Long Term Resource Monitoring Program

Program Report

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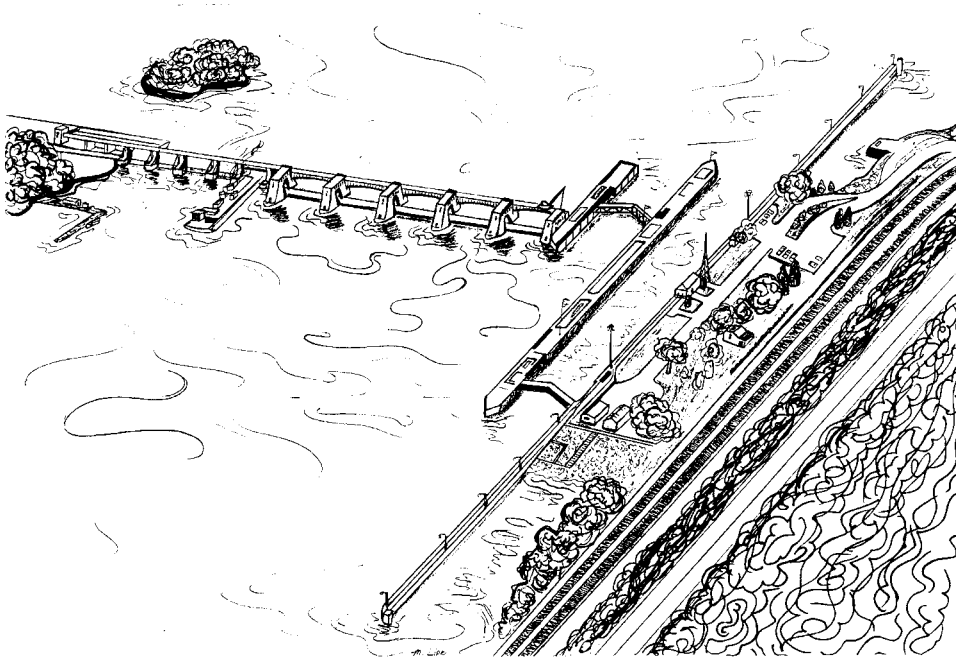
Long Term Resource Monitoring Program Procedures:

Water Surface Elevation and Discharge



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August 1995

Long Term Resource Monitoring Program Procedures: Water Surface Elevation and Discharge

by

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The Environmental Management Technical Center issues LTRMP Program Reports to provide Long Term Resource Monitoring Program partners with programmatic documentation, procedures manuals, training manuals, and geospatial applications.

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The National Biological Service . . . gathering, analyzing, and sharing the biological information necessary to support the wise stewardship of the Nation's natural resources.

Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' (Corps) Environmental Management Program. The original authorization for the LTRMP was for 10 years, starting in 1987. Authorization has since been extended for an additional 5 years (to 2002) by Section 405 of the Water Resources Act of 1990 (Public Law 101-640).

The LTRMP is being implemented by the Environmental Management Technical Center, a National Biological Service Science Center, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The Corps provides guidance and has overall Program responsibility. The mode of operation and respective roles of the agencies are outlined in a 1988 Memorandum of Agreement.

The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers. Congress has declared the UMRS to be both a nationally significant ecosystem and a nationally significant commercial navigation system. The mission of the LTRMP is to provide decision makers with information to maintain the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and impacts, develop management alternatives, manage information, and develop useful products.

Goal 2 of the LTRMP Operating Plan (USFWS 1992) is simply stated: *Monitor Resource Change*. Strategies for monitoring resource components are listed under this goal.

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Contents

Page

Preface iii

Contents v

Tables viii

1. Introduction 1
   1.1 Background 1
   1.2 Water Surface Elevations 1
   1.3 Discharge 2

2. Water Surface Elevations 2
   2.1 Historical Water Surface Elevations 2
   2.2 Obtaining Water Surface Elevation Data from the Corps of Engineers 3
      2.2.1 The Corps Database 3
      2.2.2 Downloading and Reformatting the Data 4
   2.3 Data Transformation and Quality Assurance/Quality Control Procedures 4
   2.4 Final Water Elevation Database 5
      2.4.1 SAS Database 5
      2.4.2 Obtaining Data 6
      2.4.3 Changes to the Database 6

3. Discharge 7
   3.1 Historical Discharge Data 7
   3.2 Obtaining Future Discharge Data 7
   3.3 Final Discharge Database 8
      3.3.1 SAS Database 8
      3.3.2 Obtaining Data 8

4. Reference 9

Appendix A A-1
   Data Extraction, Data Downloading, and Data Processing Procedures for the Corps St. Paul District (Unix Operating System) A-1

Appendix B B-1
   Data Extraction, Data Downloading, and Data Processing Procedures for the Corps Rock Island District (Unix Operating System) B-1

Appendix C C-1
   Data Extraction, Data Downloading, and Data Processing Procedures for the Corps St. Louis District (Unix Operating System) C-1

Appendix D D-1
Statistical Analysis System (SAS) Program for Mississippi River Water Surface Elevation Data from the Corps St. Paul District D-1

Appendix E E-1
Statistical Analysis System (SAS) Program for Mississippi River Water Surface Elevation Data from the Corps Rock Island District E-1

Appendix F F-1
Statistical Analysis System (SAS) Program for Mississippi River Water Surface Elevation Data from the Corps St. Louis District F-1

Appendix G G-1
Statistical Analysis System (SAS) Program for Illinois River Water Surface Elevation Data from the Corps Rock Island and St. Louis Districts G-1

Appendix H H-1
Statistical Analysis System (SAS) Program for Converting Stage Data to Elevations for the Rock Island District H-1

Appendix I I-1
Statistical Analysis System (SAS) Program for Converting Stage Data to Elevations for the St. Louis District I-1

Appendix J J-1
Statistical Analysis System (SAS) Program for Calculating Means to Check Surface Elevations J-1

Appendix K K-1
Program to Update and Create an Index File for the Water Surface Elevation and Discharge Databases K-1

Appendix L L-1
Information Concerning the Water Surface Elevation Database L-1

Appendix M M-1
Information Concerning the Discharge Database M-1

Appendix N N-1
Pascal Computer Program to Reformat U.S. Geological Survey Discharge Data N-1

Appendix O O-1
Statistical Analysis System (SAS) Program for U.S. Geological Survey Discharge Data O-1

Tables

Page

Table 1. Variables in SAS water surface elevation databases 6

Table 2. Variables in the SAS discharge database 9

1. Introduction

1.1 Background

Water surface elevations and discharge data are critical physical factors which influence other ecosystem components in the river floodplain. All other components listed in the Long Term Resource Monitoring Program (LTRMP) Operating Plan (USFWS 1992), including floodplain elevation, water quality, vegetation, sediment composition, macroinvertebrates, fish and wildlife, and habitat are affected by water surface elevation and discharge.

Water surface elevation and discharge are directly related in uncontrolled rivers. River discharge is usually estimated from water surface elevations, assuming that the bottom geometry remains constant. However, this relationship is negated at many of the stations within the Upper Mississippi River System (UMRS) due to a series of 36 lock and dams. For this reason, separate databases are maintained for water surface elevation and discharge.

Water surface elevation and discharge data are not collected by the LTRMP but are obtained from other agencies that collect these data as one of their mandates. Within the UMRS, water surface elevation data are collected by three district offices of the U.S. Army Corps of Engineers (Corps): St. Paul, Rock Island, and St. Louis. Discharge data are collected by the U.S. Geological Survey (USGS) by four state offices: Illinois, Iowa, Minnesota, and Missouri. These agencies have most of the historical record for both variables in electronic form. Data are available from as early as 1861, although data collection at most stations was initiated for years after 1930.

The databases developed by the LTRMP contain data only from stations under the Environmental Management Program (EMP), which includes the navigable portions of the Mississippi, St. Croix, and Illinois Rivers. Data for special projects can be obtained from the USGS and Corps for tributary stations.

1.2 Water Surface Elevations

The historical water surface elevation database at the EMTC contains data from 160 locations on the UMRS, of which 135 stations are currently active. The database includes a series of observations, each with five variables: (1) a five-character station code, (2) year, (3) Julian day, (4) time (2400-h clock), and (5) water surface elevation (feet above sea level). Data from St. Anthony Falls to Lock and Dam 22 and the St. Croix River are reported using the 1912 National Geodetic Vertical Datum (NGVD). Data from south of Lock and Dam 22 on the Mississippi River and all Illinois River data are reported as NGVD 1929. The historical database at the EMTC contains one observation per day, although multiple values per day are available from the Corps for some stations in recent years. These additional data may not be checked for accuracy by the Corps.

Most data through 1990 were transferred to the EMTC on floppy diskettes or nine-track tape. Data processing for these data is described in section 2.1. Because of problems encountered when processing data with different formats and the amount of time spent by Corps personnel preparing and sending the data to the EMTC, methods were developed in early 1992 to electronically transfer data from the Corps to the EMTC. Data for 1991 were satisfactorily processed in this manner. This method is currently used to transfer data, as described in sections 2.2 and 2.3.

1.3 Discharge

The historical discharge database contains data from 21 locations on the UMRS, of which 14 stations are currently active. The database is made up of a series of observations, each with four variables: (1) a five-character station code, (2) year, (3) Julian day, and (4) average daily discharge (cubic feet per second).

Data from the USGS are supplied in water year blocks, from October 1 of one year to September 30 of the next year. Most data through water year 1988 were obtained using a compact optical disk system (EarthInfo, Inc., Boulder, CO). Software was used to translate data for all mainstem river stations into ASCII format (which resembles data found in USGS water year records). Data for water years after 1987 were obtained directly from USGS offices. This method has been used to transfer data collected after water year 1991, using methods described in section 3. After a water year is completed, approximately 8 mo are needed by the USGS to process the data and perform QA/QC procedures. The data are then released to the public.

The USGS reports the accuracy of their discharge values as excellent, meaning 95% of the daily discharges are within 5% of the true value; good, within 10%; fair, within 15%; and poor, when data do not meet the other criteria. Some of the reported values are estimated. The EMTC discharge database does not include information about the accuracy of the data or whether or not values were estimated. This information can be obtained from the water year records published by the USGS.

2. Water Surface Elevations

2.1 Historical Water Surface Elevations

The majority of data from Corps stations from the beginning of record through 1990 were processed at the EMTC in a similar manner. Data were received from the Corps on nine-track tapes or floppy diskettes, in a number of different formats. Data were processed in one of four databases, representing data for the Mississippi River collected by the three Corps district offices and data for the Illinois River. The data were reformatted and processed using the Statistical Analysis System (SAS) and are currently available as SAS or ASCII databases. The majority of the work is done on the Suns01 690 mp computer at the EMTC. A complete history of each database is too extensive for this document but is available at the EMTC. In general, each of the four databases was processed at the EMTC in five major steps:

a. Data were received from the Corps as data blocks, including the following header information: river basin, river name, station name, frequency of data collection, date and time of first data point, type of data, units of measurement, and number of observations in the data block.

b. Each data block was processed with a computer program that parsed the data block, creating a series of observations in an ASCII database. Each observation contained the following information: river code, station name, data type (elevation or stage), year, Julian day, Julian date, hour (2400-h clock), and elevation or stage value (in feet).

c. A SAS database was created using the ASCII data from step b above. The river code, station name, and data type were used to create a five-character station code. The station name used by

the Corps was retained if it was five characters or less; if the original station name was longer than five characters, a new station name of five characters was created.

d. Data that had original readings as stages were converted to feet above sea level by adding a gage zero value obtained from the Corps.

e. Maximum, minimum, and mean elevations and the number of observations were calculated for each station for each year. Comparisons of results were made for all years for each station. Outliers were compared with data collected before and after at the same station, and at stations both up and down river. If data appeared out of line, they were reported to the Corps. Presumed outliers confirmed by the Corps as being correct remain in the EMTC database. Other outliers were corrected by the Corps and those remaining ($\leq$0.003% of the original values) were deleted from the EMTC database. A list of deleted values is available at the EMTC. Information concerning the historical water surface elevation database is included in section 2.4.

2.2 Obtaining Water Surface Elevation Data from the Corps of Engineers

2.2.1 The Corps Database

Water elevation data are developed in a different manner for the three Corps districts. Each district has a slightly different QA/QC procedure and a different way of storing historical data, due to different data gathering methods and different storage constraints on computer systems.

Water elevation data may be gathered manually by reading a vertical staff at a station or automatically by a stage recorder. Data collected with a stage recorder are transmitted by radio waves to a satellite and are relayed to computers at the Corps office in Vicksburg, Mississippi. The data are downloaded about once every 4 h to each Corps district. Individuals send manual readings to appropriate districts by mail about once a week. These readings are in handwritten or typed form, which are then keypunched into the database.

The data from the St. Paul District are from stations on the Mississippi River only and are all derived from stage recorders. Data undergo QA/QC on an approximate cycle of 6 mo to 1 yr, depending on the number of problems found. The name of the database for current data is MISS. Data processed by the District using QA/QC procedures are kept in separate databases. Each year of QA/QC data comprises a separate database. The naming convention of these databases is MISSYY.DAT, where YY stands for the appropriate year.

The data from Rock Island are from stations on the Mississippi and Illinois Rivers. They are derived from a combination of manual readings and stage recorders. Data undergo QA/QC approximately yearly. Data processed by the District using QA/QC procedures are kept in separate databases. Each year of QA/QC data comprises a separate database.

The data from the St. Louis District are from stations on the Mississippi and Illinois Rivers. They are derived from a combination of manual readings and stage recorders. Data undergo QA/QC approximately yearly. Data processed by the St. Louis District using QA/QC procedures are kept in separate databases.

There are separate databases for the Mississippi River and the Illinois River, each of which contains all the historical QA/QC data for that river. The QA/QC databases contain one reading per day only, which represents the reading at approximately 0800. (This is done to conserve resource space on the computer.) The current database contains multiple readings per day but goes back in time only 8 or 9 mo.

2.2.2 Downloading and Reformatting the Data

Water elevation data are stored in Corps databases in a format which is essentially unusable for analysis by the EMTC. Therefore, they must be extracted from the Corps database, downloaded to an EMTC computer, and processed into a different format. All Corps district computer systems have a utility program called DSSUTL (Data Storage System Utility), which is used to extract the water elevation data from the database. This program was written by the Corps Hydrologic Engineering Center at Davis, California. Required input to the program to extract water elevation data includes the name of the Corps database, a time period for the data desired, and path names for the desired data. Path names include river name, station name, data type, starting date, time interval, and a descriptor. Scripts have been designed at the EMTC which serve as this input to DSSUTL for each district. Once the database data have been extracted, they must then be downloaded to the EMTC. This is done via a file transfer program (FTP, cc:Mail, or 3-1/2 disks). Once the data have been downloaded to the EMTC, they are processed into an ASCII format that is compatible with SAS and the Oracle database management system. Exact procedures for data extraction, downloading, and data processing for each Corps district are described in Appendixes A (St. Paul District), B (Rock Island District), and C (St. Louis District). Since each district's procedure varies slightly, there is a need for a separate method for each.

2.3 Data Transformation and Quality Assurance/Quality Control Procedures

The databases produced at the EMTC using the procedures described in section 2.2 are transferred to a Sun workstation and transformed into four SAS databases. In addition to creating SAS databases, the programs (1) check for missing data; (2) create a five-character station name; (3) check for and remove outliers (those values that lie outside the historical record for a station) from the water surface elevation data; (4) create ASCII files of all outliers; and (5) sort the data by station, year, and day. The following appendixes list the SAS program and the program file name for processing the four databases: (1) Appendix D, Mississippi River data from the Corps St. Paul District, /sun04/usr2/sas_work/jhw0/histtemp/stp1.sas; (2) Appendix E, Mississippi River data from the Corps Rock Island District, /sun04/usr2/sas_work/jhw0/histtemp/ri1.sas; (3) Appendix F, Mississippi River data from the Corps St. Louis District, /sun04/usr2/sas_work/jhw0/histtemp/stl1.sas; and (4) Appendix G, Illinois River data from the Corps Rock Island and St. Louis Districts, /sun04/usr2/sas_work/jhw0/histtemp/il1.sas.

Outliers which were deleted from the SAS database are checked by reviewing data collected at the same station before and after the questionable values were taken, and at stations upstream and downstream. Data which are still considered questionable are reported to the Corps. Data which are corrected or confirmed by the Corps are processed as above and are added to the database using a SAS update procedure (after changing appropriate file names):

```
LIBNAME DAT '/net/suns01/usr2/sas_work/jhw0/hist';
    DATA DAT.TESTRI3;
    UPDATE DAT.TESTRI DAT.TESTRI2;
    BY STATION YEAR DAY ;
RUN;
```

Data originally reported as stages by Corps District Offices must be converted to elevation readings by adding a value called the gage zero. The SAS program to convert the Rock Island District data is located in Appendix H and is stored as file /sun04/usr2/sas_work/jhw0/histtemp/ri2.sas. Mississippi River stage data from the St. Louis District are converted using the program listed in Appendix I and are stored as file /sun04/usr2/sas_work/jhw0/histtemp/stl2.sas. All data in the other two databases are reported as surface elevations.

Two additional checks are made before combining new data with the historical database. Minimum, maximum, and average values, along with the number of observations, are calculated and checked for surface elevations, Julian day, and year for each station. This program is listed in Appendix J and is stored as file /sun04/usr2/sas_work/jhw0/histtemp/chkel1.sas. Information from the SAS "contents" procedure is obtained for each of the four databases to ensure data are compatible with the historical database. Lengths for the five variables are as follows: station = 5, year = 4, day = 4, hour = 4, elevation = 8.

2.4 Final Water Elevation Database

2.4.1 SAS Database

The final historical database for water surface elevations is stored in a SAS database at the EMTC (file /suns01/usr4/jhw0/hist/elvce4.ssd01). An index file is also created to allow faster interaction with the data (file /suns01/usr4/jhw0/hist/elvce4.snx01). The digit in the file name immediately following the last part of the file name "elvce" is increased by one each time the database is updated. The file elvce4.ssd01 contains data through December 1994. The SAS update procedure is used to add new data or to make corrections to the water elevation database. The SAS program to update the database and create the index file is listed in Appendix K and is stored as file /sun04/usr2/sas_work/jhw0/histtemp/
combel1.sas. Approximately 160 million bytes of temporary storage will be needed to create the index file. The final elevation and index files use approximately 142 million bytes of storage. The five-character station name, river mile, pool code, first and last years of available data, river name, Corps district collecting data, and original station name are given in Appendix L.

Three additional files must be updated after a new database name is created for water surface elevations. One program is used to subset the data into SAS or ASCII datasets (file /sun04/usr2/
sas_work/jhw0/getelv4.sas). Another program estimates water elevations on a pool-wide scale (file /sun04/usr2/sas_work/jhw0/poolelv4.sas). The final program obtains elevation data for any number of days (file /sun04/usr2/sas_work/jhw0/getmanyel.sas). The only changes that are needed to these three files are corrections of the file names.

2.4.2 Obtaining Data

Obtaining subsets of water elevation data requires access to the Sun computer system at the EMTC and enough available disk space for the files being created. An ASCII dataset for one station for 1 yr requires approximately 11,000 bytes. An equivalent SAS database requires 24,000 bytes. Information on station names and the first and last year of data in the historical record is included in Appendix L. Table 1 lists information concerning the SAS databases.

A user may interactively query the historical record to obtain subsets of the water surface elevation database. Data from one station can be obtained in an ASCII or SAS format for 1 yr or for the period of record. Data for a particular day can also be obtained. Five variables for each observation are created: station name, year, Julian Day, time (2400-h clock), and water surface elevations (feet above sea level). To use the program, you must be logged onto the Sun04 computer and enter the string:

sas /usr2/sas_work/jhw0/getelv4.sas

The following line is an example of the ASCII file created with the above SAS program:

DKTM5 1989 1 800 433.98

Table 1. Variables in SAS water surface elevation databases

SAS variable			
Name	**Length**	**Type**	**Comments**
Station	5	char.	See Appendix L for station names
Year	4	num.	See Appendix L for years of availability
Day	4	num.	Julian day (1-366)
Time	4	num.	2400-h clock (the dataset contains some values >2400, as reported by the Corps)
Elev	8	num.	Feet above mean sea level

2.4.3 Changes to the Database

August 16, 1994. All historical data for stations 0273A, 0273B, 0241A, and 0241B were replaced with a new set of data obtained from the Corps St. Louis District. The original stage data may have had incorrect gage zero values applied. Errors at stations 0273A and 0273B may have been -0.19 ft. Errors at stations 0241A and 0241B may have been 0.09 ft.

3. Discharge

3.1 Historical Discharge Data

The majority of the historical data from all USGS gages were obtained from an optical disk system purchased from EarthInfo, Inc. (Boulder, CO), with the remainder obtained directly from USGS state offices. The data were processed in five major steps:

a. Data were obtained as ASCII data blocks, with each block consisting of header information and data. Header information included station number, name, location, and the month and year of first and last data points.

b. Each data block was processed with a computer program that parsed the data block, creating a series of observations in an ASCII database. Each observation contained the year, Julian day, and discharge (cubic feet per second).

c. Using an editor, a five-character station name was added to each database.

d. A SAS database was created using the ASCII data from step c above.

e. The data were tested to assure that all values were within minimum and maximum flows as reported for the station in USGS water year records. All values were within bounds. Information concerning the historical discharge database is included in section 3.3.

3.2 Obtaining Future Discharge Data

Discharge data for a water year are available in the summer of the next year from USGS state offices in Illinois, Iowa, Minnesota, and Missouri (see Appendix M). When requesting data from the USGS, specify that the data be sent on floppy diskettes (ASCII format) using the same presentation as found in USGS water year records. Also, request a copy of the latest volume of the water year records. Data should be checked for format and content and a new request submitted if any problems are detected.

Some districts send data only for the year requested, while others send data for the entire period of record. Unless there are revised data from previous years (see USGS water year record books), extract data of interest. Due to their large size and incompatibility with WordPerfect, the period of record files should be transferred to the Sun04 workstation for editing. After the data are extracted, they should be transferred back to a PC for further revision, using a DOS editor. Change the two-character string "-e" to "-- " and change the three-character string "---" to "-99" during the edit session. Data for each station must be saved in a separate file.

Each data file is then reformatted on a DOS-based PC using a Pascal program named rdhydall.exe (Appendix N). Type "rdhydall *filename*" at the DOS prompt. The program queries for the database name and an output database name. The output database name must be the same as the five-character station name (all capitals) used in the database (Appendix M). Output from the program is in ASCII format and includes the five-character station name from above, the year, month, day of the month, and discharge in

cubic feet per second. ASCII files from all states should then be transferred to the Sun04 and combined, using an editor, in subdirectory /sun04/usr2/sas_work/jhw0/histtemp.

The combined file should then be read with a SAS program, replacing the month and day values with a Julian day value. Data are then checked for outliers, information is obtained from the SAS contents procedure, and the data are added to the historical database using the SAS update procedure. Lengths for the four variables are as follows: station = 5, year =4, day = 4, and discharge = 8. An example of the SAS program is included in Appendix O and is stored as file /sun04/usr2/sas_work/jhw0/histtemp/ gs1.sas.

3.3 Final Discharge Database

3.3.1 SAS Database

The final historical discharge database is stored as a SAS database at the EMTC (file /suns01/usr4/jhw0/hist/gsflow5.ssd01). An index file is also created to allow faster interaction with the data (file /suns01/usr4/jhw0/hist/ gsflow5.snx01). The digit in the file name immediately following "gsflow" is increased by one after new data are added. The files "gsflow5" include data through water year 1994. Each observation has four variables: a five-character station name, all capitals; the year (four characters); the Julian day (three characters); and discharge (eight characters). The five-character station name, river mile, pool code, first and last years of available data, river name, USGS state office collecting data, and original station name are given in Appendix M. The SAS program to update the database and create the index file is listed in Appendix K and is stored as file /sun04/usr2/sas_work/jhw0/ histtemp/combq1.sas. Approximately 22 million bytes of temporary storage is needed to create the index file. The final discharge and index files use approximately 17 million bytes of storage. The five-character station name, river mile, pool code, first and last years of available data, river name, USGS office collecting data, and original station name are given in Appendix M.

One additional file must be updated after a new database name is created for water surface elevations. The program is used to subset the data into SAS or ASCII datasets (file /sun04/usr2/sas_work/jhw0/ getflow4.sas). The only necessary changes to this file are corrections of the filename.

3.3.2 Obtaining Data

Obtaining subsets of discharge data requires access to the Sun computer system at the EMTC and enough available disk space for files being created. An ASCII dataset for one station for 1 yr requires approximately 10,000 bytes. An equivalent SAS database requires 24,000 bytes. Information on station names, pool, collecting office, original station name, and the first and last year of data in the historical record is included in Appendix M. Table 2 lists information concerning the SAS database.

A user may interactively query the historical record for discharge. Data from one station can be obtained in an ASCII or SAS format for 1 yr or for the period of record. Data for a particular day can also be obtained. To use the program, you must be logged onto the Sun04 computer and enter the string:

```
sas  /usr2/sas_work/jhw0/getflow4.sas
```

The following line is an example of the ASCII file created with the above SAS program:

WINON 1928 183 21300

Table 2. Variables in the SAS discharge database

SAS variable			
Name	**Length**	**Type**	**Comments**
Station	5	char.	See Appendix M for station names
Year	4	num.	See Appendix M for years of availability
Day	4	num.	Julian day (1-366)
Flow	8	num.	Cubic feet per second

4. Reference

U.S. Fish and Wildlife Service. 1992. Operating Plan for the Upper Mississippi River System Long Term Resource Monitoring Program. Environmental Management Technical Center, Onalaska, Wisconsin, Revised September 1993. EMTC 91-P002. 179 pp. (NTIS #PB94-160199)

Appendix A

Data Extraction, Data Downloading, and Data Processing Procedures for the Corps St. Paul District (Unix Operating System)

A. Login Procedures

St. Paul
tn 155.79.180.150
Login: guest
Password: guest1

You should now be logged into the St. Paul Unix computer.

B. Corps District Database

The database(s) used for the St. Paul data is(are) set up in menu-driven Unix paths which are automatically internally set; i.e., we have no control over the database assignments. We simply set up the time interval needed and extract all the USFW data (set up in the St. Paul USFW macro) for that time period. If only certain stations are needed, simply edit them out of the data (using sed, vi, or the DOS editor) after downloading USFW.data.

C. Processing Software

DSSUTL scripts: The only way to extract water elevation data from the St. Paul computer is to use the USFW Gemac (a system macro). This has a built-in DSSUTL script which uses all the station paths for all the St. Paul stations. The only variable which can be controlled is the time window. If only certain stations are needed, they will need to be edited out after all data are downloaded to the EMTC. Since the DSSUTL scripts are prewritten at the system level, there are no DSSUTL scripts for St. Paul.

Telnet software: TN (must be available on your PC or the SUN system you are on and the St. Paul Unix computer).

File Transfer Software: FTP (must be available on your PC or the SUN system you are on and the St. Paul Unix computer).

DSSUTL software: SYS*DSSUTL (must be available on the St. Paul Unix system only).

DSS/SAS conversion software: STP2SAS.EXE (must be available on your PC only) (source code is STP2SAS.C).

D. Suggested Processing Techniques

1. Once logged in, choose option 1 from the guest menu. The guest menu automatically appears at login; option 1 invokes DSSUTL.
2. Set the time window.

   Example: If the data request is for all the 1994 data, enter TI 0001,01JAN942400,31DEC94.

   The format is TI <starting time>,<starting date>, <ending time>,<ending date>. Times are in HHMM format, dates are in DDMMMYY format.

3. Type and enter: !RUN USFW. This invokes the USFW system macro.
4. Type and enter: QUIT.
5. Login to whatever SUN system or PC you wish to transfer the data to, and cd to the directory you wish to write the data to.
6. Type and enter: ftp 155.79.180.150.
7. Type and enter: get USFW.data.
8. Type and enter: quit.
9. If USFW.data was transferred to a PC, rename USFW.DAT to USFW. STP2SAS cannot have the input file with a .DAT extension (.data is truncated to .DAT in DOS).
10. Run \WTR_ELEV\STP2SAS. This creates a USFW.DAT and a USFW.STE, which are the files needed for SAS processing.
11. Rename USFW.DAT and USFW.STE to something appropriate for the request (keep the .DAT and .STE extensions; these are needed for proper SAS processing). For example, if the request was for all the 1994 St. Louis data, you might call these STL_93.DAT and STL_94.STE. Use your own discretion and ingenuity.
12. Transfer the renamed .DAT and .STE files where the requester wishes them.
13. Delete the USFW file from your SUN system or PC; it is now no longer needed.

Appendix B

Data Extraction, Data Downloading, and Data Processing Procedures for the Corps Rock Island District (Unix Operating System)

A. Login Procedures

There is no current method to login to the Rock Island system; a DSSUTL script must be cc:Mailed or mail to Rock Island on a 3-1/2-inch floppy disk. Rock Island will run the script and send the data back to the Environmental Management Technical Center (EMTC).

An input file of the station path names and time window for the DSSUTL utility must be developed. There is one file for Mississippi River data and one for Illinois River data. Only the Time Window and the Date part of the path names for the appropriate date should be changed. These files are in WTR_ELEV\ROCK_ISL\SCRIPTS.

B. Corps District Databases

Rock Island

1000DATA*MASTYY: (YY in the database name is the year desired). QAed Mississippi and Illinois River data, hourly readings (based on the time interval in the statipath name). The most recent data that can be retrieved from this database is about 1.5 to 2 mo old (Corps requires this time to QA the data).

1000DATA*TEMPDB: Non-QAed up-to-date Mississippi and Illinois River data, hourly readings (based on the time interval in the station path name). The data goes back only about 6 mo in time. The Corps uses this database as a temporary repository for new data until they are QAed. Once checked over, they are then loaded into the permanent database.

C. Processing Software

DSSUTL scripts: ROCK_MIS (hourly Mississippi readings) and ROCK_ILL (hourly Illinois readings).

Edit the appropriate DSSUTL scripts (if editing is in ASCII format, then cc:Mail or mail to Rock Island on a 3-1/2-inch floppy disk. Rock Island will run the script and send the data back to the EMTC.

DSSUTL software: SYS*DSSUTL (must be available on the Rock Island system) and DSS/SAS conversion software: ROCK2SAS.EXE (must be available on your PC only) (source code is ROCK2SAS.C).

D. Suggested Processing Techniques

1. Run \WTR_ELEV\ROCK_ISL\DATA\ROCK2SAS. This creates a W9.DAT and a W9.STE, which are the files needed for SAS processing.
2. Rename W9.DAT and W9.STE to something appropriate for the request (keep the .DAT and .STE extensions; these are needed for proper SAS processing). For example, if the request was for all the 1994 Rock Island data, you might call these ROCK_94.DAT and ROCK_94.STE. Use your own discretion and ingenuity.
3. Transfer the renamed .DAT and .STE files where the requester wishes them.
4. Delete the W9 file from your PC; it is now no longer needed.

Appendix C

Data Extraction, Data Downloading, and Data Processing Procedures for the Corps St. Louis District (Unix Operating System)

A. Login Procedures

There is no current method to login to the St. Louis system; a DSSUTL script must be cc:Mailed or mail to St. Louis on a 3-1/2-inch floppy disk. St. Louis will run the script and send the data back to Environmental Management Technical Center (EMTC).

1. An input file of the station path names and time window for the DSSUTL utility must be developed. This has already been done for the most part at the EMTC on a Dell P90 PC. There is one file for Mississippi River data and one for Illinois River data. Only the Time Window and the Date part of the path names for the appropriate date should be changed. These files are in WTR_ELEV\STL_94\SCRIPTS\STL_MISS and STL_ILL on the Dell P90 PC.

B. Corps District Databases

1. St. Louis

3026P20*ZDMISS: QAed Mississippi River data, one reading per day (mean for the day). The most recent data that can be retrieved from this database is about 1.5 to 2 mo old (Corps needs this time to QA the data).

3026P20*ZDILLI: QAed Illinois River data, one reading per day (mean for the day). The most recent data that can be retrieved from this database is about 1.5 to 2 mo old (Corps needs this time to QA the data).

3025P02*DSSDYY: (YY in the database name is the year desired). QAed Mississippi and Illinois River data, hourly readings (based on the time interval in the station path name). The most recent data that can be retrieved from this database is about 1.5 to 2 mo old (Corps requires this time to QA the data).

3025P02*DATATS: Non-QAed up-to-date Mississippi and Illinois River data, hourly readings (based on the time interval in the station path name). The data goes back only about 6 mo in time. The Corps uses this database as a temporary repository for new data until they are QAed. Once checked over, they are loaded into the permanent databases.

C. Processing Software

1. St. Louis

DSSUTL scripts: STL_MISS.DLY (daily Mississippi readings)

STL_ILLI.DLY (daily Illinois readings)
STL_MISS.HOR (hourly Mississippi readings)
STL_ILLI.HOR (hourly Illinois readings)
Edit the appropriate DSSUTL scripts (if editing is needed) accordingly, based on the data request, save the scripts in an ASCII format, then cc:Mail or send the DSSULT scripts to St. Louis.

DSSUTL software: SYS*DSSUTL (must be available on the St. Louis system) and DSS/SAS conversion software: STL2SAS.EXE (must be available on your PC only) (source code is STL2SAS.C).

D. Suggested Processing Techniques

1. Run \WTR_ELEV\STL_94\STL2SAS. This creates a W9.DAT and a W9.STE, which are the files needed for SAS processing.
2. Rename W9.DAT and W9.STE to something appropriate for the request (keep the .DAT and .STE extensions; these are needed for proper SAS processing). For example, if the request was for all the 1994 St. Louis data, you might call these STL_94.DAT and STP_94.STE. Use your own discretion and ingenuity.
3. Transfer the renamed .DAT and .STE files where the requester wishes them.
4. Delete the W9 file from your PC (it is now no longer needed).

Appendix D

Statistical Analysis System (SAS) Program for Mississippi River Water Surface Elevation Data from the Corps St. Paul District

```
LIBNAME DAT '/usr2/sas_work/jhw0/histtemp';
 DATA DAT.stp (DROP=RIV STNAME ELEV JDATE);
 INFILE '/usr2/sas_work/jhw0/histtemp/stp_94.dat' DLM=',';  LENGTH STNAME $15 STATION
$5 YEAR 4 DAY 4 TIME 4;
 INPUT RIV $ STNAME $ ELEV $ YEAR DAY JDATE TIME ELV;
  IF ELEV = 'ELEV';
 IF ELV LE -.1 THEN GOTO STOP2;
 IF YEAR = . THEN GOTO STOP2;
 IF DAY = . THEN GOTO STOP2;
 IF TIME = . THEN GOTO STOP2; IF ELV = . THEN GOTO STOP2;
IF STNAME='DAM1-POOL' THEN DO;
  STATION='DAM1P';
  IF ELV LT 721.12 OR ELV GT 734.47 THEN GOTO STOP2;
 GOTO STOP1;
 END;


 IF STNAME='DAM1-TAIL' THEN DO;
  STATION='DAM1T';
  IF ELV LT 686.2 OR ELV GT 718.92 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='DAM10-POOL' THEN DO;
 STATION='DM10P';
 IF ELV LT 609.61 OR ELV GT 624.2 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM10-TAIL' THEN DO;
 STATION='DM10T';
 IF ELV LT 602.83 OR ELV GT 623.62 THEN GOTO STOP2;
 GOTO STOP1;
END;


 IF STNAME='DAM2-POOL' THEN DO;
  STATION='DAM2P';
  IF ELV LT 686.15 OR ELV GT 697.7 THEN GOTO STOP2;
  GOTO STOP1;
END;
```

```
IF STNAME='DAM2-TAIL' THEN DO;
  STATION='DAM2T';
  IF ELV LT 674.15 OR ELV GT 696.05 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='DAM3-POOL' THEN DO;
 STATION='DAM3P';
 IF ELV LT 673.19 OR ELV GT 688.23 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM3-TAIL' THEN DO;
 STATION='DAM3T';
 IF ELV LT 666.83 OR ELV GT 687.77 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM4-POOL' THEN DO;
 STATION='DAM4P';
 IF ELV LT 664.82 OR ELV GT 676.45 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM4-TAIL' THEN DO;
 STATION='DAM4T';
 IF ELV LT 658.86 OR ELV GT 675.75 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM5-POOL' THEN DO;
 STATION='DAM5P';
 IF ELV LT 658.22 OR ELV GT 668.63 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM5-TAIL' THEN DO;
 STATION='DAM5T';
 IF ELV LT 649.9 OR ELV GT 667.69 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM5A-POOL' THEN DO;
 STATION='DM5AP';
 IF ELV LT 649.01 OR ELV GT 663.72 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM5A-TAIL' THEN DO;
 STATION='DM5AT';
 IF ELV LT 645.03 OR ELV GT 663.33 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM6-POOL' THEN DO;
 STATION='DAM6P';
 IF ELV LT 643.95 OR ELV GT 654.65 THEN GOTO STOP2;
 GOTO STOP1;
```

```
END;
IF STNAME='DAM6-TAIL' THEN DO;
 STATION='DAM6T';
 IF ELV LT 638.68 OR ELV GT 653.02 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM7-POOL' THEN DO;
 STATION='DAM7P';
 IF ELV LT 638.15 OR ELV GT 648.16 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM7-TAIL' THEN DO;
 STATION='DAM7T';
 IF ELV LT 630.27 OR ELV GT 647.48 THEN GOTO STOP2;
 GOTO STOP1;
 END;
IF STNAME='DAM8-POOL' THEN DO;
 STATION='DAM8P';
 IF ELV LT 628.24 OR ELV GT 639.17 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM8-TAIL' THEN DO;
 STATION='DAM8T';
 IF ELV LT 619.7 OR ELV GT 638.37 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM9-POOL' THEN DO;
 STATION='DAM9P';
 IF ELV LT 618.40 OR ELV GT 633.78 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='DAM9-TAIL' THEN DO;
 STATION='DAM9T';
 IF ELV LT 611.05 OR ELV GT 633.12 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='NSP' THEN DO;
 STATION='NSP';
 IF ELV LT 797. OR ELV GT 810.9 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='SAF-LOW-POOL' THEN DO;
 STATION='SAFLP';
 IF ELV LT 748.44 OR ELV GT 751.4 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME='SAF-LOW-TAIL' THEN DO;
 STATION='SAFLT';
 IF ELV LT 721.64 OR ELV GT 739.01 THEN GOTO STOP2;
```

```
 GOTO STOP1;
END;
IF STNAME='SAF-UP-POOL' THEN DO;
 STATION='SAFUP';
 IF ELV LT 796.87 OR ELV GT 803.41 THEN GOTO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'AMAW3' THEN DO;
 STATION = STNAME;
 IF ELV LT 658.73 OR ELV GT 672.3 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'BRWM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 629.4 OR ELV GT 640.2 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'CLAI4' THEN DO;
 STATION = STNAME;
 IF ELV LT 610.3 OR ELV GT 627.4 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'DKTM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 638.5 OR ELV GT 649.08 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'LACW3' THEN DO;
 STATION = STNAME;
 IF ELV LT 630.24 OR ELV GT 644. THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'LKCM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 666.65 OR ELV GT 683.3 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'LNSI4' THEN DO;
 STATION = STNAME;
 IF ELV LT 619.42 OR ELV GT 634.76 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'MCGI4' THEN DO;
 STATION = STNAME;
 IF ELV LT 610.79 OR ELV GT 630.68 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'PREW3' THEN DO;
 STATION = STNAME;
```

```
 IF ELV LT 674.45 OR ELV GT 693.1 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'SSPM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 686.39 OR ELV GT 707.1 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'STPM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 686.52 OR ELV GT 710.11 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'WABM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 666. OR ELV GT 680.05 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'WNAM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 644.5 OR ELV GT 660.82 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME = 'STLM5' THEN DO;
 STATION = STNAME;
 IF ELV LT 674.63 OR ELV GT 694.09 THEN GO TO STOP2;
 GOTO STOP1;
 END;
 STOP2: ;
  FILE'/usr2/sas_work/jhw0/histtemp/stpbad.asc';
  PUT STNAME $ 1-15 YEAR 17-20 DAY 22-24 TIME 26-29 ELV 31-39 .2;
  DELETE;
 STOP1: ;
 RUN;
 proc sort data = dat.stp nodup;
 by station year day time;
 RUN;
```

Appendix E

Statistical Analysis System (SAS) Program for Mississippi River Water Surface Elevation Data from the Corps Rock Island District

```
LIBNAME DAT '/usr2/sas_work/jhw0/histtemp';
  DATA DAT.rimiss (DROP=RIV STNAME1 STNAME2 JDATE);
  INFILE '/usr2/sas_work/jhw0/histtemp/ri_94.dat' DLM=',';    LENGTH STNAME1 $16
STNAME2 $9 STATION $5 YEAR 4 DAY 4 TIME 4;   INPUT RIV $ STNAME1 $ STNAME2 $
YEAR DAY JDATE TIME ELV;   IF RIV NE 'MISSISSI' THEN DELETE;
  IF YEAR = . THEN GOTO STOP2;
  IF DAY = . THEN GOTO STOP2;
  IF TIME = . THEN GOTO STOP2;
  IF ELV = . THEN GOTO STOP2;
  IF STNAME1='BLANCHARD ISLAND' AND STNAME2= 'STAGE' THEN DO;
STATION='BLANC';
    IF ELV LT 7.34 OR ELV GT 28 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='BURLINGTON' AND STNAME2='ELEV' THEN DO;
    STATION='BURLT';
    IF ELV LT 518 OR ELV GT 537 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='CAMANCHE' AND STNAME2='ELEV' THEN DO;
    STATION='CAMAN';
    IF ELV LT 571 OR ELV GT 587 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='CASSVILLE' AND STNAME2='STAGE' THEN DO;
    STATION='CASSV';
    IF ELV LT 6 OR ELV GT 22 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='CLINTON' AND STNAME2='STAGE' THEN DO;
    STATION='CLINT';
    IF ELV LT 4 OR ELV GT 24.84 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='L&D 11' AND STNAME2='POOL ELEV' THEN DO;
    STATION='DM11P';
    IF ELV LT 599 OR ELV GT 615 THEN GOTO STOP2;
    GOTO STOP1;
  END;
```

```
IF STNAME1='L&D 11' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM11T';
  IF ELV LT 589 OR ELV GT 614 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 12' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM12P';
  IF ELV LT 590 OR ELV GT 603 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 12' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM12T';
  IF ELV LT 577.9 OR ELV GT 604 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 13' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM13P';
  IF ELV LT 580 OR ELV GT 594 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'L&D 13' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM13T';
  IF ELV LT 570 OR ELV GT 594 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'L&D 14' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM14P';
  IF ELV LT 568 OR ELV GT 578 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 14' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM14T';
  IF ELV LT 560 OR ELV GT 574.83 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 15' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM15P';
  IF ELV LT 557 OR ELV GT 566 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 15' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM15T';
  IF ELV LT 543 OR ELV GT 566 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 16' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM16P';
  IF ELV LT 540 OR ELV GT 559 THEN GOTO STOP2;
  GOTO STOP1;
```

```
END;
IF STNAME1='L&D 16' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM16T';
  IF ELV LT 531.69 OR ELV GT 558 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 17' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM17P';
  IF ELV LT 532 OR ELV GT 553 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 17' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM17T';
  IF ELV LT 524.77 OR ELV GT 553 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 18' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM18P';
  IF ELV LT 524 OR ELV GT 541 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 18' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM18T';
  IF ELV LT 517 OR ELV GT 541 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 19' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM19P';
  IF ELV LT 513.38 OR ELV GT 520 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 19' AND STNAME2='TAIL ELEV' THEN DO;
  STATION='DM19T';
  IF ELV LT 475 OR ELV GT 506 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1='L&D 20' AND STNAME2='POOL ELEV' THEN DO;
  STATION='DM20P';
  IF ELV LT 469 OR ELV GT 496 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'L&D 20' AND STNAME2='TAIL ELEV' THEN DO;
 STATION ='DM20T';
 IF ELV LT 464.9 OR ELV GT 496 THEN GO TO STOP2;
 GOTO STOP1;
END;
IF STNAME1= 'L&D 21' AND STNAME2='POOL ELEV' THEN DO;
 STATION = 'DM21P';
 IF ELV LT 467 OR ELV GT 490 THEN GO TO STOP2;
```

```
  GOTO STOP1;
END;
IF STNAME1= 'L&D 21' AND STNAME2='TAIL ELEV' THEN DO;
  STATION ='DM21T';
  IF ELV LT 453.9 OR ELV GT 489 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'L&D 22' AND STNAME2='POOL ELEV' THEN DO;
  STATION = 'DM22P';
  IF ELV LT 457 OR ELV GT 476  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'L&D 22' AND STNAME2='TAIL ELEV' THEN DO;
  STATION = 'DM22T';
  IF ELV LT 443.2 OR ELV GT 476  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'DUBUQUE' AND STNAME2='ELEV' THEN DO;
  STATION = 'DUBUQ';
  IF ELV LT 590 OR ELV GT 610 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'FAIRPORT' AND STNAME2='ELEV' THEN DO;
  STATION = 'FAIRP';
  IF ELV LT 541 OR ELV GT 560  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'FT. MADISON' AND STNAME2='ELEV' THEN DO;
  STATION = 'FORTM';
  IF ELV LT 524 OR ELV GT 533  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1 = "GORDON'S FERRY" AND STNAME2='STAGE' THEN DO;
  STATION = 'GORDN';
  IF ELV LT 7 OR ELV GT 17 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'GREGORY LANDING' AND STNAME2='ELEV' THEN DO;
  STATION = 'GREGY';
  IF ELV LT 476 OR ELV GT 498  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'HANNIBAL' AND STNAME2='ELEV' THEN DO;
  STATION = 'HANBL';
  IF ELV LT 446.73 OR ELV GT 482 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'KEITHSBURG' AND STNAME2='ELEV' THEN DO;
  STATION = 'KEITH';
```

```
  IF ELV LT 526 OR ELV GT 548  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'LA GRANGE' AND STNAME2='STAGE' THEN DO;
  STATION = 'LAGRA';
  IF ELV LT 0 OR ELV GT 29  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'MOLINE' AND STNAME2='STAGE' THEN DO;
  STATION = 'MOLIN';
  IF ELV LT 6.5 OR ELV GT 21.5 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'MONTPELIER' AND STNAME2='ELEV' THEN DO;
  STATION = 'MONTP';
  IF ELV LT 540 OR ELV GT 561 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'MUSCATINE' AND STNAME2='ELEV' THEN DO;
  STATION = 'MUSCT';
  IF ELV LT 533.71 OR ELV GT 556.71 THEN GO TO STOP2;
  GOTO STOP1;
END;
   IF STNAME1= 'OQUAWKA' AND STNAME2='STAGE' THEN DO;
  STATION = 'OQWKA';
  IF ELV LT 10.5 OR ELV GT 29 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'PRINCETON' AND STNAME2='STAGE' THEN DO;
  STATION = 'PRNCE';
  IF ELV LT 7 OR ELV GT 19 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'QUINCY' AND STNAME2='STAGE' THEN DO;
  STATION = 'QUNCY';
  IF ELV LT 1 OR ELV GT 32 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'SABULA' AND STNAME2='STAGE' THEN DO;
  STATION = 'SABUL';
  IF ELV LT 9.5 OR ELV GT 24 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= "SPECHT'S FERRY" AND STNAME2='STAGE' THEN DO;
  STATION = 'SPECH';
  IF ELV LT 9 OR ELV GT 21.9  THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME1= 'SUNSET MARINA' AND STNAME2='STAGE' THEN DO;
```

```
    STATION = 'SUNST';
    IF ELV LT 10 OR ELV GT 27 THEN GO TO STOP2;
    GOTO STOP1;
  END;
STOP2: ;
  FILE'/usr2/sas_work/jhw0/histtemp/ribad.asc';
  PUT STNAME1 $ 1-16 STNAME2 $ 18-26 YEAR 28-31 DAY 33-35 TIME
     37-40 ELV 42-50 .2;
  DELETE;
STOP1: ;
RUN;

   proc sort data = dat.rimiss nodup;
   by station year day time;
RUN;
```

Appendix F

Statistical Analysis System (SAS) Program
for Mississippi River Water Surface Elevation Data
from the Corps St. Louis District

```
LIBNAME DAT '/usr2/sas_work/jhw0/histtemp/dat_94';
DATA DAT.stlmiss (DROP=RIV STNAME ELEV JDATE);
INFILE '/usr2/sas_work/jhw0/histtemp/stlmiss' DLM=',';
  LENGTH STNAME $5 STATION $5 YEAR 4 DAY 4 TIME 4;
  INPUT RIV $ STNAME $ ELEV $ YEAR DAY JDATE TIME ELV;
  IF YEAR = . THEN GOTO STOP2;
  IF DAY = . THEN GOTO STOP2;
  IF TIME = . THEN GOTO STOP2;
  IF ELV = . THEN GOTO STOP2;
  IF STNAME='0293A' THEN DO;
     STATION='0293A';
     IF ELV LT -2.4 OR ELV GT 29 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME='0282A' THEN DO;
     STATION='0282A';
     IF ELV LT -3.2 OR ELV GT 29 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME='0273A' THEN DO;
     STATION='0273A';
     IF ELV LT 433.1 OR ELV GT 461 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME='0273B' THEN DO;
     STATION='0273B';
     IF ELV LT 431.8 OR ELV GT 460 THEN GOTO STOP2;
     GOTO STOP1;
 END;
  IF STNAME='0265A' THEN DO;
     STATION='0265A';
     IF ELV LT .1 OR ELV GT 29 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME='0260A' THEN DO;
     STATION='0260A';
     IF ELV LT 428.2 OR ELV GT 455 THEN GOTO STOP2;
     GOTO STOP1;
  END;
```

```
IF STNAME='0250A' THEN DO;
  STATION='0250A';
  IF ELV LT -2.3 OR ELV GT 31 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0241A' THEN DO;
  STATION='0241A';
  IF ELV LT 420.11 OR ELV GT 448 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0241B' THEN DO;
  STATION='0241B';
  IF ELV LT 416 OR ELV GT 448 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0228A' THEN DO;
  STATION='0228A';
  IF ELV LT -2.4 OR ELV GT 34 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0218A' THEN DO;
  STATION='0218A';
  IF ELV LT -1 OR ELV GT 38.1 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0203A' THEN DO;
  STATION='0203A';
  IF ELV LT 407.30 OR ELV GT 433.13 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0203B' THEN DO;
  STATION='0203B';
  IF ELV LT 391.2 OR ELV GT 432.09 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0203C' THEN DO;
  STATION='0203C';
  IF ELV LT 412 OR ELV GT 440. THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0201A' THEN DO;
  STATION='0201A';
  IF ELV LT 400.20 OR ELV GT 439 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0201B' THEN DO;
  STATION='0201B';
  IF ELV LT 397.0 OR ELV GT 438 THEN GOTO STOP2;
  GOTO STOP1;
```

```
END;
IF STNAME='0196A' THEN DO;
  STATION='0196A';
  IF ELV LT 390.70 OR ELV GT 437 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0190A' THEN DO;
  STATION='0190A';
  IF ELV LT 72.80 OR ELV GT 122 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0190B' THEN DO;
  STATION='0190B';
  IF ELV LT 392.6 OR ELV GT 410.0 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0185A' THEN DO;
  STATION='0185A';
  IF ELV LT 388.95 OR ELV GT 438 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0185B' THEN DO;
  STATION='0185B';
  IF ELV LT 375.65 OR ELV GT 433 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0179A' THEN DO;
  STATION='0179A';
  IF ELV LT -6.2 OR ELV GT 50 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0176A' THEN DO;
  STATION='0176A';
  IF ELV LT -6.5 OR ELV GT 48 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0168A' THEN DO;
  STATION='0168A';
  IF ELV LT -8.6 OR ELV GT 45 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0158A' THEN DO;
  STATION='0158A';
  IF ELV LT -7.6 OR ELV GT 47 THEN GOTO STOP2;
  GOTO STOP1;
END;
IF STNAME='0146A' THEN DO;
  STATION='0146A';
  IF ELV LT 356.1 OR ELV GT 410 THEN GOTO STOP2;
```

```
   GOTO STOP1;
END;
IF STNAME='0136A' THEN DO;
   STATION='0136A';
   IF ELV LT -6.4 OR ELV GT 48 THEN GOTO STOP2;
   GOTO STOP1;
END;
IF STNAME='0125A' THEN DO;
   STATION='0125A';
   IF ELV LT 130 OR ELV GT 186 THEN GOTO STOP2;
   GOTO STOP1;
END;
IF STNAME = '0109A' THEN DO;
  STATION ='0109A';
  IF ELV LT -4.3 OR ELV GT 50 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0100A' THEN DO;
  STATION = '0100A';
  IF ELV LT -4.4 OR ELV GT 52 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0094A' THEN DO;
  STATION ='0094A';
  IF ELV LT -0.5 OR ELV GT 55 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0081A' THEN DO;
  STATION = '0081A';
  IF ELV LT -0.3 OR ELV GT 53 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0066A' THEN DO;
  STATION = '0066A';
  IF ELV LT 0.6 OR ELV GT 50 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0052A' THEN DO;
  STATION = '0052A';
  IF ELV LT 0.0 OR ELV GT 48 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0046A' THEN DO;
  STATION = '0046A';
  IF ELV LT 0.2 OR ELV GT 47 THEN GO TO STOP2;
  GOTO STOP1;
END;
IF STNAME = '0043A' THEN DO;
  STATION = '0043A';
```

```
   IF ELV LT 0.85 OR ELV GT 46 THEN GO TO STOP2;
   GOTO STOP1;
  END;
  IF STNAME = '0042A' THEN DO;
   STATION = '0042A';
   IF ELV LT -3.2 OR ELV GT 38.3 THEN GOTO STOP2;
   GOTO STOP1;
  END;
  IF STNAME = '0039A' THEN DO;
   STATION = '0039A';
   IF ELV LT -2.9 OR ELV GT 41 THEN GO TO STOP2;
   GOTO STOP1;
  END;
  IF STNAME = '0030A' THEN DO;
   STATION = '0030A';
   IF ELV LT -8.8 OR ELV GT 35 THEN GO TO STOP2;
   GOTO STOP1;
  END;
  IF STNAME = '0020A' THEN DO;
   STATION = '0020A';
   IF ELV LT 278.0 OR ELV GT 331.50 THEN GO TO STOP2;
   GOTO STOP1;
  END;
  IF STNAME = '0013A' THEN DO;
   STATION = '0013A';
   IF ELV LT -2.1 OR ELV GT 46.91 THEN GOTO STOP2;
   GOTO STOP1;
  END;
  IF STNAME = '0002A' THEN DO;
   STATION = '0002A';
   IF ELV LT -2.1 OR ELV GT 52.4 THEN GO TO STOP2;
   GOTO STOP1;
  END;
STOP2: ;
  FILE'/usr2/sas_work/jhw0/histtemp/stlbad.asc';
  PUT STNAME $ 1-5 YEAR 7-10 DAY 12-14 TIME 16-19 ELV 21-29 .2;
   DELETE;
STOP1: ;
RUN;
   proc sort data = dat.stlmiss nodup;
   by station year day time;
RUN;
  proc contents;
run;
```

Appendix G

Statistical Analysis System (SAS) Program
for Illinois River Water Surface Elevation Data
from the Corps Rock Island and St. Louis Districts

```
LIBNAME DAT '/usr2/sas_work/jhw0/histtemp';
DATA DAT.il (DROP=RIV STNAME1 STNAME2 JDATE);
INFILE '/usr2/sas_work/jhw0/histtemp/ri_94.dat' DLM=',';      LENGTH STNAME1 $20
STNAME2 $9 STATION $5 YEAR 4 DAY 4 TIME 4;   INPUT RIV $ STNAME1 $ STNAME2 $
YEAR DAY JDATE TIME ELV;   IF RIV NE 'ILLINOIS' THEN DELETE;
  IF YEAR = . THEN GOTO STOP2;
  IF DAY = . THEN GOTO STOP2;
  IF TIME = . THEN GOTO STOP2;
  IF ELV = . THEN GOTO STOP2;
  IF STNAME1='BEARDSTOWN' AND STNAME2= 'ELEV' THEN DO;
     STATION='BRDIL';
     IF ELV LT 428 OR ELV GT 448.4 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='BRANDON ROAD L&D' AND STNAME2='POOL ELEV' THEN DO;
STATION='BRNDP';
     IF ELV LT 536.8 OR ELV GT 540.5 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='BRANDON ROAD L&D' AND STNAME2='TAIL ELEV' THEN DO;
STATION='BRNDT';
     IF ELV LT 501.1 OR ELV GT 513.3 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='DRESDEN ISLAND L&D' AND STNAME2='POOL ELEV' THEN DO;
     STATION='DRSDP';
     IF ELV LT 501 OR ELV GT 509.3 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='DRESDEN ISLAND L&D' AND STNAME2='TAIL ELEV' THEN DO;
     STATION='DRSDT';
     IF ELV LT 482.5 OR ELV GT 505.2 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='KINGSTON MINES' AND STNAME2='ELEV' THEN DO;
     STATION='KINGS';
     IF ELV LT 429.4 OR ELV GT 453.7 THEN GOTO STOP2;
     GOTO STOP1;
  END;
```

```
  IF STNAME1='LA GRANGE L&D' AND STNAME2='POOL ELEV' THEN DO;
STATION='LAGRP';
    IF ELV LT 425.8 OR ELV GT 447.2 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='LA GRANGE L&D' AND STNAME2='TAIL ELEV' THEN DO;
STATION='LAGRT';
    IF ELV LT 418.7 OR ELV GT 447.1 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='LOCKPORT L&D' AND STNAME2='POOL ELEV' THEN DO;
STATION='LKPTP';
    IF ELV LT 565.7 OR ELV GT 578.8 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='LOCKPORT L&D' AND STNAME2='TAIL ELEV' THEN DO;
STATION='LKPTT';
    IF ELV LT 537.3 OR ELV GT 546.6 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1= 'MARSEILLES L&D' AND STNAME2='POOL ELEV' THEN DO;
STATION='MARDP';
    IF ELV LT 478.5 OR ELV GT 486.7 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1= 'MARSEILLES L&D' AND STNAME2='TAIL ELEV' THEN DO;
STATION='MARLT';
    IF ELV LT 449. OR ELV GT 474.7 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='MEREDOSIA' AND STNAME2='ELEV' THEN DO;
    STATION='MRDSA';
    IF ELV LT 418.9 OR ELV GT 445.6 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='MORRIS' AND STNAME2='ELEV' THEN DO;
    STATION='MORIS';
    IF ELV LT 481 OR ELV GT 500.9 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='PEORIA L&D' AND STNAME2='POOL ELEV' THEN DO;
STATION='PEORP';
    IF ELV LT 433.9 OR ELV GT 456 THEN GOTO STOP2;
    GOTO STOP1;
  END;
  IF STNAME1='PEORIA L&D' AND STNAME2='TAIL ELEV' THEN DO;
STATION='PEORT';
    IF ELV LT 429.1 OR ELV GT 455.9 THEN GOTO STOP2;
    GOTO STOP1;
```

```
  END;
  IF STNAME1='STARVED ROCK L&D' AND STNAME2='POOL ELEV' THEN DO;
STATION='SROKP';
     IF ELV LT 456.1 OR ELV GT 466.1 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='STARVED ROCK L&D' AND STNAME2='TAIL ELEV' THEN DO;
STATION='SROKT';
     IF ELV LT 439.7 OR ELV GT 464.7 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='I H21'  THEN DO;
     STATION='I H21';
     IF ELV LT 418 OR ELV GT 443 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='I P43' THEN DO;
     STATION='I P43';
     IF ELV LT 418.9 OR ELV GT 443 THEN GOTO STOP2;
     GOTO STOP1;
  END;
  IF STNAME1='IVC61'  THEN DO;
     STATION='IVC61';
     IF ELV LT 418.8 OR ELV GT 445 THEN GOTO STOP2;
     GOTO STOP1;
  END;
STOP2: ;
  FILE'/usr2/sas_work/jhw0/histtemp/ribad.asc';
  PUT STNAME1 $ 1-20 STNAME2 $ 22-30 YEAR 32-35 DAY 37-39 TIME
     41-44 ELV 46-53 .2;
  DELETE;
STOP1: ;
RUN;
    proc sort data = dat.il nodup;
   by station year day time;
RUN;
proc contents;
run;
```

Appendix H

Statistical Analysis System (SAS) Program
for Converting Stage Data to Elevations
for the Rock Island District

```
LIBNAME DAT '/usr2/sas_work/jhw0/histtemp';
  DATA DAT.rimiss2;
  SET DAT.rimiss;
  IF STATION = 'BLANC' THEN ELV = ELV + 528.2;
  IF STATION = 'CASSV' THEN ELV = ELV + 596.29;
  IF STATION = 'CLINT' THEN ELV = ELV + 566.29;
  IF STATION = 'LAGRA' THEN ELV = ELV + 464.6;
  IF STATION = 'MOLIN' THEN ELV = ELV + 551.54;
  IF STATION = 'OQWKA' THEN ELV = ELV + 513.24;
  IF STATION = 'PRNCE' THEN ELV = ELV + 563.56;
  IF STATION = 'QUNCY' THEN ELV = ELV + 458.59;
  IF STATION = 'SABUL' THEN ELV = ELV + 572.27;
  IF STATION = 'SPECH' THEN ELV = ELV + 590.59;
  IF STATION = 'SUNST' THEN ELV = ELV + 534.05;
RUN;
```

Appendix I

Statistical Analysis System (SAS) Program
for Converting Stage Data to Elevations
for the St. Louis District

```
LIBNAME DAT '/usr2/sas_work/jhw0/histtemp';
DATA DAT.stlmiss2 ;
 SET DAT.stlmiss;
   IF STATION='0293A' THEN ELV=ELV + 441.85;
   IF STATION='0282A' THEN ELV=ELV + 437.33;
   IF STATION='0265A' THEN ELV=ELV + 426.03;
   IF STATION='0250A' THEN ELV=ELV + 420.48;
   IF STATION='0228A' THEN ELV=ELV + 410.62;
   IF STATION='0218A' THEN ELV=ELV + 403.79;
   IF STATION='0190A' THEN ELV=ELV + 313.91;
   IF STATION='0179A' THEN ELV=ELV + 379.94;
   IF STATION='0176A' THEN ELV=ELV + 379.58;
   IF STATION='0168A' THEN ELV=ELV + 377.69;
   IF STATION='0158A' THEN ELV=ELV + 370.39;
   IF STATION='0136A' THEN ELV=ELV + 357.78;
   IF STATION='0125A' THEN ELV=ELV + 213.79;
   IF STATION='0109A' THEN ELV=ELV + 341.05;
   IF STATION='0100A' THEN ELV=ELV + 334.11;
   IF STATION='0094A' THEN ELV=ELV + 328.92;
   IF STATION='0081A' THEN ELV=ELV + 321.93;
   IF STATION='0066A' THEN ELV=ELV + 313.89;
   IF STATION='0052A' THEN ELV=ELV + 304.65;
   IF STATION='0046A' THEN ELV=ELV + 301.18;
   IF STATION='0043A' THEN ELV=ELV + 300;
   IF STATION='0042A' THEN ELV=ELV + 304.35;
   IF STATION='0039A' THEN ELV=ELV + 301.83;
   IF STATION='0030A' THEN ELV=ELV + 299.75;
   IF STATION='0013A' THEN ELV=ELV + 282.88;
   IF STATION='0002A' THEN ELV=ELV + 274.53;
  RUN;
```

Appendix J

Statistical Analysis System (SAS) Program for Calculating Means to Check Surface Elevations

```
 libname dat '/usr2/sas_work/jhw0/histtemp';
 data dat.all;
  set dat.stlmiss2 dat.rimiss2 dat.il dat.stp ;
 proc sort data=dat.all;
  by station year day time;
run;
 %macro el(nam1);
libname dat '/usr2/sas_work/jhw0/histtemp';
 proc means data=dat.&nam1 maxdec=2 min max mean n range std; class station;
    var elv ;
    title1 "WATER ELEVATION DATA, &nam1";
run;
 proc means data=dat.&nam1 maxdec=2 min max;
    class station;
    var year;
    title1 "WATER ELEVATION DATA, &nam1";
run;
 proc means data=dat.&nam1 maxdec=2 min max mean;
    class station ;
    var day ;
    title1 "WATER ELEVATION DATA, &nam1";
run;

proc means data=dat.&nam1 min max mean;
class station;
var time;
title1 "WATER ELEVATION, &nam1";
run;

proc contents data=dat.&nam1;
run;

 %mend el;

 %el (all)
```

Appendix K

Program to Update and Create an Index File for the Water Surface Elevation and Discharge Databases

```
/*COMBEL1.SAS  for updating and creating tag file for elevation data */ LIBNAME DAT
'/net/suns01/usr4/jhw0/hist';
libname dat2 '/usr2/sas_work/jhw0/histtemp';
   data dat.elvce4;
    update dat.elvce3 dat2.all;
    by station year day;
run;
  proc contents data= dat.elvce4;
run;
proc datasets lib=dat;
  modify elvce4;
  index create station ;
  contents data=elvce4;
run;
quit;
```

Appendix L

Information Concerning the Water Surface Elevation Database

Station code	River mile	Pool	First year	Last year	River	Corps dist.	Original Corps station name
LKPTP	291.2	LO	1974	1994	ILLINOIS	RI	LOCKPORT L&D,POOL ELEV
LKPTT	291.0	BR	1976	1994	ILLINOIS	RI	LOCKPORT L&D,TAIL ELEV
BRNDP	286.0	BR	1933	1994	ILLINOIS	RI	BRANDON ROAD L&D,POOL ELEV
BRNDT	285.8	DI	1933	1994	ILLINOIS	RI	BRANDON ROAD L&D,TAIL ELEV
DRSDP	271.5	DI	1934	1994	ILLINOIS	RI	DRESDEN ISLAND L&D,POOL LEV
DRSDT	271.3	MA	1931	1994	ILLINOIS	RI	DRESDEN ISLAND L&D,TAIL ELEV
MORIS	263.0	MA	1949	1994	ILLINOIS	RI	MORRIS ELEV
MARDP	247.1	MA	1933	1994	ILLINOIS	RI	MARSEILLES L&D,POOL ELEV
MARDT	247.0	SR	1935	1981	ILLINOIS	RI	MARSEILLES DAM,TAIL
MARLP	244.6	MA	1933	1973	ILLINOIS	RI	MARSEILLES LOCK UPPER,POOL
MARLT	244.4	SR	1933	1994	ILLINOIS	RI	MARSEILLES L&D,TAIL ELEV
SROKP	231.1	SR	1933	1994	ILLINOIS	RI	STARVED ROCK L&D,POOL ELEV
SROKT	230.1	PE	1933	1994	ILLINOIS	RI	STARVED ROCK L&D,TAIL ELEV
PEORP	157.7	PE	1936	1994	ILLINOIS	RI	PEORIA L&D,POOL ELEV
PEORT	157.5	LA	1936	1994	ILLINOIS	RI	PEORIA L&D,TAIL ELEV
KINGS	145.0	LA	1960	1994	ILLINOIS	RI	KINGSTON MINES ELEV
LIVER	128.0	LA	1929	1982	ILLINOIS	RI	LIVERPOOL
BRDIL	88.6	LA	1955	1994	ILLINOIS	RI	BEARDSTOWN,ELEV
LAGRP	80.2	LA	1937	1994	ILLINOIS	RI	LA GRANGE L&D,POOL ELEV
LAGRT	80.0	AL	1937	1994	ILLINOIS	RI	LA GRANGE L&D,TAIL ELEV
MRDSA	71.3	AL	1967	1994	ILLINOIS	RI	MEREDOSIA ELEV
IVC61	61.0	AL	1878	1994	ILLINOIS	SL	IVC61
I P43	43.0	AL	1873	1994	ILLINOIS	SL	I P43
I H21	21.0	AL	1878	1994	ILLINOIS	SL	I H21
NSP	854.0	UR	1964	1994	MISSISSIPPI	SP	NSP
SAFUP	853.2	UR	1964	1994	MISSISSIPPI	SP	SAF-UP-POOL
SAFLP	852.7	SA	1950	1994	MISSISSIPPI	SP	SAF-LOW-POOL
SAFLT	853.3	1	1950	1994	MISSISSIPPI	SP	SAF-LOW-TAIL
DAM1P	847.6	1	1904	1994	MISSISSIPPI	SP	DAM1-POOL
DAM1T	847.5	2	1904	1994	MISSISSIPPI	SP	DAM1-TAIL
STPM5	839.3	2	1930	1994	MISSISSIPPI	SP	STPM5

Station code	River mile	Pool	First year	Last year	River	Corps dist.	Original Corps station name
SSPM5	833.75	2	1931	1994	MISSISSIPPI	SP	SSPM5
DAM2P	815.45	2	1932	1994	MISSISSIPPI	SP	DAM2-POOL
DAM2T	815.1	3	1932	1994	MISSISSIPPI	SP	DAM2-TAIL
HASTS	813.7	3	1985	1986	MISSISSIPPI	SP	HASTINGS
PREW3	811.4	3	1940	1994	MISSISSIPPI	SP	PREW3
DAM3P	797.06	3	1935	1994	MISSISSIPPI	SP	DAM3-POOL
DAM3T	796.69	4	1934	1994	MISSISSIPPI	SP	DAM3-TAIL
REDM5	790.9	4	1930	1990	MISSISSIPPI	SP	REDM5
LKCM5	772.56	4	1936	1994	MISSISSIPPI	SP	LKCM5
READS	762.68	4	1985	1988	MISSISSIPPI	SP	READS LANDING
WABM5	760.4	4	1935	1994	MISSISSIPPI	SP	WABM5
DAM4P	752.95	4	1934	1994	MISSISSIPPI	SP	DAM4-POOL
DAM4T	752.58	5	1934	1994	MISSISSIPPI	SP	DAM4-TAIL
AMAW3	748.5	5	1938	1994	MISSISSIPPI	SP	AMAW3
DAM5P	738.27	5	1934	1994	MISSISSIPPI	SP	DAM5-POOL
DAM5T	737.9	5A	1934	1994	MISSISSIPPI	SP	DAM5-TAIL
FOUNT	733.5	5A	1985	1989	MISSISSIPPI	SP	FOUNTAIN CITY
DM5AP	728.65	5A	1934	1994	MISSISSIPPI	SP	DAM5A-POOL
DM5AT	728.28	6	1934	1994	MISSISSIPPI	SP	DAM5A-TAIL
WNAM5	725.69	6	1887	1994	MISSISSIPPI	SP	WNAM5
DAM6P	714.44	6	1934	1994	MISSISSIPPI	SP	DAM6-POOL
DAM6T	714.07	7	1934	1994	MISSISSIPPI	SP	DAM6-TAIL
DKTM5	707.23	7	1930	1994	MISSISSIPPI	SP	DKTM5
DAM7P	702.61	7	1934	1994	MISSISSIPPI	SP	DAM7-POOL
DAM7T	702.24	8	1934	1994	MISSISSIPPI	SP	DAM7-TAIL
LACW3	696.85	8	1937	1994	MISSISSIPPI	SP	LACW3
BRWM5	689.0	8	1930	1994	MISSISSIPPI	SP	BRWM5
DAM8P	679.32	8	1934	1994	MISSISSIPPI	SP	DAM8-POOL
DAM8T	678.9	9	1934	1994	MISSISSIPPI	SP	DAM8-TAIL
LNSI4	662.97	9	1938	1994	MISSISSIPPI	SP	LNSI4
DAM9P	648.09	9	1934	1994	MISSISSIPPI	SP	DAM9-POOL
DAM9T	647.72	10	1934	1994	MISSISSIPPI	SP	DAM9-TAIL
MCGI4	633.6	10	1936	1994	MISSISSIPPI	SP	MCGI4
CLAI4	624.5	10	1933	1994	MISSISSIPPI	SP	CLAI4
DM10P	615.2	10	1936	1994	MISSISSIPPI	SP	DAM10-POOL
DM10T	614.9	11	1935	1994	MISSISSIPPI	SP	DAM10-TAIL
CASSV	606.6	11	1973	1994	MISSISSIPPI	RI	CASSVILLE STAGE
WUPTN	600.0	11	1975	1976	MISSISSIPPI	RI	WAUPETON
SPECH	592.3	11	1975	1994	MISSISSIPPI	RI	SPECHTS
	FERRY,STAGE						
DM11P	583.1	11	1964	1994	MISSISSIPPI	RI	L&D 11, POOL ELEV
DM11T	582.9	12	1940	1994	MISSISSIPPI	RI	L&D 11, TAIL ELEV
DUBUQ	579.9	12	1976	1994	MISSISSIPPI	RI	DUBUQUE, ELEV

Station code	River mile	Pool	First year	Last year	River	Corps dist.	Original Corps station name
GORDN	566.2	12	1976	1987	MISSISSIPPI	RI	GORDONS FERRY,STAGE
DM12P	556.7	12	1966	1994	MISSISSIPPI	RI	L&D 12, POOL ELEV
DM12T	556.6	13	1936	1994	MISSISSIPPI	RI	L&D 12, TAIL ELEV
BROWN	546.4	13	1965	1986	MISSISSIPPI	RI	BROWNS LAKE
SABUL	535.0	13	1965	1994	MISSISSIPPI	RI	SABULA,STAGE
DM13P	522.5	13	1964	1994	MISSISSIPPI	RI	L&D 13, POOL ELEV
DM13T	522.4	14	1940	1994	MISSISSIPPI	RI	L&D 13, TAIL ELEV
CLINT	517.9	14	1965	1994	MISSISSIPPI	RI	CLINTON STAGE
CAMAN	511.8	14	1970	1994	MISSISSIPPI	RI	CAMANCHE ELEV
PRNCE	502.1	14	1976	1994	MISSISSIPPI	RI	PRINCETON,STAGE
LECLA	497.0	14	1972	1988	MISSISSIPPI	RI	LECLAIRE
DM14P	493.4	14	1964	1994	MISSISSIPPI	RI	L&D 14, POOL ELEV
DM14T	493.1	15	1940	1994	MISSISSIPPI	RI	L&D 14, TAIL ELEV
MOLIN	487.9	15	1951	1994	MISSISSIPPI	RI	MOLINE,STAGE
DM15P	483.0	15	1962	1994	MISSISSIPPI	RI	L&D 15, POOL ELEV
DM15T	482.8	16	1950	1994	MISSISSIPPI	RI	L&D 15, TAIL ELEV
SUNST	479.6	16	1974	1994	MISSISSIPPI	RI	SUNSET MARINA,STAGE
IML32	479.1	16	1964	1971	MISSISSIPPI	RI	I&M CANAL LOCK
MONTP	468.0	16	1963	1994	MISSISSIPPI	RI	MONTPELIER,ELEV
FAIRP	463.5	16	1964	1994	MISSISSIPPI	RI	FAIRPORT,ELEV
DM16P	457.2	16	1964	1994	MISSISSIPPI	RI	L&D 16, POOL ELEV
DM16T	457.0	17	1936	1994	MISSISSIPPI	RI	L&D 16, TAIL ELEV
MUSCT	455.2	17	1899	1994	MISSISSIPPI	RI	MUSCATINE,ELEV
BLANC	450.2	17	1968	1994	MISSISSIPPI	RI	BLANCHARD ISLAND STAGE
BASSI	448.4	17	1965	1967	MISSISSIPPI	RI	BASS ISLAND
DM17P	437.1	17	1964	1994	MISSISSIPPI	RI	L&D 17, POOL ELEV
DM17T	436.9	18	1936	1994	MISSISSIPPI	RI	L&D 17, TAIL ELEV
KEITH	428.0	18	1964	1994	MISSISSIPPI	RI	KEITHSBURG,ELEV
OQWKA	415.3	18	1963	1994	MISSISSIPPI	RI	OQUAWKA,STAGE
DM18P	410.5	18	1964	1994	MISSISSIPPI	RI	L&D 18, POOL ELEV
DM18T	410.4	19	1936	1994	MISSISSIPPI	RI	L&D 18, TAIL ELEV
BURLT	403.2	19	1961	1994	MISSISSIPPI	RI	BURLINGTON,ELEV
FORTM	383.9	19	1951	1991	MISSISSIPPI	RI	FORT MADISON ELEV
DM19P	364.3	19	1964	1994	MISSISSIPPI	RI	L&D 19, POOL ELEV
DM19T	364.1	20	1947	1994	MISSISSIPPI	RI	L&D 19, TAIL ELEV
WARSW	359.9	20	1964	1979	MISSISSIPPI	RI	WARSAW
GREGY	352.9	20	1960	1994	MISSISSIPPI	RI	GREGORY LANDING,ELEV
DM20P	343.3	20	1941	1994	MISSISSIPPI	RI	L&D 20, POOL ELEV
DM20T	343.1	21	1936	1994	MISSISSIPPI	RI	L&D 20, TAIL ELEV
LAGRA	335.6	21	1960	1994	MISSISSIPPI	RI	LAGRANGE,STAGE
QUNCY	327.0	21	1946	1994	MISSISSIPPI	RI	QUINCY,STAGE

Station code	River mile	Pool	First year	Last year	River	Corps dist.	Original Corps station name
DM21P	324.9	21	1964	1994	MISSISSIPPI	RI	L&D 21, POOL ELEV
DM21T	324.8	22	1936	1994	MISSISSIPPI	RI	L&D 21, TAIL ELEV
HANBL	309.9	22	1929	1994	MISSISSIPPI	RI	HANNIBAL,ELEV
DM22P	301.3	22	1962	1994	MISSISSIPPI	RI	L&D 22, POOL ELEV
DM22T	301.1	24	1936	1994	MISSISSIPPI	RI	L&D 22, TAIL ELEV
0293A	293.0	24	1930	1994	MISSISSIPPI	SL	0293A
0282A	282.9	24	1878	1994	MISSISSIPPI	SL	0282A
0273A	273.5	24	1939	1994	MISSISSIPPI	SL	0273A
0273B	273.2	25	1939	1994	MISSISSIPPI	SL	0273B
0265A	265.0	25	1930	1994	MISSISSIPPI	SL	0265A
0260A	260.3	25	1939	1994	MISSISSIPPI	SL	0260A
0250A	250.8	25	1930	1994	MISSISSIPPI	SL	0250A
0241A	241.5	25	1939	1994	MISSISSIPPI	SL	0241A
0241B	241.2	26	1939	1994	MISSISSIPPI	SL	0241B
0228A	228.3	26	1930	1994	MISSISSIPPI	SL	0228A
0218A	218.0	26	1879	1994	MISSISSIPPI	SL	0218A
0203A	203.0	26	1938	1991	MISSISSIPPI	SL	0203A
0203C	203.0	26	1991	1994	MISSISSIPPI	SL	0203C
0203B	202.6	26	1904	1991	MISSISSIPPI	SL	0203B
0201A	201.0	26	1990	1994	MISSISSIPPI	SL	0201A
0201B	201.0	27	1990	1994	MISSISSIPPI	SL	0201B
0196A	196.8	27	1941	1994	MISSISSIPPI	SL	0196A
0190A	190.4	27	1892	1994	MISSISSIPPI	SL	0190A
0190B	190.4	27	1976	1989	MISSISSIPPI	SL	0190B
0185A	185.3	27	1951	1994	MISSISSIPPI	SL	0185A
0185B	185.1	OR	1951	1994	MISSISSIPPI	SL	0185B
0179A	179.6	OR	1861	1994	MISSISSIPPI	SL	0179A
0176A	176.8	OR	1894	1994	MISSISSIPPI	SL	0176A
0168A	168.7	OR	1892	1994	MISSISSIPPI	SL	0168A
0158A	158.5	OR	1900	1994	MISSISSIPPI	SL	0158A
0146A	145.7	OR	1965	1994	MISSISSIPPI	SL	0146A
0136A	136.0	OR	1891	1994	MISSISSIPPI	SL	0136A
0125A	125.5	OR	1891	1994	MISSISSIPPI	SL	0125A
0109A	109.8	OR	1891	1994	MISSISSIPPI	SL	0109A
0100A	100.8	OR	1933	1994	MISSISSIPPI	SL	0100A
0094A	94.1	OR	1898	1994	MISSISSIPPI	SL	0094A
0081A	81.9	OR	1885	1994	MISSISSIPPI	SL	0081A
0066A	66.3	OR	1926	1994	MISSISSIPPI	SL	0066A
0052A	51.9	OR	1896	1994	MISSISSIPPI	SL	0052A
0046A	46.3	OR	1878	1994	MISSISSIPPI	SL	0046A
0043A	43.7	OR	1941	1994	MISSISSIPPI	SL	0043A
0042A	42.3	OR	1939	1982	MISSISSIPPI	SL	0042A
0039A	39.7	OR	1896	1994	MISSISSIPPI	SL	0039A

Station code	River mile	Pool	First year	Last year	River	Corps dist.	Original Corps station name
0030A	28.2	OR	1933	1994	MISSISSIPPI	SL	0030A
0020A	20.2	OR	1933	1994	MISSISSIPPI	SL	0020A
0013A	13.1	OR	1901	1970	MISSISSIPPI	SL	0013A
0002A	2.0	OR	1933	1994	MISSISSIPPI	SL	0002A
STLM5	23.4	SC	1937	1994	ST. CROIX	SP	STLM5

Corps = U.S. Army Corps of Engineers

Pool code:

UR = Above St. Anthony Falls, SA = St. Anthony Falls, OR = Open River, SC = St. Croix, LA = La Grange Pool, BR = Brandon Road Pool, DR = Dresden Island Pool, AL = Alton Pool, MA = Marseilles Pool, LO = Lockport Pool, SR = Starved Rock Pool, PE = Peoria Pool

Data origin:

SP = St. Paul District, RI = Rock Island District, SL = St. Louis District

Appendix M

Information Concerning the Discharge Database

Station code	River mile	Pool	First year	Last year	River	Collecting office	Original USGS station name
MARSL	246.5	SR	1919	1994	ILL.	IL	MARSEILLES. IL
HENRY	196.0	PE	1981	1994	ILL.	IL	HENRY, IL
PEORI	166.1	PE	1903	1938	ILL.	IL	PEORIA, IL
KINST	144.4	LA	1939	1994	ILL.	IL	KINGSTON MINES, IL
HAVAN	118.6	LA	1921	1989	ILL.	IL	HAVANA, IL
BEARD	88.6	LA	1920	1938	ILL.	IL	BEARDSTOWN, IL
MERDO	71.3	AL	1938	1989	ILL.	IL	MEREDOSIA, IL
VALLY	61.4	AL	1979	1994	ILL.	IL	VALLEY CITY, IL
STPAU	839.3	2	1892	1994	MISS.	MN	ST. PAUL, MN
PRESC	811.4	3	1928	1994	MISS.	MN	PRESCOTT, WI
WINON	725.7	6	1928	1994	MISS.	MN	WINONA, MN
LACRS	696.9	8	1929	1955	MISS.	WI	LACROSSE, WI
MCGRG	633.4	10	1936	1994	MISS.	IA	MCGREGOR. IA
CLNTN	511.8	14	1873	1994	MISS.	IA	CLINTON, IA
KEOKV	364.2	20	1878	1994	MISS.	IA	KEOKUK, IA
GRAFT	218.6	26	1986	1994	MISS.	MO	GRAFTON, IL
ALTON	202.7	AL	1933	1986	MISS.	MO	ALTON. IL
STLOU	180.0	OR	1933	1994	MISS.	MO	ST. LOUIS, MO
CHEST	109.9	OR	1942	1994	MISS.	MO	CHESTER, IL
THEBS	43.7	OR	1933	1994	MISS.	MO	THEBES, IL

USGS = U.S. Geological Survey

Pool code:

OR = Open River, LA = La Grange Pool, AL = Alton Pool, MA = Marseilles Pool, SR = Starved Rock Pool, PE = Peoria Pool

Appendix N

Pascal Computer Program to Reformat U.S. Geological Survey Discharge Data

```
{*************************************************
  program reads HydroDat output files and converts
  to a FLUX format (Bob Gaugush)
 *************************************************}

program HydroDatReadIowa;

uses
   Crt,Dos;

var
  Flow : array[1..12,1..31] of real;
  Year,Day,Month,I,J : integer;
  Outfile,Infile : text;
  Outfilename,Infilename : string[80];
  blank1 : string[1];
  dummy : string[80];
  yrstr : string[4];
  yearcheck : byte;
  discheck,daycheck : boolean;
  code : integer;

procedure ReadDataLine;

begin
    read(infile,day);
    for j := 1 to 12 do begin
      if j < 12 then read(infile,flow[j,day])
              else readln(infile,flow[j,day]);
    end;
end; { of ReadDataLine }

begin

textcolor(yellow);
textbackground(blue);
clrscr;
writeln(output);
writeln(output,"Hydrodat output -----> ASCII table");
writeln(output);
write("Input file name: ");
```

```
readln(Infilename);
writeln(output);

write("Output file name: ");
readln(Outfilename);
writeln(output);

assign(Outfile,Outfilename);
rewrite(Outfile);

assign(Infile,Infilename);
reset(Infile);

writeln(output,"Program running…");


repeat

    { read until the word "DISCHARGE" appears in the line
      or end-of-file }

    discheck := false;
    repeat
      readln(infile,dummy);
      if eof(infile) then begin
        close(infile);
        close(outfile);
        exit;
      end;
      if pos("DISCHARGE",dummy) > 0 then discheck := true;
    until discheck = true;

    yearcheck := pos("19",dummy);
    if yearcheck = 0 then yearcheck := pos("18",dummy);
    yrstr := copy(dummy,yearcheck,4);

    if yrstr <> "" then begin
    write(output,"     ","Reading year = ",yrstr);
    val(yrstr,year,code);

    { read until the header line above the daily values }

    daycheck := false;
    repeat
      readln(infile,dummy);
      if pos("DAY",dummy) > 0 then daycheck := true;
    until daycheck = true;
    readln(infile,dummy);
```

```
      { read flows and skip blank lines }

      for i := 1 to 36 do begin
         case i of
             6,12,18,24,30 : readln(infile,dummy);
              1..5,
              7..11,
             13..17,
             19..23,
             25..29,
             31..36  : ReadDataLine;

         end;
      end;

      writeln(output,"     Writing year = ",yrstr);
      for J := 1 to 12 do begin
         Month := J + 9;
         if Month > 12 then Month := Month - 12;
         if Month = 1 then Year := Year + 1;
         for I := 1 to 31 do begin
            if flow[j,i] <> -99 then begin
              writeln(Outfile,outfilename," ",Year:4," ",Month:2," ",I:2,
                        "  ",Flow[J,I]:8:0);
            end;
         end;
      end;

      end;

until EOF(Infile);

Close(Infile);
Close(Outfile);

end.
```

Appendix O

Statistical Analysis System (SAS) Program for U.S. Geological Survey Discharge Data

```
LIBNAME DAT "/usr2/sas_work/jhw0/histtemp";
DATA DAT.gsq92n3 (drop= julyear yr month);
INFILE "/usr2/sas_work/jhw0/histtemp/gs92n3.asc" dlm=" ";
LENGTH STATION $5 YEAR 4 DAY 4;
INPUT station $ year month day flow;
     julyear = juldate(mdy(month,day,year));
     yr = year - 1900;
     if year ge 1900 then day = julyear - (yr * 1000);
     yr = year;
     if year lt 1900 then day = julyear - (yr * 1000);
IF YEAR = . THEN GOTO STOP2;
IF DAY = .  THEN GOTO STOP2;
IF FLOW = . THEN GOTO STOP2;
IF STATION="MCGRG" THEN DO;
     IF FLOW>276000 OR FLOW<6200 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="CLNTN" THEN DO;
     IF FLOW>307000 OR FLOW<6500 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="KEOKV" THEN DO;
     IF FLOW>435000 OR FLOW<5000 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="MARSL" THEN DO;
     IF FLOW>87800 OR FLOW<1460 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="HENRY" THEN DO;
     IF FLOW>104000 OR FLOW<2040 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="KINST" THEN DO;
     IF FLOW>86700 OR FLOW<1700 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="VALLY" THEN DO;
     IF FLOW>123000 OR FLOW<1330 THEN GOTO STOP2;
     GOTO STOP1;
END;
IF STATION="MERDO" THEN DO;
```

```
        IF FLOW > 123000 OR FLOW < 1330 THEN GOTO STOP2;
        GOTO STOP1;
    END;
    IF STATION = "HAVAN" THEN DO;
        IF FLOW > 74600 OR FLOW < 4100 THEN GOTO STOP2;
        GOTO STOP1;
    END;
    IF STATION = "WINON" THEN DO;
        IF FLOW > 268000 OR FLOW < 1940 THEN GOTO STOP2;
        GOTO STOP1;
    END;
    IF STATION = "STPAU" THEN DO;
        IF FLOW > 171000 OR FLOW < 632 THEN GOTO STOP2;
        GOTO STOP1;
    END;
    IF STATION = "PRESC" THEN DO;
        IF FLOW > 228000 OR FLOW < 1380 THEN GOTO STOP2;
        GOTO STOP1;
     END;
    IF STATION = "CHEST" THEN DO;
        IF FLOW > 1001000 OR FLOW < 37000 THEN GOTO STOP2;
        GOTO STOP1;
    END;
    IF STATION = "THEBS" THEN DO;
        IF FLOW > 979000 OR FLOW < 24700 THEN GOTO STOP2;
        GOTO STOP1;
     END;
    IF STATION = "STLOU" THEN DO;
        IF FLOW > 1060000 OR FLOW < 27800 THEN GOTO STOP2;
        GOTO STOP1;
    END;

    IF STATION = "GRAFT" THEN DO;
        IF FLOW > 600000 OR FLOW < 20100 THEN GOTO STOP2;
        GOTO STOP1;
    END;

STOP2: ;
   FILE "/usr2/sas_work/jhw0/histtemp/badq92n3.asc";
   PUT STATION $ 1-5 YEAR 7-10 DAY 12-14 FLOW 16-25;
   delete;
STOP1: ;
RUN;
        options sortpgm = host;
        proc sort  nodup;
        by station year day;
RUN;
```

```
 proc means  maxdec=0 min max mean n range std;
    class station;
    var flow ;
    title1 "DISCHARGE DATA";
run;
 proc means maxdec=0 min max;
    class station;
    var year;
    title1 "DISCHARGE DATA";
run;
 proc means maxdec=0 min max mean;
    class station;
    var day;
    title1 "DISCHARGE DATA";
run;
 proc contents;
run;
 libname dat "/net/suns01/usr4/jhw0/hist";
 proc contents data=dat.gsflow3;
run;



)
```

The Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information to maintain the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The LTRMP is a cooperative effort by the National Biological Service, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.