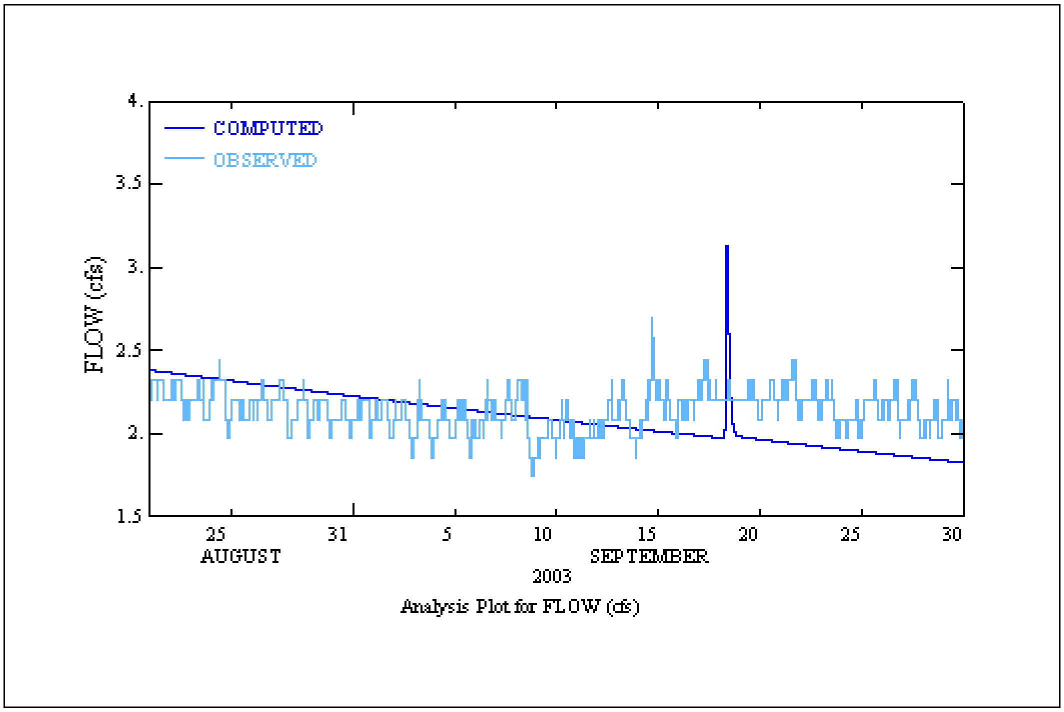


Figure I.7.H.1. Final parameter estimation results for the drainage area above the Clear Creek – West Tributary streamflow gaging, comparing simulated and observed fifteen minute flows.

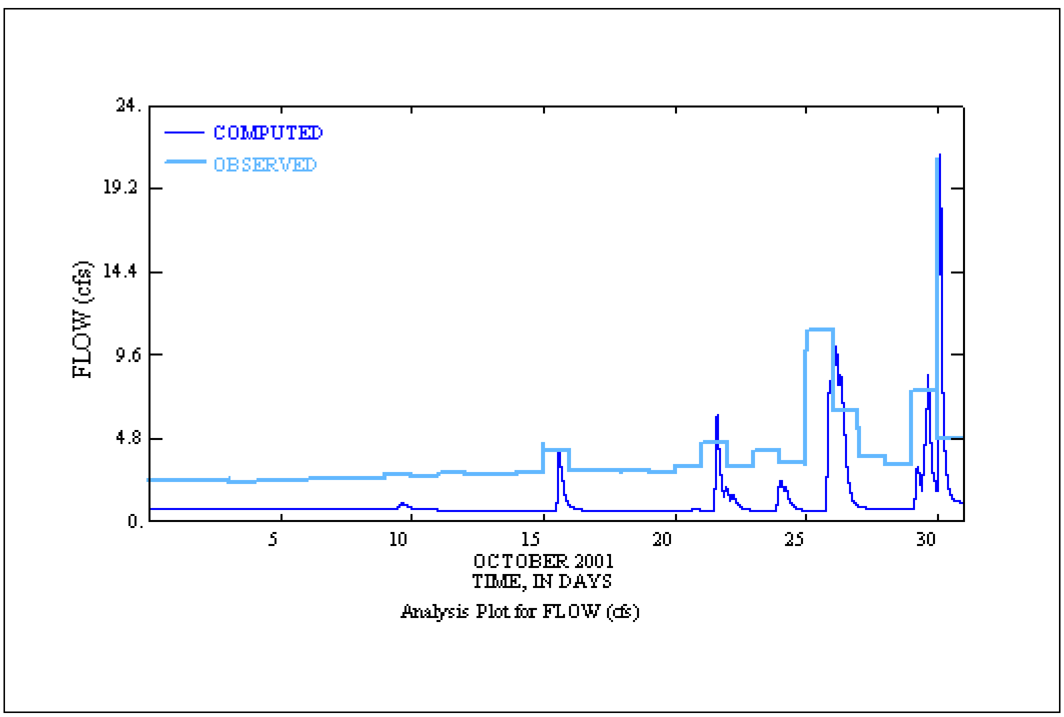


Figure I.8.A.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

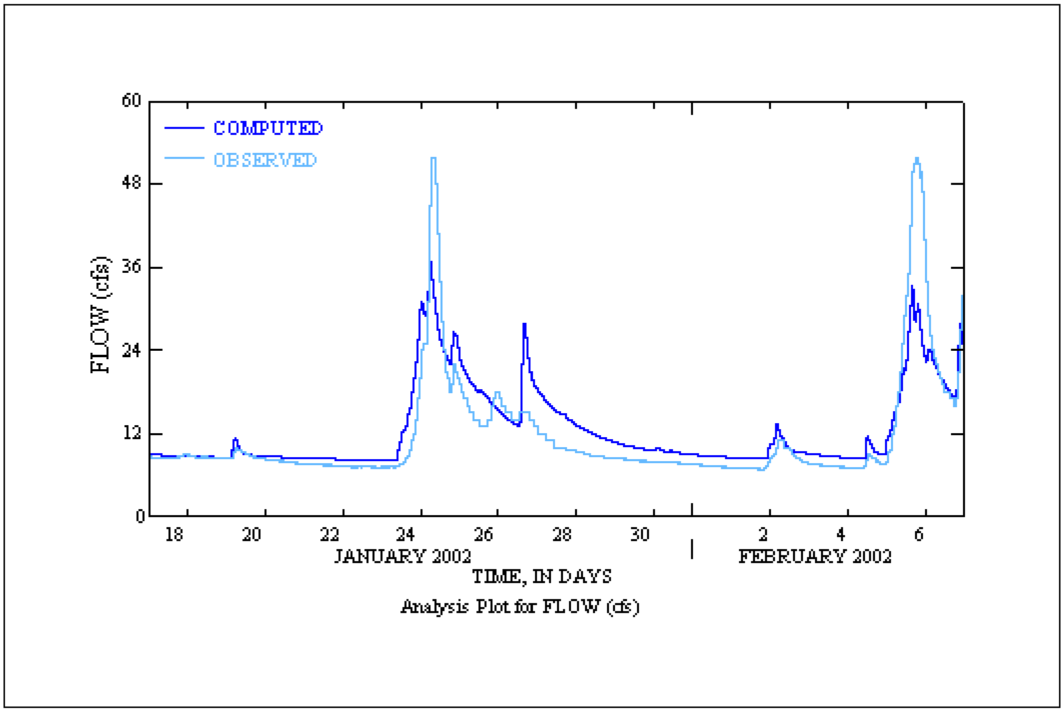


Figure I.8.B.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

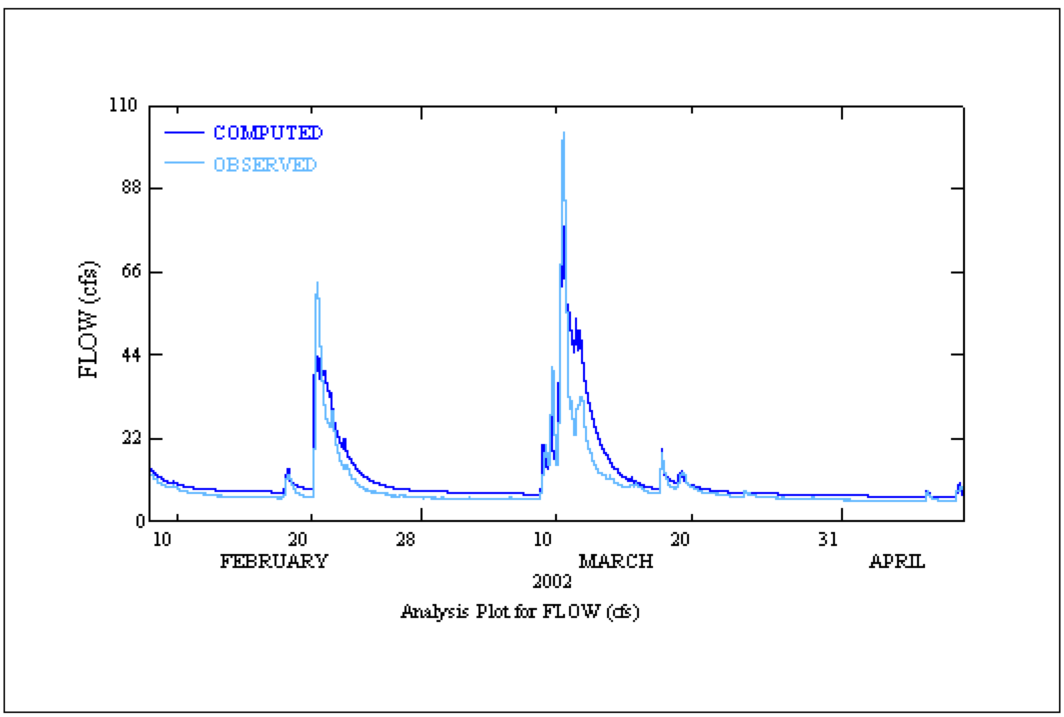


Figure I.8.C.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

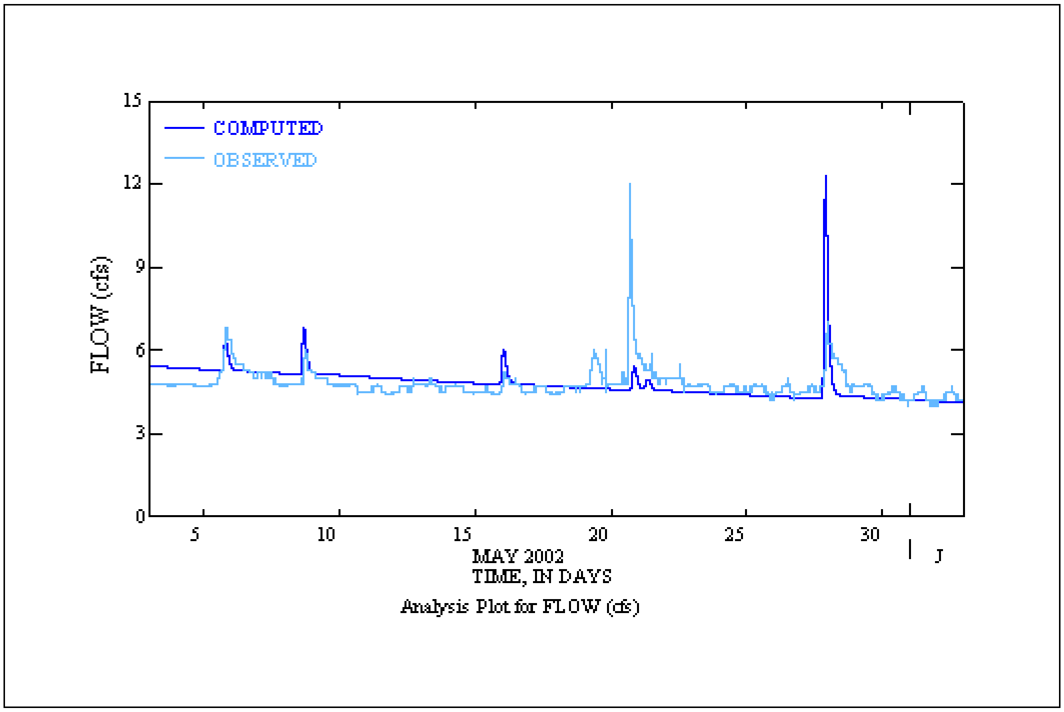


Figure I.8.D.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

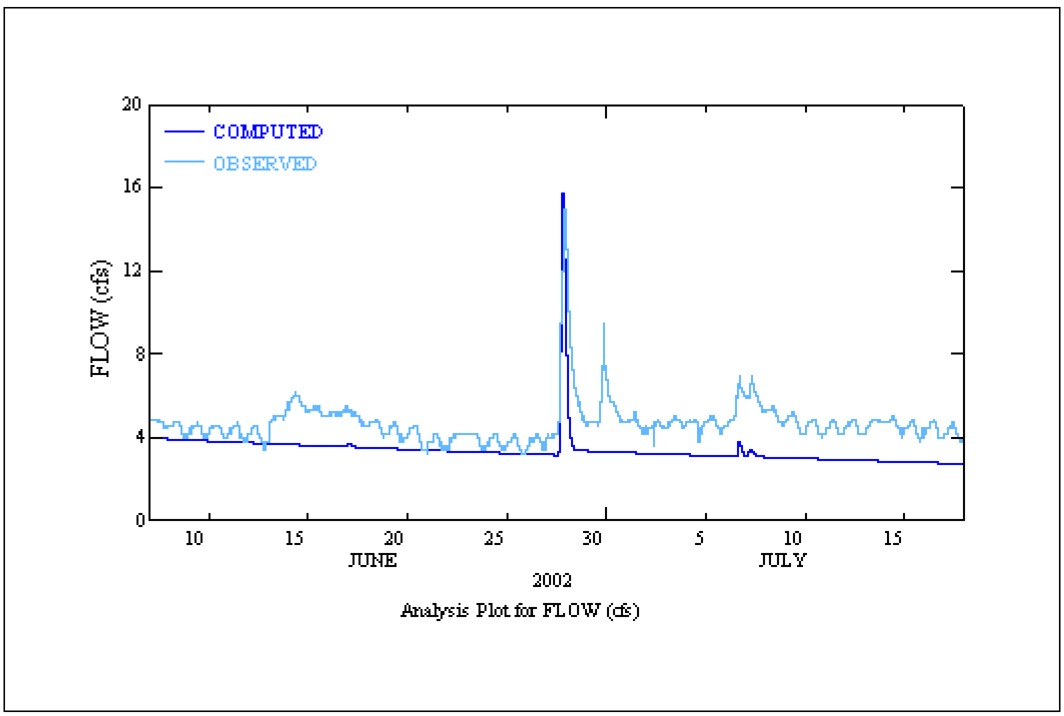


Figure I.8.E.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

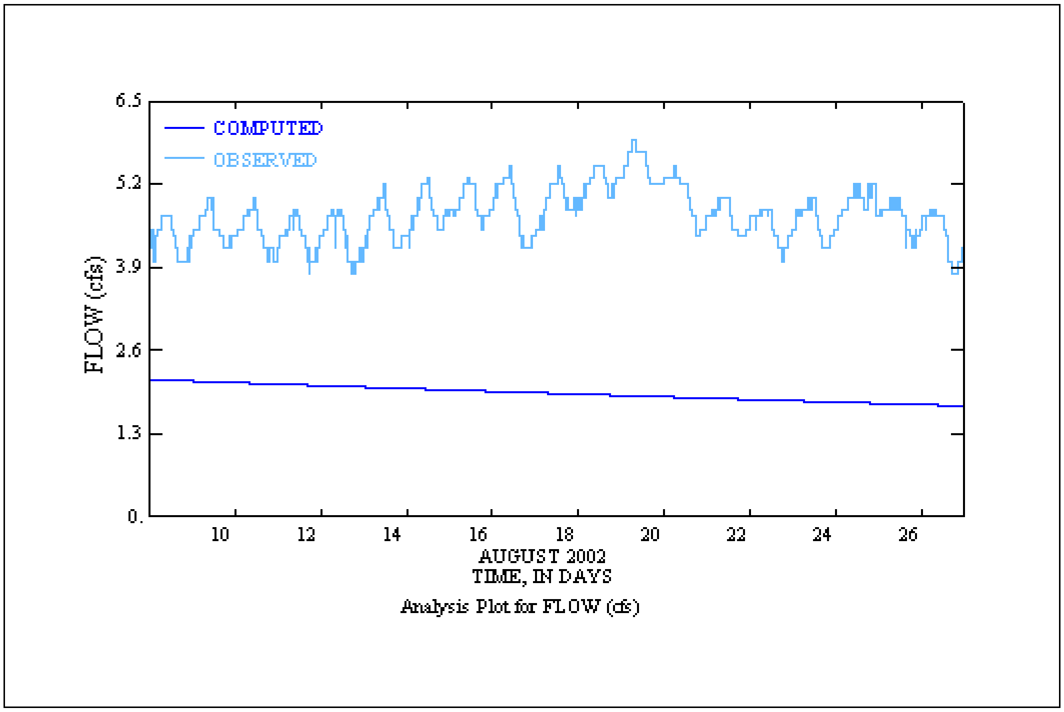


Figure I.8.F.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

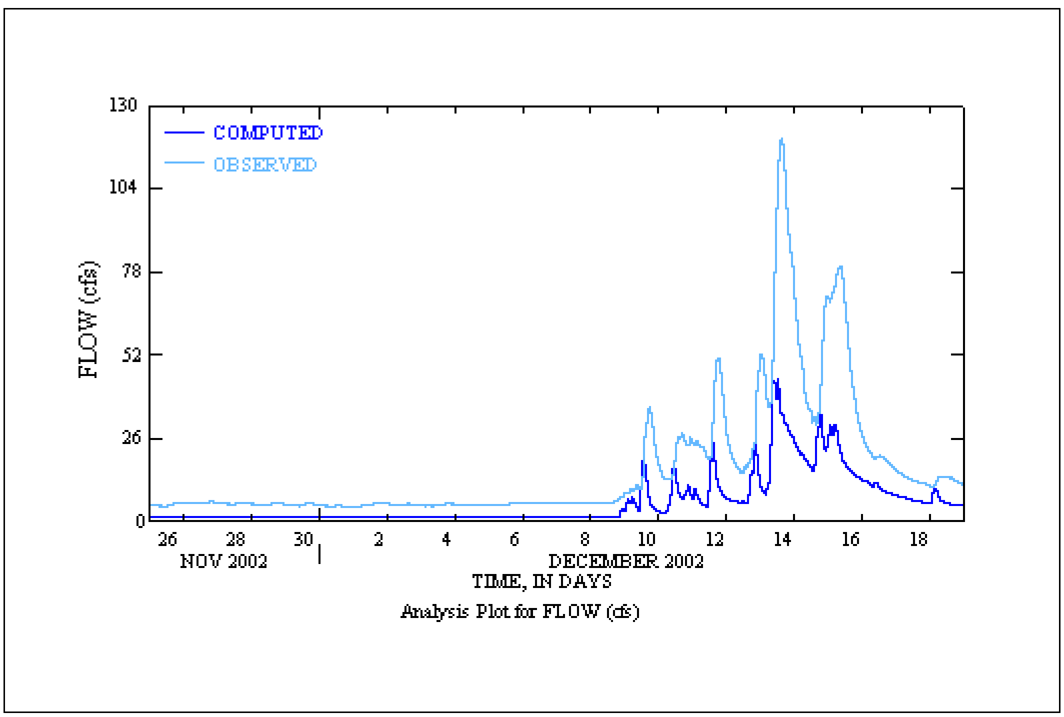


Figure I.8.G.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

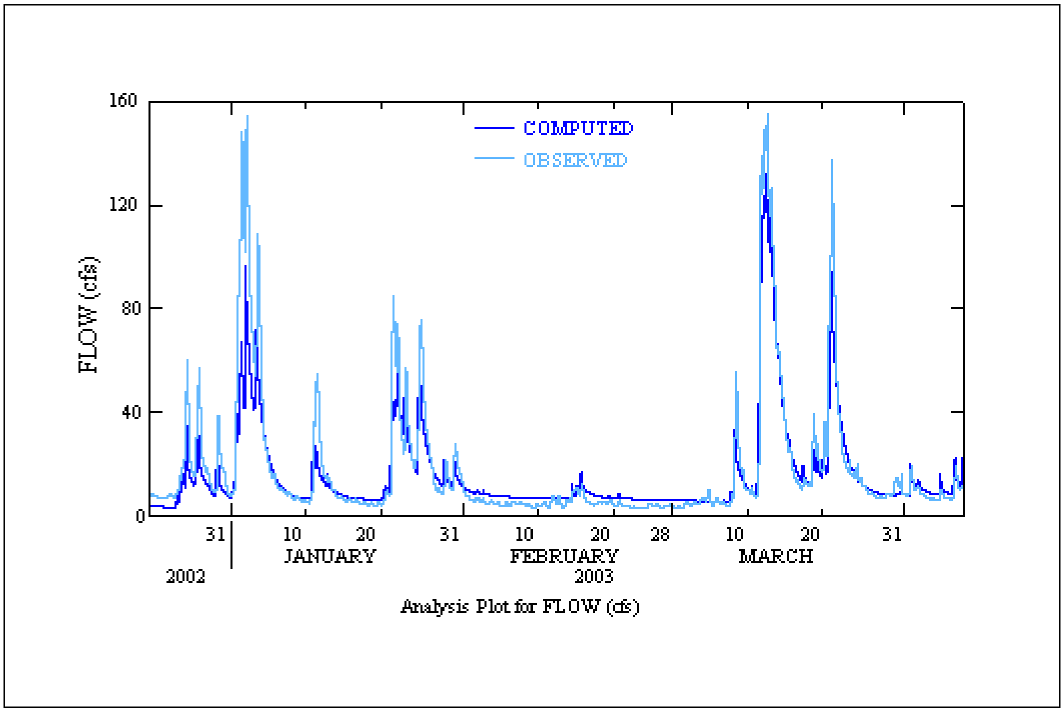


Figure I.8.H.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

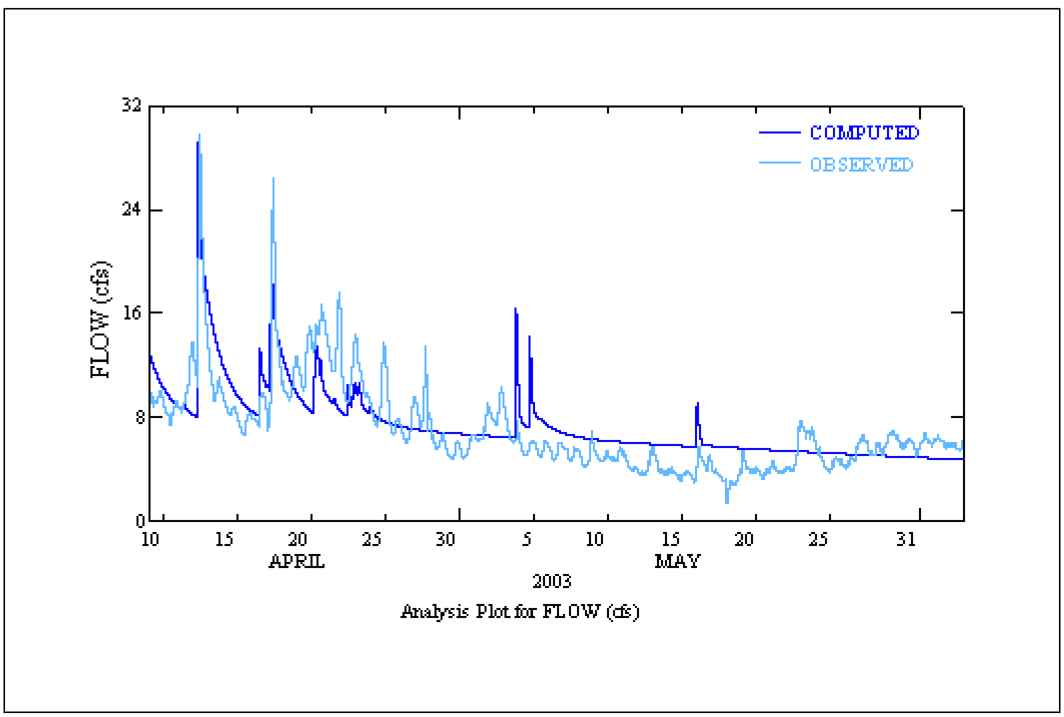


Figure I.8.I.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

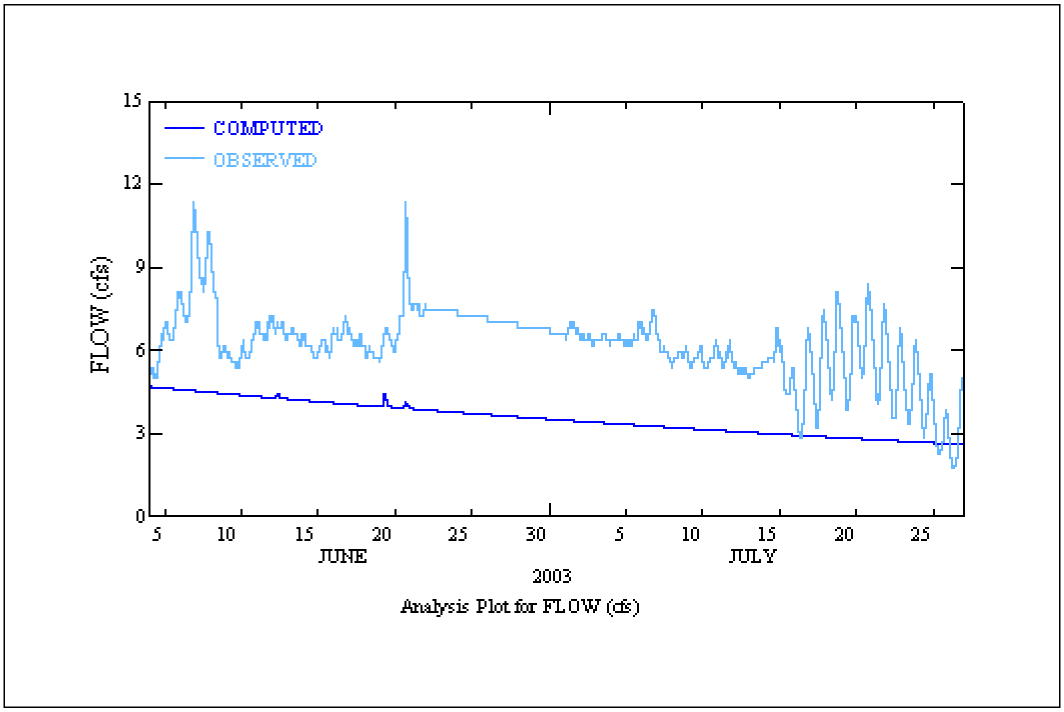


Figure I.8.J.1 Final parameter estimation results for the drainage area above the Clear Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

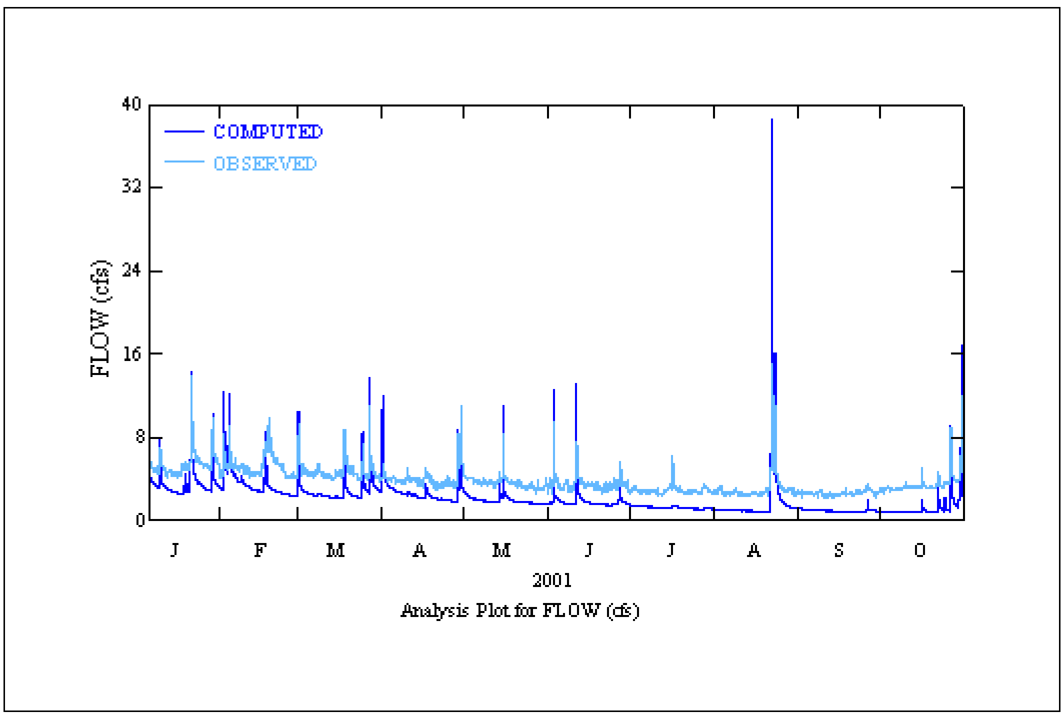


Figure I.9.A.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

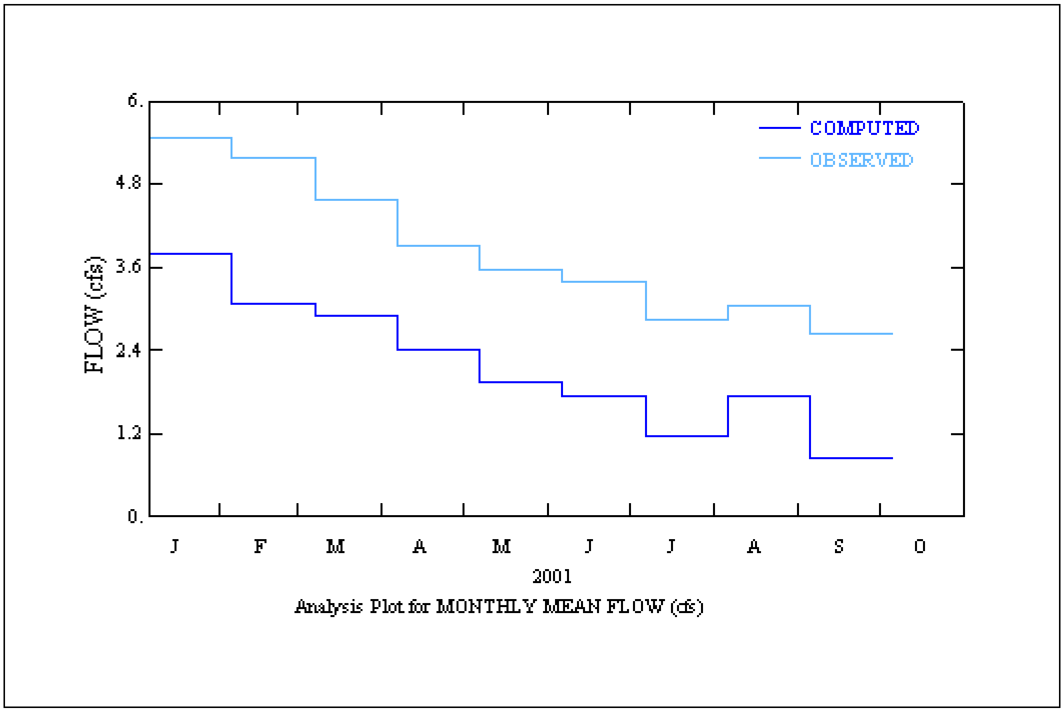


Figure I.9.A.2. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed monthly mean flows.

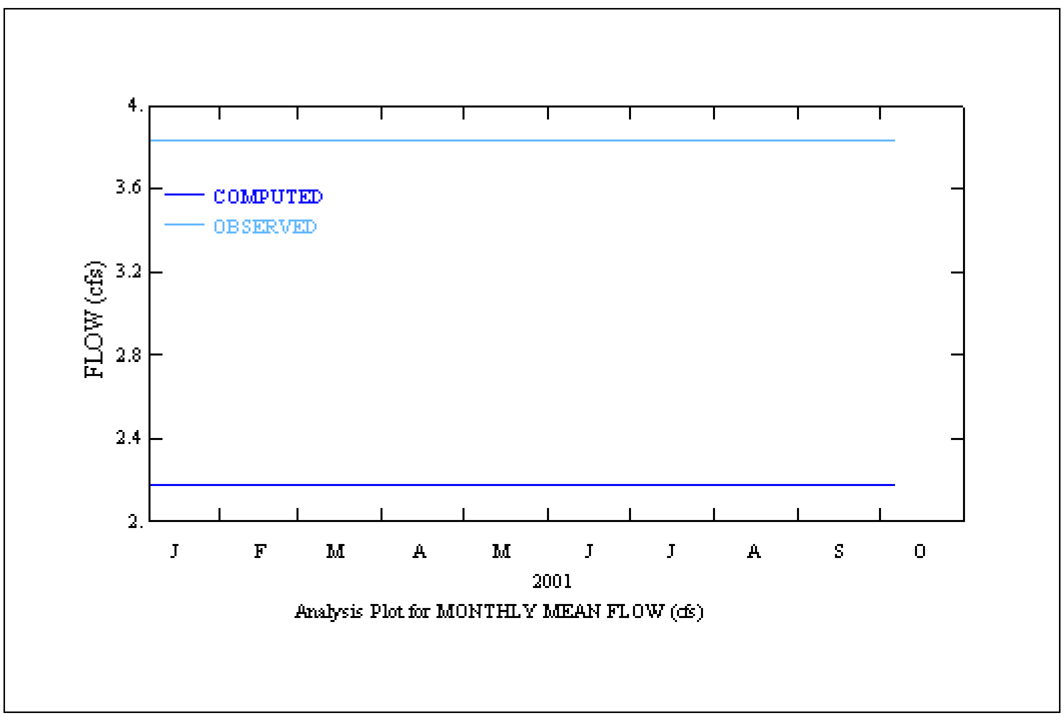


Figure I.9.A.3. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed flows for the period 01/06/2001 – 10/31/2001.

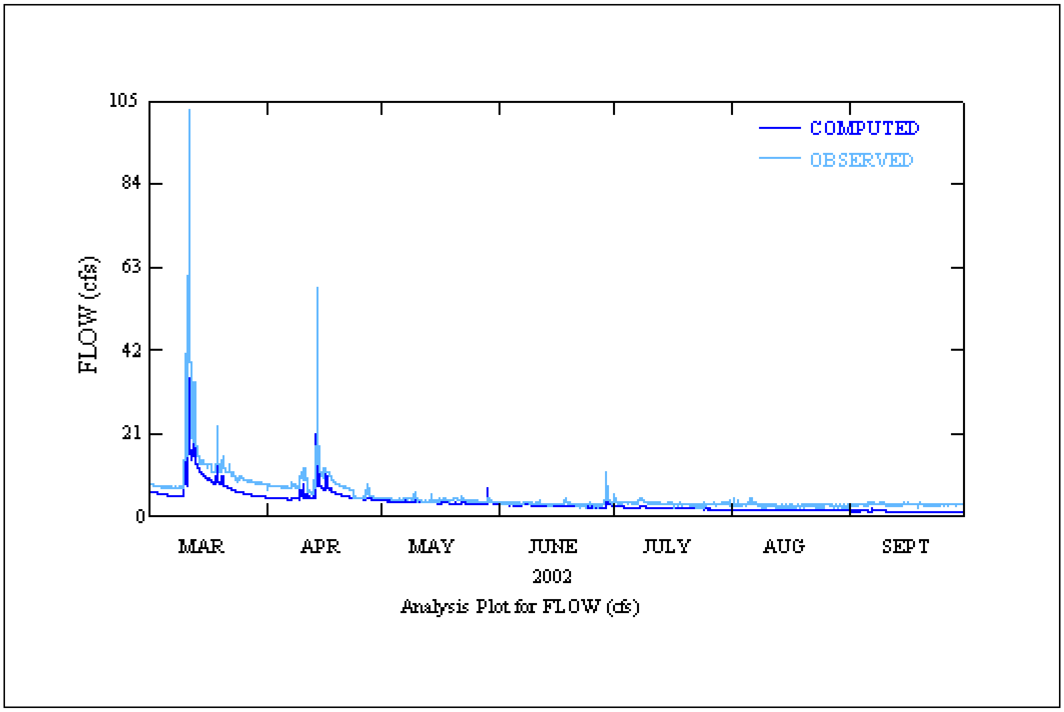


Figure I.9.B.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

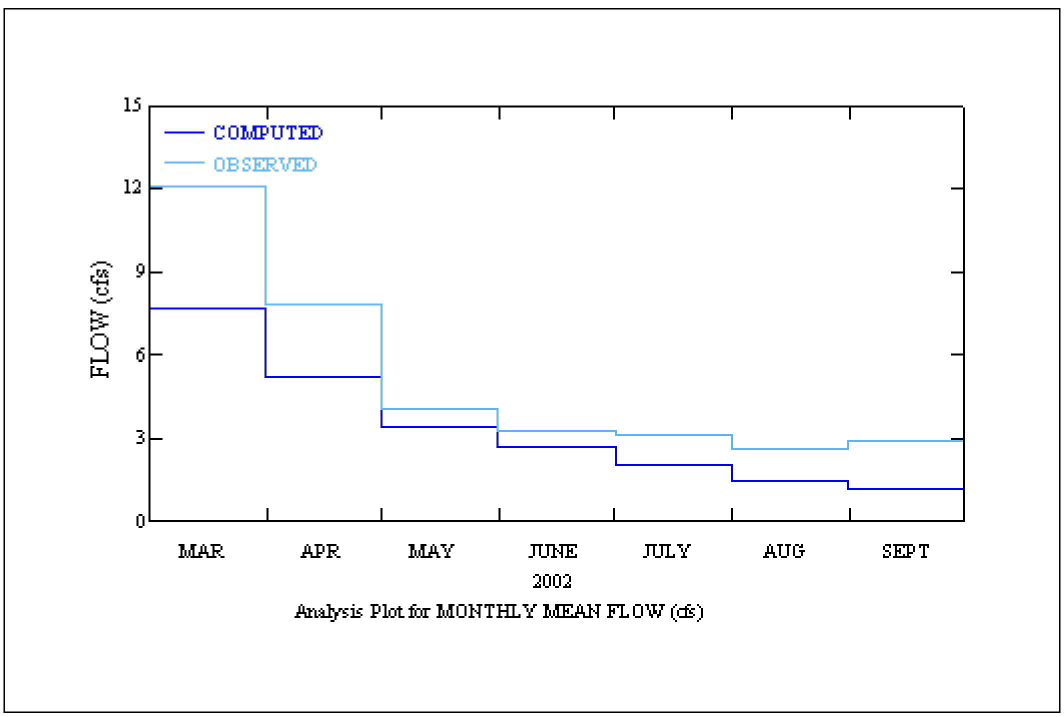


Figure I.9.B.2. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed monthly mean flows.

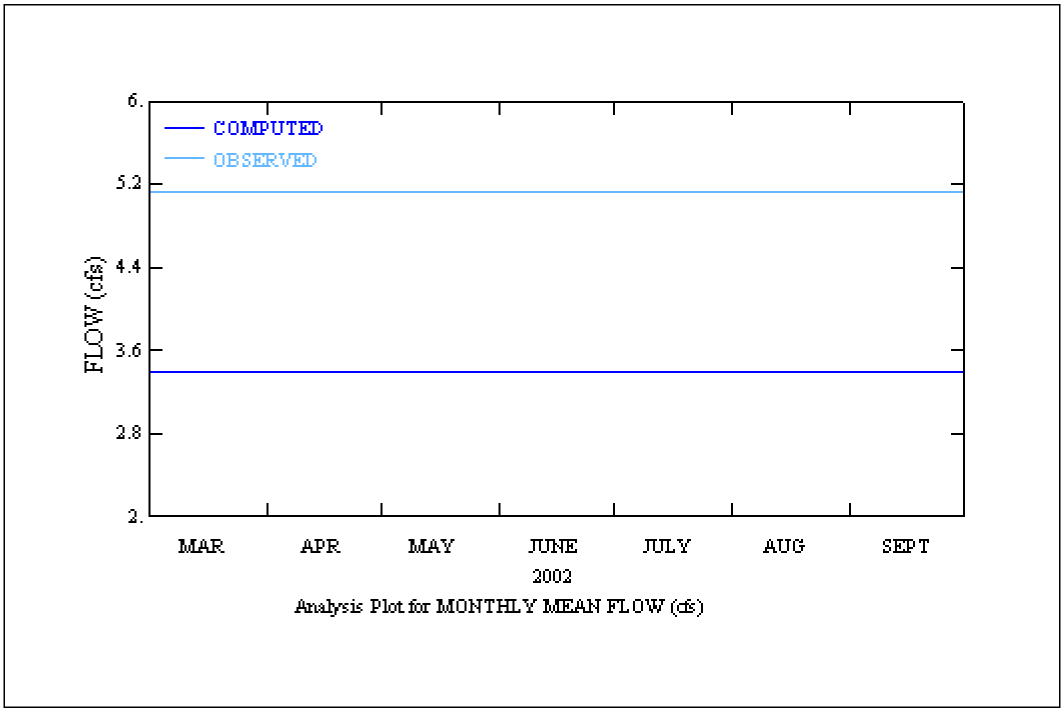


Figure I.9.B.3. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed flows for the period 03/01/2002 – 09/30/2002.

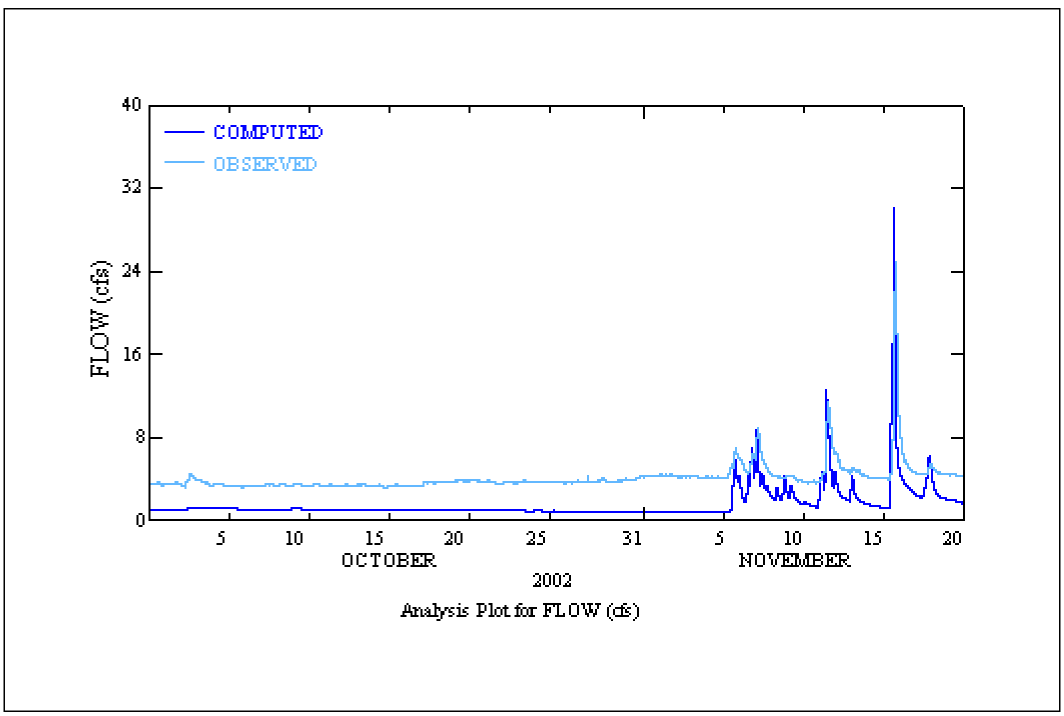


Figure I.9.C.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

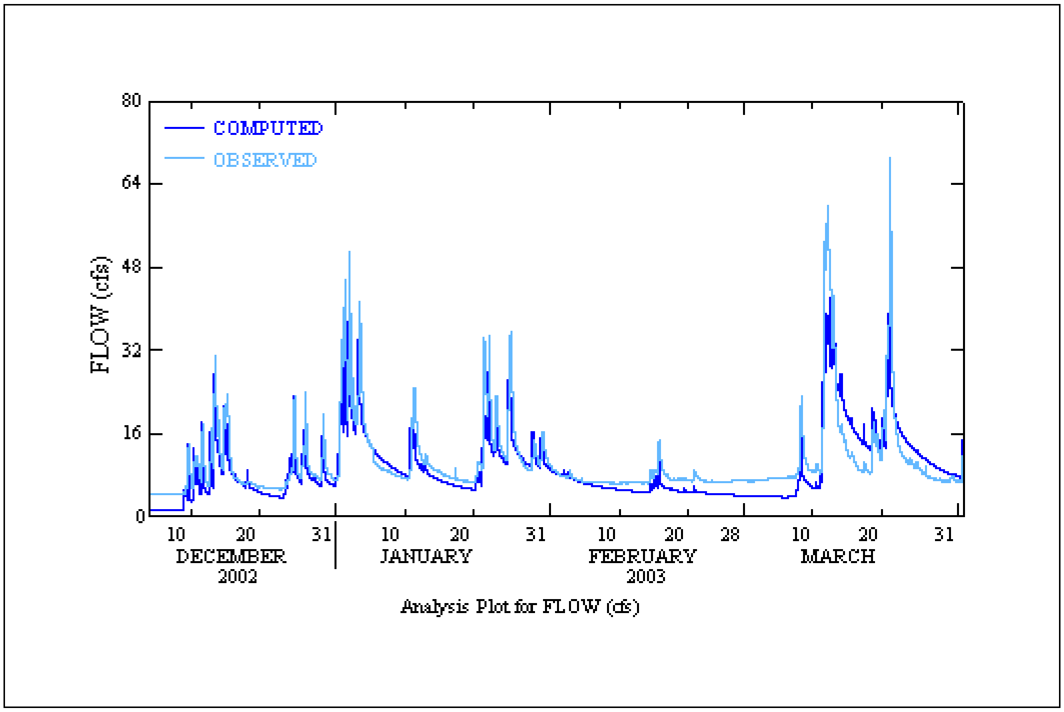


Figure I.9.D.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

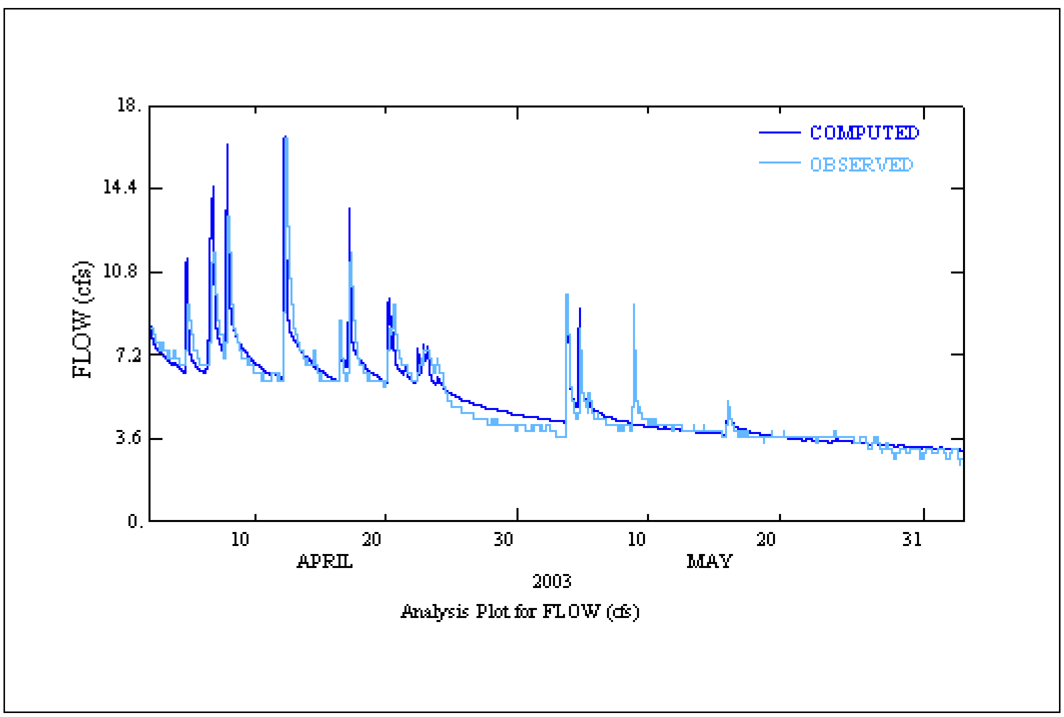


Figure I.9.E.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

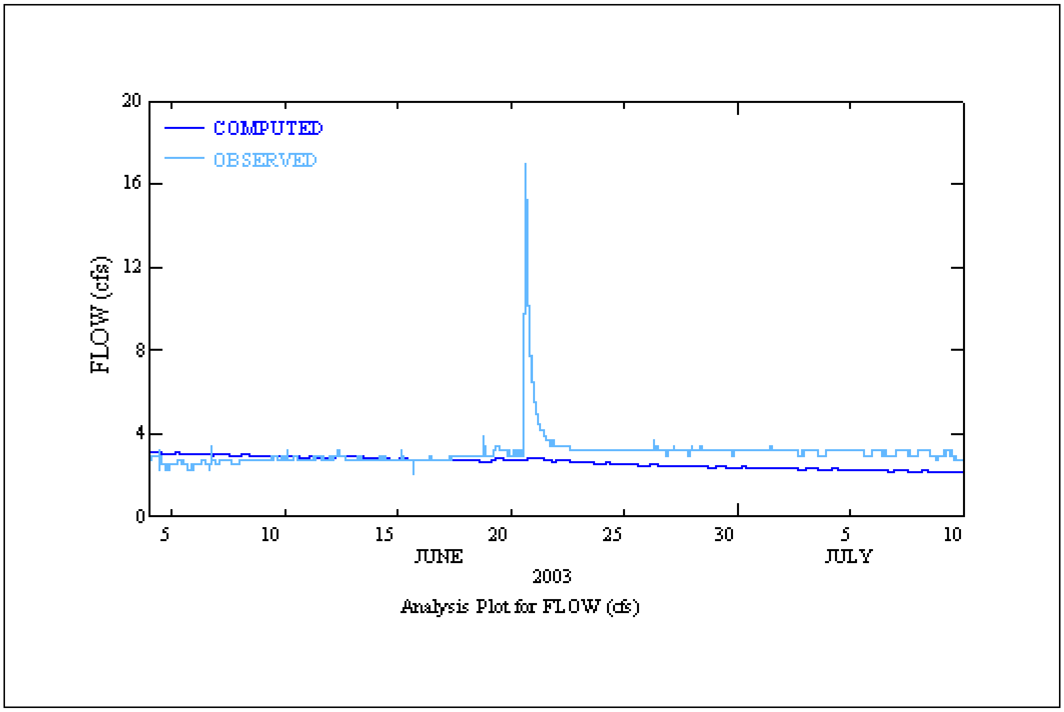


Figure I.9.F.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

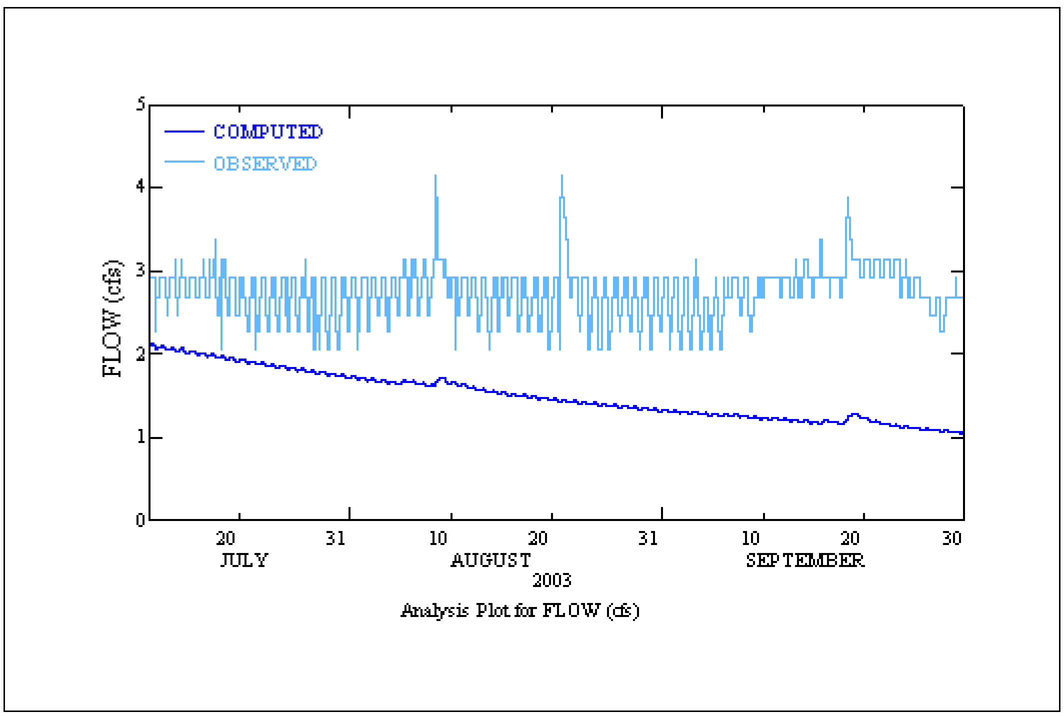


Figure I.9.G.1. Final parameter estimation results for the drainage area above the Barker Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

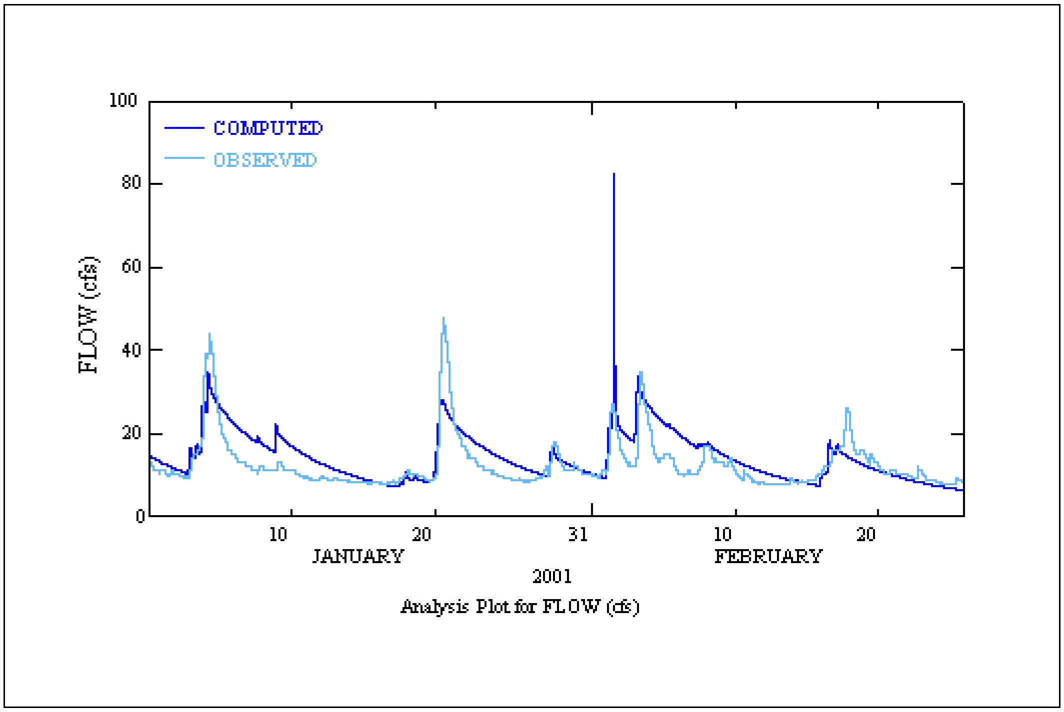


Figure I.11.A.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

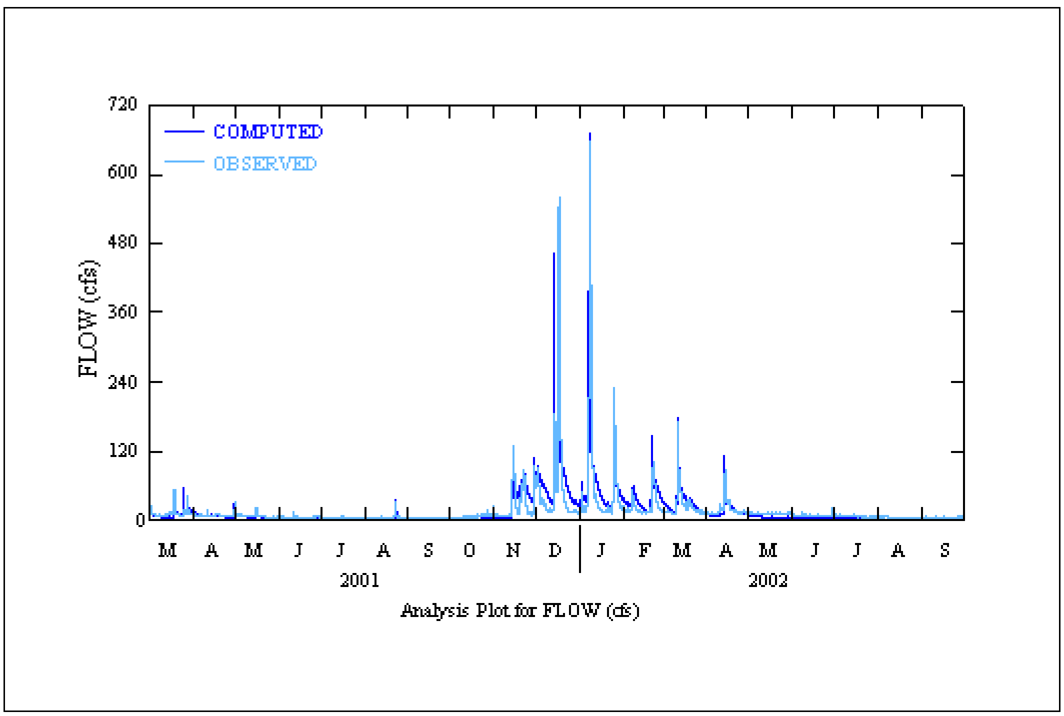


Figure I.11.B.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

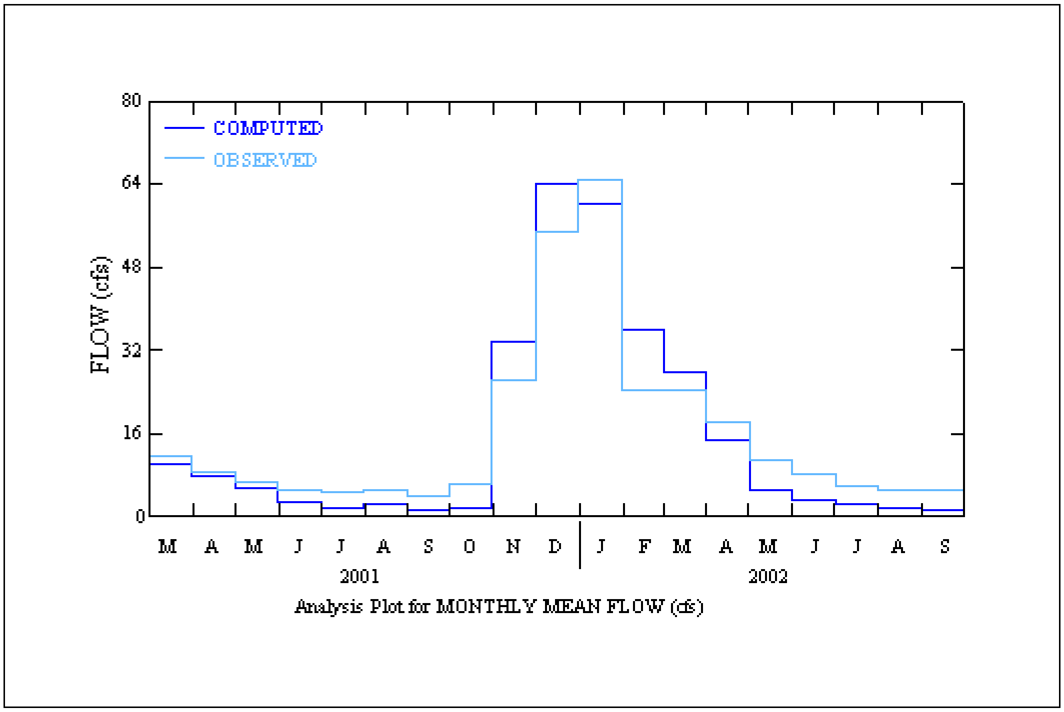


Figure I.11.B.2. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed monthly mean flows.

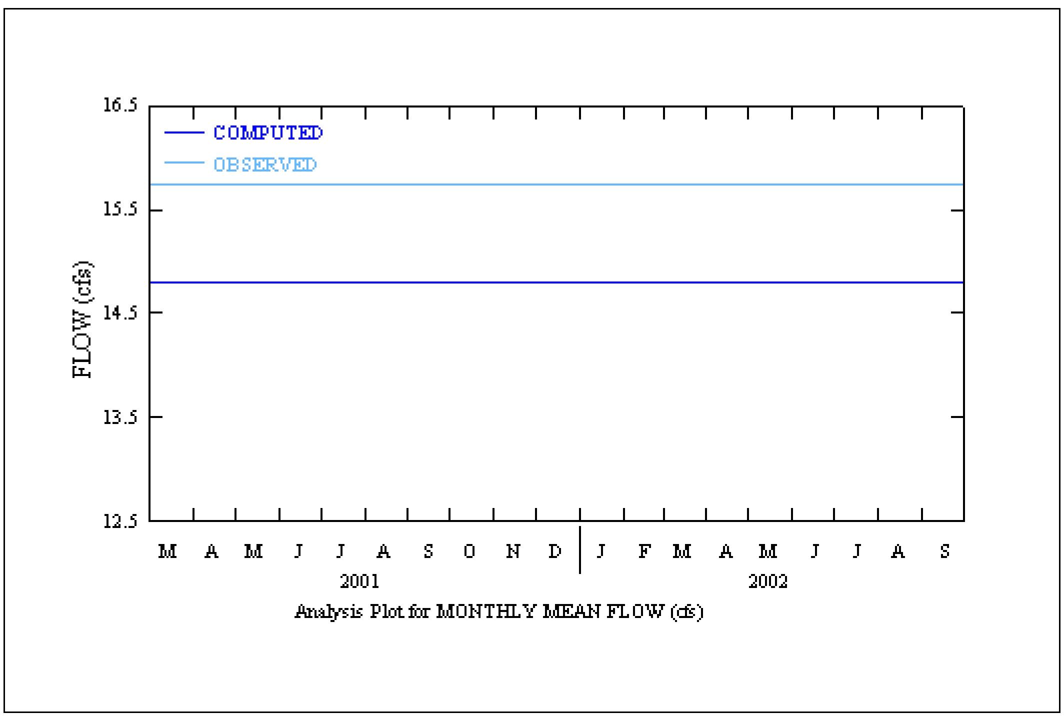


Figure I.11.B.3. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed flows for the period 03/01/2001 – 09/30/2002.

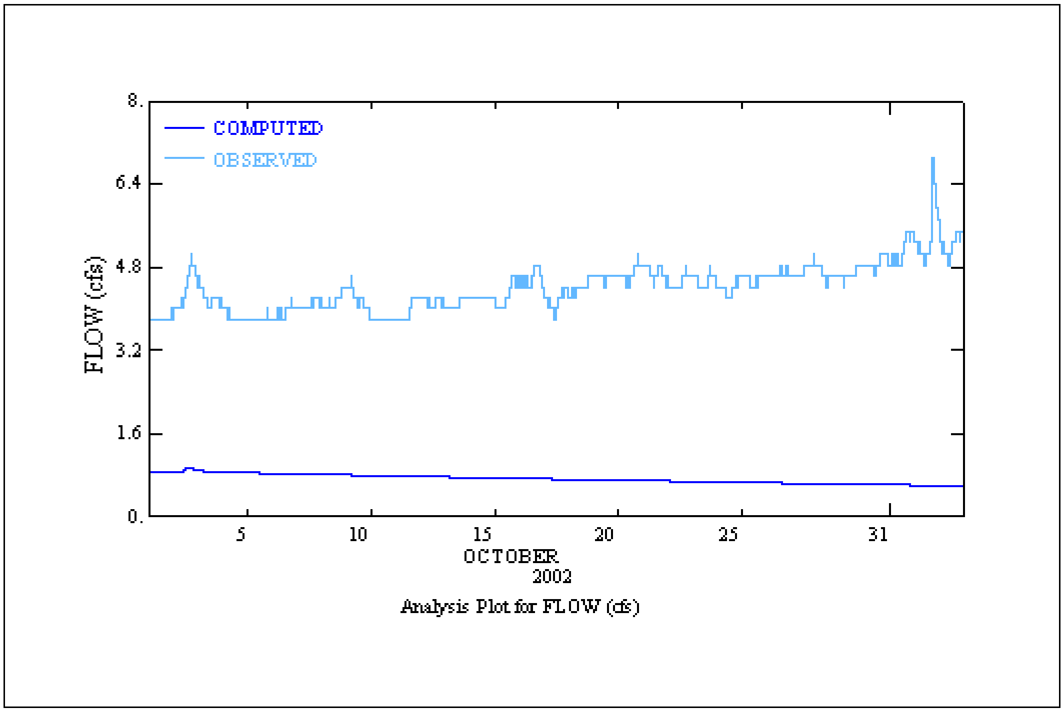


Figure I.11.C.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

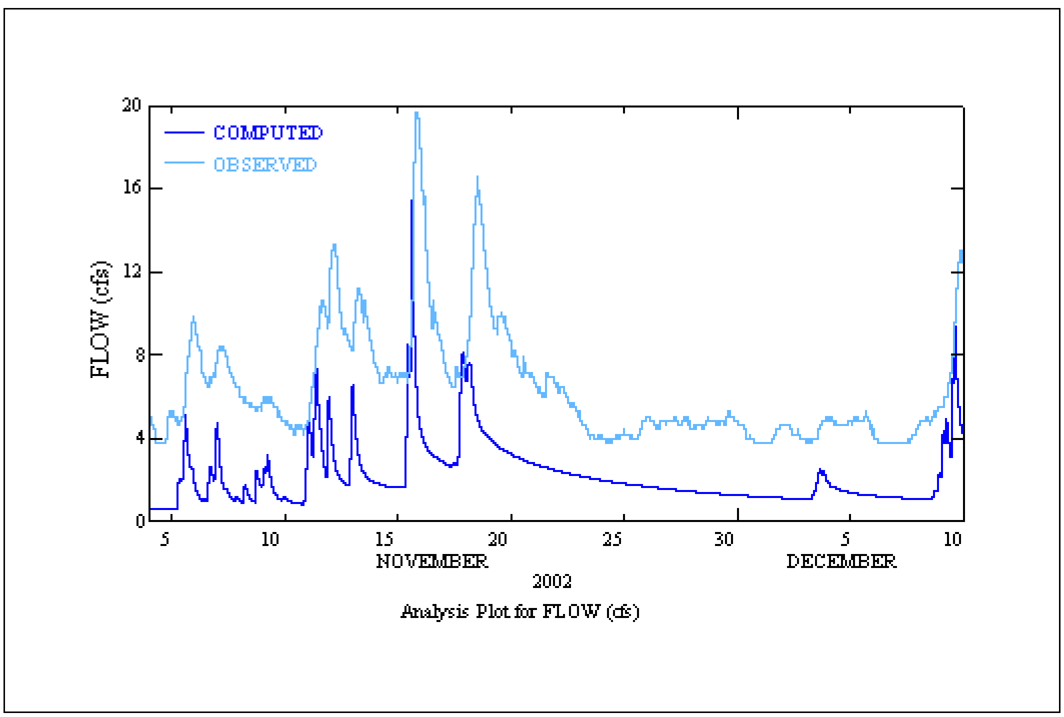


Figure I.11.D.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

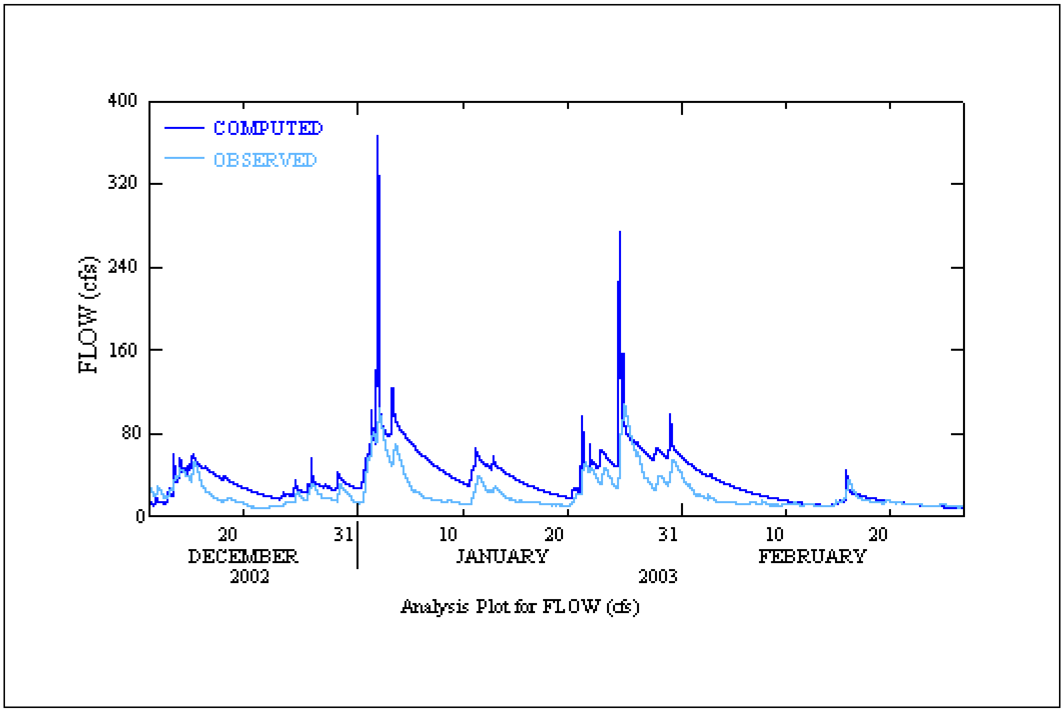


Figure I.11.E.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

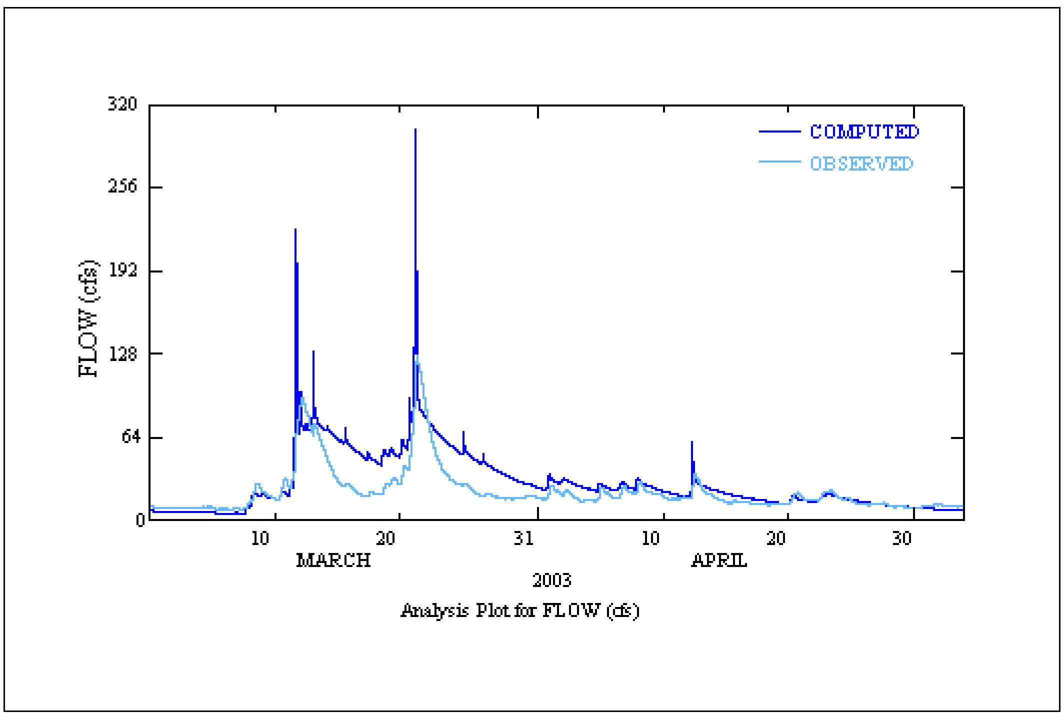


Figure I.11.F.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

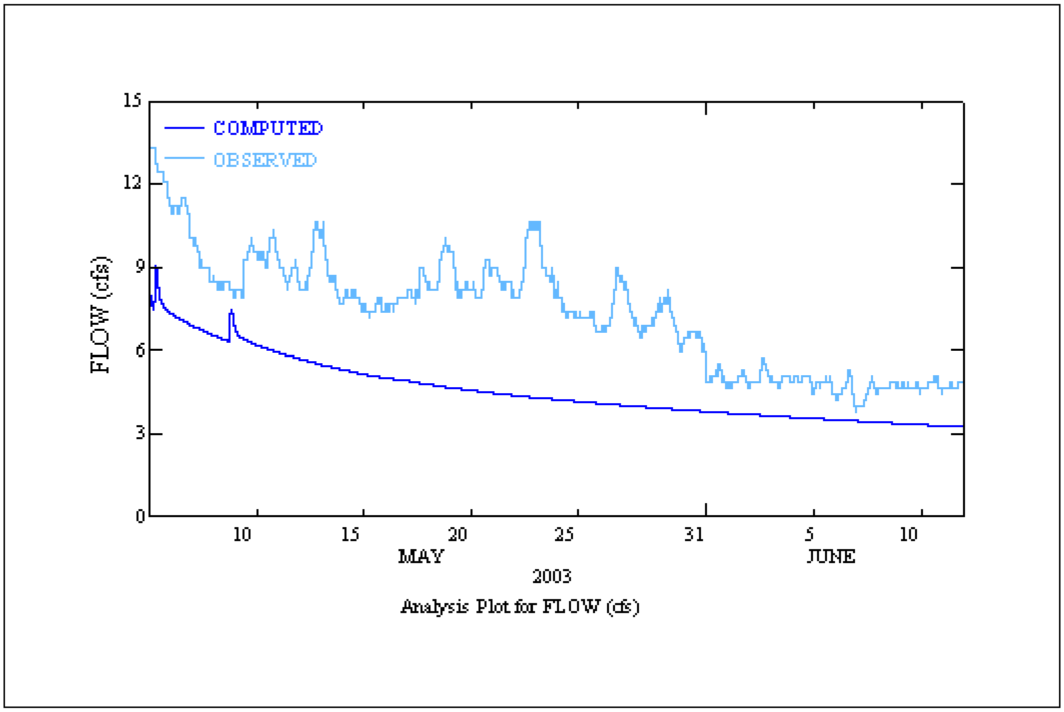


Figure I.11.G.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

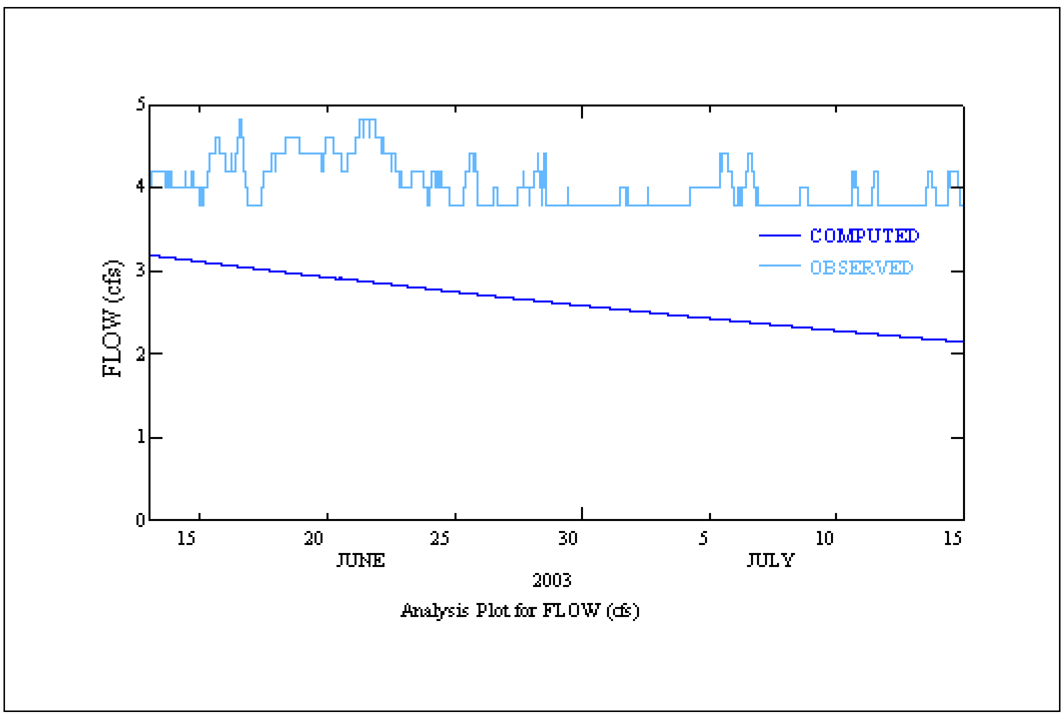


Figure I.11.H.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

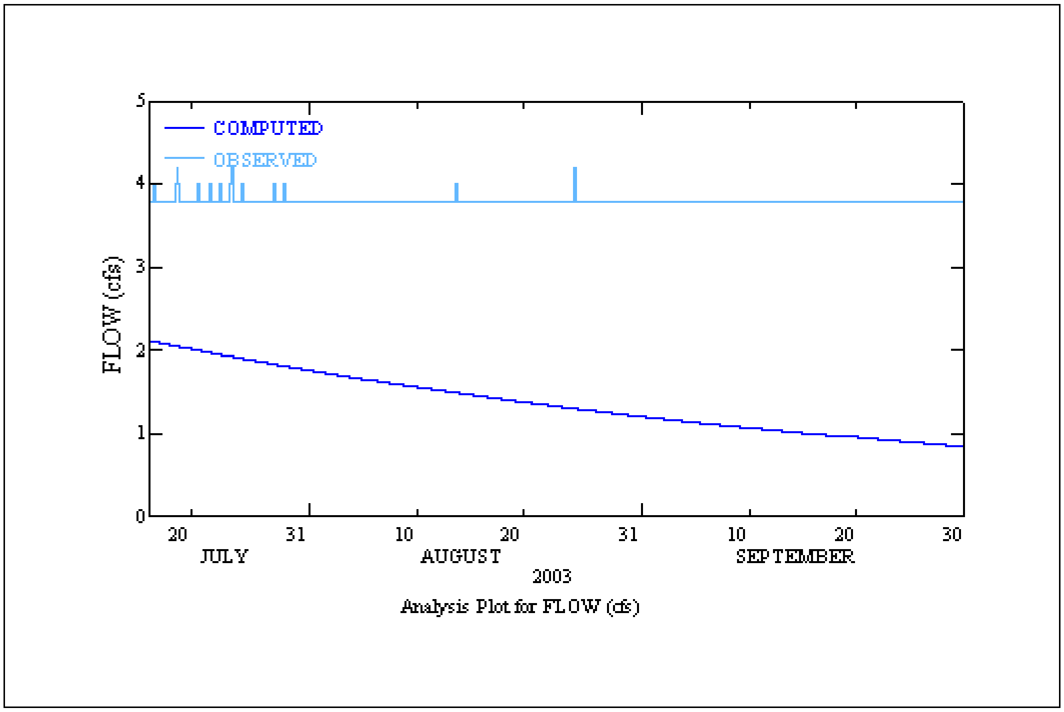


Figure I.11.I.1. Final parameter estimation results for the drainage area above the Blackjack Creek streamflow gaging, comparing simulated and observed fifteen minute flows.

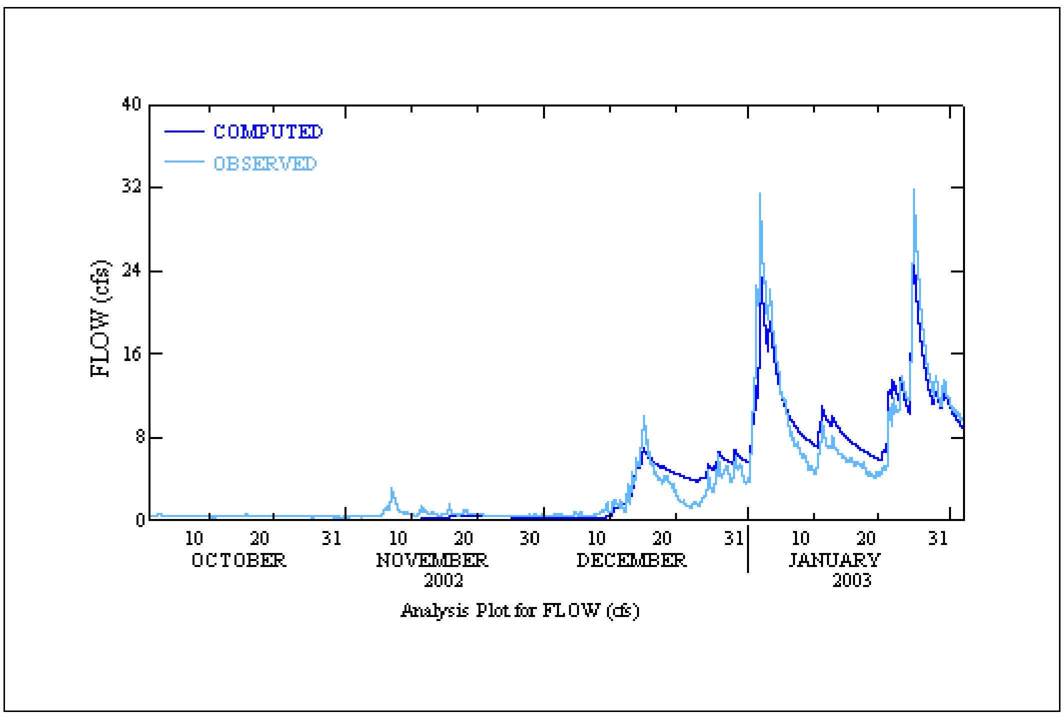


Figure I.13.A.1. Final parameter estimation results for the drainage area above the Heins Creek streamflow gaging, comparing simulated and observed daily flows.

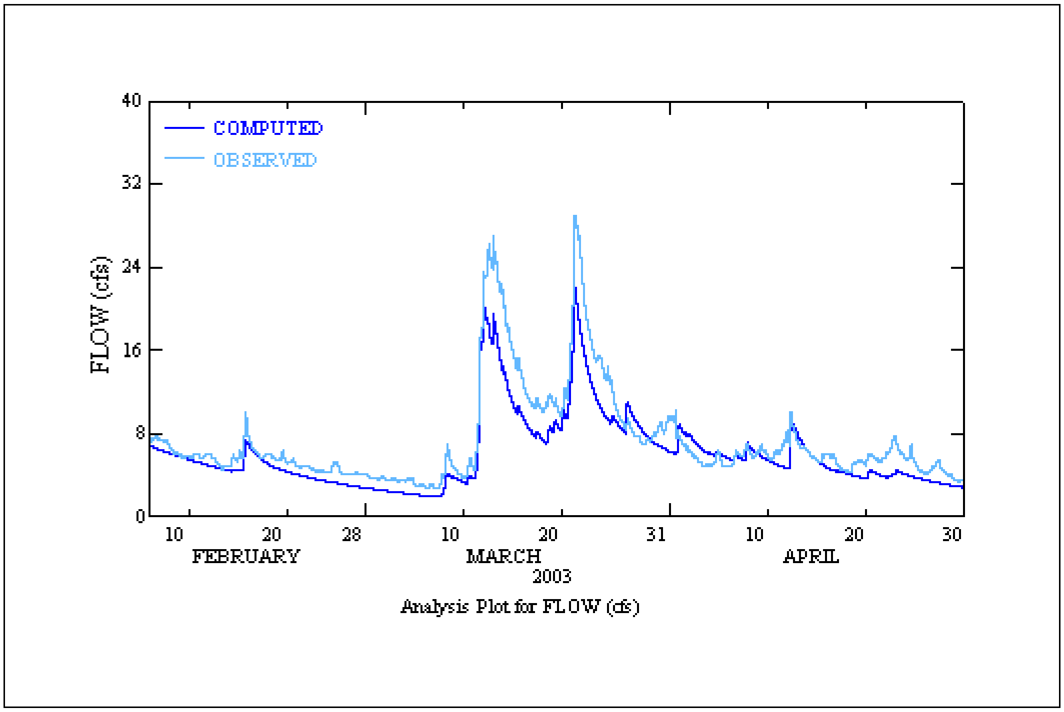


Figure I.13.B.1. Final parameter estimation results for the drainage area above the Heins Creek streamflow gaging, comparing simulated and observed daily flows.

APPENDIX J

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Kitsap Ck at lake outlet

  START       2000/10/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 1 below - da above kitsap creek at lake outlet
gaging station
      PERLND       1
      PERLND       2
      PERLND       3
      PERLND       4
      PERLND       5
      PERLND       6
      PERLND       7
      PERLND       8
      PERLND       9
      PERLND      10
      PERLND      11

      IMPLND      11
      IMPLND      12
      IMPLND      13
      IMPLND      14

*** perlnds & implnds for ZONE 15 above - da above gorst creek gaging station

      RCHRES      12
      RCHRES      27
      RCHRES       1
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                               t-series Engl Metr***
                                          in  out         ***
    1     Med. Dens. Res.                  1    1   90    0
    2     High Dens. Res.                  1    1   90    0
    3     Comm./Ind.                       1    1   90    0
    4     Acrgs/Rural Dev.                 1    1   90    0
    5     Herb. RL                         1    1   90    0
    6     Shrub & Brush RL                 1    1   90    0
    7     Deciduous Forest                 1    1   90    0
    8     Conif. Forest                    1    1   90    0
    9     Mixed Forest                     1    1   90    0
   10     Beaches                          1    1   90    0
   11     other barren lnd                 1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
    1    4    0    1    1    0    0    0    0    0    0
    5    7    0    1    1    1    0    0    0    0    1
    8   11    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)              (1/in)
(1/day)
    1            0.0  ~1~  8.0      0.15     429.0  0.043218       0.0
0.925
    2    3       0.0  ~2~  8.0      0.15     429.0  0.043218       0.0
0.925
    4   11       0.0  ~3~  8.0      0.15     429.0  0.043218       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
    1    6 ~46~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
    7    9 ~47~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   10   11 ~48~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
```

```
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                            ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
    1      ~91~  0.0       0.8       0.1       1.0       0.7       0.6
    2    3 ~92~  0.0       0.8       0.1       1.0       0.7       0.6
    4    6 ~93~  0.0       0.8       0.1       1.0       0.7       0.6
    7    9 ~94~  0.0       0.8       0.1       1.0       0.7       0.6
   10   11 ~95~  0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
    5    6 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
    7      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
    5    6  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
    7       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   11   14    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   11   14    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
```

```
*** <ILS >                         t-series Engl Metr
*** x -  x                          in  out
   11     MED. DENS. RES.            1    1   90    0
   12     HIG DENS. RES.             1    1   90    0
   13     COMM./IND.                 1    1   90    0
   14     LOW DENS. RES.             1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   11   14    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   11   14     100.0     .0338       0.1     0.055 ~166~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   11   14     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                           in  out               ***
    1                                 1         1    1   90    1    0
    2  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN      DELTH      STCOR         KS       DB50***
    1              1     1.268       0.00        0.0        0.5      0.01
   12             12     1.268       0.00        0.0        0.5      0.01
   27             27     0.783       0.00        0.0        0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1         4557.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
    2  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     1
   13    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
    15.129   223.563  3382.3000.000E+000
    18.513   246.133  4556.5890.000E+000
    18.550   246.233  4565.000    0.3298
    18.600   246.333  4576.000    1.1890
    18.750   246.433  4609.000    5.3460
    19.000   246.533  4666.000   15.7460
    19.250   246.633  4721.000   29.3150
    19.500   246.733  4777.000   45.4320
    19.750   246.833  4833.000   63.7440
    25.000   246.933  6007.000  765.5050
    27.500   247.033  6566.000 1248.2580
    30.000   247.133  7125.000 1803.8160
  END FTABLE 1
  FTABLE     12
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.741     0.0078.865E-003
     0.050     0.752     0.0371.303E-001
     0.100     0.767     0.0754.115E-001
     0.250     0.812     0.1941.890E+000
     0.500     0.885     0.4065.995E+000
     0.750     0.959     0.6361.184E+001
     1.000     1.033     0.8851.927E+001
     1.250     1.107     1.1532.824E+001
```

```
     1.500     1.180     1.4393.874E+001
     1.750     1.254     1.7435.078E+001
     2.000     1.328     2.0666.439E+001
     2.250     1.402     2.4077.959E+001
     2.500     1.475     2.7679.642E+001
     3.000     1.623     3.5411.351E+002
     4.000     1.918     5.3122.340E+002
     5.000     2.213     7.3773.636E+002
    10.000     3.689    22.1321.569E+003
    50.000    15.492       4067.450E+004
 10000.000  2951.686  147621198.905E+010
  END FTABLE 12
  FTABLE     27
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.464     0.0051.771E-002
     0.050     0.471     0.0232.602E-001
     0.100     0.481     0.0478.220E-001
     0.250     0.508     0.1213.776E+000
     0.500     0.554     0.2541.198E+001
     0.750     0.601     0.3992.365E+001
     1.000     0.647     0.5543.849E+001
     1.250     0.693     0.7225.641E+001
     1.500     0.739     0.9017.739E+001
     1.750     0.786     1.0921.014E+002
     2.000     0.832     1.2941.286E+002
     2.250     0.878     1.5081.590E+002
     2.500     0.924     1.7331.926E+002
     3.000     1.017     2.2182.700E+002
     4.000     1.201     3.3274.674E+002
     5.000     1.386     4.6217.264E+002
    10.000     2.310    13.8623.135E+003
    50.000     9.704       2541.488E+005
 10000.000  1848.759   92461051.779E+011
  END FTABLE 27
END FTABLES

SCHEMATIC
<-Volume->                  <--Area-->       <-Volume->  <ML->  ***
<Name>   x                  <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 12 and mapping equal to
12
PERLND   1                   $r12p1  $       RCHRES  12      1
PERLND   2                   $r12p2  $       RCHRES  12      1
PERLND   3                   $r12p3  $       RCHRES  12      1
PERLND   4                   $r12p4  $       RCHRES  12      1
PERLND   5                     54.0359       RCHRES  12      1
PERLND   6                     11.8343       RCHRES  12      1
PERLND   7                    278.4411       RCHRES  12      1
PERLND   8                    278.2178       RCHRES  12      1
PERLND   9                     36.3961       RCHRES  12      1
PERLND  10                      0.0000       RCHRES  12      1
PERLND  11                      0.0000       RCHRES  12      1
IMPLND  11                   $r12i1  $       RCHRES  12      2
IMPLND  12                   $r12i2  $       RCHRES  12      2
```

```
IMPLND  13                 $r12i3  $       RCHRES  12       2
IMPLND  14                 $r12i4  $       RCHRES  12       2
RCHRES  12                                 RCHRES  27       3
*** statements above are for basin with id equal to 12 and mapping equal to
12

*** statements below are for basin with id equal to 27 and mapping equal to
27
PERLND   1                 $r27p1  $       RCHRES  27       1
PERLND   2                 $r27p2  $       RCHRES  27       1
PERLND   3                 $r27p3  $       RCHRES  27       1
PERLND   4                 $r27p4  $       RCHRES  27       1
PERLND   5                  126.0979       RCHRES  27       1
PERLND   6                    8.4510       RCHRES  27       1
PERLND   7                  175.6919       RCHRES  27       1
PERLND   8                  132.1025       RCHRES  27       1
PERLND   9                   15.5676       RCHRES  27       1
PERLND  10                    0.0000       RCHRES  27       1
PERLND  11                    0.0000       RCHRES  27       1
IMPLND  11                 $r27i1  $       RCHRES  27       2
IMPLND  12                 $r27i2  $       RCHRES  27       2
IMPLND  13                 $r27i3  $       RCHRES  27       2
IMPLND  14                 $r27i4  $       RCHRES  27       2
RCHRES  27                                 RCHRES   1       3
*** statements above are for basin with id equal to 27 and mapping equal to
27
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
```

```
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 1 below
WDM   9854 PREC                     0.50     PERLND   1  11 EXTNL  PREC
WDM   1160 PREC                     0.50     PERLND   1  11 EXTNL  PREC
WDM    144 PEVT                     1.00     PERLND   1  11 EXTNL  PETINP

WDM   9854 PREC                     0.50     IMPLND  11  14 EXTNL  PREC
WDM   1160 PREC                     0.50     IMPLND  11  14 EXTNL  PREC
WDM    144 PEVT                     1.00     IMPLND  11  14 EXTNL  PETINP

WDM   9854 PREC                     0.50     RCHRES   1     EXTNL  PREC
WDM   1160 PREC                     0.50     RCHRES   1     EXTNL  PREC
WDM    144 PEVT                     1.00     RCHRES   1     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** kitsap lake
RCHRES   1 HYDR   VOL                        WDM2     1 VOL      ENGL AGGR REPL

*** kitsap creek at lake outlet
RCHRES   1 HYDR   RO                         WDM2    27 FLOW     ENGL AGGR REPL
RCHRES   1 HYDR   RO                         WDM2  1027 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.1.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station.

```
ptf $

1  7  FOREST   LZSN                 INFILT                       LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn1          $    $infilt1        $ $         lsur1$$
slsur1$       0.$         agwrc1b$
2  7  FOREST   LZSN                 INFILT                       LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn1          $    $infilt1        $ $         lsur1$$
slsur1$       0.$         agwrc1a$
3  7  FOREST   LZSN                 INFILT                       LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn1          $    $infilt1        $ $         lsur1$$
slsur1$       0.$         agwrc1b$

46   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr1    $
0.0       0.00
47   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr1    $ $
basetp1       $ 0.00
48   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr1    $
0.0       0.00

91 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC1b$  $        UZSN1b$ $       NSUR1b$ $       INTFW1b$ $
IRC1b$  $     LZETP1b$
92 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC1b$  $        UZSN1a$ $       NSUR1a$ $       INTFW1a$ $
IRC1a$  $     LZETP1b$
93 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC1b$  $        UZSN1b$ $       NSUR1b$ $       INTFW1b$ $
IRC1b$  $     LZETP1b$
94 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC1a$  $        UZSN1b$ $       NSUR1c$ $       INTFW1b$ $
IRC1b$  $     LZETP1a$
95 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC1b$  $        UZSN1b$ $       NSUR1b$ $       INTFW1b$ $
IRC1b$  $     LZETP1b$

166 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR1$ $      ISLSUR1$ $     INSUR1$ $       RETSC1$
```

File J.1.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Kitsap Creek at Lake Outlet streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Wildcat Ck at lake outlet

  START       2000/10/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 2 below - da above wildcat creek at lake
outlet gaging station
      PERLND      12
      PERLND      13
      PERLND      14
      PERLND      15
      PERLND      16
      PERLND      17
      PERLND      18
      PERLND      19
      PERLND      20
      PERLND      21
      PERLND      22

      IMPLND      21
      IMPLND      22
      IMPLND      23
      IMPLND      24

      RCHRES       7
      RCHRES       1
      RCHRES     201
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
```

```
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                            t-series Engl Metr***
                                       in  out         ***
   12     Med. Dens. Res.               1    1   90    0
   13     High Dens. Res.               1    1   90    0
   14     Comm./Ind.                    1    1   90    0
   15     Acrgs/Rural Dev.              1    1   90    0
   16     Herb. RL                      1    1   90    0
   17     Shrub & Brush RL              1    1   90    0
   18     Deciduous Forest              1    1   90    0
   19     Conif. Forest                 1    1   90    0
   20     Mixed Forest                  1    1   90    0
   21     Beaches                       1    1   90    0
   22     other barren lnd              1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   12   15    0    1    1    0    0    0    0    0    0
   16   18    0    1    1    1    0    0    0    0    1
   19   22    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)              (1/in)
(1/day)
   12           0.0  ~4~  8.0      0.15     427.0  0.043950       0.0
0.925
   13   14      0.0  ~5~  8.0      0.15     427.0  0.043950       0.0
0.925
   15   22      0.0  ~6~  8.0      0.15     427.0  0.043950       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   12   17 ~49~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   18   20 ~50~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   21   22 ~51~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                            ***
```

```
*** x -  x      CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   12       ~96~  0.0        0.8       0.1       1.0       0.7       0.6
   13   14 ~97~  0.0        0.8       0.1       1.0       0.7       0.6
   15   17 ~98~  0.0        0.8       0.1       1.0       0.7       0.6
   18   20 ~99~  0.0        0.8       0.1       1.0       0.7       0.6
   21   22 ~100~ 0.0        0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
   16   17 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   18      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   16   17  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   18       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                                ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >             Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   21   24    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   21   24    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
   21     MED. DENS. RES.              1    1   90    0
   22     HIG DENS. RES.               1    1   90    0
```

```
   23     COMM./IND.                   1    1   90    0
   24     LOW DENS. RES.               1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   21   24    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   21   24     100.0     .0212       0.1     0.055 ~167~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   21   24     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  201  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  201  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                          in  out                ***
    1                                1         1    1   90    1    0
    7  201                           1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  201  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
```

```
    1              1     0.908      0.00       0.0       0.5      0.01
    7              7     1.807      0.00       0.0       0.5      0.01
  201             18     0.244      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1        1948.0        4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
    7  201      0.0        4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE      1
   14    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     8.828    71.333     629.70.000E+000
    15.594    93.230    1454.00.000E+000
    18.677   104.280    1947.70.000E+000
    18.700   104.380    1950.1     0.162
    18.750   104.480    1955.3     0.914
    18.850   104.580    1965.8     3.333
    18.950   104.680    1976.2     6.609
    19.000   104.780    1981.4     8.505
    19.100   104.880    1991.8    12.750
    19.250   104.980    2007.5    20.100
    20.000   105.080    2085.7    70.500
    25.000   105.180    2607.1   737.000
    50.000   105.580    5214.0  8122.000
  END FTABLE  1

  FTABLE      7
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.769     0.0181.601E-002
     0.050     1.798     0.0892.352E-001
     0.100     1.833     0.1807.430E-001
     0.250     1.939     0.4633.413E+000
     0.500     2.115     0.9691.083E+001
     0.750     2.291     1.5202.137E+001
     1.000     2.467     2.1153.479E+001
     1.250     2.644     2.7545.099E+001
     1.500     2.820     3.4376.995E+001
     1.750     2.996     4.1649.170E+001
```

```
     2.000     3.172     4.9351.163E+002
     2.250     3.349     5.7501.437E+002
     2.500     3.525     6.6091.741E+002
     3.000     3.877     8.4602.440E+002
     4.000     4.582    12.6904.224E+002
     5.000     5.287    17.6246.565E+002
    10.000     8.812    52.8732.833E+003
    50.000    37.011       9691.345E+005
  10000.000  7051.501  352663191.608E+011
  END FTABLE  7
  FTABLE     18
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.189     0.0021.728E-002
     0.050     0.192     0.0102.539E-001
     0.100     0.196     0.0198.021E-001
     0.250     0.208     0.0503.684E+000
     0.500     0.226     0.1041.169E+001
     0.750     0.245     0.1632.308E+001
     1.000     0.264     0.2263.756E+001
     1.250     0.283     0.2955.505E+001
     1.500     0.302     0.3687.551E+001
     1.750     0.321     0.4469.899E+001
     2.000     0.340     0.5281.255E+002
     2.250     0.358     0.6161.551E+002
     2.500     0.377     0.7081.880E+002
     3.000     0.415     0.9062.634E+002
     4.000     0.491     1.3584.560E+002
     5.000     0.566     1.8877.088E+002
    10.000     0.943     5.6603.059E+003
    50.000     3.962       1041.452E+005
  10000.000   754.872   37753051.736E+011
  END FTABLE 18
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 7 and mapping equal to 7
PERLND  12                 $r7p1   $       RCHRES   7      1
PERLND  13                 $r7p2   $       RCHRES   7      1
***PERLND  14                 $r7p3   $       RCHRES   7      1
PERLND  15                 $r7p4   $       RCHRES   7      1
PERLND  16                  184.3653       RCHRES   7      1
PERLND  17                   19.5503       RCHRES   7      1
PERLND  18                  428.5549       RCHRES   7      1
PERLND  19                  424.8037       RCHRES   7      1
PERLND  20                  139.7744       RCHRES   7      1
PERLND  21                    0.0000       RCHRES   7      1
PERLND  22                   39.8342       RCHRES   7      1
IMPLND  21                 $r7i1   $       RCHRES   7      2
IMPLND  22                 $r7i2   $       RCHRES   7      2
***IMPLND  23                 $r7i3   $       RCHRES   7      2
IMPLND  24                 $r7i4   $       RCHRES   7      2
RCHRES   7                                 RCHRES   1      3
```

```
*** statements above are for basin with id equal to 7 and mapping equal to 7

RCHRES   1                                 RCHRES 201      3

*** statements below are for basin 201
PERLND  12                $r201p1 $        RCHRES 201      1
PERLND  13                   1.2921        RCHRES 201      1
***PERLND  14                $r201p3 $        RCHRES   7      1
***PERLND  15                $r201p4 $        RCHRES 201      1
PERLND  16                   0.0000        RCHRES 201      1
PERLND  17                   0.9096        RCHRES 201      1
PERLND  18                   0.0000        RCHRES 201      1
PERLND  19                  37.1911        RCHRES 201      1
PERLND  20                   0.0000        RCHRES 201      1
PERLND  21                   0.0000        RCHRES 201      1
PERLND  22                   0.0000        RCHRES 201      1
IMPLND  21                $r201i1 $        RCHRES 201      2
***IMPLND  22                $r201i2 $        RCHRES 201      2
***IMPLND  23                $r201i3   $        RCHRES   7      2
***IMPLND  24                $r201i4 $        RCHRES 201      2
*** statements above are for basin 201

END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
```

```
*** Zone 2 below
WDM   1163 PREC                    0.50     PERLND  12  22 EXTNL  PREC
WDM   1160 PREC                    0.50     PERLND  12  22 EXTNL  PREC
WDM    144 PEVT                    1.00     PERLND  12  22 EXTNL  PETINP

WDM   1163 PREC                    0.50     IMPLND  21  24 EXTNL  PREC
WDM   1160 PREC                    0.50     IMPLND  21  24 EXTNL  PREC
WDM    144 PEVT                    1.00     IMPLND  21  24 EXTNL  PETINP

WDM   1163 PREC                    0.50     RCHRES   1     EXTNL  PREC
WDM   1160 PREC                    0.50     RCHRES   1     EXTNL  PREC
WDM    144 PEVT                    1.00     RCHRES   1     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** wildcat creek at lake outlet
RCHRES   1 HYDR   VOL                       WDM2     1 VOL      ENGL AGGR REPL

*** wildcat creek at lake outlet
RCHRES 201 HYDR   RO                        WDM2   201 FLOW     ENGL AGGR REPL
RCHRES 201 HYDR   RO                        WDM2  1201 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.2.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station.

```
ptf $

4  7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn2          $    $infilt2        $ $         lsur2$$
slsur2$        0.$         agwrc2b$
5  7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn2          $    $infilt2        $ $         lsur2$$
slsur2$        0.$         agwrc2a$
6  7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn2          $    $infilt2        $ $         lsur2$$
slsur2$        0.$         agwrc2b$

49   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr2    $
0.0       0.00
50   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr2    $ $
basetp2       $ 0.00
51   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr2    $
0.0       0.00

96 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2b$ $       NSUR2b$ $       INTFW2b$ $
IRC2b$  $     LZETP2b$
97 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2a$ $       NSUR2a$ $       INTFW2a$ $
IRC2a$  $     LZETP2b$
98 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2b$ $       NSUR2b$ $       INTFW2b$ $
IRC2b$  $     LZETP2b$
99 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2a$  $        UZSN2b$ $       NSUR2c$ $       INTFW2b$ $
IRC2b$  $     LZETP2a$
100 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2b$ $       NSUR2b$ $       INTFW2b$ $
IRC2b$  $     LZETP2b$

167 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR2$ $      ISLSUR2$ $     INSUR2$ $       RETSC2$
```

File J.2.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Wildcat Creek at Lake Outlet streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Chico Trib. at Taylor Road

  START       2000/10/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 2 below - da above wildcat creek at lake
outlet gaging station
      PERLND      12
      PERLND      13
      PERLND      14
      PERLND      15
      PERLND      16
      PERLND      17
      PERLND      18
      PERLND      19
      PERLND      20
      PERLND      21
      PERLND      22

      IMPLND      21
      IMPLND      22
      IMPLND      23
      IMPLND      24

*** perlnds & implnds for ZONE 3 below - da above chico trib. at taylor road
gaging station
*** and below wildcat creek at lake outlet gaging station
      PERLND      23
      PERLND      24
      PERLND      25
      PERLND      26
      PERLND      27
      PERLND      28
      PERLND      29
      PERLND      30
      PERLND      31
      PERLND      32
      PERLND      33

      IMPLND      31
      IMPLND      32
      IMPLND      33
      IMPLND      34
```

```
      RCHRES       7
      RCHRES       1
      RCHRES     201

      RCHRES      26
      RCHRES       6
      RCHRES      28
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                              ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                                t-series Engl Metr***
                                           in  out          ***
   12     Med. Dens. Res.                   1    1   90    0
   13     High Dens. Res.                   1    1   90    0
   14     Comm./Ind.                        1    1   90    0
   15     Acrgs/Rural Dev.                  1    1   90    0
   16     Herb. RL                          1    1   90    0
   17     Shrub & Brush RL                  1    1   90    0
   18     Deciduous Forest                  1    1   90    0
   19     Conif. Forest                     1    1   90    0
   20     Mixed Forest                      1    1   90    0
   21     Beaches                           1    1   90    0
   22     other barren lnd                  1    1   90    0

   23     Med. Dens. Res.                   1    1   90    0
   24     High Dens. Res.                   1    1   90    0
   25     Comm./Ind.                        1    1   90    0
   26     Acrgs/Rural Dev.                  1    1   90    0
   27     Herb. RL                          1    1   90    0
   28     Shrub & Brush RL                  1    1   90    0
   29     Deciduous Forest                  1    1   90    0
   30     Conif. Forest                     1    1   90    0
   31     Mixed Forest                      1    1   90    0
   32     Beaches                           1    1   90    0
   33     other barren lnd                  1    1   90    0
  END GEN-INFO
```

```
  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   12   15    0    1    1    0    0    0    0    0    0
   16   18    0    1    1    1    0    0    0    0    1
   19   22    0    1    1    0    0    0    0    0    0

   23   26    0    1    1    0    0    0    0    0    0
   27   29    0    1    1    1    0    0    0    0    1
   30   33    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
   12            0.0  ~4~  8.0      0.15     300.0  0.075000       0.0
0.925
   13   14       0.0  ~5~  8.0      0.15     300.0  0.075000       0.0
0.925
   15   22       0.0  ~6~  8.0      0.15     300.0  0.075000       0.0
0.925

   23            0.0  ~7~  8.0      0.15     300.0  0.075000       0.0
0.925
   24   25       0.0  ~8~  8.0      0.15     300.0  0.075000       0.0
0.925
   26   33       0.0  ~9~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   12   17 ~49~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   18   20 ~50~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   21   22 ~51~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0

   23   28 ~52~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   29   31 ~53~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   32   33 ~54~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                               ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   12      ~96~  0.0       0.8       0.1       1.0       0.7       0.6
   13   14 ~97~  0.0       0.8       0.1       1.0       0.7       0.6
   15   17 ~98~  0.0       0.8       0.1       1.0       0.7       0.6
```

```
   18   20 ~99~  0.0       0.8       0.1       1.0       0.7       0.6
   21   22 ~100~ 0.0       0.8       0.1       1.0       0.7       0.6

   23      ~101~ 0.0       0.8       0.1       1.0       0.7       0.6
   24   25 ~102~ 0.0       0.8       0.1       1.0       0.7       0.6
   26   28 ~103~ 0.0       0.8       0.1       1.0       0.7       0.6
   29   31 ~104~ 0.0       0.8       0.1       1.0       0.7       0.6
   32   33 ~105~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
   16   17 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   18      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06

   27   28 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   29      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   16   17  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   18       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2

   27   28  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   29       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   21   24    0    0    1    0    0    0
   31   34    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
```

```
   21   24    0    0    6    0    0    0    0    0
   31   34    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name            Unit-systems   Printer
*** <ILS >                          t-series Engl Metr
*** x -  x                           in  out
   21      MED. DENS. RES.            1    1   90    0
   22      HIG DENS. RES.             1    1   90    0
   23      COMM./IND.                 1    1   90    0
   24      LOW DENS. RES.             1    1   90    0

   31      MED. DENS. RES.            1    1   90    0
   32      HIG DENS. RES.             1    1   90    0
   33      COMM./IND.                 1    1   90    0
   34      LOW DENS. RES.             1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   21   24    0    1    0    0    0
   31   34    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   21   24     150.0     .0054       0.1     0.055 ~167~
   31   34     150.0     .0054       0.1     0.055 ~168~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   21   24     0.000     0.000
   31   34     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  201  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  201  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                         user t-series  Engl Metr LKFG***
```

```
                                           in  out              ***
    1                                   1         1    1   90    1    0
    7  201                              1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  201  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
    1             1     0.908      0.00        0.0       0.5      0.01
    6             6     4.082      0.00        0.0       0.5      0.01
    7             7     1.807      0.00        0.0       0.5      0.01
   26            26     2.498      0.00        0.0       0.5      0.01
   28            28     1.379      0.00        0.0       0.5      0.01
  201            18     0.244      0.00        0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1         1948.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
    7  201       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE      1
   14    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     8.828    71.333     629.70.000E+000
    15.594    93.230    1454.00.000E+000
    18.677   104.280    1947.70.000E+000
    18.700   104.380    1950.1     0.162
    18.750   104.480    1955.3     0.914
    18.850   104.580    1965.8     3.333
    18.950   104.680    1976.2     6.609
    19.000   104.780    1981.4     8.505
    19.100   104.880    1991.8    12.750
```

```
   19.250   104.980    2007.5    20.100
   20.000   105.080    2085.7    70.500
   25.000   105.180    2607.1   737.000
   50.000   105.580    5214.0  8122.000
 END FTABLE  1

 FTABLE      6
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     2.474     0.0251.679E-002
    0.050     2.513     0.1252.468E-001
    0.100     2.563     0.2517.794E-001
    0.250     2.710     0.6473.580E+000
    0.500     2.957     1.3551.136E+001
    0.750     3.203     2.1252.242E+001
    1.000     3.450     2.9573.650E+001
    1.250     3.696     3.8505.349E+001
    1.500     3.942     4.8057.338E+001
    1.750     4.189     5.8219.619E+001
    2.000     4.435     6.8991.220E+002
    2.250     4.682     8.0391.508E+002
    2.500     4.928     9.2401.826E+002
    3.000     5.421    11.8272.560E+002
    4.000     6.406    17.7414.432E+002
    5.000     7.392    24.6406.887E+002
   10.000    12.320    73.9212.972E+003
   50.000    51.744      13551.411E+005
10000.000  9858.541  493050261.687E+011
 END FTABLE  6

 FTABLE      7
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     1.769     0.0181.601E-002
    0.050     1.798     0.0892.352E-001
    0.100     1.833     0.1807.430E-001
    0.250     1.939     0.4633.413E+000
    0.500     2.115     0.9691.083E+001
    0.750     2.291     1.5202.137E+001
    1.000     2.467     2.1153.479E+001
    1.250     2.644     2.7545.099E+001
    1.500     2.820     3.4376.995E+001
    1.750     2.996     4.1649.170E+001
    2.000     3.172     4.9351.163E+002
    2.250     3.349     5.7501.437E+002
    2.500     3.525     6.6091.741E+002
    3.000     3.877     8.4602.440E+002
    4.000     4.582    12.6904.224E+002
    5.000     5.287    17.6246.565E+002
   10.000     8.812    52.8732.833E+003
   50.000    37.011       9691.345E+005
10000.000  7051.501  352663191.608E+011
 END FTABLE  7
```

```
  FTABLE     18
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.189     0.0021.728E-002
     0.050     0.192     0.0102.539E-001
     0.100     0.196     0.0198.021E-001
     0.250     0.208     0.0503.684E+000
     0.500     0.226     0.1041.169E+001
     0.750     0.245     0.1632.308E+001
     1.000     0.264     0.2263.756E+001
     1.250     0.283     0.2955.505E+001
     1.500     0.302     0.3687.551E+001
     1.750     0.321     0.4469.899E+001
     2.000     0.340     0.5281.255E+002
     2.250     0.358     0.6161.551E+002
     2.500     0.377     0.7081.880E+002
     3.000     0.415     0.9062.634E+002
     4.000     0.491     1.3584.560E+002
     5.000     0.566     1.8877.088E+002
    10.000     0.943     5.6603.059E+003
    50.000     3.962       1041.452E+005
 10000.000   754.872   37753051.736E+011
  END FTABLE 18

  FTABLE     26
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.518     0.0151.004E-002
     0.050     1.542     0.0761.475E-001
     0.100     1.572     0.1544.660E-001
     0.250     1.663     0.3972.140E+000
     0.500     1.814     0.8316.789E+000
     0.750     1.965     1.3041.340E+001
     1.000     2.116     1.8142.182E+001
     1.250     2.267     2.3623.198E+001
     1.500     2.419     2.9484.387E+001
     1.750     2.570     3.5715.751E+001
     2.000     2.721     4.2337.291E+001
     2.250     2.872     4.9329.013E+001
     2.500     3.023     5.6691.092E+002
     3.000     3.326     7.2561.530E+002
     4.000     3.930    10.8842.649E+002
     5.000     4.535    15.1164.117E+002
    10.000     7.558    45.3491.777E+003
    50.000    31.744       8318.436E+004
 10000.000  6048.018  302476501.008E+011
  END FTABLE 26

  FTABLE     28
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
```

```
     0.010     0.809     0.0088.669E-003
     0.050     0.822     0.0411.274E-001
     0.100     0.838     0.0824.024E-001
     0.250     0.886     0.2121.848E+000
     0.500     0.967     0.4435.862E+000
     0.750     1.047     0.6951.158E+001
     1.000     1.128     0.9671.884E+001
     1.250     1.208     1.2592.761E+001
     1.500     1.289     1.5713.788E+001
     1.750     1.369     1.9034.966E+001
     2.000     1.450     2.2556.296E+001
     2.250     1.530     2.6287.783E+001
     2.500     1.611     3.0219.429E+001
     3.000     1.772     3.8671.321E+002
     4.000     2.094     5.8002.288E+002
     5.000     2.417     8.0553.555E+002
    10.000     4.028    24.1661.534E+003
    50.000    16.916       4437.285E+004
 10000.000  3222.898  161185168.707E+010
  END FTABLE 28
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 7 and mapping equal to 7
PERLND  12                 66.572017       RCHRES   7      1
PERLND  13                 5.8713820       RCHRES   7      1
***PERLND  14                 .08870000       RCHRES   7      1
PERLND  15                 87.004581       RCHRES   7      1
PERLND  16                  184.3653       RCHRES   7      1
PERLND  17                   19.5503       RCHRES   7      1
PERLND  18                  428.5549       RCHRES   7      1
PERLND  19                  424.8037       RCHRES   7      1
PERLND  20                  139.7744       RCHRES   7      1
PERLND  21                    0.0000       RCHRES   7      1
PERLND  22                   39.8342       RCHRES   7      1
IMPLND  21                 21.761958       RCHRES   7      2
IMPLND  22                 0.0000000       RCHRES   7      2
***IMPLND  23                 .13370000       RCHRES   7      2
IMPLND  24                 9.6671757       RCHRES   7      2
RCHRES   7                                 RCHRES   1      3
*** statements above are for basin with id equal to 7 and mapping equal to 7

RCHRES   1                                 RCHRES 201      3

*** statements below are for basin 201
PERLND  12                 15.589043       RCHRES 201      1
PERLND  13                    1.2921       RCHRES 201      1
***PERLND  14                 0.0000000       RCHRES   7      1
***PERLND  15                 0.0000000       RCHRES 201      1
PERLND  16                    0.0000       RCHRES 201      1
PERLND  17                    0.9096       RCHRES 201      1
PERLND  18                    0.0000       RCHRES 201      1
PERLND  19                   37.1911       RCHRES 201      1
PERLND  20                    0.0000       RCHRES 201      1
PERLND  21                    0.0000       RCHRES 201      1
```

```
PERLND  22                     0.0000       RCHRES 201      1
IMPLND  21                  5.0959566       RCHRES 201      2
***IMPLND  22                  0.0000000       RCHRES 201      2
***IMPLND  23                  0.000000000       RCHRES   7      2
***IMPLND  24                  0.0000000       RCHRES 201      2

RCHRES 201                                  RCHRES  26      3

*** statements above are for basin 201



*** statements below are for basin with id equal to 26 and mapping equal to
26
PERLND  23                  $r26p1  $       RCHRES  26      1
PERLND  24                  $r26p2  $       RCHRES  26      1
***PERLND  25                  $r26p3  $       RCHRES  26      1
PERLND  26                  $r26p4  $       RCHRES  26      1
PERLND  27                   174.4841       RCHRES  26      1
PERLND  28                    50.3058       RCHRES  26      1
PERLND  29                   326.9878       RCHRES  26      1
PERLND  30                  1297.3009       RCHRES  26      1
PERLND  31                   130.9764       RCHRES  26      1
PERLND  32                     0.0000       RCHRES  26      1
PERLND  33                     5.8917       RCHRES  26      1
IMPLND  31                  $r26i1  $       RCHRES  26      2
IMPLND  32                  $r26i2  $       RCHRES  26      2
***IMPLND  33                  $r26i3  $       RCHRES  26      2
IMPLND  34                  $r26i4  $       RCHRES  26      2
RCHRES  26                                  RCHRES  28      3
*** statements above are for basin with id equal to 26 and mapping equal to
26

*** statements below are for basin with id equal to 6 and mapping equal to 6
PERLND  23                  $r6p1   $       RCHRES   6      1
PERLND  24                  $r6p2   $       RCHRES   6      1
PERLND  25                  $r6p3   $       RCHRES   6      1
PERLND  26                  $r6p4   $       RCHRES   6      1
PERLND  27                   254.9831       RCHRES   6      1
PERLND  28                    42.1257       RCHRES   6      1
PERLND  29                   647.2648       RCHRES   6      1
PERLND  30                   740.2088       RCHRES   6      1
PERLND  31                   204.3877       RCHRES   6      1
PERLND  32                     0.0000       RCHRES   6      1
PERLND  33                     6.4637       RCHRES   6      1
IMPLND  31                  $r6i1   $       RCHRES   6      2
IMPLND  32                  $r6i2   $       RCHRES   6      2
IMPLND  33                  $r6i3   $       RCHRES   6      2
IMPLND  34                  $r6i4   $       RCHRES   6      2
RCHRES   6                                  RCHRES  28      3
*** statements above are for basin with id equal to 6 and mapping equal to 6

*** statements below are for basin with id equal to 28 and mapping equal to
28
PERLND  23                  $r28p1  $       RCHRES  28      1
PERLND  24                  $r28p2  $       RCHRES  28      1
PERLND  25                  $r28p3  $       RCHRES  28      1
```

```
PERLND  26                $r28p4  $       RCHRES  28       1
PERLND  27                   8.7384       RCHRES  28       1
PERLND  28                   2.9128       RCHRES  28       1
PERLND  29                  50.1896       RCHRES  28       1
PERLND  30                  77.3009       RCHRES  28       1
PERLND  31                   7.1699       RCHRES  28       1
PERLND  32                   0.0000       RCHRES  28       1
PERLND  33                   0.0000       RCHRES  28       1
IMPLND  31                $r28i1  $       RCHRES  28       2
IMPLND  32                $r28i2  $       RCHRES  28       2
IMPLND  33                $r28i3  $       RCHRES  28       2
IMPLND  34                $r28i4  $       RCHRES  28       2
***RCHRES  28                                RCHRES  29       3
*** statements above are for basin with id equal to 28 and mapping equal to
28

END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 2 below
WDM   1160 PREC                   0.50     PERLND  12  22 EXTNL  PREC
WDM   1163 PREC                   0.50     PERLND  12  22 EXTNL  PREC
WDM    144 PEVT                   1.00     PERLND  12  22 EXTNL  PETINP

WDM   1160 PREC                   0.50     IMPLND  21  24 EXTNL  PREC
```

```
WDM   1163 PREC                   0.50     IMPLND  21  24 EXTNL  PREC
WDM    144 PEVT                   1.00     IMPLND  21  24 EXTNL  PETINP

WDM   1160 PREC                   0.50     RCHRES   1     EXTNL  PREC
WDM   1163 PREC                   0.50     RCHRES   1     EXTNL  PREC
WDM    144 PEVT                   1.00     RCHRES   1     EXTNL  POTEV

*** Zone 3 below
WDM   1160 PREC                   0.50     PERLND  23  33 EXTNL  PREC
WDM   1163 PREC                   0.50     PERLND  23  33 EXTNL  PREC
WDM    144 PEVT                   1.00     PERLND  23  33 EXTNL  PETINP

WDM   1160 PREC                   0.50     IMPLND  31  34 EXTNL  PREC
WDM   1163 PREC                   0.50     IMPLND  31  34 EXTNL  PREC
WDM    144 PEVT                   1.00     IMPLND  31  34 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** wildcat creek at lake outlet
RCHRES   1 HYDR   VOL                      WDM2     1 VOL      ENGL AGGR REPL

*** wildcat creek at lake outlet
RCHRES 201 HYDR   RO                       WDM2   201 FLOW     ENGL AGGR REPL
RCHRES 201 HYDR   RO                       WDM2  1201 FLOW     ENGL AGGR REPL

*** chico trib. at taylor road
RCHRES  28 HYDR   RO                       WDM2    28 FLOW     ENGL AGGR REPL
RCHRES  28 HYDR   RO                       WDM2  1028 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.3.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Chico Tributary at Taylor Road streamflow gaging station.

```
ptf $

4  7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn2           $    $infilt2       $ $          lsur2$$
slsur2$        0.$         agwrc2b$
5  7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn2           $    $infilt2       $ $          lsur2$$
slsur2$        0.$         agwrc2a$
6  7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn2           $    $infilt2       $ $          lsur2$$
slsur2$        0.$         agwrc2b$

7  7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn3           $    $infilt3       $ $          lsur3$$
slsur3$        0.$         agwrc3b$
8  7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn3           $    $infilt3       $ $          lsur3$$
slsur3$        0.$         agwrc3a$
9  7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn3           $    $infilt3       $ $          lsur3$$
slsur3$        0.$         agwrc3b$

49   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP      AGWETP
        40.0          35.0       2.0               2.0 $ deepfr2    $
0.0       0.00
50   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP      AGWETP
        40.0          35.0       2.0               2.0 $ deepfr2    $ $
basetp2       $ 0.00
51   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP      AGWETP
        40.0          35.0       2.0               2.0 $ deepfr2    $
0.0       0.00

52   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP      AGWETP
        40.0          35.0       2.0               2.0 $ deepfr3    $
0.0       0.00
53   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP      AGWETP
        40.0          35.0       2.0               2.0 $ deepfr3    $ $
basetp3       $ 0.00
54   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP      AGWETP
        40.0          35.0       2.0               2.0 $ deepfr3    $
0.0       0.00

96 6  CEPSC                    UZSN              NSUR             INTFW
IRC            LZETP
```

```
      $        CEPSC2b$  $        UZSN2b$ $        NSUR2b$ $       INTFW2b$ $
IRC2b$  $     LZETP2b$
97 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2a$ $        NSUR2a$ $       INTFW2a$ $
IRC2a$  $     LZETP2b$
98 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2b$ $        NSUR2b$ $       INTFW2b$ $
IRC2b$  $     LZETP2b$
99 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2a$  $        UZSN2b$ $        NSUR2c$ $       INTFW2b$ $
IRC2b$  $     LZETP2a$
100 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC2b$  $        UZSN2b$ $        NSUR2b$ $       INTFW2b$ $
IRC2b$  $     LZETP2b$

101 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC3b$  $        UZSN3b$ $        NSUR3b$ $       INTFW3b$ $
IRC3b$  $     LZETP3b$
102 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC3b$  $        UZSN3a$ $        NSUR3a$ $       INTFW3a$ $
IRC3a$  $     LZETP3b$
103 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC3b$  $        UZSN3b$ $        NSUR3b$ $       INTFW3b$ $
IRC3b$  $     LZETP3b$
104 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC3a$  $        UZSN3b$ $        NSUR3c$ $       INTFW3b$ $
IRC3b$  $     LZETP3a$
105 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC3b$  $        UZSN3b$ $        NSUR3b$ $       INTFW3b$ $
IRC3b$  $     LZETP3b$

167 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR2$ $      ISLSUR2$ $     INSUR2$ $       RETSC2$

168 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR3$ $      ISLSUR3$ $     INSUR3$ $       RETSC3$
```

File J.3.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Chico Tributary at Taylor Road streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Dickerson Creek

  START       2000/10/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname------------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 4 below - da above dickerson creek gaging
station
      PERLND      34
      PERLND      35
      PERLND      36
      PERLND      37
      PERLND      38
      PERLND      39
      PERLND      40
      PERLND      41
      PERLND      42
      PERLND      43
      PERLND      44

      IMPLND      41
      IMPLND      42
      IMPLND      43
      IMPLND      44

      RCHRES       9
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                             ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0
```

```
  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                               t-series Engl Metr***
                                          in  out          ***
   34     Med. Dens. Res.                  1    1   90    0
   35     High Dens. Res.                  1    1   90    0
   36     Comm./Ind.                       1    1   90    0
   37     Acrgs/Rural Dev.                 1    1   90    0
   38     Herb. RL                         1    1   90    0
   39     Shrub & Brush RL                 1    1   90    0
   40     Deciduous Forest                 1    1   90    0
   41     Conif. Forest                    1    1   90    0
   42     Mixed Forest                     1    1   90    0
   43     Beaches                          1    1   90    0
   44     other barren lnd                 1    1   90    0

  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   34   37    0    1    1    0    0    0    0    0    0
   38   40    0    1    1    1    0    0    0    0    1
   41   44    0    1    1    0    0    0    0    0    0

  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)              (1/in)
(1/day)
   34            0.0 ~10~  8.0      0.15     300.0  0.075000       0.0
0.925
   35   36       0.0 ~11~  8.0      0.15     300.0  0.075000       0.0
0.925
   37   44       0.0 ~12~  8.0      0.15     300.0  0.075000       0.0
0.925

  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   34   39 ~55~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   40   42 ~56~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   43   44 ~57~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0

  END PWAT-PARM3

  PWAT-PARM4
```

```
*** <PLS >                                                            ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   34      ~106~ 0.0       0.8       0.1       1.0       0.7       0.6
   35   36 ~107~ 0.0       0.8       0.1       1.0       0.7       0.6
   37   39 ~108~ 0.0       0.8       0.1       1.0       0.7       0.6
   40   42 ~109~ 0.0       0.8       0.1       1.0       0.7       0.6
   43   44 ~110~ 0.0       0.8       0.1       1.0       0.7       0.6


  END PWAT-PARM4

  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
   38   39 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   40      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   38   39  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   40       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2

  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   41   44    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   41   44    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
```

```
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
   41     MED. DENS. RES.              1    1   90    0
   42     HIG DENS. RES.               1    1   90    0
   43     COMM./IND.                   1    1   90    0
   44     LOW DENS. RES.               1    1   90    0

  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   41   44    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   41   44     150.0     .0054       0.1     0.055 ~169~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   41   44     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                           in  out               ***
    1  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS       DB50***
    9               9     2.908      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE      9
   20   4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.762     0.0181.448E-002
     0.050     1.790     0.0892.128E-001
     0.100     1.825     0.1796.722E-001
     0.250     1.930     0.4613.088E+000
     0.500     2.105     0.9659.794E+000
     0.750     2.281     1.5131.934E+001
     1.000     2.456     2.1053.148E+001
     1.250     2.632     2.7424.613E+001
     1.500     2.807     3.4216.328E+001
     1.750     2.983     4.1458.296E+001
     2.000     3.158     4.9131.052E+002
     2.250     3.334     5.7241.300E+002
     2.500     3.509     6.5791.575E+002
     3.000     3.860     8.4222.208E+002
     4.000     4.562    12.6333.822E+002
     5.000     5.264    17.5455.940E+002
    10.000     8.773    52.6362.563E+003
    50.000    36.845       9651.217E+005
 10000.000  7019.860  351080721.455E+011
  END FTABLE  9
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 9 and mapping equal to 9
PERLND  34                 $ r9p1  $       RCHRES   9      1
PERLND  35                 $ r9p2  $       RCHRES   9      1
PERLND  36                 $ r9p3  $       RCHRES   9      1
PERLND  37                 $ r9p4  $       RCHRES   9      1
```

```
PERLND  38                 253.0157       RCHRES   9       1
PERLND  39                  17.8023       RCHRES   9       1
PERLND  40                 228.0924       RCHRES   9       1
PERLND  41                 865.4159       RCHRES   9       1
PERLND  42                  66.3137       RCHRES   9       1
PERLND  43                   0.0000       RCHRES   9       1
PERLND  44                  20.6952       RCHRES   9       1
IMPLND  41                $ r9i1  $       RCHRES   9       2
IMPLND  42                $ r9i2  $       RCHRES   9       2
IMPLND  43                $ r9i3  $       RCHRES   9       2
IMPLND  44                $ r9i4  $       RCHRES   9       2
RCHRES   9                                RCHRES  29       3
*** statements above are for basin with id equal to 9 and mapping equal to 9
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 4 below
WDM   9854 PREC                   0.34     PERLND  34  44 EXTNL  PREC
WDM   9854 PREC                   0.34     IMPLND  41  44 EXTNL  PREC

WDM   1160 PREC                   0.33     PERLND  34  44 EXTNL  PREC
WDM   1160 PREC                   0.33     IMPLND  41  44 EXTNL  PREC

WDM   1163 PREC                   0.33     PERLND  34  44 EXTNL  PREC
WDM   1163 PREC                   0.33     IMPLND  41  44 EXTNL  PREC
```

```
WDM    144 PEVT                   1.00     PERLND  34  44 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND  41  44 EXTNL  PETINP

***WDM    100 EVAP                   0.80     PERLND  34  44 EXTNL  PETINP
***WDM    100 EVAP                   0.80     IMPLND  41  44 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***
*** dickerson creek
RCHRES   9 HYDR   RO                       WDM2     9 FLOW     ENGL AGGR REPL
RCHRES   9 HYDR   RO                       WDM2  1009 FLOW     ENGL AGGR REPL
END EXT TARGETS
END RUN
```

File J.4.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Dickerson Creek streamflow gaging station.

```
ptf $

10 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn4         $    $infilt4        $ $         lsur4$$
slsur4$        0.$         agwrc4b$
11 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn4         $    $infilt4        $ $         lsur4$$
slsur4$        0.$         agwrc4a$
12 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn4         $    $infilt4        $ $         lsur4$$
slsur4$        0.$         agwrc4b$

55   7  PETMAX        PETMIN    INFEXP             INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0                2.0 $ deepfr4    $
0.0       0.00
56   7  PETMAX        PETMIN    INFEXP             INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0                2.0 $ deepfr4    $ $
basetp4       $ 0.00
57   7  PETMAX        PETMIN    INFEXP             INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0                2.0 $ deepfr4    $
0.0       0.00

106 6  CEPSC                    UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC4b$  $        UZSN4b$ $       NSUR4b$ $       INTFW4b$ $
IRC4b$  $     LZETP4b$
107 6  CEPSC                    UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC4b$  $        UZSN4a$ $       NSUR4a$ $       INTFW4a$ $
IRC4a$  $     LZETP4b$
108 6  CEPSC                    UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC4b$  $        UZSN4b$ $       NSUR4b$ $       INTFW4b$ $
IRC4b$  $     LZETP4b$
109 6  CEPSC                    UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC4a$  $        UZSN4b$ $       NSUR4c$ $       INTFW4b$ $
IRC4b$  $     LZETP4a$
110 6  CEPSC                    UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC4b$  $        UZSN4b$ $       NSUR4b$ $       INTFW4b$ $
IRC4b$  $     LZETP4b$

169 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR4$ $      ISLSUR4$ $     INSUR4$ $       RETSC4$
```

File J.4.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Dickerson Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Strawberry Creek

***  START       2000/1 / 1  0: 0  END    2002/ 9/30 23:45
  START       2001/6 / 1  0: 0  END    2003/ 9/30 23:45
***  START       1997/ 6/ 1  0: 0  END    2002/ 9/30 23:45
***  START       1997/ 6/ 1  0: 0  END    1998/12/31 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 6 below - da above strawberry creek gaging
station
      PERLND      56
      PERLND      57
      PERLND      58
      PERLND      59
      PERLND      60
      PERLND      61
      PERLND      62
      PERLND      63
      PERLND      64
      PERLND      65
      PERLND      66

      IMPLND      61
      IMPLND      62
      IMPLND      63
      IMPLND      64

      RCHRES     107
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
```

```
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                            t-series Engl Metr***
                                       in  out          ***
   56     Med. Dens. Res.               1    1   90    0
   57     High Dens. Res.               1    1   90    0
   58     Comm./Ind.                    1    1   90    0
   59     Acrgs/Rural Dev.              1    1   90    0
   60     Herb. RL                      1    1   90    0
   61     Shrub & Brush RL              1    1   90    0
   62     Deciduous Forest              1    1   90    0
   63     Conif. Forest                 1    1   90    0
   64     Mixed Forest                  1    1   90    0
   65     Beaches                       1    1   90    0
   66     other barren lnd              1    1   90    0

  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   56   59    0    1    1    0    0    0    0    0    0
   60   62    0    1    1    1    0    0    0    0    1
   63   66    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
   56            0.0 ~16~  8.0      0.15     300.0  0.075000       0.0
0.925
   57   58       0.0 ~17~  8.0      0.15     300.0  0.075000       0.0
0.925
   59   66       0.0 ~18~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   56   61 ~61~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   62   64 ~62~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   65   66 ~63~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
```

```
*** <PLS >                                                                 ***
*** x -  x      CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   56       ~116~ 0.0       0.8       0.1       1.0       0.7       0.6
   57   58 ~117~ 0.0       0.8       0.1       1.0       0.7       0.6
   59   61 ~118~ 0.0       0.8       0.1       1.0       0.7       0.6
   62   64 ~119~ 0.0       0.8       0.1       1.0       0.7       0.6
   65   66 ~120~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
   60   61 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   62      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   60   61  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   62       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                                 ***
*** x -  x        FZG      FZGL
    1  165        1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   61   64    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   61   64    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name            Unit-systems   Printer
*** <ILS >                          t-series Engl Metr
*** x -  x                           in  out
   61     MED. DENS. RES.             1    1   90    0
```

```
   62     HIG DENS. RES.              1    1   90    0
   63     COMM./IND.                  1    1   90    0
   64     LOW DENS. RES.              1    1   90    0

  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   61   64    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   61   64     150.0     .0054       0.1     0.055 ~171~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   61   64     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                         user t-series  Engl Metr LKFG***
                                          in  out              ***
    1  175                           1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
```

```
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
  107             107     3.076      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of 
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible 
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4 
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0 
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE    107
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.906     0.0191.194E-002
     0.050     1.936     0.0961.754E-001
     0.100     1.974     0.1945.542E-001
     0.250     2.088     0.4982.546E+000
     0.500     2.278     1.0448.074E+000
     0.750     2.467     1.6371.594E+001
     1.000     2.657     2.2782.595E+001
     1.250     2.847     2.9663.803E+001
     1.500     3.037     3.7015.217E+001
     1.750     3.227     4.4846.840E+001
     2.000     3.416     5.3148.672E+001
     2.250     3.606     6.1921.072E+002
     2.500     3.796     7.1181.299E+002
     3.000     4.176     9.1101.820E+002
     4.000     4.935    13.6663.151E+002
     5.000     5.694    18.9804.897E+002
    10.000     9.490    56.9402.113E+003
    50.000    39.858      10441.003E+005
 10000.000  7593.924  379791121.199E+011
  END FTABLE107
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 290000 and mapping equal
to 107
PERLND  56                 $r107p1 $       RCHRES 107      1
PERLND  57                 $r107p2 $       RCHRES 107      1
PERLND  58                 $r107p3 $       RCHRES 107      1
PERLND  59                 $r107p4 $       RCHRES 107      1
PERLND  60                   71.6111       RCHRES 107      1
PERLND  61                    9.1182       RCHRES 107      1
```

```
PERLND  62                   274.8800       RCHRES 107       1
PERLND  63                   587.3448       RCHRES 107       1
PERLND  64                    16.2348       RCHRES 107       1
PERLND  65                     0.0000       RCHRES 107       1
PERLND  66                     1.1120       RCHRES 107       1
IMPLND  61                  $r107i1 $       RCHRES 107       2
IMPLND  62                  $r107i2 $       RCHRES 107       2
IMPLND  63                  $r107i3 $       RCHRES 107       2
IMPLND  64                  $r107i4 $       RCHRES 107       2
***RCHRES 107                                  RCHRES  97       3
*** statements above are for basin with id equal to 290000 and mapping equal
to 107
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 6 below
WDM   1162 PREC                    1.00     PERLND  56  66 EXTNL  PREC
WDM   1162 PREC                    1.00     IMPLND  61  64 EXTNL  PREC

WDM    144 PEVT                    1.00     PERLND  56  66 EXTNL  PETINP
WDM    144 PEVT                    1.00     IMPLND  61  64 EXTNL  PETINP

***WDM    100 EVAP                    0.80     PERLND  56  66 EXTNL  PETINP
***WDM    100 EVAP                    0.80     IMPLND  61  64 EXTNL  PETINP
```

```
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** strawberry creek
RCHRES 107 HYDR   RO                       WDM2   107 FLOW     ENGL AGGR REPL
RCHRES 107 HYDR   RO                       WDM2  1107 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.6.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Strawberry Creek streamflow gaging station.

```
ptf $

16 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn6         $    $infilt6        $ $         lsur6$$
slsur6$        0.$        agwrc6b$
17 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn6         $    $infilt6        $ $         lsur6$$
slsur6$        0.$        agwrc6a$
18 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn6         $    $infilt6        $ $         lsur6$$
slsur6$        0.$        agwrc6b$

61   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr6    $
0.0       0.00
62   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr6    $ $
basetp6       $ 0.00
63   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr6    $
0.0       0.00

116 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC6b$  $       UZSN6b$ $       NSUR6b$ $       INTFW6b$ $
IRC6b$  $     LZETP6b$
117 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC6b$  $       UZSN6a$ $       NSUR6a$ $       INTFW6a$ $
IRC6a$  $     LZETP6b$
118 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC6b$  $       UZSN6b$ $       NSUR6b$ $       INTFW6b$ $
IRC6b$  $     LZETP6b$
119 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC6a$  $       UZSN6b$ $       NSUR6c$ $       INTFW6b$ $
IRC6b$  $     LZETP6a$
120 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC6b$  $       UZSN6b$ $       NSUR6b$ $       INTFW6b$ $
IRC6b$  $     LZETP6b$

171 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR6$ $      ISLSUR6$ $     INSUR6$ $       RETSC6$
```

File J.6.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Strawberry Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Clear Creek West

  START       2000/ 9/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 7 below - da above clear creek west gaging
station
      PERLND      67
      PERLND      68
      PERLND      69
      PERLND      70
      PERLND      71
      PERLND      72
      PERLND      73
      PERLND      74
      PERLND      75
      PERLND      76
      PERLND      77

      IMPLND      71
      IMPLND      72
      IMPLND      73
      IMPLND      74

      RCHRES      31
      RCHRES      34
      RCHRES      32
      RCHRES      39
      RCHRES      40
      RCHRES      33
      RCHRES      55
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                              ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                            t-series Engl Metr***
                                       in  out           ***
   67     Med. Dens. Res.               1    1   90    0
   68     High Dens. Res.               1    1   90    0
   69     Comm./Ind.                    1    1   90    0
   70     Acrgs/Rural Dev.              1    1   90    0
   71     Herb. RL                      1    1   90    0
   72     Shrub & Brush RL              1    1   90    0
   73     Deciduous Forest              1    1   90    0
   74     Conif. Forest                 1    1   90    0
   75     Mixed Forest                  1    1   90    0
   76     Beaches                       1    1   90    0
   77     other barren lnd              1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   67   70    0    1    1    0    0    0    0    0    0
   71   73    0    1    1    1    0    0    0    0    1
   74   77    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)              (1/in)
(1/day)
   67            0.0 ~19~  8.0      0.15     300.0  0.075000       0.0
0.925
   68   69       0.0 ~20~  8.0      0.15     300.0  0.075000       0.0
0.925
   70   77       0.0 ~21~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   67   72 ~64~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   73   75 ~65~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   76   77 ~66~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
```

```
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                          ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   67      ~121~ 0.0       0.8       0.1       1.0       0.7       0.6
   68   69 ~122~ 0.0       0.8       0.1       1.0       0.7       0.6
   70   72 ~123~ 0.0       0.8       0.1       1.0       0.7       0.6
   73   75 ~124~ 0.0       0.8       0.1       1.0       0.7       0.6
   76   77 ~125~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
   71   72 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   73      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   71   72  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   73       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                          ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   71   74    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   71   74    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
```

```
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
   71     MED. DENS. RES.              1    1   90    0
   72     HIG DENS. RES.               1    1   90    0
   73     COMM./IND.                   1    1   90    0
   74     LOW DENS. RES.               1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   71   74    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   71   74     150.0     .0054       0.1     0.055 ~172~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   71   74     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                           in  out               ***
    1  175                             1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN        LEN     DELTH     STCOR        KS      DB50***
   31             31      1.193      0.00       0.0       0.5      0.01
   32             32      1.510      0.00       0.0       0.5      0.01
   33             33      1.249      0.00       0.0       0.5      0.01
   34             34      0.764      0.00       0.0       0.5      0.01
   39             39      1.268      0.00       0.0       0.5      0.01
   40             40      0.876      0.00       0.0       0.5      0.01
   55             55      1.156      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     31
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.711     0.0078.225E-003
     0.050     0.723     0.0361.209E-001
     0.100     0.737     0.0723.818E-001
     0.250     0.779     0.1861.754E+000
     0.500     0.850     0.3905.563E+000
     0.750     0.921     0.6111.098E+001
     1.000     0.992     0.8501.788E+001
     1.250     1.063     1.1072.620E+001
     1.500     1.133     1.3813.594E+001
     1.750     1.204     1.6744.712E+001
     2.000     1.275     1.9835.974E+001
     2.250     1.346     2.3117.385E+001
     2.500     1.417     2.6568.946E+001
     3.000     1.558     3.4001.254E+002
     4.000     1.842     5.1002.171E+002
     5.000     2.125     7.0843.374E+002
    10.000     3.542    21.2511.456E+003
    50.000    14.876       3906.912E+004
 10000.000  2834.161  141743478.262E+010
  END FTABLE 31
  FTABLE     32
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
```

```
    0.010     0.936     0.0098.917E-003
    0.050     0.951     0.0471.310E-001
    0.100     0.969     0.0954.139E-001
    0.250     1.025     0.2451.901E+000
    0.500     1.118     0.5136.030E+000
    0.750     1.212     0.8041.191E+001
    1.000     1.305     1.1181.938E+001
    1.250     1.398     1.4562.841E+001
    1.500     1.491     1.8183.897E+001
    1.750     1.584     2.2025.108E+001
    2.000     1.678     2.6106.476E+001
    2.250     1.771     3.0418.006E+001
    2.500     1.864     3.4959.699E+001
    3.000     2.051     4.4741.359E+002
    4.000     2.423     6.7112.353E+002
    5.000     2.796     9.3213.657E+002
   10.000     4.660    27.9621.578E+003
   50.000    19.573       5137.494E+004
10000.000  3729.159  186504578.957E+010
 END FTABLE 32
 FTABLE     33
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.751     0.0071.167E-002
    0.050     0.763     0.0381.715E-001
    0.100     0.778     0.0765.416E-001
    0.250     0.823     0.1962.488E+000
    0.500     0.897     0.4117.891E+000
    0.750     0.972     0.6451.558E+001
    1.000     1.047     0.8972.536E+001
    1.250     1.122     1.1693.717E+001
    1.500     1.197     1.4585.099E+001
    1.750     1.271     1.7676.684E+001
    2.000     1.346     2.0948.474E+001
    2.250     1.421     2.4401.048E+002
    2.500     1.496     2.8051.269E+002
    3.000     1.645     3.5901.779E+002
    4.000     1.945     5.3853.079E+002
    5.000     2.244     7.4794.786E+002
   10.000     3.740    22.4372.065E+003
   50.000    15.706       4119.805E+004
10000.000  2992.368  149655791.172E+011
 END FTABLE 33
 FTABLE     34
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.470     0.0056.399E-003
    0.050     0.477     0.0249.403E-002
    0.100     0.486     0.0482.970E-001
    0.250     0.514     0.1231.364E+000
    0.500     0.561     0.2574.327E+000
    0.750     0.608     0.4038.545E+000
    1.000     0.655     0.5611.391E+001
```

```
    1.250     0.702     0.7312.038E+001
    1.500     0.748     0.9122.796E+001
    1.750     0.795     1.1053.666E+001
    2.000     0.842     1.3104.647E+001
    2.250     0.889     1.5265.745E+001
    2.500     0.935     1.7546.960E+001
    3.000     1.029     2.2459.754E+001
    4.000     1.216     3.3681.689E+002
    5.000     1.403     4.6772.624E+002
   10.000     2.339    14.0321.133E+003
   50.000     9.822       2575.377E+004
10000.000  1871.360   93591386.427E+010
  END FTABLE 34
  FTABLE     39
   20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.769     0.0086.978E-003
    0.050     0.781     0.0391.025E-001
    0.100     0.797     0.0783.239E-001
    0.250     0.843     0.2011.488E+000
    0.500     0.919     0.4214.719E+000
    0.750     0.996     0.6619.318E+000
    1.000     1.072     0.9191.517E+001
    1.250     1.149     1.1972.223E+001
    1.500     1.226     1.4943.049E+001
    1.750     1.302     1.8103.997E+001
    2.000     1.379     2.1455.068E+001
    2.250     1.455     2.4996.265E+001
    2.500     1.532     2.8727.590E+001
    3.000     1.685     3.6771.064E+002
    4.000     1.992     5.5151.842E+002
    5.000     2.298     7.6602.862E+002
   10.000     3.830    22.9791.235E+003
   50.000    16.086       4215.864E+004
10000.000  3064.691  153272857.009E+010
  END FTABLE 39
  FTABLE     40
   20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.516     0.0059.876E-003
    0.050     0.524     0.0261.451E-001
    0.100     0.535     0.0524.584E-001
    0.250     0.565     0.1352.106E+000
    0.500     0.617     0.2836.679E+000
    0.750     0.668     0.4431.319E+001
    1.000     0.720     0.6172.146E+001
    1.250     0.771     0.8033.146E+001
    1.500     0.822     1.0024.315E+001
    1.750     0.874     1.2145.657E+001
    2.000     0.925     1.4397.173E+001
    2.250     0.977     1.6778.866E+001
    2.500     1.028     1.9281.074E+002
    3.000     1.131     2.4671.505E+002
```

```
     4.000     1.337     3.7012.606E+002
     5.000     1.542     5.1404.050E+002
    10.000     2.570    15.4211.748E+003
    50.000    10.795       2838.299E+004
 10000.000  2056.688  102860109.920E+010
  END FTABLE 40
  FTABLE     55
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.737     0.0078.141E-003
     0.050     0.749     0.0371.196E-001
     0.100     0.764     0.0753.779E-001
     0.250     0.808     0.1931.736E+000
     0.500     0.881     0.4045.505E+000
     0.750     0.955     0.6331.087E+001
     1.000     1.028     0.8811.769E+001
     1.250     1.102     1.1472.593E+001
     1.500     1.175     1.4323.557E+001
     1.750     1.248     1.7354.663E+001
     2.000     1.322     2.0565.912E+001
     2.250     1.395     2.3967.309E+001
     2.500     1.469     2.7548.854E+001
     3.000     1.616     3.5251.241E+002
     4.000     1.909     5.2872.148E+002
     5.000     2.203     7.3433.339E+002
    10.000     3.672    22.0301.441E+003
    50.000    15.421       4046.841E+004
 10000.000  2938.126  146942998.177E+010
  END FTABLE 55
END FTABLES

SCHEMATIC
<-Volume->                  <--Area-->       <-Volume->  <ML->  ***
<Name>   x                  <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 31 and mapping equal to
31
PERLND  67                    $r31p1  $       RCHRES  31      1
PERLND  68                    $r31p2  $       RCHRES  31      1
PERLND  69                    $r31p3  $       RCHRES  31      1
PERLND  70                    $r31p4  $       RCHRES  31      1
PERLND  71                      32.4696       RCHRES  31      1
PERLND  72                       3.1135       RCHRES  31      1
PERLND  73                       3.1135       RCHRES  31      1
PERLND  74                      94.0730       RCHRES  31      1
PERLND  75                       4.0031       RCHRES  31      1
PERLND  76                       0.0000       RCHRES  31      1
PERLND  77                       0.0000       RCHRES  31      1
IMPLND  71                    $r31i1  $       RCHRES  31      2
IMPLND  72                    $r31i2  $       RCHRES  31      2
IMPLND  73                    $r31i3  $       RCHRES  31      2
IMPLND  74                    $r31i4  $       RCHRES  31      2
RCHRES  31                                    RCHRES  34      3
*** statements above are for basin with id equal to 31 and mapping equal to
31
```

```
*** statements below are for basin with id equal to 34 and mapping equal to
34
PERLND  67                 $r34p1  $       RCHRES  34      1
PERLND  68                 $r34p2  $       RCHRES  34      1
PERLND  69                 $r34p3  $       RCHRES  34      1
***PERLND  70                 $r34p4  $       RCHRES  34      1
PERLND  71                    0.0000       RCHRES  34      1
PERLND  72                    1.7792       RCHRES  34      1
PERLND  73                    5.5599       RCHRES  34      1
PERLND  74                  112.0870       RCHRES  34      1
PERLND  75                    0.8896       RCHRES  34      1
PERLND  76                    0.0000       RCHRES  34      1
PERLND  77                    0.0000       RCHRES  34      1
IMPLND  71                 $r34i1  $       RCHRES  34      2
IMPLND  72                 $r34i2  $       RCHRES  34      2
IMPLND  73                 $r34i3  $       RCHRES  34      2
***IMPLND  74                 $r34i4  $       RCHRES  34      2
RCHRES  34                                 RCHRES  39      3
*** statements above are for basin with id equal to 34 and mapping equal to
34

*** statements below are for basin with id equal to 32 and mapping equal to
32
PERLND  67                 $r32p1  $       RCHRES  32      1
PERLND  68                 $r32p2  $       RCHRES  32      1
PERLND  69                 $r32p3  $       RCHRES  32      1
PERLND  70                 $r32p4  $       RCHRES  32      1
PERLND  71                    0.0000       RCHRES  32      1
PERLND  72                   19.8216       RCHRES  32      1
PERLND  73                   47.8837       RCHRES  32      1
PERLND  74                  275.0528       RCHRES  32      1
PERLND  75                    1.7817       RCHRES  32      1
PERLND  76                    0.0000       RCHRES  32      1
PERLND  77                    0.0000       RCHRES  32      1
IMPLND  71                 $r32i1  $       RCHRES  32      2
IMPLND  72                 $r32i2  $       RCHRES  32      2
IMPLND  73                 $r32i3  $       RCHRES  32      2
IMPLND  74                 $r32i4  $       RCHRES  32      2
RCHRES  32                                 RCHRES  39      3
*** statements above are for basin with id equal to 32 and mapping equal to
32

*** statements below are for basin with id equal to 39 and mapping equal to
39
PERLND  67                 $r39p1  $       RCHRES  39      1
PERLND  68                 $r39p2  $       RCHRES  39      1
PERLND  69                 $r39p3  $       RCHRES  39      1
PERLND  70                 $r39p4  $       RCHRES  39      1
PERLND  71                   10.2302       RCHRES  39      1
PERLND  72                    0.0000       RCHRES  39      1
PERLND  73                   22.6843       RCHRES  39      1
PERLND  74                   96.7418       RCHRES  39      1
PERLND  75                    2.2239       RCHRES  39      1
PERLND  76                    0.0000       RCHRES  39      1
PERLND  77                    0.0000       RCHRES  39      1
IMPLND  71                 $r39i1  $       RCHRES  39      2
IMPLND  72                 $r39i2  $       RCHRES  39      2
```

```
IMPLND  73                 $r39i3  $       RCHRES  39      2
IMPLND  74                 $r39i4  $       RCHRES  39      2
RCHRES  39                                 RCHRES  40      3
*** statements above are for basin with id equal to 39 and mapping equal to
39

*** statements below are for basin with id equal to 40 and mapping equal to
40
PERLND  67                 $r40p1  $       RCHRES  40      1
PERLND  68                 $r40p2  $       RCHRES  40      1
PERLND  69                 $r40p3  $       RCHRES  40      1
PERLND  70                 $r40p4  $       RCHRES  40      1
PERLND  71                    3.3359       RCHRES  40      1
PERLND  72                    3.5583       RCHRES  40      1
PERLND  73                   23.7962       RCHRES  40      1
PERLND  74                   42.0326       RCHRES  40      1
PERLND  75                    4.0031       RCHRES  40      1
PERLND  76                    0.0000       RCHRES  40      1
PERLND  77                    0.0000       RCHRES  40      1
IMPLND  71                 $r40i1  $       RCHRES  40      2
IMPLND  72                 $r40i2  $       RCHRES  40      2
IMPLND  73                 $r40i3  $       RCHRES  40      2
IMPLND  74                 $r40i4  $       RCHRES  40      2
RCHRES  40                                 RCHRES  55      3
*** statements above are for basin with id equal to 40 and mapping equal to
40

*** statements below are for basin with id equal to 33 and mapping equal to
33
PERLND  67                 $r33p1  $       RCHRES  33      1
PERLND  68                 $r33p2  $       RCHRES  33      1
PERLND  69                 $r33p3  $       RCHRES  33      1
PERLND  70                 $r33p4  $       RCHRES  33      1
PERLND  71                    2.6830       RCHRES  33      1
PERLND  72                    0.2236       RCHRES  33      1
PERLND  73                   16.3214       RCHRES  33      1
PERLND  74                  238.1132       RCHRES  33      1
PERLND  75                    2.4594       RCHRES  33      1
PERLND  76                    0.0000       RCHRES  33      1
PERLND  77                    0.0000       RCHRES  33      1
IMPLND  71                 $r33i1  $       RCHRES  33      2
IMPLND  72                 $r33i2  $       RCHRES  33      2
IMPLND  73                 $r33i3  $       RCHRES  33      2
IMPLND  74                 $r33i4  $       RCHRES  33      2
RCHRES  33                                 RCHRES  55      3
*** statements above are for basin with id equal to 33 and mapping equal to
33

*** statements below are for basin with id equal to 55 and mapping equal to
55
PERLND  67                 $r55p1  $       RCHRES  55      1
PERLND  68                 $r55p2  $       RCHRES  55      1
PERLND  69                 $r55p3  $       RCHRES  55      1
PERLND  70                 $r55p4  $       RCHRES  55      1
PERLND  71                    5.7823       RCHRES  55      1
PERLND  72                    0.0000       RCHRES  55      1
PERLND  73                   65.8289       RCHRES  55      1
```

```
PERLND  74                   62.4930       RCHRES  55       1
PERLND  75                    7.1166       RCHRES  55       1
PERLND  76                    0.0000       RCHRES  55       1
PERLND  77                    0.0000       RCHRES  55       1
IMPLND  71                 $r55i1  $       RCHRES  55       2
IMPLND  72                 $r55i2  $       RCHRES  55       2
IMPLND  73                 $r55i3  $       RCHRES  55       2
IMPLND  74                 $r55i4  $       RCHRES  55       2
***RCHRES  55                                 RCHRES  54       3
*** statements above are for basin with id equal to 55 and mapping equal to
55

END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 7 below
WDM   1162 PREC                     1.00     PERLND  67  77 EXTNL  PREC
WDM   1162 PREC                     1.00     IMPLND  71  74 EXTNL  PREC

WDM    144 PEVT                     1.00     PERLND  67  77 EXTNL  PETINP
WDM    144 PEVT                     1.00     IMPLND  71  74 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** clear creek - west tributary
RCHRES  55 HYDR   RO                       WDM2    55 FLOW     ENGL AGGR REPL
RCHRES  55 HYDR   RO                       WDM2  1055 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.7.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Clear Creek – West Tributary streamflow gaging station.

```
ptf $

19 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn7         $    $infilt7        $ $         lsur7$$
slsur7$        0.$         agwrc7b$
20 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn7         $    $infilt7        $ $         lsur7$$
slsur7$        0.$         agwrc7a$
21 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn7         $    $infilt7        $ $         lsur7$$
slsur7$        0.$         agwrc7b$

64   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr7    $
0.0       0.00
65   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr7    $ $
basetp7       $ 0.00
66   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr7    $
0.0       0.00

121 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7b$ $       NSUR7b$ $       INTFW7b$ $
IRC7b$  $     LZETP7b$
122 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7a$ $       NSUR7a$ $       INTFW7a$ $
IRC7a$  $     LZETP7b$
123 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7b$ $       NSUR7b$ $       INTFW7b$ $
IRC7b$  $     LZETP7b$
124 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7a$  $        UZSN7b$ $       NSUR7c$ $       INTFW7b$ $
IRC7b$  $     LZETP7a$
125 6  CEPSC                        UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7b$ $       NSUR7b$ $       INTFW7b$ $
IRC7b$  $     LZETP7b$

172 4  LSUR                SLSUR          NSUR          RESTC
      $     ILSUR7$ $      ISLSUR7$ $     INSUR7$ $       RETSC7$
```

File J.7.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Clear Creek – West Tributary streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Clear Creek

  START       2001/ 6/ 1  0: 0  END    2003/ 7/31 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 7 below - da above clear creek west gaging
station
      PERLND      67
      PERLND      68
      PERLND      69
      PERLND      70
      PERLND      71
      PERLND      72
      PERLND      73
      PERLND      74
      PERLND      75
      PERLND      76
      PERLND      77

      IMPLND      71
      IMPLND      72
      IMPLND      73
      IMPLND      74

*** perlnds & implnds for ZONE 8 below - da above clear creek mainstem gaging
station
      PERLND      78
      PERLND      79
      PERLND      80
      PERLND      81
      PERLND      82
      PERLND      83
      PERLND      84
      PERLND      85
      PERLND      86
      PERLND      87
      PERLND      88

      IMPLND      81
      IMPLND      82
      IMPLND      83
      IMPLND      84
```

```
      RCHRES      31
      RCHRES      34
      RCHRES      32
      RCHRES      39
      RCHRES      40
      RCHRES      33
      RCHRES      47
      RCHRES      48
      RCHRES      35
      RCHRES      36
      RCHRES      37
      RCHRES      46
      RCHRES      38
      RCHRES      41
      RCHRES      42
      RCHRES      43
      RCHRES      45
      RCHRES      44
      RCHRES      49
      RCHRES      50
      RCHRES      55
      RCHRES      54
      RCHRES      52
      RCHRES      53
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                             ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                               t-series Engl Metr***
                                          in  out         ***
   67     Med. Dens. Res.                  1    1   90    0
   68     High Dens. Res.                  1    1   90    0
   69     Comm./Ind.                       1    1   90    0
   70     Acrgs/Rural Dev.                 1    1   90    0
   71     Herb. RL                         1    1   90    0
   72     Shrub & Brush RL                 1    1   90    0
   73     Deciduous Forest                 1    1   90    0
   74     Conif. Forest                    1    1   90    0
   75     Mixed Forest                     1    1   90    0
```

```
   76     Beaches                           1    1   90    0
   77     other barren lnd                  1    1   90    0

   78     Med. Dens. Res.                   1    1   90    0
   79     High Dens. Res.                   1    1   90    0
   80     Comm./Ind.                        1    1   90    0
   81     Acrgs/Rural Dev.                  1    1   90    0
   82     Herb. RL                          1    1   90    0
   83     Shrub & Brush RL                  1    1   90    0
   84     Deciduous Forest                  1    1   90    0
   85     Conif. Forest                     1    1   90    0
   86     Mixed Forest                      1    1   90    0
   87     Beaches                           1    1   90    0
   88     other barren lnd                  1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   67   70    0    1    1    0    0    0    0    0    0
   71   73    0    1    1    1    0    0    0    0    1
   74   77    0    1    1    0    0    0    0    0    0

   78   81    0    1    1    0    0    0    0    0    0
   82   84    0    1    1    1    0    0    0    0    1
   85   88    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
   67            0.0 ~19~  8.0      0.15     300.0  0.075000       0.0
0.925
   68   69       0.0 ~20~  8.0      0.15     300.0  0.075000       0.0
0.925
   70   77       0.0 ~21~  8.0      0.15     300.0  0.075000       0.0
0.925

   78            0.0 ~22~  8.0      0.15     300.0  0.075000       0.0
0.925
   79   80       0.0 ~23~  8.0      0.15     300.0  0.075000       0.0
0.925
   81   88       0.0 ~24~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   67   72 ~64~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   73   75 ~65~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
```

```
   76   77 ~66~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0

   78   83 ~67~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   84   86 ~68~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   87   88 ~69~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                            ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   67      ~121~ 0.0       0.8       0.1       1.0       0.7       0.6
   68   69 ~122~ 0.0       0.8       0.1       1.0       0.7       0.6
   70   72 ~123~ 0.0       0.8       0.1       1.0       0.7       0.6
   73   75 ~124~ 0.0       0.8       0.1       1.0       0.7       0.6
   76   77 ~125~ 0.0       0.8       0.1       1.0       0.7       0.6

   78      ~126~ 0.0       0.8       0.1       1.0       0.7       0.6
   79   80 ~127~ 0.0       0.8       0.1       1.0       0.7       0.6
   81   83 ~128~ 0.0       0.8       0.1       1.0       0.7       0.6
   84   86 ~129~ 0.0       0.8       0.1       1.0       0.7       0.6
   87   88 ~130~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
   71   72 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   73      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06

   82   83 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   84      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   71   72  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   73       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2

   82   83  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   84       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
```

```
    1 165      0.0        0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   71   74    0    0    1    0    0    0
   81   84    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   71   74    0    0    6    0    0    0    0    0
   81   84    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name            Unit-systems   Printer
*** <ILS >                          t-series Engl Metr
*** x -  x                           in  out
   71     MED. DENS. RES.             1    1   90    0
   72     HIG DENS. RES.              1    1   90    0
   73     COMM./IND.                  1    1   90    0
   74     LOW DENS. RES.              1    1   90    0

   81     MED. DENS. RES.             1    1   90    0
   82     HIG DENS. RES.              1    1   90    0
   83     COMM./IND.                  1    1   90    0
   84     LOW DENS. RES.              1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   71   74    0    1    0    0    0
   81   84    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   71   74     150.0     .0054       0.1     0.055 ~172~

   81   84     150.0     .0054       0.1     0.055 ~173~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   71   74     0.000     0.000
   81   84     0.000     0.000
  END IWAT-STATE1
```

```
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                           in  out               ***
    1  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
   31             31     1.193      0.00       0.0       0.5      0.01
   32             32     1.510      0.00       0.0       0.5      0.01
   33             33     1.249      0.00       0.0       0.5      0.01
   34             34     0.764      0.00       0.0       0.5      0.01
   35             35     1.007      0.00       0.0       0.5      0.01
   36             36     1.249      0.00       0.0       0.5      0.01
   37             37     0.261      0.00       0.0       0.5      0.01
   38             38     1.100      0.00       0.0       0.5      0.01
   39             39     1.268      0.00       0.0       0.5      0.01
   40             40     0.876      0.00       0.0       0.5      0.01
   41             41     0.112      0.00       0.0       0.5      0.01
   42             42     0.671      0.00       0.0       0.5      0.01
   43             43     0.820      0.00       0.0       0.5      0.01
   44             44     0.690      0.00       0.0       0.5      0.01
   45             45     0.597      0.00       0.0       0.5      0.01
   46             46     1.547      0.00       0.0       0.5      0.01
   47             47     1.081      0.00       0.0       0.5      0.01
   48             48     0.746      0.00       0.0       0.5      0.01
   49             49     0.690      0.00       0.0       0.5      0.01
   50             50     0.597      0.00       0.0       0.5      0.01
   52             52     1.081      0.00       0.0       0.5      0.01
   53             53     0.186      0.00       0.0       0.5      0.01
```

```
   54              54     0.168      0.00       0.0       0.5      0.01
   55              55     1.156      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     31
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.711     0.0078.225E-003
     0.050     0.723     0.0361.209E-001
     0.100     0.737     0.0723.818E-001
     0.250     0.779     0.1861.754E+000
     0.500     0.850     0.3905.563E+000
     0.750     0.921     0.6111.098E+001
     1.000     0.992     0.8501.788E+001
     1.250     1.063     1.1072.620E+001
     1.500     1.133     1.3813.594E+001
     1.750     1.204     1.6744.712E+001
     2.000     1.275     1.9835.974E+001
     2.250     1.346     2.3117.385E+001
     2.500     1.417     2.6568.946E+001
     3.000     1.558     3.4001.254E+002
     4.000     1.842     5.1002.171E+002
     5.000     2.125     7.0843.374E+002
    10.000     3.542    21.2511.456E+003
    50.000    14.876      3906.912E+004
 10000.000  2834.161  141743478.262E+010
  END FTABLE 31
  FTABLE     32
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.936     0.0098.917E-003
     0.050     0.951     0.0471.310E-001
     0.100     0.969     0.0954.139E-001
     0.250     1.025     0.2451.901E+000
     0.500     1.118     0.5136.030E+000
     0.750     1.212     0.8041.191E+001
     1.000     1.305     1.1181.938E+001
     1.250     1.398     1.4562.841E+001
```

```
     1.500     1.491     1.8183.897E+001
     1.750     1.584     2.2025.108E+001
     2.000     1.678     2.6106.476E+001
     2.250     1.771     3.0418.006E+001
     2.500     1.864     3.4959.699E+001
     3.000     2.051     4.4741.359E+002
     4.000     2.423     6.7112.353E+002
     5.000     2.796     9.3213.657E+002
    10.000     4.660    27.9621.578E+003
    50.000    19.573       5137.494E+004
 10000.000  3729.159  186504578.957E+010
  END FTABLE 32
  FTABLE     33
   20     4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.751     0.0071.167E-002
     0.050     0.763     0.0381.715E-001
     0.100     0.778     0.0765.416E-001
     0.250     0.823     0.1962.488E+000
     0.500     0.897     0.4117.891E+000
     0.750     0.972     0.6451.558E+001
     1.000     1.047     0.8972.536E+001
     1.250     1.122     1.1693.717E+001
     1.500     1.197     1.4585.099E+001
     1.750     1.271     1.7676.684E+001
     2.000     1.346     2.0948.474E+001
     2.250     1.421     2.4401.048E+002
     2.500     1.496     2.8051.269E+002
     3.000     1.645     3.5901.779E+002
     4.000     1.945     5.3853.079E+002
     5.000     2.244     7.4794.786E+002
    10.000     3.740    22.4372.065E+003
    50.000    15.706       4119.805E+004
 10000.000  2992.368  149655791.172E+011
  END FTABLE 33
  FTABLE     34
   20     4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.470     0.0056.399E-003
     0.050     0.477     0.0249.403E-002
     0.100     0.486     0.0482.970E-001
     0.250     0.514     0.1231.364E+000
     0.500     0.561     0.2574.327E+000
     0.750     0.608     0.4038.545E+000
     1.000     0.655     0.5611.391E+001
     1.250     0.702     0.7312.038E+001
     1.500     0.748     0.9122.796E+001
     1.750     0.795     1.1053.666E+001
     2.000     0.842     1.3104.647E+001
     2.250     0.889     1.5265.745E+001
     2.500     0.935     1.7546.960E+001
     3.000     1.029     2.2459.754E+001
     4.000     1.216     3.3681.689E+002
```

```
    5.000     1.403     4.6772.624E+002
   10.000     2.339    14.0321.133E+003
   50.000     9.822       2575.377E+004
10000.000  1871.360   93591386.427E+010
 END FTABLE 34
 FTABLE     35
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.600     0.0068.894E-003
    0.050     0.610     0.0301.307E-001
    0.100     0.622     0.0614.129E-001
    0.250     0.657     0.1571.896E+000
    0.500     0.717     0.3296.015E+000
    0.750     0.777     0.5161.188E+001
    1.000     0.837     0.7171.933E+001
    1.250     0.896     0.9342.833E+001
    1.500     0.956     1.1653.887E+001
    1.750     1.016     1.4125.095E+001
    2.000     1.076     1.6736.460E+001
    2.250     1.136     1.9507.986E+001
    2.500     1.195     2.2419.674E+001
    3.000     1.315     2.8691.356E+002
    4.000     1.554     4.3032.347E+002
    5.000     1.793     5.9763.648E+002
   10.000     2.988    17.9291.574E+003
   50.000    12.551       3297.475E+004
10000.000  2391.182  119588998.934E+010
 END FTABLE 35
 FTABLE     36
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.758     0.0089.695E-003
    0.050     0.770     0.0381.425E-001
    0.100     0.785     0.0774.500E-001
    0.250     0.830     0.1982.067E+000
    0.500     0.906     0.4156.556E+000
    0.750     0.981     0.6511.295E+001
    1.000     1.057     0.9062.107E+001
    1.250     1.132     1.1793.088E+001
    1.500     1.207     1.4724.236E+001
    1.750     1.283     1.7835.553E+001
    2.000     1.358     2.1137.041E+001
    2.250     1.434     2.4628.704E+001
    2.500     1.509     2.8301.054E+002
    3.000     1.660     3.6221.478E+002
    4.000     1.962     5.4342.558E+002
    5.000     2.264     7.5473.976E+002
   10.000     3.773    22.6411.716E+003
   50.000    15.848       4158.147E+004
10000.000  3019.489  151012189.738E+010
 END FTABLE 36
 FTABLE     37
  20    4
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    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.142     0.0011.094E-002
    0.050     0.144     0.0071.608E-001
    0.100     0.147     0.0145.078E-001
    0.250     0.155     0.0372.333E+000
    0.500     0.169     0.0787.399E+000
    0.750     0.184     0.1221.461E+001
    1.000     0.198     0.1692.378E+001
    1.250     0.212     0.2213.485E+001
    1.500     0.226     0.2754.781E+001
    1.750     0.240     0.3346.267E+001
    2.000     0.254     0.3957.946E+001
    2.250     0.268     0.4619.823E+001
    2.500     0.282     0.5301.190E+002
    3.000     0.311     0.6781.668E+002
    4.000     0.367     1.0172.887E+002
    5.000     0.424     1.4124.487E+002
   10.000     0.706     4.2371.937E+003
   50.000     2.966    77.6719.194E+004
10000.000   565.024   28258271.099E+011
 END FTABLE 37
 FTABLE     38
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.693     0.0071.121E-002
    0.050     0.704     0.0351.647E-001
    0.100     0.718     0.0705.202E-001
    0.250     0.759     0.1812.389E+000
    0.500     0.828     0.3807.578E+000
    0.750     0.897     0.5951.496E+001
    1.000     0.966     0.8282.436E+001
    1.250     1.035     1.0793.570E+001
    1.500     1.104     1.3464.897E+001
    1.750     1.173     1.6316.419E+001
    2.000     1.243     1.9338.139E+001
    2.250     1.312     2.2521.006E+002
    2.500     1.381     2.5891.219E+002
    3.000     1.519     3.3131.708E+002
    4.000     1.795     4.9702.957E+002
    5.000     2.071     6.9034.596E+002
   10.000     3.451    20.7091.984E+003
   50.000    14.496      3809.417E+004
10000.000  2761.838  138126411.126E+011
 END FTABLE 38
 FTABLE     39
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.769     0.0086.978E-003
    0.050     0.781     0.0391.025E-001
    0.100     0.797     0.0783.239E-001
    0.250     0.843     0.2011.488E+000
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    0.500     0.919     0.4214.719E+000
    0.750     0.996     0.6619.318E+000
    1.000     1.072     0.9191.517E+001
    1.250     1.149     1.1972.223E+001
    1.500     1.226     1.4943.049E+001
    1.750     1.302     1.8103.997E+001
    2.000     1.379     2.1455.068E+001
    2.250     1.455     2.4996.265E+001
    2.500     1.532     2.8727.590E+001
    3.000     1.685     3.6771.064E+002
    4.000     1.992     5.5151.842E+002
    5.000     2.298     7.6602.862E+002
   10.000     3.830    22.9791.235E+003
   50.000    16.086      4215.864E+004
10000.000  3064.691  153272857.009E+010
 END FTABLE 39
 FTABLE     40
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.516     0.0059.876E-003
    0.050     0.524     0.0261.451E-001
    0.100     0.535     0.0524.584E-001
    0.250     0.565     0.1352.106E+000
    0.500     0.617     0.2836.679E+000
    0.750     0.668     0.4431.319E+001
    1.000     0.720     0.6172.146E+001
    1.250     0.771     0.8033.146E+001
    1.500     0.822     1.0024.315E+001
    1.750     0.874     1.2145.657E+001
    2.000     0.925     1.4397.173E+001
    2.250     0.977     1.6778.866E+001
    2.500     1.028     1.9281.074E+002
    3.000     1.131     2.4671.505E+002
    4.000     1.337     3.7012.606E+002
    5.000     1.542     5.1404.050E+002
   10.000     2.570    15.4211.748E+003
   50.000    10.795      2838.299E+004
10000.000  2056.688  102860109.920E+010
 END FTABLE 40
 FTABLE     41
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.065     0.0012.336E-003
    0.050     0.066     0.0033.432E-002
    0.100     0.067     0.0071.084E-001
    0.250     0.071     0.0174.980E-001
    0.500     0.077     0.0351.579E+000
    0.750     0.084     0.0563.119E+000
    1.000     0.090     0.0775.076E+000
    1.250     0.097     0.1017.440E+000
    1.500     0.103     0.1261.021E+001
    1.750     0.109     0.1521.338E+001
    2.000     0.116     0.1801.696E+001
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    2.250     0.122     0.2102.097E+001
    2.500     0.129     0.2412.540E+001
    3.000     0.142     0.3093.560E+001
    4.000     0.167     0.4646.164E+001
    5.000     0.193     0.6449.579E+001
   10.000     0.322     1.9324.134E+002
   50.000     1.352    35.4181.963E+004
10000.000   257.651   12885772.346E+010
 END FTABLE 41
 FTABLE     42
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.411     0.0048.926E-003
    0.050     0.417     0.0211.312E-001
    0.100     0.425     0.0424.143E-001
    0.250     0.450     0.1071.903E+000
    0.500     0.491     0.2256.036E+000
    0.750     0.532     0.3531.192E+001
    1.000     0.573     0.4911.940E+001
    1.250     0.613     0.6392.843E+001
    1.500     0.654     0.7983.900E+001
    1.750     0.695     0.9665.113E+001
    2.000     0.736     1.1456.483E+001
    2.250     0.777     1.3348.014E+001
    2.500     0.818     1.5349.708E+001
    3.000     0.900     1.9631.361E+002
    4.000     1.063     2.9452.356E+002
    5.000     1.227     4.0903.661E+002
   10.000     2.045    12.2691.580E+003
   50.000     8.588      2257.501E+004
10000.000  1636.310   81835948.966E+010
 END FTABLE 42
 FTABLE     43
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.499     0.0058.225E-003
    0.050     0.507     0.0251.209E-001
    0.100     0.517     0.0513.818E-001
    0.250     0.547     0.1311.754E+000
    0.500     0.597     0.2735.562E+000
    0.750     0.646     0.4291.098E+001
    1.000     0.696     0.5971.788E+001
    1.250     0.746     0.7772.620E+001
    1.500     0.795     0.9693.594E+001
    1.750     0.845     1.1744.712E+001
    2.000     0.895     1.3925.974E+001
    2.250     0.944     1.6227.385E+001
    2.500     0.994     1.8648.946E+001
    3.000     1.094     2.3861.254E+002
    4.000     1.292     3.5792.171E+002
    5.000     1.491     4.9713.374E+002
   10.000     2.485    14.9131.456E+003
   50.000    10.439      2736.912E+004
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10000.000  1988.885   99469108.262E+010
 END FTABLE 43
 FTABLE     44
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.408     0.0048.775E-003
    0.050     0.415     0.0211.289E-001
    0.100     0.423     0.0414.073E-001
    0.250     0.447     0.1071.871E+000
    0.500     0.488     0.2245.935E+000
    0.750     0.529     0.3511.172E+001
    1.000     0.569     0.4881.907E+001
    1.250     0.610     0.6362.795E+001
    1.500     0.651     0.7933.835E+001
    1.750     0.691     0.9615.027E+001
    2.000     0.732     1.1396.373E+001
    2.250     0.773     1.3277.879E+001
    2.500     0.813     1.5259.545E+001
    3.000     0.895     1.9521.338E+002
    4.000     1.057     2.9282.316E+002
    5.000     1.220     4.0673.599E+002
   10.000     2.034    12.2011.553E+003
   50.000     8.541      2247.375E+004
10000.000  1627.270   81383818.815E+010
 END FTABLE 44
 FTABLE     45
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.345     0.0031.818E-002
    0.050     0.350     0.0172.671E-001
    0.100     0.357     0.0358.437E-001
    0.250     0.378     0.0903.876E+000
    0.500     0.412     0.1891.229E+001
    0.750     0.446     0.2962.427E+001
    1.000     0.481     0.4123.950E+001
    1.250     0.515     0.5375.790E+001
    1.500     0.550     0.6707.943E+001
    1.750     0.584     0.8111.041E+002
    2.000     0.618     0.9621.320E+002
    2.250     0.653     1.1211.632E+002
    2.500     0.687     1.2881.977E+002
    3.000     0.756     1.6492.771E+002
    4.000     0.893     2.4734.797E+002
    5.000     1.030     3.4347.455E+002
   10.000     1.717    10.3033.217E+003
   50.000     7.212      1891.527E+005
10000.000  1374.139   68724111.826E+011
 END FTABLE 45
 FTABLE     46
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
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    0.010     0.944     0.0091.108E-002
    0.050     0.959     0.0481.628E-001
    0.100     0.978     0.0965.142E-001
    0.250     1.034     0.2472.362E+000
    0.500     1.128     0.5177.491E+000
    0.750     1.222     0.8111.479E+001
    1.000     1.316     1.1282.407E+001
    1.250     1.410     1.4693.528E+001
    1.500     1.504     1.8334.840E+001
    1.750     1.598     2.2216.345E+001
    2.000     1.692     2.6328.045E+001
    2.250     1.786     3.0679.945E+001
    2.500     1.880     3.5251.205E+002
    3.000     2.068     4.5121.689E+002
    4.000     2.444     6.7682.923E+002
    5.000     2.820     9.4004.543E+002
   10.000     4.700    28.1991.961E+003
   50.000    19.739       5179.309E+004
10000.000  3760.801  188087031.113E+011
 END FTABLE 46
 FTABLE     47
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.653     0.0071.078E-002
    0.050     0.664     0.0331.584E-001
    0.100     0.677     0.0665.002E-001
    0.250     0.716     0.1712.298E+000
    0.500     0.781     0.3587.288E+000
    0.750     0.846     0.5611.439E+001
    1.000     0.911     0.7812.342E+001
    1.250     0.976     1.0173.433E+001
    1.500     1.041     1.2694.709E+001
    1.750     1.106     1.5376.173E+001
    2.000     1.171     1.8227.827E+001
    2.250     1.236     2.1239.675E+001
    2.500     1.301     2.4401.172E+002
    3.000     1.432     3.1241.643E+002
    4.000     1.692     4.6852.844E+002
    5.000     1.952     6.5074.420E+002
   10.000     3.254    19.5221.907E+003
   50.000    13.666       3589.056E+004
10000.000  2603.631  130214101.082E+011
 END FTABLE 47
 FTABLE     48
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.453     0.0051.179E-002
    0.050     0.460     0.0231.733E-001
    0.100     0.469     0.0465.475E-001
    0.250     0.496     0.1182.515E+000
    0.500     0.541     0.2487.976E+000
    0.750     0.586     0.3891.575E+001
    1.000     0.631     0.5412.563E+001
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     1.250     0.676     0.7043.757E+001
     1.500     0.721     0.8795.154E+001
     1.750     0.766     1.0656.756E+001
     2.000     0.811     1.2628.566E+001
     2.250     0.856     1.4711.059E+002
     2.500     0.902     1.6901.283E+002
     3.000     0.992     2.1641.798E+002
     4.000     1.172     3.2463.113E+002
     5.000     1.352     4.5084.837E+002
    10.000     2.254    13.5232.088E+003
    50.000     9.466       2489.912E+004
 10000.000  1803.557   90200391.185E+011
  END FTABLE 48
  FTABLE     49
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.459     0.0051.365E-002
     0.050     0.467     0.0232.005E-001
     0.100     0.476     0.0476.335E-001
     0.250     0.503     0.1202.910E+000
     0.500     0.549     0.2529.229E+000
     0.750     0.595     0.3951.822E+001
     1.000     0.641     0.5492.966E+001
     1.250     0.686     0.7154.347E+001
     1.500     0.732     0.8925.963E+001
     1.750     0.778     1.0817.818E+001
     2.000     0.824     1.2819.912E+001
     2.250     0.869     1.4931.225E+002
     2.500     0.915     1.7161.484E+002
     3.000     1.007     2.1962.080E+002
     4.000     1.190     3.2943.602E+002
     5.000     1.373     4.5765.597E+002
    10.000     2.288    13.7272.416E+003
    50.000     9.609       2521.147E+005
 10000.000  1830.678   91556791.371E+011
  END FTABLE 49
  FTABLE     50
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.373     0.0041.436E-002
     0.050     0.379     0.0192.110E-001
     0.100     0.387     0.0386.665E-001
     0.250     0.409     0.0983.062E+000
     0.500     0.446     0.2049.711E+000
     0.750     0.483     0.3211.917E+001
     1.000     0.520     0.4463.121E+001
     1.250     0.558     0.5814.574E+001
     1.500     0.595     0.7256.274E+001
     1.750     0.632     0.8788.226E+001
     2.000     0.669     1.0411.043E+002
     2.250     0.706     1.2131.289E+002
     2.500     0.743     1.3941.562E+002
     3.000     0.818     1.7842.189E+002
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    4.000     0.966     2.6763.789E+002
    5.000     1.115     3.7175.889E+002
   10.000     1.858    11.1512.542E+003
   50.000     7.806       2041.207E+005
10000.000  1487.144   74375761.442E+011
  END FTABLE 50
  FTABLE     52
   20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.654     0.0074.346E-003
    0.050     0.665     0.0336.386E-002
    0.100     0.678     0.0662.017E-001
    0.250     0.717     0.1719.267E-001
    0.500     0.782     0.3592.939E+000
    0.750     0.847     0.5625.803E+000
    1.000     0.913     0.7829.446E+000
    1.250     0.978     1.0191.384E+001
    1.500     1.043     1.2711.899E+001
    1.750     1.108     1.5402.490E+001
    2.000     1.173     1.8253.156E+001
    2.250     1.239     2.1273.902E+001
    2.500     1.304     2.4454.727E+001
    3.000     1.434     3.1296.625E+001
    4.000     1.695     4.6931.147E+002
    5.000     1.956     6.5191.783E+002
   10.000     3.259    19.5567.693E+002
   50.000    13.689       3593.652E+004
10000.000  2608.151  130440174.365E+010
  END FTABLE 52
  FTABLE     53
   20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.119     0.0014.532E-003
    0.050     0.121     0.0066.659E-002
    0.100     0.123     0.0122.104E-001
    0.250     0.130     0.0319.663E-001
    0.500     0.142     0.0653.065E+000
    0.750     0.154     0.1026.051E+000
    1.000     0.166     0.1429.849E+000
    1.250     0.178     0.1851.444E+001
    1.500     0.190     0.2311.980E+001
    1.750     0.202     0.2802.596E+001
    2.000     0.214     0.3323.291E+001
    2.250     0.225     0.3874.069E+001
    2.500     0.237     0.4454.929E+001
    3.000     0.261     0.5696.908E+001
    4.000     0.308     0.8541.196E+002
    5.000     0.356     1.1861.859E+002
   10.000     0.593     3.5598.021E+002
   50.000     2.491    65.2443.808E+004
10000.000   474.620   23736954.552E+010
  END FTABLE 53
  FTABLE     54
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    20    4
      DEPTH       AREA    VOLUME     DISCH   SEEPAGE***
       (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
      0.000      0.000     0.0000.000E+000
      0.010      0.099     0.0011.339E-002
      0.050      0.100     0.0051.967E-001
      0.100      0.102     0.0106.215E-001
      0.250      0.108     0.0262.855E+000
      0.500      0.118     0.0549.054E+000
      0.750      0.128     0.0851.788E+001
      1.000      0.138     0.1182.910E+001
      1.250      0.147     0.1544.265E+001
      1.500      0.157     0.1925.850E+001
      1.750      0.167     0.2327.669E+001
      2.000      0.177     0.2759.724E+001
      2.250      0.187     0.3211.202E+002
      2.500      0.197     0.3691.456E+002
      3.000      0.216     0.4722.041E+002
      4.000      0.256     0.7083.533E+002
      5.000      0.295     0.9835.491E+002
     10.000      0.491     2.9492.370E+003
     50.000      2.064    54.0591.125E+005
  10000.000    393.257   19667751.345E+011
   END FTABLE 54
   FTABLE     55
    20    4
      DEPTH       AREA    VOLUME     DISCH   SEEPAGE***
       (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
      0.000      0.000     0.0000.000E+000
      0.010      0.737     0.0078.141E-003
      0.050      0.749     0.0371.196E-001
      0.100      0.764     0.0753.779E-001
      0.250      0.808     0.1931.736E+000
      0.500      0.881     0.4045.505E+000
      0.750      0.955     0.6331.087E+001
      1.000      1.028     0.8811.769E+001
      1.250      1.102     1.1472.593E+001
      1.500      1.175     1.4323.557E+001
      1.750      1.248     1.7354.663E+001
      2.000      1.322     2.0565.912E+001
      2.250      1.395     2.3967.309E+001
      2.500      1.469     2.7548.854E+001
      3.000      1.616     3.5251.241E+002
      4.000      1.909     5.2872.148E+002
      5.000      2.203     7.3433.339E+002
     10.000      3.672    22.0301.441E+003
     50.000     15.421      4046.841E+004
  10000.000   2938.126  146942998.177E+010
   END FTABLE 55
 END FTABLES

 SCHEMATIC
 <-Volume->                <--Area-->       <-Volume->  <ML->  ***
 <Name>   x                <-factor->       <Name>   #      #  ***
 *** statements below are for basin with id equal to 31 and mapping equal to
 31
 PERLND  67                 14.975264       RCHRES  31      1
```

```
PERLND  68                19.113656       RCHRES  31      1
PERLND  69                30.082870       RCHRES  31      1
PERLND  70                9.7075349       RCHRES  31      1
PERLND  71                  32.4696       RCHRES  31      1
PERLND  72                   3.1135       RCHRES  31      1
PERLND  73                   3.1135       RCHRES  31      1
PERLND  74                  94.0730       RCHRES  31      1
PERLND  75                   4.0031       RCHRES  31      1
PERLND  76                   0.0000       RCHRES  31      1
PERLND  77                   0.0000       RCHRES  31      1
IMPLND  71                4.0394954       RCHRES  31      2
IMPLND  72                14.023176       RCHRES  31      2
IMPLND  73                71.329179       RCHRES  31      2
IMPLND  74                1.0786150       RCHRES  31      2
RCHRES  31                                RCHRES  34      3
*** statements above are for basin with id equal to 31 and mapping equal to
31

*** statements below are for basin with id equal to 34 and mapping equal to
34
PERLND  67                5.5172024       RCHRES  34      1
PERLND  68                11.545161       RCHRES  34      1
PERLND  69                20.385103       RCHRES  34      1
***PERLND  70                .11119742       RCHRES  34      1
PERLND  71                   0.0000       RCHRES  34      1
PERLND  72                   1.7792       RCHRES  34      1
PERLND  73                   5.5599       RCHRES  34      1
PERLND  74                 112.0870       RCHRES  34      1
PERLND  75                   0.8896       RCHRES  34      1
PERLND  76                   0.0000       RCHRES  34      1
PERLND  77                   0.0000       RCHRES  34      1
IMPLND  71                1.4882352       RCHRES  34      2
IMPLND  72                8.4703747       RCHRES  34      2
IMPLND  73                48.334904       RCHRES  34      2
***IMPLND  74                0.0000000       RCHRES  34      2
RCHRES  34                                RCHRES  39      3
*** statements above are for basin with id equal to 34 and mapping equal to
34

*** statements below are for basin with id equal to 32 and mapping equal to
32
PERLND  67                32.273839       RCHRES  32      1
PERLND  68                28.390576       RCHRES  32      1
PERLND  69                8.7867952       RCHRES  32      1
PERLND  70                0.0000000       RCHRES  32      1
PERLND  71                   0.0000       RCHRES  32      1
PERLND  72                  19.8216       RCHRES  32      1
PERLND  73                  47.8837       RCHRES  32      1
PERLND  74                 275.0528       RCHRES  32      1
PERLND  75                   1.7817       RCHRES  32      1
PERLND  76                   0.0000       RCHRES  32      1
PERLND  77                   0.0000       RCHRES  32      1
IMPLND  71                8.7056913       RCHRES  32      2
IMPLND  72                20.829403       RCHRES  32      2
IMPLND  73                20.834278       RCHRES  32      2
IMPLND  74                0.0000000       RCHRES  32      2
RCHRES  32                                RCHRES  39      3
```

```
*** statements above are for basin with id equal to 32 and mapping equal to
32

*** statements below are for basin with id equal to 39 and mapping equal to
39
PERLND  67                22.419108       RCHRES  39      1
PERLND  68                41.562581       RCHRES  39      1
PERLND  69                35.624452       RCHRES  39      1
PERLND  70                0.0000000       RCHRES  39      1
PERLND  71                  10.2302       RCHRES  39      1
PERLND  72                   0.0000       RCHRES  39      1
PERLND  73                  22.6843       RCHRES  39      1
PERLND  74                  96.7418       RCHRES  39      1
PERLND  75                   2.2239       RCHRES  39      1
PERLND  76                   0.0000       RCHRES  39      1
PERLND  77                   0.0000       RCHRES  39      1
IMPLND  71                6.0474318       RCHRES  39      2
IMPLND  72                30.493349       RCHRES  39      2
IMPLND  73                84.468764       RCHRES  39      2
IMPLND  74                0.0000000       RCHRES  39      2
RCHRES  39                                RCHRES  40      3
*** statements above are for basin with id equal to 39 and mapping equal to
39

*** statements below are for basin with id equal to 40 and mapping equal to
40
PERLND  67                28.374184       RCHRES  40      1
PERLND  68                20.524731       RCHRES  40      1
PERLND  69                5.7394950       RCHRES  40      1
PERLND  70                0.0000000       RCHRES  40      1
PERLND  71                   3.3359       RCHRES  40      1
PERLND  72                   3.5583       RCHRES  40      1
PERLND  73                  23.7962       RCHRES  40      1
PERLND  74                  42.0326       RCHRES  40      1
PERLND  75                   4.0031       RCHRES  40      1
PERLND  76                   0.0000       RCHRES  40      1
PERLND  77                   0.0000       RCHRES  40      1
IMPLND  71                7.6537808       RCHRES  40      2
IMPLND  72                15.058444       RCHRES  40      2
IMPLND  73                13.608856       RCHRES  40      2
IMPLND  74                0.0000000       RCHRES  40      2
RCHRES  40                                RCHRES  55      3
*** statements above are for basin with id equal to 40 and mapping equal to
40

*** statements below are for basin with id equal to 33 and mapping equal to
33
PERLND  67                25.972242       RCHRES  33      1
PERLND  68                54.809455       RCHRES  33      1
PERLND  69                33.957323       RCHRES  33      1
PERLND  70                1.0061119       RCHRES  33      1
PERLND  71                   2.6830       RCHRES  33      1
PERLND  72                   0.2236       RCHRES  33      1
PERLND  73                  16.3214       RCHRES  33      1
PERLND  74                 238.1132       RCHRES  33      1
PERLND  75                   2.4594       RCHRES  33      1
PERLND  76                   0.0000       RCHRES  33      1
```

```
PERLND  77                0.0000       RCHRES  33      1
IMPLND  71             7.0058702       RCHRES  33      2
IMPLND  72             40.212225       RCHRES  33      2
IMPLND  73             80.515853       RCHRES  33      2
IMPLND  74             0.0000000       RCHRES  33      2
RCHRES  33                             RCHRES  55      3
*** statements above are for basin with id equal to 33 and mapping equal to
33

*** statements below are for basin with id equal to 47 and mapping equal to
47
PERLND  78             $r47p1  $       RCHRES  47      1
PERLND  79             $r47p2  $       RCHRES  47      1
PERLND  80             $r47p3  $       RCHRES  47      1
PERLND  81             $r47p4  $       RCHRES  47      1
PERLND  82                3.1135       RCHRES  47      1
PERLND  83                0.0000       RCHRES  47      1
PERLND  84               18.9036       RCHRES  47      1
PERLND  85               50.9284       RCHRES  47      1
PERLND  86                0.0000       RCHRES  47      1
PERLND  87                0.0000       RCHRES  47      1
PERLND  88                0.0000       RCHRES  47      1
IMPLND  81             $r47i1  $       RCHRES  47      2
IMPLND  82             $r47i2  $       RCHRES  47      2
IMPLND  83             $r47i3  $       RCHRES  47      2
IMPLND  84             $r47i4  $       RCHRES  47      2
RCHRES  47                             RCHRES  46      3
*** statements above are for basin with id equal to 47 and mapping equal to
47

*** statements below are for basin with id equal to 48 and mapping equal to
48
PERLND  78             $r48p1  $       RCHRES  48      1
PERLND  79             $r48p2  $       RCHRES  48      1
PERLND  80             $r48p3  $       RCHRES  48      1
PERLND  81             $r48p4  $       RCHRES  48      1
PERLND  82                0.0000       RCHRES  48      1
PERLND  83                0.0000       RCHRES  48      1
PERLND  84               38.9191       RCHRES  48      1
PERLND  85               41.5878       RCHRES  48      1
PERLND  86                0.4448       RCHRES  48      1
PERLND  87                0.0000       RCHRES  48      1
PERLND  88                0.0000       RCHRES  48      1
IMPLND  81             $r48i1  $       RCHRES  48      2
IMPLND  82             $r48i2  $       RCHRES  48      2
IMPLND  83             $r48i3  $       RCHRES  48      2
IMPLND  84             $r48i4  $       RCHRES  48      2
RCHRES  48                             RCHRES  46      3
*** statements above are for basin with id equal to 48 and mapping equal to
48

*** statements below are for basin with id equal to 35 and mapping equal to
35
PERLND  78             $r35p1  $       RCHRES  35      1
PERLND  79             $r35p2  $       RCHRES  35      1
PERLND  80             $r35p3  $       RCHRES  35      1
PERLND  81             $r35p4  $       RCHRES  35      1
```

```
PERLND  82                    0.4448       RCHRES  35      1
PERLND  83                    0.0000       RCHRES  35      1
PERLND  84                   22.4619       RCHRES  35      1
PERLND  85                   32.6920       RCHRES  35      1
PERLND  86                    3.1135       RCHRES  35      1
PERLND  87                    0.0000       RCHRES  35      1
PERLND  88                    0.0000       RCHRES  35      1
IMPLND  81                 $r35i1  $       RCHRES  35      2
IMPLND  82                 $r35i2  $       RCHRES  35      2
IMPLND  83                 $r35i3  $       RCHRES  35      2
IMPLND  84                 $r35i4  $       RCHRES  35      2
RCHRES  35                                 RCHRES  38      3
*** statements above are for basin with id equal to 35 and mapping equal to
35

*** statements below are for basin with id equal to 36 and mapping equal to
36
PERLND  78                 $r36p1  $       RCHRES  36      1
PERLND  79                 $r36p2  $       RCHRES  36      1
PERLND  80                 $r36p3  $       RCHRES  36      1
PERLND  81                 $r36p4  $       RCHRES  36      1
PERLND  82                   17.5692       RCHRES  36      1
PERLND  83                    0.6672       RCHRES  36      1
PERLND  84                  100.5225       RCHRES  36      1
PERLND  85                  150.3389       RCHRES  36      1
PERLND  86                   10.4526       RCHRES  36      1
PERLND  87                    0.0000       RCHRES  36      1
PERLND  88                    0.0000       RCHRES  36      1
IMPLND  81                 $r36i1  $       RCHRES  36      2
IMPLND  82                 $r36i2  $       RCHRES  36      2
IMPLND  83                 $r36i3  $       RCHRES  36      2
IMPLND  84                 $r36i4  $       RCHRES  36      2
RCHRES  36                                 RCHRES  38      3
*** statements above are for basin with id equal to 36 and mapping equal to
36

*** statements below are for basin with id equal to 37 and mapping equal to
37
PERLND  78                 $r37p1  $       RCHRES  37      1
PERLND  79                 $r37p2  $       RCHRES  37      1
PERLND  80                 $r37p3  $       RCHRES  37      1
PERLND  81                 $r37p4  $       RCHRES  37      1
PERLND  82                    4.0031       RCHRES  37      1
PERLND  83                    0.0000       RCHRES  37      1
PERLND  84                    0.2224       RCHRES  37      1
PERLND  85                    9.3406       RCHRES  37      1
PERLND  86                    0.0000       RCHRES  37      1
PERLND  87                    0.0000       RCHRES  37      1
PERLND  88                    0.0000       RCHRES  37      1
IMPLND  81                 $r37i1  $       RCHRES  37      2
IMPLND  82                 $r37i2  $       RCHRES  37      2
IMPLND  83                 $r37i3  $       RCHRES  37      2
IMPLND  84                 $r37i4  $       RCHRES  37      2
RCHRES  37                                 RCHRES  38      3
*** statements above are for basin with id equal to 37 and mapping equal to
37
```

```
*** statements below are for basin with id equal to 46 and mapping equal to
46
PERLND  78                $r46p1  $       RCHRES  46      1
PERLND  79                $r46p2  $       RCHRES  46      1
PERLND  80                $r46p3  $       RCHRES  46      1
PERLND  81                $r46p4  $       RCHRES  46      1
PERLND  82                   0.6672       RCHRES  46      1
PERLND  83                   1.3344       RCHRES  46      1
PERLND  84                  15.7900       RCHRES  46      1
PERLND  85                  29.5785       RCHRES  46      1
PERLND  86                   0.0000       RCHRES  46      1
PERLND  87                   0.0000       RCHRES  46      1
PERLND  88                   2.6687       RCHRES  46      1
IMPLND  81                $r46i1  $       RCHRES  46      2
IMPLND  82                $r46i2  $       RCHRES  46      2
IMPLND  83                $r46i3  $       RCHRES  46      2
IMPLND  84                $r46i4  $       RCHRES  46      2
RCHRES  46                                RCHRES  43      3
*** statements above are for basin with id equal to 46 and mapping equal to
46

*** statements below are for basin with id equal to 38 and mapping equal to
38
PERLND  78                $r38p1  $       RCHRES  38      1
PERLND  79                $r38p2  $       RCHRES  38      1
PERLND  80                $r38p3  $       RCHRES  38      1
PERLND  81                $r38p4  $       RCHRES  38      1
PERLND  82                  12.6765       RCHRES  38      1
PERLND  83                   3.5583       RCHRES  38      1
PERLND  84                  70.2768       RCHRES  38      1
PERLND  85                  86.7340       RCHRES  38      1
PERLND  86                   3.5583       RCHRES  38      1
PERLND  87                   0.0000       RCHRES  38      1
PERLND  88                   0.0000       RCHRES  38      1
IMPLND  81                $r38i1  $       RCHRES  38      2
IMPLND  82                $r38i2  $       RCHRES  38      2
IMPLND  83                $r38i3  $       RCHRES  38      2
IMPLND  84                $r38i4  $       RCHRES  38      2
RCHRES  38                                RCHRES  43      3
*** statements above are for basin with id equal to 38 and mapping equal to
38

*** statements below are for basin with id equal to 41 and mapping equal to
41
PERLND  78                $r41p1  $       RCHRES  41      1
PERLND  79                $r41p2  $       RCHRES  41      1
PERLND  80                $r41p3  $       RCHRES  41      1
PERLND  81                $r41p4  $       RCHRES  41      1
PERLND  82                   6.4495       RCHRES  41      1
PERLND  83                   0.0000       RCHRES  41      1
PERLND  84                  30.9129       RCHRES  41      1
PERLND  85                  11.7869       RCHRES  41      1
PERLND  86                   1.5568       RCHRES  41      1
PERLND  87                   0.0000       RCHRES  41      1
PERLND  88                   0.0000       RCHRES  41      1
IMPLND  81                $r41i1  $       RCHRES  41      2
IMPLND  82                $r41i2  $       RCHRES  41      2
```

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IMPLND  83                 $r41i3  $       RCHRES  41      2
IMPLND  84                 $r41i4  $       RCHRES  41      2
RCHRES  41                                 RCHRES  42      3
*** statements above are for basin with id equal to 41 and mapping equal to
41

*** statements below are for basin with id equal to 42 and mapping equal to
42
PERLND  78                 $r42p1  $       RCHRES  42      1
PERLND  79                 $r42p2  $       RCHRES  42      1
***PERLND  80                 $r42p3  $       RCHRES  42      1
PERLND  81                 $r42p4  $       RCHRES  42      1
PERLND  82                    0.0000       RCHRES  42      1
PERLND  83                    0.2224       RCHRES  42      1
PERLND  84                    7.3390       RCHRES  42      1
PERLND  85                   29.5785       RCHRES  42      1
PERLND  86                    0.4448       RCHRES  42      1
PERLND  87                    0.0000       RCHRES  42      1
PERLND  88                    0.0000       RCHRES  42      1
IMPLND  81                 $r42i1  $       RCHRES  42      2
IMPLND  82                 $r42i2  $       RCHRES  42      2
***IMPLND  83                 $r42i3  $       RCHRES  42      2
IMPLND  84                 $r42i4  $       RCHRES  42      2
RCHRES  42                                 RCHRES  45      3
*** statements above are for basin with id equal to 42 and mapping equal to
42

*** statements below are for basin with id equal to 43 and mapping equal to
43
PERLND  78                 $r43p1  $       RCHRES  43      1
PERLND  79                 $r43p2  $       RCHRES  43      1
PERLND  80                 $r43p3  $       RCHRES  43      1
PERLND  81                 $r43p4  $       RCHRES  43      1
PERLND  82                   23.3515       RCHRES  43      1
PERLND  83                    1.1120       RCHRES  43      1
PERLND  84                   35.1384       RCHRES  43      1
PERLND  85                   29.3561       RCHRES  43      1
PERLND  86                    0.0000       RCHRES  43      1
PERLND  87                    0.0000       RCHRES  43      1
PERLND  88                    0.4448       RCHRES  43      1
IMPLND  81                 $r43i1  $       RCHRES  43      2
IMPLND  82                 $r43i2  $       RCHRES  43      2
IMPLND  83                 $r43i3  $       RCHRES  43      2
IMPLND  84                 $r43i4  $       RCHRES  43      2
RCHRES  43                                 RCHRES  52      3
*** statements above are for basin with id equal to 43 and mapping equal to
43

*** statements below are for basin with id equal to 45 and mapping equal to
45
PERLND  78                 $r45p1  $       RCHRES  45      1
PERLND  79                 $r45p2  $       RCHRES  45      1
PERLND  80                 $r45p3  $       RCHRES  45      1
PERLND  81                 $r45p4  $       RCHRES  45      1
PERLND  82                   11.7869       RCHRES  45      1
PERLND  83                    0.0000       RCHRES  45      1
PERLND  84                   12.2317       RCHRES  45      1
```

```
PERLND  85                   48.7045       RCHRES  45       1
PERLND  86                    0.0000       RCHRES  45       1
PERLND  87                    0.0000       RCHRES  45       1
PERLND  88                    0.4448       RCHRES  45       1
IMPLND  81                 $r45i1  $       RCHRES  45       2
IMPLND  82                 $r45i2  $       RCHRES  45       2
IMPLND  83                 $r45i3  $       RCHRES  45       2
IMPLND  84                 $r45i4  $       RCHRES  45       2
RCHRES  45                                 RCHRES  52       3
*** statements above are for basin with id equal to 45 and mapping equal to
45

*** statements below are for basin with id equal to 44 and mapping equal to
44
PERLND  78                 $r44p1  $       RCHRES  44       1
PERLND  79                 $r44p2  $       RCHRES  44       1
PERLND  80                 $r44p3  $       RCHRES  44       1
PERLND  81                 $r44p4  $       RCHRES  44       1
PERLND  82                   26.6874       RCHRES  44       1
PERLND  83                    3.5583       RCHRES  44       1
PERLND  84                   14.0109       RCHRES  44       1
PERLND  85                   37.8071       RCHRES  44       1
PERLND  86                    0.0000       RCHRES  44       1
PERLND  87                    0.0000       RCHRES  44       1
PERLND  88                    0.0000       RCHRES  44       1
IMPLND  81                 $r44i1  $       RCHRES  44       2
IMPLND  82                 $r44i2  $       RCHRES  44       2
IMPLND  83                 $r44i3  $       RCHRES  44       2
IMPLND  84                 $r44i4  $       RCHRES  44       2
RCHRES  44                                 RCHRES  52       3
*** statements above are for basin with id equal to 44 and mapping equal to
44

*** statements below are for basin with id equal to 49 and mapping equal to
49
PERLND  78                 $r49p1  $       RCHRES  49       1
PERLND  79                 $r49p2  $       RCHRES  49       1
PERLND  80                 $r49p3  $       RCHRES  49       1
PERLND  81                 $r49p4  $       RCHRES  49       1
PERLND  82                    0.0000       RCHRES  49       1
PERLND  83                    0.0000       RCHRES  49       1
PERLND  84                    0.0000       RCHRES  49       1
PERLND  85                   28.4665       RCHRES  49       1
PERLND  86                    0.0000       RCHRES  49       1
PERLND  87                    0.0000       RCHRES  49       1
PERLND  88                    0.0000       RCHRES  49       1
IMPLND  81                 $r49i1  $       RCHRES  49       2
IMPLND  82                 $r49i2  $       RCHRES  49       2
IMPLND  83                 $r49i3  $       RCHRES  49       2
IMPLND  84                 $r49i4  $       RCHRES  49       2
RCHRES  49                                 RCHRES  50       3
*** statements above are for basin with id equal to 49 and mapping equal to
49

*** statements below are for basin with id equal to 50 and mapping equal to
50
PERLND  78                 $r50p1  $       RCHRES  50       1
```

```
PERLND  79                $r50p2  $       RCHRES  50       1
PERLND  80                $r50p3  $       RCHRES  50       1
PERLND  81                $r50p4  $       RCHRES  50       1
PERLND  82                   0.8896       RCHRES  50       1
PERLND  83                   0.0000       RCHRES  50       1
PERLND  84                   6.2271       RCHRES  50       1
PERLND  85                  11.5645       RCHRES  50       1
PERLND  86                   0.0000       RCHRES  50       1
PERLND  87                   0.0000       RCHRES  50       1
PERLND  88                   0.0000       RCHRES  50       1
IMPLND  81                $r50i1  $       RCHRES  50       2
IMPLND  82                $r50i2  $       RCHRES  50       2
IMPLND  83                $r50i3  $       RCHRES  50       2
IMPLND  84                $r50i4  $       RCHRES  50       2
RCHRES  50                                RCHRES  52       3
*** statements above are for basin with id equal to 50 and mapping equal to
50

*** statements below are for basin with id equal to 55 and mapping equal to
55
PERLND  67                47.465456       RCHRES  55       1
PERLND  68                17.317742       RCHRES  55       1
PERLND  69                3.8263300       RCHRES  55       1
PERLND  70                0.0000000       RCHRES  55       1
PERLND  71                   5.7823       RCHRES  55       1
PERLND  72                   0.0000       RCHRES  55       1
PERLND  73                  65.8289       RCHRES  55       1
PERLND  74                  62.4930       RCHRES  55       1
PERLND  75                   7.1166       RCHRES  55       1
PERLND  76                   0.0000       RCHRES  55       1
PERLND  77                   0.0000       RCHRES  55       1
IMPLND  71                12.803547       RCHRES  55       2
IMPLND  72                12.705562       RCHRES  55       2
IMPLND  73                9.0725710       RCHRES  55       2
IMPLND  74                0.0000000       RCHRES  55       2
RCHRES  55                                RCHRES  54       3
*** statements above are for basin with id equal to 55 and mapping equal to
55

*** statements below are for basin with id equal to 54 and mapping equal to
54
PERLND  78                $r54p1  $       RCHRES  54       1
PERLND  79                $r54p2  $       RCHRES  54       1
PERLND  80                $r54p3  $       RCHRES  54       1
PERLND  81                $r54p4  $       RCHRES  54       1
PERLND  82                   0.8896       RCHRES  54       1
PERLND  83                   0.4448       RCHRES  54       1
PERLND  84                   4.8927       RCHRES  54       1
PERLND  85                  20.4603       RCHRES  54       1
PERLND  86                   0.0000       RCHRES  54       1
PERLND  87                   0.0000       RCHRES  54       1
PERLND  88                   0.0000       RCHRES  54       1
IMPLND  81                $r54i1  $       RCHRES  54       2
IMPLND  82                $r54i2  $       RCHRES  54       2
IMPLND  83                $r54i3  $       RCHRES  54       2
IMPLND  84                $r54i4  $       RCHRES  54       2
RCHRES  54                                RCHRES  52       3
```

```
*** statements above are for basin with id equal to 54 and mapping equal to
54

*** statements below are for basin with id equal to 52 and mapping equal to
52
PERLND  78                 $r52p1  $       RCHRES  52      1
PERLND  79                 $r52p2  $       RCHRES  52      1
PERLND  80                 $r52p3  $       RCHRES  52      1
PERLND  81                 $r52p4  $       RCHRES  52      1
PERLND  82                   53.5972       RCHRES  52      1
PERLND  83                    3.1135       RCHRES  52      1
PERLND  84                   26.0202       RCHRES  52      1
PERLND  85                    7.3390       RCHRES  52      1
PERLND  86                    0.0000       RCHRES  52      1
PERLND  87                    0.0000       RCHRES  52      1
PERLND  88                    0.8896       RCHRES  52      1
IMPLND  81                 $r52i1  $       RCHRES  52      2
IMPLND  82                 $r52i2  $       RCHRES  52      2
IMPLND  83                 $r52i3  $       RCHRES  52      2
IMPLND  84                 $r52i4  $       RCHRES  52      2
RCHRES  52                                 RCHRES  53      3
*** statements above are for basin with id equal to 52 and mapping equal to
52

*** statements below are for basin with id equal to 53 and mapping equal to
53
PERLND  78                 $r53p1  $       RCHRES  53      1
PERLND  79                 $r53p2  $       RCHRES  53      1
PERLND  80                 $r53p3  $       RCHRES  53      1
PERLND  81                 $r53p4  $       RCHRES  53      1
PERLND  82                    2.6687       RCHRES  53      1
PERLND  83                    0.0000       RCHRES  53      1
PERLND  84                    2.2239       RCHRES  53      1
PERLND  85                    0.0000       RCHRES  53      1
PERLND  86                    0.0000       RCHRES  53      1
PERLND  87                    0.0000       RCHRES  53      1
PERLND  88                    0.0000       RCHRES  53      1
IMPLND  81                 $r53i1  $       RCHRES  53      2
IMPLND  82                 $r53i2  $       RCHRES  53      2
IMPLND  83                 $r53i3  $       RCHRES  53      2
IMPLND  84                 $r53i4  $       RCHRES  53      2
RCHRES  53                                 RCHRES  51      3
*** statements above are for basin with id equal to 53 and mapping equal to
53
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 7 below
WDM   1162 PREC                   1.00     PERLND  67  77 EXTNL  PREC
WDM   1162 PREC                   1.00     IMPLND  71  74 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND  67  77 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND  71  74 EXTNL  PETINP

*** Zone 8 below
WDM   1162 PREC                   1.00     PERLND  78  88 EXTNL  PREC
WDM   1162 PREC                   1.00     IMPLND  81  84 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND  78  88 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND  81  84 EXTNL  PETINP
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** clear creek - west tributary
RCHRES  55 HYDR   RO                       WDM2    55 FLOW     ENGL AGGR REPL
RCHRES  55 HYDR   RO                       WDM2  1055 FLOW     ENGL AGGR REPL

*** clear creek mainstem
RCHRES  53 HYDR   RO                       WDM2    53 FLOW     ENGL AGGR REPL
RCHRES  53 HYDR   RO                       WDM2  1053 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.8.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Clear Creek streamflow gaging station.

```
ptf $

19 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn7         $    $infilt7        $ $         lsur7$$
slsur7$       0.$         agwrc7b$
20 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn7         $    $infilt7        $ $         lsur7$$
slsur7$       0.$         agwrc7a$
21 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn7         $    $infilt7        $ $         lsur7$$
slsur7$       0.$         agwrc7b$

22 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn8         $    $infilt8        $ $         lsur8$$
slsur8$       0.$         agwrc8b$
23 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn8         $    $infilt8        $ $         lsur8$$
slsur8$       0.$         agwrc8a$
24 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn8         $    $infilt8        $ $         lsur8$$
slsur8$       0.$         agwrc8b$

64   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0               2.0 $ deepfr7    $
0.0       0.00
65   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0               2.0 $ deepfr7    $ $
basetp7       $ 0.00
66   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0               2.0 $ deepfr7    $
0.0       0.00

67   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0               2.0 $ deepfr8    $
0.0       0.00
68   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0               2.0 $ deepfr8    $ $
basetp8       $ 0.00
69   7  PETMAX        PETMIN    INFEXP            INFILD   DEEPFR
BASETP       AGWETP
        40.0          35.0       2.0               2.0 $ deepfr8    $
0.0       0.00

121 6  CEPSC                         UZSN              NSUR             INTFW
IRC            LZETP
```

```
      $        CEPSC7b$  $        UZSN7b$ $        NSUR7b$ $       INTFW7b$ $
IRC7b$  $     LZETP7b$
122 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7a$ $        NSUR7a$ $       INTFW7a$ $
IRC7a$  $     LZETP7b$
123 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7b$ $        NSUR7b$ $       INTFW7b$ $
IRC7b$  $     LZETP7b$
124 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7a$  $        UZSN7b$ $        NSUR7c$ $       INTFW7b$ $
IRC7b$  $     LZETP7a$
125 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC7b$  $        UZSN7b$ $        NSUR7b$ $       INTFW7b$ $
IRC7b$  $     LZETP7b$

126 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC8b$  $        UZSN8b$ $        NSUR8b$ $       INTFW8b$ $
IRC8b$  $     LZETP8b$
127 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC8b$  $        UZSN8a$ $        NSUR8a$ $       INTFW8a$ $
IRC8a$  $     LZETP8b$
128 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC8b$  $        UZSN8b$ $        NSUR8b$ $       INTFW8b$ $
IRC8b$  $     LZETP8b$
129 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC8a$  $        UZSN8b$ $        NSUR8c$ $       INTFW8b$ $
IRC8b$  $     LZETP8a$
130 6  CEPSC                         UZSN             NSUR             INTFW
IRC            LZETP
      $        CEPSC8b$  $        UZSN8b$ $        NSUR8b$ $       INTFW8b$ $
IRC8b$  $     LZETP8b$

172 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR7$ $      ISLSUR7$ $     INSUR7$ $       RETSC7$

173 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR8$ $      ISLSUR8$ $     INSUR8$ $       RETSC8$
```

File J.8.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Clear Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Barker Creek

***  START       2001/8 / 1  0: 0  END    2002/ 9/30 23:45
  START       2000/ 9/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname------------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 9 below - da above barker creek gaging station
      PERLND      89
      PERLND      90
      PERLND      91
      PERLND      92
      PERLND      93
      PERLND      94
      PERLND      95
      PERLND      96
      PERLND      97
      PERLND      98
      PERLND      99

      IMPLND      91
      IMPLND      92
      IMPLND      93
      IMPLND      94

      RCHRES      18
      RCHRES       1
      RCHRES      17
      RCHRES      16
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
```

```
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                                t-series Engl Metr***
                                           in  out        ***
   89     Med. Dens. Res.                   1    1   90    0
   90     High Dens. Res.                   1    1   90    0
   91     Comm./Ind.                        1    1   90    0
   92     Acrgs/Rural Dev.                  1    1   90    0
   93     Herb. RL                          1    1   90    0
   94     Shrub & Brush RL                  1    1   90    0
   95     Deciduous Forest                  1    1   90    0
   96     Conif. Forest                     1    1   90    0
   97     Mixed Forest                      1    1   90    0
   98     Beaches                           1    1   90    0
   99     other barren lnd                  1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                  Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
   89   92    0    1    1    0    0    0    0    0    0
   93   95    0    1    1    1    0    0    0    0    1
   96   99    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
   89            0.0 ~25~  8.0      0.15     300.0  0.075000       0.0
0.925
   90   91       0.0 ~26~  8.0      0.15     300.0  0.075000       0.0
0.925
   92   99       0.0 ~27~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
   89   94 ~70~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   95   97 ~71~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
   98   99 ~72~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                                ***
```

```
*** x -  x      CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   89      ~131~ 0.0        0.8       0.1       1.0       0.7       0.6
   90   91 ~132~ 0.0        0.8       0.1       1.0       0.7       0.6
   92   94 ~133~ 0.0        0.8       0.1       1.0       0.7       0.6
   95   97 ~134~ 0.0        0.8       0.1       1.0       0.7       0.6
   98   99 ~135~ 0.0        0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
   93   94 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
   95      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
   93   94  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
   95       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x        FZG      FZGL
    1  165        1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >              Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
   91   94    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
   91   94    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
   91     MED. DENS. RES.              1    1   90    0
   92     HIG DENS. RES.               1    1   90    0
```

```
   93     COMM./IND.                    1    1   90    0
   94     LOW DENS. RES.                1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
   91   94    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
   91   94     150.0     .0054       0.1     0.055 ~174~

  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
   91   94     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                         user t-series  Engl Metr LKFG***
                                          in  out             ***
    1                                 1         1    1   90    1    0
    2  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
```

```
    x -   x  DSN FTBN       LEN      DELTH      STCOR        KS       DB50***
    1              1     3.299       0.00        0.0        0.5      0.01
   16             16     3.299       0.00        0.0        0.5      0.01
   17             17     2.498       0.00        0.0        0.5      0.01
   18             18     0.336       0.00        0.0        0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1          836.7       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
    2  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     1
   18    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     5.864    13.267    77.8000.000E+000
    12.371    34.049   421.2000.000E+000
    14.604    41.834   610.9000.000E+000
    17.267    48.452   836.6000.000E+000
    17.300    48.502   838.225     0.277
    17.350    48.552   840.650     1.108
    17.400    48.602   843.175     2.247
    17.450    48.652   845.500     3.627
    17.550    48.702   850.325     6.975
    17.650    48.752   855.250    10.982
    17.750    48.802   860.075    15.553
    18.000    48.852   872.100    29.076
    18.250    48.902   884.225    45.156
    18.750    48.952   908.550    83.675
    19.000    49.002   920.675   105.700
    20.000    49.052   969.000   209.335
    30.000    49.102  1454.025  2105.128
  END FTABLE 1
  FTABLE     16
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.999     0.0209.595E-003
     0.050     2.030     0.1011.410E-001
     0.100     2.070     0.2034.454E-001
     0.250     2.190     0.5232.046E+000
     0.500     2.389     1.0956.489E+000
```

```
     0.750     2.588     1.7171.281E+001
     1.000     2.787     2.3892.085E+001
     1.250     2.986     3.1113.057E+001
     1.500     3.185     3.8824.193E+001
     1.750     3.384     4.7035.497E+001
     2.000     3.583     5.5746.969E+001
     2.250     3.782     6.4958.615E+001
     2.500     3.981     7.4651.044E+002
     3.000     4.379     9.5551.463E+002
     4.000     5.176    14.3332.532E+002
     5.000     5.972    19.9063.935E+002
    10.000     9.953    59.7191.698E+003
    50.000    41.804      10958.064E+004
 10000.000  7964.580  398328559.638E+010
  END FTABLE 16
  FTABLE     17
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.537     0.0158.095E-003
     0.050     1.561     0.0771.190E-001
     0.100     1.592     0.1563.758E-001
     0.250     1.684     0.4021.726E+000
     0.500     1.837     0.8425.475E+000
     0.750     1.990     1.3201.081E+001
     1.000     2.143     1.8371.759E+001
     1.250     2.296     2.3922.579E+001
     1.500     2.449     2.9853.537E+001
     1.750     2.602     3.6174.637E+001
     2.000     2.755     4.2865.880E+001
     2.250     2.909     4.9947.268E+001
     2.500     3.062     5.7418.805E+001
     3.000     3.368     7.3481.234E+002
     4.000     3.980    11.0222.136E+002
     5.000     4.592    15.3083.320E+002
    10.000     7.654    45.9251.433E+003
    50.000    32.147       8426.803E+004
 10000.000  6124.862  306319638.131E+010
  END FTABLE 17
  FTABLE     18
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.189     0.0021.728E-002
     0.050     0.192     0.0102.539E-001
     0.100     0.196     0.0198.021E-001
     0.250     0.208     0.0503.684E+000
     0.500     0.226     0.1041.169E+001
     0.750     0.245     0.1632.308E+001
     1.000     0.264     0.2263.756E+001
     1.250     0.283     0.2955.505E+001
     1.500     0.302     0.3687.551E+001
     1.750     0.321     0.4469.899E+001
     2.000     0.340     0.5281.255E+002
     2.250     0.358     0.6161.551E+002
```

```
     2.500     0.377     0.7081.880E+002
     3.000     0.415     0.9062.634E+002
     4.000     0.491     1.3584.560E+002
     5.000     0.566     1.8877.088E+002
    10.000     0.943     5.6603.059E+003
    50.000     3.962       1041.452E+005
 10000.000   754.872   37753051.736E+011
  END FTABLE 18
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 18 and mapping equal to
18
PERLND  89                 $r18p1  $       RCHRES  18      1
PERLND  90                 $r18p2  $       RCHRES  18      1
PERLND  91                 $r18p3  $       RCHRES  18      1
PERLND  92                 $r18p4  $       RCHRES  18      1
PERLND  93                    8.2286       RCHRES  18      1
PERLND  94                    5.3375       RCHRES  18      1
PERLND  95                  101.1897       RCHRES  18      1
PERLND  96                  114.9781       RCHRES  18      1
PERLND  97                    6.2271       RCHRES  18      1
PERLND  98                    0.0000       RCHRES  18      1
PERLND  99                    0.0000       RCHRES  18      1
IMPLND  91                 $r18i1  $       RCHRES  18      2
IMPLND  92                 $r18i2  $       RCHRES  18      2
IMPLND  93                 $r18i3  $       RCHRES  18      2
IMPLND  94                 $  r18i4$       RCHRES  18      2
RCHRES  18                                 RCHRES   1      3
*** statements above are for basin with id equal to 18 and mapping equal to
18

RCHRES   1                                 RCHRES  17      3

*** statements below are for basin with id equal to 17 and mapping equal to
17
PERLND  89                 $r17p1  $       RCHRES  17      1
PERLND  90                 $r17p2  $       RCHRES  17      1
PERLND  91                 $r17p3  $       RCHRES  17      1
PERLND  92                 $r17p4  $       RCHRES  17      1
PERLND  93                   60.9362       RCHRES  17      1
PERLND  94                    3.1135       RCHRES  17      1
PERLND  95                  193.2611       RCHRES  17      1
PERLND  96                  122.3172       RCHRES  17      1
PERLND  97                    3.7807       RCHRES  17      1
PERLND  98                    0.0000       RCHRES  17      1
PERLND  99                    0.0000       RCHRES  17      1
IMPLND  91                 $r17i1  $       RCHRES  17      2
IMPLND  92                 $r17i2  $       RCHRES  17      2
IMPLND  93                 $r17i3  $       RCHRES  17      2
IMPLND  94                 $r17i4  $       RCHRES  17      2
RCHRES  17                                 RCHRES  16      3
*** statements above are for basin with id equal to 17 and mapping equal to
17
```

```
*** statements below are for basin with id equal to 16 and mapping equal to
16
PERLND  89                 $r16p1  $       RCHRES  16      1
PERLND  90                 $r16p2  $       RCHRES  16      1
PERLND  91                 $r16p3  $       RCHRES  16      1
PERLND  92                 $r16p4  $       RCHRES  16      1
PERLND  93                  113.4510       RCHRES  16      1
PERLND  94                    4.6715       RCHRES  16      1
PERLND  95                  124.3512       RCHRES  16      1
PERLND  96                  114.3408       RCHRES  16      1
PERLND  97                    5.7838       RCHRES  16      1
PERLND  98                    0.0000       RCHRES  16      1
PERLND  99                    0.0000       RCHRES  16      1
IMPLND  91                 $r16i1  $       RCHRES  16      2
IMPLND  92                 $r16i2  $       RCHRES  16      2
IMPLND  93                 $r16i3  $       RCHRES  16      2
IMPLND  94                 $r16i4  $       RCHRES  16      2
***RCHRES  16                                 RCHRES  19      3
*** statements above are for basin with id equal to 16 and mapping equal to
16
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 9 below
WDM   1162 PREC                   1.00     PERLND  89  99 EXTNL  PREC
```

```
WDM   1162 PREC                   1.00     IMPLND  91  94 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND  89  99 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND  91  94 EXTNL  PETINP

WDM   1162 PREC                   1.00     RCHRES   1     EXTNL  PREC
WDM    144 PEVT                   1.00     RCHRES   1     EXTNL  POTEV

WDM2  9999 FLOW     ENGL     $      x$     RCHRES  17     EXTNL  IVOL

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** island lake volume
RCHRES   1 HYDR   VOL                      WDM2     1 VOL      ENGL AGGR REPL

*** barker creek
RCHRES  16 HYDR   RO                       WDM2    16 FLOW     ENGL AGGR REPL
RCHRES  16 HYDR   RO                       WDM2  1016 FLOW     ENGL AGGR REPL
RCHRES  16 HYDR   ROVOL                    WDM2  3016 RVOL     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.9.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Barker Creek streamflow gaging station.

```
ptf $

25 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn9          $    $infilt9        $ $         lsur9$$
slsur9$        0.$         agwrc9b$
26 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn9          $    $infilt9        $ $         lsur9$$
slsur9$        0.$         agwrc9a$
27 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn9          $    $infilt9        $ $         lsur9$$
slsur9$        0.$         agwrc9b$

70   7  PETMAX          PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0            35.0       2.0                 2.0 $ deepfr9    $
0.0       0.00
71   7  PETMAX          PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0            35.0       2.0                 2.0 $ deepfr9    $ $
basetp9       $ 0.00
72   7  PETMAX          PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0            35.0       2.0                 2.0 $ deepfr9    $
0.0       0.00

131 6  CEPSC                         UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC9b$  $        UZSN9b$ $        NSUR9b$ $       INTFW9b$ $
IRC9b$  $     LZETP9b$
132 6  CEPSC                         UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC9b$  $        UZSN9a$ $        NSUR9a$ $       INTFW9a$ $
IRC9a$  $     LZETP9b$
133 6  CEPSC                         UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC9b$  $        UZSN9b$ $        NSUR9b$ $       INTFW9b$ $
IRC9b$  $     LZETP9b$
134 6  CEPSC                         UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC9a$  $        UZSN9b$ $        NSUR9c$ $       INTFW9b$ $
IRC9b$  $     LZETP9a$
135 6  CEPSC                         UZSN             NSUR             INTFW
IRC             LZETP
      $        CEPSC9b$  $        UZSN9b$ $        NSUR9b$ $       INTFW9b$ $
IRC9b$  $     LZETP9b$

174 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR9$ $      ISLSUR9$ $     INSUR9$ $       RETSC9$
```

File J.9.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Barker Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Karcher Ck

  START       2000/10/ 1  0: 0  END    2002/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 10 below - da above karcher creek gaging
station
      PERLND     100
      PERLND     101
      PERLND     102
      PERLND     103
      PERLND     104
      PERLND     105
      PERLND     106
      PERLND     107
      PERLND     108
      PERLND     109
      PERLND     110

      IMPLND     101
      IMPLND     102
      IMPLND     103
      IMPLND     104

      RCHRES      20
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0
```

```
  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                               t-series Engl Metr***
                                          in  out         ***
  100     Med. Dens. Res.                  1    1   90    0
  101     High Dens. Res.                  1    1   90    0
  102     Comm./Ind.                       1    1   90    0
  103     Acrgs/Rural Dev.                 1    1   90    0
  104     Herb. RL                         1    1   90    0
  105     Shrub & Brush RL                 1    1   90    0
  106     Deciduous Forest                 1    1   90    0
  107     Conif. Forest                    1    1   90    0
  108     Mixed Forest                     1    1   90    0
  109     Beaches                          1    1   90    0
  110     other barren lnd                 1    1   90    0

  END GEN-INFO

  PWAT-PARM1
*** <PLS >                  Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
  100  103    0    1    1    0    0    0    0    0    0
  104  106    0    1    1    1    0    0    0    0    1
  107  110    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
  100            0.0 ~28~  8.0      0.15     300.0  0.075000       0.0
0.925
  101  102       0.0 ~29~  8.0      0.15     300.0  0.075000       0.0
0.925
  103  110       0.0 ~30~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
  100  105 ~73~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  106  108 ~74~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  109  110 ~75~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                               ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  100      ~136~ 0.0       0.8       0.1       1.0       0.7       0.6
```

```
  101  102 ~137~ 0.0       0.8       0.1       1.0       0.7       0.6
  103  105 ~138~ 0.0       0.8       0.1       1.0       0.7       0.6
  106  108 ~139~ 0.0       0.8       0.1       1.0       0.7       0.6
  109  110 ~140~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
  104  105 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
  106      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
  104  105  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
  106       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                             ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  101  104    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  101  104    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
  101     MED. DENS. RES.              1    1   90    0
  102     HIG DENS. RES.               1    1   90    0
  103     COMM./IND.                   1    1   90    0
  104     LOW DENS. RES.               1    1   90    0
```

```
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  101  104    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
  101  104     150.0     .0054       0.1     0.055 ~175~

  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  101  104     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer      ***
    # -  #                         user t-series  Engl Metr LKFG***
                                          in  out              ***
    1  175                           1        1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
   20             20     2.088      0.00       0.0       0.5      0.01
  END HYDR-PARM2
```

```
  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     20
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.266     0.0131.201E-002
     0.050     1.286     0.0641.765E-001
     0.100     1.311     0.1295.575E-001
     0.250     1.387     0.3312.561E+000
     0.500     1.513     0.6938.122E+000
     0.750     1.639     1.0881.604E+001
     1.000     1.765     1.5132.610E+001
     1.250     1.891     1.9703.826E+001
     1.500     2.017     2.4595.248E+001
     1.750     2.143     2.9796.880E+001
     2.000     2.269     3.5308.723E+001
     2.250     2.396     4.1141.078E+002
     2.500     2.522     4.7281.306E+002
     3.000     2.774     6.0521.831E+002
     4.000     3.278     9.0783.170E+002
     5.000     3.782    12.6084.926E+002
    10.000     6.304    37.8252.126E+003
    50.000    26.477       6931.009E+005
 10000.000  5044.536  252289821.206E+011
  END FTABLE 20
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 20 and mapping equal to
20
PERLND 100                 $r20p1  $       RCHRES  20      1
PERLND 101                 $r20p2  $       RCHRES  20      1
PERLND 102                 $r20p3  $       RCHRES  20      1
PERLND 103                 $r20p4  $       RCHRES  20      1
PERLND 104                   14.4846       RCHRES  20      1
PERLND 105                    0.0000       RCHRES  20      1
PERLND 106                  142.6174       RCHRES  20      1
PERLND 107                  206.3496       RCHRES  20      1
PERLND 108                    4.0111       RCHRES  20      1
```

```
PERLND 109                  0.0000       RCHRES  20      1
PERLND 110                  0.0000       RCHRES  20      1
IMPLND 101               $r20i1  $       RCHRES  20      2
IMPLND 102               $r20i2  $       RCHRES  20      2
IMPLND 103               $r20i3  $       RCHRES  20      2
IMPLND 104               $r20i4  $       RCHRES  20      2
***RCHRES  20                               RCHRES 161      3
*** statements above are for basin with id equal to 20 and mapping equal to
20
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 10 below
WDM   9852 PREC                   1.00     PERLND 100 110 EXTNL  PREC
WDM   9852 PREC                   1.00     IMPLND 101 104 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND 100 110 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND 101 104 EXTNL  PETINP

WDM2  9999 FLOW     ENGL     $      x$     RCHRES  20     EXTNL  IVOL

END EXT SOURCES

EXT TARGETS
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** karcher creek
RCHRES  20 HYDR   RO                       WDM2    20 FLOW     ENGL AGGR REPL
RCHRES  20 HYDR   RO                       WDM2  1020 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.10.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Karcher Creek streamflow gaging station.

```
ptf $

28 7  FOREST   LZSN                 INFILT                       LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn10         $    $infilt10       $ $        lsur10$$
slsur10$        0.$        agwrc10b$
29 7  FOREST   LZSN                 INFILT                       LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn10         $    $infilt10       $ $        lsur10$$
slsur10$        0.$        agwrc10a$
30 7  FOREST   LZSN                 INFILT                       LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn10         $    $infilt10       $ $        lsur10$$
slsur10$        0.$        agwrc10b$

73   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr10   $
0.0       0.00
74   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr10   $ $
basetp10      $ 0.00
75   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr10   $
0.0       0.00

136 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC10b$  $       UZSN10b$ $       NSUR10b$ $      INTFW10b$ $
IRC10b$  $    LZETP10b$
137 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC10b$  $       UZSN10a$ $       NSUR10a$ $      INTFW10a$ $
IRC10a$  $    LZETP10b$
138 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC10b$  $       UZSN10b$ $       NSUR10b$ $      INTFW10b$ $
IRC10b$  $    LZETP10b$
139 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC10a$  $       UZSN10b$ $       NSUR10c$ $      INTFW10b$ $
IRC10b$  $    LZETP10a$
140 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC10b$  $       UZSN10b$ $       NSUR10b$ $      INTFW10b$ $
IRC10b$  $    LZETP10b$

175 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR10$ $      ISLSUR10$ $     INSUR10$ $       RETSC10$
```

File J.10.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Karcher Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for BJ Creek

  START       2000/ 9/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 11 below - da above blackjack creek gaging
station
      PERLND     111
      PERLND     112
      PERLND     113
      PERLND     114
      PERLND     115
      PERLND     116
      PERLND     117
      PERLND     118
      PERLND     119
      PERLND     120
      PERLND     121

      IMPLND     111
      IMPLND     112
      IMPLND     113
      IMPLND     114

      RCHRES      22
      RCHRES      30
      RCHRES      21
      RCHRES      23
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
```

```
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                            t-series Engl Metr***
                                       in  out          ***
  111     Med. Dens. Res.               1    1   90    0
  112     High Dens. Res.               1    1   90    0
  113     Comm./Ind.                    1    1   90    0
  114     Acrgs/Rural Dev.              1    1   90    0
  115     Herb. RL                      1    1   90    0
  116     Shrub & Brush RL              1    1   90    0
  117     Deciduous Forest              1    1   90    0
  118     Conif. Forest                 1    1   90    0
  119     Mixed Forest                  1    1   90    0
  120     Beaches                       1    1   90    0
  121     other barren lnd              1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
  111  114    0    1    1    0    0    0    0    0    0
  115  117    0    1    1    1    0    0    0    0    1
  118  121    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
  111            0.0 ~31~  8.0      0.15     300.0  0.075000       0.0
0.925
  112  113       0.0 ~32~  8.0      0.15     300.0  0.075000       0.0
0.925
  114  121       0.0 ~33~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
  111  116 ~76~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  117  119 ~77~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  120  121 ~78~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                             ***
```

```
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  111      ~141~ 0.0       0.8       0.1       1.0       0.7       0.6
  112  113 ~142~ 0.0       0.8       0.1       1.0       0.7       0.6
  114  116 ~143~ 0.0       0.8       0.1       1.0       0.7       0.6
  117  119 ~144~ 0.0       0.8       0.1       1.0       0.7       0.6
  120  121 ~145~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
  115  116 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
  117      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
  115  116  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
  117       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                          ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >             Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  111  114    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  111  114    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
  111     MED. DENS. RES.              1    1   90    0
  112     HIG DENS. RES.               1    1   90    0
```

```
  113     COMM./IND.                   1    1   90    0
  114     LOW DENS. RES.               1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  111  114    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
  111  114     150.0     .0054       0.1     0.055 ~176~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  111  114     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                         user t-series  Engl Metr LKFG***
                                          in  out                ***
    1  175                           1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS       DB50***
   21             21     1.324      0.00       0.0       0.5       0.01
```

```
   22              22     2.517      0.00       0.0       0.5      0.01
   23              23     0.597      0.00       0.0       0.5      0.01
   30              30     5.220      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     21
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.783     0.0085.825E-003
     0.050     0.795     0.0398.560E-002
     0.100     0.811     0.0802.704E-001
     0.250     0.857     0.2051.242E+000
     0.500     0.935     0.4293.940E+000
     0.750     1.013     0.6727.779E+000
     1.000     1.091     0.9351.266E+001
     1.250     1.169     1.2181.856E+001
     1.500     1.247     1.5202.546E+001
     1.750     1.325     1.8423.337E+001
     2.000     1.403     2.1834.231E+001
     2.250     1.481     2.5435.230E+001
     2.500     1.559     2.9236.336E+001
     3.000     1.715     3.7428.880E+001
     4.000     2.027     5.6131.537E+002
     5.000     2.339     7.7952.389E+002
    10.000     3.898    23.3861.031E+003
    50.000    16.370      4294.895E+004
 10000.000  3118.933  155985645.851E+010
  END FTABLE 21
  FTABLE     22
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.549     0.0158.535E-003
     0.050     1.574     0.0781.254E-001
     0.100     1.605     0.1573.962E-001
     0.250     1.698     0.4051.820E+000
     0.500     1.852     0.8495.772E+000
     0.750     2.006     1.3311.140E+001
     1.000     2.161     1.8521.855E+001
```

```
    1.250     2.315     2.4112.719E+001
    1.500     2.469     3.0093.730E+001
    1.750     2.624     3.6464.889E+001
    2.000     2.778     4.3216.199E+001
    2.250     2.932     5.0357.663E+001
    2.500     3.087     5.7879.283E+001
    3.000     3.395     7.4081.301E+002
    4.000     4.012    11.1112.252E+002
    5.000     4.630    15.4333.501E+002
   10.000     7.716    46.2981.511E+003
   50.000    32.408       8497.173E+004
10000.000  6174.584  308806358.573E+010
 END FTABLE 22
 FTABLE     23
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.357     0.0044.960E-003
    0.050     0.363     0.0187.288E-002
    0.100     0.370     0.0362.302E-001
    0.250     0.391     0.0931.058E+000
    0.500     0.427     0.1963.354E+000
    0.750     0.463     0.3076.623E+000
    1.000     0.498     0.4271.078E+001
    1.250     0.534     0.5561.580E+001
    1.500     0.569     0.6942.167E+001
    1.750     0.605     0.8412.841E+001
    2.000     0.641     0.9963.602E+001
    2.250     0.676     1.1614.453E+001
    2.500     0.712     1.3355.395E+001
    3.000     0.783     1.7087.561E+001
    4.000     0.925     2.5621.309E+002
    5.000     1.068     3.5592.034E+002
   10.000     1.779    10.6768.779E+002
   50.000     7.473       1964.168E+004
10000.000  1423.861   71210844.982E+010
 END FTABLE 23
 FTABLE     30
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     3.148     0.0316.519E-003
    0.050     3.198     0.1599.580E-002
    0.100     3.261     0.3203.026E-001
    0.250     3.449     0.8231.390E+000
    0.500     3.762     1.7244.409E+000
    0.750     4.076     2.7048.705E+000
    1.000     4.389     3.7621.417E+001
    1.250     4.703     4.8992.077E+001
    1.500     5.016     6.1132.849E+001
    1.750     5.330     7.4073.734E+001
    2.000     5.643     8.7784.735E+001
    2.250     5.957    10.2295.853E+001
    2.500     6.270    11.7577.091E+001
    3.000     6.897    15.0489.938E+001
```

```
     4.000     8.151    22.5731.720E+002
     5.000     9.405    31.3512.674E+002
    10.000    15.676    94.0531.154E+003
    50.000    65.837      17245.479E+004
 10000.000 12543.536  627333556.548E+010
  END FTABLE 30
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 22 and mapping equal to
22
PERLND 111                 $r22p1  $       RCHRES  22      1
PERLND 112                 $r22p2  $       RCHRES  22      1
PERLND 113                 $r22p3  $       RCHRES  22      1
PERLND 114                 $r22p4  $       RCHRES  22      1
PERLND 115                   96.9808       RCHRES  22      1
PERLND 116                   17.9847       RCHRES  22      1
PERLND 117                  326.0012       RCHRES  22      1
PERLND 118                  783.5868       RCHRES  22      1
PERLND 119                   51.4499       RCHRES  22      1
PERLND 120                    0.0000       RCHRES  22      1
PERLND 121                    2.9595       RCHRES  22      1
IMPLND 111                 $r22i1  $       RCHRES  22      2
IMPLND 112                 $r22i2  $       RCHRES  22      2
IMPLND 113                 $r22i3  $       RCHRES  22      2
IMPLND 114                 $r22i4  $       RCHRES  22      2
RCHRES  22                                 RCHRES  30      3
*** statements above are for basin with id equal to 22 and mapping equal to
22

*** statements below are for basin with id equal to 30 and mapping equal to
30
PERLND 111                 $r30p1  $       RCHRES  30      1
PERLND 112                 $r30p2  $       RCHRES  30      1
PERLND 113                 $r30p3  $       RCHRES  30      1
PERLND 114                 $r30p4  $       RCHRES  30      1
PERLND 115                  511.4285       RCHRES  30      1
PERLND 116                   26.5185       RCHRES  30      1
PERLND 117                  538.8384       RCHRES  30      1
PERLND 118                  976.0596       RCHRES  30      1
PERLND 119                   34.7638       RCHRES  30      1
PERLND 120                    0.0000       RCHRES  30      1
PERLND 121                   52.1457       RCHRES  30      1
IMPLND 111                 $r30i1  $       RCHRES  30      2
IMPLND 112                 $r30i2  $       RCHRES  30      2
IMPLND 113                 $r30i3  $       RCHRES  30      2
IMPLND 114                 $r30i4  $       RCHRES  30      2
RCHRES  30                                 RCHRES  23      3
*** statements above are for basin with id equal to 30 and mapping equal to
30

*** statements below are for basin with id equal to 21 and mapping equal to
21
PERLND 111                 $r21p1  $       RCHRES  21      1
PERLND 112                 $r21p2  $       RCHRES  21      1
```

```
PERLND 113                 $r21p3  $       RCHRES  21      1
PERLND 114                 $r21p4  $       RCHRES  21      1
PERLND 115                  199.6960       RCHRES  21      1
PERLND 116                   17.8663       RCHRES  21      1
PERLND 117                  233.3933       RCHRES  21      1
PERLND 118                  771.4191       RCHRES  21      1
PERLND 119                   15.6048       RCHRES  21      1
PERLND 120                    0.0000       RCHRES  21      1
PERLND 121                   13.1171       RCHRES  21      1
IMPLND 111                 $r21i1  $       RCHRES  21      2
IMPLND 112                 $r21i2  $       RCHRES  21      2
IMPLND 113                 $r21i3  $       RCHRES  21      2
IMPLND 114                 $r21i4  $       RCHRES  21      2
RCHRES  21                                 RCHRES  23      3
*** statements above are for basin with id equal to 21 and mapping equal to
21

*** statements below are for basin with id equal to 23 and mapping equal to
23
PERLND 111                 $r23p1  $       RCHRES  23      1
PERLND 112                 $r23p2  $       RCHRES  23      1
PERLND 113                 $r23p3  $       RCHRES  23      1
PERLND 114                 $r23p4  $       RCHRES  23      1
PERLND 115                   19.5707       RCHRES  23      1
PERLND 116                    4.2255       RCHRES  23      1
PERLND 117                   15.3452       RCHRES  23      1
PERLND 118                    3.3359       RCHRES  23      1
PERLND 119                    1.5568       RCHRES  23      1
PERLND 120                    0.0000       RCHRES  23      1
PERLND 121                    0.0000       RCHRES  23      1
IMPLND 111                 $r23i1  $       RCHRES  23      2
IMPLND 112                 $r23i2  $       RCHRES  23      2
IMPLND 113                 $r23i3  $       RCHRES  23      2
IMPLND 114                 $r23i4  $       RCHRES  23      2
***RCHRES  23                                 RCHRES 165      3
*** statements above are for basin with id equal to 23 and mapping equal to
23
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2
```

```
  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 11 below
WDM   9852 PREC                   0.50     PERLND 111 121 EXTNL  PREC
WDM   9852 PREC                   0.50     IMPLND 111 114 EXTNL  PREC

WDM   1161 PREC                   0.50     PERLND 111 121 EXTNL  PREC
WDM   1161 PREC                   0.50     IMPLND 111 114 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND 111 121 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND 111 114 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** blackjack creek
RCHRES  23 HYDR   RO                       WDM2    23 FLOW     ENGL AGGR REPL
RCHRES  23 HYDR   RO                       WDM2  1023 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.11.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Blackjack Creek streamflow gaging station.

```
ptf $

31 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn11         $    $infilt11       $ $        lsur11$$
slsur11$        0.$        agwrc11b$
32 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn11         $    $infilt11       $ $        lsur11$$
slsur11$        0.$        agwrc11a$
33 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn11         $    $infilt11       $ $        lsur11$$
slsur11$        0.$        agwrc11b$

76   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr11   $
0.0       0.00
77   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr11   $ $
basetp11      $ 0.00
78   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr11   $
0.0       0.00

141 6  CEPSC                     UZSN             NSUR            INTFW
IRC            LZETP
      $       CEPSC11b$  $       UZSN11b$ $       NSUR11b$ $      INTFW11b$ $
IRC11b$  $    LZETP11b$
142 6  CEPSC                     UZSN             NSUR            INTFW
IRC            LZETP
      $       CEPSC11b$  $       UZSN11a$ $       NSUR11a$ $      INTFW11a$ $
IRC11a$  $    LZETP11b$
143 6  CEPSC                     UZSN             NSUR            INTFW
IRC            LZETP
      $       CEPSC11b$  $       UZSN11b$ $       NSUR11b$ $      INTFW11b$ $
IRC11b$  $    LZETP11b$
144 6  CEPSC                     UZSN             NSUR            INTFW
IRC            LZETP
      $       CEPSC11a$  $       UZSN11b$ $       NSUR11c$ $      INTFW11b$ $
IRC11b$  $    LZETP11a$
145 6  CEPSC                     UZSN             NSUR            INTFW
IRC            LZETP
      $       CEPSC11b$  $       UZSN11b$ $       NSUR11b$ $      INTFW11b$ $
IRC11b$  $    LZETP11b$

176  4  LSUR               SLSUR         NSUR          RESTC
      $     ILSUR11$ $      ISLSUR11$ $     INSUR11$ $       RETSC11$
```

File J.11.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Blackjack Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Anderson Creek

  START       1997/ 7/ 1  0: 0  END    2001/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 12 below - da above anderson creek gaging
station
      PERLND     122
      PERLND     123
      PERLND     124
      PERLND     125
      PERLND     126
      PERLND     127
      PERLND     128
      PERLND     129
      PERLND     130
      PERLND     131
      PERLND     132

      IMPLND     121
      IMPLND     122
      IMPLND     123
      IMPLND     124

      RCHRES      15
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0
```

```
  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                              t-series Engl Metr***
                                         in  out           ***
  122     Med. Dens. Res.                 1    1   90    0
  123     High Dens. Res.                 1    1   90    0
  124     Comm./Ind.                      1    1   90    0
  125     Acrgs/Rural Dev.                1    1   90    0
  126     Herb. RL                        1    1   90    0
  127     Shrub & Brush RL                1    1   90    0
  128     Deciduous Forest                1    1   90    0
  129     Conif. Forest                   1    1   90    0
  130     Mixed Forest                    1    1   90    0
  131     Beaches                         1    1   90    0
  132     other barren lnd                1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                     Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
  122  125    0    1    1    0    0    0    0    0    0
  126  128    0    1    1    1    0    0    0    0    1
  129  132    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)              (1/in)
(1/day)
  122            0.0 ~34~  8.0      0.15     300.0  0.075000       0.0
0.925
  123  124       0.0 ~35~  8.0      0.15     300.0  0.075000       0.0
0.925
  125  132       0.0 ~36~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
  122  127 ~79~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  128  130 ~80~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  131  132 ~81~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                            ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  122       ~146~ 0.0       0.8       0.1       1.0       0.7       0.6
  123  124 ~147~ 0.0       0.8       0.1       1.0       0.7       0.6
```

```
  125  127 ~148~ 0.0       0.8       0.1       1.0       0.7       0.6
  128  130 ~149~ 0.0       0.8       0.1       1.0       0.7       0.6
  131  132 ~150~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
  126  127 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
  128      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
  126  127  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
  128       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  121  124    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  121  124    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
  121     MED. DENS. RES.              1    1   90    0
  122     HIG DENS. RES.               1    1   90    0
  123     COMM./IND.                   1    1   90    0
  124     LOW DENS. RES.               1    1   90    0
  END GEN-INFO
```

```
  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  121  124    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
  121  124     150.0     .0054       0.1     0.055 ~177~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  121  124     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                           in  out               ***
    1  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
   15             15     2.405      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
```

```
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     15
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.445     0.0141.321E-002
     0.050     1.468     0.0731.942E-001
     0.100     1.497     0.1476.133E-001
     0.250     1.583     0.3782.817E+000
     0.500     1.727     0.7928.936E+000
     0.750     1.871     1.2421.764E+001
     1.000     2.015     1.7272.872E+001
     1.250     2.159     2.2494.209E+001
     1.500     2.303     2.8075.774E+001
     1.750     2.447     3.4017.569E+001
     2.000     2.591     4.0309.596E+001
     2.250     2.735     4.6961.186E+002
     2.500     2.879     5.3971.437E+002
     3.000     3.167     6.9092.014E+002
     4.000     3.742    10.3633.487E+002
     5.000     4.318    14.3935.419E+002
    10.000     7.197    43.1802.339E+003
    50.000    30.226       7921.110E+005
 10000.000  5758.726  288008271.327E+011
  END FTABLE 15
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 15 and mapping equal to
15
PERLND 122                 $r15p1  $       RCHRES  15      1
PERLND 123                 $r15p2  $       RCHRES  15      1
PERLND 124                 $r15p3  $       RCHRES  15      1
PERLND 125                 $r15p4  $       RCHRES  15      1
PERLND 126                  117.9337       RCHRES  15      1
PERLND 127                   22.4742       RCHRES  15      1
PERLND 128                  343.7880       RCHRES  15      1
PERLND 129                  534.7072       RCHRES  15      1
PERLND 130                   54.2940       RCHRES  15      1
PERLND 131                    0.0000       RCHRES  15      1
PERLND 132                    2.4477       RCHRES  15      1
```

```
IMPLND 121                 $r15i1  $       RCHRES  15      2
IMPLND 122                 $r15i2  $       RCHRES  15      2
IMPLND 123                 $r15i3  $       RCHRES  15      2
IMPLND 124                 $r15i4  $       RCHRES  15      2
***RCHRES  15                                 RCHRES 171      3
*** statements above are for basin with id equal to 15 and mapping equal to
15
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 12 below
WDM   9852 PREC                  0.50      PERLND 122 132 EXTNL  PREC
WDM   9852 PREC                  0.50      IMPLND 121 124 EXTNL  PREC

WDM   1161 PREC                  0.50      PERLND 122 132 EXTNL  PREC
WDM   1161 PREC                  0.50      IMPLND 121 124 EXTNL  PREC

WDM    144 PEVT                  1.00      PERLND 122 132 EXTNL  PETINP
WDM    144 PEVT                  1.00      IMPLND 121 124 EXTNL  PETINP

WDM2  9999 FLOW     ENGL     $      x$     RCHRES  15     EXTNL  IVOL

END EXT SOURCES

EXT TARGETS
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** anderson creek
RCHRES  15 HYDR   RO                       WDM2    15 FLOW     ENGL AGGR REPL
RCHRES  15 HYDR   RO                       WDM2  1015 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.12.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Anderson Creek streamflow gaging station.

```
ptf $

34 7  FOREST   LZSN                 INFILT                         LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn12         $    $infilt12       $ $        lsur12$$
slsur12$       0.$        agwrc12b$
35 7  FOREST   LZSN                 INFILT                         LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn12         $    $infilt12       $ $        lsur12$$
slsur12$       0.$        agwrc12a$
36 7  FOREST   LZSN                 INFILT                         LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn12         $    $infilt12       $ $        lsur12$$
slsur12$       0.$        agwrc12b$
79   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                  2.0 $ deepfr12   $
0.0       0.00
80   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                  2.0 $ deepfr12   $ $
basetp12      $ 0.00
81   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                  2.0 $ deepfr12   $
0.0       0.00

146 6  CEPSC                       UZSN             NSUR             INTFW
IRC             LZETP
      $       CEPSC12b$  $       UZSN12b$ $       NSUR12b$ $      INTFW12b$ $
IRC12b$  $    LZETP12b$
147 6  CEPSC                       UZSN             NSUR             INTFW
IRC             LZETP
      $       CEPSC12b$  $       UZSN12a$ $       NSUR12a$ $      INTFW12a$ $
IRC12a$  $    LZETP12b$
148 6  CEPSC                       UZSN             NSUR             INTFW
IRC             LZETP
      $       CEPSC12b$  $       UZSN12b$ $       NSUR12b$ $      INTFW12b$ $
IRC12b$  $    LZETP12b$
149 6  CEPSC                       UZSN             NSUR             INTFW
IRC             LZETP
      $       CEPSC12a$  $       UZSN12b$ $       NSUR12c$ $      INTFW12b$ $
IRC12b$  $    LZETP12a$
150 6  CEPSC                       UZSN             NSUR             INTFW
IRC             LZETP
      $       CEPSC12b$  $       UZSN12b$ $       NSUR12b$ $      INTFW12b$ $
IRC12b$  $    LZETP12b$
177 4  LSUR                 SLSUR         NSUR          RESTC
      $     ILSUR12$ $      ISLSUR12$ $     INSUR12$ $       RETSC12$
```

File J.12.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Anderson Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Heins Creek

  START       2002/ 2/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname----------------------------------------
-->
WDM         21   envvest.wdm
WDM2        22   output.wdm
MESSU       25   hspf.ech
            90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 13 below - da above heins creek gaging station
      PERLND     133
      PERLND     134
      PERLND     135
      PERLND     136
      PERLND     137
      PERLND     138
      PERLND     139
      PERLND     140
      PERLND     141
      PERLND     142
      PERLND     143

      IMPLND     131
      IMPLND     132
      IMPLND     133
      IMPLND     134


      RCHRES      10
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                             ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0
```

```
  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                               t-series Engl Metr***
                                          in  out          ***
  133     Med. Dens. Res.                  1    1   90    0
  134     High Dens. Res.                  1    1   90    0
  135     Comm./Ind.                       1    1   90    0
  136     Acrgs/Rural Dev.                 1    1   90    0
  137     Herb. RL                         1    1   90    0
  138     Shrub & Brush RL                 1    1   90    0
  139     Deciduous Forest                 1    1   90    0
  140     Conif. Forest                    1    1   90    0
  141     Mixed Forest                     1    1   90    0
  142     Beaches                          1    1   90    0
  143     other barren lnd                 1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
  133  136    0    1    1    0    0    0    0    0    0
  137  139    0    1    1    1    0    0    0    0    1
  140  143    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
  133            0.0 ~37~  8.0      0.15     300.0  0.075000       0.0
0.925
  134  135       0.0 ~38~  8.0      0.15     300.0  0.075000       0.0
0.925
  136  143       0.0 ~39~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
  133  138 ~82~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  139  141 ~83~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  142  143 ~84~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                            ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  133      ~151~ 0.0       0.8       0.1       1.0       0.7       0.6
  134  135 ~152~ 0.0       0.8       0.1       1.0       0.7       0.6
```

```
  136  138 ~153~ 0.0       0.8       0.1       1.0       0.7       0.6
  139  141 ~154~ 0.0       0.8       0.1       1.0       0.7       0.6
  142  143 ~155~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
  137  138 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
  139      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
  137  138  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
  139       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                             ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  131  134    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  131  134    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name            Unit-systems   Printer
*** <ILS >                          t-series Engl Metr
*** x -  x                           in  out
  131     MED. DENS. RES.             1    1   90    0
  132     HIG DENS. RES.              1    1   90    0
  133     COMM./IND.                  1    1   90    0
  134     LOW DENS. RES.              1    1   90    0
  END GEN-INFO
```

```
  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  131  134    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
  131  134     150.0     .0054       0.1     0.055 ~178~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  131  134     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                          user t-series  Engl Metr LKFG***
                                           in  out               ***
    1  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS       DB50***
   10             10     1.435      0.00       0.0       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
```

```
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     10
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.899     0.0091.125E-002
     0.050     0.914     0.0451.652E-001
     0.100     0.932     0.0915.220E-001
     0.250     0.985     0.2352.398E+000
     0.500     1.075     0.4937.605E+000
     0.750     1.165     0.7731.502E+001
     1.000     1.254     1.0752.444E+001
     1.250     1.344     1.4003.582E+001
     1.500     1.433     1.7474.914E+001
     1.750     1.523     2.1176.442E+001
     2.000     1.613     2.5098.168E+001
     2.250     1.702     2.9231.010E+002
     2.500     1.792     3.3601.223E+002
     3.000     1.971     4.3001.714E+002
     4.000     2.329     6.4512.968E+002
     5.000     2.688     8.9594.612E+002
    10.000     4.480    26.8771.991E+003
    50.000    18.814      4939.450E+004
 10000.000  3584.513  179270451.130E+011
  END FTABLE 10
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 10 and mapping equal to
10
PERLND 133                 $r10p1  $       RCHRES  10      1
PERLND 134                 $r10p2  $       RCHRES  10      1
PERLND 135                 $r10p3  $       RCHRES  10      1
PERLND 136                 $r10p4  $       RCHRES  10      1
PERLND 137                   73.0700       RCHRES  10      1
PERLND 138                   22.5356       RCHRES  10      1
PERLND 139                  425.9002       RCHRES  10      1
PERLND 140                  337.3512       RCHRES  10      1
PERLND 141                  143.6360       RCHRES  10      1
PERLND 142                    0.0000       RCHRES  10      1
PERLND 143                    2.7316       RCHRES  10      1
```

```
IMPLND 131                 $r10i1  $       RCHRES  10      2
IMPLND 132                 $r10i2  $       RCHRES  10      2
IMPLND 133                 $r10i3  $       RCHRES  10      2
IMPLND 134                 $r10i4  $       RCHRES  10      2
***RCHRES  10                                 RCHRES  14      3
*** statements above are for basin with id equal to 10 and mapping equal to
10
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 13 below
WDM   9852 PREC                   1.00     PERLND 133 143 EXTNL  PREC
WDM   9852 PREC                   1.00     IMPLND 131 134 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND 133 143 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND 131 134 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***
```

```
*** heins creek
RCHRES  10 HYDR   RO                                WDM2    10 FLOW     ENGL AGGR REPL
RCHRES  10 HYDR   RO                                WDM2  1010 FLOW     ENGL AGGR REPL


END EXT TARGETS
END RUN
```

File J.13.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Heins Creek streamflow gaging station.

```
ptf $

37 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn13         $    $infilt13       $ $        lsur13$$
slsur13$        0.$       agwrc13b$
38 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn13         $    $infilt13       $ $        lsur13$$
slsur13$        0.$       agwrc13a$
39 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY             AGWRC
          0.  $lzsn13         $    $infilt13       $ $        lsur13$$
slsur13$        0.$       agwrc13b$

82   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr13   $
0.0       0.00
83   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr13   $ $
basetp13      $ 0.00
84   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr13   $
0.0       0.00

151 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC13b$  $       UZSN13b$ $       NSUR13b$ $      INTFW13b$ $
IRC13b$  $    LZETP13b$
152 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC13b$  $       UZSN13a$ $       NSUR13a$ $      INTFW13a$ $
IRC13a$  $    LZETP13b$
153 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC13b$  $       UZSN13b$ $       NSUR13b$ $      INTFW13b$ $
IRC13b$  $    LZETP13b$
154 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC13a$  $       UZSN13b$ $       NSUR13c$ $      INTFW13b$ $
IRC13b$  $    LZETP13a$
155 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC13b$  $       UZSN13b$ $       NSUR13b$ $      INTFW13b$ $
IRC13b$  $    LZETP13b$

178 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR13$ $      ISLSUR13$ $     INSUR13$ $       RETSC13$
```

File J.13.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Heins Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Parrish Creek

  START       2001/10/ 1  0: 0  END    2003/ 9/30 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname------------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 14 below - da above parish creek gaging
station
      PERLND     144
      PERLND     145
      PERLND     146
      PERLND     147
      PERLND     148
      PERLND     149
      PERLND     150
      PERLND     151
      PERLND     152
      PERLND     153
      PERLND     154

      IMPLND     141
      IMPLND     142
      IMPLND     143
      IMPLND     144

      RCHRES      11
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >               Active Sections                              ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0
```

```
  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                            t-series Engl Metr***
                                       in  out          ***
  144     Med. Dens. Res.                1    1   90    0
  145     High Dens. Res.                1    1   90    0
  146     Comm./Ind.                     1    1   90    0
  147     Acrgs/Rural Dev.               1    1   90    0
  148     Herb. RL                       1    1   90    0
  149     Shrub & Brush RL               1    1   90    0
  150     Deciduous Forest               1    1   90    0
  151     Conif. Forest                  1    1   90    0
  152     Mixed Forest                   1    1   90    0
  153     Beaches                        1    1   90    0
  154     other barren lnd               1    1   90    0

  END GEN-INFO

  PWAT-PARM1
*** <PLS >                  Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
  144  147    0    1    1    0    0    0    0    0    0
  148  150    0    1    1    1    0    0    0    0    1
  151  154    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)             (1/in)
(1/day)
  144            0.0 ~40~  8.0      0.15     300.0  0.075000       0.0
0.925
  145  146       0.0 ~41~  8.0      0.15     300.0  0.075000       0.0
0.925
  147  154       0.0 ~42~  8.0      0.15     300.0  0.075000       0.0
0.925
  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
  144  149 ~85~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  150  152 ~86~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  153  154 ~87~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                              ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  144      ~156~ 0.0       0.8       0.1       1.0       0.7       0.6
```

```
  145  146 ~157~ 0.0       0.8       0.1       1.0       0.7       0.6
  147  149 ~158~ 0.0       0.8       0.1       1.0       0.7       0.6
  150  152 ~159~ 0.0       0.8       0.1       1.0       0.7       0.6
  153  154 ~160~ 0.0       0.8       0.1       1.0       0.7       0.6
  END PWAT-PARM4

  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
  148  149 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
  150      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
  148  149  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
  150       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                             ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  141  144    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  141  144    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
  141     MED. DENS. RES.              1    1   90    0
  142     HIG DENS. RES.               1    1   90    0
  143     COMM./IND.                   1    1   90    0
  144     LOW DENS. RES.               1    1   90    0
```

```
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  141  144    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
  141  144     150.0     .0054       0.1     0.055 ~179~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  141  144     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                         user t-series  Engl Metr LKFG***
                                          in  out                ***
    1  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN       LEN     DELTH     STCOR        KS      DB50***
   11             11     2.740      0.00       0.0       0.5      0.01
  END HYDR-PARM2
```

```
  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE     11
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.681     0.0171.227E-002
     0.050     1.708     0.0851.803E-001
     0.100     1.741     0.1715.695E-001
     0.250     1.842     0.4402.616E+000
     0.500     2.009     0.9218.297E+000
     0.750     2.177     1.4441.638E+001
     1.000     2.344     2.0092.666E+001
     1.250     2.511     2.6163.908E+001
     1.500     2.679     3.2655.361E+001
     1.750     2.846     3.9567.028E+001
     2.000     3.014     4.6888.910E+001
     2.250     3.181     5.4631.101E+002
     2.500     3.349     6.2791.334E+002
     3.000     3.683     8.0371.870E+002
     4.000     4.353    12.0553.238E+002
     5.000     5.023    16.7435.032E+002
    10.000     8.372    50.2292.172E+003
    50.000    35.161       9211.031E+005
 10000.000  6698.926  335030031.232E+011
  END FTABLE 11
END FTABLES

SCHEMATIC
<-Volume->                <--Area-->       <-Volume->  <ML->  ***
<Name>   x                <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 11 and mapping equal to
11
PERLND 144                 $r11p1  $       RCHRES  11      1
PERLND 145                 $r11p2  $       RCHRES  11      1
PERLND 146                 $r11p3  $       RCHRES  11      1
PERLND 147                 $r11p4  $       RCHRES  11      1
PERLND 148                   60.5654       RCHRES  11      1
PERLND 149                   10.4653       RCHRES  11      1
PERLND 150                  215.9870       RCHRES  11      1
PERLND 151                  452.2367       RCHRES  11      1
PERLND 152                   19.1494       RCHRES  11      1
PERLND 153                    0.0000       RCHRES  11      1
```

```
PERLND 154                    0.0000       RCHRES  11      1
IMPLND 141                 $r11i1  $       RCHRES  11      2
IMPLND 142                 $r11i2  $       RCHRES  11      2
IMPLND 143                 $r11i3  $       RCHRES  11      2
IMPLND 144                 $r11i4  $       RCHRES  11      2
***RCHRES  11                                 RCHRES  14      3
*** statements above are for basin with id equal to 11 and mapping equal to
11


END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 14 below
WDM   1161 PREC                   1.00     PERLND 144 154 EXTNL  PREC
WDM   1161 PREC                   1.00     IMPLND 141 144 EXTNL  PREC

WDM    144 PEVT                   1.00     PERLND 144 154 EXTNL  PETINP
WDM    144 PEVT                   1.00     IMPLND 141 144 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
```

```
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***

*** parish creek
RCHRES  11 HYDR   RO                        WDM2    11 FLOW     ENGL AGGR REPL
RCHRES  11 HYDR   RO                        WDM2  1011 FLOW     ENGL AGGR REPL

END EXT TARGETS
END RUN
```

File J.14.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Parish Creek streamflow gaging station.

```
ptf $

40 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn14        $    $infilt14       $ $        lsur14$$
slsur14$        0.$        agwrc14b$
41 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn14        $    $infilt14       $ $        lsur14$$
slsur14$        0.$        agwrc14a$
42 7  FOREST   LZSN                INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn14        $    $infilt14       $ $        lsur14$$
slsur14$        0.$        agwrc14b$

85   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr14   $
0.0       0.00
86   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr14   $ $
basetp14      $ 0.00
87   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr14   $
0.0       0.00

156 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC14b$  $       UZSN14b$ $       NSUR14b$ $      INTFW14b$ $
IRC14b$  $    LZETP14b$
157 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC14b$  $       UZSN14a$ $       NSUR14a$ $      INTFW14a$ $
IRC14a$  $    LZETP14b$
158 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC14b$  $       UZSN14b$ $       NSUR14b$ $      INTFW14b$ $
IRC14b$  $    LZETP14b$
159 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC14a$  $       UZSN14b$ $       NSUR14c$ $      INTFW14b$ $
IRC14b$  $    LZETP14a$
160 6  CEPSC                     UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC14b$  $       UZSN14b$ $       NSUR14b$ $      INTFW14b$ $
IRC14b$  $    LZETP14b$

179 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR14$ $      ISLSUR14$ $     INSUR14$ $       RETSC14$
```

File J.14.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Parish Creek streamflow gaging station.

```
ptf $
RUN
GLOBAL
  HSPF Hydrologic Model for Gorst Creek

  START       2000/ 9/ 1  0: 0  END    2003/ 5/ 1 23:45
  RUN INTERP OUTPT LEVELS    9    9
  RESUME     0 RUN     1                         UNITS     1
END GLOBAL
FILES
<type>  <fun>***<------------fname-----------------------------------------
-->
WDM        21   envvest.wdm
WDM2       22   output.wdm
MESSU      25   hspf.ech
           90   hspf.out
END FILES
OPN SEQUENCE
    INGRP              INDELT  0:15
*** perlnds & implnds for ZONE 15 below - da above gorst creek gaging station
      PERLND     155
      PERLND     156
      PERLND     157
      PERLND     158
      PERLND     159
      PERLND     160
      PERLND     161
      PERLND     162
      PERLND     163
      PERLND     164
      PERLND     165

      IMPLND     151
      IMPLND     152
      IMPLND     153
      IMPLND     154

*** perlnds & implnds for ZONE 15 above - da above gorst creek gaging station

      RCHRES       8
      RCHRES      10
      RCHRES      11
      RCHRES      14
    END INGRP
END OPN SEQUENCE
PERLND
  ACTIVITY
    <PLS >              Active Sections                               ***
    x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1  165    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
*********
    1  165    0    0    6    0    0    0    0    0    0    0    0    0    0
0

  END PRINT-INFO

  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer***
    x -  x                            t-series Engl Metr***
                                       in  out           ***
  155     Med. Dens. Res.               1    1   90    0
  156     High Dens. Res.               1    1   90    0
  157     Comm./Ind.                    1    1   90    0
  158     Acrgs/Rural Dev.              1    1   90    0
  159     Herb. RL                      1    1   90    0
  160     Shrub & Brush RL              1    1   90    0
  161     Deciduous Forest              1    1   90    0
  162     Conif. Forest                 1    1   90    0
  163     Mixed Forest                  1    1   90    0
  164     Beaches                       1    1   90    0
  165     other barren lnd              1    1   90    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE
  155  158    0    1    1    0    0    0    0    0    0
  159  161    0    1    1    1    0    0    0    0    1
  162  165    0    1    1    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** <PLS >    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY
AGWRC
*** x -  x                (in)   (in/hr)      (ft)              (1/in)
(1/day)
  155            0.0 ~43~  8.0      0.15     300.0  0.075000       0.0
0.925
  156  157       0.0 ~44~  8.0      0.15     300.0  0.075000       0.0
0.925
  158  165       0.0 ~45~  8.0      0.15     300.0  0.075000       0.0
0.925

  END PWAT-PARM2

  PWAT-PARM3
*** <PLS >    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP
AGWETP
*** x -  x   (deg F)   (deg F)
  155  160 ~88~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  161  163 ~89~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
  164  165 ~90~ 40.0      35.0       2.0       2.0       0.0       0.0
0.0
```

```
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >                                                            ***
*** x -  x     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  155      ~161~ 0.0       0.8       0.1       1.0       0.7       0.6
  156  157 ~162~ 0.0       0.8       0.1       1.0       0.7       0.6
  158  160 ~163~ 0.0       0.8       0.1       1.0       0.7       0.6
  161  163 ~164~ 0.0       0.8       0.1       1.0       0.7       0.6
  164  165 ~165~ 0.0       0.8       0.1       1.0       0.7       0.6

  END PWAT-PARM4

  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
  159  160 .063 0.06 .065 .078 .095 .098 .098 .094 .095 .077 .072 .067
  161      0.06 0.06 0.06  0.1 0.16 0.16 0.16 0.16 0.16  0.1 0.06 0.06
  END MON-INTERCEP

  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
  159  160  0.2  0.2  0.3  0.3 0.40 0.40 0.40 0.40 0.40 0.30 0.20  0.2
  161       0.2  0.2  0.3  0.4 0.70 0.70 0.70 0.70 0.60 0.50  0.3  0.2
  END MON-LZETPARM

  PWAT-PARM5
*** <PLS>                                                            ***
*** x -  x       FZG      FZGL
    1  165       1.0       0.1
  END PWAT-PARM5

  PWAT-STATE1
*** <PLS>  PWATER state variables (in)
*** x - x      CEPS      SURS       UZS      IFWS       LZS      AGWS
GWVS
    1 165      0.0       0.0     0.50       0.0     5.000       1.0       0.0
  END PWAT-STATE1

END PERLND

IMPLND

  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  151  154    0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  151  154    0    0    6    0    0    0    0    0
  END PRINT-INFO

  GEN-INFO
```

```
*** <ILS >      Name             Unit-systems   Printer
*** <ILS >                           t-series Engl Metr
*** x -  x                            in  out
  151     MED. DENS. RES.              1    1   90    0
  152     HIG DENS. RES.               1    1   90    0
  153     COMM./IND.                   1    1   90    0
  154     LOW DENS. RES.               1    1   90    0
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  151  154    0    1    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (ft)
  151  154     150.0     .0054       0.1     0.055 ~180~
  END IWAT-PARM2

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  151  154     0.000     0.000
  END IWAT-STATE1
END IMPLND

RCHRES
  ACTIVITY
    RCHRES Active Sections (1=Active, 0=Inactive)***
    x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1  175  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  175  6    0    0    0    0    0    0    0    0    0    0    9
  END PRINT-INFO

  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer     ***
    # -  #                         user t-series  Engl Metr LKFG***
                                          in  out                 ***
    1  175                            1         1    1   90    0    0
  END GEN-INFO

  HYDR-PARM1
***        Flags for HYDR section
*** # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for
each
***         FG FG FG FG  possible   exit *** possible   exit     possible
exit
    1  175  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 ***
    x -  x  DSN FTBN        LEN      DELTH      STCOR         KS       DB50***
    8              8      2.964       0.00        0.0        0.5      0.01
   10             10      1.435       0.00        0.0        0.5      0.01
   11             11      2.740       0.00        0.0        0.5      0.01
   14             14      0.795       0.00        0.0        0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
*** RCHRES  Initial conditions for HYDR section    ***
    # -  #       VOL     Initial  value  of COLIND *** Initial  value  of
OUTDGT
             (ac-ft)     for  each  possible  exit *** for  each  possible
exit
                           EX1  EX2  EX3  EX4  EX5 ***   EX1  EX2  EX3  EX4
EX5
    1  175       0.0       4.0  4.0  4.0  4.0  4.0       0.0  0.0  0.0  0.0
0.0
  END HYDR-INIT

END RCHRES

FTABLES
  FTABLE      8
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     1.850     0.0181.011E-002
     0.050     1.880     0.0931.485E-001
     0.100     1.916     0.1884.692E-001
     0.250     2.027     0.4842.155E+000
     0.500     2.211     1.0136.836E+000
     0.750     2.395     1.5891.350E+001
     1.000     2.580     2.2112.197E+001
     1.250     2.764     2.8793.220E+001
     1.500     2.948     3.5934.417E+001
     1.750     3.133     4.3535.791E+001
     2.000     3.317     5.1597.342E+001
     2.250     3.501     6.0129.076E+001
     2.500     3.685     6.9101.099E+002
     3.000     4.054     8.8451.541E+002
     4.000     4.791    13.2672.668E+002
     5.000     5.528    18.4264.146E+002
    10.000     9.213    55.2791.789E+003
    50.000    38.696      10138.495E+004
 10000.000  7372.435  368713881.015E+011
  END FTABLE  8
  FTABLE     10
   20    4
     DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
      (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
     0.000     0.000     0.0000.000E+000
     0.010     0.899     0.0091.125E-002
     0.050     0.914     0.0451.652E-001
```

```
    0.100     0.932     0.0915.220E-001
    0.250     0.985     0.2352.398E+000
    0.500     1.075     0.4937.605E+000
    0.750     1.165     0.7731.502E+001
    1.000     1.254     1.0752.444E+001
    1.250     1.344     1.4003.582E+001
    1.500     1.433     1.7474.914E+001
    1.750     1.523     2.1176.442E+001
    2.000     1.613     2.5098.168E+001
    2.250     1.702     2.9231.010E+002
    2.500     1.792     3.3601.223E+002
    3.000     1.971     4.3001.714E+002
    4.000     2.329     6.4512.968E+002
    5.000     2.688     8.9594.612E+002
   10.000     4.480    26.8771.991E+003
   50.000    18.814      4939.450E+004
10000.000  3584.513  179270451.130E+011
 END FTABLE 10
 FTABLE     11
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     1.681     0.0171.227E-002
    0.050     1.708     0.0851.803E-001
    0.100     1.741     0.1715.695E-001
    0.250     1.842     0.4402.616E+000
    0.500     2.009     0.9218.297E+000
    0.750     2.177     1.4441.638E+001
    1.000     2.344     2.0092.666E+001
    1.250     2.511     2.6163.908E+001
    1.500     2.679     3.2655.361E+001
    1.750     2.846     3.9567.028E+001
    2.000     3.014     4.6888.910E+001
    2.250     3.181     5.4631.101E+002
    2.500     3.349     6.2791.334E+002
    3.000     3.683     8.0371.870E+002
    4.000     4.353    12.0553.238E+002
    5.000     5.023    16.7435.032E+002
   10.000     8.372    50.2292.172E+003
   50.000    35.161      9211.031E+005
10000.000  6698.926  335030031.232E+011
 END FTABLE 11
 FTABLE     14
  20    4
    DEPTH      AREA    VOLUME     DISCH   SEEPAGE***
     (FT)   (ACRES)   (AC-FT)     (CFS)     (CFS)***
    0.000     0.000     0.0000.000E+000
    0.010     0.470     0.0056.399E-003
    0.050     0.477     0.0249.403E-002
    0.100     0.486     0.0482.970E-001
    0.250     0.514     0.1231.364E+000
    0.500     0.561     0.2574.327E+000
    0.750     0.608     0.4038.545E+000
    1.000     0.655     0.5611.391E+001
    1.250     0.702     0.7312.038E+001
    1.500     0.748     0.9122.796E+001
```

```
     1.750     0.795     1.1053.666E+001
     2.000     0.842     1.3104.647E+001
     2.250     0.889     1.5265.745E+001
     2.500     0.935     1.7546.960E+001
     3.000     1.029     2.2459.754E+001
     4.000     1.216     3.3681.689E+002
     5.000     1.403     4.6772.624E+002
    10.000     2.339    14.0321.133E+003
    50.000     9.822      2575.377E+004
 10000.000  1871.360   93591386.427E+010
  END FTABLE 14
END FTABLES

SCHEMATIC
<-Volume->                  <--Area-->       <-Volume->  <ML->  ***
<Name>   x                  <-factor->       <Name>   #      #  ***
*** statements below are for basin with id equal to 8 and mapping equal to 8
PERLND 155                   $r8p1   $       RCHRES   8      1
PERLND 156                   $r8p2   $       RCHRES   8      1
PERLND 157                   $r8p3   $       RCHRES   8      1
PERLND 158                   $r8p4   $       RCHRES   8      1
PERLND 159                    442.6547       RCHRES   8      1
PERLND 160                     30.9141       RCHRES   8      1
PERLND 161                    545.0298       RCHRES   8      1
PERLND 162                   1806.2374       RCHRES   8      1
PERLND 163                     88.0381       RCHRES   8      1
PERLND 164                      0.0000       RCHRES   8      1
PERLND 165                      5.1524       RCHRES   8      1
IMPLND 151                   $r8i1   $       RCHRES   8      2
IMPLND 152                   $r8i2   $       RCHRES   8      2
IMPLND 153                   $r8i3   $       RCHRES   8      2
IMPLND 154                   $r8i4   $       RCHRES   8      2
RCHRES   8                                   RCHRES  14      3
*** statements above are for basin with id equal to 8 and mapping equal to 8

*** statements below are for basin with id equal to 10 and mapping equal to
10
PERLND 155                   $r10p1  $       RCHRES  10      1
PERLND 156                   $r10p2  $       RCHRES  10      1
PERLND 157                   $r10p3  $       RCHRES  10      1
PERLND 158                   $r10p4  $       RCHRES  10      1
PERLND 159                     73.0700       RCHRES  10      1
PERLND 160                     22.5356       RCHRES  10      1
PERLND 161                    425.9002       RCHRES  10      1
PERLND 162                    337.3512       RCHRES  10      1
PERLND 163                    143.6360       RCHRES  10      1
PERLND 164                      0.0000       RCHRES  10      1
PERLND 165                      2.7316       RCHRES  10      1
IMPLND 151                   $r10i1  $       RCHRES  10      2
IMPLND 152                   $r10i2  $       RCHRES  10      2
IMPLND 153                   $r10i3  $       RCHRES  10      2
IMPLND 154                   $r10i4  $       RCHRES  10      2
RCHRES  10                                   RCHRES  14      3
*** statements above are for basin with id equal to 10 and mapping equal to
10
```

```
*** statements below are for basin with id equal to 11 and mapping equal to
11
PERLND 155                 $r11p1  $       RCHRES  11      1
PERLND 156                 $r11p2  $       RCHRES  11      1
PERLND 157                 $r11p3  $       RCHRES  11      1
PERLND 158                 $r11p4  $       RCHRES  11      1
PERLND 159                   60.5654       RCHRES  11      1
PERLND 160                   10.4653       RCHRES  11      1
PERLND 161                  215.9870       RCHRES  11      1
PERLND 162                  452.2367       RCHRES  11      1
PERLND 163                   19.1494       RCHRES  11      1
PERLND 164                    0.0000       RCHRES  11      1
PERLND 165                    0.0000       RCHRES  11      1
IMPLND 151                 $r11i1  $       RCHRES  11      2
IMPLND 152                 $r11i2  $       RCHRES  11      2
IMPLND 153                 $r11i3  $       RCHRES  11      2
IMPLND 154                 $r11i4  $       RCHRES  11      2
RCHRES  11                                 RCHRES  14      3
*** statements above are for basin with id equal to 11 and mapping equal to
11

*** statements below are for basin with id equal to 14 and mapping equal to
14
PERLND 155                 $r14p1  $       RCHRES  14      1
PERLND 156                 $r14p2  $       RCHRES  14      1
PERLND 157                 $r14p3  $       RCHRES  14      1
PERLND 158                 $r14p4  $       RCHRES  14      1
PERLND 159                   52.9300       RCHRES  14      1
PERLND 160                    6.0047       RCHRES  14      1
PERLND 161                  205.4928       RCHRES  14      1
PERLND 162                  371.1770       RCHRES  14      1
PERLND 163                   16.2348       RCHRES  14      1
PERLND 164                    0.0000       RCHRES  14      1
PERLND 165                    0.0000       RCHRES  14      1
IMPLND 151                 $r14i1  $       RCHRES  14      2
IMPLND 152                 $r14i2  $       RCHRES  14      2
IMPLND 153                 $r14i3  $       RCHRES  14      2
IMPLND 154                 $r14i4  $       RCHRES  14      2
*** statements above are for basin with id equal to 14 and mapping equal to
14
END SCHEMATIC

MASS-LINK

  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
```

```
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>            <Name> x x<-factor->strg <Name>                <Name> x x
***
RCHRES     HYDR   ROVOL                    RCHRES         INFLOW IVOL
  END MASS-LINK    3

END MASS-LINK

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->
***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #
***
*** Zone 15 below
WDM   9852 PREC                     0.50     PERLND 155 165 EXTNL  PREC
WDM   9852 PREC                     0.50     IMPLND 151 154 EXTNL  PREC

WDM   1161 PREC                     0.50     PERLND 155 165 EXTNL  PREC
WDM   1161 PREC                     0.50     IMPLND 151 154 EXTNL  PREC

WDM    144 PEVT                     1.00     PERLND 155 165 EXTNL  PETINP
WDM    144 PEVT                     1.00     IMPLND 151 154 EXTNL  PETINP

***WDM    100 EVAP                     0.80     PERLND 155 165 EXTNL  PETINP
***WDM    100 EVAP                     0.80     IMPLND 151 154 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd
***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>qf  tem strg
strg***
*** gorst creek
RCHRES  14 HYDR   RO                       WDM2     8 FLOW     ENGL AGGR REPL
RCHRES  14 HYDR   RO                       WDM2  1008 FLOW     ENGL AGGR REPL
END EXT TARGETS
END RUN
```

File J.15.A. PEST template file for the Users Control Input file for the HSPF hydrologic model for the drainage area above the Gorst Creek streamflow gaging station.

```
ptf $

43 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn15         $    $infilt15      $ $        lsur15$$
slsur15$        0.$        agwrc15b$
44 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn15         $    $infilt15      $ $        lsur15$$
slsur15$        0.$        agwrc15a$
45 7  FOREST   LZSN                 INFILT                        LSUR
SLSUR       KVARY            AGWRC
          0.  $lzsn15         $    $infilt15      $ $        lsur15$$
slsur15$        0.$        agwrc15b$

88   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr15   $
0.0       0.00
89   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr15   $ $
basetp15      $ 0.00
90   7  PETMAX         PETMIN    INFEXP              INFILD   DEEPFR
BASETP       AGWETP
        40.0           35.0       2.0                 2.0 $ deepfr15   $
0.0       0.00

161 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC15b$  $       UZSN15b$ $      NSUR15b$ $      INTFW15b$ $
IRC15b$  $    LZETP15b$
162 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC15b$  $       UZSN15a$ $      NSUR15a$ $      INTFW15a$ $
IRC15a$  $    LZETP15b$
163 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC15b$  $       UZSN15b$ $      NSUR15b$ $      INTFW15b$ $
IRC15b$  $    LZETP15b$
164 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC15a$  $       UZSN15b$ $      NSUR15c$ $      INTFW15b$ $
IRC15b$  $    LZETP15a$
165 6  CEPSC                    UZSN             NSUR             INTFW
IRC            LZETP
      $       CEPSC15b$  $       UZSN15b$ $      NSUR15b$ $      INTFW15b$ $
IRC15b$  $    LZETP15b$

180 4  LSUR                SLSUR         NSUR          RESTC
      $     ILSUR15$ $      ISLSUR15$ $     INSUR15$ $       RETSC15$
```

File J.15.B. PEST template file for the Supplementary Input file for the HSPF hydrologic model for the drainage area above the Gorst Creek streamflow gaging station.