WATSTORE user's guide

National Water Data Storage and Retrieval System

U.S. GEOLOGICAL SURVEY

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Volume I

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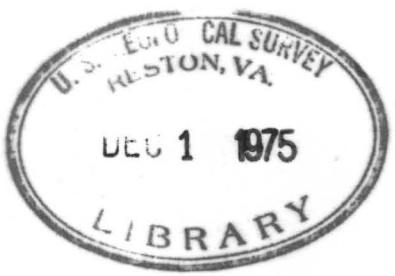

For additional information write to:

Chief Hydrologist
U.S. Geological Survey
National Center, MS 409
Reston, Virginia 22092

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WATSTORE -- NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM OF THE U.S. GEOLOGICAL SURVEY -- USER'S GUIDE

Management Overview

The U.S. Geological Survey investigates the occurrence, quantity, quality, distribution, and movement of the surface and underground water resources of the Nation. The investigations, which are conducted by the Water Resources Division, of the Survey include: systematic collection, analysis, and interpretation of water data; investigation of industrial, domestic, and agricultural water requirements; research and development to improve study techniques and methodologies to better understand the hydrologic principles that form the scientific basis of investigation; and publication and other forms of release to the public of results and data from these investigations.

A large scale computerized storage and retrieval system is used by the Geological Survey to store and disseminate water data acquired through its many activities. The Geological Survey's National Water Data Storage and Retrieval System (WATSTORE) was implemented in November 1971. In addition to its data processing, storage, and retrieval capabilities, WATSTORE has the capability of providing computer-printed tables, computer-printed graphs, statistical analyses of data, and digital plots. The system is operated and maintained on the central computer facility of the Survey at its National Center, Reston, Va. and through approximately 50 terminals in Water Resources Division district and subdistrict offices located in major cities throughout the country. Access to WATSTORE is limited by hardware, available telephone lines, etc; for example, direct access is possible only through terminal equipment capable of interfacing with an IBM 370/155 computer.

WATSTORE is now (1975) available to other Federal agencies and selected cooperators of the Geological Survey who acquire and(or) use water data. The WATSTORE User's Guide describes the system and how it operates.

Authorization to use WATSTORE must be obtained from the Chief Hydrologist, U.S. Geological Survey, National Center, Mail Stop 409, Reston, Virginia, 22092. When the request is approved, a notice of authorization along with an assigned agency (user) code and account numbers are provided to the requester. WATSTORE then is available to the user for the use of

data placed in the system by others, unless the data are of a proprietary nature, and also for entry and retrieval of a user's own data.

It is recommended that the user carefully review Chapters I and II of the WATSTORE User's Guide before moving to the chapters describing programs for entering and retrieving data. A brief description of each chapter in Volume 1 is given below. Volume 2, to be issued later, will contain information on new additions to the WATSTORE system.

Chapter I -- General Information

Chapter I contains administrative (management) information including user-related information, access procedures, information on data security, output options, cost and billing procedures, and a general explanation of WATSTORE's two major data files--the Station Header File and the Daily Values File.

Chapter II -- User Information

Chapter II contains information common to all WATSTORE programs, such as:

- Job Control Language instructions that identify a job to the computer.
- Station identification number assignment procedures for general users and USGS users.
- Entry and activation of passwords for data security.
- Record access keys which are used to uniquely identify a record in the files.
- How to obtain user assistance.

Chapter III -- Station Header File

The Station Header File, as it pertains to an individual water-measurement site contains identifiers that locate and describe the station, such as latitude/longitude, state code, agency code and station name. Sixteen such identities are used and they form an independently useful record. Procedures for entry and retrieval of data in this file are also discussed.

Entry of data, for which there are seven mandatory and nine optional entry items, is accomplished by two types of cards: the Station Header Card and the Station Name Card. Items such as agency code, station identification number, state code, county code, latitude-longitude, station name, and site code are required for each site prior to entry of data. Retrieval of Station Header records may be specified through a variety of options such as retrievels based on station identification numbers, ranges of station identification numbers, and station names. Records may be specified by state, county, and hydrologic unit codes, or by geologic unit, site, and aquifer codes. Additionally, retrieval may be specified on the basis of drainage-area size and location, well depth or datum, or on the basis of a contiguous string of characters appearing in the station name. Map plots may be obtained for sites stored in the Station Header File which indicate the existence of wells and values for well depths, datum and drainage area. Grid reference points may be included as needed for clarity and the map scales changed as required.

Chapter IV -- Daily Values Files

The Daily Values File is limited to water data collected on a continuous or daily basis. Although the number of specific parameters is not large, the volume of data available is very large due to the frequency of measurement. These data include streamflow values, ground-water levels, sediment concentrations, and a limited number of water-quality parameters. Chapter IV describes application programs for use with this file. Programs included are:

- Entry and Computation Program -- used to enter data into the Daily Values File and simulate data records from existing records in the file.

- Retrieval Program -- permits retrieval of data as computer printout, punch cards, or on magnetic tape or disk.

- Table Program -- prepares computer-printed tables of data ready for publication.

- Inventory Listing Program -- used to produce a data inventory of selected portions of the file.

- Plot Program -- used to produce a parameter versus time plot of Daily Values on a Calcomp plotter located at the Geological Survey's National Center.

- Monthly and Annual Statistics Program -- permits computation of eight groups of monthly and annual statistics for specified water years.

- Statistics Program -- produces duration tables, low-flow and high-flow values tables, and fits the data from these tables to a log-Pearson Type III frequency distribution.

Appendices

The User's Guide contains several groups of codes to aid the user in coding data and in formulating retrievals. These are agency codes (Appendix A), state codes (Appendix B), county codes (Appendix C), parameter codes (Appendix D), statistic codes (Appendix E), and aquifer codes (Appendix F).

Acknowledgment

Mary C. Marrs, Research Associate, PRC Systems Sciences Company, McLean, Virginia served as a consultant on the organization of the User's Guide, wrote or assembled information contained in the Glossary and Chapters I and II, provided editorial assistance, and supervised the typing for the complete volume.

GLOSSARY

alphabetic character: A character of the set A, B, C, ..., Z.

alphanumeric character: a character of the set which includes the characters A through Z, digits 0 through 9, and usually other characters, such as punctuation marks.

argument: a parameter passed between a calling program and a subprogram or statement function.

ascending order: characters ordered as follows: "special characters," A, B, C, ...,Z; 1, 2, ..., 9.

backfile: a data set (file) residing on magnetic tape that contains historical data. In the WATSTORE system, this is generally data that is more than two years old.

binary coded decimal (BCD): (1) pertaining to a decimal notation in which the individual decimal digits are each represented by a group of binary digits; e.g., in the 8-4-2-1 binary coded decimal notation the number 23 is represented as 0010 0011, whereas in binary notation 23 is represented as 10111. (2) also used to designate a character set represented by a certain bit configuration.

blank: a term which describes how the computer reads a column of the computer card which has no holes punched in it.

blocking factor: combining two or more records into one block. Blocking factor=number of logical records combined to form a block (physical record).

card image: a 1:1 representation of the contents of a punched card onto a magnetic device.

catalog: (1) in the WATSTORE system, a collection of data set indexes that are used by the control program to locate a volume containing a specific data set; (2) to include the volume and unit identification of a data set in a catalog.

cataloged data set: a data set that is represented in an index or hierarchy of indexes which provide the means for locating it.

cataloged procedure: a set of job control statements that has been placed in the procedure library, and which can be retrieved by naming it in an execute (EXEC) statement. (See "procedure library").

character: a letter digit or other symbol that is used as part of the organization, control, or representation of data.

computing system: a central processing unit together with the main storage input/output channels, control units, direct access storage devices, and input/output devices connected to it.

control block: a program that is designated to schedule and supervise the performance of data processing work by a computing system.

core storage: the storage of data on a device which is an integral part of a computer. Synonymous with (internal memory) and contrasted with (external storage).

data definition (DD) statement: a job control statement that describes a data set associated with a particular job step.

data file: a collection of related data records organized in a specific manner. For example, the WATSTORE Station Header File (one record for each water measuring station showing the station's I.D. number, the agency code of the agency monitoring it, etc.) or the Daily Values File (one record per year) for each of the several parameters measured at a water measuring station.

data management: a major function of the operating system that involves organizing, cataloging, locating, sorting, retrieving, and maintaining data.

default option: a language statement option that is selected by the operating system control program or processing program in the absence of a selection from several options by the user.

density: the number of useful storage elements per unit of dimension, e.g., the number of bits per inch stored on a magnetic tape or drum track.

digit: a character used to represent one of the non-negative integers that is smaller than the base, e.g., in base 10 (decimal notation), one of the characters 0 through 9.

direct access device: a device in which the access time is effectively independent of the lcoation of the data.

disk pack: a direct access storage volume containing magnetic disks on which data are stored. When being used, a disk pack is mounted on a disk storage drive.

dispatching priority: a number assigned to tasks and used to determine precedence for use of the central processing unit of the computer in a multitask situation.

error message: a message which will be printed out for the user in the event that one of a number of previously anticipated erros has occurred during the processing of data.

execute (EXEC) statement: an operating system job control statement that marks the beginning of a job step and identifies the program to be executed.

external storage: a device, not an integral part of a computer, on which data usable by a computer is stored, such as off-line magnetic tape units, disk drives, or punch card devices.

field: in this manual, the number of columns on a computer card which are reserved for specific information. Several fields may be distributed over the 80-column card.

format: in this manual, a sample of the wording to be used in writing control statements having variables.

input: (1) the data to be processed; (2) the process of transferring data from an external storage to an internal storage.

instruction: a statement that specifies an operation and the values or locations of its operands (items being operated upon). (See "program").

I/O: input/output

job: the major unit of work performed under operating system control. A job consists of one or several related steps. It is defined by a series of job control language statements consisting of a JOB statement, one or more job step (EXEC) statements, and, for each step, one or more data definition (DD) statements.

job control language (JCL): a high-level programming language used to code job control statements. These statements control the allocation of the resources of the computer. Only the rudiments required for using WATSTORE are given in this manual.

job control statement: a statement in a job that is used in identifying the job or describing its requirements to the operating system.

job management: a major function of the operating system involving the reading and interpretation of job definitions, the scheduling of jobs, the initiation and termination of jobs and job steps, and the recording of job output data.

job priority: a value assigned to an MVT job that, together with an assigned job class, determines th priority (relative to other jobs) to be used in scheduling the job and allocating resources to it.

job (JOB) statement: a job control statement that is used to identify the beginning of a job. It contains such information as the name of the job, an account number, and the class and priority assigned to the job.

job step: a subdivision of a job performed as a separate task and defined by an execute (EXEC) statement that, among other things, contains the name of a program or cataloged procedure that is to be executed to perform the step.

library: (1) in general, a collection of objects (e.g., computer programs, data sets, volumes, card decks) associated with a particular use, and the location of which is identified in a directory of some type; (2) any partitioned data set.

listing: see printout

load module: a program in a format suitable for loading into main storage for execution.

logical record: a record whose scope, direction, or length is governed by the specific nature of the information or data which it contains instead of by some feature or limitation of the storage device that holds it. Such records differ in size from the physical records in which they are contained. Physical records might be limited to 400-character physical record size, but many logical records might require fewer or more than the limit.

MFT: multiprogramming with a fixed number of tasks.

multiprogramming: executing more than one program concurrently by interleaving the execution of one with that of another. The term "multiprogramming" is also broadly used to refer to the performance of more than one data processing task concurrently whether or not a single reenterable program, or several programs, are executed to perfom the tasks.

MVT: multiprogramming with a variable number of tasks.

on-line data: data accessable to the computer without manual intervention.

output: (1) data that have been processed; (2) the process of transferring data from an internal storage to an external storage.

parameter: a characteristic element or constant factor, such as agency code, streamflow, peak flow, or a symbolic word used in place of a variable.

parity bit: a binary digit appended to an array of bits to make the number of all the bits either always odd or always even.

partitioned data set: a special type of data set that is stored in direct access storage and which can be cataloged like any other data set. A partitioned data set is usually called a program library. It is divided into independent partitions, each of which normally contains a program, or part of a program, in the form of one or more sequential data blocks. Each program library contains a built-in directory (or index) that the control program can use to locate a program in the library.

physical record: a record from the standpoint of the manner or form in which it is stored, retrieved and moved.

printout: the printing of coded characters on a device that expresses coded characters as hard copy.

procedure library: a program library in direct access storage containing job definitions. The reader/interpreter component of the computer can be directed to read and interpret a particular job definition by an execute statement in a job stream.

program: a logically self-contained sequence of instructions that can be executed by a computing system to perform a specific task.

program fetch: a part of the operating system supervisor that retrieves load modules from auxiliary storage and places them in main storage, relocating them as necessary.

proprietary data: data that are generally not available to the casual user.

record: a collection of related items treated as a unit.

response time: (1) the time between the submission of an item of work to a computing system and the return of the results. Loosely, turn-around time; (2) in online systems, the time between the end of a block of user input and the display of system response at the terminal.

routine: a part of a program or subprogram that may have general or frequent use.

run: a single, continuous performance of a computer program or routine.

setting up: the act of preparing a computing system to perform a job or job step. Setting up is usually performed by an operator and often involves performing routine functions, such as mounting tape reels and loading card decks.

setup time: the time required by an operator to prepare a computer system to perform a job or job step.

sorting: the act of collating records of a data set or file in accordance with a prescribed sequence.

special character: a character that is neither numeric or alphabetic, such as, /*$=)(.

symbolic parameters: constants used in a job control (JCL) statement format to be replaced by the user with a required variable. This is a method used to input variable JCL information to JCL statements contained within cataloged procedures.

terminal: a point in a system or communication network at which data can either enter or leave.

time sharing: a method of using a computing system that allows a number of users to execute programs concurrently and to interact with the programs during execution.

turnaround time: the elapsed time between submission of a job to a computing center and the return of results.

utility programs: a collection of programs that are designed to perform everyday tasks; such as transcribing data from one storage or input/output device to another.

variable: a data item which is represented in a format by a symbolic name and which allows a program or job step to be altered each time the program is run.

zone punch: a punch in the 0, 11, or 12 rows on a punched card. The top three rows of a punch card.

CHAPTER I. GENERAL INFORMATION

SECTION I.A. Administrative Information

CHAPTER I. GENERAL INFORMATION

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I.A. Administrative Information

I.A.1. Initial User Information

I.A.1.a. Authorization

Authorization to use WATSTORE via a selected user terminal may be obtained by writing to the following address:

Chief Hydrologist
U. S. Geological Survey
National Center, MS 409
Reston, Virginia 22092

This authorization will allow a selected user outside the USGS to access the computer programs and data files described in this manual.

The request for authorization should include, 1) a general description of the type of data to be stored and/or retrieved, 2) the frequency of use, i.e., daily, weekly, or occasional, and 3) the name address, and telephone number of a contact individual in your organization.

I.A.1.b. Agency Codes and Account Numbers

Upon making WATSTORE available to other Federal agencies and principal cooperators, USGS developed a system for identifying agencies entering or retrieving data directly from WATSTORE. Agency codes are assigned by the USGS and requests for a code assignment may be made by writing to the above address. Each user will additionally be given a user's registration number and an account number with the USGS for billing purposes. An explanation of how agency codes are used in entering or retrieving data are contained in Chapters III and IV. Agency codes are also discussed in Appendix A. Section II.A.I. describes how to code account numbers and other identification codes on the JOB card.

I.A.1.c. Priority Criteria

Since the computer only performs one operation at a time (albeit in milleseconds) and there are a large number of

users, it is necessary to establish priorities (classes) for job processing. The cost increases as the priority is raised. Generally the turnaround time for a Class H job is 15 minutes, Class A job is 1 hour, Class B job is 2 hours, Class C and D jobs are overnight, and Class E and F jobs are over a weekend. In the Table given on page I.7, A and H priorities cost roughly twice and three times, respectively, as much as Class B and C. Priorities B and C are about twice as costly as Class D and E. Users determine their own priorities based on urgency and cost. How to specify the priority required is detailed in Section II.A.1.e.

I.A.1.d. User Interface to Computer

Chapter II of this manual contains information which is common to all computer operations available in the WATSTORE system. Section II.A. is a summary of Job Control Language (JCL) and Job Processing activities which must be performed each time a user accesses WATSTORE. In order to perform these activities ("interfaces") some understanding of JCL is necessary and helpful. Job Control Language is a written language applicable to the computer which processes all of the WATSTORE programs. Sections II.A.1 and II.A.2 illustrate how JCL is used to initiate contact with the computer and to prepare it for processing specific operations. Also given is an explanation of cataloged procedures and symbolic parameters, which reduce the time and effort required for certain operations.

I.A.2. Access Procedures and Administrative Contact

Once authorization is obtained, data transformed into punched cards may be entered at the central computer in Reston, Virginia, at any USGS regional or district terminal, or a selected user terminal. It will only be necessary then to provide proof of authorization by coding a valid agency code and account number on a JOB card as described in Section II.A.1. to gain access to the computer. A list of district offices is contained in the Appendix. Administrative information can be obtained by contacting the Water Resources Division of the USGS in Reston, Virginia, telephone (703) 860-6879

I.A.3. Data Security

In order to insure the protection of proprietary data, the WRD has instituted a data security system which is based on the use

of passwords. In brief, the user's records will be identified by unique code words known only to himself. The data are secured by a user-controlled checking system between the data file and the Station Header File. It is possible for the user to secure both the Station Header File and the data in the Daily Values File, or either one. The password system is explained in detail in Section II.C.

I.A.4. Output Options

Data may be retrieved in the form of printouts or in machine-readable form as: (1) punch cards or card images on magnetic tape, (2) a 408-byte magnetic tape format usable by most computers or (3) a 1,656-byte magnetic tape format usable on IBM 360 and 370 series computers. The magnetic tapes may be either 7-track (even or odd parity) or 9-track (odd parity), 556 or 800 bits per inch (7-track), and 800 or 1,600 bits per inch (9-track). Each of these formats are described in detail in later sections. Punched card output is not desirable for response to requests for large volumes of data because of the handling and mailing difficulties associated with masses of cards. However, if the user will be accessing the data directly and providing card transport himself, card output presents no problem to USGS terminals that have card punch capability.

I.A.5. Cost and Billing Procedures

The data requester will be billed the computer charges associated with the preparation of data in response to his request. There are many variables associated with estimating these charges in advance. Some of the factors are: (1) the amount of data requested, (2) the output format selected, (3) the priority required by the requester, and (4) whether or not the requester provides the magnetic tape onto which the data are copied.

A general rule of thumb to determine charges would be to estimate $0.20 per station year for output on cards, $0.10 per station year for output on 7-track magnetic tape (408-byte format) and $0.05 per station year for output on 9-track magnetic tape (1,656-byte format). Computer printout (tables) cost approximately $0.20 per table (station year). These charges are based on more than a minimum volume of output.

The cost for individual requests can vary considerably from these estimates. The estimates do not include the cost of any

magnetic tapes required. See Table 1 for Computer Center charges. The Department of Interior has adopted this uniform fee schedule (Table 1) for all of its constituent units effective February 19, 1975. The schedule is appended to Part 2 of Title 43, Code of Federal Regulations. In addition to the above computer charges, there is a nominal charge for storing records in the disk file. Computer charges will be billed to Federal agencies monthly on Standard Form 1080 or 1081. Non-Federal users will be billed on Form DI-1040, and payment by non-Federal users will be made by check payable to the U.S. Geological Survey.

	Class	Minimum Charge Per Job	Per Thousand Tape Accesses	Per Thousand Disk Accesses	Per Thousand Drum Accesses	Central Processor Charge per Hour	per Minute	per Second
	H	$16.00 +	$33.03 +	$11.01 +	$3.67 +	$1320	$22.00	$.367
	A	7.50 +	21.96 +	7.32 +	2.44 +	880	14.67	.244
Basic	B	3.00 +	10.98 +	3.66 +	1.22 +	440	7.33	.122
Batch	C	3.00 +	10.98 +	3.66 +	1.22 +	440	7.33	.122
Processing	D	1.50 +	6.48 +	2.16 +	.72 +	260	4.33	.072
Charges	E	1.50 +	6.48 +	2.16 +	.72 +	260	4.33	.072
	F	1.00 +	3.24 +	1.08 +	.36 +	130	2.17	.036

Core Use for Computer Jobs	a.	If in any Job Step the amount of core reserved exceeds the amount of core used by more than 20K, the basic charges are increased for every Job Step by 1% for each 1K of such excess core reserved. If the excess condition exists in more than one Job Step, the maximum excess is applied to the charges for all Job Steps.
	b.	If in any Job Step the amount of core reserved exceeds 756K, the basic charges are increased for every Job Step by 0.2% for each 1K of such excess core reserved. If the excess condition exists in more than one Job Step, the maximum excess is applied to the charges for all Job Steps. The minimum charge is $10.00.
	c.	WATSTORE utilizes Houston Asynchronous Spooling and Priority (HASP) systems. If so much core is reserved that HASP cannot be used, the basic charges are tripled.

Set-up and Mounting Charges: Disk mount: $3.00 each Tape set-up: $1.00 each

Print Charges for Computer Jobs: For each 1,000 lines in excess of the established limits, there is a charge of $1.50 for one-part paper and $3.00 for multi-part paper.

Class	Lines Limit
A,B,	10,000
C,D	25,000
E,F	100,000

(Terminal users will not normally be concerned with this item.)

TABLE 1

COMPUTER CENTER DIVISION
U.S. GEOLOGICAL SURVEY

SCHEDULE OF CHARGES FOR EQUIPMENT AND SERVICES

CHAPTER I. GENERAL INFORMATION

SECTION I.B. WATSTORE Description

CHAPTER I. GENERAL INFORMATION

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I.B. WATSTORE Description

The two major USGS files which are being made available consist of a Station Header File and a Daily Values File. These are part of the National Water Data Storage and Retrieval System (WATSTORE).

I.B.1. Station Header File

I.B.1.a. Function

The function of the Station Header File is to eliminate the need for storing fixed site identification and location parameters in each of the various files in WATSTORE and to provide an automated index of the file. Since Station Header data are recorded as a separate file, they can be updated without disturbing the voluminous measurement records represented. The Station Header File also facilitates the data security system which is described in Section II.C.

I.B.1.b Contents

The Station Header File contains the following data items:

- Agency Code
- Station Identification Number
- Station Locator (Latitude and Longitude)
- State Code (FIPS Code)
- District Code (USGS Users only)
- County Code (FIPS Code)
- Drainage Area
- Contributing Drainage Area
- Site Code
- Station Name
- Hydrologic Unit Code
- Gage or Land Surface Datum
- Geologic Unit Code

- Well Depth
- Aquifer Type
- Data Security Passwords

Detailed definitions and instructions for recording each of these items are found in Section III.A.

I.B.1.c. Operations

Station Header information can be entered or retrieved using a number of basic operations:

I.B.1.c.(1) Input Operations

- Station Header Data Input and Update
- Agency Code and Station Identification Number Changes
- Station Header Record Deletions
- Station Header Record Listing

I.B.1.c.(2) Output Operations

- Retrieval by latitude-longitude polygon
- Retrieval by qualified record
- Retrieval by geologic function
- Retrieval on basis of drainage area size
- Retrieval by Station Name
- Retrieval by Station Number
- Retrieval by Station Number Range

These operations and the program and job control card requirements are explained in detail in Section III.A. and III.B. For all procedures, the user is responsible for keypunch entries on locally-obtained industry standard card stock.

I.B.2. Daily Values File

I.B.2.a. Contents

The Daily Values File is limited to water data collected on a continuous or daily basis. Each daily value record has provision for storing at each site one value per day identified by a parameter code and statistic code as described in Appendix D and E. These data include:

- Streamflow
- Stream and Reservoir Levels
- Water Temperature
- Specific Conductance
- Rainfall
- Limited Water Quality Parameters

I.B.2.b. Input Operations

Input operations of the Daily Values File consist of entering, updating or deleting data. The instructions in Section IV.A. define how to prepare input, how to organize the data, and describes provisions available for data conversions (such as gallons to acre feet) and simulation.

I.B.2.c. Output Operations

Output operations for the daily Values File include retrieval by parameter code, statistic code, and range of data values, as well as those listed for the Station Header File in Section I.B.1. Details on retrieval of data from the Daily Values File are contained in Section IV.B.

CHAPTER II. INFORMATION COMMON TO ALL WATSTORE PROGRAMS

SECTION II.A. Job Control Language

CHAPTER II. INFORMATION COMMON TO ALL WATSTORE PROGRAMS

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II.A. Job Control Language

A common procedure in the computer industry is to "catalog" in a "library" instructions to the computer which are used many times, rather than entering these instructions for each application (job). These instructions are called Job Control Statements and they allocate the resources of the computer by telling the computer which of its available programs and data are needed for a job. The Job Control Statement (JOB card) is the first step in preparing to "run" a job. The function of the JOB card is chiefly to identify the user. A PROCLIB (procedure library) card is required to identify the library containing the requested procedure(s). A SETUP card is needed if the job requires a magnetic tape for input or output. An EXEC (execute) card is submitted which identifies the program or procedure to be executed. Following the EXEC statement (card), a DD (Data Definition) statement may be submitted which specifies card input to be used by the program. Each EXEC statement and its associated DD statements are called a procedure (job) step. The next step is feeding into the computer the cards (data cards) required to activate the program which will perform the actual operations on the data (such as "H" card, "N" card, etc.). Lastly, it is then necessary to end the job by telling the computer to complete the program execution. This last step is accomplished by using Job Control Language statements commonly referred to as delimiter and null statements.

This manual contains format instructions in job control language for the user to copy when initiating and running jobs. However, the formats are and must be general enough to accommodate words of instruction that vary from job to job. Thus, the word "format" itself refers to a general pattern which the computer recognizes as being valid.

Formats in instruction manuals are expressed similar to the following:

```
//wxxyyyzz JOB (aaaaaaaaa,bbbbb,cccc,dddd,eeee,ffff,g,h,ii),'your name'
```

This particular example happens to be a part of the JOB card used by USGS to initiate a job. Since it is a format, or pattern, certain of the items which appear in it must be replaced by information

specific to your organization, your account number, etc. In general, the rule is that lower case letters in the format are to be replaced on the card by specific information supplied by you but expressed in all capital letters. Words that appear in all caps in the format remain as shown. Another general rule is that spacing (or the lack of it) must be duplicated. It should be remembered that each letter or character or space in the format corresponds to exactly one column on a computer card, beginning with the first column on the left. Also, if items appear in parentheses, such as (aaaa), the parentheses would appear on the JOB card: (USGS). The same rule applies for single quotation marks: 'your name' should appear for example, 'MARY MARRS'.

Punctuation, if required, must also be very carefully inserted. Note that if an item in the format is omitted, the commas which would have followed the character(s) are not omitted. In the entry "cccc,,,,N" items dddd, eeee, and ffff have been omitted so that default values would be assigned to them. The computer recognizes commas as markers of the variable length fields.

Each format which is encountered in this manual will have instructions telling what the characters in the format represent, such as:

```
//bbbxxxx(rrrr,ss)
```

where bbb is a 3-digit user code
xxxx is the year
etc.

The number of characters usually indicates the size of the entry needed. This is also referred to as a "field." If a field is "variable length," the position of the entry does not matter as long as it appears in that segment of the card. If a field is not variable but is "fixed," it is necessary to make sure that zeros appear at the proper points before and after to complete the field.

The following sections discuss Job Control Language in terms of the execution of cataloged procedures.

II.A.1. JOB Card

The JOB card (and all other cards described herein) is punched by the user on standard industry card stock. The format of the JOB statement allows variable-length fields.

II.A.1.a. Description of Fields

The format of the JOB statement is as follows:

```
//wxxyyyzz JOB (aaaaaaaaa,bbbbb,cccc,dddd,eeee,ffff,g,h,ii), 'your name'
```

where: // a symbol needed by the computer to recognize a JCL statement

w an alphabetic character indicating the organization location from which the job was submitted

xx two alphanumeric characters indicating the user's organization. One of the following codes, for example, G1, would be entered on the card where xx appears in the format.

yyy are three alphanumeric characters indicating the user's registration code. This is a unique number for each individual user. It is assigned to users by the Computer Center at any of its locations where machine services are offered.

zz are two alphanumeric characters chosen by the user to ensure the uniqueness of characters in the combined wxxyyyzz field. If more than one job appears in the system with identical characters in this combined field, the results to both jobs are not predictable.

aaaaaaaaa are nine alphanumeric characters indicating the account number against which utilization will be recorded. Account numbers are generally assigned to USGS users by their own administrative offices. Other non-USGS users will have an account number assigned by USGS through the authorization procedure described in Section I.A.1.a.

bbbbb are four or five alphanumeric characters indicating the program number of the job. Since this is a variable length field, a leading zero is not required if only four character numbers are used. Program numbers are listed in Chapters III and IV.

cccc are one to four decimal digits indicating the estimated execution time in minutes required for all steps of the job, including I/O time. (The value must be equal to or greater than the sum of all TIME parameters on each EXEC statement in the JOB.) If this field is omitted, a default of 2 minutes is automatically assigned. A discussion of time is contained in Section II.A.4.a.(2). Estimated run times are given in the program instructions in Chapters III and IV.

NOTE: A default value is one assigned automatically by the computer if a needed value is omitted by the user.

dddd are one to four decimal digits indicating the maximum number of print lines permitted by the job. (The value is expressed in thousands of lines, e.g., 3 = 3,000 lines of print). If this field is omitted, a default of 2 (2,000 lines) is automatically assigned. Estimated printing requirements are given in the program instructions in Chapters III and IV.

eeee are one to four decimal digits indicating the maximum number of cards permitted to be punched by the job. The value is expressed in multiples of 6 (e.g., 100 = 600 cards to be punched). If this field is omitted, a default of 600 is automatically assigned.

ffff are one to four decimal digits indicating that a special form is to be mounted on the line printer. This field should not be used when output is to be printed on a terminal printer.

g is a decimal digit which is reserved for future use. Users must punch a numeric "1" in this field, or omit it. The Computer Center will not guarantee job integrity if any other character is placed in this field.

h is an alphabetic character; if "N" is indicated, the job will be returned to the user with all output produced by the uncompleted run. If any other character is used or if the field is omitted, the assumption is made that the job can be rerun.

ii — are one or two decimal digits indicating the number of lines to be printed on each output page during program execution. (This facility is not applicable to language processors, the IBM Linkage Editor, or the IBM Utility programs; these all have predetermined limits for lines per page). If this field is omitted, 61 lines per page are assumed and a new page will be started every 61 lines. This is referred to as "page ejection." To disable page ejection altogether, code "0" (a zero) in the field.

'agency, yourname' — is a variable length field up to 10 alphanumeric characters in length plus enclosing apostrophes (single quotes). "agency" is the agency code for the organization accessing WATSTORE and to whom computer charges will be assessed. THE AGENCY SUB-FIELD IS NOT REQUIRED FOR USGS USERS. "yourname" is the programmer name, the name of the person submitting the job, or the name of the person for whom the output is intended. The 10-character limit applies to the total field between apostrophes (i.e., 3-5 characters left justified for "agency" and 5-7 characters for "yourname"). A comma must immediately follow the last character of the agency code. Two samples are given below.

```
USGS user - 'JOHN DOE'
NON USGS  - 'NY001,JSM'
```

continuation card — when it is not possible to get all of the information on the JOB card between columns 1 through 71, it is permissible to use a continuation card. Code a comma after the last parameter. Code // in columns 1 and 2 of the next card and continue the next parameter starting in any column between columns 4 and 16.

■ II.A.1.b. Positioning of Fields

The following fields are fixed both as to their length and their column positions on the JOB statement card:

```
Col. 1                  Col. 10                 Col. 20

•                       •                       •
1 2 3 4 5 6 7 8 9       0 1 2 3 4 5 6 7 8 9     0 1 2 3
/ / w x x y y y z       z   J O B   ( a a a     a a a ,
```

It is mandatory that items be entered for these fields. No default options are provided. Whether the entry is to be left or right-justified will be indicated in the instructions. If no indication is given, the entry may be placed anywhere within that particular field.

Except for the fields mentioned above, the rest of the fields on the JOB card are variable in length and vary in their column position on the card depending on the number of defaults taken. The entry of an item in one of the remaining fields, bbbbb (program number), is mandatory. It may be 4 or 5 digits depending upon the program number. The rest are optional with default options provided where necessary.

Subfields in the accounting information field (items in parentheses in the format) can be dropped except for the aaaaaaaaa field. If values after aaaaaaaaa in the accounting field are dropped, then their positions must be maintained by commas.

Examples:

(aaaaaaaaa,bbbb) Fields dropped from right

(aaaaaaaaa,bbbb,,,200) Fields cccc and dddd omitted

II.A.1.c. Default Options Provided for JOB Card

The following is a summary of the current default options provided by the system when a user omits a field:

(cccc)	Est. execution time	2 minutes
(dddd)	Est. lines of print	2,000 lines
(eeee)	Est. cards to be punched	600 cards
(ffff)	Special forms	One part unlined paper
(h)	Can job be rerun?	Yes
(ii)	Lines per page	61
	Class	D priority

II.A.1.d. Examples of Typical JOB Cards

A minimum JOB statement would be for a job that runs in 2 minutes of less, prints fewer than 2,000 lines, produces fewer than 600 cards, uses standard one-part unlined paper, can be rerun if necessary, and uses the standard page spacing:

```
//wxxyyyzz JOB (aaaaaaaaa,bbbbb),'your name'
-------------------------------------------
//WG680201 JOB (450000xyz,W0103),'MARY MARRS'
```

If a user wishes to override the 600 default to punch 1,800 cards but, otherwise same as above (remember that cards are requested in multiples of 6):

```
------------------------------------------------
//WG68020l JOB (450000xyz,W0l03,,,300),'MARY MARRS'
------------------------------------------------
```

User wishes to suppress page ejection to plot continuous curves page-to-page. Remainder of standard defaults are acceptable:

```
------------------------------------------------
//WG68020l JOB (450000xyz,W0l03,,,,,,,0),'MARRS'
------------------------------------------------
```

User has instructed Computer Center not to rerun program in the event of either a job or system failure because he may be updating the data set:

```
------------------------------------------------
//WG68020l JOB (450000xyz,W0l03,14,30,,,,N),'MARRS'
------------------------------------------------
```

■ II.A.1.e. Job Card Parameter (Class)

The keyword parameter indicating the MVT class is coded on the JOB card. It permits the user to specify the scheduling priority of his job. The absence of this parameter will cause a default to CASSS=D. The format is:

```
------------------------------------------------
//WG80120l JOB (acctg.info.),'MARY MARRS',CLASS=n
------------------------------------------------
```

or

```
//wxxyyyzz JOB (aaaaaaaaa,bbbbb),'your name'
------------------------------------------
//WG80120l JOB (acctg.info.),'MARY MARRS',
//             CLASS=n
------------------------------------------
```

Where 'n' is defined as follows:

Class	Description	User Charge
H	Urgent	Highest (10F)
A	Daytime priority	Second Highest (7F)
B	Daytime routine	Third Highest (4F)
C	Nighttime priority	Third Highest (4F)
D	Nighttime routine	Fourth Highest (2F)
E	Weekend priority	Fourth Highest (2F)
F	Weekend routine	Lowest (F)

The figures in parentheses under user charge indicate the approximate relative cost compared to the lowest rate (F). See Table I in Section I.A.5. for exact charges. "Daytime" means that Class A and B jobs are normally run during the daytime hours, but any such jobs still on hand at night would be run ahead of lower class jobs. "Nighttime" means that Class C and D jobs would normally not be run during daytime hours, regardless of the daytime workload. "Weekend" means that Class E and F jobs would normally not be run at all during the regular work week. In the event of a job failure, a class E or F job will not be run again until the following weekend. When jobs are run at night or on weekends, the completed job is held for the user until he "signs on" the terminal in the morning.

II.A.2 PROCLIB Card

The PROCLIB card is required to identify the library containing the requested cataloged procedure(s). The format of the PROCLIB card is:

Col.1	Col. 12
•	•
/*PROCLIB	WRD.PROCLIB

II.A.3 SETUP Card

Use of the SETUP card for job setup information is mandatory. Jobs submitted that require tape or disk mounting but have

no SETUP card will be cancelled by the operator. The SETUP card is used to indicate job setup requirements in terms of physical facilities such as tapes or disks. The format of the SETUP card is:

```
Col. 1              Col. 12
●                   ●
/*SETUP             volserno/F,volserno/F,...volserno/F
(do not punch beyond column 71)
(Multiple SETUP cards may be used if required)
```

Where: volserno is a tape volume serial number on a disk volume serial number

and F = Disk, or, if tape, then give either t, R, or N

II.A.3.a. Format of SETUP Card for Tape Mounting

```
Col. 1          Col. 12
●               ●
/*SETUP         volserno/tRN
```

Where: volserno is the volume serial number appearing on the VOLUME parameter of the DD card

t is the numeric 9 for a 9-track tape or a 7 for a 7-track tape

R instructs the operator to mount the tape with the file protection ring in (meaning the tape is to be written on; if R is omitted, the tape can only be read, not written on). Not to be confused with passwords, this applies to this job only.

N indicates that the tape has no standard label (used when LABEL parameter of the DD card does not specify or default to SL (standard label).

When the user is requesting tapes from WATSTORE backfile, the standard volume serial number takes the form xxxxxx/9. If user is writing his own tape, he would then use the N and/or R parameters.

II.A.3.b. Format of SETUP Card for Disk Mounting

```
Col 1                Col. 12
•                    •
/*SETUP              volserno/DISK
```

where: volserno is the volume serial number appearing on the VOLUME parameter of the DD card in column 12. The format volserno/DISK must be adhered to because the first blank in a column following column 12 will terminate the card scan. An incorrect SETUP card will take the job out of "hold," change in the "/*SETUP" to "//SETUP" and cause the job to fail with the JCL error.

Example: In a job which requires the mounting of

1. Tape 001346--a 9-track, standard-labeled tape to be used for input. This is the format in which WATSTORE backfile magnetic tapes must be specified.

2. Tape 222222--A 9-track, unlabeled tape to be used for input.

3. Tape 001047--a 7-track, unlabeled tape to be used for input.

4. Disk pack CCD046.

The setup information might be indicated as follows:

```
-------------------------------------------
/*SETUP        001346/9,222222/9N,001047/7N
/*SETUP        CCD046/DISK
-------------------------------------------
```

II.A.4. Cataloged Procedures

Programs that require many JCL statements and that are used on a regular basis by a large number of people have been simplified by the use of cataloged procedures. These procedures and the way to use them are included with the discussions of the programs to which they pertain. Variable information is passed to a procedure by coding symbolic parameters on the EXEC card as described in Section II.A.4.a(3).

II.A.4.a. EXEC Card (Execute Statement

The EXEC statement is the first statement in each job step and procedure step. Its function is to identify the cataloged JCL procedure to be executed.

The format of the Execute (EXEC) statement is:

```
--------------------------------------------
//stepname EXEC xxxx,REGION=xxxxk,TIME=(x,y)
--------------------------------------------
```

Where: stepname would be an entry chosen by the user to define each of the steps in the job, such as STEPA or STEP1 (be sure to leave a space before and after EXEC)

xxxx is the name of a WATSTORE cataloged procedure

REGION & TIME are explained and illustrated below; however, REGION and TIME are usually included in the cataloged procedure and therefore require no user action.

NOTE that spaces may appear only immediately before and after "EXEC."

II.A.4.a(1) The REGION Parameter

The REGION parameter of the EXEC card specifies the amount of core to be assigned to the job step. If the REGION parameter is left out, a default region will be assigned by the cataloged procedure. This is the most common situation therefore the user need not normally be concerned with REGION. Instructions given in later sections of the manual will contain guidelines for estimating the amount of core needed for certain types of jobs and data. It is important for the user to follow these guidelines since the amount of core needed has a bearing on the overall cost of processing the job. The REGION parameter is coded as follows:

```
-------------------------------------
//Stepname EXEC procedure,REGION=xxxxk
-------------------------------------
```

Where: xxxx stands for the number of 1024-byte blocks of core that are to be used for the job step and can be any number between 52 and 750. The "K" must be included after the xxx. Example:

```
--------------------------------
//STEPA EXEC DVINPUT,REGION=310K
--------------------------------
```

Except for special cases, the user will not have to override the default values for REGION assigned by the cataloged procedure.

II.A.4.a(2) The TIME Parameter

The TIME parameter on the EXEC card specifies the amount of time that is to be allotted to the job step. If the TIME parameter is left out, a default time will be assigned by the cataloged procedure. As with the REGION parameter, guidelines for estimating needed time will appear along with program instructions later in this manual. However, the time allotted has no bearing on cost, and the user will be charged only for the time used. Time is important, however, because the computer will stop the job at the end of the time specified, regardless of whether the job is complete. Therefore, it is preferable that a user estimate time generously enough to complete the job. Example:

```
------------------------------
//STEPA EXEC DVINPUT,TIME=(x,y)
------------------------------
```

Where x stands for the number of minutes and may be any number less than 1440. y stands for the number of seconds. If the time is to be expressed only in minutes, the parentheses may be eliminated, i.e., TIME=5. If the time is to be expressed only in seconds, the parentheses must be included and the number of seconds be preceded by a comma, i.e., TIME=(,45). If TIME is expressed in minutes and seconds, then use TIME=(5,45). Except for jobs that process a large amount of data, the user will not have to override the default values for TIME assigned by the cataloged procedures.

II.A.4.a(3) Symbolic Parameters

Most users should not be concerned with symbolic parameters since the discussions of the individual programs will provide detailed instructions as needed.

Symbolic parameters are used when a need exists to provide variable information to a "canned" procedure. Symbolic parameters are JCL parameters within a cataloged procedure that may vary with each job. An example of such a parameter within a procedure might be a need for different magnetic tapes to be used for successive executions of the procedure. Rather than write a different procedure for each tape needed, symbolic parameters are used to cue the computer to access a specific tape for that job step. The user would follow a format similar to the following to accomplish the step:

```
------------------------------
//STEP1 EXEC DVRETR,VOL1=111042
------------------------------
```

The symbolic parameter in this execute statement is VOL1. For the DVRETR cataloged JCL procedure, the VOL1 symbolic parameter identifies the volume serial number of one of the numerous Daily Values Back File tapes.

Symbolic parameters are dealt with in detail as appropriate in discussions of specific update and retrieval procedures in Chapters III and IV of this manual. A list of symbolic parameters used in WATSTORE cataloged procedures is contained in Table I.

II.A.4.b. Data Definition Card (DD Statement)

Data sets (files) that are used by a program being run must be represented by data definition (DD) statements. The DD statements for magnetic tape and disk files are generally included automatically within the cataloged procedures named on the EXEC card, and the user need not be concerned with them unless they are specifically mentioned in a discussion of the program control cards or unless he wishes to override them. A DD statement to identify card input is also required at times to provide for reading data cards or retrieval control cards. The format of this card is as follows:

```
//stepname.ddname DD *
```

The "ddname" is usually SYSIN for card input data sets. The user should not attempt to override Data Definition cards in the WATSTORE cataloged JCL procedures unless the user has a high proficiency in the use of IBM JCL. Changes in the physical record lengths (BLKSIZE) must be compensated

TABLE I - SYMBOLIC PARAMETERS USED IN
WATSTORE CATALOGED PROCEDURES

The following symbolic parameters are used to pass user information to WATSTORE cataloged JCL procedures.

PARAMETER	DESCRIPTION
NAME1	Data set name. This would be the first assignment within a procedure. Subsequent names would be NAME2, NAME3, etc.
VOL1	Volume serial number. First assignment. USE VOL2, VOL3, etc., for additional volumes.
UNIT1	Device type, i.e., tape, disk, etc.
SP1	Space assignment in units of cylinders or tracks, depending on the application.
FILE1	File designation within the LABEL parameter.
NEWYR	New year.
OLDYR	Old year.
YR	Year.
DISP1	Data set disposition.
DUM1	Dummy DD.
REGION1	Region size.
TIME1	Step time.
AGENCY	Agency abbreviation.
PASSWRD	Password (either update or retrieval).
OPTION	Program parameter (PARM).

If any of the above parameters are required more than once within a procedure, then the digit "1" should be replaced with 2, 3, or etc., to differentiate each assignment of the name.

in the REGION parameter. The user is referrred to the following publication for a complete discussion of IBM or JCL: IBM System/360 Operating System, JCL Reference, GC 28-6704.

II.A.4.c. Delimiter Statement

Data delimiter statements are required to separate successive card input files from each other. Delimiter statements for a simple procedure usually appear as coded below:

```
                Col. 1
                •
(delimiter)     /*
```

II.A.5. Null Statement

Null statements are coded as follows:

```
                Col. 1
                •
                //
```

II.A.6. Sample Job Setup

The following is a sample job setup utilizing all of the JCL Cards described in II.A.1. above:

```
Col. 1          Col. 12
•               •
//wxxyyyzz      JOB (aaaaaaaaa,W0103),'MARY MARRS'
/*PROCLIB       WRD.PROCLIB
/*SETUP         001342/9
//STEPA EXEC    DVRETR,VOL1=001342
//SYSIN DD *
                •
                data cards (program control cards)
                •
                •
/*
//
```

CHAPTER II. INFORMATION COMMON TO ALL WATSTORE PROGRAMS

SECTION II.B. Station Identification Numbers

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II.B Station Identification Numbers

The Station Identification Number is a mandatory entry to either the Station Header File or Daily Values File. Each station for which data are entered in WATSTORE must have a single, unique station identification number. By "unique" is meant that a number assigned to a site should be assigned only to that site and should be changed only for the most serious reasons. The number should never be reassigned to another site. Should a station be destroyed or removed from service, its unique number will continue to be associated in the historical files with the data from the deactivated site. In the event of an incorrect entry, a procedure is available for correction, and these instructions are contained in Section II.A. and IV.A.

Agencies other than USGS should use the numbering procedure described below in Section II.B.1.

II.B.1. General User Station Identification Numbers

Users other than USGS may merely assign any number to a station operated by them as long as it contains no more than fifteen digits. The Agency Code (see Record Access Keys, Section II.D.) assigned then assures the uniqueness of the number within the WATSTORE system. However, it is the responsibility of the user to develop a numbering system which insures the uniqueness of numbers within his agency. Duplicate station identification numbers within an agency will cause the WATSTORE system to consider the data as belonging to one sampling site. Once the user has formulated a station identifier within the allotted 15 character field, it is necessary that the identifier be coded character for character exactly the same for each transaction made against the WATSTORE Files. For example, if a station was identified by the characters 100 placed in the 5th, 6th and 7th positions of the 15 character field, then all references to that station must be made with "100" coded in EXACTLY THE SAME POSITIONS. Due to this stipulation it is generally easier to use the same positions for all station numbers entered by the user.

USGS USERS ONLY

II.B.2 USGS User Station Identification Numbers

U.S. Geological Survey offices are required to develop station I.D. numbers which conform to the current USGS criteria. A number may be composed of latitude, longitude, and a two-digit sequence number (a total of 15 digits), or it may be an eight-digit downstream order number.

II.B.2.a Downstream Order Number

For the efficiency of data retrieval, the downstream order number is related to the river basin in which the station is located. Under certain conditions, the downstream order number may change, such as a different stream being designated as the headwater stream. This number is usually assigned by users entering data into WATSTORE.

The eight-digit downstream order number must be used for on-stream sites where records are systematically collected. Examples of sites that meet these criteria are:

- Regular surface-water stations
- Partial-record (surface-water and water-quality stations)
- Regular water-quality sites
- Spring stations where discharge measurements are made

When the downstream order is used, columns 2-8 of the station identification field are left blank and the downstream order number is entered in columns 9-16. NOTE: A digit must appear in each of the columns 9-16, that is, preceding and following zeros must be included, such as "01030500." Punctuation such as periods or dashes must not be used in the number.

II.B.2.b. Latitude-Longitude-Sequence Identifier

A latitude-longitude identifier is used primarily for offstream sites, however, they may be assigned to onstream sites where there is difficulty in assigning a meaningful downstream order number, and where data are obtained intermittently. Examples of the sites that meet these criteria are:

- Water-quality grab sample sites
- Wells
- Surface-water sites at which miscellaneous measurements are made
- Large open-water areas (lakes, reservoirs, bays)

If latitude and longitude to the nearest second are used, a two-digit sequence number must be appended to differentiate between stations with the same latitude and longitude. The format of a latitude-longitude identifier is:

Latitude	Longitude	Seq. number
ddmmss	dddmmss	nn

where d=degrees, m=minutes, s=seconds, n=number

The Station Identification Number and Agency Code make up the Primary Access Key for the Station Header File. Record Access Keys for the Station Header File and Daily Values File are discussed in Section II.E.

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SECTION II.C. Data Security

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II.C. Data Security

A data security system was developed to enable users to protect data from unauthorized updates or retrievals, especially with regard to data that are preliminary in nature. In the WATSTORE system, the use of the security system is optional. It is strongly recommended that passwords be used only when absolutely necessary. When they are necessary, they should be assigned so that they are not different from site to site within an agency. If they vary from site to site, then group retrievals (station range, polygon, etc.) for that agency will be impossible. The data security system provides that current records subject to update may be protected, while historical records are unprotected and made available to all users, if desired.

Security is provided by the use of two passwords. One password is referred to as the Update/Retrieval Password; the other as the Retrieval Only Password. For each user, the two passwords, assigned by the user, accomplish: (1) the protection of records in the Station Header File (fixed data) against unauthorized updates; and (2) the protection of the data in the Daily Values File against unauthorized updates and retrievals. The two passwords must contain no more than four (4) characters which may be numbers, letters of the alphabet, or a combination of both. Both of these passwords are stored in the Station Header File.

If a user wishes to protect his data, he may, under the Section Header Input/Update Program (G316), use one of two methods to enter a password.

II.C.1. Entry of Passwords

Passwords are to be submitted through the use of the Z card. A Z card is shown in Section II.C.4. Updates or deletions of passwords may be requested only by the use of the Z card. Passwords are entered and updated using program G316 (See Chapter III.A.).

II.C.2. Recognition of Passwords for Data Processing

In order to simplify the processing of data that has been password protected, symbolic parameters will be placed within the cataloged JCL procedures to allow for a simple method of coding the two passwords. Symbolic parameters can not be used to enter or update a password stored in the Station Header File. The Z card is the only method to be used to store or change a password. Several examples of

using symbolic parameters on the EXEC card are: (Note that these are not formats but rather representations of sample EXEC cards. This is why the options, such as MYDT and USGS, are already capitalized.)

```
---------------------------------------------
//STEP1 EXEC DVINPUT,PASSWRD=MYDT,AGENCY=USGS
//STEP2 EXEC DVRETR,PASSWRD=MYDT,AGENCY=USGS
---------------------------------------------
```

Where: PASSWRD is the symbolic parameter for the Passwords.

and, AGENCY is the symbolic parameter for the agency code.

The secondary or card input method (Z card) is provided so that passwords may be recognized when the amount of data being handled is so large or complex that use of the program parameters is not sufficient. Card input of passwords can be used with all of the WATSTORE input, update and retrieval programs for the Station Header and Daily Values Files.

It should be noted that the Z card input of passwords has priority over passwords initially submitted by program parameters. This means simply that passwords submitted on the card will override passwords submitted through the program parameter.

As mentioned previously, assignment and control over passwords are maintained by the users. Unless a password is deleted by the user, the password will be retained for the life of the Station Header Record.

The USGS retains access to all records by means of a Master Password which is kept secure by the central office. This Master Password will be recognized by all Station Header interface procedures in order to bypass password checking. This form of control is mandatory for the internal operation and maintenance of the computer system.

For USGS Users Only

Computer programs involved in processing data from files other than the Daily Values File will activate interface procedures that will bypass agency and password processing. To access the Daily Values Files, USGS users will be required to supply appropriate passwords for password-protected data.

II.C.3. Input/Update Security

For updating a record in either the Daily Values File or the Station Header Record, the Update/Retrieval Password should be supplied to the computer, if, of course, the record(s) has been previously secured by a password. Securing the data against unauthorized updates is accomplished by the internal checking of the user-supplied password against the Update/Retrieval Password stored in the Station Header File. Whenever Program H475 is used to input or update data in the Daily Values File, the program checks the user-supplied Update/Retrieval password stored in the Station Header File. A mismatch or failure by the user to submit a password will result in an error message that the data are password protected and that an incorrect password was submitted, or that no password was submitted. The user need not submit a password if he is sure that the data are not password protected.

II.C.4. Retrieval Security

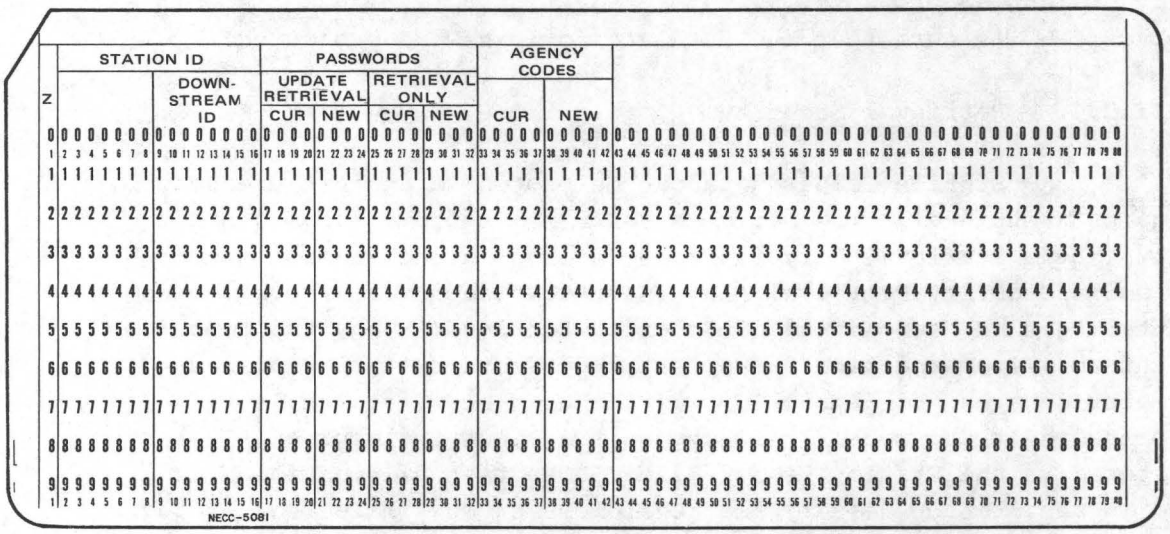
Station Header data can be protected against updates, but not against retrieval. The Daily Values File is protected against retrieval by a Retrieval Only Password (stored in the Station Header File) and a Security Retrieval Flag (stored in each data record). Upon encountering this user-activated Security Retrieval Flag, the computer will inform all prospective users that a password must be supplied before the data can be retrieved. If the user supplies the Retrieval Only password, the computer will check it against the appropriate password stored in the Station Header File. Note that all passwords are stored in the Station Header File regardless of what file they protect.

The Record Security Flag is set in an "on" or "off" position by the user. If the Flag is "on," password checking will be required. If the Flag is "off," checking will be bypassed.

All historical data records ("backfile") will be stored in the backfile with the Security Flag in the "OFF" condition.

Note that the Security Flag relates to securing data in the Daily Values File only against retrieval. Securing data against unauthorized updates is accomplished by the internal checking of a user-supplied password against the Update/Retrieval password in the Station Header File. (See Section II.C.3.)

Security Retrieval Flags will be set to the "on" or "off" condition by the Daily Values data Input/Update program H475 through the inclusion with other program control cards of a Z card ("Password-Agency Code" Card) that contains the valid (i.e., previously entered) Retrieval Only Password for the given site.



Z CARD (PASSWORD/AGENCY IDENTIFICATION CARD)

The Z card must precede the Daily Values Code Card that identifies the data record(s) being updated or retrieved. To set the Retrieval Flag to "ON," code the word "FLAG" in columns 25-28 of the Z card. To set the Retrieval Flag "OFF," code the word "NULL" in the columns 25-28 of the Z card.

If no Z card is processed, or if columns 25-28 of the Z card are left blank, then the Retrieval Security Flag will be set to the "OFF" condition for new records, and will remain unchanged for old records.

CHAPTER II. INFORMATION COMMON TO ALL WATSTORE PROGRAMS

SECTION II.D. Input of Password-Agency Codes

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II.D. Input of Password-Agency Codes

There are two methods by which a user may identify a password (Update or Retrieval) and the agency code. An agency code must be submitted for each site processed. The use of a password is optional. The user may submit these codes by the use of symbolic parameters on the cataloged JCL procedure EXEC card or by means of the Password-Agency Identification card (Z card). Submitting the agency code and password by the use of symbolic parameters is discussed in Section II.C. The format of the Password-Agency Identification of the discussion in this section is intended to define the scope of the codes submitted by each of the two methods.

The scope of an agency code or password submitted by use of the symbolic parameter is considered to apply to every site processed except for those sites that are specifically qualified by a Z card that is placed preceding a Daily Values Code Card (Update) or a Station Selection Card (Retrieval).

A retrieval example will be given to illustrate the point.

```
// EXEC DVRETR,AGENCY=USGS,PASSWRD=01
//SYSIN DD *
M                    (master control card)
D sta. a             (station list card)
Z sta. b             (password-agency)
D sta. b
D sta. c
Z                    (password-agency)
S sta. x sta. y      (station range card)
```

The password (Retrieval) and the agency code submitted on the EXEC card will be used to process station a and c.

The password and agency code submitted on the first Z card will be used to process station b. The password and agency code submitted on the second Z card will be used to process all sites in the range of station x to station y.

CHAPTER II. INFORMATION COMMON TO ALL WATSTORE PROGRAMS

SECTION II.E. Record Access Keys

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II.E. Record Access Keys

"Record Access Key" merely refers to the item or items within a record that uniquely identify it as separate from all other records in the data bank. Thus, it is the means by which the computer pinpoints the desired data. Each station has a Primary and a Secondary Access Key. The Primary and Secondary Keys for a given station may be the same, however, two stations, as indicated above, may not share the same keys.

II.E.1. Station Header Record Access Keys

In the Station Header File, the Primary Access Key is composed of the Agency Code and the Station Identification Number. Methods of developing the Station Identification Number are explained in Section II.B. The Secondary Access Key is the combination of a Station Locator and the Agency Code of the agency which controls the station. The Station Locator is a number consisting of the latitude, longitude and sequence number. Note from your reading of Section II.B. that the Station Locator number can be the same as the Station Identification number. This is perfectly acceptable. However, once a number is assigned to a station as either a Primary or Secondary Key, or both, it may not be assigned to any other station in any capacity (Primary or Secondary). The mechanics of entering the Station Locator into the file are given in Chapter III.A.

The Secondary Access Key (Station Locator) is used to facilitate retrievals by users involving specified areas of the earth, called Polygon Retrievals. (Polygon Retrievals are discussed in Chapter III.B.)

II.E.2. Daily Values File Access Keys

Since the Daily Values File contains numerous records for each station, several items are required to be specified in order to pinpoint the particular file desired. These are listed below:

- State Code -- See Appendix B
- Agency Code -- See Appendix A
- Station Identification Number -- Fifteen digit station identification as described in Section II.B.

- Cross-Section Location -- The distance of the sampling point in feet from the left bank (as determined by looking downstream).

- Depth Location -- The depth of the sampling point in feet with positive values measured in feet below the water surface.

- Parameter Code -- A 5-digit code to identify the type of data. See Appendix D.

- Water Year -- A water year is defined as the first day of October through the end of September of the following calendar year.

- Statistic Code -- A 5-digit code to further qualify a parameter, such as to identify it as a daily maximum or minimum. See Appendix E.

The sum total of these identifiers comprise a single access key.

The mechanics of entering these identifiers into the Daily Values File are given in Chapter IV.A.

CHAPTER II. INFORMATION COMMON TO ALL WATSTORE PROGRAMS

SECTION II.F. User Assistance

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II.F. User Assistance

The following discussion outlines some procedures the WATSTORE user should follow in checking out abnormal program endings and printouts.

II.F.1. Program Error Messages

All WATSTORE programs will print error messages for the most common types of abnormal end. A list of these error messages and the appropriate action to take in each case is given in the sections pertaining to particular programs discussed in Chapters III and IV.

II.F.2. IBM OS Completion Codes

The manual, "IBM System/360 Operating System: Messages and Codes, GC28-6631" should be consulted for information on system completion codes and numbered messages of the form IHExxx, etc.

II.F.3. Job Control Language (JCL) Errors

The manual, "IBM System/360 Operating System: Job Control Language Reference, GC28-6704" should be consulted for information on correcting JCL errors.

II.F.4. Technical Assistance

Technical assistance can be obtained by calling USGS, Reston, Virginia, telephone (703) 860-7131. Before taking this step, however, it may be useful in certain instances to re-run the job and invoke the "dump" option in program G316 and H475 to obtain a printout of the record in question. The User Services Section in Reston may request that a job deck be relayed to print and/or punch in Reston. A job deck may be relayed to Reston by coding the following cards:

Col. 1	Col. 10	Col. 16	Col. 25
•	•	•	•
/*RELAY	PUNCH	REMOTE14	RE1

```
     WRD RELAY JOB FROM (name) TO (name)
//   Complete job deck except for job card.
//   Include data or program control cards.
$$$
```

To re-execute the job and route the print to Reston, place ROUTE and COMMENT card behind the JOB card and re-run the job. The format of the ROUTE and COMMENT cards are:

Col. 1	Col. 10	Col. 16	Col. 25
•	•	•	•
/*ROUTE	PRINT	REMOTE14	RE1
//*FROM (name) to (name)			

II.F.5. List of WATSTORE Terminals

WATSTORE terminals are located in all Water Resources Division district offices except Hawaii, Nevada, and Puerto Rico. Information as to the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from each of the Water Resources Division's district offices listed below.

ALABAMA, Tuscaloosa

ALASKA, Anchorage

ARIZONA, Tucson

ARKANSAS, Little Rock

CALIFORNIA, Menlo Park

COLORADO, Lakewood (Denver)

CONNECTICUT, Hartford

FLORIDA, Tallahassee

GEORGIA, Doraville

HAWAII, Honolulu (includes American Samoa and Guam)

IDAHO, Boise

ILLINOIS, Champaign

INDIANA, Indianapolis

IOWA, Iowa City

KANSAS, Lawrence

KENTUCKY, Louisville

LOUISIANA, Baton Rouge

MARYLAND, Parkville (includes Delaware and District of Columbia)

MASSACHUSETTS, Boston (includes New Hampshire, Rhode Island and Vermont)

MICHICAN, Okemos

MINNESOTA, St. Paul

MISSISSIPPI, Jackson

MISSOURI, Rolla

MONTANA, Helena

NEBRASKA, Lincoln

NEVADA, Carson City

NEW JERSEY, Trenton

NEW MEXICO, Albuquerque

NEW YORK, Albany

NORTH CAROLINA, Raleigh

NORTH DAKOTA, Bismarck

OHIO, Columbus

OKLAHOMA, Oklahoma City

OREGON, Portland

PENNSLYVANIA, Harrisburg

PUERTO RICO, San Juan (includes the Virgin Islands)

SOUTH CAROLINA, Columbia

SOUTH DAKOTA, Huron

TENNESSEE, Nashville

TEXAS, Austin

UTAH, Salt Lake City

VIRGINIA, Richmond

WASHINGTON, Tacoma

WEST VIRGINIA, Charleston

WISCONSIN, Madison

WYOMING, Cheyenne

CHAPTER III. INSTRUCTIONS FOR STATION HEADER FILE

SECTION III.A. Entering and Updating Data Stored in the Station Header File (Program G316)

by William G. Shope, Jr.

CHAPTER III. INSTRUCTIONS FOR STATION HEADER FILE

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III.A. Entering and Updating Data Stored in the Station Header File (Program G316)

III.A.1. Introduction

New and updated station header data are processed by the use of computer program number G316 (Station Header Update Procedure). The purpose of the Station Header File is to provide a single source of station identification information for all WATSTORE data processing programs.

A Station Header Record comprised of 16 fixed items of site identification information is available in the Station Header File for each data collection site for which data are stored in the WATSTORE data files. Data will not be stored in, or retrieved from the WATSTORE Daily Values File, unless the header entries for the stations to be processed are in the Station Header File. In other words, this restriction ensures that all data are associated with a properly identified station.

Special procedures are provided for making agency code and station identification number changes and for making deletions. The program also allows for listing header data by site. The retrieval of station header data is discussed in Section III.B.

Users of the Station Header File have the option to "password" protect data entered into WATSTORE for one or more specified sites. Station Header Data may be protected against updates only. Data entered into the Daily Values File may be protected against both update and retrieval. The passwords stored in the Station Header File will be the basis for all WATSTORE data security. See Section II.C. for a detailed discussion of data security.

III.A.2. Data Organization

The types of data stored in the Station Header File are listed below:

- AGENCY CODE
- STATION IDENTIFICATION NUMBER
- STATION LOCATOR

- STATE CODE
- DISTRICT CODE (USGS Users Only)
- COUNTY CODE
- DRAINAGE AREA
- CONTRIBUTING DRAINAGE AREA
- SITE CODE
- STATION NAME
- HYDROLOGIC UNIT CODE
- GAGE OR LAND SURFACE DATUM
- GEOLOGIC UNIT CODE
- WELL DEPTH
- AQUIFER TYPE
- PASSWORDS

The eight underlined items are mandatory entries to the Station Header File for each station. All eight mandatory items must be reported prior to input, update, or retrieval of data from the Daily Values File. The combination of the eight mandatory entries plus the eight optional entries make up a Station Header Record. Station Header Records are stored in an on-line direct access data file that is referred to as the WATSTORE Station Header File. Initial entry of a site into the Station Header File requires that all of the eight mandatory items be entered on the input data cards discussed in Section III.A.3. The optional items may also be entered into the file on the initial site entry, or these data may be entered when available. When updating data stored in the Station Header File, the user must always identify the agency code and station identification number. A listing of the Station Header Records (Section III.A.3.e.) may be produced by providing the agency code plus either the station identification number, or the station locator.

Program G316 was written in PL/1 for the IBM 360 or 370 computer series by William G. Shope, Jr., USGS, Reston, Virginia.

III.A.3. Preparation of the Input

Program number G316 can perform five operations that involve the Station Header File. These operations include:

1. Processing Agency Codes and Passwords
2. Station Header Data Input and Update
3. Station Identification Number Changes
4. Station Header Record Deletes
5. Station Header Record Listing

All operations are controlled by the use of six input data cards. The use and formats of these data cards are described in the following sections.

III.A.3.a. Processing Agency Codes and Passwords

An agency code is mandatory for all computer processing (retrievals, updates, deletes) that involves station header data. (A list of agency codes is in Appendix A.) The use of passwords is optional unless a station header record has been previously password protected. The discussion in this section will be limited to the input and update of passwords. The use of passwords is outlined in Section II.C.

Agency Codes may be submitted to program number G316 by means of either symbolic parameters on the EXEC (execution) card, or through the use of the Z card (Password-Agency Identification Card--see Figure 1). Passwords are submitted on the Z card only.

III.A.3.a.(1) Symbolic JCL Parameters

Agency Codes coded on the EXEC card of the HDRUPD (see Section III.A.4.) cataloged JCL procedure will apply to each site processed by the station header update program unless one or more Z cards are submitted with the input data cards. See the example below in which each line represents a card. The first entry of each line represents the character that would be placed in column 1 of the card. Those cards beginning with a slash (/) are Job Control Language (JCL) cards. The others are data cards and the type of card as identified by the first character. The second character of the data card (A, B, or C) represents fictitious station identifiers.

```
// EXEC HDRUPD,AGENCY=US1
//HUPD.SYSIN DD *
HA - Update data for station A
ZB - Passwords and Agency Codes for station B
NB - Update data for station B
IC D - Change Station Identification Number from C to D
/*
```

For this example both methods of inputing agency codes have been used.

The agency code submitted through the symbolic JCL parameters apply to the data submitted for stations A and C. For these stations, the Agency Code is US1 (AGENCY=US1). If an Update/ Retrieval Password is required to update sites A and C, the update operations for these sites will be bypassed, and an error message will be printed. The Z card must be used for the processing of all passwords. The agency code entered on the EXEC card will be used to access existing Header Records and to create new Header Records unless a Z card is used for each site being updated or entered. The positioning of the Z card before the update data causes the agency code on the EXEC card to be ignored for Station B in the above example, in favor of the agency code and passwords on the Z card. The Z card format is discussed in the following paragraph.

■ III.A.3.a.(2) Password-Agency Identification Card (Z Card)

Entries on the Z card always override entries made through the use of the Agency Symbolic JCL parameter. When used in conjunction with other station data cards for a particular station, the Z card must immediately precede the data cards (H, N, I, and D cards).

Use of the Z card with program number G316 will enable the user to:

a. Input new and current agency codes and passwords for a given site. The input of current entries identifies (agency code) and authorizes (Update/Retrieval Password) updates to existing station header records.

b. Change current agency code or password.

c. Remove a current password.

The format of the Z card is given below:

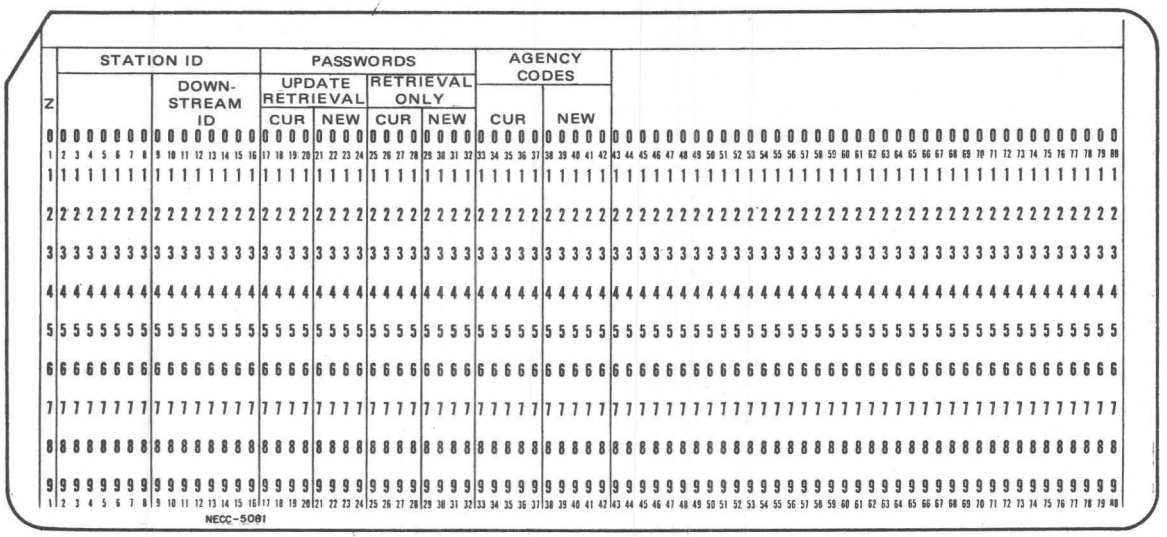

FIGURE 1. Z CARD (PASSWORD/AGENCY IDENTIFICATION CARD)

Col. 1 Always enter a Z

Col. 2-16 Station Identification Number -- The format and use of this identifier is discussed in Section II.B.

Col. 17-20 Current Update/Retrieval Password -- This password will be used to authorize data entries and updates in the Station Header Record for the site identified in columns 2-16. A complete discussion of passwords is given in Section II.C. If an Update/Retrieval password is not currently stored in the Station Header Record, columns 17-20 should be left blank. If an Update/Retrieval password does currently exist, then it must be supplied in columns 17-20 before the Station Header Record can be processed.

Col. 21-24 New Update/Retrieval Password -- These columns are used to enter a new password (initial entry), change existing (current) passwords, or to delete a password from the Station Header Record. To enter an Update/Retrieval password, merely code it in columns 21-24. To change a password, code the current password in columns 17-20, and the new password in columns 21-24. To delete a password, code the current password in columns 17-20 and the word NULL in columns 21-24.

Col. 25-28 Blank.

Col. 29-32 New Retrieval Only Password -- This entry is used to enter a new password (initial entry), change existing (current) passwords, or to delete a password from the Station Header Record. For all operations involving the Retrieval Only Password, the Update/ Retrieval Password must also be coded on the Z card in either columns 17-20 (current) or columns 21-24 (Initial Entry of Both Passwords). To enter or update a Retrieval Only Password, code the new password in columns 29-32. To delete a password, code the word NULL in columns 29-32.

Col. 33-37 Current Agency Code -- The agency code, when combined with the station identifier, will be used to reference the Station Header Record stored in the WATSTORE Station Header File. If no Station Header Record exists for the site, the agency code will be taken from columns 38-42 and combined with the header data on the cards that follow the Z card, and a Station Header Record will be created and stored.

Col. 38-42 New Agency Code -- This entry is used to specify an agency code for a new Station Header Record or to change an existing Agency Code for a given site. To To change the agency code, enter the current agency code in columns 33-37 and enter the new agency code in columns 38-42. Changes to the agency code in the Station Header File must accompany changes by the user to agency codes stored in the Daily Values

File. For changing agency codes in the Daily Values File, refer to the instructions for program number H475 (Section IV.A). Complete information on record access keys is given in Section II.A.

Col. 43-79 Blank

Col. 80 EPA Data Transfer Option -- This option controls the transfer of Station Header data to the EPA STORET files. The USGS has an agreement with EPA to transfer water quality data to STORET on a regular basis. The specification of the option depends on the user's agency code. If the user's agency code is USGS, data will automatically be transferred unless an X is entered in column 80. For all other users, header data will be transferred only if a Y is coded in column 80.

III.A.3.b. Station Header Data Input and Update

Station Header Data are entered in the computer file on the Station Header Card (Form 9-1872) (Figure 2), and a Station Name Card (Form 9-1843) (Figure 4). The formats for these two cards are described in the following sections. Sample forms for coding data to be punched on the Station Header Card and Station Name Card are shown in Figures 3 and 5.

III.A.3.b.(1) Station Header Card

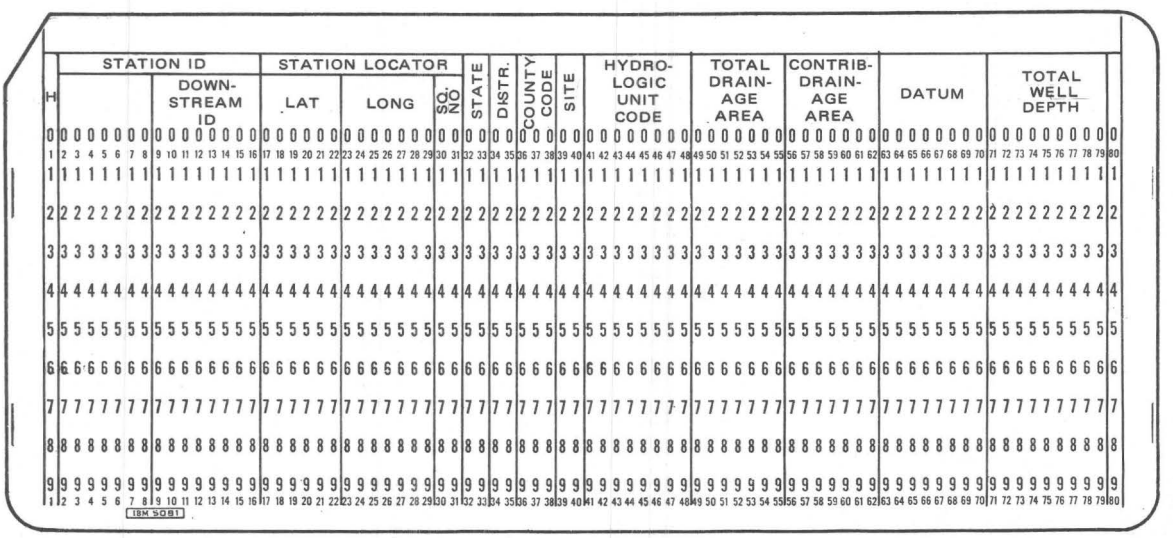

FIGURE 2. STATION HEADER CARD

OFFICE ________ NAME ________ PHONE ________	U.S. DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY Water Resources Division	ACCOUNT NUMBER ________ PROGRAM ________	SHEET ____ OF ____

CODING FORM FOR STATION HEADER DATA

REMARKS: ________

Card columns 1–80; rows 1–30.

Columns	Field
1	TYPE
2–30	STATION ID (LATITUDE, LONGITUDE, SEQ)
18–30	STATION LOCATOR (LATITUDE, LONGITUDE, SEQ)
9–17	DOWNSTREAM
32–33	STATE CODE
34–35	DISTRICT CODE
37–38	COUNTY CODE
39–40	SITE CODE
42–49	HYDROLOGIC UNIT CODE
50–56	DRAINAGE AREA, TOTAL
57–63	DRAINAGE AREA, CONTRIB.
64–73	DATUM
74–79	TOTAL WELL DEPTH
80	EPA OPT.

FORM 9—1872A
NOV. 1973

[O] = ZERO [Ø] = ALPHA O [1] = ONE [I] = ALPHA I [2] = TWO [Z] = ALPHA Z [/] = SLASH [|] = VERT. BAR [-] = MINUS [_] = HORZ. BAR

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FIGURE 3. CODING FORM FOR STATION HEADER CARD

Col. 1 — Always enter an H

Col. 2-16 — Station Identification Number (MANDATORY) -- A complete discussion of the format and use of this field is given in Chapter II.B.

Col. 17-31 — Station Locator (MANDATORY entry except for update operations) -- Latitude-Longitude-Sequence Number. When these items are entered into columns 17-31, no blank spaces or alphabetic characters are allowed.

Col. 17-22 — Latitude

Col. 17-18	Degrees
Col. 19-20	Minutes
Col. 21-22	Seconds

Col. 23-29 — Longitude

Col. 23-25	Degrees (code a zero in column 23 for degrees less than 100)
Col. 26-27	Minutes
Col. 28-29	Seconds

Col. 30-31 — Sequence Number within Quadrant -- Columns 30-31 must contain a two-digit number. This number is used to differentiate between stations having the same latitude and longitude and to identify the site location in relation to the Earth's spherical quadrants. Allowable sequence numbers by quadrant are listed below:

Quadrant	Sequence Number	Description
Northwest	00-69	North Latitude West Longitude
Northeast	70-79	North Latitude West Longitude
Southeast	80-89	South Latitude East Longitude
Southwest	90-99	South Latitude West Longitude

If a sequence number within quadrant is less than 10, code a zero in column 30.

Col. 32-33 State Code (MANDATORY entry except for update operations) -- Use the code of the state in which the station is located physically. State codes are listed in Appendix B. The user is cautioned that the state code is a part of the Daily Values Record Access Key (Section II.E.), and that changes to state codes in the Station Header File must also be followed by changes in data records stored in the Daily Values File. Instructions for updating the Daily Values Record Access Keys are given in Section IV.A.

Col. 34-35 District Code (MANDATORY entry except for update operations) -- This entry applies only to U.S. Geological Survey (AGENCY=USGS) users. All other users are to leave this entry blank. Use the state code of the district or the billing code of the regional project having the fiscal responsibility for processing the data. Use leading zeros.

Col. 36-38 County Code (MANDATORY entry except for update operations) -- Use the code of the county in which the station is located physically. County codes are presented in Appendix C. County codes are three digit numbers with leading zeros when necessary.

Col. 39-40 Site Code (MANDATORY entry except for update operations) -- Enter one of the following codes:

'SW' = Stream	'GW' = Well
'SP' = Spring	'LK' = Lake or Reservoir
'ES' = Estuary	'ME' = Meteorological

If more than one site code is required to identify the primary sources of data, site codes 2 and 3 may be entered in columns 74-77 of the Station Name Card. The site code entered on this card is site code 1 and may be updated by submitting a new code in columns 39-40 of the Station Header Card.

For USGS Users Only

The 'SS' site code described here applies only to U.S. Geological Survey (AGENCY=USGS) users. The 'SS' code does not apply to the Daily Values Data File. If the codes listed above do not describe the site, then the specific source code ('SS') may be used. The 'SS' code indicates that a sample source code will be stored in the Water Quality Data Files through the use of parameter code 72005 within individual analyses. See the publication "Identification Codes for the Storage and Retrieval of Water Data" for a list of the sample source codes. The user should note that parameter code 72005 is not restricted to sites that have been identified with an 'SS' site code. Many of the sample source codes pertain to a 'GW' or well site. A site code is an important file entry for retrieving data; however, the incorrect use of an 'SS' code in describing ground-water sites could cause many stations to be omitted in a retrieval that specifies 'GW' as the site code. In general, the 'SS' site code should be used only when absolutely necessary.

Col. 41-48 Hydrologic Unit Code -- Hydrologic unit codes are given in the U.S. Geological Survey map series "State Basic Hydrologic Unit Maps." As the maps are made available, data for this field should be entered. The series provides a uniform, national consistent set of maps showing drainage, culture, hydrography, and hydrologic boundaries of: (1) Water Resources Council Regions, (2) Water Resources Council Subregions, (3) National Water Data Network Accounting Units, and (4) Cataloging Units of the Catalog of Information on Water Data maintained by the Office of Water Data Coordination. Each of these units is identified by an 8-digit number; the number for the unit in which the site is located is to be entered as the Hydrologic Unit Code.

Col. 49-55 Total Drainage Area (square miles) -- If the value contains a fractional part of a square mile, then the decimal point must be entered. The value may appear anywhere within the specified card field.

Col. 56-62 Contributing Drainage Area (square miles) -- This item need be entered only if the contributing area is different from the total drainage area. This situation can occur when part of the drainage area consists of porous soil or depressions that either allow runoff to enter the ground-water zone or traps the water in ponds so that rainfall does not contribute to runoff.

Col. 63-70 Datum -- Report the gage or land surface datum (reference to mean sea level) to the nearest hundredth of a foot. The value must include a decimal point and may appear anywhere within the specified card field. Negative values are coded with a minus sign preceding the first digit.

Col. 71-79 Depth of Well -- Report the greatest depth at which water can enter the well. For screened or perforated wells, report the depth to the bottom of the screen, or the lowest perforations. For open-hole or open-end wells, report total depth of the well.

Col. 80 EPA Data Transfer Option -- This option controls the transfer of station header data to the EPA STORET Files. The code to be used depends on the user's agency code. If the user's agency code is USGS, data will automatically be transferred unless an X is entered in column 80. For all other users, header data will be transferred only if a Y is coded in column 80.

III.A.3.b.(2) Station Name Card

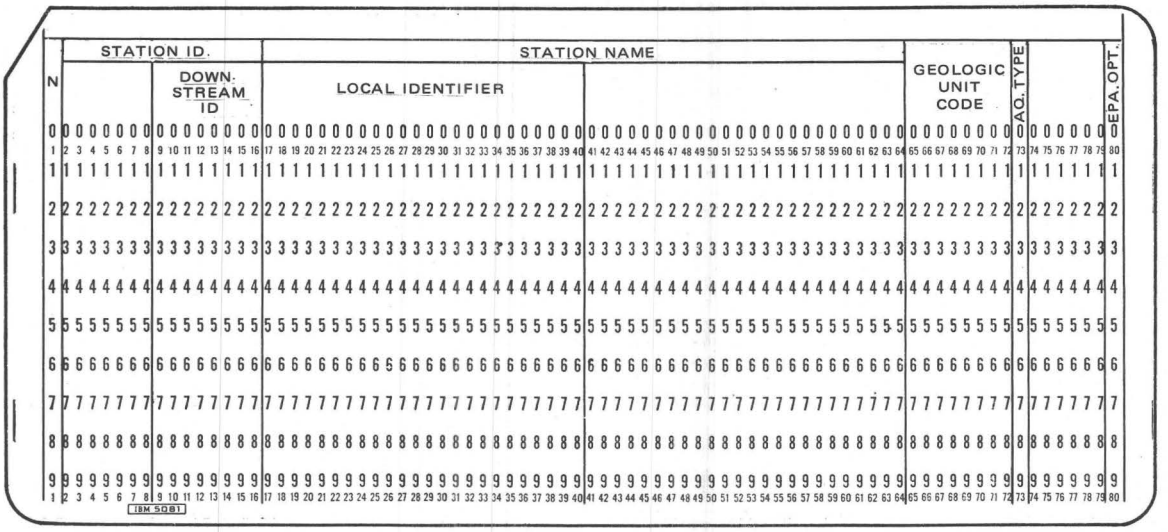


FIGURE 4. STATION NAME CARD

Col. 1 Always enter an "N"

Col. 2-16 Station Identification Number (MANDATORY entry)

Col. 17-64 Station Name and Location or Local Identifier (MANDATORY entry except for update operations) -- This field contains forty-eight characters including spaces and punctuation. It should take a form similar to:

PENDLETON HILL BK NR LITTLETON FALLS PA

Meaningful abbreviations may be used. Users must exercise care in assigning a Local Identifier to this field. Requests for a listing of the Local Identifier using program number A534 (see Section III.B.4.a.) will result in a printing of only the first 24 characters of this entry. All other programs that are documented in Chapters III and IV process the full 48 characters.

OFFICE _____ NAME _____ PHONE _____

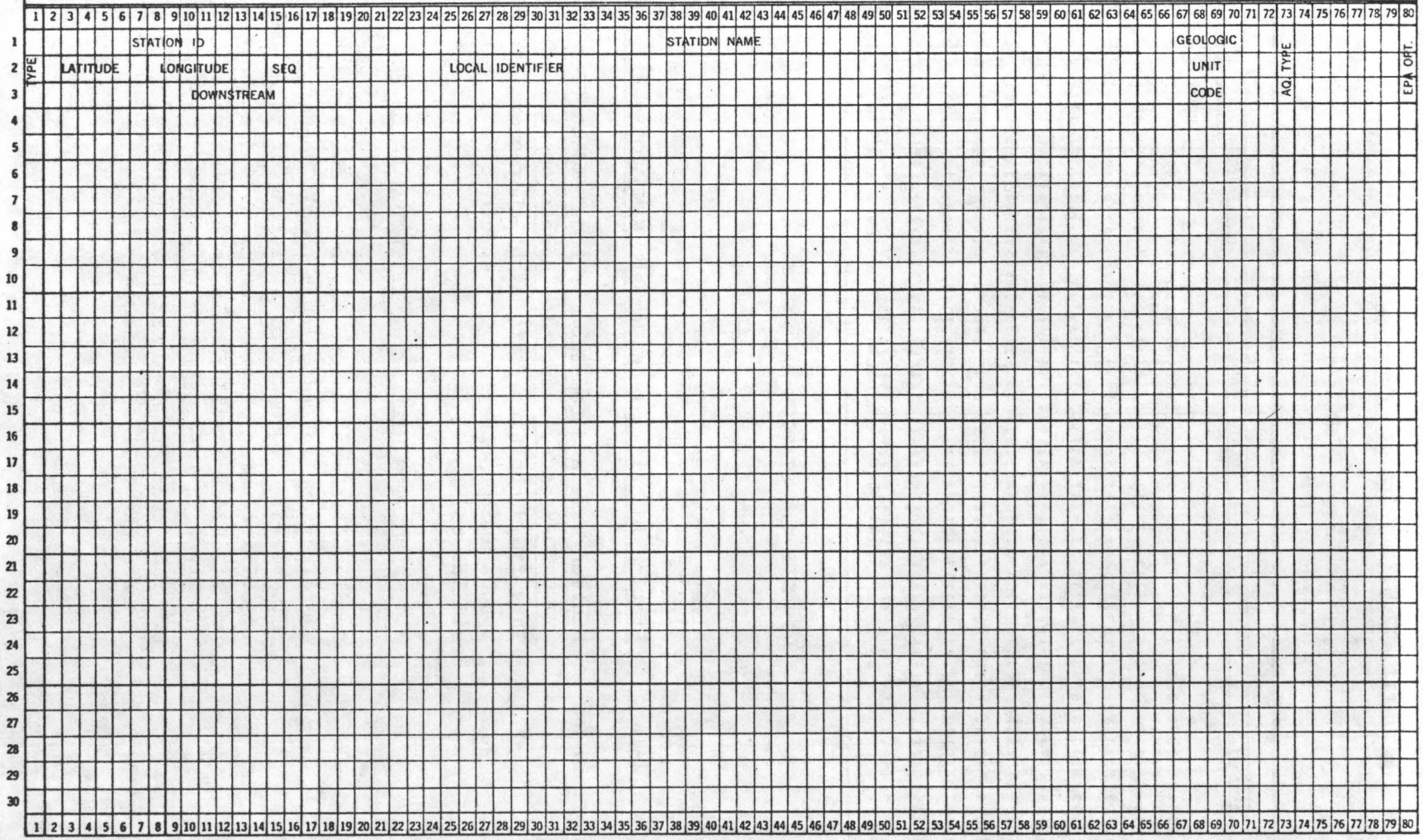
U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division

ACCOUNT NUMBER _____ PROGRAM _____

SHEET _____ OF _____

CODING FORM FOR STATION NAME

REMARKS: _____



FORM 9—1843A
NOV. 1973

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

☆ U.S. GOVERNMENT PRINTING OFFICE: 1974—527-371

FIGURE 5. CODING FORM FOR STATION NAME CARD

In coding the station name or local identifier, the user should be as consistent as possible in assigning names, codes, or abbreviations. This is very important in retrieving data from the Header File. One of the retrieval options allows the user to specify strings of data from 1 to 48 characters in length. If this string of characters appears anywhere within the station name or local identifier, then the header record will be retrieved (providing all other retrieval controls are also satisfied). An example might be to retrieve all header records that have the three characters 'PA.' appearing anywhere within the station name field. If the abbreviation 'PENNA' is used in addition to 'PA.', then the retrieval will not be complete.

Col. 65-72 Geologic Unit Code -- Reference Appendix F -- Left-justify the code with no embedded blanks. Report the geologic unit code for the aquifer supplying water to the well. If the well taps more than one aquifer, indicate the geologic unit of major importance. An indication that the well taps more than one aquifer is coded in column 73.

Col. 73 Aquifer Type (for wells only) -- Enter one of the following codes:

U	-	Unconfined single aquifer
N	-	Unconfined multiple aquifers
C	-	Confined single aquifer
M	-	Confined multiple aquifers
X	-	Mixed (confined and unconfined) multiple aquifers

Col. 74-77 Additional Site Codes -- A complete discussion of site codes is given in Section III.A.3.b.(1). Site codes are to be entered on this card only when there is more than one principal type of data collected at the same site. An example would be the collection of surface water stream data (SW) and meteorological data (ME) at the same station. When there is a need for more than one site code, site code 1 is entered and updated using the Station Header Card (H card).

Site code 2 (columns 74-75) and site code 3 (columns 76-77) are entered and updated using the Station Name Card (N card). The entries made for site code 2 and 3 may be deleted by using the B string option described below.

Col. 80 — EPA Data Transfer Option -- This option controls the transfer of Station Header data to the EPA STORET files. The code to be used depends on the user's agency code. If the user's agency code is 'USGS', data will automatically be transferred unless an X is entered in column 80. For all other users, header data will be transferred only if a Y is coded in column 80.

The Station Header Card and the Station Name Card may be submitted without regard to sequence, or, for update operations, the cards may be submitted separately. If a data field is left blank, then the item will not be changed in an update operation. If either a mandatory field is left blank on initial entry of data or an error is detected in a data field, an error condition will be raised, and no entries for the given station will be made in the Header File. The resultant error messages are listed in Section III.A.5.b.

III.A.3.b.(3) Deleting Non-Mandatory Entries

Non-mandatory entries may be deleted from a Station Header Record by resubmitting either a properly identified Station Header or Station Name card with a character string of capital letter B's filling the field(s) in the item(s) to be deleted. For example, if an entry had been made in the Total Well Depth Field for a surface water station, the entry can be deleted by processing a Station Header Card with the character B coded in columns 71 through 79.

III.A.3.c. Station Identification Number Changes

Station identification numbers are changed in the Station Header File by the use of a Station Identifier Change Card. The format of this card is given below:

Col. 1	Always enter an I
Col. 2-16	"OLD" or Current Station Identification Number
Col. 17-31	"NEW" Station Identification Number
Col. 32-79	Blank
Col. 80	EPA Data Transfer Option -- This option controls the transfer of Station Header data to the EPA STORET files. The code to be used depends on the user's agency code. If the user's agency code is USGS, data will automatically be transferred unless an X is entered in column 80. For all other users, header data will be transferred only if a Y is coded in column 80.

Prior to submitting a station identification number change for the Station Header File, be sure that the "OLD" station number is in the Header File, and the "NEW" station number is not. Failure to make these checks may result in an error condition. The error messages associated with a station identification number change are listed in Section III.A.5.b.

The change operation applies only to station header data that are stored in the WATSTORE Station Header File and the EPA STORET Data Files. Station number changes for the Header File also must be made in other major WATSTORE Data Files. A change in a station identification number affects the record access keys (Section II.E.) of all data files and therefore should be undertaken only when absolutely necessary. A change in identifier used in the record access keys for the Daily Values file must be made using program number H475 (Section IV.A.). Within the USGS, users must recognize that other files besides the Daily Values File may also be affected.

III.A.3.d. Station Header Record Deletes

Station Header Records are deleted from the Station Header File by the use of a Header Record Delete Card. The format of this card is given below:

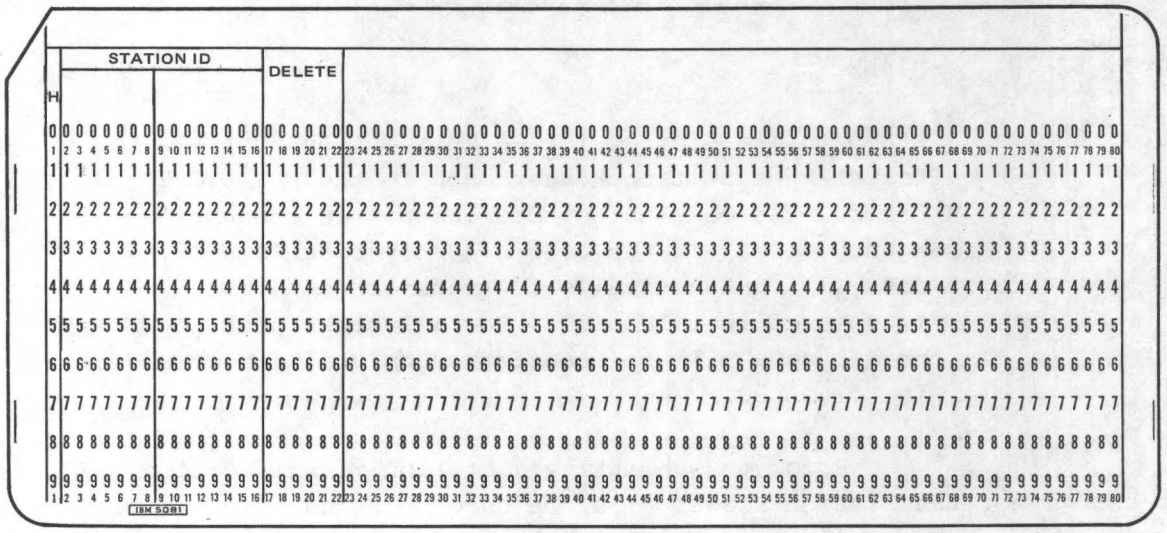


FIGURE 6. STATION HEADER RECORD DELETE CARD

Col. 1 Always enter an H

Col. 2-16 Station Identification Number

Col. 17-22 Enter the word DELETE

Col. 23-80 Blank

III.A.3.e. Station Header Record Listing

An option is available that allows the user to retrieve and list specified station header records. A header record may be retrieved by specifying the agency code and either the station identification number or the latitude-longitude sequence number. The Data Retrieval Card is used to request listing of Station Header Records. The format of this card is shown below:

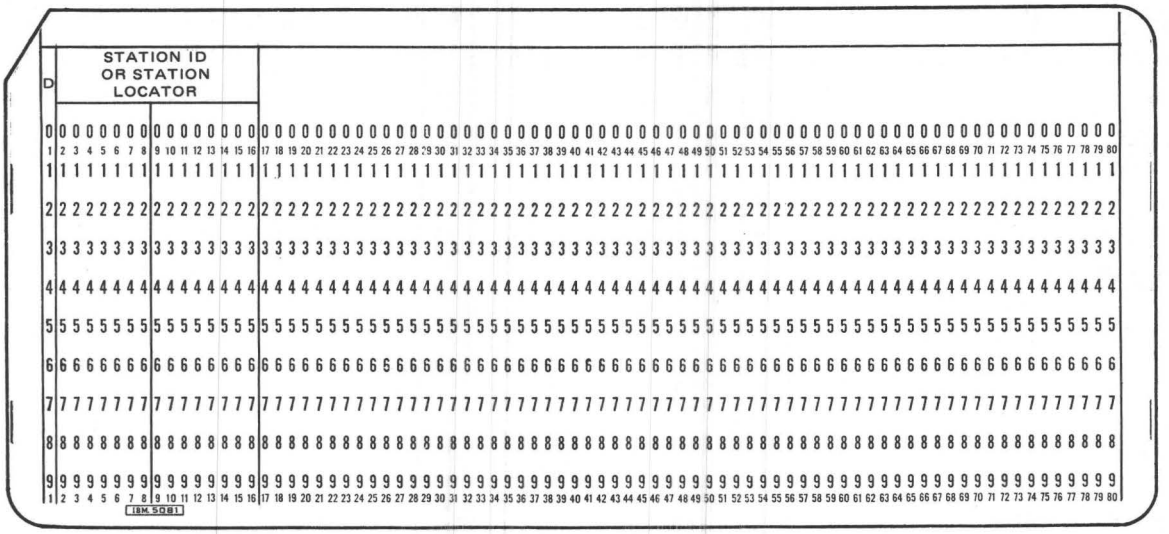


FIGURE 7. DATA RETRIEVAL CARD

Col. 1 Always enter a D

Col. 2-16 Station Identification Number or Station Locator

Col. 17-80 Blank

Sample listings of Station Header Records are shown in Section III.B.5.

■ III.A.3.f. Restrictions

A Station Header Record cannot be processed unless a valid record access key can be defined for the site. Users must ensure that an agency code and a station identifier is specified for each site processed. If a number is to be used as the station identification number and/or entered as the station locator for a given station, no other station for the same agency may be identified or located by that 15 character code. If a conflict in the station locator exists for two or more sites, the two character sequence number (Section III.A.3.b.) can be used to create a unique 15 character locator field for sites that are located by an identical latitude-longitude.

III.A.4. Cataloged JCL Procedure

A cataloged job control language (JCL) procedure for storing and updating data in the WATSTORE Station Header File has been stored in a system library. The procedure name is HDRUPD and the procedure may be executed using the following cards:

```
Col. 1                  Col. 12

•                       •
//xxxxxxxx              JOB      (xxxxxxxxx,xxxx,.....
/*PROCLIB               WRD.PROCLIB
// EXEC HDRUPD
//HUPD.SYSIN  DD          *
...   ...   data cards for program G316
/*
//
```

The first character in each of the above lines corresponds to the character that is to be entered in column 1 of the punch card. The data cards for program G316 must be punched in accordance with the instructions given in Section III.A.3.a and III.A.3.b.

An option is available to specify the agency code on the EXEC card through the use of Agency Symbolic JCL parameter. An example is given below:

```
// EXEC HDRUPD,AGENCY=US1
```

The agency code is specified by using the symbolic JCL parameter AGENCY. In the above example, the agency code is US1. If the agency code is not specified on the EXEC card, then the Z card (see Section III.A.3.a.) must be submitted for each station processed.

If the execution time coded in the procedure (1 minute) is not sufficient, then the time may be changed by coding TIME.HUPD=time, on the procedure execution card as follows:

```
// EXEC HDRUPD,TIME.HUPD=2
```

The execution time coded in the procedure (1 minute) is sufficient to process about 300 cards. Allow approximately 50 lines of print for each station processed.

An additional input file (DDNAME=HDRINPT) is available for submitting new and update data to the Station Header File. The DD (Data Definition) card describing the file is to be placed between the EXEC and SYSIN JCL cards. The records stored in the file describing the HDRINPT DD card must conform to the format given in Figure 8. An example of the use of this option is given below: (Remember that each line represents one card.)

```
//  EXEC HDRUPD
//HUPD.HDRINPT DD DSN=dsname,UNIT=unitno,DISP=OLD,
//  VOL=SER=Volserno,DCB=(RECFM=FB,LRECL=152,BLKSIZE=3040)
//HUPD.SYSIN  DD  *
  Data Cards for Program G316
            •
            •
            •
/*
```

The underlined items must be replaced by the user with valid entries. An increase in BLKSIZE may require an increase in the REGION size. If there were no data cards, the SYSIN card would not be needed.

III.A.5. Output

The output from program G316 includes printed output, updated data records for STORET, and new or updated station header records (see Figure 8). The printed output includes program revision dates, listing of station header records and error messages. The error messages are listed in Section III.A.5.b. The listing of station header records depends on the operation attempted. The listings shown in Figures 9-14 will result for the indicated operations.

III.A.5.a. Sample Output

III.A.5.a.(1) Station Header Input and Update -- (see Figures 9 and 10)

An update header record will always be listed. This record contains the data that were submitted on the type Z, H, and N cards.

A current header record will be listed if a station header record is in the file.

A new header record will be listed in order to reflect the new or update entries.

■ III.A.5.a.(2) Station Identification Number/Agency Code Change -- (see Figure 11)

The old and new station identification numbers and agency codes will be listed.

The new station header record will be listed in order to reflect the update.

■ III.A.5.a.(3) Station Header Record Delete -- (see Figures 12 and 13)

An update header record will be listed with the word DELETE.

The old header record will be listed if a record for the site exists in the Station Header File.

A message indicates that the station was deleted from the header files.

■ III.A.5.a.(4) Station Header Record Listing -- (see Figure 14)

The current station header record will be listed, or a message will be printed indicating that the record could not be located.

■ III.A.5.b. Error Messages

The error messages are listed in capital letters followed by a brief explanation and a recommended user response.

HU001 INVALID AGENCY CODE - Agency Code, Station Number, Station Identifier -- An invalid agency code was submitted to program G316. Data processing cannot continue if the code was submitted via the AGENCY symbolic JCL parameter on the EXEC card.

User Response: Correct the agency code if the code was incorrect or request that the code be added to the WATSTORE agency code list.

HU002 AGENCY CODE NOT SUBMITTED FOR STATION - Station Identifier -- The AGENCY symbolic JCL parameter was not specified, and no Z card was submitted for the station that is identified immediately following the message.

User Response: Submit an agency code and reprocess.

HU003 PASSWORD VIOLATION FOR STATION - Station Identifier; AGENCY - Agency Code -- The user did not submit the correct Update/Retrieval Password for the station that is identified following the error message.

User Response: If the correct password is known, reprocess using the current password. If the password is not known, the user may submit a request to the WATSTORE Data Processing Group for permission to access the given Station Header Record.

HU004 THE FOLLOWING DATA FIELDS FOR THE HEADER RECORD LISTED ABOVE WERE FOUND TO CONTAIN NO DATA. THESE ENTRIES ARE MANDATORY FOR NEW STATIONS. -- Following the above message, any or all of the items listed below will be printed:

AGENCY CODE
LAT-LONG-SQN
STATE CODE
DISTRICT CODE--(Checked only if AGENCY=USGS)
COUNTY CODE
SITE CODE
STATION NAME

User Response: Enter the missing identifier(s) on the Header Card(s) and reprocess.

HU005 THE FOLLOWING DATA FIELDS FOR THE HEADER RECORD LISTED ABOVE WERE FOUND TO CONTAIN ONE OR MORE ERRORS. -- Following the above messages, any or all of the items listed below will be printed:

STATION ID. NO.--(Checked only if AGENCY=USGS)
LAT-LONG-SQN--(Edit check only)
STATE CODE--(Illegal code)
DISTRICT CODE--(Checked only if AGENCY=USGS)
COUNTY CODE--(Edit check only)
SITE CODE--(Illegal code)
DRAINAGE AREA--(Edit check only)
CNTRB. DR. AREA--(Edit check only)
HYDROL. UNIT CODE--(Edit check only)
DATUM--(Edit check only)
GEOLOGIC UNIT--(Illegal code)
WELL DEPTH--(Edit check only)
AQUIFER TYPE--(Illegal code)
SITE AMBIGUITY--(A conflict exists between the site code and other identifiers, i.e., well depth reported for a 'SW' site.)
LAT/LG OUTSIDE STATE--(The reported location of the site was found to be outside of the recognized state boundaries.
UPDTE PASSWD MISSING--(A current update/retrieval password must be coded in columns 17-20 of the Z card before a retrieval only password can be updated or added to a station header record.

User Response: Enter the indicated identifier(s) and reprocess.

HU006 NO UPDATES MADE -- The Station Header File was not updated due to errors listed in a previous error message.

User Response: Respond to the error message listed prior to this message.

HU007 OLD STATION NOT FOUND -- An attempt was made to change a Station Identification number, and the 'OLD' Station Identifier (columns 2-16 Type I card) could not be found in the Header File.

User Response: If the 'OLD' Station Identifier (columns 2-16 Type I card) was coded correctly, then the user should abandon the Station Identifier change operation, and enter the header data for the new identifier using card types H and N.

HU009 ILLEGAL CARD TYPE - Card Image -- A card type (column 1) other than Z, H, N, I, and D was found in the input data.

User Response: Correct the card type, or remove the card.

HU010 STATION IDENTIFICATION NUMBER - Station Id; AGENCY=agency code WAS NOT FOUND IN THE WATSTORE STATION HEADER FILE -- An entry in the Header File could not be found for the Station Identifier specified in columns 2-16 of a Type D (Data Retrieval) card.

User Response: If necessary, enter the Station Header Data into the File using the Type H and N data cards.

HU011 ERROR FOUND IN HDRUPD PROC/ERROR MESSAGE - Error Message

User Response: Contact the WATSTORE Data Processing Group

HU012 STATION LOCATOR MATCHES LOCATOR OR ID. NO. FOR STATION - ID. Station I.D. -- An attempt to enter a station locator (columns 17-31 Type H card) into the Header File has failed due to a conflict with a previous entry. The Station Identifier for the previous entry is identified in the error message. The Station Identifier for the current update operation is listed below the error message in the Station Header record listing. The user should note that due to the conflict, no Lat-Long-Sqn number (Station Locator) has been stored for this station.

User Response: If the Lat-Long-Sqn number was originally coded correctly, then the user should modify the sequence number (columns 30-31 H card) in order to generate a unique location identifier. After modifying the Lat-Long-Sqn number, reprocess the H card.

HU013 PRIME STA. ID. NOT SPECIFIED FOR UPDATE OR DELETE OPERATION - PRIME STA. ID = Station I.D. -- The 15-character station identifier specified in columns 2-26 of the H, N, or I cards has been previously entered into the file as a Station Locator. The Station I.D. for which the original Station Locator was entered, is listed in the error message following PRIME STA. ID. =

User Response: The identifier specified on the I, N, or H card is not stored in the Header File as a Station Identifier. Further attempts to use the identifier should not be made unless the Station Location for the Station Identifier in the error message can be changed.

HU014 '****ATTEMPT TO PROCESS MULTIPLE H OR N CARDS FOR STATION Station No. IS ILLEGAL' -- The program found two or more Station Name cards or two or more Station Header cards while processing header updates for the Station listed in the error message.

User Response: Remove duplicate cards and reprocess.

HU015 **********THE STATION ID. SPECIFIED WAS CODED INCORRECTLY - ID = Station Id. No. -- This check is made only if the AGENCY= USGS. An eight-digit downstream station identification number was coded incorrectly. The first digit must be coded in column 9 and the last digit coded in column 16.

User Response: Recode the station identifier and reprocess the card.

HU016 **********NEW STATION ID. SPECIFIED INCORRECTLY -- This check is made only if the AGENCY=USGS. The eight-digit downstream station identification number entered in columns 17-31 of the I (station number change) card was coded incorrectly. The first digit must be coded in column 24 and the last digit coded in column 31.

User Response: Recode the new Station Identifier and re-process the I card.

HU017 INPUT TO HDRINPT FILE CONTAINS ILLEGAL FORMAT -- The user has attempted to enter station header records in the 152-byte format (see Section III.A.5.a. (Figure 8)), and the update program has detected a format error.

User Response: Data submitted through the HDRINPT file must conform to the correct format. Check carefully the data stored in the first two bytes of the Station Header Records.

HU018 HEADER FILE OVERFLOW FILLED -- The overflow area of the Station Header File has been filled and the file must be recreated.
User Response: Contact the WATSTORE Data Processing Unit in Reston, Virginia.

HU019 KEYCOND=code -- An Input/Output Error has occurred in processing a Station Header Record.

User Response: Attempt to reprocess the data. If the error persists, contact the WATSTORE Data Processing Unit in Reston, Virginia.

HU020 DATA NOT TRANSFERRED TO STORET DUE TO ERROR IN LAT-LONG -- An error has been found in a Station Locator in attempting to transfer data to STORET.

User Response: Correct the Station Locator (Latitude-Longitude) and reprocess.

Bytes	Data Format	Item
1	CHAR(1)	RESERVED
2	CHAR(1)	Charater '1'
3-7	CHAR(5)	Agency Code as assigned by WATSTORE
8-22	CHAR(15)	Station Identification Number
23-37	CHAR(15)	Station Locator
23-28	CHAR(6)	Latitude DDMMSS
29-35	CHAR(7)	Longitude DDDMMSS
36-37	CHAR(2)	Sequence Number NN
		D=Degree M=Minute
		S=Second N=0-9
38-39	CHAR(2)	FIPS numeric state code where station is located
40-41	CHAR(2)	For USGS sites only, the district (numeric state code) or the alpha project code will be stored for the office responsible for collecting and storing the data.
42-44	CHAR(3)	FIPS county code where the station is located.
45-50(4)	CHAR(2)	An array of 3 possible site codes indicating the major class of data collected at the site. Codes are assigned by WATSTORE.
51-52	CHAR(2)	Reserved
53-100	CHAR(48)	Station Name
101-108	CHAR(8)	Major Geologic Unit codes are assigned by WATSTORE

FIGURE 8. STATION HEADER RECORD FORMAT (April 1975)

Figure 8, Continued

Bytes	Data Format	Item
109	CHAR(1)	Aquifer Type Code assigned by WATSTORE
110-120		Reserved
121-124	FIXED BIN(31)	Hydrologic Unit Code from USGS State Hydrologic Unit Maps
125-128	FLOAT(6)	Drainage Area in square miles
129-132	FLOAT(6)	Contributing Drainage Area in square miles
133-136	FIXED DEC(7,2)	Datum - Feet above mean sea level
137-140	FLOAT(6)	Well Depth in feet
141-152	CHAR(12)	Reserved

UPDATE HEADER RECORD

MAR 18, 1975

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	323232120323200	323232	1203232	02	06	06	016	GW	10842010		

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
TEST WELL # J163/75	112SVLG	688.23	U	1344.57	NULL	NULL	100001000

NEW HEADER RECORD

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	323232120323200	323232	1203232	02	06	06	016	GW	10842010		

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
TEST WELL # J163/75	112SVLG	688.23	U	1344.57	NULL	NULL	100001000

FIGURE 9. STATION HEADER RECORD INPUT AND UPDATE

UPDATE HEADER RECORD

MAR 18, 1975

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02290718				14	12			40010010	7.52	

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
STA # 18 NAME TEST				1.69	NULL	NULL	100001000

OLD HEADER RECORD

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02290718	253110	0802048	00	12	12	025	SW			

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
10BCANAL 102 AB S21A NR HOMESTEAD FLA					1234	5678	100001000

HU005 THE FOLLOWING DATA FIELDS FOR THE HEADER RECORD LISTED ABOVE, WERE FOUND TO CONTAIN ONE OR MORE ERRORS

LAT/LG OUTSIDE STATE

HU006 ********** NO UPDATES MADE **********

FIGURE 10. STATION HEADER INPUT AND UPDATE WITH ERROR MESSAGES

RECORD ACCESS KEY CHANGE

AGENCY	OLD STATION IDENT.	AGENCY	NEW STATION IDENT.
USGS	323232120323200	USGS	323232120323202

OLD HEADER RECORD

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	323232120323200	323232	1203232	00	06	06	016	GW	10842010		

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
TEST WELL # J163/75	112SVLG	688.23	U	1344.57	NULL	NULL	100001100

NEW HEADER RECORD

MAR. 18, 1975

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	323232120323202	323232	1203232	00	06	06	016	GW	10842010		

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
TEST WELL # J163/75	112SVLG	688.23	U	1344.57	NULL	NULL	100001000

FIGURE 11. STATION IDENTIFICATION NUMBER/AGENCY CODE CHANGE

DELETE HEADER RECORD

MAR 18, 1975

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02290731	DELETE									

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
					NULL	NULL	100001000

OLD HEADER RECORD

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02290731	330000	0833000	31	13	02	001	LK			

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
INITIAL ENTRY					NULL	NULL	100001000

STATION DELETED FROM WRD STATION HEADER FILE

FIGURE 12. STATION HEADER RECORD DELETE

DELETE HEADER RECORD

MAR 18, 1975.

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	330000083300031	DELETE									

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
					NULL	NULL	100001000

OLD HEADER RECORD

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	330000083300031		022907	31	13	02	001	LK			

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
INITIAL ENTRY					NULL	NULL	100001000

****

HU013 PRIME STATION ID. NOT SPECIFIED FOR UPDATE OR DELETE OPERATION, PRIME STA. ID. = 02290731

****

HU006 ********** NO UPDATES MADE **********

FIGURE 13. STATION HEADER RECORD DELETE WITH ERROR MESSAGES

CURRENT HEADER RECORD

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM.	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1 #2 #3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	323232120323200	323232	1203232	00	06	06	016	GW	10842010		

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERNAL USE TDQPUMLER
TEST WELL # J163/75	112SVLG	688.23	U	1344.57	NULL	NULL	200001100

CURRENT HEADER RECORD

HU010 STATION IDENTIFICATION NUMBER 323232120323202 FOR AGENCY USGS WAS NOT FOUND IN THE WATSTORE STATION HEADER FILE.
PLEASE CHECK INDENTIFICATION ALIGNMENT.

FIGURE 14. STATION HEADER RECORD LISTING

CHAPTER III. INSTRUCTIONS FOR STATION HEADER FILE

SECTION III.B. Retrieving Data from the Station Header File (Program G745)

by William G. Shope, Jr.

CHAPTER III. INSTRUCTIONS FOR STATION HEADER FILE

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III.B. Retrieving Data from the Station Header File (Program G745)

III.B.1. Introduction

The records stored in the Station Header File are for stations identified by station identification numbers and located by latitudes and longitudes. The types of data in the file include state and district codes, county codes, site codes, hydrologic unit codes, and station names. Records for surface-water sites also include drainage area, contributing drainage area, and gage datum. Records for ground-water sites include land surface datum, geologic-unit code, well depth, and aquifer type. A complete description of the Station Header File content is in Section III.A.

The retrieval procedures described in this section permit: (1) listing of the station header records, (2) output of data on punch cards or magnetic tape, and (3) creation of temporary data sets for use with selected application programs (QWTABLES, LPLOT). The primary retrieval program is G745. This program is supported by an IBM utility sort, a station header record listing, and card punch program (Program number G748). These programs have been incorporated into two user procedures which are described in the following instructions.

This set of instructions supplements the "Instructions for Entering and Updating Data Stored in the WATSTORE Station Header File" (Section III.A.).

Programs G745 (Retrieval) and G748 (Listing-Punch) were written by William G. Shope, Jr. and Charles F. Merk, U.S. Geological Survey, Reston, Virginia.

III.B.2. Retrieval Specifications

Retrieval specifications may be either extremely simple or quite complex. An example of a simple retrieval would be to supply only the requirement to retrieve station header data for one site. This would involve submitting only the following three items.

- Agency Code (1 entry on EXEC card, AGENCY=code)
- Master Retrieval Control Card (1 entry, M in column 1)
- Station List Card (2 entries, D in column 1, Station Identifier in columns 2-16)

The retrieval specifications given above will be discussed in detail at a later point within this section. Depending on the user's needs, the retrieval specifications could grow to a point where large numbers of sites are involved for a request that includes controls or limits on every data item (i.e., county, datum, etc.) associated with a Station Header Record.

Retrievals can be broken up into two classes of specifications; mandatory, which are required for each retrieval, and optional, which allow the user to define the characteristics of the sites and data desired. For example, a retrieval might be made of data for all surface-water sites with a drainage area greater than 100 square miles in Somerset County, Pennsylvania. This retrieval calls for four optional specifications to define the appropriate sites.

The two classes of retrieval specifications are outlined briefly in the following two sections. Specific instructions for coding specifications are given within this section (III.B.2.).

III.B.2.a. Mandatory Specifications

Three mandatory control items must be submitted for each Station retrieval: (1) agency code; (2) Master Control card; and (3) Station Selection card.

III.B.2.a.(1) Agency Code

The agency code is a key part of the identification of a data collection site and must be provided for each retrieval.

Either of two methods for identifying the agency to the retrieval program (G745) may be used. First, if the major part of a retrieval involves station header data collected by a single agency, the agency code should be placed on the EXEC card and identified by the use of the AGENCY symbolic JCL parameter. Second, if the Station Header data belongs to several agencies, use the Password/Agency Identification card (Z card). This card must be positioned before (ahead of) a station selection card. Codes submitted on the Z card will override the agency code on the EXEC card. Both options are described in Section III.B.2.i.

A special code (ALLAG) may be used for regional type (polygon) retrievals where data are to be retrieved for all stations in a given area regardless of the agencies operating the stations. The ALLAG code may be used with a special class of station range as described in Section III.B.2.i.(2). Polygon retrievals are discussed further in Section III.B.2.j.(3).

III.B.2.a.(2) Master Control Card

This card must appear as the first card for each retrieval, even if the card is blank except for the M in column 1.

III.B.2.a.(3) Station Selection Cards

Three station selection card options are available that will be discussed in more detail later in these instructions.

- Station Identification Number List
- Station Identification Number Ranges
- Polygons defined by vertices of latitude and longitude given in degrees, minutes, and seconds.

III.B.2.b. Optional Specifications

The optional specifications apply to all data items in the Station Header record, with the exception of the agency code, station identifier, station locator, and passwords. The optional specifications are provided to the computer either by a list, or by submitting a range of values. A summary of these options and their limits is given in Table 1. The last column in Table 1 lists the card type used for entering the specifications. For range specifications, either maximum and minimum may be given, or, each may be submitted separately (alone).

If the maximum or minimum for a range is omitted, the check on the omitted value will be bypassed. Note that all range specifications are inclusive (i.e., 2-10 includes the values 2 and 10). If the maximum value specified is less than, or if the minimum value

Entry in Station Header Record	Retrieval Method	Maximum List Size	Control Card Type
State Code	List	5	L
District Code	List	5	L
County Code	List	25	L
Site Code	List	5	A
Station Name/Local Well Number	List and Range	5	N N
Hydrologic Unit	List	5	L
Drainage Area	Range		E
Contributing Drainage Area	Range		E
Datum	Range		E
Well Depth	Range		E
Geologic Unit	List	5	A
Aquifer Type	List	5	A

TABLE 1. OPTIONAL RETRIEVAL SPECIFICATIONS

specified is greater than the corresponding data value in a header record, the site will be rejected (header value outside of the range). For list retrievals, the list may contain from one up to and including the maximum number of items given in Table 1. All entries in a user specified list are compared with the corresponding entry in each header record until a list is exhausted (record rejected) or a match is found (record accepted).

The omission of an optional specification indicates to the computer that the item is not to be considered during the processing of the retrieval specifications.

If a station header record passes all retrieval specifications, the entire record with all entries will be retrieved. Detailed instructions for preparing the control cards are given in the following sections.

III.B.2.c. Multiple Retrievals

More than one retrieval request may be submitted for each execution of a Station Header File Retrieval Procedure providing that there are no output sort requests, or that all sort requests are identical. Sort requests are discussed in the next section. Each retrieval request must begin with a Master Control Card (M card) and end with a station selection card. The organization of the control cards is discussed in Section III.B.2.1. The retrieval program will sequence the output to insure that the data resulting from each request will be processed as specified.

III.B.2.d. Master Control Card

The Master Control Card must be coded for each retrieval and must be the first card of each retrieval set. Figure 1 shows the portions of the Master Control Card that pertain to the Station Header Retrieval Procedures. The explanation of the card format is given following Figure 1.

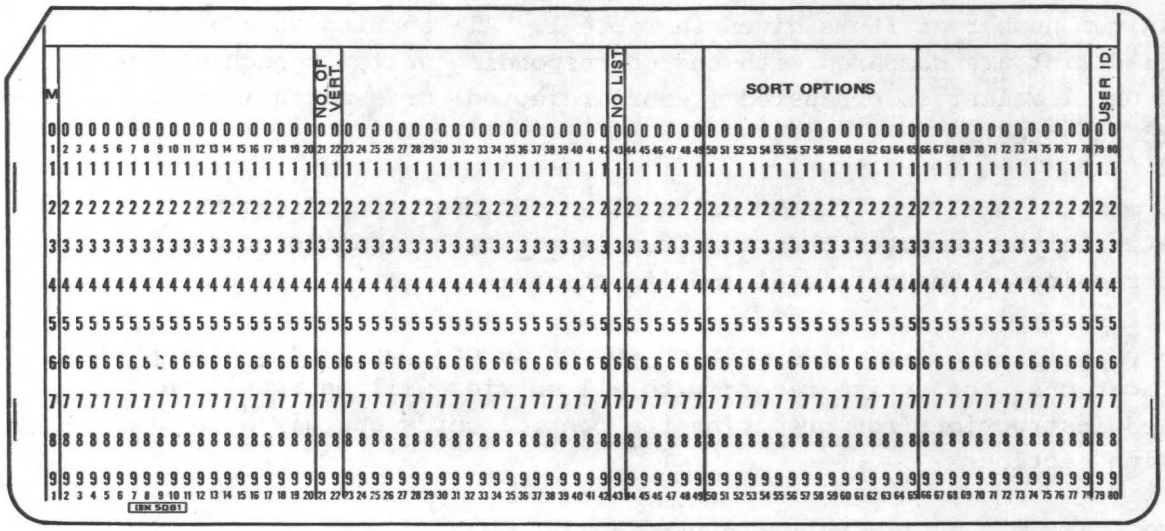


FIGURE 1. MASTER CONTROL CARD

Col. 1 — Card Type -- Enter an M

Col. 2-17 — Blank

Col. 21-22 — Number of vertices to be considered if a polygon is included in the retrieval. These columns are left blank if the retrieval specifications do not include a polygon. Code a leading zero if the value is less than 10. Polygon retrievals are discussed in Section III.B.2.j.(3).

Col. 20-42 — Blank

Col. 43 — To suppress the listings of the retrieval control cards, code an X in column 43. The default condition is to list all user-prepared control cards in the printed output.

Col. 44-49 — Blank

Col. 50-65 Sort Options. To specify the sorting order for output, a list of sort codes must be entered in columns 50-65. The available sort codes are listed below.

Sort Codes	Sort Control Item
A	Agency Code
C	County Code
D	District Code
E	Well Depth
G	Geologic Unit
H	Hydrologic Unit Code
I	Site Code
L	Station Locator (latitude-longitude-seq. no.)
P	Station Identifier
Q	Drainage Area
S	State Code
T	Aquifer Type
U	Datum
W	Station Name/Local Well Number

A maximum of nine sort control items may be requested. There are special options available for the W code (Section III.B.2.d.(2)) which allow for multiple use of this code. Each use of the W code accounts for one sort control item. Instructions

for coding columns 50-65 are given in Section III.B.2.d.(1). If more than one retrieval request is submitted for a given execution of a Station Header Retrieval Procedure, columns 50-65 of each M card must be identical. In other words, for multiple retrievals, there must be no sort requests, or all sort requests must be identical.

Col. 66-78 Blank

Col. 79-80 User Defined Retrieval Identifier. This field appears on most of the control cards and is intended to allow the user to properly sequence the cards in case the deck should become shuffled. This field will be ignored by the retrieval program.

■ III.B.2.d.(1) Sort Options

"Sorting" refers to the organization of the data into categories for printout. Should the user specify state (major sort control) and Agency (minor sort control), (SA) the computer would first select the header records for all of the states specified on the L card. Then, of these states (for example, Arizona (04), Nevada (32), Tennessee (47)), the computer would arrange the station header records into ascending order by state code. The next step would be to sort the station header records by agency codes (for example, EPA, USGS) within each state so that the agencies will be organized in alphabetical order. Thus, the records for all of the stations in Arizona, operated by EPA, would first be printed out, then all of those in Arizona operated by USGS, then the EPA stations in Nevada, and so on. For each retrieval, it is possible to do this for nine sort control items arranged in any order desired. If a sort option is not selected, the output from the retrieval will be in ascending order by agency code (major) and station identification number (minor).

The major to minor sort codes are to be inserted on the card by the user from left to right beginning in column 50 of the M card. The use of the W code may require more than one entry to define a sort control item. Therefore, the sort control specifications may require from 1 to 16 characters left-justified in columns 50-65 to describe the required number of sort control items. As an example, if it is required to order the header data by ascending county

code numbers, and local well numbers within each county, a C would be coded in column 50 (major sort field) and a W would be coded in column 51 (minor sort field).

III.B.2.d.(2) Extended Sort Option

When using the sort code W, an additional option ("extended sort option") is available which allows the user to specify a sort control field within the 48 characters of the station name field. This field is 48 characters long in the Station Header Record. As explained in Section III.A., it may contain a name, or some other local identifiers.

The general format for the extended sort option is Wp,n, where p is a one- or two-digit number which indicates the position (within the Header File station name/local well number field) of the first character which the computer should look at when sorting. Examples are given below. The letter n indicates how many characters should be looked at in the "sort field." If p and n are not given, the appearance of a W defaults to W1,24, which means the first character of the station name field, and the following characters, 24 in all.

The following examples demonstrate the use of the extended sort option for W codes.

Assume that a user defined municipal code had been entered in the 25th thru the 28th positions of the station name. These positions correspond to columns 41 thru 44 of the station name card (N card). It is desired to list the data by ascending well depth within ascending municipal code within county. Beginning in column 50 of the M Card, the following sort options would be coded: 'CW25,4E'. No intervening blanks are allowed in the sort option field.

Assume that a township number is coded in the first 4 positions of the station name field, and that a range number is coded in positions 5 thru 8 of the name field. It is desired to sort, in ascending order, township numbers within range number. Beginning in column 50 code 'W5,4W1,4'. Note that range number has been chosen as the major sort field. For this example, 2 sort fields have been identified within the station name field.

If no sort option is selected, the output from the retrieval will be in ascending order by agency code and station identification number.

There are 4 error messages (see Section III.B.5.c.) associated with the sort options.

The first message (SORT REQUEST CONFLICT) indicates that the user attempted a multiple retrieval with sort options specified for one or more of the retrievals. This is legitimate only if the sort options appearing on the first retrieval also appear on each successive retrieval. If this is not done, the error message will be printed and the retrieval will be bypassed.

The second message (ERROR IN SORT OPTIONS) indicates that either an illegal code has been entered in the sort option field, or that the options have been coded incorrectly. The program will attempt to point to the problem by listing the image of the M card and then placing the character X over the suspect code.

The third message (NO. SORT FLDS> 9) indicates that more than nine items have been specified as sort control fields.

The fourth message (ERROR IN DATA TYPE FOR SORT) indicates a system problem. The user should contact the WATSTORE ADP group in Reston, Virginia.

III.B.2.e. Locator Card

The L card (see Figure 2) is used to specify a maximum of 5 state codes, 5 district codes, 25 county codes, and 5 hydrologic unit codes to be used in qualifying station header records for retrieval. This card and all fields contained on the card are optional and need to be coded only if a retrieval is to be restricted to a given set of codes. For example, the absence of state codes on the retrieval specification indicates that the state code is not to be considered in selecting station header records for retrieval. The format of the locator card is given below.

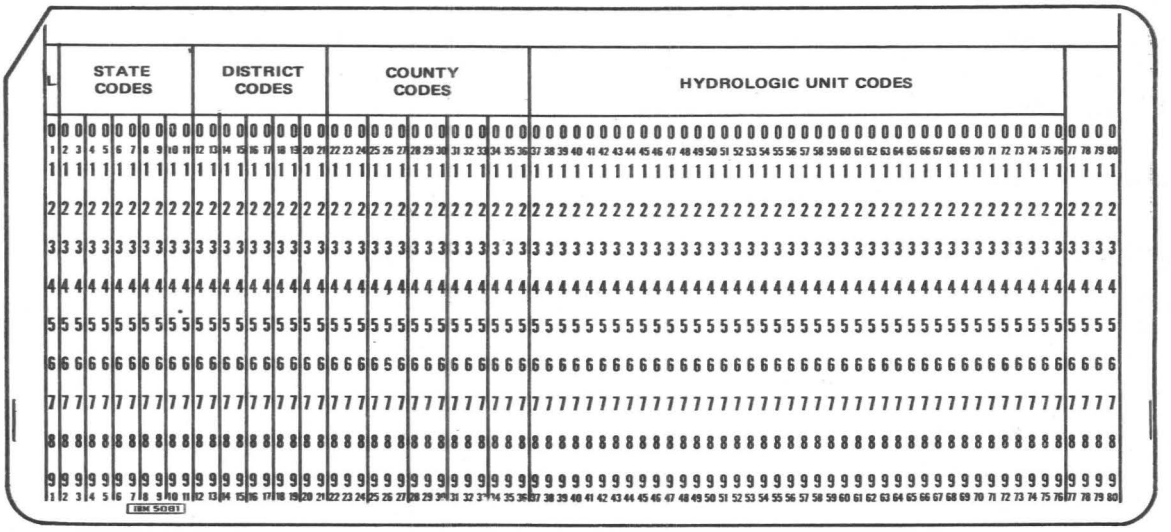


FIGURE 2. LOCATOR CARD

Col. 1	Enter an L
Col. 2-3, 4-5, 6-7, 8-9, 10-11	Two-digit state codes. See Appendix B for a list of numeric state codes.
Col. 12-13, 14-15, 16-17, 18-19, 20-21.	Two-digit district codes. For USGS users only.
Col. 22-24, 25-27, 28-30, 31-33, 34-36	Three-digit county codes. See Appendix C for list of codes. The station header re trieval allows for the listing of a maximum of 25 county codes therefore, 5 L cards may be required for a given retrieval. If multiple L cards are needed, the state, district, and hydrologic unit codes are to be entered on only the first L card.

	If county codes are specified, only one state code may be given, otherwise an error condition will be raised, and the retrieval will be bypassed.
Col. 37-44, 45-52, 53-60, 6]-68, 69-76	Hydrologic Unit Codes. Hydrologic unit codes are on the U.S. Geological Survey State Hydrologic Unit Maps.
Col. 77-78	Blank
Col. 79-80	User defined retrieval identifier. Same I.D. that appears on M card.

An example of the use of the L card is given below.

```
//xxxxxxnn  JOB (........
/*PROCLIB   WRD.PROCLIB
//  EXEC    HDRETR,AGENCY=USGS
//HDR.SYSIN DD *
M        (Master Control Card)
L42 (state code)  111051009 (county codes)
S   03020000        03100000
L24 (state code)  023001 (county codes)
S   03020000        03100000
/*
//
```

The S (station range) card is discussed in Section III.B.2.j.2 and the JCL is discussed in Section III.B.3.

This example allows for the retrieval of data from five counties; three in Pennsylvania, two in Maryland.

III.B.2.f. Additional Identifier Card

The A card (see Figure 3) is used to specify a maximum of 5 geologic unit codes, 5 site codes, and 5 aquifer type codes to be used in qualifying station header records for retrieval. This card and all fields contained on the card are optional and need be coded only if a retrieval is to be restricted to a given set of codes. For example, the absence of site codes on the A card indicates that the site code is not to be considered in selecting station header records for retrieval. The format of the Additional Identifier Card is given below.

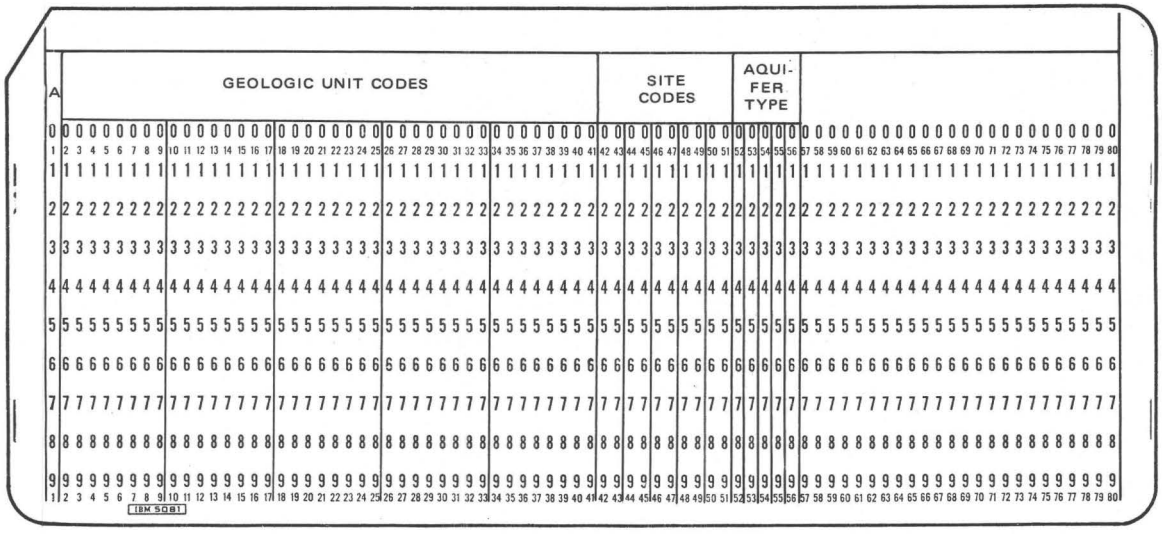


FIGURE 3. ADDITIONAL IDENTIFIER CARD

Col. 1	Enter an A
Col. 2-9, 10-17, 18-25, 26-33, 34-41	Eight-character geologic unit codes left justified. See Appendix F for a list of codes. A discussion of the options available for retrievals based on the geologic unit codes is given Section III.B.2.f.(1).
Col. 42-43, 44-45, 46-47, 48-49, 50-51	Two-digit site codes. The site codes are as follows:

Stream	=	SW
Well	=	GW
Spring	=	SP
Lake or Reservoir	=	LK
Estuary	=	ES
Meteorological	=	ME

Specific Source	=	SS - Sample Source

The SS code applies only to U.S. Geological Survey users (AGENCY=USGS). The SS code does not apply to the Daily Values Data Files. For multiple parameter data records, the sample source will be identified through the use of parameter code 72005.

Col. 52, 53, 54, 55, 56	One character aquifer type code. See "Instructions for Entering and Updating Data stored in the WATSTORE Station Header File" (Section III.A.) for a listing of the aquifer type codes and their use.
Col. 57-78	Blank
Col. 79-80	User defined retrieval identifier.

III.B.2.f.(1) Geologic Unit Code Retrieval Specifications (on A Card)

When specifying a list of geologic unit code(s) in columns 2-41 of the A card, the user has two options.

1. Specifying the entire geologic unit code so that retrieval will depend on the exact match with codes stored in the header records.

2. Specifying a portion or all of the geologic age so that retrieval will be made for those header records that contain geologic unit codes belonging to the specified age group.

To use the second option, the first n (n varies from 1 to 3) digits of the geologic age group to be retrieved should be coded beginning in column 2. (Column 1 is for A.) The digits must be left-justified in the control field(s). Based only on the geologic unit criteria, a header record will be selected for retrieval providing that it contains a geologic unit whose first n digits match one of the specifications coded in the control fields. As an example, if 11 had been coded in columns 2 and 3, header records containing geologic units belonging to the Cenozoic Era Quarternary System would be eligible for retrieval. Options 1 and 2 may be mixed in specifying a list of geologic units.

III.B.2.g. Extended Retrieval Control Card

The extended retrieval control card (see Figure 4) is used for specifying a maximum and minimum drainage area, contributing drainage area, well depth, and datum. The E card is optional, and need not be submitted unless the user wishes to restrict the retrieval of station header records based on one or more of the available data ranges. When coding a range of values for retrieval the user has 3 options:

1. The user may code both the maximum and minimum field. This defines an inclusive range of values that will allow for the retrieval of only those header records that contain a data value within the specified range.

2. The user may code only the maximum value--station header records containing a data value less than or equal to the

maximum value will be made available for retrieval. All other records will be rejected.

3. The user may code only the minimum value-station header records containing a value greater than or equal to the minimum value will be made available for retrieval. All other records will be rejected.

For all control fields, a decimal point must be entered if a fractional portion of a value is coded. The decimal point should occupy one column space. The control values may be entered anywhere within the specified input fields.

Column 9, 17, 25, 33, 42, 51, 60, and 69 have been reserved for overflow checks. These columns must be left blank or the error message "POSITION ERROR ON E CARD" will be printed, and the retrieval will be bypassed. The format of the E card is given below.

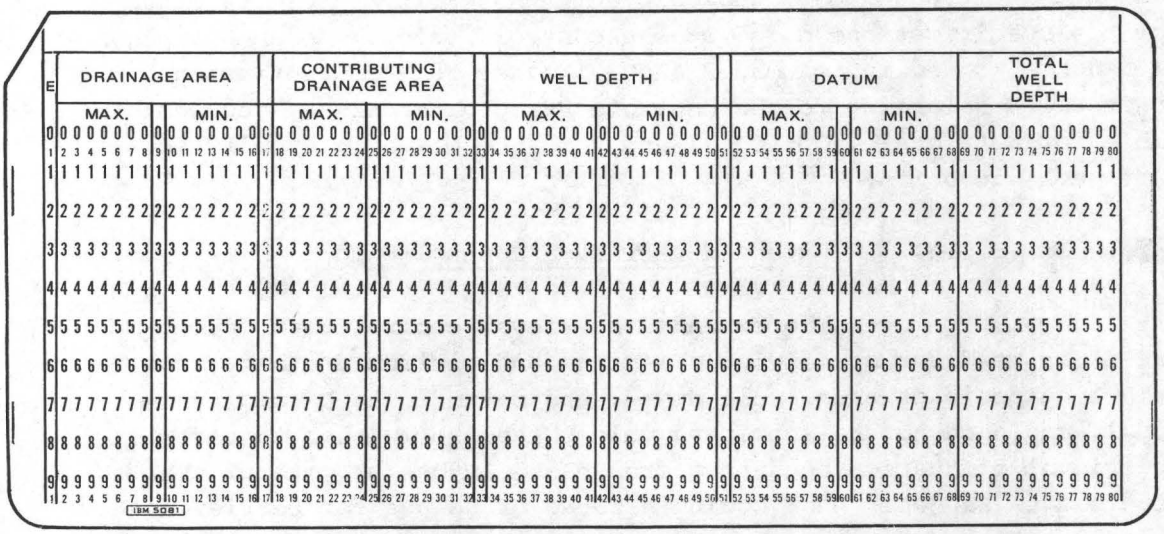


FIGURE 4. EXTENDED RETRIEVAL CONTROL CARD

Col. 1	Enter an E
Col. 2-8	Maximum Drainage Area
Col. 9	Must be blank
Col. 10-16	Minimum Drainage Area
Col. 17	Must be blank
Col. 18-24	Maximum Contributing Drainage Area
Col. 25	Must be blank
Col. 26-32	Minimum Contributing Drainage Area
Col. 33	Must be blank
Col. 34-41	Maximum Well Depth
Col. 42	Must be blank
Col. 43-50	Minimum Well Depth
Col. 51	Must be blank
Col. 52-59	Maximum Datum
Col. 60	Must be blank
Col. 61-68	Minimum Datum
Col. 69	Must be blank
Col. 70-78	Blank
Col. 79-80	User defined retrieval identifier

■ III.B.2.h. Station Name Retrieval Card

The Station Name Retrieval Card (Figure 5) is used for retrieving station header records based on information in the station name local identifier field. Two options are provided: (1) MAX-MIN range retrieval, (2) String Search Retrieval. The options may be mixed within a given retrieval.

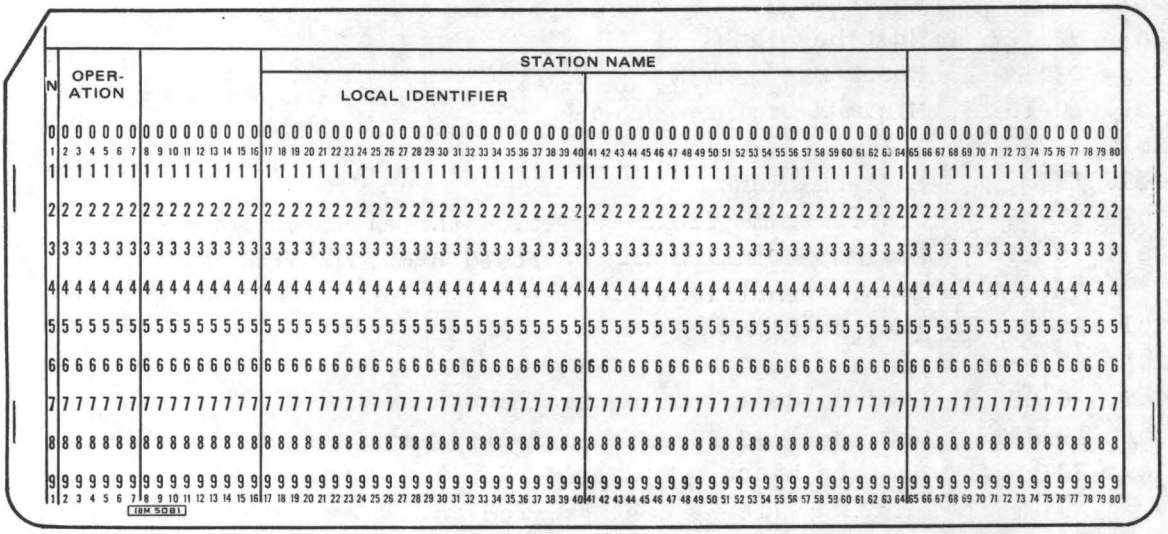


FIGURE 5. STATION NAME RETRIEVAL CARD

■ III.B.2.h.(1) MAX-MIN Range Retrieval Option

If the user has subdivided the name field into one or more fixed fields that contain local identifiers, then the name range retrieval option may be applicable for retrieving station header data. Only one subfield may be defined per retrieval. The subfield limits are identified to the retrieval program by the position within the N card name field of a specified maximum or minimum value. The first non-blank character found in the station name field (N card) is recognized as the beginning of the subfield. If the minimum value contains leading blanks, then replace the first or leading blank with an asterisk (*). This symbol will be converted to a blank after the beginning point of the subfield has been identified. The end of the subfield is located by an asterisk symbol (*) which follows the last position in the subfield. If no (*) symbol is found, the subfield extends to the end of the name field. The value entered on the N card is identified as a maximum or minimum by the operand coded in columns 2-4. The values coded may contain alpha, numeric, or special characters ((*) symbol excluded). The collating sequence (min. to max.) are special characters, alpha (A-Z), and numeric (0-9).

The format of the N card for the MAX-MIN range option is as follows:

Col. 1	Enter an N
Col. 2-4	Enter MAX or MIN
Col. 5-16	Blank
Col. 17-64	Station name field--Position the value string corresponding to the subfield that contains the local identifiers.
Col. 65-78	Blank
Col. 79-80	User defined retrieval identifier

It is not required to submit both a MAX and MIN card. An upper limit (MAX) or lower limit (MIN) may be submitted separately for a given retrieval. An example of the use of this option is given below. Assume that a district consistantly entered a township number right justified in the 10th thru the 13th positions of the station name field. The township numbers for the given district range from 90N to 101N. For this example, it is desired to retrieve only those sites within the range of 99N to 100N inclusive. The two N cards are coded as follows:

First Card

Col. 1	Enter an N
Col. 2-4	MIN
Col. 5-25	Blank--First 9 positions of the name field are blank thus positioning the first character of the subfield in the 10th position of the name field.
Col. 26	* Asterisk indicating the beginning character is blank.
Col. 27-29	99N remainder of the minimum value.

Col. 30 * asterisk follows the last character in the subfield.

Col. 31-78 Blank

Second Card

Col. 1 N - Second card

Col. 2-4 MAX

Col. 5-25 Blank

Col. 26-29 100N

Col. 30 * end of subfield

Col. 31-78 Blank

■ III.B.2.h.(2) String Search Retrieval Option

If a specifically identified contiguous string of characters (length 1 to 48) appears in fixed or varying locations within the station name field, that string can be used for retrieval. A maximum of 5 strings may be submitted for each retrieval. The first value of the string is coded in column 17 of the N card. An asterisk is coded following the last character in the string. The format for the N card for this option is as follows:

Col. 1	Col. 2-7	Col. 8-16	Col. 17-64 (Station Name Field)
N	SEARCH		xxxxxx.....*

where xxxxxx....represents a string of characters such as the name of a river, which appears in the station name field.

The retrieval program will search through the entire station name field of station header records attempting to match the search string and a substring of the station name. A match will retrieve the header record. The following example illustrates this option.

Identify all sites for which records are in the file that are located on the Mississippi or Missouri Rivers. The station name fields in the header records contain, at varying positions, the full name of the river. The two N cards required to make this retrieval are shown below.

First Card

Col. 1	Enter an N
Co. 2-7	SEARCH
Col. 8-16	Blank
Col. 17-27	MISSISSIPPI
Col. 28	* (end of string)
Col. 29-78	Blank

Second Card

Col. 1	N
Col. 2-7	SEARCH
Col. 8-16	Blank
Col. 17-24	MISSOURI
Col. 25	* (end of string)
Col. 26-78	Blank

■ III.B.2.i. Password-Agency Identification Card

The Password-Agency card is used to identify the agency operating one or more data collection sites for which records are in the Header file. (See Figure 6.)

When used, the Password-Agency Identification card (Z card) must be positioned in the job deck so that it immediately precedes the station selection card to which it applies. Station selection cards are discussed in the next section. If a station selection card is not preceded by a Z card, the agency code for the site will be taken from the AGENCY symbolic JCL parameter coded on the EXEC card. When the Z card is used, the association with station selection cards (D, S, and V) cards is as follows:

- Station List Card (D card) -- One Z card preceding each D card
- Station Range Card (S card) -- One Z card preceding each S card
- Polygon Vertex Cards (V cards) -- From one to five Z cards (up to five agencies) preceding each set of V cards (each V card has one or two latitude-longitude identifiers on it) that define a polygon. (Polygon Retrieval is discussed below in Section III.B.2.j.(3).

An example is given below to illustrate the association of agency codes with station selection cards. (Cards beginning with a slash (/) are job control language (JCL) cards.) The D, V, and S cards are station selection cards. The number with parantheses on the station selection cards represents a reference number for the purposes of this discussion.

```
Col. 1              Col. 12                      Col. 27

●                   ●                            ●
//wxxyyyzz           JOB (aaaaaaaaa,bbbbb),       'your name'
/*PROCLIB           WRD.PROCLIB
/*SETUP             volserno/9
//Stepname   EXEC   HDRLIST,AGENCY=USAG
//HDR.SYSIN DD *
M       (master control card)
D       (station list card)                      (1)
D                                                (2)
Z             USGS  (agency=USGS)
D                                                (3)
Z             USACE (agency=USACE)
S       (station range card)                     (4)
```

```
S                                                          (5)
Z              USGS  (agency=USGS)
Z              USEPA (agency=USEPA)
V                                                          (6)
V                                                          (7)
V                                                          (8)
/*        (delimiter card)
//        (null card)
```

In this example, Station Selection Cards (1), (2), and (5) will be associated with the agency coded in the symbolic JCL parameter AGENCY=USAG on the EXEC card. The agency code USGS on the first Z card will be used by the computer to retrieve the site identified on Station Selection card (3). The agency code USACE on the second Z card will be used to retrieve all sites that are a part of the station range defined on Station Range card (4). Cards (6), (7), and (8) define a polygon. The polygon retrieval will include all sites within that polygon that are associated with the agencies identified as USEPA and USGS on the two Z cards preceding (6), (7), and (8).

The format of the Z card as it applies to Station Header retrievals is shown below.

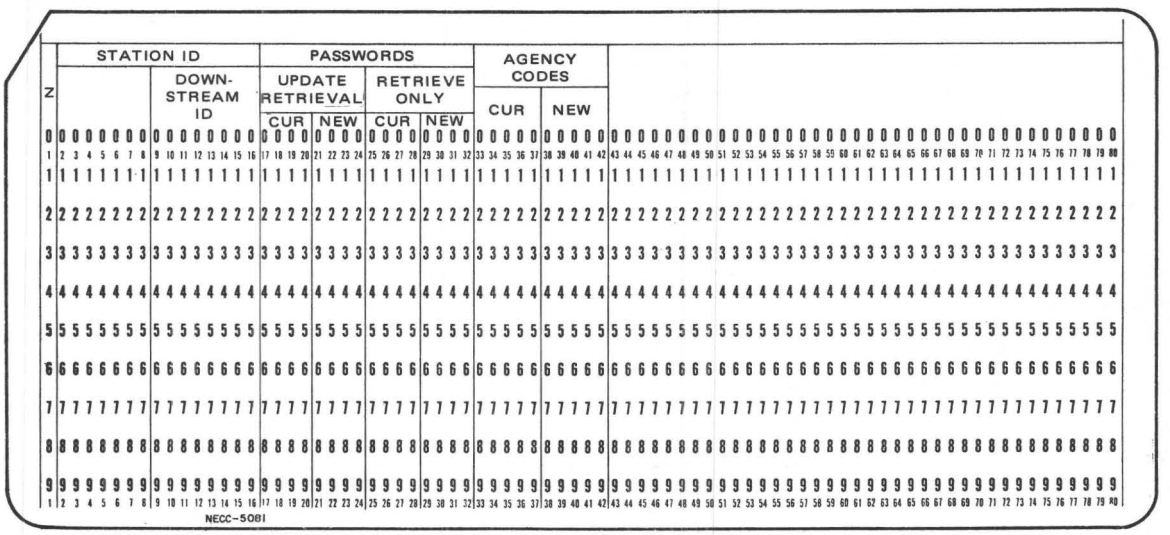


FIGURE 6. PASSWORD-AGENCY IDENTIFICATION CARD
CARD TYPE Z

Col. 1	Enter a Z
Col. 2-16	Station Identification Number. This entry is left blank when the Z card precedes an S card or a set of V cards.
Col. 17-24	Blank
Col. 25-28	Retrieval Password. The use of this field is discussed in Chapter IV.B. For retrieval of station header data this field is ignored by the computer program.
Col. 29-32	Blank
Col. 33-37	Agency Code. When the Z card is used, this agency code will qualify the sites listed on the station selection card that immediately follows the Z card.
Col. 38-80	Blank

III.B.2.j. Station Selection Cards (D, S, V cards)

The three types of station selection cards provide for obtaining: (1) a list of individual stations, by site identifier (D cards); (2) a group of stations whose station identification numbers fall into a defined range (S cards); or (3) a group of stations that lie within a polygon whose vertices are defined by latitude and longitude (V cards). The user must submit for each retrieval segment one or more station selection cards that define one or more of the three retrieval methods noted above. Within certain limits (i.e., all polygons must contain the number of vertices specified on the M card) a given retrieval may use one, two, or all three methods with repetitions of any or all of the methods. It must be noted that station selection specifications are additive rather than conjunctive, that is, each group of D, S, or V cards will be treated as a separate retrieval, regardless of any duplication that might occur. If a polygon (V cards) is specified and followed by a station range (S card), all stations in the polygon will be retrieved followed by a retrieval of all stations in the station range. It is possible to have a retrieval that includes a station list (D cards), one or more station ranges (S cards), and one or more polygons (V cards). Since each station selection is handled

independently, the user should attempt to ensure that multiple references to the same station are avoided in order to prevent duplicate processing.

The station selection cards activate the retrieval of data, therefore these cards must be placed at the end of each retrieval. This will become clear in Section III.B.2.l. where organization of the cards for a job is discussed. If this is not done, other retrieval specifications (i.e., state code) may be omitted.

For each station selection card or group of station selection cards (vertex cards) submitted, an agency code must be available in order to complete or qualify the identification of the sampling sites. The two methods for entry of an agency code are described in the previous section (Section III.B.2.i.). If an agency code is not available prior to the processing of a station selection card, an error message will be printed, and the retrieval will be bypassed.

A detailed description of each of the three station selection methods is given below.

III.B.2.j.(1) Retrieval by Individual Station Identification Numbers (D Card)

Data for any number of individual stations selected may be requested for a given retrieval (station identification number list). The format of the list card (D card) is given below.

Col. 1	Enter a D
Col. 2-16	Station Identification Number. Care must be taken to insure that the placement or alignment of the identifier within the 15-character field is consistent. An error involving one or more positions will cause the retrieval to fail. If the user does not know all station I.D. numbers, he should obtain them from the agency operating the stations, or he may use a polygon retrieval.
Col. 17-78	Blank
Col. 79-80	User defined retrieval identifier

III.B.2.j.(2) Retrieval by Station Range (S Cards)

The station range retrieval permits the retrieval of a group of selected stations operated by a given agency. The specifications require a beginning and ending station identifier which might be numerical or alphabetical, or both. A site will be considered a candidate for retrieval if the collating sequence of its 15-character station identifier is greater than or equal to the beginning station identifier, and less than or equal to the ending station identifier. There is one major limitation to this method of site or station selection. If a requested site is identified by the same 15-characters that were used as the station locator, then that site will be excluded from the range retrieval. When there is a possibility that this condition (site identifier=site locator) exists, a polygon retrieval must be used.

Care must be taken in coding the beginning and ending station identifiers. If a station identifier is coded in the wrong positions, the retrieval may fail, or the range may be incorrectly expanded to include a great many more sites than desired. If multiple types of station selection cards are processed in the same retrieval, the S card, if required, must always follow the D, and/or V cards.

The format of the station range card (S card) is given below.

Col. 1	Enter an S
Col. 2-16	Beginning station identifier
Col. 17-31	Ending station identifier
Col. 32-78	Blank
Col. 79-80	User defined retrieval identifier

The values coded in columns 2-16 and 17-31 do not have to be valid station numbers that actually occur in the Station Header file.

For a given retrieval, any number of ranges may be submitted. The ALLAG agency code may be used with a station range given the following conditions.

- Program G745 is being used as a preprocessor for a Daily Values Retrieval.

- The beginning and ending station identifiers define a range that provides for the station identification formats of all agencies.

- A, N, and E cards are <u>not</u> submitted.

- Only state code(s) are listed on an L card (columns 12-78 of the L card are left blank).

III.B.2.j.(3) Polygon Retrieval (V Cards)

Polygon retrievals provide an option to retrieve all data from within a specified area that is enclosed by a user defined polygon.

Retrieval (station selection) by station locator (latitude-longitude) requires coding of three or more latitude-longitude vertices that define a polygon. A maximum of 25 vertex cards are allowed providing for 50 vertices (2 vertices per card) for each polygon. The number of vertices submitted must match the entry in columns 21-22 of the M card.

The vertices must be ordered in a <u>counterclockwise</u> direction beginning at any vertex. The program will automatically close the polygon by extending a line from the last vertex to the starting point. Any number of polygons may be submitted for a retrieval, providing the number of vertices for each polygon is equal to the number given on the preceding M card. A polygon may not cross the equator or the zero and 180 degree meridians. The format of the vertex card (V card) is given below.

Col. 1	Enter a V
Col. 2-14	Vertex -- code all leading or trailing zeros
Col. 2-7	Latitude -- ddmmss where dd=degrees, mm=minutes, ss=seconds
Col. 8-14	Longitude -- dddmmss

Col. 15-16 Blank

Col. 17-29 Vertex

Col. 17-22 Latitude -- ddmmss

Col. 23-29 Longitude -- dddmmss

Col. 30-31 Blank

Col. 32-46 Begin Station Identifier -- This entry will be used only when it is necessary to limit the sites retrieved based on the collating sequence of the site identifiers. Code this entry only on the 01 card.

Col. 47-61 End Station Identifier -- Defines the end of the range. See discussion above.

Col. 77-78 Sequence number of card. These columns must be coded. Code 01, 02, 03, etc., as required. (MANDATORY ENTRY) If more than one polygon is specified, the numbering sequence (01, 02, etc.) is repeated for each set of V cards that define a polygon.

Col. 79-80 User defined retrieval identifier

■ III.B.2.j.(3).(a) Generated Polygons (V Card)

An option is available to request the retrieval program to generate a rectangular polygon that will encompass one or more states or one or more counties within a state. A single V card with the word "GENERATE" in columns 2-9 can be used to replace the two or more vertex cards that would normally be required. The state and county codes entered on the L card in the deck will be used to define the polygon.

If the "GENERATE" option is selected, and an invalid state or county code is in the L card, the retrieval will not take place, and an error message (NO LAT-LNG AVAILABLE) will be printed. It will not be necessary to code the number of vertices (columns 21-22, M card) for this option.

The format of the V Generate Card is given below.

Col. 1	Enter a V
Col. 2-9	GENERATE
Col. 10-31	Blank
Col. 32-61	Begin/End Station Identifiers - (see previous discussion of V card format)
Col. 62-78	Blank
Col. 79-80	User defined retrieval identifier

III.B.2.k. Restrictions

For each execution of the cataloged procedures described in this section, the number of retrievals is governed by the size of the output file (see Section III.B.3.a.(5)). Each retrieval must begin with an M card. A station locator cannot be used in place of a station identification number in a station list (D card) unless the two values are equal. The use of the station locator (latitude-longitude identifier) is limited to polygon retrievals only. The station range specification (S card) must not be used if there are any sites where the station identification number and the station locator are equal. For this situation, a polygon retrieval must be used.

III.B.2.l. Organization of the Control Cards

For each execution of the Station Header Record Retrieval Procedure, the control cards must be organized as follows:

	Col. 1	Col. 12	Reference
	•	•	
1.	//	JOB card	(II.A.2)
2.	/*PROCLIB	WRD.PROCLIB	(II.A.3)
3.	//STEPA EXEC	HDRETR	(II.A.5)
4.	//HDR.SYSIN	DD *	(II.A.6)
5.		(Master Control Card)	
6.		(Optional Control Cards: L,A, E, N, cards). The optional retrieval cards may be submitted in any order that the user desires.	

```
 7.                    (Station Selection Cards:  D,
                         S, and/or V cards)
 8.                    (Master Control Card for
                         retrieval number 2)
 9.                    (Optional Control Cards for
                         retrieval number 2)
10.                    (Station Selection Cards for
                         retrieval number 2)
                       •
                       •
                       •
11.  /*                                          (II.A.7)
12.  //                                          (II.A.7)
```

Any number of retrievals may be submitted for each execution of a retrieval procedure. The limiting factors will be disk space for the output data, lines of print and execution (CPU) time. For multiple retrievals, the user may wish to code a retrieval identifier in columns 79 and 80 of the control cards. The retrieval program does not read or process these card columns.

III.B.3. Cataloged JCL Procedures: HDRLIST and HDRETR

The previous section explained and illustrated the control cards necessary to retrieve data from the Station Header File. This section discusses how those cards are used in conjunction with the cataloged JCL procedures.

There are two cataloged job control language procedures for retrieving and processing station header data. The uses of the two procedures (HDRLIST and HDRETR) are described in the following two sections. The user should note that the EXEC card for each procedure allows for the entry of an agency code, i.e., // EXEC HDRETR,AGENCY=USGS. The scope of this agency code is described in Section III.B.2.i.

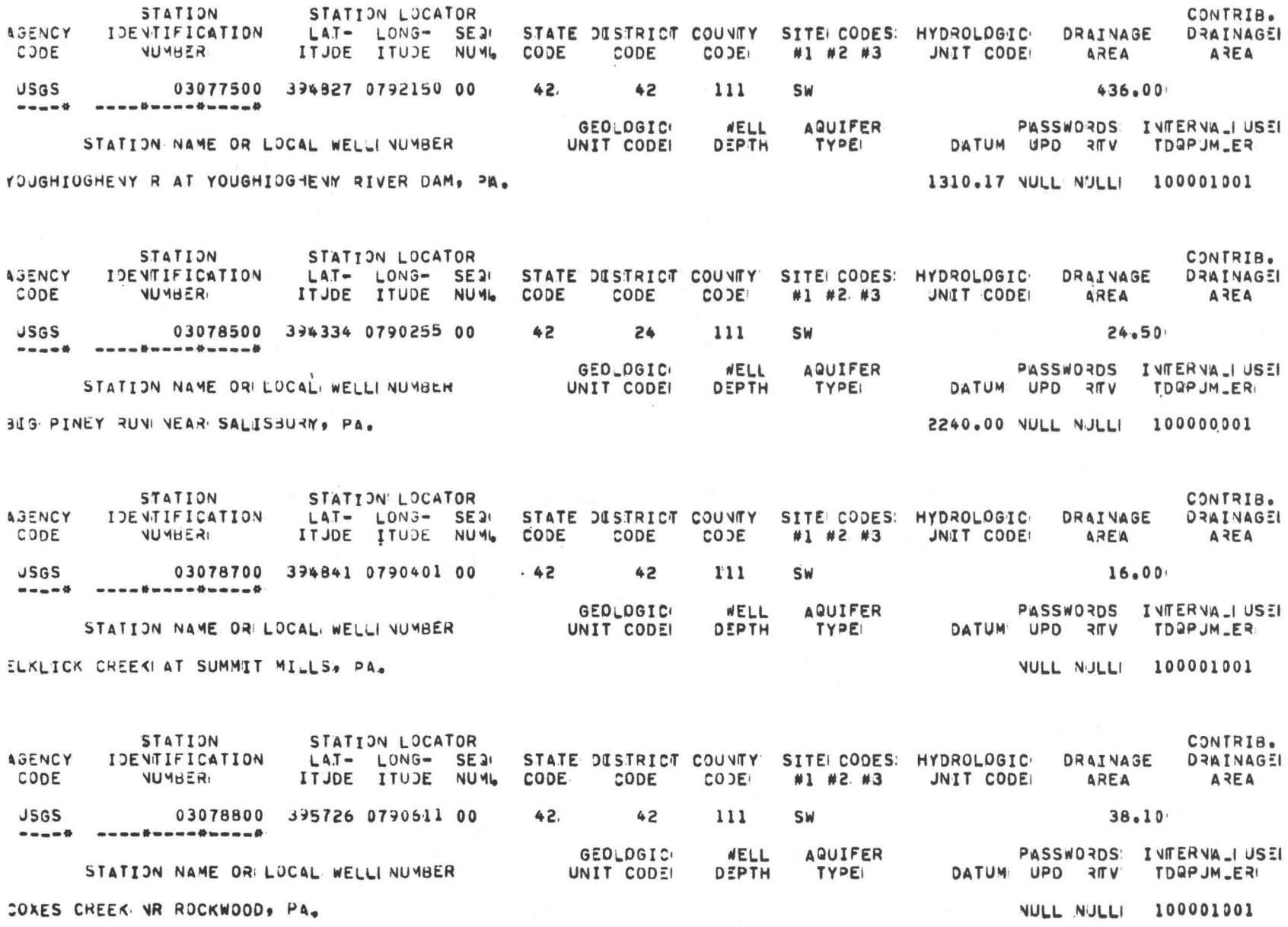
III.B.3.a. HDRLIST

The HDRLIST procedure can be used to produce the following output:

1. Station Header Record Listing (see Figure 7)

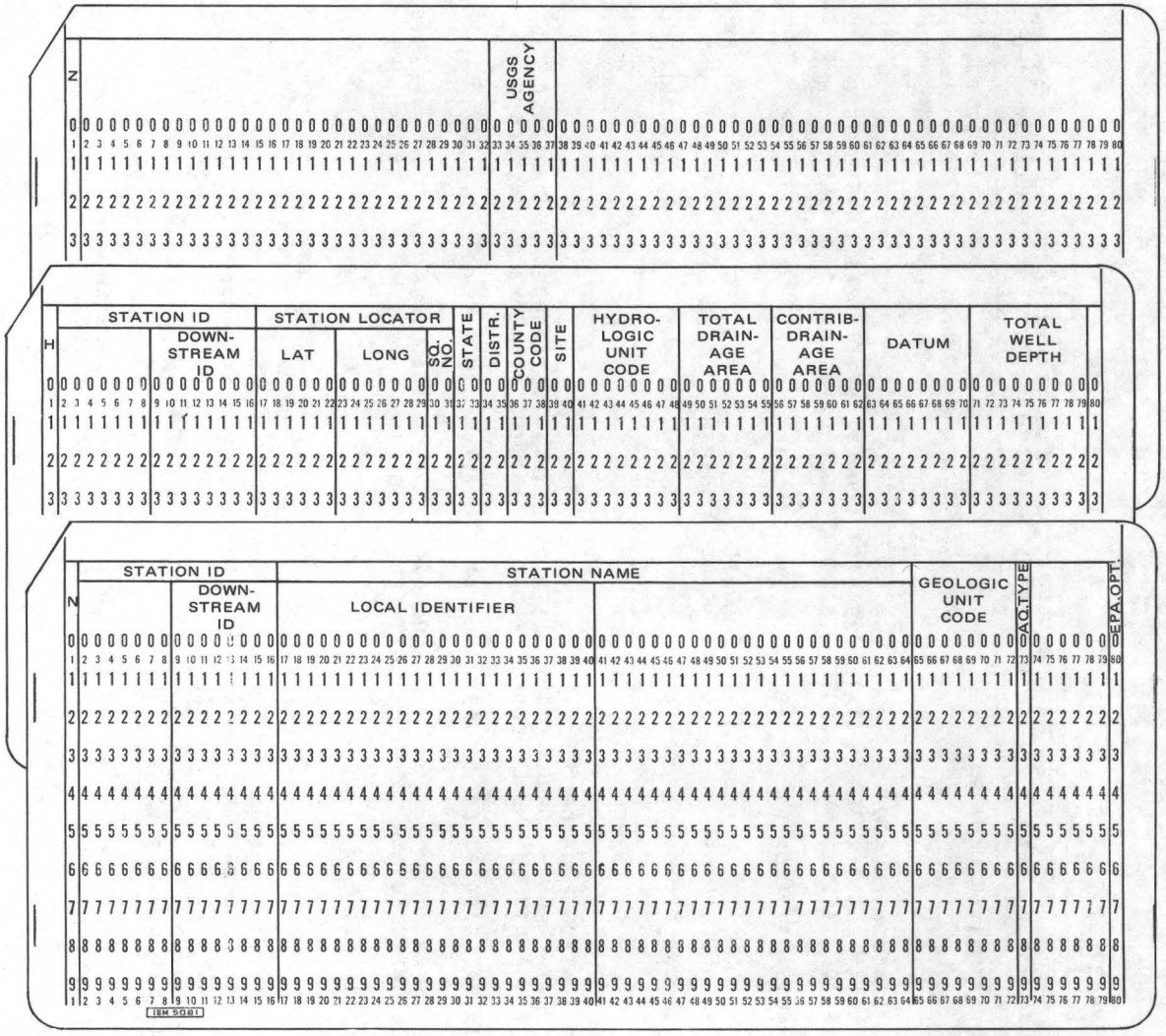
2. Punch Card Output (see Figure 8)

3. Station Header Records stored on magnetic tape or disk pack (see Figure 9)



```
AGENCY CODE | STATION IDENTIFICATION NUMBER | STATION LOCATOR LAT-ITUDE | LONG-ITUDE | SEQ NUM | STATE CODE | DISTRICT CODE | COUNTY CODE | SITE CODES #1 #2 #3 | HYDROLOGIC UNIT CODE | DRAINAGE AREA | CONTRIB. DRAINAGE AREA
USGS | 03077500 | 394827 | 0792150 | 00 | 42 | 42 | 111 | SW | | 436.00 |

STATION NAME OR LOCAL WELL NUMBER | GEOLOGIC UNIT CODE | WELL DEPTH | AQUIFER TYPE | DATUM | PASSWORDS UPD | PASSWORDS RTV | INTERVAL USER TDQPJM_ER
YOUGHIOGHENY R AT YOUGHIOGHENY RIVER DAM, PA. | | | | 1310.17 | NULL | NULL | 100001001

AGENCY CODE | STATION IDENTIFICATION NUMBER | STATION LOCATOR LAT-ITUDE | LONG-ITUDE | SEQ NUM | STATE CODE | DISTRICT CODE | COUNTY CODE | SITE CODES #1 #2 #3 | HYDROLOGIC UNIT CODE | DRAINAGE AREA | CONTRIB. DRAINAGE AREA
USGS | 03078500 | 394334 | 0790255 | 00 | 42 | 24 | 111 | SW | | 24.50 |

STATION NAME OR LOCAL WELL NUMBER | GEOLOGIC UNIT CODE | WELL DEPTH | AQUIFER TYPE | DATUM | PASSWORDS UPD | PASSWORDS RTV | INTERVAL USER TDQPJM_ER
BIG PINEY RUN NEAR SALISBURY, PA. | | | | 2240.00 | NULL | NULL | 100000001

AGENCY CODE | STATION IDENTIFICATION NUMBER | STATION LOCATOR LAT-ITUDE | LONG-ITUDE | SEQ NUM | STATE CODE | DISTRICT CODE | COUNTY CODE | SITE CODES #1 #2 #3 | HYDROLOGIC UNIT CODE | DRAINAGE AREA | CONTRIB. DRAINAGE AREA
USGS | 03078700 | 394841 | 0790401 | 00 | 42 | 42 | 111 | SW | | 16.00 |

STATION NAME OR LOCAL WELL NUMBER | GEOLOGIC UNIT CODE | WELL DEPTH | AQUIFER TYPE | DATUM | PASSWORDS UPD | PASSWORDS RTV | INTERVAL USER TDQPJM_ER
ELKLICK CREEK AT SUMMIT MILLS, PA. | | | | | NULL | NULL | 100001001

AGENCY CODE | STATION IDENTIFICATION NUMBER | STATION LOCATOR LAT-ITUDE | LONG-ITUDE | SEQ NUM | STATE CODE | DISTRICT CODE | COUNTY CODE | SITE CODES #1 #2 #3 | HYDROLOGIC UNIT CODE | DRAINAGE AREA | CONTRIB. DRAINAGE AREA
USGS | 03078800 | 395726 | 0790611 | 00 | 42 | 42 | 111 | SW | | 38.10 |

STATION NAME OR LOCAL WELL NUMBER | GEOLOGIC UNIT CODE | WELL DEPTH | AQUIFER TYPE | DATUM | PASSWORDS UPD | PASSWORDS RTV | INTERVAL USER TDQPJM_ER
COXES CREEK NR ROCKWOOD, PA. | | | | | NULL | NULL | 100001001
```

Figure 7 - Station Header Record Listing



Card Type

Z Password-Agency Identification Card
H Station Header Card
N Station Name Card

FIGURE 8. STATION HEADER PUNCH CARDS

FORMAT FOR WATSTORE STATION HEADER RECORDS
April 1975

Bytes	Data Format	Item
1	CHAR(1)	RESERVED
2	CHAR(1)	Character '1'
3-7	CHAR(5)	Agency Code as assigned by WATSTORE
8-22	CHAR(15)	Station Identification Number
23-37	CHAR(15)	Station Locator
23-28	CHAR(6)	Latitude DDMMSS
29-35	CHAR(7)	Longitude DDDMMSS
36-37	CHAR(2)	Sequence Number NN
		D = Degree M = Minute
		S = Second N = 0-9
38-39	CHAR(2)	FIPS numeric state code where station is located
40-41	CHAR(2)	For USGS sites only, the district (numeric state code) or the alpha project code will be stored for the office responsible for collecting and storing the data.
42-44	CHAR(3)	FIPS county code where the station is located
45-50	3(CHAR(2))	An array of 3 possible site codes indicating the major class of data collected at the site. Codes are assigned by WATSTORE.
51-52	CHAR(2)	Reserved

FIGURE 9. STATION HEADER RECORD FORMAT

Bytes	Data Format	Item
53-100	CHAR(48)	Station Name
101-108	CHAR(8)	Major Geologic Unit codes as assigned by WATSTORE
109	CHAR(1)	Aquifer Type Code assigned by WATSTORE
110-120		Reserved
121-124	FIXED BIN(31)	Hydrologic Unit Code from USGS State Hydrologic Unit Maps
125-128	FLOAT(6)	Drainage Area in square miles
129-132	FLOAT(6)	Contributing Drainage Area in square miles
133-136	FIXED DEC(7,2)	Datum--feet above mean sea level
137-140	FLOAT(6)	Well depth in feet
141-152	CHAR(12)	Reserved

FIGURE 9. STATION HEADER RECORD FORMAT (continued)

The control cards for requesting the station header data are discussed in Section III.B.2. The type of output (i.e., list, punch) is not affected by the retrieval control cards. However, the ordering of the output is determined by the sort options placed on the Master Control card (Section III.B.2.d.(1). The remainder of the discussion in this section will deal with producing the various types of output once the data has been retrieved.

III.B.3.a.(1) Listing Station Header Data with HDRLIST

The format for listing station header data by use of the HDRLIST procedure is shown in Figure 7. The standard output or default option of the HDRLIST procedure is to list all station header records that have met the retrieval specifications. The JCL cards required to list all output from program G745 is shown below.

```
Col. 1              Col. 12

•                   •
//xxxxxxxx          JOB (accntnumb,G745)      (job card)
/*PROCLIB           WRD.PROCLIB               (proclib card)
// EXEC HDRLIST,AGENCY=USGS                   (exec card)
//HDR.SYSIN DD *                             (card input)
      control cards                           (III.B.4.)
/*                                            (end of control)
//                                            (end of job)
```

In the remaining examples of JCL, only the EXEC card will be shown. In controlling the output options, only the EXEC card need be changed.

There are two options associated with listing station header data that can be used to edit the data stored in the WATSTORE Station Header File. The first option provides for listing a subset of the complete retrieval. This subset would be comprised of only those records that were missing one or or more of the eight mandatory entries (see Section III.A.2.). To list only this subset, modify the EXEC card as follows:

```
// EXEC HDRLIST,OUTPUT=LINC,AGENCY=code
```

The second edit option allows for printing only those station header records that were rejected during the retrieval

because an item that was a part of the retrieval specifications was found missing from one or more station header records. For example, if one or more county codes were specified in a retrieval request, then station header records meeting other major retrieval specifications (i.e., state code) but not containing a county code, will be retrieved and listed under this option. Records meeting the specifications, or records with county codes other than those requested would not be retrieved. This option is intended to allow the user to scan his data for missing header entries. It must be noted that an item (i.e., well depth) will be checked for a missing entry only if a retrieval specification has been made on the item (i.e., Max. or Min. well depth specified). If this edit option is not coded (Procedure Default), only header records meeting all retrieval specifications will be retrieved.

To use the rejected record edit option, code the EXEC card as follows:

```
// EXEC HDRLIST,OPTION=HINCP
```

III.B.3.a.(2) Station Header Data Punch Card Output Using HDRLIST

The formats of the punch card output are shown in Figure 8. The advantage of retrieving data in the form of punched cards is that these cards may then be used to enter data directly into another computer. Two options are available for producing punch card output. The first option allows for punching all data that has been retrieved. The EXEC card shown below will produce this type of output.

```
// EXEC HDRLIST,OUTPUT=PALL
```

The second option allows for punching only a subset of the complete retrieval. This subset would be comprised of only those records that were missing one or more of the eight mandatory entries (see Section III.A.2.). The EXEC card shown below will produce this type of output:

```
// EXEC HDRLIST,OUTPUT=PINC
```

The punching and listing options may be combined as shown in the following examples:

```
// EXEC HDRLIST,OUTPUT='LINC,PINC'
```

In this example only the incomplete station header records will be listed and punched.

III.B.3.a.(3) Storing Station Header Records on a User-Defined Magnetic Tape or Disk Using HDRLIST

The format of the 152-byte Station Header Record is shown in Figure 9. Four symbolic JCL parameters have been provided to allow the user to define the output file to be used for storing the station header records that met all retrieval specifications. The four parameters are listed below.

NAME1 Data set name of the user's data file.

DISP1 Disposition of the user's data file after completion of the job. Code DISP=KEEP if the data file is to be retained by the WATSTORE system. The default condition is to delete the file after the data has been listed or punched.

UNIT1 Unit of the user defined data set, i.e., tape unit is 2400.

VOL1 Volume serial number of the user defined data set.

When storing station header records on tape or disk, the user will need to consider whether or not the data are to be listed in addition to being placed on tape or disk. The default option is to list the data. In the example shown below, the data will not be listed (OUTPUT=NULL).

```
// EXEC HDRLIST,NAME1=MYDATA,DISP1=KEEP,UNIT1=2400,
// VOL1=000100,OUTPUT=NULL,AGENCY=USGS
```

III.B.3.a.(4) Station Header Record Count Option Using HDRLIST

A special option is provided for obtaining only the count of station header records that meet all retrieval requirements. An example of the EXEC card that will produce this type of count is shown below.

```
// EXEC HDRLIST,OPTION=COUNT
```

When the procedure is executed, no data will be retrieved or listed. The primary output of the retrieval will be a count of the number of sites that met all retrieval specifications.

III.B.3.a.(5) Allocating Additional Workspace for HDRLIST

The default conditions of the HDRLIST procedure allows for the retrieval and temporary storage of approximately 4800 station header records. If additional temporary (disk) storage is required, the symbolic JCL parameter SP5 may be modified to provide extra space. The default assignment of the SP5 parameter is 60 (tracks). One 3330 disk track will hold 81 station header records. The EXEC card listed below would allow for retrieval and temporary storage of 8100 station header records (100 x 81).

```
// EXEC HDRLIST,SP5=100
```

A second JCL parameter for increasing work space for the sort is also provided. The parameter SP4 controls the number of cylinders used for sorting. The default is 5, which allows for the sorting of 15,000 station header records. The example given below allows for sorting 50,000 station header records.

```
// EXEC HDRLIST,SP4=17
```

III.B.3.b. HDRETR

The primary purpose of the HDRETR is to retrieve station header data and to reformat the records for processing by two application procedures. The two application procedures (QWTABLES and LPLOT) are discussed in Section III.B.4. The control cards for requesting the station header data are discussed in Section III.B.2. The type of application is not affected by the retrieval cards. The order in which the data are listed (QWTABLES) will be affected by the sort options placed on the Master Control Card (Section III.B.2.d.(1)).

III.B.3.b.(1) Allocating Additional Workspace for HDRETR

The default conditions of the HDRETR procedure allows for the retrieval and storage of approximately 4300

reformatted station header records. If additional space (disk) is required, the symbolic JCL parameter SP5 may be modified to provide extra space. The default assignment of the SP5 parameter is 60 (tracks). One 3330 disk track will hold approximately 72 modified station header records. The EXEC card shown below would allow 7200 reformatted station header records to be retrieved or stored.

```
// EXEC HDRETR,SP5=100
```

A second JCL parameter for increasing work space for the sort is also provided. The parameter SP4 controls the number of cylinders used for sorting. The default is 5 which allows for the sorting of 12,500 reformatted station header records. Increasing SP4 by 1 will increase the capacity of the sort by 2500. Shown below is an example showing card setup for executing HDRETR followed by QWTABLES and LPLOT:

```
Col. 1                    Col. 12

•                         •
//xxxxxxxx                JOB (----)
/*PROCLIB                 WRD.PROCLIB
//STEP1 EXEC HDRETR,SP5=100
//HDR.SYSIN DD *
            •
            •
      Control cards -- (Including x cards for programs A534 and
       W4317)
            •
            •
/*
// EXEC QWTABLES
// EXEC LPLOT
//
```

For this example, the station header data will be printed (one site per line) by the QWTABLES procedure. The data will also be plotted in accordance with the specifications placed on the X cards. Note that the X cards for the listing (QWTABLES) and plotting (LPLOT) procedures must be included with the control cards following the HDR.SYSIN DD card and following the M card for each retrieval.

III.B.4. Retrieval Application Procedures

Application procedures supplement the routine retrieval procedures described in the previous sections. To employ the application procedures, first retrieve the data using data and station selection cards (as well as the JOB and other control cards). The retrieved data can then be consolidated into a table or a visual plot by the use of an application procedure. The application procedure cards must be included in the same deck which contains the retrieval cards, thus enabling the computer to process the retrieval and the application procedure as a single job.

There are two application procedures for listing (QWTABLES) or plotting (LPLOT) data stored in the Station Header File. Both procedures are executed in conjunction with the cataloged JCL procedure called HDRETR. The HDRETR procedure retrieves data from the Station Header File and formats the data for input to the two application procedures. The use of the HDRETR JCL procedure is discussed in Section III.B.3.b. The use of the application procedure QWTABLES and LPLOT are discussed in the following sections.

III.B.4.a. Retrieval Application - Formatted Tables (QWTABLES)

An example of printing station header data in a formatted table of header data is shown in Figure 10. In order to request this table, the user must submit an application control card (X card) for program number A534, and place an EXEC card for the cataloged JCL procedure QWTABLES in the job stream as shown in the example given later in this section.

An X card must be included with the control cards for the station header retrieval. Place the X card between the M card (Master Control) and the station selection card(s). The format of the application card is given below.

Col. 1	Enter an X
Col. 2-5	Enter A534
Col. 6-78	Blank
Col. 79-80	User defined retrieval identifier. Same identifier coded on M card.

PROCESS DATE 04/01/75

STATION NUMBER	LAT-I-TUDE	LONG-I-TUDE	SEQ. NO.	SITE	DATE OF SAMPLE	SURFACE AREA (SQUARE MILES)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE MSL)	TOTAL DEPTH OF WELL (FT)
394709079103701	39 47 09	079 10 37	01	GW	00-00-00	--	3213	131
394713078593801	39 47 13	078 59 38	01	GW	00-00-00	--	2500	100
394847079013601	39 48 47	079 01 36	01	GW	00-00-00	--	1950	125
395446079100001	39 54 46	079 10 00	01	GW	00-00-00	--	1820	150
395454078573001	39 54 54	078 57 30	01	GW	00-00-00	--	2150	72
395602078465701	39 56 02	078 46 57	01	GW	00-00-00	--	2040	207
395916078475201	39 59 16	078 47 52	01	GW	00-00-00	--	1565	40
400008079142701	40 00 08	079 14 27	01	GW	00-00-00	--	--	--
400008079142801	40 00 08	079 14 28	01	GW	00-00-00	--	2040	450
400104079044501	40 01 04	079 04 45	01	GW	00-00-00	--	2100	120
400128079082501	40 01 28	079 08 25	01	GW	00-00-00	--	2020	275
400258078592201	40 02 58	078 59 22	01	GW	00-00-00	--	2020	158
400642078580401	40 06 42	078 58 04	01	GW	00-00-00	--	1900	267
400722078484401	40 07 22	078 48 44	01	GW	00-00-00	--	2150	430
400838079025101	40 08 38	079 02 51	01	GW	00-00-00	--	1825	278
395924079144200	39 59 24	079 14 42	00	LK	00-00-00	--	--	--
400323079133000	40 03 23	079 13 30	00	LK	00-00-00	--	--	--
394337079025301	39 43 37	079 02 53	01	SP	00-00-00	--	2235	--
394740079130901	39 47 40	079 13 09	01	SP	00-00-00	--	2530	--
400024079011701	40 00 24	079 01 17	01	SP	00-00-00	--	2410	--
400302079155201	40 03 02	079 15 52	01	SP	00-00-00	--	2510	--
400351079143201	40 03 51	079 14 32	01	SP	00-00-00	--	2360	--
400412079152501	40 04 12	079 15 25	01	SP	00-00-00	--	2490	--
01600400	39 50 57	078 47 53	00	SW	00-00-00	9.7	--	--
03039200	40 02 49	078 50 00	00	SW	00-00-00	3.6	2340	--
03039700	40 06 18	078 47 55	00	SW	00-00-00	8.5	--	--
03039800	40 12 15	078 42 18	00	SW	00-00-00	5.1	--	--
03077500	39 48 27	079 21 50	00	SW	00-00-00	436	1310	--
03078500	39 43 34	079 02 55	00	SW	00-00-00	24	2240	--
03078700	39 48 41	079 04 01	00	SW	00-00-00	16	--	--
03078800	39 57 26	079 06 11	00	SW	00-00-00	38	--	--
03078820	39 54 49	079 09 14	00	SW	00-00-00	55	--	--
03079000	39 51 35	079 13 40	00	SW	00-00-00	382	1655	--
03079200	39 47 44	079 19 24	00	SW	00-00-00	430	--	--
03079500	40 00 32	079 14 04	00	SW	00-00-00	38	--	--
03080000	39 49 22	079 19 14	00	SW	00-00-00	121	1335	--
03081200	39 51 39	079 21 50	00	SW	00-00-00	6.7	--	--

Figure 10 - Formatted Table of Station Header Data

An optional list control card (O card--alphabetic O) is provided for controlling the format of the table. This card must also be included with the control cards for the station header retrieval. Place the O card just after the X card. The format of the output list control card is given below.

Col. 1	Enter an O (alphabetic)
Col. 2-6, 7-11, 12-16, 17-21, 22-26, 27-31, 32-36, 37-41, 42-46, 47-51, 52-56, 57-61, 62-66, 67-71, 72-76	Format control parameters; from 1 to 15 parameters may be entered in the columns specified. The parameters will be listed in the table in the same order coded on the O card.

*STAID	Station Identifier
*LATLG	Station Locator
*LOCAL	Local Identifier (first 24 characters of Station Name)
STATE	State Code
DISTR	District Code
CNTYC	County Code
SITEC	Site Code
GUNIT	Geologic Unit
SNAME	Station Name
HUNIT	Hydrologic Unit
CTBDA	Contributing Drainage Area
AGNCY	Agency
00049	Drainage Area
72000	Datum
72008	Well Depth

(*---One of three items marked with an asterisk must be the first code in the list.)

Col. 57-78	Blank
Col. 79-80	User defined retrieval identifier. Same identifier coded on M card.

If an output list control card is not submitted, the default condition will be to print the underlined parameters in the order specified in the above list.

A sample JCL setup for requesting formatted tables would appear as follows:

```
Col. 1                    Col. 12

•                         •
//xxxxxxnn                JOB
/*PROCLIB                 WRD.PROCLIB
// EXEC HDRETR
//HDR.SYSIN DD *
      Station header retrieval control cards including X card for
      program number A534
/*
// EXEC QWTABLES (execute program A534)
//   (end of job)
```

(Note: a delimiter statement (/*) is not required after EXEC QWTABLES.)

■ III.B.4.b. Retrieval Application - Line Printer Plots (LPLOT)

An example of line printer plots of station header data is given in Figures 11 and 12. In order to request these plots, the user must submit one or more application control cards (X card) for program number W4317, and place an EXEC card for the cataloged JCL procedure LPLOT in the job stream.

The application control card(s) for program number W4317 must be included with the control cards for the station header retrieval. Place the X card(s) between the M card (Master Control) and the station selection card(s). The formats of the X card(s) for program W4317 are described separately in Section III.C. because of the detail involved. A sample JCL setup for requesting line printer plots of station header data would appear as follows.

```
Col. 1                    Col.12

•                         •
//xxxxxxnn                JOB            (job card)
/*PROCLIB                 WRD.PROCLIB
// EXEC HDRETR
//HDR.SYSIN DD *
      Station header retrieval control cards including X card(s)
      for program number W4317
```

PROGRAM NO. = W4317

STATION HEADER DATA FOR SITE PLOTS

STATION ID. NO.	LAT.	LONG.	SN	ST.	DT.	CO.	SC	G. UNIT	PLOT NO.	STATION NAME OR LOCAL WELL NO.	
394709079103701	394709	0791037	01	42	42	111	GW	324PSVL	1	56	907356915001
394713078593801	394713	0785938	01	42	42	111	GW	337POCN	2	100	908356944
394847079013601	394847	0790136	01	42	42	111	GW	321MRSN	3	61	907356801001
395446079100001	395446	0791000	01	42	42	111	GW	324PSVL	4	53	907456935001
395454078573001	395454	0785730	01	42	42	111	GW	321CNMG	5	68	908456911001
395602078465701	395602	0784557	01	42	42	111	GW	341CMNG	6	69	908156905001
395916078475201	395916	0784752	01	42	42	111	GW	341CSKL	7	97	908156905002
400008079142701	400008	0791427	01	42	42	111	GW		8	U 2	
400008079142801	400008	0791428	01	42	42	111	GW	324PSVL	9	2	807356927001
400104079044501	400104	0790445	01	42	42	111	GW	321MNNG	10	23	807256940001
400128079082501	400128	0790825	01	42	42	111	GW	321CNMG	11	94	807456802
400258078592201	400258	0785922	01	42	42	111	GW	324KNNG	12	44	808356940002
400642078580401	400642	0785804	01	42	42	111	GW	324JNSN	13	42	508356935
400722078484401	400722	0784844	01	42	42	111	GW	324PSVL	14	34	808256938
400838079025101	400838	0790251	01	42	42	111	GW	324PSVL	15	13	807156922001
395924079144200	395924	0791442	00	42	42	111	LK		16	LAUREL HILL LAKE, PA.	
400323079133000	400323	0791330	00	42	42	111	LK		17	KOOSER LAKE, PA.	
394337079025301	394337	0790253	01	42	42	111	SP	327MCCK	18	9	807256919001
394740079130901	394740	0791309	01	42	42	111	SP	324PSVL	19	7	907356915002
400024079011701	400024	0790117	01	42	42	111	SP	324FRPR	20	1	807256940004
400302079155201	400302	0791552	01	42	42	111	SP	327MCCK	21	8	806256921004
400351079143201	400351	0791432	01	42	42	111	SP	327MCCK	22	11	807356921002
400412079152501	400412	0791525	01	42	42	111	SP	337POCN	23	6	806256921003
01600400	395057	0784753	00	42	42	111	SW		24	SHAFFERS RUN NEAR FAIRHOPE, PA.	
03039200	400249	0785000	00	42	42	111	SW		25	CLEAR RUN NEAR BUCKSTOWN, PA.	
03039700	400618	0784755	00	42	42	111	SW		26	DARK SHADE CR. AT CENTRAL CITY, PA.	
03039800	401215	0784218	00	42	42	111	SW		27	CLEAR SHADE CR AT OGLETOWN, PA.	
03077500	394827	0792150	00	42	42	111	SW		28	YOUGHIOGHENY R AT YOUGHIOGHENY RIVER DAM, PA.	
03078500	394334	0790255	00	42	24	111	SW		29	BIG PINEY RUN NEAR SALISBURY, PA.	
03078700	394841	0790401	00	42	42	111	SW		30	ELKLICK CREEK AT SUMMIT MILLS, PA.	
03078800	395726	0790611	00	42	42	111	SW		31	COXES CREEK NR ROCKWOOD, PA.	
03078820	395449	0790914	00	42	42	111	SW		32	COXES CREEK AT ROCKWOOD, PA.	
03079000	395135	0791340	00	42	42	111	SW		33	CASSELMAN RIVER AT MARKLETON, PA.	
03079200	394744	0791924	00	42	42	111	SW		34	CASSELMAN RIVER AT HARNEDSVILLE, PA.	
03079600	400032	0791404	00	42	42	111	SW		35	LAUREL HILL CR. NR. BAKERSVILLE, PA.	
03080000	394922	0791914	00	42	42	111	SW		36	LAUREL HILL CREEK AT URSINA, PA.	
03081200	395139	0792150	00	42	42	111	SW		37	DRAKE RUN NEAR CONFLUENCE, PA.	

PROGRAM EXECUTION ENDED DUE TO PROCESSING COMPLETED = EOFB

Figure 11 - Station Header Data for Site Plots

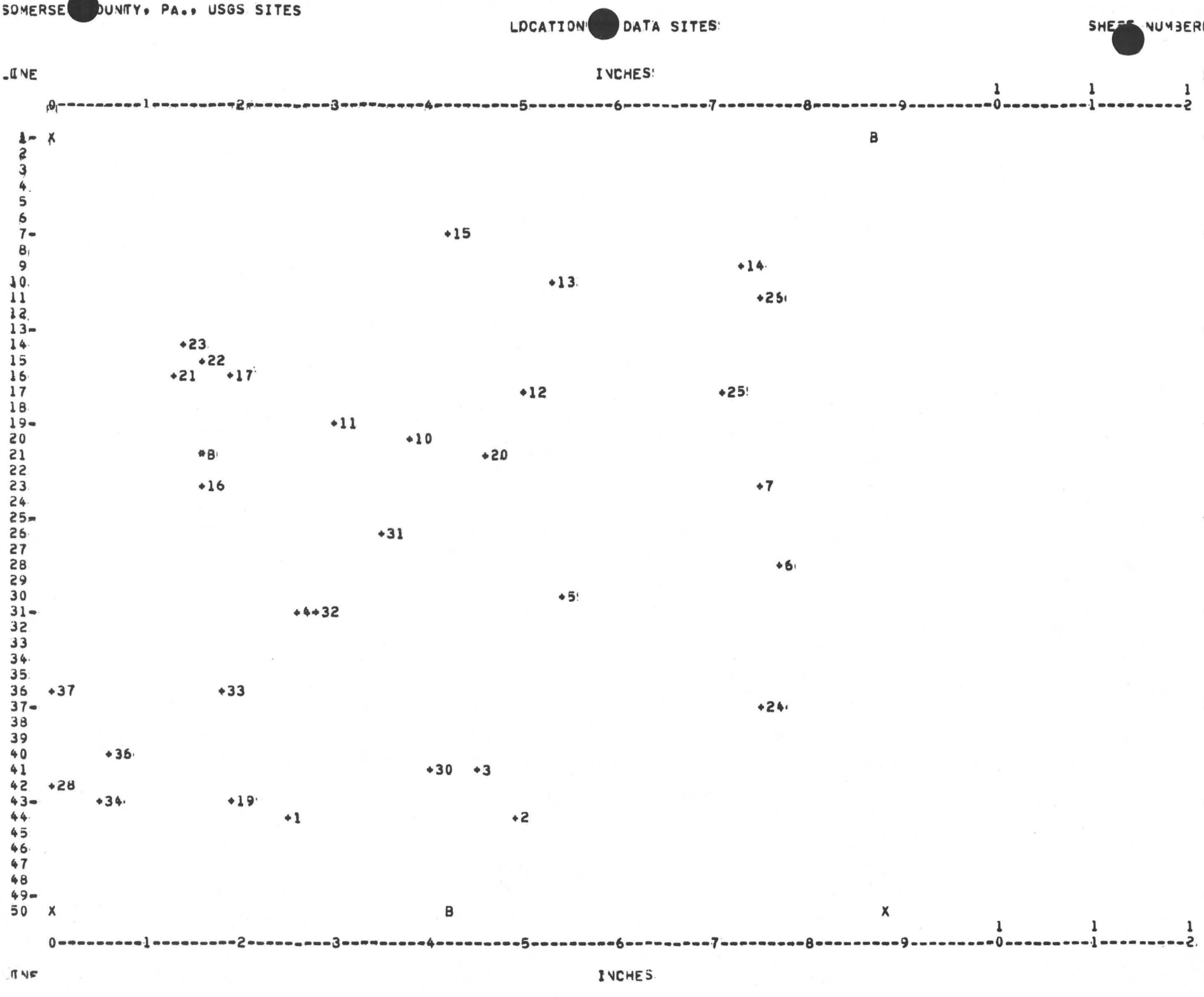


Figure 12 - Location of Data Sites

```
/*
// EXEC LPLOT (execute program W4317)
//          (end of job)
```

(Note: a delimiter statement (/*) is not required after EXEC LPLOT.)

III.B.5. Output

Requirements for computer time to complete a retrieval and the number of lines of print are given below in Section III.B.7.a. Sample printed output from the retrieval and processing of station header data can be found in Section III.B.5.b. The user should note on the sample printout that an attempt has been made to list each control card with abbreviated headings.

The program messages generated by the retrieval program are listed in Section III.B.5.c.

A description of the machine readable output can be found in Figures 8 and 9. This output includes punch cards and the 152-byte station header record. Instructions for specifying the type of output desired are given in Section III.B.3.

III.B.5.a. Time and Lines of Print

Each retrieval will require a minimum of 200 lines of print. If the HDRLIST procedure is executed with printed output, allow 8 lines of print for each station listed. The time provided (one minute) on the JCL procedures should allow for the retrieval of up to 2000 stations. If additional time is required, code the TIME parammeter on the EXEC card as shown below:

```
// EXEC HDRLIST,TIME=2
          or
// EXEC HDRETR,TIME=2
```

III.B.5.b. Sample Retrievals and Printout

To illustrate the use of the Station Header Retrieval Program and its associated procedures, five sample retrievals are given on the following pages. The first two retrievals are quite simple while the third and fourth retrievals are more complex. Sample

problem five is tied together with the fourth retrieval. Sample output has been included for retrievals 3, 4, and 5.

Sample Retrieval Number 1:

The object of this retrieval is to list all USGS stations within the station identification range 02150000 thru 02250000. The JCL and control cards required to complete this problem are given below:

```
//xxxxxxxx          JOB
/*PROCLIB           WRD.PROCLIB
// EXEC HDRLIST,AGENCY=USGS
//HDR.SYSIN DD *
M
S            02150000              02250000
/*
//
```

Sample Retrieval Number 2:

The object of this retrieval is to list all data sorted by site type, that are stored in the WATSTORE Station Header File for the state of Ohio. The JCL and control cards required to complete this problem are given below:

```
//xxxxxxxx          JOB
/*PROCLIB           WRD.PROCLIB
// EXEC HDRLIST,AGENCY=ALLAG
//HDR.SYSIN DD *
M            04 (polygon)     IP (sort)
L39          (state code for Ohio)
V3827000844900   3827000803100                01
V4157000803100   4157000844900                02
/*
//
```

The IP in columns 50-51 of the M card will cause the data to be listed by ascending station identification number for each site type present. All ES sites will be listed followed by the GW sites, etc. The vertices for the polygon were taken from a map. An alternate method of defining the polygon that surrounds Ohio would have been to request the retrieval program to generate a

polygon for Ohio. This can be done by replacing the two V cards shown above with a single V card with the term GENERATE in columns 2-9. The use of this option requires that a L card with the state code also be submitted.

Sample Retrieval Number 3:

The objective of this retrieval is to list and plot (line printer) all USGS Delaware River surface water sites between Port Jervis, New York, and Marcus Hook, Pennsylvania. The listing and plotting will be done by program W4317 (LPLOT).

The control cards used to complete this problem are shown on the sample output following this problem. A brief explanation of the use of these cards is given below.

1. The retrieval was based on a polygon which enclosed the Delaware River from Port Jervis, New York, to Marcus Hook, Pennsylvania, (V cards).

2. The site type (SW) is specified on the A card.

3. The state codes for Pa. (42), N.Y. (36) and N.J. (34) are given on the L card.

4. The surface water sites that are used for measuring the flow of the Delaware contain the river name within the station name. The NSEARCH card specified that only those sites containing the name DELAWARE R in the station name field be made available for retrieval.

5. The output is to be plotted and listed by program W4317 (LPLOT).

The sample output follows the explanation of the problem. The grid point (X) locates Reading, Pennsylvania. The JCL required to solve this problem are listed below.

```
//xxxxxxxx          JOB
/*PROCLIB           WRD.PROCLIB
//STEPR EXEC HDRETR,AGENCY=USGS
//HDR.SYSIN DD *
   control cards for program G745
```

```
WATSTORE STATION HEADER FILE RETRIEVAL PROGRAM. (PGM.NO. G745) - DATE OF LAST REVISION: MAR. 23, 1975.

THIS VERSION OF PROGRAM G745 PROCESSES THE STATION HEADER FILE THAT INCLUDES AGENCY AND PASSWORD CODES.

AGENCY CODE USGS  WAS SUBMITTED THROUGH THE AGENCY SYMBOLIC JCL PARAMETER ON THE EXEC CARD.
            -----

CODES SUBMITTED THROUGH SYMBOLIC JCL PARAMETERS ON THE EXEC CARDS WILL BE TEMPORARILY OVERRIDDEN
IF A Z CARD WITH VALID ENTRIES, IS PLACED PRECEDING A STATION SELECTION CARD.




**********************************************  RETRIEVAL NO.  1   APR 01, 1975  **********************************************

STATION HEADER DATA HAS BEEN REQUESTED TO BE WRITTEN INTO AN OUTPUT FILE, IN THE FORMAT LISTED BELOW.

SW BACKFILE RECORDS                          OUTPUT RECORDS WILL BE SORTED.

                                                    <- SORT OPTNS ->                  M CARD  ***

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
MI                   04                             P                        01

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
KW4317  TITLDELAWARE RIVER SW SITES ADJACENT TO PA.

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
KW4317  PLOT   -9999

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
KW4317  GRID   4020000755500

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
KW4317  OPTI1013760.    1

 STATE     DISTRICT  COUNTY CODES:  HYDROLOGIC UNIT CODES
 1122334455112233445511122233344455511111111222222223333333344444444555555555     L CARD  ***
_B43642

 GEOLOGIC UNIT CODES                         SITE TYPE AQUIFER
 1111111122222222333333334444444455555555112233445512345                          A CARD  ***
A,                                           SW

 OPT             <- STATION NAME    2         3         4
                 12345678901234567890123456789012345678901234567890                N CARD  ***
NSEARCH          DELAWARE R*

SEARCH STRING NO. 1 = DELAWARE R
```

Printout For Sample Retrieval Number 3

```
                    ----------

 LAT.  LONG.     LAT.  LONG.                                        CD
 DDMMSSDDDMMSS   DDMMSSDDDMMSS                                     NO
V4123590743000  4123590753000                                     01

 LAT.  LONG.     LAT.  LONG.                                        CD
 DDMMSSDDDMMSS   DDMMSSDDDMMSS                                     NO
V3940000753000  3940000743000                                     02


BASED ONLY ON INFORMATION AVAILABLE FROM THE STATION HEADER FILE.    44 SITES WERE SELECTED FOR RETRIEVAL NO.  1

*****************************************************************************************************************

RETRIEVAL PROCESSING ENDED
```

Printout For Sample Retrieval Number 3

PROGRAM NO. =: W4317

STATION HEADER DATA FOR SITE PLOTS

STATION ID. NO.	LAT.	LONG.	SN	ST.	DT.	CO.	SC	G. UNIT	PLOT NO.	STATION NAME OR LOCALE WELL NO.
01434000	412220	0744150	00	36	36	071	SW		1	DELAWARE RIVER AT PORT JERVIS, NY
01438500	411830	0744750	00	34	34	037	SW		2	DELAWARE R AT MONTAGUE NJ.
01439000	411312	0745140	00	42	34	103	SW		3	DELAWARE R AT DINGHAMS FERRY PA.
01440090	410240	0750142	00	42	42	089	SW		4	DELAWARE RIVER NEAR EAST STROUDSBURG, PA.
01440200	410042	0750509	00	34	34	041	SW		5	DELAWARE R BLI TOCKS I NR DELAWARE WATERI GAPI PA
01443000	405530	0750555	00	42	34	095	SW		6	DELAWARE R AT PORTLAND PA.
01444500	405355	0750440	00	34	34	041	SW		7	DELAWARE R AT DELAWARE NJ.
01444800	404944	0750506	00	34	34	041	SW		8	DELAWARE R NR RICHMOND PA. (BELVIDERE NJ)
01446500	404936	0750502	00	34	34	041	SW		9	DELAWARE R AT BELVIDERE NJ
01446550	404720	0750559	00	42	42	095	SW		10	DELAWARE R NR. MARTINS CREEK, PA.
01446560	404629	0751028	00	42	42	095	SW		11	DELAWARE RIVER AT MARTINS CREEK, PA.
01446700	404243	0751148	00	42	42	095	SW		12	DELAWARE RIVER AT EASTON, PA.
01447000	404130	0751215	00	42	42	095	SW		13	DELAWARE RIVER AT EASTON, PA.
01454752	404120	0751212	00	42	34	095	SW		14	DELAWARE R BLI LEHIGH R AT EASTON PA
01457500	403536	0751117	00	34	34	041	SW		15	DELAWARE R AT RIEGELSVILLE NJ
01458000	403400	0750555	00	34	34	019	SW		16	DELAWARE R AT MILFORD NJ
01458500	403140	0750400	00	34	34	019	SW		17	DELAWARE R AT FRENCHTOWN NJ
01459000	402525	0750350	00	42	34	017	SW		18	DELAWARE R AT POINT PLEASANT PA.
01459010	402523	0750342	00	34	34	019	SW		19	DELAWARE R TR AT BYRAM NJ.
01461000	402425	0750220	00	42	34	017	SW		20	DELAWARE R AT LUMBERVILLEI PA
01461500	402410	0745360	00	34	34	019	SW		21	DELAWARE R AT STOCKTON NJ.
01462000	402150	0745555	00	34	34	019	SW		22	DELAWARE R AT LAMBERTVILLE NJ.
01462500	401740	0745210	00	34	34	021	SW		23	DELAWARE R AT WASHINGTON CROSSING NJ
01462900	401533	0745049	00	34	34	021	SW		24	DELAWARE R AT SCUDDER FALLS NJ
01463000	401445	0745010	00	42	34	017	SW		25	DELAWARE R AT YARDLEY PA
01463480	401304	0744544	00	42	34	017	SW		26	DELAWARE R DIV AT MORRISVILLE PA
01463500	401318	0744542	00	34	34	021	SW		27	DELAWARE R AT TRENTON NJ
01464030	401232	0744604	00	34	34	021	SW		28	DELAWARE R AT RT 1 BDG AT TRENTON NJ
01464560	400734	0744859	00	34	34	005	SW		29	DELAWARE R AT FLORENCE NJ.
01464598	400442	0745228	00	34	34	005	SW		30	DELAWARE R AT BURLINGTON NJ.
01464600	400555	0745158	00	42	42	017	SW		31	DELAWARE RIVER AT BRISTOL PA.
01467030	400157	0745946	00	42	42	101	SW		32	DELAWARE R AT TORRESDALE INTAKE, PHILA., PA.
01467060	400105	0750216	00	34	34	007	SW		33	DELAWARE R AT PALYMRA NJ
01467090	395857	0750429	00	42	35	101	SW		34	DELAWARE R AT DELAIR NJ
01467100	395809	0750641	00	42	42	101	SW		35	DELAWARE R AT LEHIGH AVE, PHILA., PA.
01467200	395711	0750805	00	42	42	101	SW		36	DELAWARE R AT PHILA. (BEN FRANKLIN BRIDGE), PA.
01467300	395554	0750811	00	42	42	101	SW		37	DELAWARE R AT WHARTON ST, PHILA., PA.
01467400	395256	0751043	00	42	42	101	SW		38	DELAWARE R AT LEAGUE ISLAND, PHILA., PA.
01474702	395243	0751138	00	42	34	101	SW		39	DELAWARE R BLI SCHUYLKILL R AT PHILADELPHIA PA
01474703	395245	0751211	00	42	42	101	SW		40	DELAWARE RIVER AT FORT MIFFLIN, PA.
01475200	395042	0751610	00	34	34	015	SW		41	DELAWARE R AT PAULSBORO NJ
01476200	395057	0751943	00	42	42	045	SW		42	DELAWARE R AT EDDYSTONE, PA.
01477050	395012	0752200	00	42	42	045	SW		43	DELAWARE RIVER AT CHESTER, PA.
01477200	394801	0752510	00	42	42	045	SW		44	DELAWARE RIVER AT MARCUS HOOK, PA.

Printout For Sample Retrieval Number 3

Printout For Sample
Retrieval Number 3

MAP PLOT PROGRAM (M4317)--REVISED APRIL 1974

DATE PROCESSED-- 4/ 1/75

EXPLANATION OF MAP PLOT

MAP PLOTTED BY ALBERS EQUAL AREA CONIC PROJECTION.
NORTH IS AT TOP OF PLOT. GRID POINTS ARE DENOTED BY THE SYMBOL X.
LOCATION OF DATA POINTS, REPRESENTED BY +, -, AND OVERPRINT SYMBOLS (*, LETTERS), ARE PLOTTED TO THE CLOSEST LINES AND COLUMNS.
OVERPRINT SYMBOLS (VALUES ARE LISTED BENEATH PLOT AND IDENTIFIED AS TO LINE NUMBER) ARE ORDERED FROM LEFT TO RIGHT HORIZONTALLY
AND TOP TO BOTTOM VERTICALLY.
A -1 DENOTES DATA SAMPLING POINT AT WHICH SPECIFIED PLOT VALUE WAS NOT DETERMINED (PLOTTED ONLY IF REQUESTED ON OPTION CARD).

SCALE IS 16.000 MILES PER INCH OR 1 TO 1013760.

VERTICAL PRINTING INCREMENT = 2.667 MILES PER LINE. (+ MARKS BY LINE NUMBERS ARE ONE INCH APART)

HORIZONTAL PRINTING INCREMENT = 1.600 MILES PER COLUMN.

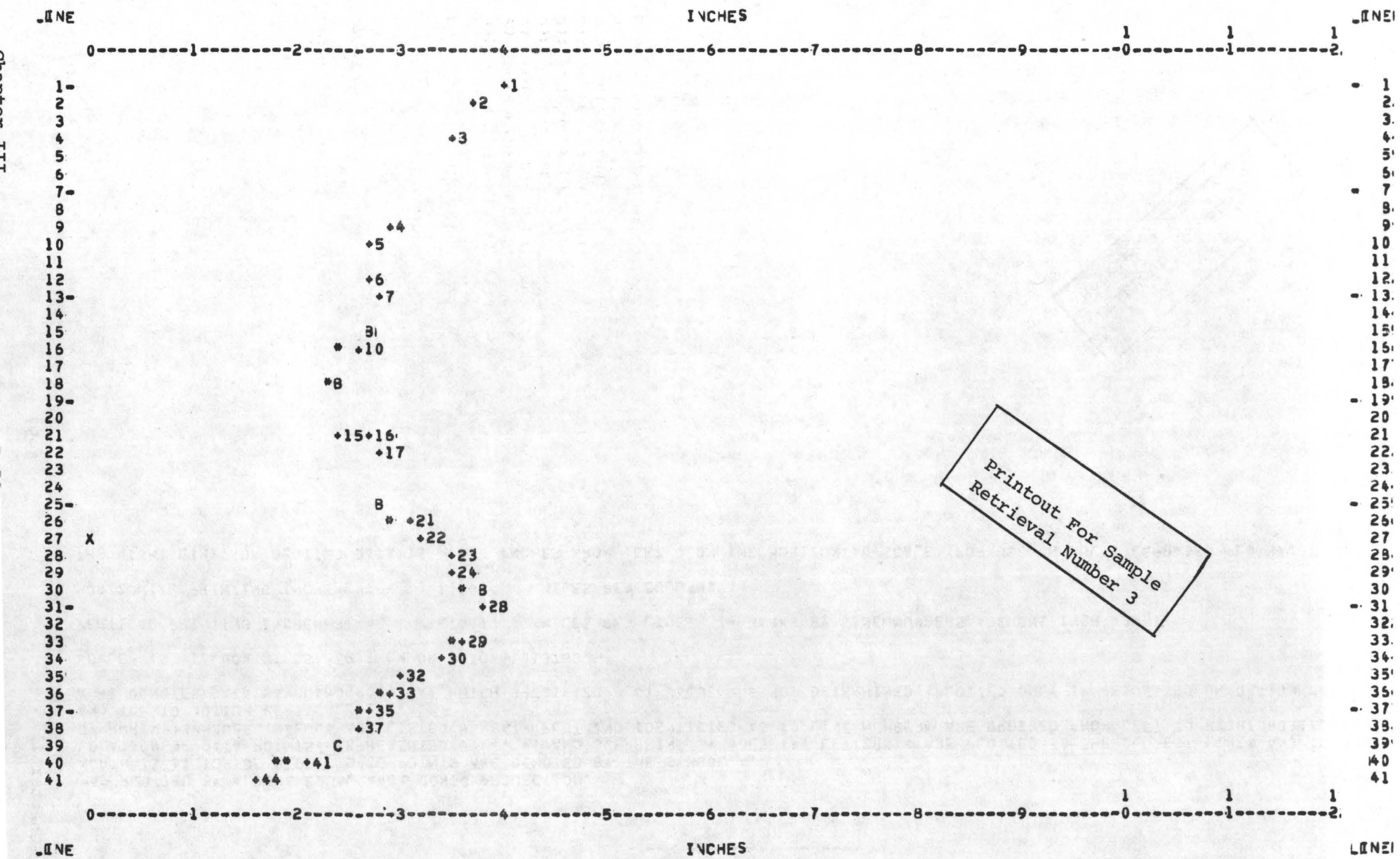
THE RIGHT LIMIT OF PLOTTED DATA IS 4.2 INCHES FROM LEFT 0 ON THE HORIZONTAL SCALE (FOR USE ON MULTIPLE-PAGED PLOTS).

Printout For Sample
Retrieval Number 3

DELAWARE RIVER SW SITES ADJACENT TO PA.

LOCATION OF DATA SITES

SHEET NUMBER 1



SCALE IS 16.000 MILES PER INCH OR 1 TO 1013760.

OVERPRINT VALUES

LINE 15 B 8 9

Printout For Sample Retrieval Number 3

```
_LINE 16  *     11
_LINE 18  *     13
          B     14
                12
_LINE 25  B     18
                19
_LINE 26  *     20
_LINE 30  *     25
          B     26
                27
_LINE 33  *     31
_LINE 36  *     34
_LINE 37  *     36
_LINE 39  C     40
                39
                38
_LINE 40  *     43
          *     42
```

```
/*
//STEPL EXEC LPLOT
/*
//
```

Sample Retrieval Number 4:

The object of this retrieval is to list those wells that are found in Jackson County Mississippi that meet the following criteria.

a. The wells tap aquifers of the Tertiary system (age group).
b. The well depths are equal to or greater than 200 feet.
c. The wells are located in any of Sections 1 thru 12 for the township identified as 08S06W.

Before continuing with the retrieval specifications it is necessary to list the format of the local identifiers used by the Mississippi District.

Positions	
1	Map Grid Letter
2-4	Well numbers within Grid (Minor Sort Field)
5	Quarter-Quarter Section
6	Quarter Section
7-8	Section Number (require 01 thru 12) (Major Sort Field)
9-11	Township Number (require 08S)
12-14	Range Number (require 06W)

The cards used to make the retrieval are shown in the sample output following the problem statement. A detailed listing of the retrieval and output specifications are given below. For each

specification, the card(s) used for input of the requirement(s) are referenced.

1. The retrieval will be based on a four-sided polygon that encloses Jackson County (V cards).

2. The state and district code for Mississippi is 28 (L card).

3. The code for Jackson County is 059 (L card).

4. The site type for wells is GW (A card).

5. The request for all aquifers belonging to the Tertiary system (12) is placed in columns 2 and 3 of the A card.

   Note that all aquifer codes beginning with a 12 will satisfy the aquifer retrieval specification.

6. The Township control is given on the NSEARCH card. See the local identifier format given above. If the contiguous string of characters 08S06W appears anywhere within the station name, the site will be a candidate for retrieval.

7. It is desired to further restrict the retrieval to a given range of section numbers. The minimum Section number (01) is coded in columns 23-24 (Positions 7-8 of station name) of the NMIN card. The maximum section number (12) is coded in the same location on the NMAX card.

8. The minimum well depth (200 ft) is coded in columns 43-45 of the E card.

9. The data is to be printed by program A534 (QWTABLES) using the ground-water format (X card).

10. The data is to be listed by ascending the well number (positions 2-4 of Local ID.) within section number (Major Sort Field). The sort control is coded in columns 50-57 of the M card.

```
STATION HEADER FILE RETRIEVAL PROGRAM. (PGM.NO. G745) - DATE OF LAST REVISION: MAR. 23, 1975.

THIS VERSION OF PROGRAM G745 PROCESSES THE STATION HEADER FILE THAT INCLUDES AGENCY AND PASSWORD CODES.

AGENCY CODE ALLAS WAS SUBMITTED THROUGH THE AGENCY SYMBOLIC JCL PARAMETER ON THE EXEC CARD.
            -----

CODES SUBMITTED THROUGH SYMBOLIC JCL PARAMETERS ON THE EXEC CARDS WILL BE TEMPORARILY OVERRIDDEN
IF A Z CARD WITH VALID ENTRIES, IS PLACED PRECEDING A STATION SELECTION CARD.




********************************************** RETRIEVAL NO. 1   APR 01, 1975   **********************************************

STATION HEADER DATA HAS BEEN REQUESTED TO BE WRITTEN INTO AN OUTPUT FILE, IN THE FORMAT LISTED BELOW.

ZW BACKFILE RECORDS                          OUTPUT RECORDS WILL BE SORTED

                                                  <- SORT OPTNS ->                M CARD ***

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
MI                    04                                  W7,2W2,3                01

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
KA534   3    T          L

 STATE     DISTRICT  COUNTY CODES:  HYDROLOGIC UNIT CODES
 1122334455112233445511122233344455511111111222222223333333344444444555555555     L CARD ***
-28        28.       059

 GEOLOGIC UNIT CODES                          SITE TYPE AQUIFER
 1111111122222222333333334444444455555555112233445512345                          A CARD ***
A12                                           GW

 OPT             <- STATION NAME    2         3         4
                 12345678901234567890123456789012345678901234567890                N CARD ***
NMIN                  01*

NIN STRING = 01  BEGINNING POSITION WITHIN THE NAME FIELD =  7
             --

 OPT             <- STATION NAME    2         3         4
                 12345678901234567890123456789012345678901234567890                N CARD ***
NMAX                  12*

NAX STRING = 12  BEGINNING POSITION WITHIN THE NAME FIELD =  7
             --

 OPT             <- STATION NAME    2         3         4
                 12345678901234567890123456789012345678901234567890                N CARD ***
```

Printout for Sample Retrieval Number 4

```
NSEARCH          08S06W*

SEARCH STRING NO. 1 = 08S06W
                      ------

 DRAINAGE AREA    CONTRIB. AREA    WELL DEPTH          DATUM
 MAX.... MIN....  MAX.... MIN.... MAX..... MIN.....  MAX..... MIN.....          E CARD  ***
EI                                      200

 LAT.  LONG.      LAT.  LONG.                                                    CD
 DDMMSSDDDMMSS    DDMMSSDDDMMSS                                                  NO
W3010000881500   3110000881500                                                  01

 LAT.  LONG.      LAT.  LONG.                                                    CD
 DDMMSSDDDMMSS    DDMMSSDDDMMSS                                                  NO
W3110000895500   3010000895500                                                  02


BASED ONLY ON INFORMATION AVAILABLE FROM THE STATION HEADER FILE.    30 SITES WERE SELECTED FOR RETRIEVAL NO.  1

HR000      28 POSSIBLE SITE SELECTIONS WERE REJECTED DUE TO MISSING    COUNTY CODES

**********************************************************************************************************************************

RETRIEVAL PROCESSING ENDED
```

Printout for Sample Retrieval Number 4

Printout for Sample Retrieval Number 4

PROGRAM A534 REVISED 02/14/74.
FOLLOWING TABLES ARE FOR RETRIEVAL NO. 1
PROCESS DATE 04/01/75

PROCESS DATE 04/01/75

STATION NUMBER	LAT-I-TUDE	LONG-I-TUDE	SEQ. NO.	LOCAL IDENT-I-FIER	DATE OF SAMPLE	STATE	DIS-TRICT	COUNTY	SITE
302253088321201	30 22 53	088 32 12	01	P067BA0108S06W	00-00-00	28	28	059	GW
302241088321701	30 22 41	088 32 17	01	P069CA0108S06W	00-00-00	28	28	059	GW
302221088330903	30 22 21	088 33 09	03	P072CC0108S06W	00-00-00	28	28	059	GW
302248088333501	30 22 48	088 33 35	01	P073B30108S06W	00-00-00	28	28	059	GW
302236088315401	30 22 36	088 31 54	01	P142AD0108S06W	00-00-00	28	28	059	GW
302218088321701	30 22 18	088 32 17	01	P147AC0108S06W	00-00-00	28	28	059	GW
302244088325801	30 22 44	088 32 58	01	P068DA0208S06W	00-00-00	28	28	059	GW
302252088365501	30 22 52	088 36 55	01	P094B30208S06W	00-00-00	28	28	059	GW
302242088350701	30 22 42	088 35 07	01	P082 0408S06W	00-00-00	28	28	059	GW
302149088340601	30 21 49	088 34 06	01	P108 0508S06W	00-00-00	28	28	059	GW
302205088334001	30 22 05	088 33 40	01	P109B30508S06W	00-00-00	28	28	059	GW
302205088334003	30 22 05	088 33 40	03	P111B30508S06W	00-00-00	28	28	059	GW
302205088334004	30 22 05	088 33 40	04	P112B30508S06W	00-00-00	28	28	059	GW
302205088334005	30 22 05	088 33 40	05	P113B30508S06W	00-00-00	28	28	059	GW
302157088334901	30 21 57	088 33 49	01	P115 30508S06W	00-00-00	28	28	059	GW
302134088330802	30 21 34	088 33 08	02	P123 0508S06W	00-00-00	28	28	059	GW
302101088334701	30 21 01	088 33 47	01	P130BC0508S06W	00-00-00	28	28	059	GW
302056088334301	30 20 55	088 33 43	01	P131 C0508S06W	00-00-00	28	28	059	GW
302042088331801	30 20 42	088 33 18	01	P134 D0508S06W	00-00-00	28	28	059	GW
302120088330001	30 21 20	088 33 00	01	P145C30508S06W	00-00-00	28	28	059	GW
302237088340203	30 22 37	088 34 02	03	P077 B0708S06W	00-00-00	28	28	059	GW
302237088340205	30 22 37	088 34 02	05	P079 0708S06W	00-00-00	28	28	059	GW
302134088330803	30 21 34	088 33 08	03	P124CD0708S06W	00-00-00	28	28	059	GW
302249088332901	30 22 49	088 33 29	01	P148 B0708S06W	00-00-00	28	28	059	GW
302040088333901	30 20 40	088 33 39	01	P132 0808S06W	00-00-00	28	28	059	GW
302047088332801	30 20 47	088 33 28	01	P138B30808S06W	00-00-00	28	28	059	GW
302100088341501	30 21 00	088 34 15	01	P291 0808S06W	00-00-00	28	28	059	GW
302228088365901	30 22 28	088 36 59	01	P102A30908S06W	00-00-00	28	28	059	GW
302134088330901	30 21 34	088 33 09	01	P121CD1108S06W	00-00-00	28	28	059	GW
302134088330801	30 21 34	088 33 08	01	P122CD1108S06W	00-00-00	28	28	059	GW

Printout for Sample Retrieval Number 4

STATION NUMBER	DATE OF SAMPLE	GEOLOGIC UNIT	SURFACE AREA (SQUARE MILES)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE MSL)	TOTAL DEPTH OF WELL (FT)
302253088321201	00-00-00	1213RMF	--	13	300
302241088321701	00-00-00	122MOCN	--	14	302
302221088330903	00-00-00	1213RMF	--	16	336
302248088333501	00-00-00	122MOCN	--	7.0	900
302236088315401	00-00-00	122PCGL	--	15	650
302218088321701	00-00-00	1213RMF	--	12	294
302244088325801	00-00-00	1213RMF	--	12	292
302252088365501	00-00-00	122PCGL	--	10	758
302242088350701	00-00-00	1213RMF	--	11	304
302149088340601	00-00-00	122PCGL	--	7.0	783
302205088334001	00-00-00	122PCGL	--	14	875
302205088334003	00-00-00	122MOCN	--	14	1600
302205088334004	00-00-00	122PCGL	--	14	800
302205088334005	00-00-00	121CRVL	--	13	388
302157088334901	00-00-00	1213RMF	--	8.0	316
302134088330802	00-00-00	122MOCN	--	6.0	340
302101088334701	00-00-00	121CRVL	--	3.0	200
302056088334301	00-00-00	122PCGL	--	4.0	812
302042088331801	00-00-00	122PCGL	--	11	750
302120088330001	00-00-00	122PCGL	--	10	805
302237088340203	00-00-00	122MOCN	--	3.0	230
302237088340205	00-00-00	122MOCN	--	4.0	294
302134088330803	00-00-00	122PCGL	--	11	801
302249088332901	00-00-00	1213RMF	--	10	350
302040088333901	00-00-00	1213RMF	--	5.0	357
302047088332801	00-00-00	122PCGL	--	10	750
302100088341501	00-00-00	1213RMF	--	10	280
302228088365901	00-00-00	122MOCN	--	10	262
302134088330901	00-00-00	122MOCN	--	9.0	340
302134088330801	00-00-00	1213RMF	--	14	340

Printout for Sample Retrieval Number 4

Since the data is to be listed by QWTABLES procedure, the header data must first be retrieved and then converted to the QW format. The JCL cards necessary to do this and print the tables are shown below.

```
//xxxxxxxx          JOB
/*PROCLIB           WRD.PROCLIB
//STEPA EXEC HDRETR,AGENCY=ALLAG   (Retrieval and conversion)
//HDR.SYSIN DD *
                •
      control cards for program G745
                •
/*
//STEB EXEC QWTABLES
//
```

Sample Retrieval Number 5:

The listings from the previous problem indicated that 28 possible site selections were rejected due to missing county codes. The object of program is to list those 28 sites. The JCL and control cards required to do this are listed below.

```
//XXXXXXXX              JOB
/*PROCLIB               WRD.PROCLIB
//STEPL EXEC HDRLIST,OPTION=HINCP,AGENCY=ALLAG
//HDR.SYSIN DD *
                •
      control cards used in problem 4
                •
/*
//
```

It is important to note that the same control cards used in problem 4 are also used in problem 5. The printed output resulting from this problem includes a listing in the standard station header record format, of the 28 sites that do not have a county code stored in the WATSTORE Station Header File. A portion of the listing is given following this problem. The stations listed are not ground water wells as requested by the control cards, but the sites do appear within the polygon. The sites are tested for county codes prior to the site type test. When a retrieval test fails because of a "no value," succeeding tests are omitted.

```
THIS VERSION OF PROGRAM G745 PROCESSES THE STATION HEADER FILE THAT INCLUDES AGENCY AND PASSWORD CODES.

AGENCY CODE ALLAG WAS SUBMITTED THROUGH THE AGENCY SYMBOLIC JCL PARAMETER ON THE EXEC CARD.
            -----

CODES SUBMITTED THROUGH SYMBOLIC JCL PARAMETERS ON THE EXEC CARDS WILL BE TEMPORARILY OVERRIDDEN
IF A Z CARD WITH VALID ENTRIES, IS PLACED PRECEDING A STATION SELECTION CARD.




**********************************************  RETRIEVAL NO.  1   APR 01, 1975  **********************************************

STATION HEADER DATA HAS BEEN REQUESTED TO BE WRITTEN INTO AN OUTPUT FILE IN THE FORMAT LISTED BELOW.

INCOMPLETE STA. HDR. RCDS.                OUTPUT RECORDS WILL BE SORTED

                                                  <- SORT OPTNS ->                  M CARD  ***

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
MI                    04                                  P                    01

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
KA534   3    T          L

 STATE     DISTRICT  COUNTY CODES   HYDROLOGIC UNIT CODES
 11223344551122334455112223334446555111111112222222233333333444444445555555      L CARD  ***
 28        28        059

 GEOLOGIC UNIT CODES                       SITE TYPE AQUIFER
 11111111222222223333333344444444555555551122334455123 45                         A CARD  ***
A12                                        GW

 OPT            <- STATION NAME    2         3         4
                12345678901234567890123456789012345678901234567890                N CARD  ***
NSEARCH         08S06W*

SEARCH STRING NO. 1 = 08S06W
                      ------

 OPT            <- STATION NAME    2         3         4
                12345678901234567890123456789012345678901234567890                N CARD  ***
NMIN                 01*

NUM STRING = 01  BEGINNING POSITION WITHIN THE NAME FIELD =  7
             --

 OPT            <- STATION NAME    2         3         4
                12345678901234567890123456789012345678901234567890                N CARD  ***
```

Printout for Sample Retrieval Number 5

```
NMAX                    12*

MAX STRING = 12  BEGINNING POSITION WITHIN THE NAME FIELD =  7
                 --

 DRAINAGE AREA    CONTRIB. AREA    WELL DEPTH          DATUM
 MAX.... MIN.... MAX.... MIN.... MAX..... MIN..... MAX..... MIN.....              E CARD  ***
EI                                      200

 LAT.  LONG.     LAT.  LONG.                                                    CD
 DDMMSSDDDMMSS   DDMMSSDDDMMSS                                                  NO
V3010000881500   3110000881500                                                  01


 LAT.  LONG.     LAT.  LONG.                                                    CD
 DDMMSSDDDMMSS   DDMMSSDDDMMSS                                                  NO
V3110000895500   3010000895500                                                  02


BASED ONLY ON INFORMATION AVAILABLE FROM THE STATION HEADER FILE.     28 SITES WERE SELECTED FOR RETRIEVAL NO.  1

HR000       28 POSSIBLE SITE SELECTIONS WERE ACCEPTED DUE TO MISSING     COUNTY CODES

*****************************************************************************************************************************

RETRIEVAL PROCESSING ENDED
```

Printout for Sample Retrieval Number 5

WRD STATION HEADER RECORD LISTING PROGRAM (PGM. NO. 6748) - DATE OF LAST REVISION 5/22/74

LISTING CODES: MANDITORY DATA MISSING

L	LAT-LONG-SGN
S	STATE CODE
D	DISTRICT CODE
C	COUNTY CODE
I	SITE CODE
N	STATION NAME

A. LISTING OF AVAILABLE INPUT PARAMETERS TO THIS PROGRAM IS GIVEN BELOW.

LALL	-	LIST ALL HEADER RECORDS
LINC	-	LIST ONLY INCOMPLETE HEADER RECORDS
PALL	-	PUNCH ALL HEADER RECORDS
PINC	-	PUNCH ONLY INCOMPLETE HEADER RECORDS
NULL	-	BYPASS LIST/PUNCH OPERATIONS

INPUT PARAMETER(S) SPECIFIED FOR THIS EXECUTION - LALL

Printout for Sample Retrieval Number 5

STATION HEADER RECORD LIST/PUNCH FOR RETRIEVAL NUMBER: 1

Printout for Sample Retrieval Number 5

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1	#2	#3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02474750	310955	0885455	00	28	28		SW					

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERVAL USE TDQPJM_ER	
CARTERS C. AT BEAUMONT, MISS.					NULL	NULL	100000001	?????? C

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1	#2	#3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02474850	310747	0885118	00	28	28		SW					

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERVAL USE TDQPJM_ER	
LITTLE C. NR. BEAUMONT, MISS.					NULL	NULL	100000001	?????? C

AGENCY CODE	STATION IDENTIFICATION NUMBER	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NUM	STATE CODE	DISTRICT CODE	COUNTY CODE	SITE CODES #1	#2	#3	HYDROLOGIC UNIT CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
USGS	02475082	305900	0884400	00	28	28		SW					

STATION NAME OR LOCAL WELL NUMBER	GEOLOGIC UNIT CODE	WELL DEPTH	AQUIFER TYPE	DATUM	PASSWORDS UPD	PASSWORDS RTV	INTERVAL USE TDQPJM_ER	
LEAF R. AT MERRILL, MISS.					NULL	NULL	100000001	?????? C

III.B.5.c. Program Messages

This section has been divided into the following three subsections.

- Information Messages
- Warning Messages
- Error Messages

The first subsection lists the information type messages that require no action by the user. These messages are not numbered as are the warning and error messages. An explanation will be given for those messages that are not self explanatory. The second section contains warning messages and an explanation of their meanings. In most cases these messages are concerned with missing data from the Station Header File. The warning messages are numbered HR000 thru HR020.

The last part of this section discusses the program error messages. In most cases the error messages relate to errors found in the retrieval control cards. Once an error is found, the retrieval program will stop processing the control cards that are associated with the last Master Retrieval Control Card (M card) read into the computer. An error message will be listed, and the retrieval will be bypassed. If there are additional retrieval requests, the retrieval program will search for a new M card and will attempt to complete the remaining retrievals.

Error messages are numbered from HR021 thru HR999. For each error message that is listed, a brief explanation is given followed where necessary by a recommended user response. Many of the messages will contain a printed image of the control card which contains the error.

III.B.5.c.(1) Information Messages

- WATSTORE STATION HEADER FILE RETRIEVAL PROGRAM (PGM.NO.G745) -- DATA OF LAST REVISION -- date

- AGENCY CODE agency code WAS SUBMITTED THROUGH THE AGENCY SYMBOLIC JCL PARAMETER ON THE EXEC CARD.

Explanation: This message will be listed only when the agency code is entered by coding the AGENCY Symbolic JCL parameter on an EXEC card.

- THE PASSWORD password WAS SUBMITTED AS INPUT THROUGH THE PASSWORD SYMBOLIC JCL PARAMETER ON THE EXEC CARD.

  Explanation: This message will be listed only when the password is entered by coding the PASSWRD Symbolic JCL parameter on an EXEC card.

- CODES SUBMITTED THROUGH SYMBOLIC JCL PARAMETERS ON THE EXEC CARDS WILL BE TEMPORARILY OVERRIDDEN IF A Z CARD WITH VALID ENTRIES IS PLACED PRECEDING A STATION SELECTION CARD.

  Explanation: See Section III.B.2.i.

- A STATION HEADER RECORD LIST WILL NOT BE GENERATED FOR THE RETRIEVAL.

  Explanation: The retrieval specifications do not require that the preprocessor search the Station Header File for sites that meet the retrieval criteria. The preprocessor has determined that the retrieval is data dependent, and that the data retrieval program will be able to search for, and check all retrieval specifications. The Station Header File will be accessed after the data records have been accepted for retrieval.

- BASED ONLY ON INFORMATION AVAILABLE FROM THE STATION HEADER FILE, nnn SITES WERE SELECTED FOR RETRIEVAL NO. yyy

  The underlined items (nnn,yyy) will be replaced with numerical values. The selection of a site for retrieval indicates that all retrieval specifications that are related to the information stored in a station header record have been satisfied. Once retrieved, the station header data is subject to the output specifications that are requested by the user. The number yyy is set by program G745. If the value of nnn is zero (0), there were no sites that met all of the specifications given on the retrieval control cards.

- RETRIEVAL NO. yyy date

  This message identifies the beginning of the retrieval numbered yyy where yyy is set by the retrieval program. The word date will be replaced with the calendar date when the retrieval was completed.

- STATION HEADER DATA HAS BEEN REQUESTED TO BE WRITTEN INTO AN OUTPUT FILE IN THE FORMAT LISTED BELOW.

  Following this message, one of the following messages will be printed.

  QW BACKFILE RECORDS -- Results from the execution of the HDRETR JCL Procedure. The resulting QW records will be processed by one or both of the application procedures (LPLOT, QWTABLES).

  STATION HEADER RECORDS -- Standard output from the HDRLIST JCL Procedure.

  STATION HEADER RECORD LIST -- Program G745 is being run as a preprocessor for a data retrieval program. A second message may indicate that the retrieval is totally data dependent and that the list was not created.

  INCOMPLETE STA. HRD. RCDS. -- Indicates that the HDRLIST JCL Procedure is being executed with OPTION=HINCP. See Section III.B.3.a.(1).

  STATION HEADER RECORD COUNT -- Indicates that the HDRLIST JCL Procedure is being executed with OPTION=COUNT. See Section III.B.3.a.(4).

  OUTPUT RECORDS WILL BE SORTED -- A request has been made on the M card for sorted output, or the program has determined that a sort is necessary to insure that the output records are in ascending order by agency code and by station identifier within agency.

- Formatted Card Images of all control cards. Unless the user suppresses the printing of retrieval and application control

cards (Column 43 M card), all input cards processed by program G745 will be listed. Those cards directly related to station header data will be listed beneath specific headings. Other cards will be listed under a general heading.

III.B.5.c.(2) Warning Messages

HR000 nnn POSSIBLE SITE SELECTIONS WERE disposition DUE TO MISSING header item.

Where: nnn equals the number of sites found to have the missing entry.

disposition -- For standard retrievals, this term will be replaced by the word REJECTED.
header item -- The station header entry that was found to be missing in nnn records. It must be noted, that a header entry (i.e, county code) will not be checked unless it has been specified as a retrieval control item.
user response -- The user may list the header records that contain the missing entries by executing the HDRLIST procedure with OPTION=HINCP (see Section III.B.3.a.(1)). When the HINCP option is used, the term identified as disposition will be replaced with the word ACCEPTED. A sample warning message is given below.

HR000 20 POSSIBLE SITE SELECTIONS WERE REJECTED DUE TO MISSING DRAINAGE AREAS.

This message indicates that:

One of the retrieval specifications was a Drainage Area Range (E card). For all of those sites that were considered candidates for retrieval, 20 stations were rejected because the header records for those stations did not contain a value for drainage area.

The value of 20 does not reflect those sites that were rejected because a reported drainage area was outside of the requested range.

HR001 WARNING, IF STA. ID = LOCATOR, DATA CAN NOT BE RETRIEVED USING STATION RANGE

The user has submitted a station range (S card) with a beginning and ending identifier that may define a range that includes sites whose station identifier and locator (latitude-longitude) are equal. Because of the file structure, these types of sites (Id.=Locator) cannot be retrieved using a station range retrieval. A polygon (V cards) or a station list (D cards) will retrieve those sites that have been identified by use of the latitude-longitude locations.

■ III.B.5.c.(3) Error Messages

HR021 CONTROL CARDS FOR RETRIEVAL NO. nn DID NOT INCLUDE EITHER D, S, OR V STATION SELECTION CARDS

User Response -- Enter the appropriate station selection cards. Station selection cards are a mandatory entry.

HR022 AN ERROR WAS FOUND IN ATTEMPTING TO RETRIEVE DATA FOR STATION Station Identifier AGENCY CODE agency code.
PLEASE CHECK ID ALIGNMENTS--ERROR MESSAGE - error message

Where error message will be replaced by one of the following statements:

STATION NOT FOUND -- There currently exists no station header record in the WATSTORE file with an identifier that matches the entry printed in the error message. Check the D card for alignment errors and if necessary, enter the site in the Station Header File using the instructions in Section III.A.

AGENCY CODE MISSING -- An agency code was not submitted by either the AGENCY symbolic JCL parameter or by placing the code on a Z card that precedes the D station list card.

STA. ID. MISSING -- Columns 2-16 on the D card were left blank.

If a message other than those three listed above is printed, contact the WATSTORE ADP group in Reston, Virginia.

HR023 THE FOLLOWING CONTROL FIELDS HAVE BEEN CODED INCORRECTLY.

Following the above message, any or all of the items listed below will be printed. Reference to an authorized list or a discussion of the indicated entry are given with parenthesis.

SITE CODE -- Invalid code listed (Section III.B.2.f.)

GW SITE CODE MISSING -- There is a conflict between a requested site code (A card) and one or more other retrieval specifications. If one or more site codes are requested, and if the retrieval specifications also include aquifer codes, aquifer types or well depths, then one of the requested site codes must be either GW and/or SP.

SW SITE CODE MISSING -- A conflict exists between a requested site code (A card) and one or more other retrieval specifications. If one or more site codes are requested, and if the retrieval specifications include drainage area or contributing drainage areas, then the requested site codes must include one or more of the following three codes: SW, LK, ES.

STATE CODE -- Invalid code listed (Appendix B).

DISTRICT CODE -- Invalid code listed (USGS users only).

COUNTY CODE -- Invalid code listed (Appendix C).

STATE/COUNTY CODE CONFLICT -- County codes have been listed in combination with more than one state code. A maximum of one state code may be listed if county codes are specified.

GEOLOGIC UNIT -- Coded incorrectly (Appendix F).

AQUIFER TYPE -- Invalid code (Section III.A.4.b.).

User Response -- Check entries on the L or A card and correct indicated error before reprocessing.

This error message will be followed by an error message numbered HR090 which will list the L or A card that contains the error.

HR060 - HR102 The following error messages will all be listed using the following format.

HRnnn HEADER FILE ACCESSING ENDED, COMPLETION MESSAGE - message
LAST CARD PROCESSED - Card image

With the exception of error message HR090, the Card image will represent the control card that contains the error.

The value of nnn depends on the message printed. The various messages and associated causes are listed below:

HR060 - HR067 CONV. ERROR - E CARD -- An error occurred in attempting to convert an entry to a numeric value. The numeric value following the HR indicates the exact entry that was miscoded.

060 - Maximum Drainage Area
061 - Minimum Drainage Area
062 - Maximum Contributing Drainage Area
063 - Minimum Contributing Drainage Area
064 - Maximum Well Depth
065 - Minimum Well Depth
066 - Maximum Datum
067 - Minimum Datum

The numeric values coded in the above control fields must not contain embedded blanks or alphabetic characters.

HR070 ERROR IN DATA TYPE FOR SORT -- Contact WATSTORE ADP group in Reston, Virginia.

HR071 NO. SORTFLDS. > 9 -- Not more than 9 items may be specified as a sort control field for any given sort request.

HR072 ALLAG CANNOT BE PROCESSED -- The generalized agency code ALLAG has been used with either a station range (S card) or a station list. Except where noted in the instructions (Section III.B.2.j.(2)) the use of the ALLAG agency code is restricted to polygon retrievals.

HR075 PASSWORD INCORRECT -- The password submitted thru the PASSWRD symbolic JCL parameter contains more than the allotted four characters.

HR076 NO. PARMS > 15 -- More than 15 parameters were specified on an Output List Control Card (O (alphabetic) card).

HR077 NO. AGENCIES > 5 -- More than 5 agency codes were submitted in building an agency code list for a polygon retrieval.

HR079 AGENCY CODE MISSING -- An agency code was not submitted by either the AGENCY symbolic parameter or by use of the Z card.

HR080 ILLEGAL CARD TYPE -- Check column 1 for an illegal character.

HR082 CONV. ERROR L CARD -- Error in coding a hydrologic unit code.

HR083 NO. COUNTY CODES > 25 -- The number of county codes is limited to a maximum of 25 per retrieval.

HR084 N CARD NAME POSITION ERROR -- Search string must begin in column 17.

HR086 ERROR IN M CARD NO. VERT. -- Error in the number of vertices listed in columns 21-22 of the M card.

HR087 ERROR IN VERTEX CARDS -- Latitude-longitude error, or card numbering error in a V card.

HR088 POSITION ERROR ON E CARD -- An entry extended into an area reserved for blanks. (Columns 9, 17, 25, 33, 42, 51, 60, 69)

HR089 N CARD OPTION UNDEFINED -- Option coded in columns 2-7 not recognized.

HR090 ERROR ON L OR A CARD -- This error message is related to error message HR023 which immediately precedes HR090. This message will list the L or A card containing the error.

HR091 M CARD MISSING -- No M card was found preceding other control cards.

HR092 S CARD OUT OF ORDER -- When multiple types of station selection cards are processed in the same retrieval, the D and/or V cards must precede S (Station Range) cards.

HR093 ERROR IN STATION RANGE -- The identifier specified as the beginning station identifier exceeds the identifier listed as the ending station identifier.

HR094 NO. SEARCH STRINGS > 5 -- More than 5 N cards requesting a string SEARCH have been submitted for a retrieval.

HR095 ILLEGAL OPTION -- An illegal entry was submitted to the program thru the use of the OPTION symbolic JCL parameter.

HR096 SORT REQUEST CONFLICT -- More than one sort per retrieval may be made only if all sort requests are identical.

HR097 NO. VERTICES < 3 -- At least 3 vertices must be given to define a polygon.

HR098 ERROR IN SORT OPTIONS -- An invalid sort code has been coded in columns 50-65 of the M card. The card image printed preceding this message will contain an X printed above the suspected illegal character.

HR099 NO STATE CODES GIVEN -- An attempt was made to GENERATE a polygon based on state codes or state and county codes. The program was unable to form the polygon because no state codes were submitted.

HR100 NO LAT-LNG AVAILABLE -- An attempt was made to GENERATE a polygon based on state codes or state and county codes. The program was unable to form the polygon because latitude-longitude data was not available for a given state or county. The state or county will be identified in an error message numbered HR101 (state) or HR102 (county).

HR101 UNABLE TO GENERATE A POLYGON BASED ON STATE CODE -- State Code -- Insufficient data is available to generate a polygon for the state identified in the error message. User must submit a polygon based on actual latitude-longitude verticies.

HR102 UNABLE TO GENERATE A POLYGON BASED ON COUNTY CODE - county code FOR STATE state code -- Insufficient data is available to generate a polygon for the county identified in the error message. User must submit a polygon based on actual latitude-longitude verticies.

III.B.6. Interface with the Daily Values Data Retrieval Program

In addition to functioning as an independent retrieval program for station header data, program number G745 also acts as a preprocessor for the Daily Values Retrieval Program (H475). The Daily Values Retrieval is discussed in detail in Section IV.B. Mention of the subject is made here so that users could be made aware of four important points involved in the relationship between Program G745 and the Daily Values Retrieval Program. Those users that are interested only in the retrieval of station header data need not be concerned with this section.

III.B.6.a. Control Cards

The control cards described in Section III.B.2. are also used by the Daily Values Retrieval Procedure to define retrieval specifications that involve Station Header Data (i.e., county code, datum, etc.).

III.B.6.b. Program Messages

The program messages listed in Section III.B.5.c. are included in the printed output of the Daily Values Retrieval Procedure. Program G745 is executed as the first step of the Daily Values Retrieval, therefore, the preprocessor messages appear first in the printed output.

III.B.6.c. Passwords

Station header records are not password protected for retrieval, however, password checking for authorization to retrieve Daily Values Data is a function of Program G745. The use of passwords to authorize retrieval of Daily Values Data Records is described in Section IV.B. When the Password-Agency Identification card is processed (see Section III.B) the password entries are ignored. The passwords retrieved from the Station Header Records by program G745 will not appear in the output. This will not affect the original passwords that are stored in the Station Header File.

III.B.6.d. Preprocessor JCL

When utilized as a preprocessor, the Job Control Language (JCL) for Program G745 will be included automatically in the cataloged JCL procedure for the retrieval of Daily Values data. The JCL procedures described herein pertain only to the retrieval of station header data.

CHAPTER III. INSTRUCTIONS FOR STATION HEADER FILE

SECTION III C. Map Output from the Line Printer (Program W4317)

by Charles O. Morgan

CHAPTER III. INSTRUCTIONS FOR STATION HEADER FILE

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III.C. Map Output from the Line Printer (Program W4317)

III.C.1. Introduction

Computer program number W4317 plots on the line printer maps of parameter distribution using data from the WATSTORE Station Header File. These map plots (Good, 1964) use Alber's equal area conic projections with two standard parallels as the technique for terrestrial distribution (Tolber, 1965; U.S. Army, 1956). The program allows plotting of maps to any desired scale. Ground-water data can be mapped on the basis of geologic formation. The program was written in Fortran IV (G) for the IBM 360 and 370 Computer series by Charles O. Morgan, U.S. Geological Survey, Laguna Niguel, California.

Output includes: (a) a table of Station Header data; (b) an explanation of the map plot; and (c) the requested map plot. Examples of the output from the computer program are given in Section III.C.4.

III.C.2. Input

Input to computer program W4317 is station header data arranged in the format described for the Retrieval program (G745; Section III.B.). The data are assumed to have been sorted by the retrieval program; however, program W4317 has the capability of sorting by geologic units.

The control cards for the map plot program must be submitted with the Station Header Retrieval Program (G745) control cards which are outlined in detail in Section III.B. The retrieval program (G745) will select the data upon which program W4317 is to operate.

III.C.2.a. Control Cards

At least one of the program control cards listed below must be submitted in order to execute program W4317. Each card will result in a specific type of output as explained in the following discussion.

Title Card

Plot Card

Option Card

Grid Card
Geologic Unit Card

The control cards for program W4317 are identified by an X in column 1 and W4317 in columns 2-6. The control cards are placed immediately following the Master Retrieval Control Card (M Card), (See Section III.B.2). The control cards for program W4317 may be arranged in any desired order. Each of the cards will result in a specific type of output as is explained in the following discussions. Included in these discussions are the default conditions that will result from the absence of a user request.

■ III.C.2.a.(1) Title Card

The card is used to identify data to be plotted in map form (input data). As shown in Figure 1, the title may be very general, such as "SAMPLING SITES ON STREAMS IN SOUTHERN CALIFORNIA." Another title could be a specific township, range, section of a particular valley or river drainage basin. The title should, however, describe the input data obtained by retrieval program G745. The use of the TITL card is limited to one per retrieval.

If the TITL card is not submitted, the title, INPUT DATA NOT IDENTIFIED, will be printed on the output sheet.

The format of the title card:

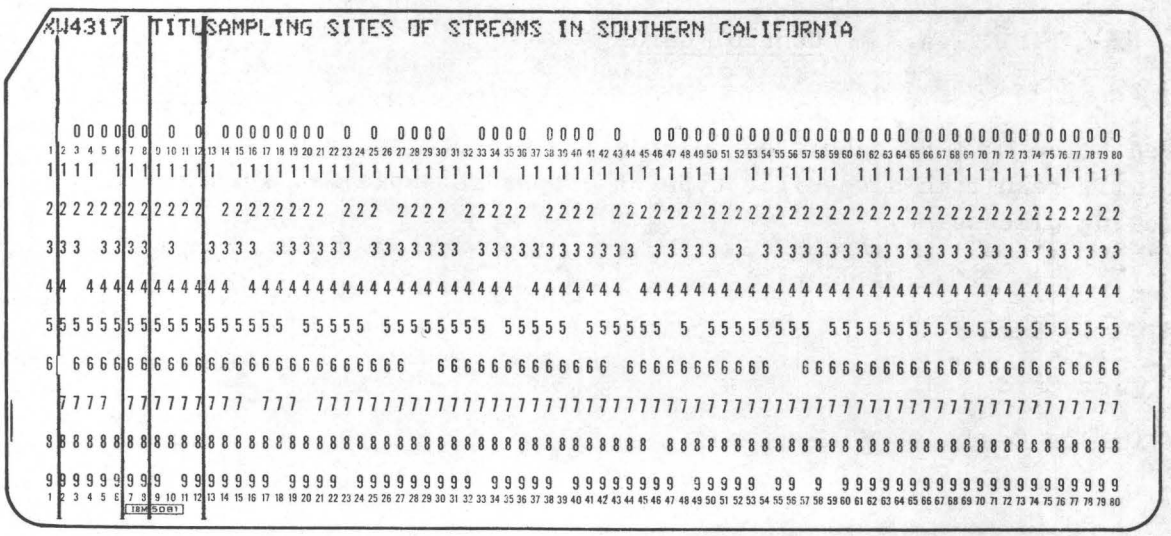


FIGURE 1. TITLE CARD

Col. 1	Col. 2-6	Col. 9-12	Col. 13-78
•	•	•	•
X	W4317	TITL	titlexxxxxxxxx

■ III.C.2.a.(2) Plot Card

This card is used to specify parameters to be plotted. The available parameters are:

- Site location (-9999) -- latitude-longitude
- Drainage area at site location (00049)
- Datum value at site location (72000)
- Well depth value at site location (72008)

One or more of these parameters may be specified. One map will be printed for each parameter requested. A maximum of four fields are provided on the Plot Card for requesting parameters. If only one parameter is to be plotted, then code the parameter code in columns 16-20 leaving the remaining entries blank. If a plot of two parameters is requested, then the second parameter code should be coded in columns 21-25, etc. If the PLOT card is not submitted, the default condition will be to plot the site locacions (-9999).

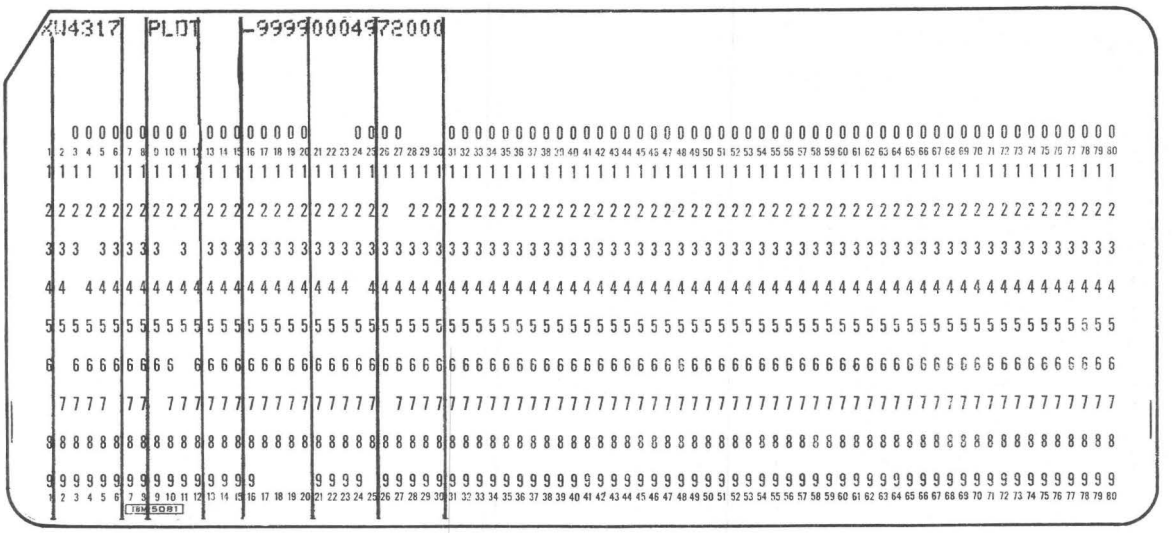


FIGURE 2. PLOT CARD

The format of the Plot Card is:

Col. 1	Col. 2-6	Col. 9-12	Col. 16-20
•	•	•	•
X	W4317	PLOT	parameter
	Col. 21-25	**Col. 26-30**	**Col. 31-35**
	•	•	•
	parameter	parameter	parameter

III.C.2.a.(3) Option Card

Four of the program default conditions may be changed by the Option Card. (1) The scale of the map plot may be changed from 3 miles per inch to one of the Input Values given in Table 1 or a value of the user's choice. (2) A listing of parameter values may be requested. (3) Also, data sites may be plotted on the map regardless of whether data for the requested parameters are available for them. (4) Overprint values beneath the map plot, which are usually listed, may be deleted. An overprint value is defined as where more than one value falls at the same print position. Also included as a overprint value is a single data location where there is not room on the map for the number value (i.e., well depth) to be printed to the right side of the location position.

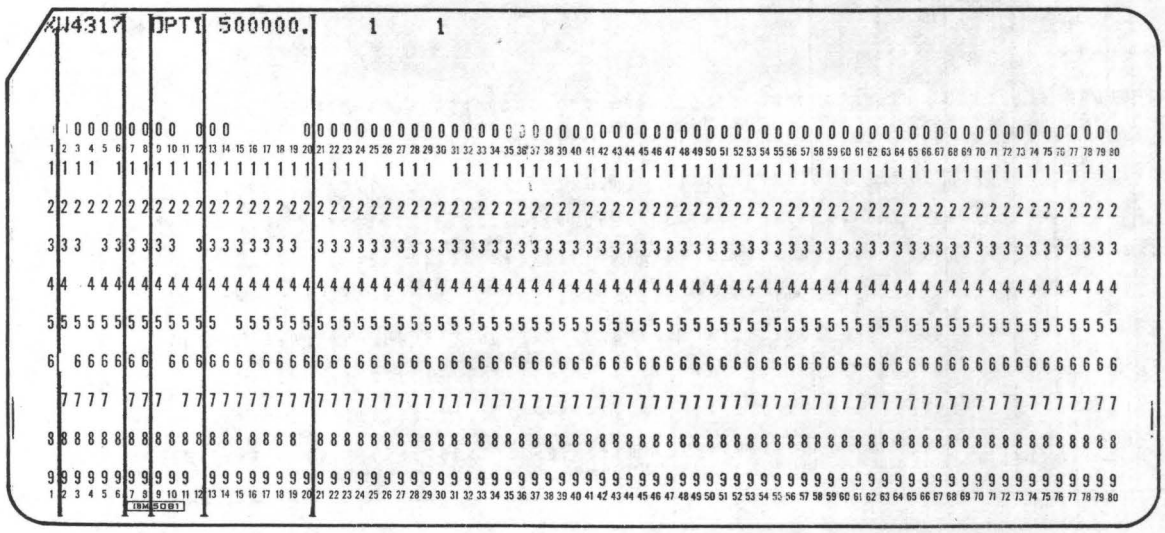


FIGURE 3. OPTION CARD

The format is as follows (values shown are for example only):

Col. 1	Col. 2-6	Col. 9-12	Col. 13-20	Col. 25	Col. 30	Col. 35
•	•	•	•	•	•	•
X	W4317	OPTI	63360.	1	1	1

The following will explain entries after Column 12:

Col. 13-20 — Control for changing scale of map (default is 1 to 190080 or 3 miles per inch). Punch the desired scale in columns 13-20. See Table 1 for common scales (note that any scale value can be used). The decimal point must be punched. The example scale (63360) given in the format shown above, represents a scale of 1 mile per inch.

Col. 25 — Punch a 1 if it is desired to produce the listing of the parameter values (00049, 72000, 72008) requested on the Plot Card. A separate listing will list pertinent site location data.

Col. 30 — Punch a 1 if it is desired to have all sites plotted whether there is data for the requested parameters. (Default is to delete such sites from the Plot). At those sites where no data was available, a -1 will be printed on the map.

Col. 35 — Punch a 1 in Column 35 if it is desired to delete overprint values beneath the map plot.

Default will occur for those entries that are left blank.

III.C.2.a.(4) Grid Card

The Grid Card allows input of grid reference points for use in positioning the map plot. The reference points may be quad corners, township corners, the trace of a stream, or any other geographic detail. These grid points are shown on the plot as an X. (Default is for the program to determine the outer boundaries of the

Input Values		Miles Per Inch
24000.	=	.37879
30000.	=	.47349
31680.	=	.50000
42240.	=	.66666
45000.	=	.71023
62500.	=	.98642
63360.	=	1.00000
84480.	=	1.33333
90000.	=	1.42046
95040.	=	1.50000
125000.	=	1.97285
126720.	=	2.00000
187500.	=	2.95926
190080.	=	3.00000
250000.	=	3.94570
253440.	=	4.00000
316800.	=	5.00000
380160.	=	6.00000
500000.	=	7.89141
506880.	=	8.00000
1000000.	=	15.78282
1013760.	=	16.00000

TABLE 1. COMMON MAP SCALES

data coordinates and plot an X at the northeast, northwest, southwest, and southeast corners). The program can handle a maximum of 200 grid points. Four latitude-longitude points per card may be entered. For longitude degrees having less than three digits, enter a zero in the first position: 3245220144000. Latitude must be six numbers (ddmmss) and longitude seven (dddmmss -- d=degree, m=minute, s=second).

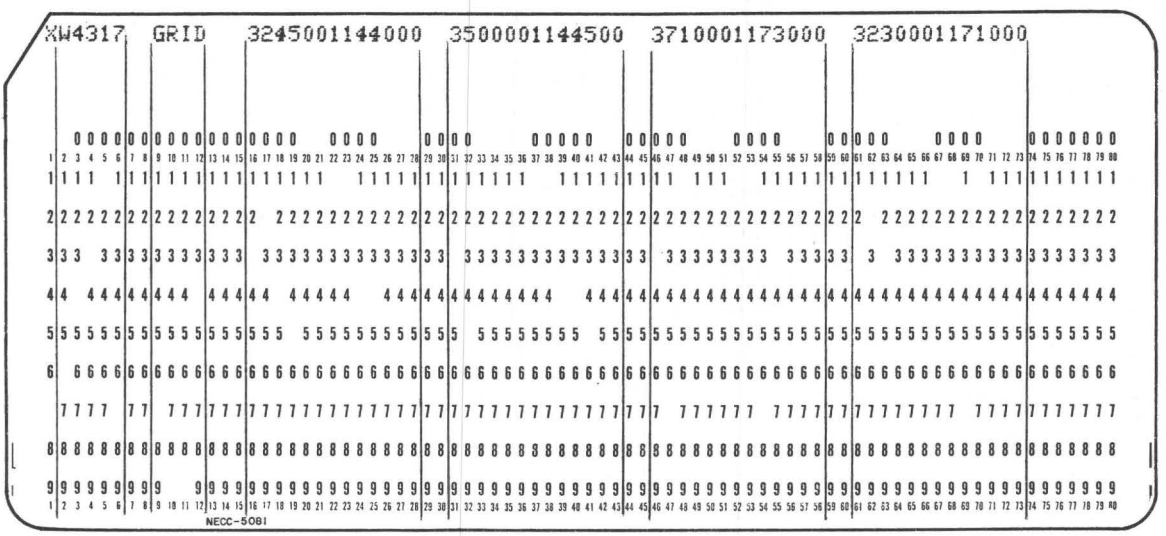


FIGURE 4. GRID CARD

The card is coded as follows:

Col. 1	Col. 2-6	Col. 9-12	Col. 16-28	Col. 31-43
X	W4317	GRID	latitudelongitude	latitudelongitude

Col. 46-58	Col. 61-73
latitudelongitude	latitudelongitude

■ III.C.2.a.(5) Geologic Unit Card

The Geologic Unit Card is required only for plotting ground water data sites. It allows the plotting of data for specific geologic units. A set of maps is obtained for each geologic

unit. The number in the set is governed by the number of parameters requested (PLOT CARD). The program allows for a maximum of 36 geologic units.

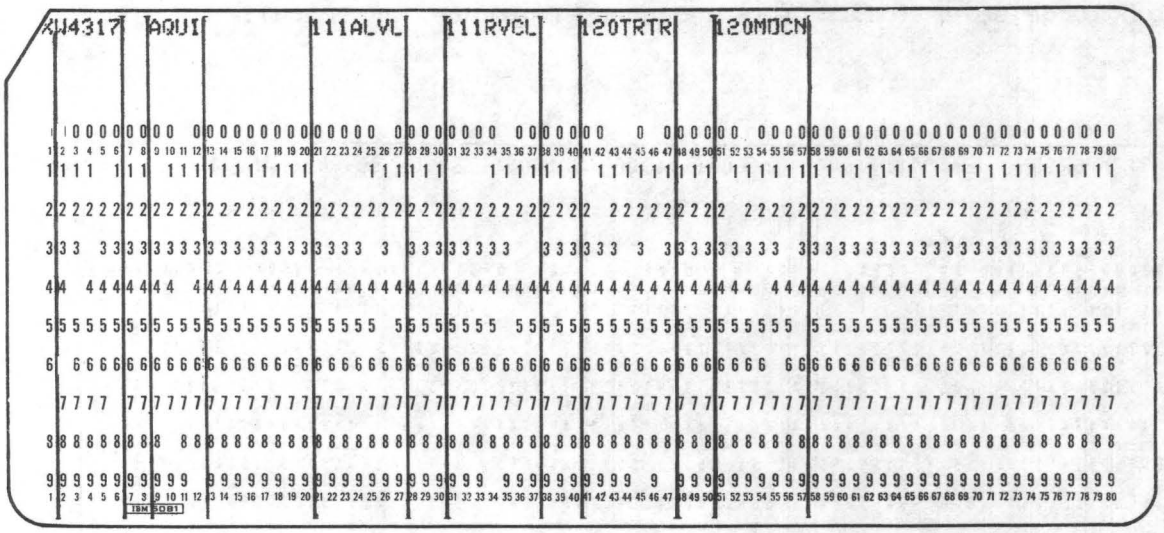


FIGURE 5. GEOLOGIC UNIT CARD

The format of the Geologic Unit Card is shown below. Geologic unit codes shown below are for example only.

Col. 1	Col. 2-6	Col. 9-12	Col. 21-28	Col. 31-38	Col. 41-48
X	W4317	AQUI	310JSVL	313GDLP	221MRSN

Col. 51-58	Col. 61-68	Col. 71-78
300PLZC	121SLLK	122YKFK

Geologic Unit codes are listed in Appendix F.

■ III.C.2.b. Restrictions

- The program is limited to a maximum of 10,000 plotting points.

- The program is limited to a maximum of 5,000 overprint values on the map.

- A maximum of 36 geologic unit sorts are available with the program.

- A maximum of 200 grid points can be entered to outline boundaries or denote geographic features on the plot. The grid points are included in the 10,000 maximum plot points.

- Exercise care in selecting a scale for the plot. A scale too small will print endless reams of output, while a scale too large will condense the plot into nothing but overprint values. Also, the smaller the scale of the plot, the more computer time is required for execution.

- The program will attempt to plot any latitude-longitude coordinate entered from the data file or as a grid point. Be sure that these coordinates fall in the range of the map plot. A polygon retrieval (Section III.B.) will insure that all sites required are contained with predefined bounds.

III.C.2.c. Execution Time

Execution time on the 370/155 is approximately 17 seconds for four different maps of parameters from 100 stations in a one township area at a scale of 1/63360. The time to complete the job will increase as the number of miles per inch is decreased.

III.C.2.d. Lines of Print

1. The table identifying input from the Station Header File requires four lines per site. The grid points require three lines each.

2. Messages for identifying geologic unit and null data for a requested plot requires a separate sheet of paper.

3. The explanation of the map plot requires one sheet of paper.

4. The lines of print required for the map plot depends on the size of the area and the scale requested.

III.C.3. Cataloged JCL Procedure LPLOT

A cataloged procedure is available in the WATSTORE library to plot on the line printer maps of parameters (Station location, drainage area, well depth, datum) from the Station Header File. The procedure includes program W4317 only. The procedure name is LPLOT and may be executed using the following cards:

```
Col. 1                  Col. 12

•                       •
//jobnumber             JOB  (accntnumber,W4317,3,3,,,,,0), ---
/*PROCLIB               WRD.PROCLIB
//      EXEC                HDRETR
//HDR.SYSIN               DD     *
                          •
                          •
Retrieval cards for program G745
including X cards for program W4317
                          •
/*
//      EXEC            LPLOT
//
```

Procedure LPLOT must be executed following the retrieval procedure HDRETR. All retrieval options are specified on the input cards for program G745. To execute LPLOT, at least one X card for program W4317 must be included with the card input (X card(s) immediately follow the Master Control Card). Note the five commas and the number zero following the line count on the JOB card. This allows for suppression of the automatic page ejection, thus permitting the plot to be printed over the page perforations. If the TIME and REGION specified in the procedure are not sufficient for a particular retrieval, then these parameters can be changed by coding the EXEC card as follows:

```
//   EXEC  LPLOT,TIME.LTLG=zz,REGION.LTLG=xxx
```

The REGION size should not vary significantly. The TIME coded in the procedure (2 minutes) is sufficient to plot approximately 40 maps.

III.C.4. Output

III.C.4.a. Program Messages

1. The following printed message identifies the program, indicates when it was most recently revised, and gives the date on which program is run.

   MAP PLOT PROGRAM (W4317)--REVISED APRIL 1974

   DATE PROCESSED--(month/day/year)

2. Each new segment of output is identified by the title submitted on the TITL card or by the default title.

3. The table of site header data has the following title:

   STATION HEADER DATA FOR SITE PLOTS

   This table contains the following information for each site for which data are plotted.

   a. Station Identification Number
   b. Latitude-Longitude-Sequence Number
   c. State Code (FIPS)
   d. District or USGS Project Code
   e. County Code
   f. Site Code (SW, GW, Etc.)
   g. Geologic Unit, if reported.
   h. Plot Number -- This value is used in the site plot.
   i. Station Name or Local Well No.

4. The table or the plotted values has the following heading:

   TABLE OF SITE IDENTIFICATIONS, LATITUDE-LONGITUDE COORDINATES, AND SELECTED VALUES FOR MAP PLOTS.

SITE IDENTIFICATION	LATITUDE-LONGITUDE	PARAMETER CODES		
		(CODE)	(CODE)	(ETC.)

This table lists the requested data (-1.0 means no value) and identifies these data as to site identification, and latitude-longitude.

5. Grid points are identified on the table in the following ways:

   a. **GRID POINT (for coordinates entered on the GRID control cards)

   b. **COMPUTED GRID POINT (for coordinates computed within the program)

6. Map plots for individual geologic units are identified by the following:

   AQUIFER CODE = (code)

7. When no data are available for a parameter, the following message is written:

   NO DATA AVAILABLE FOR PARAMETER (code)

   AREA SPECIFIED FOR MAP (title)

8. When no data are available for a parameter sorted by geologic unit, the following message is written:

   NO DATA AVAILABLE FOR THE ABOVE AQUIFER FOR PARAMETERS (code)

   AREA SPECIFIED FOR MAP (title)

9. The following explanation is printed on the page preceding each map:

   MAP PLOTTED BY ALBERS EQUAL AREA CONIC PROJECTION. NORTH IS AT TOP OF PLOT. GRID POINTS ARE DENOTED BY THE SYMBOL X.

   LOCATIONS OF DATA POINT, REPRESENTED BY +, -, AND OVERPRINT SYMBOLS (*, letters), IS PLOTTED TO THE CLOSEST LINE AND COLUMN.

OVERPRINT SYMBOLS (VALUES ARE LISTED BENEATH PLOT AND IDENTIFIED AS TO LINE NUMBER) ARE ORDERED FROM LEFT TO RIGHT HORIZONTALLY AND TOP TO BOTTOM VERTICALLY.

A -1 DENOTES DATA SAMPLING POINT AT WHICH SPECIFIED PLOT VALUE WAS NOT DETERMINED (PLOTTED ONLY IF REQUESTED ON OPTION CARD).

SCALE IS (number) MILES PER INCH OR 1 TO (number).

VERTICAL PRINTING INCREMENT = (number) MILES PER COLUMN.

THE RIGHT LIMIT OF PLOTTED DATA IS (number) INCHES FROM LEFT ON THE HORIZONTAL SCALE (FOR USE ON MULTIPLE-PAGES PLOTS).

10. At the top of the map is printed the title and the following:

    a. For plotted parameters --

       IDENTIFICATION CODE OF PLOTTED PARAMETER=(code)

       SHEET NUMBER=(number)

    b. For a plot of data site locations --

       LOCATION OF DATA SIZES

       SHEET NUMBER=(number)

    c. If some of plotted values are below 10 units, the following message will be printed:

       VALUES ON PLOT ARE TIMES (multiplier) TO INCLUDE VALUES BELOW 10 THAT HAVE DECIMALS

    d. The top (north) and bottom (south) of the plot are divided into 12 one-inch units.

       The sides of the plot (east and west) are identified by line numbers (for ease in denoting overprint values) and inch marks denoted by ticks.

    e. The scale is given below the map plot as follows:

       SCALE IS (number) MILES PER INCH OR 1 TO (number)

11. If overprint values are on the map plot, they will be below the printout. They are identified by the heading:

    OVERPRINT VALUES

    Beneath the heading are the overprinted values identified as to line number and overprint character. If grid points happened to be included in the overprint value table, the following message is printed.

    ***THE -1000000 VALUE(s) ARE FOR GRID POINTS

    If the option for deleting the listing of overprint values is used, the following message will be printed:

    ***OVERPRINT VALUES DELETED AS REQUESTED-----

12. When the width of a map plot exceeds the width of the printer paper (about 11.5 inches), the program will print a second sheet, third sheet, etc., each to be positioned to the right of the preceding one, until the eastern-most data point is plotted. The zero (0) horizontal position of each added sheet will overlay the right limit of the immediately preceding sheet: e.g., sheet one on left may have "RIGHT LIMIT OF PLOTTED DATA IS 11.5 INCHES", (See Item 9) therefore, the zero of sheet two, on right, overlies sheet one at the 11.5 inch position. In many cases the length of the maps will exceed one sheet. The user should request suppression of the automatic page ejection so as to permit the plot to be printed over the page perforations (See Section III.C.3.).

III.C.4.b. Sample Output

Given below is the JCL and program control cards for a sample job that requests the use of program W4317 (LPLOT). The X cards request three line printer plots; by site location (-9999); datum plotted at the site location (72000); and well depth plotted at the site location (72008).

```
Col. 1                  Col. 12

•                       •
//VG423320             JOB  (400000000,W4317,2,3,,,,,0),'M.MARRS',
// CLASS=B
/*PROCLIB              WRD.PROCLIB
// EXEC  HDRETR
//HDR.SYSIN             DD  *
M                        04                        W9,3
XW4317                  TITLCOACHELLA VALLEY--T.4S.,R.6E.
XW4317                  OPTI 63360. 1
XW4317                  PLOT     -99997200072008
XW4317    GRID          3351371141802  3351371162418   3346221161801
A                                                  GWSP
NSEARCH                 00450006E*
NMIN                             05*
NMAX                             34*
V3351371161802          3351371162418
V3346201162418          3346221161801
/*
//   EXEC LPLOT
//
```

The computer printout produced by this "job" is shown on the following pages. Only the site location and datum plots are shown in the sample output.

PROGRAM NO. = W4317

STATION HEADER DATA FOR SITE PLOTS

STATION ID. NO.	LAT.	LONG.	SN	ST.	DT.	CO.	SC	G. UNIT	PLOT NO.	STATION NAME OR LOCAL WELL NO.
335101116230701	335101	1162307	01	06	06	065	GW		1	004S006E05M01S
335017116224501	335017	1162245	01	06	06	065	GW		2	004S006E08L01S
334942116194401	334942	1161944	01	06	06	065	GW		3	004S006E14C01S
334901116222301	334901	1162223	01	06	06	065	GW		4	004S006E17R01S
335017116234501	335017	1162345	01	06	06	065	GW		5	004S006E18K01S
334910116233401	334910	1162334	01	06	06	065	GW		6	004S006E18Q02S
334857116234801	334857	1162348	01	06	06	065	GW		7	004S006E19C01S
334831116232901	334831	1162329	01	06	06	065	GW		8	004S006E19J02S
334847116222801	334847	1162228	01	06	06	065	GW		9	004S006E20A01S
334836116225001	334836	1162250	01	06	06	065	GW		10	004S006E20F01S
334821116225201	334821	1162252	01	06	06	065	GW		11	004S006E20L01S
334804116211801	334804	1162118	01	06	06	065	GW		12	004S006E25C01S
334728116210601	334728	1162106	01	06	06	065	GW		13	004S006E27N01S
334754116211701	334754	1162117	01	06	06	065	GW		14	004S006E28A01S
334753116221201	334753	1162212	01	06	06	065	GW		15	004S006E28E01S
334743116211301	334743	1162113	01	06	06	065	GW		16	004S006E28H01S
334741116213601	334741	1162136	01	06	06	065	GW		17	004S006E28K01S
334804116221301	334804	1162213	01	06	06	065	GW		18	004S006E29A01S
334751116231201	334751	1162312	01	06	06	065	GW		19	004S006E29E01S
334713116204901	334713	1162049	01	06	06	065	GW		20	004S006E34C01S
334647116202301	334647	1162023	01	06	06	065	GW		21	004S006E34K01S
334641116203601	334641	1162036	01	06	06	065	GW		22	004S006E34K02S
334623116203601	334623	1162036	01	06	06	065	GW		23	004S006E34Q02S

PROGRAM EXECUTION ENDED DUE TO PROCESSING COMPLETED - EOFB

MAP PLOT PROGRAM (W4317)--REVISED APRIL 1974

DATE PROCESSED-- 8/21/75

EXPLANATION OF MAP PLOT

MAP PLOTTED BY ALBERS EQUAL AREA CONIC PROJECTION.
NORTH IS AT TOP OF PLOT. GRID POINTS ARE DENOTED BY THE SYMBOL X.
LOCATION OF DATA POINTS, REPRESENTED BY +, -, AND OVERPRINT SYMBOLS (*, LETTERS), ARE PLOTTED TO THE CLOSEST LINES AND COLUMNS.
OVERPRINT SYMBOLS (VALUES ARE LISTED BENEATH PLOT AND IDENTIFIED AS TO LINE NUMBER) ARE ORDERED FROM LEFT TO RIGHT HORIZONTALLY AND TOP TO BOTTOM VERTICALLY.
A -1 DENOTES DATA SAMPLING POINT AT WHICH SPECIFIED PLOT VALUE WAS NOT DETERMINED (PLOTTED ONLY IF REQUESTED ON OPTION CARD).

SCALE IS 1.000 MILES PER INCH OR 1 TO 63360.

VERTICAL PRINTING INCREMENT = 0.1667 MILES PER LINE. (- MARKS BY LINE NUMBERS ARE ONE INCH APART)

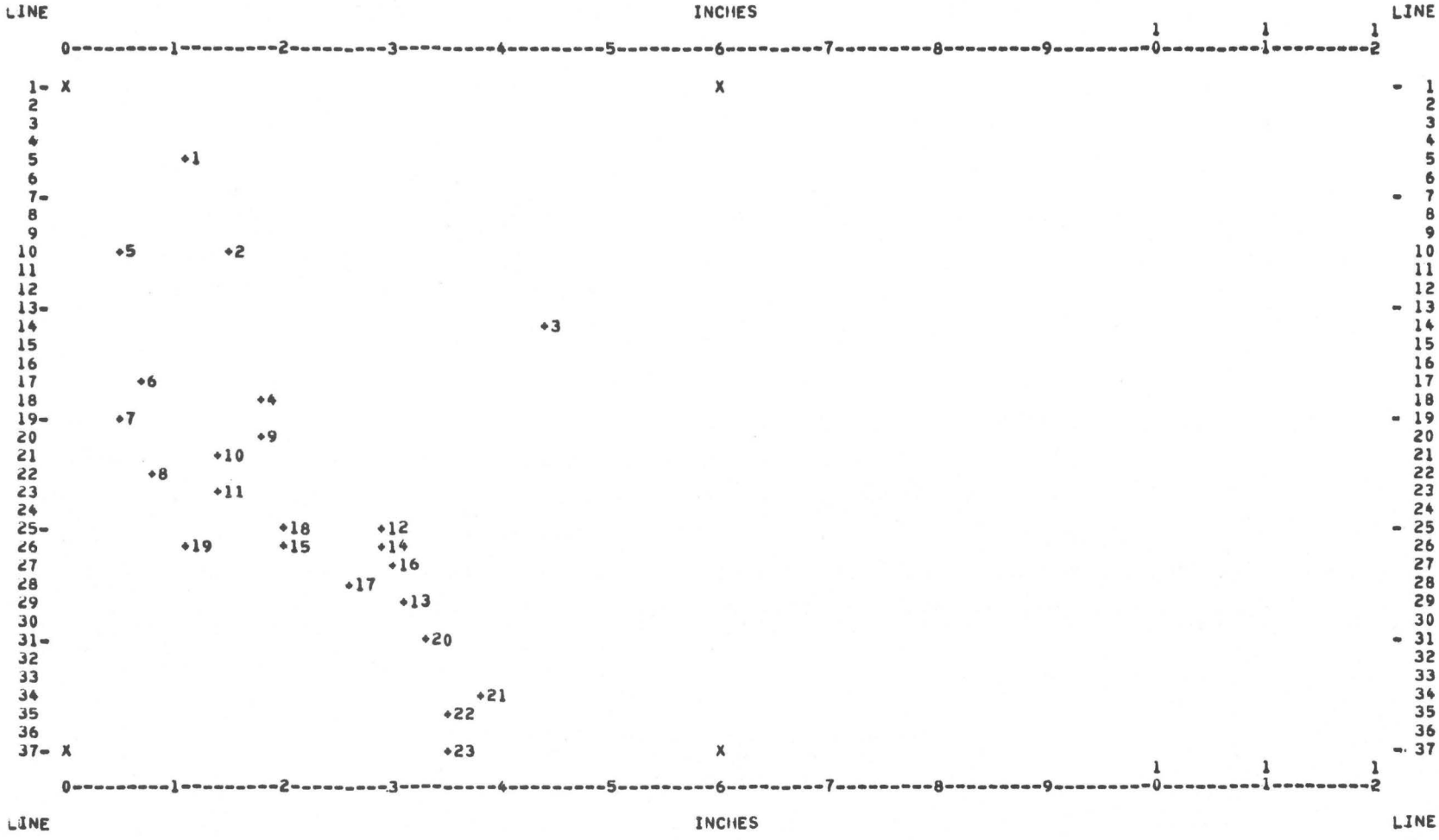
HORIZONTAL PRINTING INCREMENT = 0.1000E 00 MILES PER COLUMN.

THE RIGHT LIMIT OF PLOTTED DATA IS 6.2 INCHES FROM LEFT 0 ON THE HORIZONTAL SCALE (FOR USE ON MULTIPLE-PAGED PLOTS).

COACHELLA VALLEY--T.4S.,R.6E.

LOCATION OF DATA SITES

SHEET NUMBER 1



SCALE IS 1.000 MILES PER INCH OR 1 TO 63360.

EXPLANATION OF MAP PLOT

MAP PLOTTED BY ALBERS EQUAL AREA CONIC PROJECTION.
NORTH IS AT TOP OF PLOT. GRID POINTS ARE DENOTED BY THE SYMBOL X.
LOCATION OF DATA POINTS, REPRESENTED BY +, -, AND OVERPRINT SYMBOLS (*, LETTERS), ARE PLOTTED TO THE CLOSEST LINES AND COLUMNS.
OVERPRINT SYMBOLS (VALUES ARE LISTED BENEATH PLOT AND IDENTIFIED AS TO LINE NUMBER) ARE ORDERED FROM LEFT TO RIGHT HORIZONTALLY AND TOP TO BOTTOM VERTICALLY.
A -1 DENOTES DATA SAMPLING POINT AT WHICH SPECIFIED PLOT VALUE WAS NOT DETERMINED (PLOTTED ONLY IF REQUESTED ON OPTION CARD).

SCALE IS 1.000 MILES PER INCH OR 1 TO 63360.

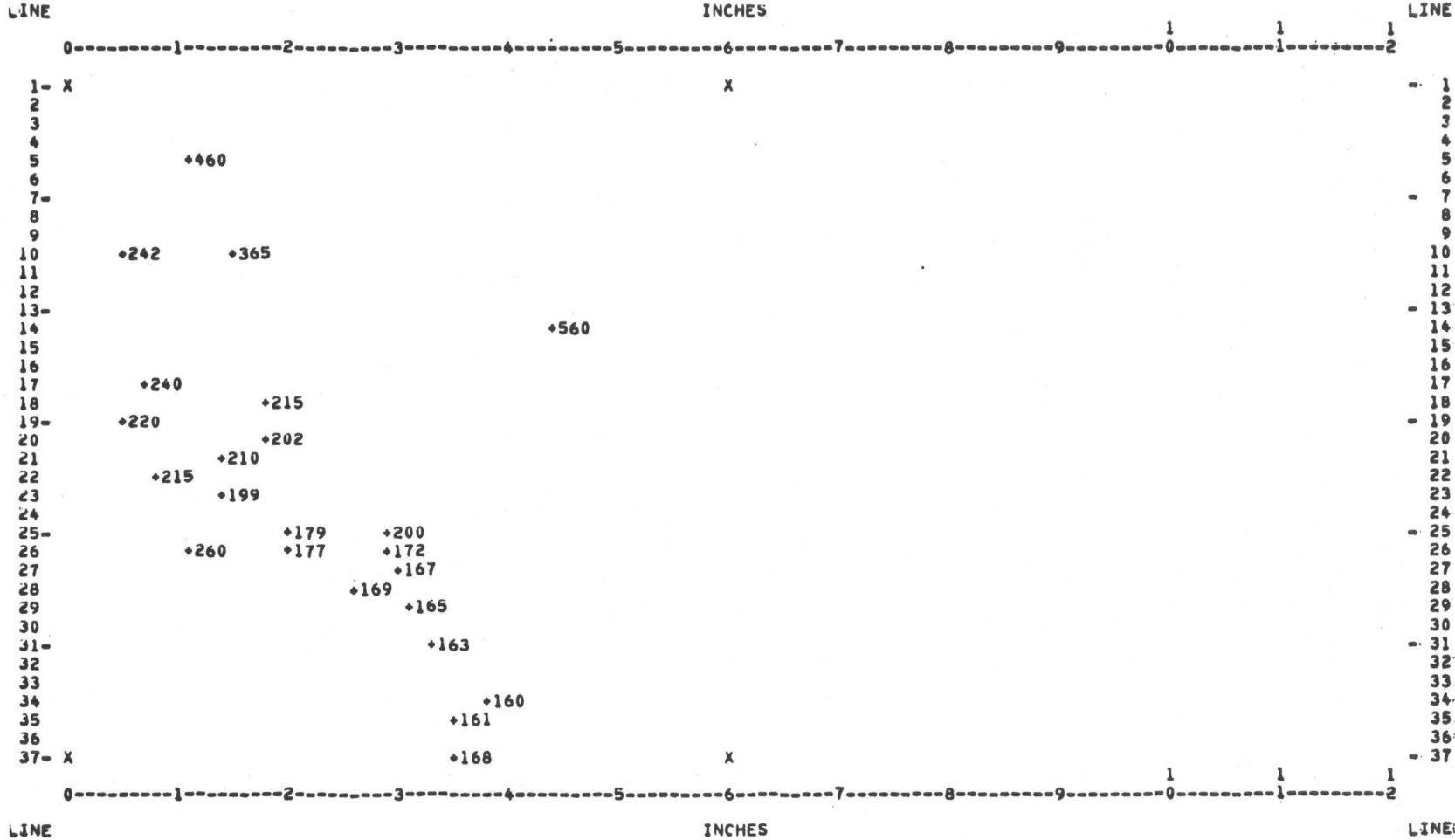
VERTICAL PRINTING INCREMENT = 0.1667 MILES PER LINE. (- MARKS BY LINE NUMBERS ARE ONE INCH APART)

HORIZONTAL PRINTING INCREMENT = 0.1000E 00 MILES PER COLUMN.

THE RIGHT LIMIT OF PLOTTED DATA IS 6.2 INCHES FROM LEFT 0 ON THE HORIZONTAL SCALE (FOR USE ON MULTIPLE-PAGED PLOTS).

COACHELLA VALLEY--T.4S.,R.6E.

IDENTIFICATION CODE OF PLOTTED PARAMETER = 72000 SHEET NUMBER 1



SCALE IS 1.000 MILES PER INCH OR 1 TO 63360.

III.C.4.c. Error Messages

HP001 ILLEGAL CONTROL CODE (program number) (control card) FOR MAP PROGRAM, EXECUTION TERMINATED

Solution: Check control card for errors.

HP002 OVERPRINT VALUES HAVE EXCEEDED ARRAY, PLOT OF THIS MAP DISCONTINUED.

Solution: The program is limited to 5000 overprint values; reduce data group size.

HP003 ****INPUT DATA HAS EXCEEDED PROGRAM ARRAY SIZE OPERATION CONTINUING WITH 1000 LOCATION.

Solution: Reduce Input Data Size.

III.C.5. References

Good, D.I., 1964, FORTRAN II Trend - Surface Program for the IBM 1620; Kansas Geol. Survey Spec. Distrib. Publ 14, 54 p.

Lowell, B.H., Morgan, C.O., and McNellis, J.M., 1970, Brief Description of and Examples of Output From Computer Programs Developed for use with water data in Kansas; Kansas Geol. Survey Spec. Distrib. Pub. 48, 54 p.

Tobler, W.R., 1965, Geological Coordinate Computation in Computer Techniques for the Petroleum Geologist: University of Michigan Engineering Summer Conferences May 11-21, 1965, 6502, 28 p.

U.S. Army, 1958, Universal Transverse Mercator Grid; Dept. of Army Tech. Manual, TM 5-241-8, July 1958, 66 p.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION A. Daily Values Data Entry and Computation (Program H475)

by Owen O. Williams

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.A. Daily Values Data Entry and Computation (Program H475)

IV.A.1. Introduction

The Daily Values Data Entry and Computation Program (program number H475) has been designed to (1) enter and update data in the Daily Values File; (2) compute data and store the results in the Daily Values File; (3) delete data from the file; and (4) correct the data identifiers.

The agency code, station identification number, parameter code, and statistic code must be furnished for each item to be stored. The cross section location and depth location should be furnished only in special cases (i.e., to identify temperatures collected at top and bottom locations). The state code, district code, county code, station name, latitude and longitude, and site type must be available in the Station Header File in order to store data in the Daily Values File. In the case of daily streamflow where computations are to be made, the drainage area also must be available. For information concerning the entry and updating of the Station Header File refer to Section III.A., entitled, "Instructions for Entering and Updating Data Stored in the Station Header File." The job control language for program number H475 has been cataloged and the procedure name is DVINPUT. Symbolic parameters are available within the cataloged procedure for specifying an agency code, an update password and an edit suppress.

In any given execution of the cataloged procedure, data may be entered from a tape or disk in the standard daily values record format (see Section IV.B.4.d. for format description) with or without data cards. The program will first transfer the data in the standard daily values record format on to a disk file and then process the data control cards.

Ten operations are available when using card input. Operation codes have been established to request each operation and a daily values code card (see Section IV.A.5.a.(2)) is used to designate the operation.

Program H475 was written in PL/1 for the IBM 360 and 370 Computer Series by the following USGS personnel: Owen O. Williams, Reston, Virginia, Harry W. Doyle, Salt Lake City, Utah, and Michael G. McDonald, Trenton, New Jersey.

IV.A.2. Daily Values File Organization

The Daily Values File is a general purpose file for the storage of water data collected or measured on a daily schedule. The file is divided into two basic subfiles: (1) the current file and (2) the historical file (backfile). The current file is a direct-access, on-line file that contains all daily values data being actively processed and updated. The current file contains all daily values data that were collected during the current or immediately preceding water year, plus updates to the historical file. A water year is defined as the twelve-month period beginning October 1 and ending September 30. The historical file is a sequential file stored on magnetic tapes and contains daily values data that were collected in water years that precede the two most current water years. Historical data are removed from the current file at six-month intervals and merged into the historical file. Historical data entered into the Daily Values File between merges will reside in the current file until it is merged into the historical file. Program H475 stores all data in the current file in ascending order of the record access key (refer to Section II.E.). The record access key consists of the identifiers in the order listed below.

1.	State Code --	See Appendix B for list of state codes.
2.	Agency Code --	See Appendix A for list of agency codes.
3.	Station identification number --	See Section II.B. for discussion of station identification numbers.
4.	Cross section locator --	Distance in feet from left bank (as determined by facing downstream).
5.	Sampling depth --	The depth in feet at which observation was made.
6.	Parameter code --	See Appendix D for list of parameter codes.
7.	Water year --	The 12-month period, October 1 through September 30, spanning

two calendar years and designated by the year in which the 12-month period ends.

8. Statistic code -- See Appendix E for the list of statistic codes.

IV.A.3. Data Security

Program H475 allows for the protection against unauthorized updates and retrievals of daily values records. The data security features are optional and should be utilized only when there is a need to prevent others from accessing specific data records. If an Update/Retrieval Password has been stored in a station header record, a daily values record for that station cannot be created or updated unless the user supplies a matching password. If the user-supplied password does not match the Update/Retrieval Password in the station header record, the input for that station will not be processed and an error message will be printed. A user-supplied password need not be specified if an Update/Retrieval Password is not stored in the station header record.

Daily Values records also may be protected against unauthorized retrievals if: (1) both an Update/Retrieval Password and a Retrieval Only Password have been stored in the station header record (see Section III.A.) and (2) the Daily Values Record security flag has been set "on" (see Section IV.A.3.b.).

Data that were processed from card input may be protected against unauthorized retrieval at time of initial entry or at a later time during an update operation. A detailed discussion of the steps required to request retrieval protection is given in Section IV.A.3.b. The retrieval of daily values records is discussed in Section IV.B.

Input data in the standard daily values record format (see Section IV.A.7.) from tape or disk cannot be protected against unauthorized retrievals until after the data are stored. During an update of these records the security retrieval flag may be set "on." This may be performed during the same execution of DVINPUT.

IV.A.3.a. Symbolic Parameter (PASSWRD)

The symbolic parameter PASSWRD within the cataloged procedure DVINPUT is available for specifying an Update/Retrieval Password. The password is specified on the job control language (JCL) EXEC card (see Section II.A.) as shown below:

```
// EXEC DVINPUT,PASSWRD=your password
```

where "your password" is the user-supplied password.

The password specified by means of the symbolic parameter PASSWRD remains in effect throughout the execution of the cataloged procedure DVINPUT, except when it has been temporarily superseded by a password submitted by means of a password/agency identification card. The password submitted on the password/agency identification card will apply to only the daily values record defined on the succeeding daily values code card or special program option card (see Section IV.A.5.a.)

IV.A.3.b. Password/Agency Identification Card (Z Card)

The password/agency identification card (Z card) which is optional, is shown in Figure 1. When required, it immediately precedes either a daily values code card or special program option card. The Z card may be used to:

(1) Separate the data and identify the password

(2) Request the protection of data against unauthorized retrievals

(3) Separate and identify the data by agency (detailed discussion in Section IV.A.5.a.(1))

(4) Update the agency and state codes in the daily values records (detailed discussion in Section IV.A.5.h.).

A Z card indicates that one of the above options are to be applied to the data which are identified by the succeeding daily values code card or special program option card. The password coded on the Z card will supersede the password submitted by means of the symbolic parameter only for records identified by the card that immediately follows the Z card. Only an Update/Retrieval Password may be coded on a Z card preceding a daily values code card. Either an

update/Retrieval Password or a Retrieval Only password may be coded on a Z card preceding a special program option card, except when correcting data identifiers (see Section IV.A.5.h.). Then, the Update/Retrieval password, if required, is specified. A security retrieval flag is stored in each daily values data record. Processing of this item relates to the security of data retrieval only. If a flag is "on" then password checking will be required prior to allowing a user to retrieve the data record. If the flag is "off" then password checking will be bypassed on retrieval. Security flags will be set to the "on" or "off" condition by the appearance of a password/agency identification card that contains the valid Update/Retrieval Password for the given site. The card must precede the daily values code card that identifies the data records. If columns 25-28 (Figure 1) of the Z card are coded with the word FLAG then the retrieval flag is set "on." If they are coded with the word NULL then the retrieval flag already set to "on" will be set "off." If no agency identification card is processed, or if columns 25-28 are left blank, the security retrieval flag will remain unchanged for all data records being updated and set "off" for initial entry. Security retrieval flags cannot be set "on" or "off" for any data identified by a special program option card, i.e., columns 25-28 of a Z card are ignored when a special program option card follows.

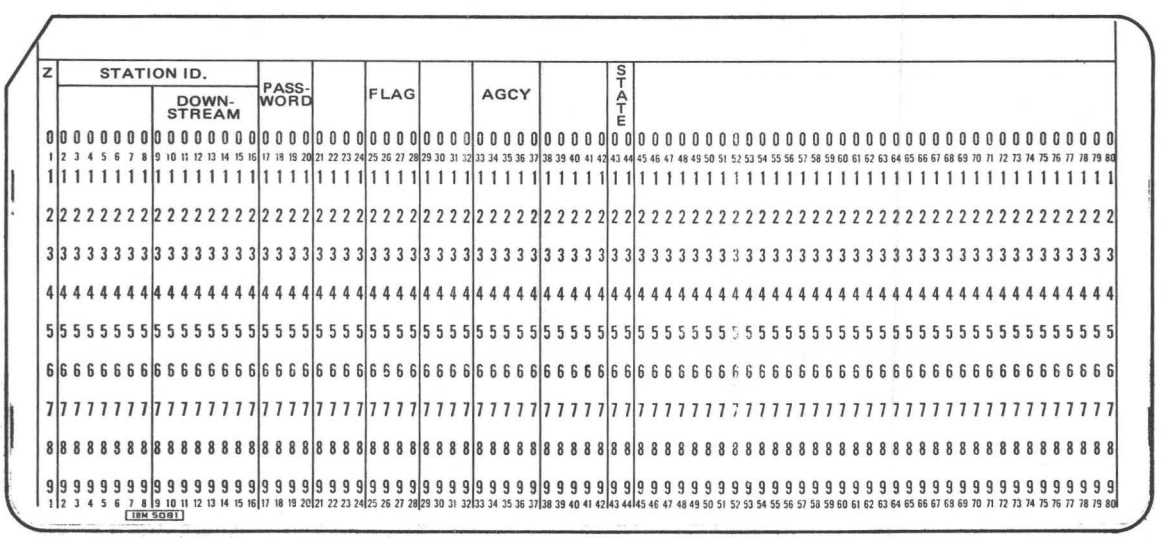

FIGURE 1. PASSWORD/AGENCY IDENTIFICATION CARD (Z CARD)

The password agency identification card format is described below.

The password agency identification card format is described below.

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Code only the Update/Retrieval Password if a daily values code card follows. Code either an Update/Retrieval or Retrieval Only Password if a special program option card follows.
Col. 21-24	Blank.
Col. 25-28	Code the word FLAG if the security retrieval flag is to be set "on." Code the word NULL if an existing security retrieval flag is to be set "off." If this field is left blank, security retrieval is set "off" on initial entry, and unchanged during update. This field is applicable only when the daily values code card follows the Z card.
Col. 29-32	Blank.
Col. 33-37	Agency Code -- code this field with the agency code that identifies the data in the Daily Values File (see Section IV.A.5.a.(1)).
Col. 38-42	Blank.
Col. 43-44	State Code -- When doing a CID or a DSP operation and the state code is to be corrected or deleted, then code this field with the state code with which the data in the Daily Values File is identified. Otherwise, leave this field blank. See Sections IV.A.5.h. and IV.A.5.j.
Col. 45-80	Blank.

IV.A.4. Data Editing

Program H475 edits data according to USGS standards (see Appendix D) prior to entry or update. However, the user retains the option to have coded (non-computed) values entered into the Daily Values File exactly as the value appears on the input cards. To request this option, the user must code the EDIT symbolic parameter on the EXEC card as follows:

```
// EXEC DVINPUT,EDIT=NORND
```

If the NORND is not requested, the default will be to round all input data according to USGS standards prior to storage in the WATSTORE Daily Values File. All computed values will be rounded prior to storage.

IV.A.5. Program Operations

Ten program operations are available when using card input. Table 1 summarizes the operations and lists the corresponding code to request each operation. The last column in the table indicates the card types available for each operation. The operation code is specified by means of the daily values code card.

The card formats as they apply to each operation are described in Sections IV.A.5.b. through IV.A.5.j. Some descriptions may be repetitious, however, the objective is to aid the user by having all requirements for each operation within a section.

IV.A.5.a. Data Identification

Some operations require as many as three data records which are uniquely identified by the following items: agency code, station identification number, cross section location, sampling depth, parameter code, and statistic code. For simplicity of discussion, all the above listed identifiers, except agency code, are referred to as the primary identifiers.

IV.A.5.a.(1) Agency Identification

The agency responsible for the data stored in the Daily Values File is identified by a code consisting of 3 to 5 alphanumeric characters (see Section I.A.). Each record in the Daily Values File must be identified by an agency code. The use of an agency code in processing daily values data is MANDATORY. A data record not identified by agency will result in an error message, and the data will be ignored. The agency code may be specified by means of the symbolic parameter AGENCY or the password/agency identification card.

Code	Operation	Cards
'ENT'	Enter data from cards into Daily Values File	Z,2,3,T
'SSD'	Make subdivided days computation for concentrations (mg/l) and water-quality discharges (tons/day) and store results in Daily Values Files	Z,2,6,5
'MPL'	Compute data using general log-log first order derivative equation $Y = a + bX^c$	Z,2,6
'RAT'	Compute data from a conversion table	Z,2,6,7
'CON'	Compute water-quality discharge (tons/day) using equation $L = 0.0027QC$	Z,2,6
'ADD'	Add two data records	Z,2,6
'SUB'	Subtract one data record from another	Z,2,6
'CID'	Correct the identifiers with which data in the Daily Values File are stored	Z,2,6
'YER'	Correct the water year with which data in the Daily Values File are stored	Z,2
'DSP'	Request a period of record to be deleted or other available record disposition feature	Z,2

TABLE 1. SUMMARY OF OPERATIONS AND CORRESPONDING CODES

■ IV.A.5.a.(1).(a) Symbolic Parameter (AGENCY)

AGENCY is the symbolic parameter within the cataloged procedure DVINPUT for specifying the agency code on the EXEC card.

```
//  EXEC DVINPUT,AGENCY=agency code
```

where "agency code" is the agency code to be stored with the data upon initial entry, or the agency code identifying the data during an update.

The agency code specified by means of the symbolic parameter AGENCY remains in effect for all input data except when temporarily superseded by an agency code submitted by means of the password/agency identification card. The agency code submitted by means of the password/agency identification card will be in effect only for the daily values record defined on the succeeding daily values code card or special program option card.

■ IV.A.5.a.(1).(b) Password/Agency Identification Card (Z Card)

The Z card (Figure 1), which is optional, may be used to separate and identify data by agency. When required, it immediately precedes either a daily values code card or a special program option card. The agency code on the Z card will supersede the agency code submitted by means of the symbolic parameter only for records identified by the card that follows the Z card. The Z card format is described in Section IV.A.3.b.

■ IV.A.5.a.(2) Primary Identifier

The primary identifiers are specified on the daily values code card (Figure 2) or the special program option card (Figure 3). The format of these two cards is given below.

■ IV.A.5.a.(2).(a) Daily Values Code Card (2 Card)

The daily values code card (2 card) is required to identify the data to be entered or updated in the Daily Values File and to specify the operation. The daily values code card is described below.

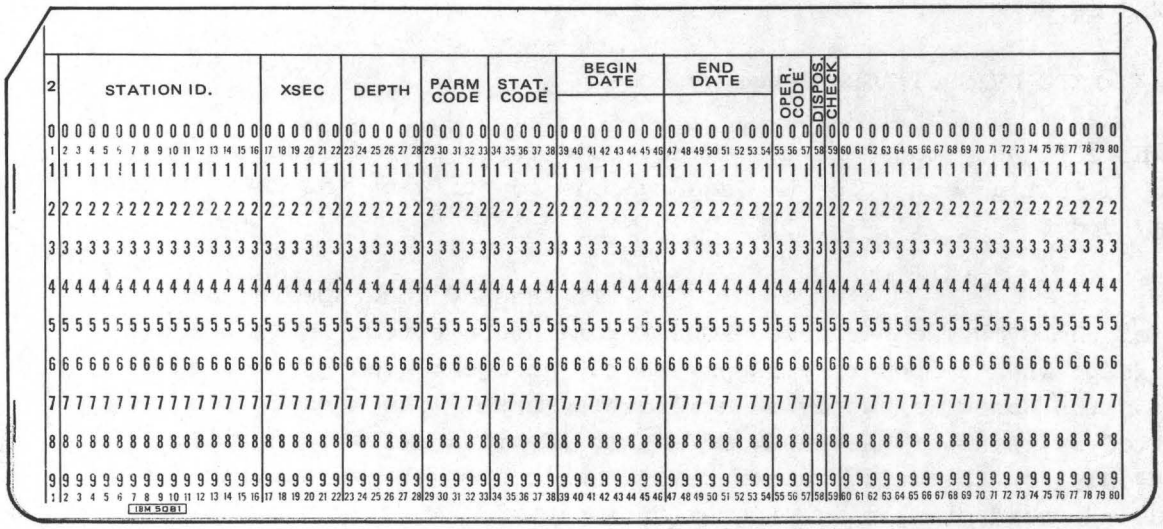

FIGURE 2. DAILY VALUES CODE CARD (2 CARD)

Col. 1 Enter a 2.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator (ft) -- The distance of the sampling point in feet from left bank (as determined by facing downstream). If not applicable leave this field blank.

Col. 23-28 Sampling depth -- Depth in feet at which sample was taken. Positive value is measured down from water surface. If not applicable leave this field blank.

Col. 29-33 Parameter code (Appendix D).

Col. 34-38 Statistic code (Appendix E).

Col. 39-54 Date Fields -- The use of the date fields depends on the operation (Col. 55-57) requested. Detailed instructions are given in Sections IV.A.5.b. through IV.A.5.j.

Col. 39-42 Beginning calendar year -- Code this field with the beginning calendar year of the period of record to be processed. If operation code is YER then code this field with the water year to be corrected. If operation code is ENT or SSD, then leave this field blank.

Col. 43-44 Beginning month -- Code this field with a two-digit number which represents the beginning month of the period of record to be processed (e.g., 01 for January, 12 for December). If the operation code is YER, ENT, or SSD, then leave this field blank.

Col. 45-46 Beginning day -- Code this field with a two-digit number representing the beginning day of the month of the period of record to be processed. If the operation code is YER, ENT, or SSD, then leave this field blank.

Col. 47-50 Ending calendar year -- Code this field with the ending calendar year of the period of record to be processed. If operation code is YER, then code this field with the correct water year. If operation code is ENT or SSD, then leave this field blank.

Col. 51-52 Ending month -- Code this field with the two-digit number which represents the ending month of the period of record to be processed. If the operation code is YER, ENT, or SSD, then leave this field blank.

Col. 55-57 Operation code -- Detailed instructions are given in Sections IV.A.5.b. through IV.A.5.j.

ENT -- Data entry.
SSD -- Subdivided day computation and entry of dissolved or suspended water quality discharges.
MPL -- Data computation.
CON -- Compute chemical discharges.
RAT -- Compute from a conversion table.
ADD -- Add two records.
SUB -- Subtract two records.

CID -- Change record access key.
DSP -- Delete records or apply the record disposition code specified.

Col. 58 Record disposition code -- This code is only applicable if columns 55-57 are coded with DSP (see Section IV.A.5.j.).

Col. 59 Check code -- This code is applicable only if columns 55-57 are coded with ADD or SUB (see Section IV.A.5.g.).

Col. 60-64 Concentration parameter code -- This field is applicable only if columns 55-57 are coded with SSD.

Col. 65 Blank.

■ IV.A.5.a.(2).(b) Special Program Option Card (6 Card)

The special program option card (6 card) is used to identify the data required for computations or corrections. Records identified by "6" cards (see Figure 3) must reside in the current file and will remain unchanged after the operation is performed; except if the operation code is CID (refer to Section IV.A.5.h.). The special program option card is described below.

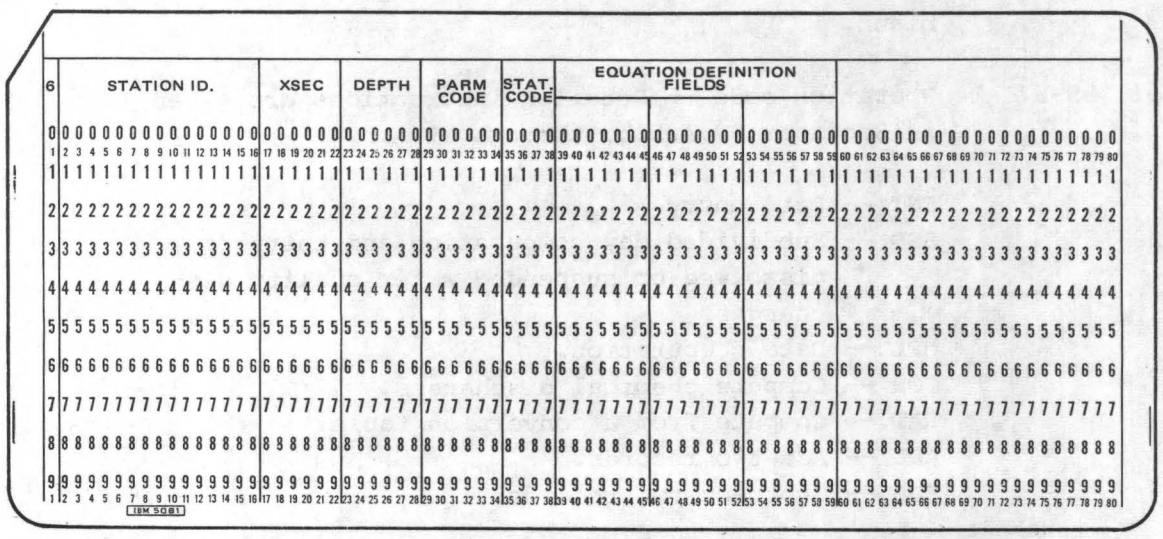

FIGURE 3. SPECIAL PROGRAM OPTION CARD (6 CARD)

Col. 1	Enter a 6.
Col. 2-16	Station identification number.
Col. 17-22	Cross section locator.
Col. 23-28	Sampling depth.
Col. 29-33	Parameter code (Appendix D).
Col. 34-38	Statistic code (Appendix E).
Col. 39-59	Equation definition fields for use with MPL operation (see Section IV.A.5.g.).
Col. 60-80	Blank.

IV.A.5.b. Data Entry (ENT)

The operation code ENT indicates daily values data are to be entered from cards and stored in the daily values current file. The primary identifiers, i.e., station identification number, cross section locator, sampling depth, parameter code, and statistic code, are specified on the daily values code card along with the operation code ENT. The daily values data are entered on the daily values data card (see Figure 4) immediately following the daily values code card. The user also has the option of using a total check card (Figure 5) which, if used, must immediately follow the daily values cards for the water year to which it applies. The total check card is used to check the total value of the days existing in the record after the daily values data cards are processed.

IV.A.5.b.(1) Preparation of Input

Four card formats are available for input by operation ENT. These are as follows:

(1) Password/Agency identification card (Z card), optional.

(2) Daily values code card (2 card), mandatory.

(3) Daily values data card (3 card), mandatory.

(4) Total check card (T card), optional.

IV.A.5.b.(1).(a) Password/Agency Identification Card (Z Card)

The Z card is optional. If required during an ENT operation, it must precede the daily values code card. The update/retrieval password and/or agency code specified on the Z card will supersede the password and/or agency code submitted through the symbolic parameter. The security retrieval flag may be set "on" or "off" by means of the Z card (refer to Section IV.A.3.b.). The format of the Z card used in an ENT operation is described below.

Col. 1 — Enter a Z.

Col. 2-16 — Blank.

Col. 17-20 — Update/Retrieval password -- If it is necessary to override the PASSWRD symbolic JCL parameter, then this entry must be coded.

Col. 21-24 — Blank.

Col. 25-28 — Security retrieval flag -- If this field is left blank, the flag is set "off" on initial entry and unchanged during update. If not applicable, leave this field blank or:

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."
Refer to Section IV.A.3.b.

Col. 29-32 — Blank.

Col. 33-37 — Agency code -- If it is necessary to override the AGENCY symbolic JCL parameter, then code this field.

Col. 38-80 — Blank.

IV.A.5.b.(1).(b) Daily Values Code Card (2 Card)

The "2" card (Figure 2) is required to identify the data to be entered or updated in the Daily Values

File. The format of the "2" card as it applies to the ENT operation is described below.

Col. 1	Enter a 2.
Col. 2-16	Station identification number.
Col. 17-22	Cross section locator.
Col. 23-28	Sampling depth.
Col. 29-33	Parameter code (Appendix D).
Col. 34-38	Statistic code (Appendix E).
Col. 39-54	Blank.
Col. 55-57	Operation code -- Enter ENT.
Col. 58-80	Blank.

■ IV.A.5.b.(1).(c) Daily Values Data Card (3 Card)

The Daily Values Data Card (3 card) is required for entering data, updating data, or deleting data for individual days. The "3" card (Figure 4) can be used only when the operation code ENT is specified on the daily values code card. The "3" card format is described below.

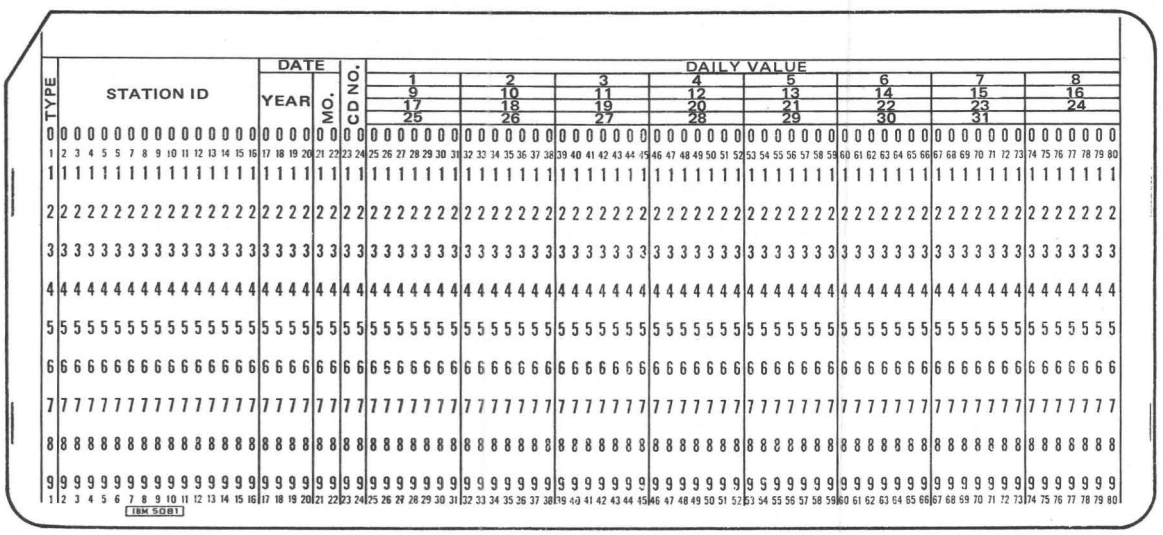

FIGURE 4. DAILY VALUES DATA CARD

Col. 1 Enter a 3.

Col. 2-16 Station identification number -- Same as on daily values code card.

Col. 17-20 Calendar year -- Code a four-digit number representing actual calendar year of data on the card.

Col. 21-22 Month -- Code a two-digit number representing the month. For example, March is punched as 03. November is punched as 11.

Col. 23-24 Card number -- A two-digit number representing the fraction of the month that the data values were collected. This number is coded as follows:

Card No.	Days
01	1-8
02	9-16
03	17-24
04	25-31

Col. 25-80 Daily values -- Eight seven-column fields in which the daily values are punched for the designated days. The value is punched with decimal point and significant digits to the right of the decimal point where needed. Whole numbers need no decimal point. Blank fields will be interpreted as no data available (initial entry) or no modifications necessary (updates). The data value may be punched anywhere in the field (e.g., bb19.2b, where b=blank). There must be no alphabetic characters or embedded blanks within the data values. The decimal point is punched only when a fractional portion is to be reported. A field of 999999 will be interpreted as a deletion code on an update, and the value in the current disk file for the corresponding day will be deleted. A field of 999998 will be interpreted as a deletion code on an update, and the value in the current disk file and the magnetic tape backfile for the corresponding day will be deleted.

A field of -99999 in day 01 for any particular month will cause a complete month of zero values to be stored. See discussion of "Total Check Card" below for method to enter complete year of zero flow.

■ IV.A.5.b.(1).(d) Total Check Card (T Card)

The total check card (Figure 5) is optional and may be used only when the operation code ENT has been specified on the daily values code card. It is used to check the total value for the water year after the type 3 cards are processed. This total will include the values submitted on the preceding "3" cards, plus all other data values that were previously stored in the record.

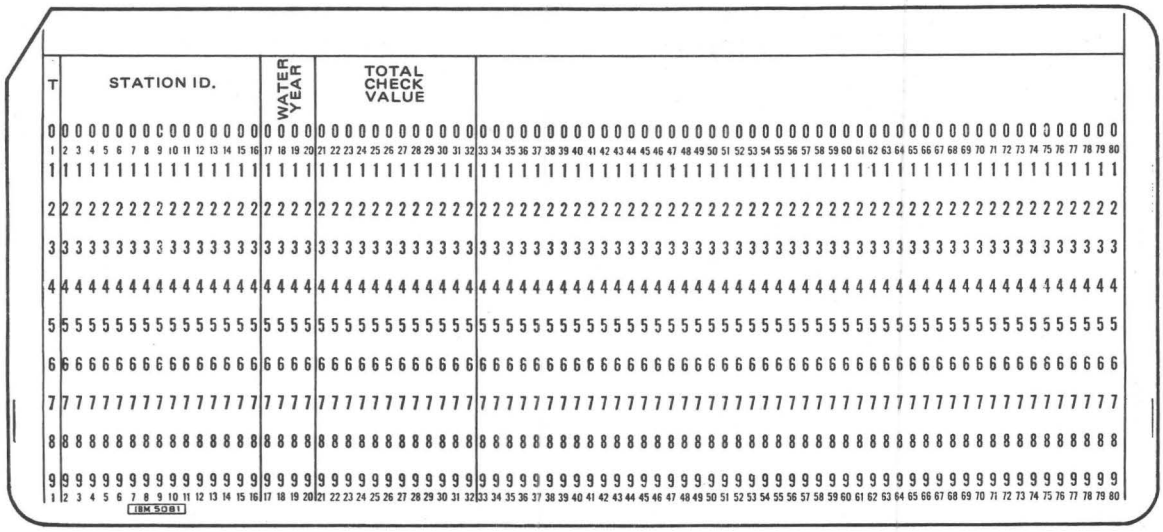

FIGURE 5. TOTAL CHECK CARD

Col. 1 Enter a T.

Col. 2-16 Station identification number -- Same as on the daily values code card.

Col. 17-20 Water year -- A four-digit number representing the water year for which the total value is to be checked.

Col. 21-32 The total value (sum of daily values in record) -- This value is punched with a decimal point and following significant digits if necessary. If an incomplete water year of daily values is submitted for processing, the total on this card, if used, must be the total for the days for the data existing in the file after processing the preceding "3" cards. The total check card must immediately follow the daily values cards for the water year to which it applies. The absence of a total check card for a water year will cause an advisory message to be printed, but will not prevent data from being entered into the file. To enter a complete water year of zero values, this field (col. 21-32) should be coded with -99999. It is strongly recommended that the total card be used as a quality control device for all data to be entered into storage. The use of the total card not only is a check on the keypunch and verification process, but it also is a check on data communication lines, in the case of computer terminals, and the card reader facilities on the computer or terminal. If the total card is not used, then manual proofreading of the data is required to ensure that the data have been correctly punched and entered into storage.

Col. 33-80 Blank.

IV.A.5.b.(2) Data Conversion Upon Entry

Provisions are made in the computer program for using the operation code ENT to convert streamflow in million gallons per day (mgd) to streamflow in cubic feet per second (cfs), air and water temperature in degrees Fahrenheit (^{o}F) to temperature in degrees Celsius (^{o}C), and reservoir storage in thousands of acre-feet to reservoir storage in acre-feet. When the parameter codes for mgd, ^{o}F, or thousand acre-feet are specified on the daily values code card, the computer program automatically converts the values to cfs, ^{o}C, or acre-feet before storage. When these data are to be retrieved at a later date, the parameter codes for cfs, ^{o}C, or acre-feet must be used. Table 2 shows the units and input code, and the corresponding output code and units.

Input Code	Units	Output Code	Units
99994	Reservoir Storage thousands of ac-ft.	00054	Reservoir Storage in ac-ft.
99996	Temperature, Water in degrees F.	00010	Temperature, Water in degrees C.
99997	Temperature, Air in degrees F.	00020	Temperature, Air in degrees C.
99998	Streamflow in million gallons per day.	00060	Streamflow in cubic feet per sec.

TABLE 2. DATA CONVERSIONS PERFORMED BY OPERATION ENT

IV.A.5.b.(3) Zero Value Input

In order to relieve the user from entering zero values for every day, provision has been made for entering one daily values data card to indicate a complete month of zero values or one total check card to indicate a complete water year of zero values. If the field for day 01 for any particular month on the daily values card is coded with -99999, a complete month of zero values will be stored. If the field for the total values (sum of daily values entries) on the total check card is coded with -99999, a complete water year of zero values will be stored.

IV.A.5.b.(4) Updating and Deleting Data

Data may be updated (corrected) and individual days deleted in the current disk file using the operation code ENT. Data also may be updated and individual days deleted in the historical file on magnetic tape. All update information for the historical file is entered into the current file.

The historical file is then corrected by merging the new information from the current file about twice a year. Prior to the merge operation, the Daily Values Retrieval Program (Section IV.B.) will apply the updates to data retrieved from the historical tape files. The procedures for updating and deleting data available using operation ENT are explained below:

(1) To update data in either the current disk file or the magnetic tape historical file, enter the data onto the current disk file. The data being entered will overwrite data previously entered for the same period or day. Data in the historical file will be overwritten when the data are merged into the historical file (about twice yearly). Blank fields on the daily value data card indicate the daily value is not to be changed when updating.

(2) To delete individual days from the current disk record only, enter a daily value of 999999 on the day to be deleted. The corresponding day in the magnetic tape historical file (if it exists) will not be deleted.

(3) To delete individual days from the magnetic tape historical file, enter a daily value of 999998 on the day to be deleted. This day in the current disk file (if it exists) will be deleted immediately, and/or the corresponding day in the magnetic tape historical file will be deleted during the merge of data to the historical file.

■ IV.A.5.b.(5) Sample Input and Output

A sample card deck setup using only the ENT operation is shown in Figure 6. Cards beginning with a slash are job control (JCL) cards. Note that each time the primary identifier changes a "2" card is required. A sample printout produced from these cards is shown in Figure 7.

■ IV.A.5.c. Subdivided Computation and Entry of Water-Quality Discharge (SSD)

The operation code SSD indicates that daily suspended or dissolved water-quality discharge data are to be computed from subdivided day of values of streamflow (cfs) and dissolved or suspended water-quality concentrations (mg/l). Basically, the input consists of streamflow and concentration. The input values represent daily means, mean values for a specified period of time (hours), or instantaneous values. The output consists of new or updated daily values water-quality concentrations (mg/l) and water-quality discharge (tons/day) records stored in the Daily Values File.

```
//          JOB (----),'     ',CLASS=
/*PROCLIB   WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
Z                          FLAG
2         01463500              0006000003                    ENT
3         01463500197310 01     1000    1000    1000    1000    1000    1000    1000    1000
3         01463500197310 02     1000    1000    1000    1000    1000    1000    1000    1000
3         01463500197310 03     1000    1000    1000    1000    1000    1000    1000    1000
T         01463500197412 24000
3         01463500197410 01     1000    1000    1000    1000    1000    1000    1000    1000
3         01463500197410 02     1000    1000    1000    1000    1000    1000    1000    1000
T         01463500197512 16000
2         01463500              0001000003                    ENT
3         01463500197310 0110     10      10      10      10      10      10      10
3         01463500197310 0210     10      10      10      10      10      10      10
3         01463500197410 0110     10      10      10      10      10      10      10
3         01463500197410 0210     10      10      10      10      10      10      10
Z                          NULL
2         01463500              0001000001                    ENT
3         01463500197310 0110     10      10      10      10      10      10      10
3         01463500197310 0210     10      10      10      10      10      10      10
3         01463500197410 0110     10      10      10      10      10      10      10
3         01463500197410 0210     10      10      10      10      10      10      10
/*
//
//
```

FIGURE 6. SAMPLE CARD INPUT USING THE ENT OPERATION CODE

```
YOU HAVE SUBMITTED A Z CARD TO PROGRAM H475 WHICH RESULTED THE FOLLOWING CONDITIONS:

    AGENCY CODE = USGS
    UPDATE PASSWORD =
    SECURITY RETRIEVAL FLAG TURNED ON FOR ALL DATA UPDATED OR CREATED

THE ABOVE CONDITIONS WILL BE USED FOR THIS PROGRAM ONLY FOR THE NEXT INPUT DATA


DATA ENTER   BY OPERATION ENT          AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-ON
STATION=       01463500, XSECTION=       , DEPTH=       , PARM_CODE= 00060, STATISTIC=00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                 DELAWARE R AT TRENTON NJ
  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
 72720.00 189180.00 963050.00 602700.00 458140.00 596900.00 791400.00 453110.00 227810.00 149590.00 177600.00 350840.00  5033040.00
   TOTAL OF DAILY FIGURES DOES NOT AGREE WITH PUNCHED CHECK TOTAL                                                        CHECK TOTAL=    24000.00
1975
 123590.00 277620.00 610760.00 577780.00 602190.00 546400.00                                                                2738340.00
   TOTAL OF DAILY FIGURES DOES NOT AGREE WITH PUNCHED CHECK TOTAL                                                        CHECK TOTAL=    16000.00


DATA ENTER   BY OPERATION ENT          AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500, XSECTION=       , DEPTH=       , PARM_CODE= 00010, STATISTIC=00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                 DELAWARE R AT TRENTON NJ
  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
    326.39     204.29     119.32      43.68      79.89      98.14     318.45     538.87     542.75     794.10     438.53     530.03     4034.44
                                                                                                                                  NO CHECK TOTAL
1975
    266.74     280.07     109.08      23.13      59.36                                                                            738.38
                                                                                                                                  NO CHECK TOTAL


YOU HAVE SUBMITTED A Z CARD TO PROGRAM H475 WHICH RESULTED THE FOLLOWING CONDITIONS:

    AGENCY CODE = USGS
    UPDATE PASSWORD =
    SECURITY RETRIEVAL FLAG TURNED OFF FOR ALL DATA UPDATED OR CREATED

THE ABOVE CONDITIONS WILL BE USED FOR THIS PROGRAM ONLY FOR THE NEXT INPUT DATA
THESE CONDITIONS WILL THEN BE REPLACED BY THE ORIGINAL PASSWORDS THAT WERE SUBMITTED TO PROGRAM H475


DATA ENTER   BY OPERATION ENT          AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500, XSECTION=       , DEPTH=       , PARM_CODE= 00010, STATISTIC=00001,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                 DELAWARE R AT TRENTON NJ
  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
    354.39     229.02     134.89      50.40      96.57     115.16     340.66     563.85     613.39     844.89     465.68     576.40     4385.30
                                                                                                                                  NO CHECK TOTAL
1975
    271.32     295.96     123.96      28.52      67.42                                                                            787.18
                                                                                                                                  NO CHECK TOTAL


                                                    RECORDS TRANSFERRED TO DISK
STATE   AGENCY      STATION        WATER YEAR   PCODE      STATISTIC     XSECTION     DEPTH     OPERATION   RETRIEVAL FLAG
                                                                                              ENT         ON
  34    USGS       01463500          1974      00060      00003                                ENT         ON
  34    USGS       01463500          1975      00060      00003                                ENT         OFF
  34    USGS       01463500          1974      00010      00003                                ENT         OFF
  34    USGS       01463500          1975      00010      00003                                ENT         OFF
  34    USGS       01463500          1974      00010      00001                                ENT         OFF
  34    USGS       01463500          1975      00010      00001

NORMAL END OF PROCESSING OF PROGRAM H475
```

FIGURE 7. SAMPLE PRINTOUT WHEN OPERATION ENT PERFORMED

The mean daily concentration value stored is computed as follows:

$$C_m = \frac{\sum_{i=1}^{i=n} C_i \, \Delta t_i}{24}$$

Where C_m is the daily mean concentration,

C_i is the concentration (mg/l) measured over an incremental time period,
Δt_i is the incremental time period (hrs.),
n is the total number of increments, and
24 is the number of hours in a day.

The mean daily water-quality discharge value is computed as follows:

$$L = 0.0027 \quad \frac{\sum_{i=1}^{i=n} C_i \, Q_i \, \Delta t_i}{24}$$

Where L is the mean daily water-quality discharge (tons/day)

C_i is the mean concentration (mg/l) measured over an incremental time period,
Q_i is the mean streamflow measured over the incremental time period,
Δt_i is the incremental time period (hrs.),
n is the total number of increments,
.0027 is the conversion factor, and
24 is the number of hours in a day.

■ IV.A.5.c.(1) Preparation of Input

Four card types are available for input when operation code SSD is specified. They are:

(1) Password/agency identification card (optional),

(2) Daily Values code card (mandatory),

(3) Special program option card (mandatory),

(4) Water-quality discharge card (mandatory).

■ IV.A.5.c.(1).(a) Password/Agency Identification Card (Z Card)

The password/agency card is optional. If required, it must precede the daily values code and/or the special program option card. When preceding the daily values code card, the password specified must be an Update/Retrieval Password, and the security retrieval flag may be set "on" or "off." When preceding the special program option card, the password may be either an Update/Retrieval Password or a Retrieval Only Password. A brief description of the format for use with the SSD operation code follows (see Section IV.A.3.b. for detailed description):

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag -- Applicable only when preceding a daily values code card. If left blank flag is set "off" on initial entry and unchanged upon update.

Code

FLAG -- set flag "on."
NULL -- set flag "off."

Col. 29-32	Blank.
Col. 33-37	Agency code (if required).
Col. 38-80	Blank.

■ IV.A.5.c.(1).(b) Daily Values Code Card (2 Card)

The "2" card is required to identify the water-quality discharge and the concentration data to be entered in the Daily Values File. The primary identifiers for the water-quality discharge and the concentration must be the same with the exception of the parameter code. The water-quality discharge parameter code is specified in columns 29-33 and the parameter code for the concentration is specified in columns 60-64. The format of the daily values code card is described below:

Col. 1	Enter a 2.
Col. 2-16	Station identification number.
Col. 17-22	Cross section locator.
Col. 23-28	Sampling depth.
Col. 29-33	Water-quality discharge parameter code (Appendix D).
Col. 34-38	Statistic code (Appendix E).
Col. 39-54	Blank
Col. 55-57	Operation code -- Enter SSD.
Col. 58-59	Blank.
Col. 60-64	Concentration parameter code (Appendix D).
Col. 65-80	Blank.

■ IV.A.5.c.(1).(c) Special Program Option Card (6 Card)

The "6" card is required to identify the streamflow data to be used for the computation of the water-quality discharge. The "6" card must follow the "2" card, unless a Z card is required to further identify the streamflow. When needed, the Z card follows the "2" card and precedes the "6" card. The format of the special program option card is described below:

Col. 1 Enter a 6.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code -- Enter 00060.

Col. 34-38 Statistic code.

Col. 39-80 Blank.

■ IV.A.5.c.(1).(d) Water-Quality Discharge Card (5 Card)

For subdivided day processing, the streamflow and concentration data along with the corresponding date and time entries are entered on the water-quality discharge card (Figure 8). If it is desired to override the computed water-quality discharge value, then code the discharge value in tons per day in the appropriate field (col. 48-58) on the water-quality discharge card. Do not enter daily mean streamflow data on the water-quality discharge card if the streamflow values are to be obtained from the daily values current file. A water-quality discharge card may contain input values that represent the entire day (time not given) or portions of a subdivided day (time reported). For complete months of zero flow, code a -99999 in the field for streamflow on the water-quality discharge card along with the station identification number, year, and month. Leave the remainder of the card blank (including day number). The concentration and water-quality discharge daily values for the month will be set equal to zero. Thus, the user is relieved of entering zero values for every day.

The "5" cards follow the "6" card. The format of the water-quality discharge card is described below:

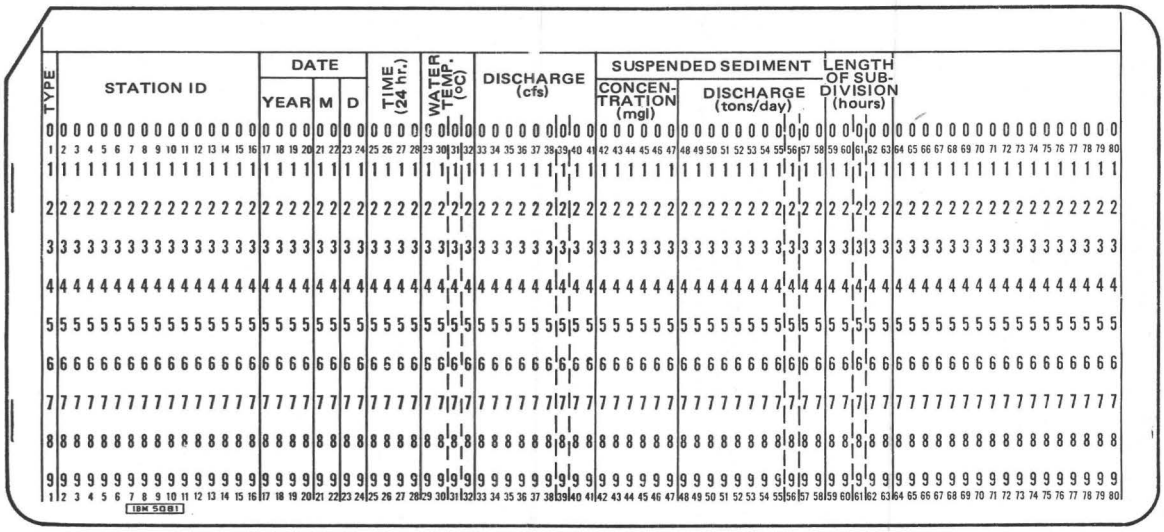

FIGURE 8. WATER-QUALITY DISCHARGE CARD

Col. 1 Enter a 5.

Col. 2-16 Station identification number (same as on "2" card).

Col. 17-20 Calendar year -- Code a four-digit number representing actual calendar years of data on the card.

Col. 21-22 Month -- Code a two-digit number representing the month. For example, March is coded as 03; November as 11.

Col. 23-24 Day of the month.

Col. 25-28 Time designation -- The following options apply to these columns and to:

Columns 59-63:

a. Leave all time entries blank if the streamflow (cfs) and concentration (mg/l) apply to the whole day (no subdivision).

b. Subdivided days can be handled by two different methods as follows:

1. The time at the beginning and end of the subdivision can be reported (use 24 hours clock system and code all values in col. 25-28). If this option is used, the first card of the subdivided day must have a time equal to 0000 coded in col. 25-28. The user must then code on consecutive cards, the instantaneous streamflow and sediment concentration for the beginning and end of a given subdivision. For example, if the first period in a given subdivided day ended at 1530, 0000 would be coded in col. 25-28 of the first card for that day, then 1530 would be coded in col. 25-28 of the second card. The values coded on the second card will be interpreted as the instantaneous ending values for the first period, and the beginning values for the second period. The instantaneous values at the beginning and ending of each subdivision will be averaged to find the mean concentration and streamflow for the subdivided period. The time of the last card for each subdivided day must be coded as 2400 in col. 25-28.

2. An alternate method based on time intervals for computing subdivided days is to code the number of hours (to the nearest hundredth of an hour) that the streamflow and sediment concentrations is applicable in col. 59-63. The streamflow and sediment concentration shown must then be the mean for the given time interval. Note that the decimal point is always punched on col. 61. Also note that the number of hours for a subdivided day must add up to 24 hours.

Col. 29-32 Blank.

Col. 33-41 Streamflow (cfs) -- Code the mean (daily or subdivided) or instantaneous streamflow in these

columns. It is not necessary to code daily mean streamflow that are available from the Daily Values current file. The computer program will compute a time-weighted daily mean streamflow from the subdivided values entered on the input cards. Streamflow data specified in these columns or computed from these columns are not stored in the Daily Values File.

Col. 42-47 Suspended or dissolved concentration (mg/l) -- Code the mean (daily or subdivided) or instantaneous concentration in these columns. A zero, "0", concentration is to be reported for days of no flow. When entering an estimated water-quality discharge (tons/day), a mean concentration for that discharge also must be provided.

Col. 48-58 Dissolved or suspended water-quality discharge (tons/day) -- If these columns are left blank, the computer program will compute the discharge from the available information. If it is desired that the program not compute the discharge value, then code the desired value, in these columns.

Col. 59-63 Time interval -- See discussion included with col. 25-28.

Col. 64-80 Blank.

IV.A.5.c.(1).(e) Sample Input and Output

A sample card deck setup using only operation code SSD is shown in Figure 9. Cards beginning with a slash are job control language (JCL) cards. Note that the Z card, if required, precedes the "2" card and/or "6" card. A sample printout produced from these cards is shown in Figure 10.

IV.A.5.d. Data Computation (MPL)

The operation code MPL indicates that each daily value within a period of record (specified by dates) in the file is to be the independent variable (X) in the general log-log first order derivative relation,

$$Y = a + bX^{c}$$

```
//          JOB (----),'     ',CLASS=
/*PROCLIB  WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2        01463500              8015500003                    SSD  80154
6        01463500              0006000003
5        0146350019730213                          75       17.36
5        0146350019730214             100.00       75
5        01463500197302160000          90.00       14
5        01463500197302161200          50.00       13
5        01463500197302162400          10.00       12
5        0146350019730217              80.00       15            12.00
5        0146350019730217              70.00       14             6.00
5        0146350019730217              60.00       13             6.00
5        01463500197310               -99999
/*
//
//
```

FIGURE 9. SAMPLE CARD INPUT USING THE SSD OPERATION CODE

```
 DATA COMPUTED BY OPERATION SSD          AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION=       01463500, XSECTION=       , DEPTH=       , PARM_CODE= 80155, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA=    6780.00                 DELAWARE R AT TRENTON NJ

  YR   OCT       NOV       DEC       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       TOTAL
1973 CONC
                                               177.00                                                                          177.00
1973 LOAD
                                                42.00                                                                           42.00


                                                                RECORDS TRANSFERRED TO DISK
STATE   AGENCY       STATION          WATER YEAR   PCODE      STATISTIC      XSECTION      DEPTH      OPERATION   RETRIEVAL FLAG
  34     USGS        01463500            1973      80155        00003                                    SSD           OFF
  34     USGS        01463500            1973      80154        00003                                    SSD           OFF

NORMAL END OF PROCESSING OF PROGRAM H475
```

FIGURE 10. SAMPLE PRINTOUT WHEN OPERATION SSD PERFORMED

Where Y is the dependent variable to be computed and stored, "a" is a constant, "b" is the coefficient, and "c" is the exponent. The station identifiers for the dependent variable (Y), the period of record, and the operation code MPL are specified on the daily values code card. The station identifiers for the independent variable (X) along with the required values for "a," "b," and "c" in the above equation are specified on the special program option card.

If "a," "b," or "c" are not specified, the default value for each are as follows:

a = 0, b = 1, and c = 1.

By not specifying "a," the log-log relation $Y = bX^c$ may be computed; by not specifying "c," the linear least-square equation Y = a + bX may be computed; and by not specifying "b" or "c," the equation Y = a + X may be computed. The values for "a," "b," and "c" may be specified as negative by prefixing the value with the minus (-) sign. This operation may be used to make corrections to already existing data records by specifying the same primary identifiers on the special program option card as on the daily values code card. An example of the use of this option for making corrections would be datum corrections or correcting data in which a decimal has been misplaced. A request for this operation consists of only one daily values code card and one special program card, each preceded by a Z card if required.

■ IV.A.5.d.(1) Preparation of Input

Three card types are available for use with operation MPL. They are:

(1) Password/agency identification card (optional)

(2) Daily Values code card (mandatory) and

(3) Special program option card (mandatory).

■ IV.A.5.d.(1).(a) Password/Agency Identification (Z Card)

If required, the Z card must precede the daily values code card and/or the special program option card. When preceding the daily values code card, the Update/Retrieval Password must be specified and the security retrieval flag may be set

"on" or "off." When preceding the special program option card the Retrieval Only password may be specified.

A brief description of the Z card (see Section IV.A.3.b. for a detailed description) follows:

Col. 1 Enter a Z.

Col. 2-16 Blank.

Col. 17-20 Password (if required).

Col. 21-24 Blank.

Col. 25-28 Security retrieval flag -- Applicable only when preceding a daily values code card. If left blank, flag is set "off" upon initial entry and unchanged during update.

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32 Blank.

Col. 33-37 Agency code (if required).

Col. 38-80 Blank.

■ IV.A.5.d.(1).(b) Daily Values Code Card (2 Card)

The primary identifiers for the dependent variable (Y) and the period of record to be computed are specified on the "2" card. The "2" card is described below:

Col. 1 Enter a Z.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code (Appendix D).

Col. 34-38 Statistic code (Appendix E).

Col. 39-42 Beginning calendar year -- Code a four-digit number representing the beginning calendar year of the period of record to be processed.

Col. 43-44 Beginning month -- Code a two-digit number representing the beginning month of period of record to be processed, e.g., 01 for January.

Col. 45-46 Beginning day -- Code the beginning day of the period of record to be processed.

Col. 47-50 Ending calendar year -- Code the ending year of the period of record to be processed.

Col. 51-52 Ending month -- Code the ending month of the period of record to be processed.

Col. 53-54 Ending day -- Code the ending day of the period of record to be processed.

Col. 55-57 Operation code -- Enter MPL.

Col. 58-80 Blank.

■ IV.A.5.d.(1).(c) Special Program Option Card (6 Card)

The primary identifiers for the independent variable X, the constant a, the coefficient b, and the exponent c, in the general log-log equation,

$$Y = a + bX^c$$

are specified on the "6" card (see Section IV.A.5.a. for general discussion of the "6" card).

A description of the "6" card as it applies when operation code MPL is specified follows:

Col. 1 Enter a 6.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code (Appendix D).

Col. 34-38 Statistic code (Appendix E).

Col. 39-45 This field is coded with the value for the constant "a" in the equation $Y = a + bX^c$. The value may be in any contiguous part of the field with decimal if appropriate. If this field is left blank then a default for "a" is a value of zero. This field is applicable only for operation code MPL.

Col. 46-52 This field is coded with the value for the coefficient "b" in the equation $Y = a + bX^c$. The value may be in any contiguous part of the field with decimal if appropriate. If this field is left blank then the default for "b" is a value of one. This field is applicable only for operation codes MPL.

Col. 53-59 This field is coded with the value for the exponent "c" in the equation $Y = a + bX^c$. The value may be in any contiguous part of the field with decimal if appropriate. If the field is left blank, the default for "c" is a value of 1. This field is applicable only for operation code MPL.

Col. 60-80 Blank.

IV.A.5.d.(2) Sample Input and Output

A sample card deck setup using only the MPL operation is shown in Figure 11. Note that only "2" and "6" cards are mandatory. Z cards precede the "2" and "6" cards if required. A sample printout produced from these cards is shown in Figure 12.

```
//          JOB (----),'     ',CLASS=
/*PROCLIB   WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2         01463500              80154000031973100119750630MPL
6         01463500              0009500003          .01
2         01463500              00915000031973100119750630MPL
6         01463500              0009500003          .02
2         01463500              70300000031973100119750630MPL
6         01463500              0009500003          .1
/*
//
//
```

FIGURE 11. SAMPLE CARD INPUT USING THE MPL OPERATION CODE

DATA COMPUTED BY OPERATION MPL AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 80154, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	781.00	230.00	395.00	80.00	42.00	31.00	33.00	81.00	351.00	246.00	537.00	1129.00	3936.00
1975	30.00	45.00	26.00	10.00	29.00	2750.00					589.00		3479.00

DATA COMPUTED BY OPERATION MPL AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 00915, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	86.00	80.00	53.00	36.00	75.00	75.00	70.00	70.00	36.00	23.00	12.00	6.00	622.00
1975	62.00	94.00	68.00	25.00	52.00								301.00

DATA COMPUTED BY OPERATION MPL AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 70300, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	429.00	391.00	277.00	187.00	397.00	386.00	373.00	357.00	173.00	118.00	66.00	30.00	3184.00
1975	311.00	476.00	322.00	123.00	262.00								1494.00

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	XSECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01463500	1974	80154	00003			MPL	OFF
34	USGS	01463500	1975	80154	00003			MPL	OFF
34	USGS	01463500	1974	00915	00003			MPL	OFF
34	USGS	01463500	1975	00915	00003			MPL	OFF
34	USGS	01463500	1974	70300	00003			MPL	OFF
34	USGS	01463500	1975	70300	00003			MPL	OFF

NORMAL END OF PROCESSING OF PROGRAM H475

FIGURE 12. SAMPLE PRINTOUT WHEN OPERATION MPL PERFORMED

IV.A.5.e. Data Computation from Conversion Table (RAT)

The operation code RAT indicates that a period of record is to be computed by applying a rating (conversion) table to a period of record stored in the file. The operation provides only for rectilinear interpolation between points.

IV.A.5.e.(1) Preparation of Input

Four card types are available for use with operation code RAT. They are:

(1) Password/agency identification card (optional)

(2) Daily Values code card (mandatory)

(3) Special program option card (mandatory)

(4) Rating/conversion card (mandatory)

IV.A.5.e.(1).(a) Password/Agency Card (Z Card)

The Z card is optional. It may be required to: (1) supersede the password submitted by means of the symbolic parameter, (2) supersede the agency code submitted by means of the symbolic parameter, and (3) set the security retrieval flag "on" or "off" for data identified on the "2" card. The Z card must precede the "2" card or the "6" card. The password specified on the Z card, when it precedes the "2" card, must be the Update/Retrieval Password. The password may be the Retrieval Only Password when the Z card precedes the "6" card. A brief description of the Z card (see Section IV.A.3.b. for a detailed description) follows:

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag -- Applicable only when preceding a daily values code card. If left blank flag is set "off" upon initial entry and unchanged during update.

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32 Blank.

Col. 33-37 Agency code (if required).

Col. 38-80 Blank.

IV.A.5.e.(1).(b) Daily Values Code Card (2 Card)

The primary identifiers for the data to be computed and the period of record are specified on the daily values code card. A "2" card is the first card of a RAT operation request unless preceded by a Z card. A description of the "2" card as it applies to the RAT operation follows:

Col. 1 Enter a 2.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code (Appendix D).

Col. 34-38 Statistic code (Appendix E).

Col. 39-42 Beginning calendar year of period record to be processed.

Col. 43-44 Beginning month of period of record to be processed.

Col. 45-46 Beginning day of period of record to be processed.

Col. 47-50 Ending calendar year of period of record to be processed.

Col. 51-52 Ending month of period of record to be processed.

Col. 53-54 Ending day of period of record to be processed.

Col. 55-57 Operation code -- Enter RAT.

Col. 58-80 Blank.

IV.A.5.e.(1).(c) Special Program Option Card (6 Card)

The primary identifiers for the data in the daily values file to be used for the computation are specified on the "6" card. The "6" card follows the "2" card unless a Z card is required to further identify the "6" card. In this case, a Z card is placed after the "2" card and preceding the "6" card. A description of the "6" card as it applies to the operation RAT follows:

Col. 1 Enter a 6.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code (Appendix D).

Col. 34-38 Statistic code (Appendix E).

Col. 39-80 Blank.

IV.A.5.e.(1).(d) Rating/Conversion Card (7 Card)

The rating/conversion card (see Figure 13) is used only when the RAT option is to be performed. This program provides only for rectilinear interpolation between points. A maximum of 48 rating points or 12 cards can be used with each rating. The "7" cards always follow the "6" card. One rating is allowed for each RAT operation. The format of this card is described below:

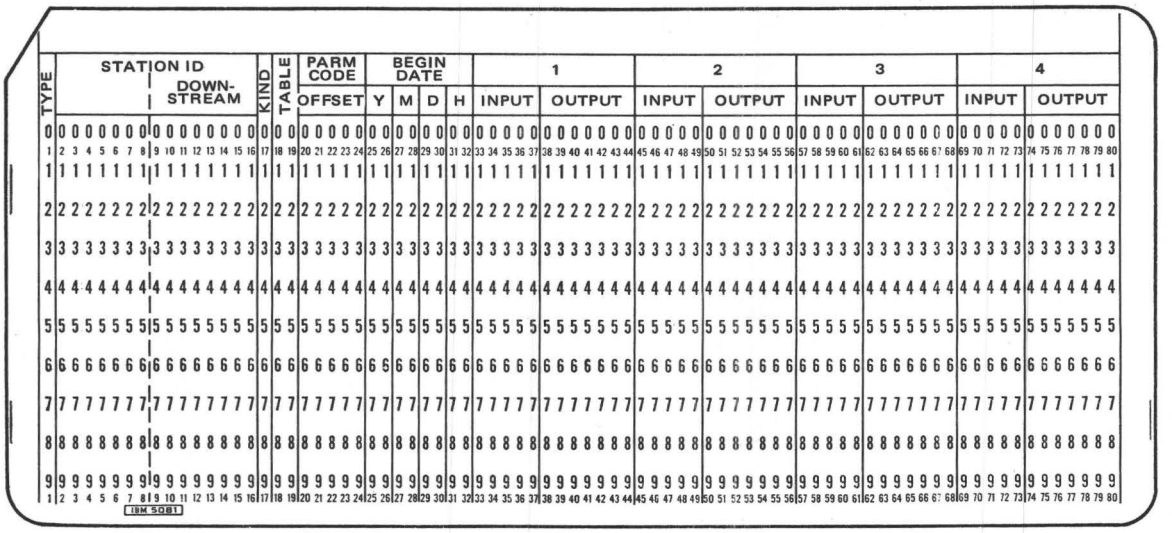

FIGURE 13. RATING/CONVERSION CARD

Col. 1 Enter a 7.

Col. 2-16 Station identification number. Same as on the daily values code card.

Col. 17-19 Blank.

Col. 20-24 Parameter code (Appendix D). Same as on the daily values code card.

Col. 25-32 Blank.

Col. 33-80 Rating points -- There are four sets of fields, each containing a five-digit input value, and a seven-digit output value. In both subfields, code values in whole numbers unless a significant digit is required to the right of the decimal point, in which case code the decimal point in the appropriate place. The input values are coded in columns 33-37, 45-49, 57-61, and 69-73, and the corresponding

output values are coded in columns 38-44, 50-56, 62-68, and 74-80. Input values must be coded in ascending order, and each output value must be equal to or greater than the previous value. For example, if dissolved chloride concentrations are to be computed from a rating with conductivity, the values for conductivity are coded in columns 33-37, 45-49, 57-61, and 69-73 in ascending order and the values for chloride concentration are coded in columns 38-44, 50-56, 62-68, and 74-80 with each value equal to or greater than the previous value.

IV.A.5.e.(2) Sample Input and Output

A sample card deck setup using the RAT operation code is shown in Figure 14. The printout produced from these cards is shown in Figure 15.

IV.A.5.f. Computation of Water-Quality Discharge (CON)

The operation code CON indicates that a water-quality discharge (tons/day) is to be computed using the relation

$$L = 0.0027QC$$

where L is the water-quality discharge in tons/day, Q is the streamflow in cfs, C is the concentration in mg/l and 0.0027 is the conversion factor.

The concentration and the streamflow data must exist in the daily values current file.

IV.A.5.f.(1) Preparation of Input

Three card types are available for use when operation code CON is specified. They are:

(1) Password/agency identification card (optional)

(2) Daily values code card (mandatory)

(3) Special program option card (mandatory)

```
//          JOB (----),'     ',CLASS=
/*PROCLIB  WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2         01463500                0094500003197310011975063ORAT
6         01463500                0009500003
7         01463500    00945             0       0  100      99  300     290 1000     900
2         01397000                0006000003197310011975063ORAT
6         01386000                0006000003
7         01397000    00060             0       0   50     100   51     204  300    1200
/*
//
//
```

FIGURE 14. SAMPLE CARD INPUT USING THE RAT OPERATION CODE

```
 DATA COMPUTED BY OPERATION RAT          AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION=       01463500, XSECTION=       , DEPTH=       , PARM_CODE= 00945, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA=    6780.00                DELAWARE R AT TRENTON NJ

  YR    OCT       NOV       DEC       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       TOTAL
1974
   4165.00   3787.00   2711.00   1830.00   3885.00   3784.00   3658.00   3479.00   1669.00   1155.00    643.00    295.00  31061.00
1975
   2944.00   4634.00   3156.00   1199.00   2551.00                                                                       14484.00

 DATA COMPUTED BY OPERATION RAT          AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION=       01397000, XSECTION=       , DEPTH=       , PARM_CODE= 00060, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA=     147.00                SB RARITAN R AT STANTON NJ

  YR    OCT       NOV       DEC       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       TOTAL
1974
    463.80    324.40   9787.80   3076.00   1794.00   3476.00   4870.00   2378.00    701.20    221.00    186.60   1834.80  29113.60
1975
    812.80   1039.00   7369.00   8166.00   5700.00    590.00                                                                23676.80


                                                    RECORDS TRANSFERRED TO DISK
STATE   AGENCY      STATION          WATER YEAR   PCODE      STATISTIC     XSECTION      DEPTH      OPERATION   RETRIEVAL FLAG

  34    USGS       01463500           1974       00945      00003                                    RAT         OFF
  34    USGS       01463500           1975       00945      00003                                    RAT         OFF
  34    USGS       01397000           1974       00060      00003                                    RAT         OFF
  34    USGS       01397000           1975       00060      00003                                    RAT         OFF

NORMAL END OF PROCESSING OF PROGRAM H475
```

FIGURE 15. SAMPLE PRINTOUT WHEN OPERATION RAT PERFORMED

■ IV.A.5.f.(1).(a) Password/Agency Identification Card (Z Card)

If required, the password/agency identification card must precede the daily values code card or special program option to which it applies. If it is necessary to supersede the password submitted by means of the symbolic parameter PASSWRD:

(1) The password specified on the Z card preceding the daily values code card must match the update/retrieval password in the station header record.

(2) The password specified on the Z card preceding the special program option card must match either the Update/Retrieval Password or the Retrieval Only Password in the station header record. A brief description of the Z card (see Section IV.A.3.b. for detailed description) follows:

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag -- Only applicable if preceding a daily values code card. If left blank, the flag is unchanged on update and set "off" upon initial entry.

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32	Blank.
Col. 33-37	Agency code (if required).
Col. 38-80	Blank.

IV.A.5.f.(1).(b) Daily Values Code Card (2 Card)

The primary identifiers for the water-quality discharge data and the period of record to be computed are specified on the "2" card. The "2" card is the first card for each request of the CON operation except when preceded by a Z card. Refer to Section IV.A.5.a. for a general description of the "2" card. A description of the "2" card when CON is specified follows:

Col. 1	Enter a 2.
Col. 2-16	Station identification number.
Col. 17-22	Cross section locator.
Col. 23-28	Sampling depth.
Col. 29-33	Parameter code (Appendix D).
Col. 34-38	Statistic code (Appendix E).
Col. 39-42	Beginning calendar year of period of record to be processed.
Col. 43-44	Beginning month of period of record to be processed.
Col. 45-46	Beginning day of period of record to be processed.
Col. 47-50	Ending calendar year of period of record to be processed.
Col. 51-52	Ending month of period of record to be processed.
Col. 53-54	Ending day of period of record to be processed.
Col. 55-57	Operation code -- Enter CON.
Col. 58-80	Blank.

IV.A.5.f.(1).(c) Special Program Option Card (6 Card)

Two "6" cards are required when the operation code CON is specified. The primary identifiers for the concentration data are specified on the first "6" card following the "2" card and the primary identifiers for the streamflow data are specified on the second "6" card. A Z card may precede each "6" card if required.

A brief description of the "6" card follows:

Col. 1	Enter a 6.
Col. 2-16	Station identification number.
Col. 17-22	Cross section locator.
Col. 23-28	Sampling depth.
Col. 29-33	Parameter code.
Col. 34-38	Statistic code.
Col. 39-80	Blank.

IV.A.5.f.(2) Sample Input and Output

A sample card deck setup is shown in Figure 16. The printout produced from the cards is shown in Figure 17.

IV.A.5.g. Add or Subtract Two Records (ADD/SUB)

The code ADD indicates that the daily values from two different records stored in the file are to be combined for a specified period, and the results stored in the Daily Values File. The code SUB indicates the daily values from one record in the file are to be subtracted from the daily values of another record in the file for a specified period, and the results stored in the file.

```
//          JOB (----),'     ',CLASS=
/*PROCLIB  WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2         01463500              8015500003197310011975063OCON
6         01463500              8015400003
6         01463500              0006000003
2         01463500              7029000003197310011975063OCON
6         01463500              0091500003
6         01463500              0006000003
2         01463500              7030200003197310011975063OCON
6         01463500              7030000003
6         01463500              0006000003
/*
//
//
```

FIGURE 16. SAMPLE CARD INPUT USING THE CON OPERATION CODE

DATA COMPUTED BY OPERATION CON AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 80155, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	23216.00	6042.00	34795.00	4310.00	1686.00	1612.00	2230.00	2771.00	7491.00	3279.00	10019.00	45715.00	143166.00
1975	592.80	1040.00	1390.00	496.00	1003.00	101000.00					203150.04		308671.84

DATA COMPUTED BY OPERATION CON AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 70290, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	337.70	1181.00	3780.00	2077.00	3132.00	3836.00	4724.00	2720.00	702.00	356.00	124.00	416.00	23385.70
1975	1246.00	2196.00	3394.00	1204.00	1868.00								9908.00

DATA COMPUTED BY OPERATION CON AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 70302, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	1703.00	5791.00	19959.00	10801.00	16664.00	19989.00	25425.00	13835.00	3378.00	1841.00	682.00	2080.00	122148.00
1975	6254.00	11220.00	16039.00	5989.00	9380.00								48882.00

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	XSECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01463500	1974	80155	00003			CON	OFF
34	USGS	01463500	1975	80155	00003			CON	OFF
34	USGS	01463500	1974	70290	00003			CON	OFF
34	USGS	01463500	1975	70290	00003			CON	OFF
34	USGS	01463500	1974	70302	00003			CON	OFF
34	USGS	01463500	1975	70302	00003			CON	OFF

NORMAL END OF PROCESSING OF PROGRAM H475

FIGURE 17. SAMPLE PRINTOUT WHEN OPERATION CON PERFORMED

■ IV.A.5.g.(1) Preparation of Input

Three card types are available for use when ADD or SUB code is specified. They are:

(1) Password/agency identification card (optional)

(2) Daily values code card (mandatory)

(3) Special program option card (mandatory)

■ IV.A.5.g.(1).(a) Password/Agency Identification Card (Z Card)

The Z card is optional. Detailed descriptions of its use for password specification, and retrieval protection are in Section IV.A.3.b. Detailed description of its use for agency specification is in Section IV.A.5.a.(1).(b). A brief description of the Z card follows:

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag. Applicable only if Z card precedes a "2" card. If left blank, the flag is set "off" on initial entry and unchanged during update.

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32	Blank.
Col. 33-37	Agency code (if required).
Col. 38-80	Blank.

IV.A.5.g.(1).(b) Daily Values Code Card (2 Card)

The primary identifiers for the data being computed, the period of record to be computed, and the operation code are specified on the "2" card. A check option may be coded in column 59. If this column is left blank, a no-value indicator will be stored for those days where data are missing for either of the two records specified on the special program option cards. If a "1" is coded in column 59 and data is missing for the record identified by the second "6" card then the data from the record identified by the first "6" card will be stored with the results. The "2" card is described below:

Col. 1 Enter a 2.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code.

Col. 34-38 Statistic code.

Col. 39-42 Beginning calendar year of period of record to be processed.

Col. 43-44 Beginning month of period of record to be processed.

Col. 45-46 Beginning day of period of record to be processed.

Col. 47-50 Ending calendar year of period of record to be processed.

Col. 51-52 Ending month of period of record to be processed.

Col. 53-54 Ending day of period of record to be processed.

Col. 55-57 Operation code.

Code

ADD -- Add two records.
SUB -- Subtract two records.

Col. 58 Blank.

Col. 59 Check code.

Blank -- Store no-value indicator if data for record identified by second special program option card is missing.

"1" -- Store data from record identified by first special program option card if data for record identified by second program option card is missing.

Col. 60-80 Blank.

■ IV.A.5.g.(1).(c) Special Program Option Card (6 Card)

Two special program option cards are required for each ADD or SUB operation.

When SUB is specified on the daily values code card, the data identified on the second "6" card is subtracted from the data identified by the first "6" card. If required, a Z card may precede each "6" card.

A brief description of the "6" card follows:

Col. 1 Enter a 6.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code.

Col. 34-38 Statistic code.

Col. 39-80 Blank.

IV.A.5.g.(2) Sample Input and Output

A sample card deck setup using the ADD and the SUB operation cards is shown in Figure 18. The printout produced from these cards is shown in Figure 19.

IV.A.5.h. Change Data Identifiers (CID)

The operation code CID indicates that records in the file are to have one or more of the following identifiers updated:

Agency Code

State Code

Station Identification Number

Cross Section Locator

Sampling Depth

Parameter Code

Statistic Code

The new or corrected identifiers, with the exception of agency code and state code, must be specified on the daily values code card along with the operation code CID and the period of record. The current identifiers, with the exception of the agency code and state code, must be specified on the special program option card. If the agency code or state code has been updated in the Station Header File, then the new agency code (col. 3-37) and/or new state code (col. 43-44) must be specified on the Z card preceding the daily values code card; and the current agency code and/or current state code must be specified on the Z card preceding the special program option card. If the operation CID is to be performed upon records residing in the historical file, they must be retrieved by the cataloged procedure DVRETR (see Section IV.B.) and entered into the current file using the cataloged procedure DVINPUT. An example of using both procedures is shown in Section IV.A.9. All records specified on the special program option card will be marked with a D, indicating they are to be deleted during a merge/update or retrieval operation.

IV.A.5.h.(1) Preparation of Input

The three card types available for use with operation code CID are:

```
//          JOB (----),'     ',CLASS=
/*PROCLIB  WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
?         01460500              00060000031973100119750630SUB
6         01460501              0006000003
6         01463500              0006000003
2         01460501              00060000031973100119750630ADD
6         01463500              0006000003
6         01460500              0006000003
/*
//
//
```

FIGURE 18. SAMPLE CARD DECK USING ADD AND SUB OPERATION CARDS

DATA COMPUTED BY OPERATION SUB AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01460500, XSECTION= , DEPTH= , PARM_CODE= 00060, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 0.00 DELAWARE AND RARITAN CA AT KINGSTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974													
	3040.00	3010.00	3100.00	3100.00	2770.00	3100.00	3000.00	2990.00	2500.00	2770.00	2850.00	2870.00	35100.00
1975													
	3100.00	3000.00	3120.00	3070.00	2790.00	300.00							15380.00

DATA COMPUTED BY OPERATION ADD AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01460501, XSECTION= , DEPTH= , PARM_CODE= 00060, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 0.00 DEL & RARITAN CANAL AT KINGSTON NJ 'B'

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974													
	75760.00	192190.00	966150.00	605800.00	460910.00	600000.00	794400.00	456100.00	230310.00	152360.00	180450.00	353710.00	5068140.00
1975													
	126690.00	280620.00	613880.00	580850.00	604980.00	96800.00							2303820.00

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	XSECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01460500	1974	00060	00003			SUB	OFF
34	USGS	01460500	1975	00060	00003			SUB	OFF
34	USGS	01460501	1974	00060	00003			ADD	OFF
34	USGS	01460501	1975	00060	00003			ADD	OFF

NORMAL END OF PROCESSING OF PROGRAM H475

FIGURE 19. ADD AND SUB OPERATION PRINTOUT

(1) Password/agency identification card (optional)

(2) Daily values code card (mandatory)

(3) Special program option card (mandatory)

■ IV.A.5.h.(1).(a) Password/Agency Identification Card (Z Card)

The password/agency identification card is optional. It may be required to:

(1) Supersede the password submitted by the symbolic parameter

(2) Supersede the agency code submitted by the symbolic parameter

(3) Correct the agency code in the daily values file

(4) Correct the state code in the daily values file

If the agency code is to be corrected, then the correct agency is specified in columns 33-37 of the Z card preceding the daily values code card, and the current agency code is specified in columns 33-37 of the Z card preceding the special program option card. Likewise, when correcting the state code, the correct state code is specified in columns 43-44 of the Z card, preceding the daily values code card, and the current state code in columns 43-44 of the Z card preceding the special program option card. The password, if required, must be an Update/Retrieval Password whether the Z card precedes a "2" card or a "6" card. A brief description of the Z card follows:

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Update/Retrieval Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag. Applicable only if Z card precedes a "2" card. If left blank, flag is set "off."

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32 Blank.

Col. 33-37 Agency code (if required).

Col. 38-42 Blank.

Col. 43-44 State code (if required).

Col. 45-80 Blank.

■ IV.A.5.h.(1).(b) Daily Values Code Card (2 Card)

The correct primary identifiers for the data are coded on the daily values code card. The period of record and the operation code CID also are coded on the daily values code card. The "2" card is the first card except when preceded by a Z card. Refer to Section IV.A.5.a.(2). for general description of the daily values code card. A description of the "2" card as it applies to the CID operation follows:

Col. 1 Enter a 2.

Col. 2-16 Correct station identification number.

Col. 17-22 Correct cross section locator.

Col. 23-28 Correct sampling depth.

Col. 29-33 Correct parameter code.

Col. 34-38 Correct statistic code.

Col. 39-42 Beginning calendar year of period of record to be processed.

Col. 43-44 Beginning month of period of record to be processed.

Col. 45-46 Beginning day of period of record to be processed.

Col. 47-50 Ending calendar year of period of record to be processed.

Col. 51-52 Ending month of period of record to be processed.

Col. 53-54 Ending day of period of record to be processed.

Col. 55-57 Operation code -- Enter CID.

Col. 58-60 Blank.

IV.A.5.h.(1).(c) Special Program Option Card (6 Card)

The current primary identifiers are coded on the special program option card. The "6" card follows the "2" card. If required, a Z card may precede the "6" card. Refer to Section IV.A.5.a.(3). for a detailed description of the special program option card. A description of the "6" card as it applies to the CID operation follows:

Col. 1 Enter a 6.

Col. 2-16 Current station identification number.

Col. 17-22 Current cross section locator.

Col. 23-28 Current sampling depth.

Col. 29-33 Current parameter code.

Col. 34-38 Current statistic code.

Col. 39-80 Blank.

IV.A.5.h.(2) Sample Input and Output

A sample card deck setup using the CID operation code is shown in Figure 20. A sample printout produced from these cards is shown in Figure 21.

```
//          JOB (----),'     ',CLASS=
/*PROCLIB   WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2         01463500              0091500001196310011965093OCID
6         01463500              0091500003
2         01463500              8015400001196310011965093OCID
6         01463500              8015400003
/*
//
//
```

FIGURE 20. SAMPLE CARD DECK SETUP USING CID OPERATION CODE

```
OPERATION CID PERFORMED                                    OLD STATION RECORD
                                                           AGENCY CODE = USGS
STATION=        01463500,  XSECTION=       ,  DEPTH=       ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

                                                           NEW STATION RECORD
                                           AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       ,  DEPTH=       ,  PARM_CODE= 00915,  STATISTIC= 00001,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

1964 COMPLETED

1965 COMPLETED


OPERATION CID PERFORMED                                    OLD STATION RECORD
                                                           AGENCY CODE = USGS
STATION=        01463500,  XSECTION=       ,  DEPTH=       ,  PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

                                                           NEW STATION RECORD
                                           AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       ,  DEPTH=       ,  PARM_CODE= 80154,  STATISTIC= 00001,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

1964 COMPLETED

1965 COMPLETED
```

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	XSECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01463500	1964	00915	00001			CID	OFF
34	USGS	01463500	1965	00915	00001			CID	OFF
34	USGS	01463500	1964	80154	00001			CID	OFF
34	USGS	01463500	1965	80154	00001			CID	OFF

```
NORMAL END OF PROCESSING OF PROGRAM H475
```

FIGURE 21. SAMPLE PRINTOUT WHEN OPERATION CID PERFORMED

IV.A.5.i. Update Water Year (YER)

The code YER indicates that a record in the file has been stored with an incorrect water year which is to be corrected. Only the daily values code card is required for this operation. The password/agency identification card is optional. The primary identifiers and the code YER are specified on the daily values code card. The current water year is specified in columns 39-42 and the correct water year in columns 47-50. If the record to be corrected resides in the historical file, it must be brought forward to the current file prior to use of this operation (see Section IV.A.9.).

IV.A.5.i.(1) Preparation of Input

The two cards available for use when updating the water years are:

(1) Password/agency identification card (optional)

(2) Daily values code card (mandatory)

IV.A.5.i.(1).(a) Password/Agency Identification Card (Z Card)

If required, the password/agency identification card must precede the daily values code card. Refer to Section IV.A.3.b. for a detailed description. A brief description of the Z card follows:

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Update/Retrieval Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag. If left blank, flag is set "off."

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32 Blank.

Col. 33-37 Agency code (if required).

Col. 38-80 Blank.

IV.A.5.i.(1).(b) Daily Values Code Card (2 Card)

The primary identifiers, the current water year, the correct water year, and the operation code YER are coded on the daily values code card. A description of the "2" card as it applies to the YER operation follows:

Col. 1 Enter a 2.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code.

Col. 34-38 Statistic code.

Col. 39-42 Current water year.

Col. 43-46 Blank.

Col. 47-50 Correct water year.

Col. 51-54 Blank.

Col. 55-57 Operation code -- Enter YER.

Col. 58-80 Blank.

IV.A.5.i.(2) Sample Input and Output

A sample card deck setup is shown in Figure 22. A sample printout produced from these cards is shown in Figure 23.

```
//          JOB (----),'     ',CLASS=
/*PROCLIB   WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2         01463500              80154000031974     1964     YER
2         01463500              80154000031975     1965     YER
2         01463500              00915000031974     1964     YER
2         01463500              00915000031975     1965     YER
/*
//
//
```

FIGURE 22. SAMPLE CARD INPUT USING YER OPERATION CODE

```
OPERATION YER PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       ,  PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1974 TO WATER YEAR= 1964


OPERATION YER PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       ,  PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1975 TO WATER YEAR= 1965


OPERATION YER PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1974 TO WATER YEAR= 1964


OPERATION YER PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1975 TO WATER YEAR= 1965
```

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	XSECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01463500	1964	80154	00003			YER	OFF
34	USGS	01463500	1965	80154	00003			YER	OFF
34	USGS	01463500	1964	00915	00003		-	YER	OFF
34	USGS	01463500	1965	00915	00003			YER	OFF

```
NORMAL END OF PROCESSING OF PROGRAM H473
```

FIGURE 23. SAMPLE PRINTOUT WHEN OPERATION YER PERFORMED.

IV.A.5.j. Record Disposition and Delete (DSP)

An operation code is given to indicate that data records are to be deleted or that a special request for the disposition of data records has been submitted. This code is DSP and must be coded in columns 55-57 of the daily values code card. An additional code, called a record disposition code, has been established to differentiate which of the delete and record disposition options is requested. The record disposition code is entered in column 58 of the daily values code card.

If the record disposition code in column 58 is an A and the operation code is DSP, then the complete water years of data within the specified period of record will be deleted from the current disk file without affecting the historical file. Fractional water years within the specified period of record will have the data values for individual days set to 999999, i.e., deleted from current file but not from historical file during update merge and retrieval operations.

If the record disposition code in column 58 is a D, then complete water years of data within the specified period of record are marked with D indicating corresponding records in historical file are to be deleted during update/merge and retrieval operations. Fractional water years within specified period of record will have the data values for individual days set to 999998, indicating the corresponding data values are to be deleted from the historical file during update/merge and retrieval operations.

If the record disposition code in column 58 is an L, then all records within the specified period of record will be marked with an L so as not to be merged into the historical file. The records will reside in the current file until they are no longer a part of the two current water years. Once removed from the current file, the data will be lost.

If the record disposition code in column 58 is a K, then all records within the specified period of record will not be removed from the current file for the historical file merge until its data are not part of the current two water years or until the records have existed on the disk file for at least three months.

If the record disposition code in column 58 is an R, then all records within the specified period of record previously marked with a D, L, or K will have the marks removed and be treated in normal manner during update/merge and retrieval operations.

If a station header record does not exist in the Station Header File for the data records when these options are requested, the state code must be specified on the Z card. If a station header record is available, the Update/Retrieval Password must be specified, if a password has been stored in the header record.

IV.A.5.j.(1) Preparation of Input

The two card types available when requesting the record disposition and delete operation are:

(1) Password/agency identification card (optional)

(2) Daily values code card (mandatory)

IV.A.5.j.(1).(a) Password/Agency Identification Card (Z Card)

If required, the Z card must precede the daily values code card. Refer to Section IV.A.3.b. for a detailed description of the Z card. A brief description follows:

Col. 1	Enter a Z.
Col. 2-16	Blank.
Col. 17-20	Update/Retrieval Password (if required).
Col. 21-24	Blank.
Col. 25-28	Security retrieval flag. If left blank, security retrieval flag is unchanged.

Code

FLAG -- Set flag "on."
NULL -- Set flag "off."

Col. 29-32	Blank.

Col. 33-37 Agency code (if required).

Col. 38-42 Blank.

Col. 43-44 State code (if required).

Col. 45-80 Blank.

■ IV.A.5.j.(1).(b) Daily Values Code Card (2 Card)

The primary identifiers, the period of record (specified by date), the operation code DSP, and the record disposition code are specified on the daily values code card. Refer to Section IV.A.5.a.(2) for detailed description of daily values code card.

Col. 1 Enter a Z.

Col. 2-16 Station identification number.

Col. 17-22 Cross section locator.

Col. 23-28 Sampling depth.

Col. 29-33 Parameter code.

Col. 34-38 Statistic code.

Col. 39-42 Beginning calendar year of period of record to be processed.

Col. 43-44 Beginning month of period of record to be processed.

Col. 45-46 Beginning day of period of record to be processed.

Col. 47-50 Ending calendar year of period of record to be processed.

Col. 51-52 Ending month of period of record to be processed.

Col. 53-54 Ending day of period of record to be processed.

Col. 55-57 Operation code -- Enter DSP.

Col. 58 Record disposition code

Code

A -- Delete complete water years of data within the specified period of record from the current file without affecting historical file. For fractional water years within specified period of record, set data values for individual days to 999999, i.e., deleted from current file but not from historical file.

D -- Mark complete water years of data with a D indicating corresponding records in historical file are to be deleted during update/merge and retrieval operations. For fractional water years within specified period of record, set data values for individual days to 999998, indicating the corresponding data values are to be deleted from historical file during update/merge and retrieval operations.

L -- Mark all records within the specified period of record with an L so as not to be merged into the historical file.

K -- Mark all records within specified period of record with a K so that they are not removed from the current file for historical file merge until they have existed in the current file for at least three months.

R -- Remove marks from all records within specified period of record previously marked with a D, K, or L.

Col. 59-80 Blank.

IV.A.5.j.(2) Sample Input and Output

A sample card deck setup using operation code DSP is shown in Figure 24. A sample printout produced by these cards is shown in Figure 25.

```
//          JOB (----),'     ',CLASS=
/*PROCLIB   WRD.PROCLIB

//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
2         01463500              80154000031973100119750930DSPR
2         01463500              00915000031973100119750930DSPR
2         01463500              00915000031963100119650930DSPD
/*
//
//
```

FIGURE 24. SAMPLE CARD DECK USING OPERATION CODE DSP

```
OPERATION DSP PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH=        ,  PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34

WATER YEAR= 1974 WAS UPDATED WITH DSP OPTION AND  DISP.  CODE= R

WATER YEAR= 1975 WAS UPDATED WITH DSP OPTION AND  DISP. CODE= R


OPERATION DSP PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH=        ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

WATER YEAR= 1974 WAS UPDATED WITH DSP OPTION AND  DISP.  CODE= R

WATER YEAR= 1975 WAS UPDATED WITH DSP OPTION AND  DISP. CODE= R


OPERATION DSP PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH=        ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

WATER YEAR= 1964 WAS UPDATED WITH DSP OPTION AND DISP.   CODE= D

WATER YEAR= 1965 WAS UPDATED WITH DSP OPTION AND  DISP.  CODE= D
```

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	XSECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01463500	1974	80154	00003			DSP	OFF
34	USGS	01463500	1975	80154	00003			DSP	OFF
34	USGS	01463500	1974	00915	00003			DSP	OFF
34	USGS	01463500	1975	00915	00003			DSP	OFF
34	USGS	01463500	1964	00915	00003			DSP	OFF
34	USGS	01463500	1965	00915	00003			DSP	OFF

```
NORMAL END OF PROCESSING OF PROGRAM H475
```

FIGURE 25. SAMPLE PRINTOUT WHEN OPERATION DSP PERFORMED

IV.A.6. Multiple Operations

Any number of operations may be submitted for a given execution of the cataloged procedure DVINPUT. Each "2" card indicates the beginning of an operation.

IV.A.6.a. Organization of Input Data Cards

The input data cards must be organized in accordance with the following rules:

(1) When a password/agency card (Z card) is required, it must precede the daily values code card (2 card) or the special progam option card (6 card) to which it applies.

(2) The first card for each operation must be a "2" card except when a Z card precedes the "2" card.

(3) Daily values data cards (3 card) are used only when the operation code on the preceding "2" card is ENT.

(4) Total check cards, if required, must follow the "3" cards to which they apply, except when used to set an entire water year of data equal to zero. In which case, the T card immediately follows the "2" card if the operation code is ENT.

(5) Water-quality discharge cards (5 card) are used only when the operation code on the preceding "2" card is SSD.

(6) Special program option cards (6 card) are used only when the operation code on the preceding "2" card is MPL, CON, RAT, SUB, ADD, SSD, or CID.

(7) Rating/conversion cards (7 card) are used only if the operation code on the preceding "2" card is RAT. The type "7" cards must follow the "6" card and a maximum of twelve "7" cards are allowed per operation.

A sample deck setup using multiple operations in the same job is shown in Figure 26.

```
//         JOB (----),'     ',CLASS=
/*PROCLIB  WRD.PROCLIB
//      EXEC DVINPUT,AGENCY=USGS
//DVIN.SYSIN DD *
Z                    FLAG
2       01463500             00006000003                    ENT
3       0146350019731001   1000   1000   1000   1000   1000   1000   1000   1000
3       0146350019731002   1000   1000   1000   1000   1000   1000   1000   1000
3       0146350019731003   1000   1000   1000   1000   1000   1000   1000   1000
T       014635001974 24000
3       0146350019741001   1000   1000   1000   1000   1000   1000   1000   1000
3       0146350019741002   1000   1000   1000   1000   1000   1000   1000   1000
T       014635001975  16000
2       01463500             00001000003                    ENT
3       0146350019731001l0     10     10     10     10     10     10     10
3       0146350019731002l0     10     10     10     10     10     10     10
3       0146350019741001l0     10     10     10     10     10     10     10
3       0146350019741002l0     10     10     10     10     10     10     10
Z                   NULL
2       01463500             00001000001                    ENT
3       0146350019731001l0     10     10     10     10     10     10     10
3       0146350019731002l0     10     10     10     10     10     10     10
3       0146350019741001l0     10     10     10     10     10     10     10
3       0146350019741002l0     10     10     10     10     10     10     10
2       01463500             009450000319731001197506301RAT
6       01463500             00095000003
7       01463500   00945           0      0  100     99  300     290 1000     900
2       01397000             000600000319731001197506301RAT
6       01386000             00060000003
7       01397000   00060           0      0   50    100   51     204  300    1200
2       01463500             80155000003                    SSD  80154
6       01463500             00060000003
5       0146350019730213                      75       17.36
5       0146350019730214              100.00   75
5       0146350019730216l200           90.00   14
5       0146350019730216l400           50.00   13
5       0146350019730216240            10.00   12
5       0146350019730217               80.00   15            12.00
5       0146350019730217               70.00   14             6.00
5       0146350019730217               60.00   13             6.00
5       01463500197310               -99999
2       01463500             801540000319731001197506301MPL
6       01463500             00095000003          .01
2       01463500             009150000319731001197506301MPL
6       01463500             00095000003          .02
2       01463500             703000000319731001197506301MPL
6       01463500             00095000003          .1
2       01463500             801550000319731001197506301CON
6       01463500             80154000003
6       01463500             00060000003
2       01463500             702900000319731001197506301CON
6       01463500             00915000003
6       01463500             00060000003
2       01463500             703020000319731001197506301CON
6       01463500             70300000003
6       01463500             00060000003
2       01460500             000600000319731001197506301SUB
6       01460501             00060000003
6       01463500             00060000003
2       01460501             000600000319731001197506301ADD
6       01463500             00060000003
6       01460500             00060000003
2       01463500             80154000031974     1964     YER
2       01463500             80154000031975     1965     YER
2       01463500             00915000031974     1964     YER
2       01463500             00915000031975     1965     YER
2       01463500             801540000319731001197509301DSPR
2       01463500             009150000319731001197509301DSPR
2       01463500             009150000319631001196509301DSPD
2       01463500             009150000119631001196509301CID
6       01463500             00915000003
2       01463500             801540000119631001196509301CID
6       01463500             80154000003
/*
//
//
```

FIGURE 26. SAMPLE DECK SETUP USING MULTIPLE OPERATIONS

IV.A.7. Standard Daily Values Record Format Input

In any given job step, data may be entered from a tape or a disk in the standard daily values record format (see Section IV.B. for format description) with or without card input by means of program number H475. The program will first transfer the data in the standard daily values record format to the current disk and then process the card input. The cataloged procedure (DVINPUT) has been designed for this capability (see Section IV.A.9.).

IV.A.8. Output

The output consists of daily values records stored in the current file that are the result of the data entered or computed by program H475. In addition, a printout (Figure 27) is received listing the data records stored or deleted, and monthly totals for data entered or converted. The printout in Figure 27 was produced from the card deck setup shown in Figure 26.

IV.A.8.a. Diagnostic Messages

Diagnostic messages are printed to show the status of the processing by program H475. The diagnostic messages are identified by DUxxx, where DU is a unique abbreviation for program number H475 and xxx is a three-digit sequence number. All diagnostic messages printed by program number H475 are sequentially listed below. The card image on which an error was detected will generally be printed immediately above the error message.

DU001 STATION NOT ON HEADER FILE-PROCESSING FOR THIS STATION TERMINATED.

Check card for error and resubmit if there was an error on card. If no card error, make update or correction to station header file.

DU002 MANDATORY ENTRIES MISSING FROM STATION HEADER FILE.

XXX ETC.XXX = 1
XXX ETC.XXX = 2
XXX ETC.XXX = 3
XXX ETC.XXX = 4
XXX ETC.XXX = 5
XXX ETC.XXX = 6

```
DATA ENTEREN BY OPERATION ENT          AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-ON
STATION=        01463500,  XSECTION=        ,  DEPTH=        , PARM_CODE= 00060, STATISTIC=00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                   DELAWARE R AT TRENTON NJ
  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
 72720.00 189180.00 963050.00 602700.00 458140.00 596900.00 791400.00 453110.00 227810.00 149590.00 177600.00 350840.00  5033040.00
   TOTAL OF DAILY FIGURES DOES NOT AGREE WITH PUNCHED CHECK TOTAL                                                        CHECK TOTAL=    24000.00
1975
 123590.00 277620.00 610760.00 577780.00 602190.00 546400.00                                                                2738340.00
   TOTAL OF DAILY FIGURES DOES NOT AGREE WITH PUNCHED CHECK TOTAL                                                        CHECK TOTAL=    16000.00


DATA ENTEREN BY OPERATION ENT          AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=        ,  DEPTH=        , PARM_CODE= 00010, STATISTIC=00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                   DELAWARE R AT TRENTON NJ
  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
   326.39     204.29     119.32      43.68      79.89      98.14     318.45     538.87     542.75     794.10     438.53     530.03     4034.44
                                                                                                                                  NO CHECK TOTAL
1975
   266.74     280.07     109.08      23.13      59.36                                                                              738.38
                                                                                                                                  NO CHECK TOTAL


YOU HAVE SUBMITTED A Z CARD TO PROGRAM H475 WHICH RESULTED THE FOLLOWING CONDITIONS:

    AGENCY CODE = USGS
    UPDATE PASSWORD =
    SECURITY RETRIEVAL FLAG TURNED OFF FOR ALL DATA UPDATED OR CREATED

THE ABOVE CONDITIONS WILL BE USED FOR THIS PROGRAM ONLY FOR THE NEXT INPUT DATA
THESE CONDITIONS WILL THEN BE REPLACED BY THE ORIGINAL PASSWORDS THAT WERE SUBMITTED TO PROGRAM H475


DATA ENTEREN BY OPERATION ENT          AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=        ,  DEPTH=        , PARM_CODE= 00010, STATISTIC=00001,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                   DELAWARE R AT TRENTON NJ
  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
   354.39     229.02     134.89      50.40      96.57     115.16     340.66     563.85     613.39     844.89     465.68     576.40     4385.30
                                                                                                                                  NO CHECK TOTAL
1975
   271.32     295.96     123.96      28.52      67.42                                                                              787.18


 DATA COMPUTED BY OPERATION RAT          AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION=        01463500,  XSECTION=        ,  DEPTH=        ,  PARM_CODE= 00945,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                   DELAWARE R AT TRENTON NJ

  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
  4165.00    3787.00    2711.00    1830.00    3885.00    3784.00    3657.00    3479.00    1669.00    1155.00     643.00     295.00    31060.00
1975
  2944.00    4634.00    3156.00    1199.00    2551.00                                                                             14484.00


 DATA COMPUTED BY OPERATION RAT          AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION=        01397000,  XSECTION=        ,  DEPTH=        ,  PARM_CODE= 00060,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=     147.00                   SB RARITAN R AT STANTON NJ

  YR    OCT        NOV        DEC        JAN        FEB        MAR        APR        MAY        JUN        JUL        AUG        SEP        TOTAL
1974
   463.80     324.40    9787.80    3076.00    1844.00    4426.00    4870.00    2378.00     701.20     221.00     186.60    1834.80    30113.60
1975
   812.80    1039.00    7419.00    8166.00    5700.00     640.00                                                                             23776.80
```

FIGURE 27. PRINTOUT PRODUCED FROM CARD DECK SETUP IN FIGURE 26

DATA COMPUTED BY OPERATION SSD AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 80155, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1973 CONC					177.00								177.00
1973 LOAD					42.00								42.00

DATA COMPUTED BY OPERATION MPL AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 80154, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	781.00	230.00	395.00	80.00	42.00	31.00	33.00	81.00	351.00	246.00	537.00	1129.00	3936.00
1975	30.00	45.00	26.00	10.00	29.00	2750.00					589.00		3479.00

DATA COMPUTED BY OPERATION MPL AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 00915, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	86.00	80.00	53.00	36.00	75.00	75.00	70.00	70.00	36.00	23.00	12.00	6.00	622.00
1975	62.00	94.00	68.00	25.00	52.00								301.00

DATA COMPUTED BY OPERATION MPL AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 70300, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	429.00	391.00	277.00	187.00	397.00	386.00	373.00	357.00	173.00	118.00	66.00	30.00	3184.00
1975	311.00	476.00	322.00	123.00	262.00								1494.00

FIGURE 27, Continued

DATA COMPUTED BY OPERATION CON AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 80155, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	23216.00	6042.00	34795.00	4310.00	1686.00	1612.00	2230.00	2771.00	7491.00	3279.00	10019.00	45715.00	143166.00
1975	592.80	1040.00	1390.00	496.00	1003.00	101000.00					203150.04		308671.84

DATA COMPUTED BY OPERATION CON AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 70490, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	337.70	1161.00	3780.00	2077.00	3132.00	3836.00	4724.00	2720.00	702.00	356.00	124.00	416.00	23385.70
1975	1246.00	2196.00	3394.00	1204.00	1868.00								9908.00

DATA COMPUTED BY OPERATION CON AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01463500, XSECTION= , DEPTH= , PARM_CODE= 70302, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 6780.00 DELAWARE R AT TRENTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	1703.00	5791.00	19959.00	10801.00	16664.00	19989.00	25425.00	13835.00	3378.00	1841.00	682.00	2080.00	122148.00
1975	6254.00	11220.00	16039.00	5989.00	9380.00								48882.00

DATA COMPUTED BY OPERATION SUB AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION= 01460500, XSECTION= , DEPTH= , PARM_CODE= 00060, STATISTIC= 00003, STATE= 34, DISTRICT= 34
DRAINAGE AREA= 0.00 DELAWARE AND RARITAN CA AT KINGSTON NJ

YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1974	3040.00	3010.00	3100.00	3100.00	2770.00	3100.00	3000.00	2990.00	2500.00	2770.00	2850.00	2870.00	35100.00
1975	3100.00	3000.00	3120.00	3070.00	2790.00	300.00							15380.00

FIGURE 27, Continued

```
 DATA COMPUTED BY OPERATION ADD          AGENCY CODE = USGS SECURITY RETRIEVAL FLAG_OFF
STATION=       01460501,  XSECTION=       , DEPTH=       , PARM_CODE= 00060,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=       0.00                  DEL & RARITAN CANAL AT KINGSTON NJ '8'

  YR    OCT       NOV       DEC       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       TOTAL
1974
  75760.00 192190.00 966150.00 605800.00 460910.00 600000.00 794400.00 456100.00 230310.00 152360.00 180450.00 353710.00  5068140.00
1975
 126690.00 280620.00 613860.00 580850.00 604980.00  96800.00                                                                2303820.00


OPERATION YER PERFORMED                 AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       , PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1974 TO WATER YEAR= 1964


OPERATION YER PERFORMED                 AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       , PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1975 TO WATER YEAR= 1965


OPERATION YER PERFORMED                 AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       , PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1974 TO WATER YEAR= 1964


OPERATION YER PERFORMED                 AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       , PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

OPTION YER EXECUTED CHANGING WATER YEAR= 1975 TO WATER YEAR= 1965


OPERATION DSP PERFORMED                 AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=       01463500,  XSECTION=       , DEPTH=       , PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34

WATER YEAR= 1974 WAS UPDATED WITH DSP OPTION AND DISP.  CODE= R

WATER YEAR= 1975 WAS UPDATED WITH DSP OPTION AND  DISP.  CODE= R
```

FIGURE 27, Continued

```
OPERATION DSP PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH=        ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

WATER YEAR= 1974 WAS UPDATED WITH DSP OPTION AND  DISP. CODE= R

WATER YEAR= 1975 WAS UPDATED WITH DSP OPTION AND  DISP.  CODE= R


OPERATION DSP PERFORMED                    AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH=        ,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34

WATER YEAR= 1964 WAS UPDATED WITH DSP OPTION AND  DISP. CODE= D

WATER YEAR= 1965 WAS UPDATED WITH DSP OPTION AND  DISP. CODE= D


OPERATION CID PERFORMED                                  OLD STATION RECORD
                                                         AGENCY CODE = USGS
STATION=        01463500,  XSECTION=       , DEPTH= 999999,  PARM_CODE= 00915,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

                                                         NEW STATION RECORD
                                           AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH= 999999,  PARM_CODE= 00915,  STATISTIC= 00001,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

1964 COMPLETED

1965 COMPLETED


OPERATION CID PERFORMED                                  OLD STATION RECORD
                                                         AGENCY CODE = USGS
STATION=        01463500,  XSECTION=       , DEPTH= 999999,  PARM_CODE= 80154,  STATISTIC= 00003,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

                                                         NEW STATION RECORD
                                           AGENCY CODE = USGS  SECURITY RETRIEVAL FLAG-OFF
STATION=        01463500,  XSECTION=       , DEPTH= 999999,  PARM_CODE= 80154,  STATISTIC= 00001,  STATE= 34,  DISTRICT= 34
DRAINAGE AREA=    6780.00                  DELAWARE R AT TRENTON NJ

1964 COMPLETED

1965 COMPLETED
```

FIGURE 27, Continued

RECORDS TRANSFERRED TO DISK

STATE	AGENCY	STATION	WATER YEAR	PCODE	STATISTIC	ASECTION	DEPTH	OPERATION	RETRIEVAL FLAG
34	USGS	01463500	1974	00060	00003			ENT	ON
34	USGS	01463500	1975	00060	00003			ENT	ON
34	USGS	01463500	1974	00010	00003			ENT	OFF
34	USGS	01463500	1975	00010	00003			ENT	OFF
34	USGS	01463500	1974	00010	00001			ENT	OFF
34	USGS	01463500	1975	00010	00001			ENT	OFF
34	USGS	01463500	1974	00945	00003			RAT	OFF
34	USGS	01463500	1975	00945	00003			RAT	OFF
34	USGS	01397000	1974	00060	00003			RAT	OFF
34	USGS	01397000	1975	00060	00003			RAT	OFF
34	USGS	01463500	1973	80155	00003			SSD	OFF
34	USGS	01463500	1973	80154	00003			SSD	OFF
34	USGS	01463500	1974	80154	00003			MPL	OFF
34	USGS	01463500	1975	80154	00003			MPL	OFF
34	USGS	01463500	1974	00915	00003			MPL	OFF
34	USGS	01463500	1975	00915	00003			MPL	OFF
34	USGS	01463500	1974	70300	00003			MPL	OFF
34	USGS	01463500	1975	70300	00003			MPL	OFF
34	USGS	01463500	1974	80155	00003			CON	OFF
34	USGS	01463500	1975	80155	00003			CON	OFF
34	USGS	01463500	1974	70290	00003			CON	OFF
34	USGS	01463500	1975	70290	00003			CON	OFF
34	USGS	01463500	1974	70302	00003			CON	OFF
34	USGS	01463500	1975	70302	00003			CON	OFF
34	USGS	01460500	1974	00060	00003			SUB	OFF
34	USGS	01460500	1975	00060	00003			SUB	OFF
34	USGS	01460501	1974	00060	00003			ADD	OFF
34	USGS	01460501	1975	00060	00003			ADD	OFF
34	USGS	01463500	1964	80154	00003			YER	OFF
34	USGS	01463500	1965	80154	00003			YER	OFF
34	USGS	01463500	1964	00915	00003			YER	OFF
34	USGS	01463500	1965	00915	00003			YER	OFF
34	USGS	01463500	1974	80154	00003			DSP	OFF
34	USGS	01463500	1975	80154	00003			DSP	OFF
34	USGS	01463500	1974	00915	00003			DSP	OFF
34	USGS	01463500	1975	00915	00003			DSP	OFF
34	USGS	01463500	1964	00915	00003			DSP	OFF
34	USGS	01463500	1965	00915	00003			DSP	OFF
34	USGS	01463500	1964	00915	00001			CID	OFF
34	USGS	01463500	1965	00915	00001			CID	OFF
34	USGS	01463500	1964	80154	00001			CID	OFF
34	USGS	01463500	1965	80154	00001			CID	OFF

NORMAL END OF PROCESSING OF PROGRAM H475

FIGURE 27, Continued

Station header record was found, and from 1 to 6 of the mandatory entries was missing. Check card for error and resubmit if there was an error on card. If no card error, make update or correction to station header file.

DU003 PASSWORD SECURITY VIOLATION-DATA FOR THIS STATION NOT PROCESSED.

Check card for error and resubmit if there was an error on card. If no card error, then password submitted thru H475 was in error, or no password was submitted.

DU004 AGENCY CODE MISSING-DATA FOR THIS STATION NOT PROCESSED.

Check card for error and resubmit if there was an error on card. If no card error, then agency symbolic parameter passed into H475 was in error.

DU005 IMPROPER OR MISSING STATION IDENTIFIER.

Check card for error and resubmit card with valid station ID.

DU008 NO PARAMETER CODE-DATA NOT PROCESSED.

No parameter code submitted on "2" card. Correct cards and resubmit.

DU009 NO STATISTIC CODE DATA NOT PROCESSED.

No statistic code submitted on "2" card. Correct card and resubmit.

DU010 CODE CARD MISSING.

No "2" card submitted for "3" or T card. Submit correct "2" card and resubmit data.

DU011 WRONG STATION NUMBER-CARD IGNORED.

Station ID submitted on "3" card did not match station ID on "2" card.

DU013 WRONG WATER YEAR-CARD IGNORED.

Water year on T card did not match water year submitted on "3" card. Correct card type T card and resubmit.

DU014 DATE ERROR-CARD IGNORED.

Erroneous date submitted. Correct and resubmit.

DU015 ERRONEOUS CARD NUMBER-CARD IGNORED.

Erroneous card number submitted for "3" card--correct and resubmit.

DU016 ILLEGAL PARAMETER CODE TAPE-DATA NOT PROCESSED.

Illegal parameter code yyyyy encountered during processing--correct and resubmit.

DU017 ILLEGAL PARAMETER CODE-DATA NOT PROCESSED.

Illegal parameter code yyyyy encountered during processing--correct and resubmit.

DU019 MISSING BEGIN OR END DATE-OPERATION NOT COMPLETED.

Supply missing begin or end date and reprocess data.

DU020 NO STATE CODE AVAILABLE-RECORD NOT DELETED.

No header record was found and no Z card submitted supplying a state code. Correct and resubmit data.

DU021 NO STATE CODE AVAILABLE-RECORD ID NOT CHANGED.

No header record was found and no Z card submitted supplying a state code. Correct and resubmit data.

DU024 RECORD NOT ON DISK.

Heading supplied above this message indicates record not found on disk. Correct card or check header record for error and resubmit data.

DU025 INCORRECT OPTION SPECIFIED.

Heading supplied above this message indicates record for which illegal option specified. Correct and resubmit.

DU028 NO TYPE 6 CARD SUBMITTED.

Entire period not completed. Only one "6" card submitted and operation required two "6" cards. Correct and resubmit.

DU029 INVALID TYPE CARD SUBMITTED-OPERATION NOT COMPLETED.

Heading supplied above this message indicates record for invalid data card. Correct and resubmit.

DU041 PARAMETER AND STATION ID ON "7" CARD DO NOT AGREE WITH "2" CARD.

Correct "7" card to match parameter code and station ID on "2" card and resubmit data.

DU044 VALUE OUTSIDE RANGE OF TABLE.

Daily value in daily value file was outside range of submitted rating cards and could not be computed. Therefore, processing terminated. Correct "7" card to include erroneous data value or change daily value and resubmit data for processing.

DU045 TABLE CONSISTS OF ONLY ONE ENTRY.

Number of set values has to be at least two. Correct "7" cards. Correct and resubmit data for processing.

DU046 MORE THAN 48 ENTRIES SUBMITTED FOR TABLE.

Program H475 can handle up to 48 sets of rating points on twelve "7" cards; correct data input and resubmit for processing.

DU047 HEADER RECORD NOT AVAILABLE.

Record disposition option specified as K, L, or R but no available header record. Correct and resubmit data for processing.

DU057 FIRST INSTANTANEOUS TIME IS NOT 0000.

When computing daily chemical loads from instantaneous samples the first card must have a time of "0000."

DU061 TOTAL TIME FOR DAY EXCEEDS 24 HOURS.

When computing daily load the total number of hours covered by the concentrations on the "5" cards exceeded 24 hours.

DU062 ERROR IN SPECIFICATION OF TIME IN TYPE "5" CARD.

Correct time and resubmit.

DU063 CONCENTRATION NOT SUBMITTED ON "5" CARD-CARD IGNORED.

When using the SSD option a concentration must be entered on every "5" card.

DU064 DISCHARGE IS NOT AVAILABLE FOR CHEMICAL LOAD COMPUTATION.

Discharge was not entered in the "5" card and no "6" card was submitted.

IV.A.9. Cataloged Procedure

A cataloged procedure for the entry and update of data, the computation and simulation of data, the deletion of data, and the correction of record access-keys by means of the program H475 has been stored in the WATSTORE procedure library. The procedure name is DVINPUT and the procedure may be executed for card input by using the following cards:

Col. 1	Col. 12
•	•
//xxxxxxxx	JOB (----)
/*PROCLIB	WRD.PROCLIB

```
//    EXEC DVINPUT,AGENCY=agency,PASSWRD=password
//DVIN.SYSIN        DD *
                    •
                    •
Data cards for program H475
                    •
                    •
/*
//
```

where "agency" is the agency code indicating the agency responsible for the data and "password" is the password required to access data that has been password protected for updating. If the data has not been password protected, a password is not required.

If the input data is on a nine-track tape in the standard daily values record format (LRECL=1656 see Section IV.B. for record format), then the procedure should be executed by using the following cards:

```
Col. 1              Col. 12

•                   •
//xxxxxxxx          JOB (----)
/*SETUP            tapeno/9
/*PROCLIB          WRD.PROCLIB
// EXEC DVINPUT,AGENCY=agency,PASSWRD=password,VOL1=tapeno,
//                              NAME1=dataset1,UNIT1=TAPE9
```

where "tapeno" is the volume serial number of the input nine-track tape, and "dataset1" is the data set name.

If any of the operations require data that are stored on one of the daily values historical file tapes, use the following card setup:

```
//xxxxxxxx          JOB (----)
/*SETUP            tapein/9
/*PROCLIB          WRD.PROCLIB
//  EXEC DVRETR,VOL1=tapein,AGENCY=agency,PASSWRD=password
//HDR.SYSIN        DD *
                    •
                    •
                    Retrieval cards for program G490
/*
```

```
//  EXEC DVINPUT,AGENCY=agency,PASSWRD=password,NAME1='&BKREC'
//DVIN.SYSIN        DD *
                    •
   Data cards for H475
                    •
/*
//
```

where "tapein" is the volume serial number of a daily values historical file magnetic tape. See description of procedure DVRETR in Section IV.B. The DVRETR procedure will retrieve the required data from the historical tape. The DVINPUT procedure will store the retrieved data in the current disk file and will perform those operation requested by means of the data cards. For this operation, card input is optional.

If the execution time coded in the procedure is not sufficient, then the time may be changed by coding TIME1=time on the execute card as shown below:

```
//  EXEC DVINPUT,TIME1=4
```

The symbolic parameter TIME1 is in minutes. The complete list of symbolic parameters that may be used with procedure DVINPUT and the default values are listed below.

Parameter	Description
VOL1	Volume serial number of the input magnetic disk or tape containing data in the standard daily values record format. Code VOL1=xxxxxx.
NAME1	The data set name that has been assigned to the input data set on tape or disk. Code NAME1=name. If this data set is created on a systems disk by DVRETR in the same job as a temporary data set, then code NAME1='&BKREC.'
UNIT1	Device type for input data set in standard daily values record format on tape or disk. For a 9-track tape, code UNIT1= TAPE9. For a private disk code, UNIT1=2314

	or UNIT1=3330. Default is SYSDK for a temporary data set passed from DVRETR.
FILE1	The data set sequence number which specifies the relative position on a magnetic tape of the input data set in the standard daily values record format. The default is FILE1=1.
LB1	The label type subparameter which tells the system what type of label is associated with the magnetic tape input data set in standard daily values record format. The default is LB1=SL.
AGENCY	The agency which is responsible for the data. Code AGENCY=agency.
PASSWRD	The Update/Retrieval Password required for password protected data. Code PASSWRD= password.
EDIT	Code EDIT=NORND if it is required to have coded (non-computed) data entered into the Daily Values File exactly as the value appears on the input cards.
TIME1	If the execution time in the procedure is not sufficient, then the time may be changed by coding TIME1=time where "time" is in minutes.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION B. Daily Values Retrieval (Program G490)

by Owen O. Williams

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.B. Daily Values Retrieval (Program G490)

IV.B.1. Introduction

The Daily Values File retrieval program (program number G490) permits the retrieval of data from the WATSTORE Daily Values File. The data may be retrieved (1) in the form of a computer printout, (2) in punch card output, (3) in monthly character format on a magnetic device, and (4) in the standard daily values record format on a magnetic device.

Data retrieved in the standard daily values record format, either in a permanent or temporary data set, may be presented by selected application programs.

Retrieval specifications, entered by means of data control cards, are edited first by the preprocessor program G745. This program also creates a subfile of required station header records. When the execution of program G745 is completed, program G490 is invoked. Program G490 retrieves daily values data records from the Daily Values File if the records satisfy the specifications on the data control cards and have a corresponding station header record in the subfile created by program G745. If sorting is specified and the standard daily values format is requested for output, the system sort routine is invoked when program G490 is finished executing.

In order to simplify the retrieval of data from the Daily Values File, the job control language (JCL) for program G490, including the associated preprocessor program G745, and system sort routine has been cataloged in a procedure called "DVRETR" (Refer to Section IV.B.5 for detailed discussion of "DVRETR").

Section III.B. describes the options available for the retrieval of data from the Station Header File by program G745. All retrieval options discussed in Section III.B. are applicable to the retrieval of daily values data from the Daily Values File. Reference should be made to Section III.B. prior to continuing with this section.

Program G490 was written in PL/1 for the IBM 360 and 370 computer series by Owen O. Williams, U.S. Geological Survey, Reston, Virginia.

IV.B.2. Daily Values File Organization

The Daily Values File is a general purpose file for the storage of water data collected or measured on a daily schedule. The

file is divided into two basic subfiles: (1) the current file and (2) the historical file (backfile). The current file is a direct-access, on-line file that contains all daily values data being actively processed and updated. This file contains all daily values data for the current and immediately preceding water year, plus any updates to the historical file that were entered since the last merge of data to the historical file. The historical file is a sequential file stored on magnetic tapes and contains all data that were collected prior to the two most current water years. Historical data are removed at six-month intervals from the current file and merged into the historical file. Historical data entered into the current file between merges will reside in the current file until it is merged into the historical file.

All data are stored in the Daily Values File in ascending order of the record access key (Refer to Section II.E). The record access key consists of eight identifiers in the order listed below.

1.	State code	See Appendix B for list of state codes.
2.	Agency code	See Appendix A for list of agency codes.
3.	Station identification numbers	See Chapter II.B. for discussion of station identification numbers.
4.	Cross section locator	Distance in feet from left bank (as determined by facing downstream).
5.	Sampling depth	The depth in feet at which observation was made.
6.	Parameter code	See Appendix D for list of parameter codes.
7.	Water year	The 12-month period, October 1 through September 30, spanning two calendar years and designated by the calendar year in which the 12-month period ends.
8.	Statistic code	See Appendix E for list of statistic codes.

IV.B.3. Retrieval Specifications

Retrieval specifications define the Daily Values records that are to be retrieved by program G490. All identifiers and parameter values are applicable retrieval specifications. Three specifications are mandatory. The omission of a mandatory specification will cause the retrieval request to be ignored and a diagnostic message to be printed. Eighteen specifications are optional. The omission of an optional specification indicates that the item is not to be considered during the processing of retrieval specifications. If a station header record and daily values record passes all retrieval specifications, both records with all entries are merged and retrieved.

IV.B.3.a. Mandatory Specifications

The three mandatory specifications required for each retrieval are (1) agency code, (2) station selection method, and (3) input file type.

IV.B.3.a.(1) Agency Code (see Appendix A)

The agency code for each retrieval is furnished either by a symbolic parameter within the cataloged procedure (see Section IV.B.5.) or password/agency identification cards (see Section IV.B.3.d.(8)). An agency specified by a password/agency identification card for a given station specification will supersede the agency specified by a symbolic parameter. If data for all agencies are required, use the code "ALLAG" either in the symbolic parameter or in the proper field on the password/agency identification card.

IV.B.3.a.(2) Station Selection Method

Data may be retrieved, (1) by listing individual station identification number(s) (see Section III.B.2.j.(1)), (2) by a range of station identification numbers described by a beginning and ending station number, and (3) by geographic area using vertices of latitude and longitude which describe a polygon. Data for any number of individual stations may be requested. All three methods with repetitions of any or all of them may be incorporated in one retrieval. Note that a retrieval using more than one station selection method, such as a range and a polygon, may result in the same stations being selected twice and therefore cause duplication in the data retrieval. All polygon specifications that are part of a retrieval must contain the same number of

vertices. The type of station selection is specified by coding the station selection cards (see Section III.B. for card formats and detailed discussion on station selection method).

IV.B.3.a.(3) Input File

Each retrieval may encompass data from the Daily Values historical file only, the Daily Values current file, or both files. When making a retrieval from both files, the selected records from the historical file records are updated and merged with records from the current file and the resulting data is placed into a user specified output format. The type of file selection is specified on the master control card (see Section IV.B.3.d.(1)).

IV.B.3.b. Optional Specifications

Each optional specification is either given by a list of identifiers or parameter values, or a range of values defined by a maximum and a minimum. A summary of these options and the maximum number per retrieval are listed in Table 1 in Section IV.B.4.a. The last column in Table 1 lists the card type for entering the specifications. For optional specifications involving a range, both a maximum and a minimum value may be submitted, or either may be submitted alone. If a maximum value is submitted alone, then the value of the corresponding entry, either in the station header record or in the daily values record, must be less than or equal to the given maximum value in order for the daily values record to be retrieved. If a minimum value is submitted alone, then the value of the corresponding entry in the data files must be greater than or equal to the given minimum for the daily values record to be retrieved. If maximum and minimum values are submitted, the value of the corresponding entry must be greater than or equal to the minimum value and less than or equal to the maximum value for the daily values record to be retrieved. For list retrievals, the list may contain from one to as many as the maximum number shown in Table 1. Entries in a list are compared with the corresponding entry in the station header record or daily values record until a list is exhausted (record rejected) or a match is found (record accepted).

IV.B.3.c. Data Security

A security retrieval flag is stored in each record in the daily values current file to protect against unauthorized retrieval. The flag is tested to see if password checking is required.

Entry in Station Header Record and/or Daily Values Record	Retrieval Method	Maximum List Size	Control Card Type
Password	List	1	Agency Identification (Z)
State Code	List	5	Locator (L)
District Code	List	5	Locator (L)
County Code	List	25	Locator (L)
Hydrologic Unit Code	List	5	Locator (L)
Station Name	List	5	Station name (N)
	Range	-	Station name (N)
Drainage Area	Range	-	Extended Retrieval (E)
Contributing Drainage Area	Range	-	Extended Retrieval (E)
Datum	Range	-	Extended Retrieval (E)
Well Depth	Range	-	Extended Retrieval (E)
Geologic Unit Code	List	5	Additional Identifier (A)
Aquifer Type	List	5	Additional Identifier (A)
Site Code	List	5	Additional Identifier (A)
Cross Section Locator	List	12	Cross Section Locator (P)
Sampling Depth	List	12	Sampling Depth (Q)
Parameter Code	List	15	Retrieval List (R)
Year	Range	-	Master Control (M)
Statistic Code	List	15	Statistics List (F)
Daily Values Data	Range		Control Values (C)

TABLE 1. RETRIEVAL OPTIONS FOR DAILY VALUES RETRIEVAL PROGRAM

If required, the user-supplied password will be checked against the two passwords stored in the Station Header File. If a match is found, the data are retrieved; if not, a diagnostic message is printed indicating the sites for which data could not be retrieved. Data stored in the historical file cannot be protected by a security retrieval flag. Thus, passwords need not be supplied if a retrieval encompasses data from the historical file only. A password is specified by means of the symbolic parameter, PASSWRD, within the cataloged procedure or by means of the password/agency identification card. Refer to Section II.C. for a detailed discussion on data security.

IV.B.3.d. Control Cards

Fourteen types of control cards are available for retrieval specifications. The formats and coding instructions for the seven listed below are described fully in Section III.B.2.

1. Locator control card--card type L
2. Additional identifier control card--card type A
3. Extended retrieval control card--card type E
4. Station name control card--card type N
5. Station list card--card type D
6. Station range card--card type S
7. Polygon retrieval card--card type V

The other seven types of control cards, listed below, are described fully in the following sections.

1. Master control card--card type M
2. Application control card--card type X
3. Cross section locator list card--card type P
4. Sampling depth list card--card type Q
5. Parameter code list card--card type R
6. Statistic code list card--card type F
7. Password/agency identification card--card type Z

IV.B.3.d.(1) Master Control Card

The master control card (Figure 1) is required for each retrieval and must be the first card of each retrieval set. This card is used to specify the input files, the period of record, the number of vertices of a polygon retrieval, the output format, sort options, and the 12-month period the daily values data array is to comprise when the output is in the standard daily values record format (refer to Section IV.B.4.d.(1) for the description of the data array within the standard daily values format).

The format for the master control card is described below.

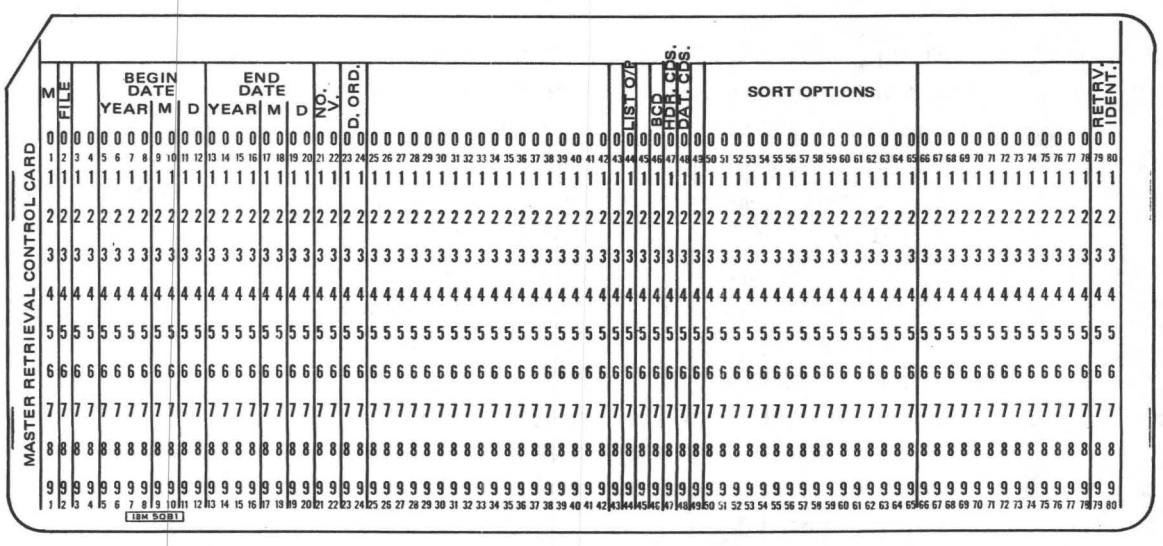

FIGURE 1. MASTER CONTROL CARD (TYPE M)

Col. 1 Enter an M

Col. 2 Type of input file.

Code
1 - Current file only.
2 - Backfile only.
3 - Both files.

Col. 3-4 Blank

Col. 5-8 Beginning calendar year -- Thie field is coded with a four-digit number which represents the first calendar year of period requested (e.g., '1971'). If this field is left blank then columns 9-10 should be left blank and the earliest year of record in the Daily Values File will be made available for retrieval.

Col. 9-10 Beginning month -- This field is coded with a two-digit number which represents the first month of the period requested (e.g., code '01' for January, '12' for December). If the output is in the standard daily values format the data array for the beginning year will comprise a 12-month period which includes the beginning month requested.

Col. 11-12 Blank

Col. 13-16 Ending calendar year -- This field is coded with a four-digit number which represents the last calendar year of period requested. If this field is left blank then columns 17-18 should be left blank and the year coded in columns 5-8 will be made available for retrieval. If the beginning year also is left blank, then the entire period of record in the Daily Values File will be made available for retrieval.

Col. 17-18 Ending month -- Code this field with a two-digit number which represents the last month of the period requested. If the output is in the standard daily values record format the data array for the ending year will comprise a 12-month period which includes the ending month.

Col. 19-20 Blank

Col. 21-22 Number of vertices to be considered if a polygon is included in the retrieval. Refer to Section III.B.2.j.(3).

Col. 23-24 A two-digit number to specify the first month of each 12-month period the daily values data array is to comprise when the output is in the standard daily values record format (refer to Section IV.B.4.d.(1) for the description of the data array within the standard daily values format). If this field is left blank the default is '10' (water year).

Col. 25-43 Blank

Col. 44 Code this column with any non-blank character if a printout is required of each record retrieved. This option may be selected with any of the option in columns 46-48. See Table 2 for a sample printout.

Col. 45 Blank

Col. 46 Code this column with any non-blank character to request that the output data set be in the monthly character record format (see Section IV.B.4.c.) with a record length of 408 bytes. Do not code this column if column 48 is coded.

Col. 47 Code this column with any non-blank character to request that the output data set produced be card-images of station header data. The format is described in Section III.A. This column is coded only if column 48 also is coded.

Col. 48 Code this column with any non-blank character to request that the output data be card-images of daily values data, i.e., the daily values code card (type 2) and the daily values data card (type 3). The card formats are described in Section IV.A.

Note: If no code is in columns 46-48, the output will be in the standard daily values record format (1656-byte record).

Col. 49 Blank

Col. 50-65 Sort options -- Seventeen record identifiers are available for sorting. However only nine identifiers (any nine of the 17) may be specified, in any

order, for a retrieval. If a sort option is not selected, the output will be in ascending order by state code, ascending order by agency code within the state, and ascending order by station identification number for stations belonging to the agency. From one to nine codes may be inserted in the card from left to right beginning in column 50 according to the order in which the output is required. As an example, if it is required to order the header data by ascending county code numbers, and local well numbers within each county, code a C in column 50 and a W in column 51. When using the sort code W, an extended sort option is available. Its use is described in Section III.B.2.d.(2).

If a number of retrievals within a given execution of the procedure, DVRETR, are to be sorted, the sort options must be identical on each master control card (refer to Section IV.B.3.d.(9) for example setup).

The sort options are applicable only if output requested is in the standard daily values record format.

The sort control items are listed alphabetically with corresponding codes.

Agency code	A
Aquifer type	T
County code	C
Datum	U
District code	D
Drainage area	Q
Geologic unit code	G
Hydrologic unit code	H
Site code	I
Parameter code	R
State code	S
Station identifier	P
Station locator (latitude-longitude sequence number)	L

	Station name/local well number	W
	Statistic code	F
	Well depth	E
	Year	Y

Col. 66-78 Blank

Col. 79-80 User defined retrieval identifier. Any alpha-numeric characters. Optional field.

■ IV.B.3.d.(2) Application Control Card

The application control card (Figure 2) identifies the application program that will process the data retrieved. If an application control card(s) is required it immediately follows the master control card. An application control card indicates that another procedure will be executed following the retrieval. An application control card is not to be used if output is in the monthly character format or Daily Values punch card format.

The format of the application card is described below.

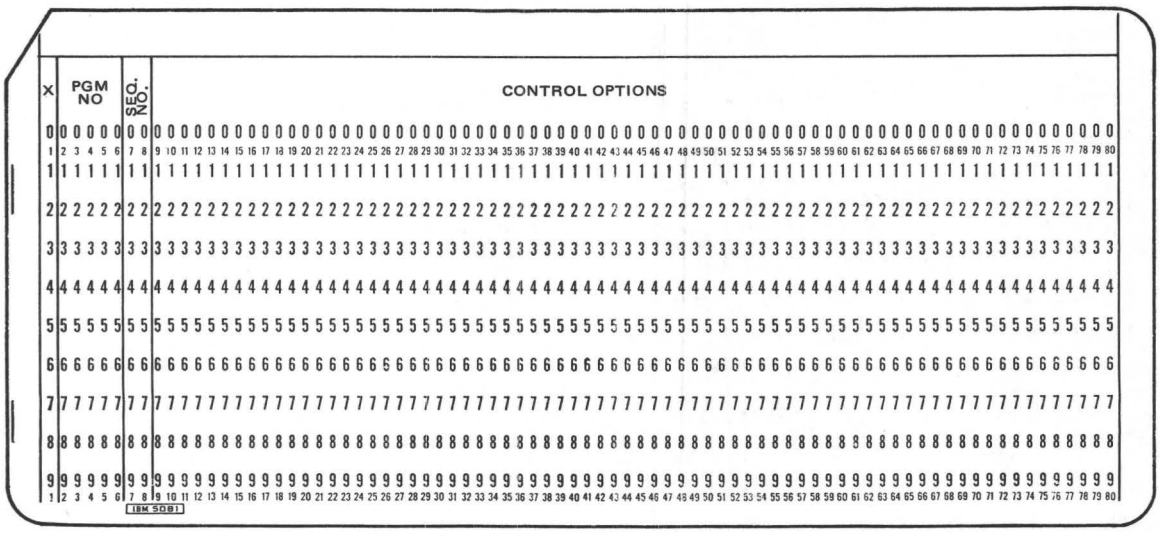

FIGURE 2. APPLICATION CONTROL CARD (TYPE X)

Col. 1	Enter an X
Col. 2-6	Program number of the application program left justified
Col. 7-8	Optional sequence number to be processed by the application program
Col. 9-78	Control options for the application program. Refer to Sections IV.C. through IV.G. for detailed description.
Col. 79-80	Retrieval identifier

■ IV.B.3.d.(3) Cross Section Locator List Card

The cross section locator card (Figure 3) specifies as many as 12 cross section locators (see Section II.E.) for a given retrieval. This list is checked against the cross section stored with each daily values record. If a match is found and the record meets the other specified options, it is retrieved. This card need be coded only if a retrieval is to be restricted to a given set of cross sections. The cross sections are to be coded beginning in the left most field. If records for which cross section locators are not applicable (have not been reported) are to be retrieved, properly code '999999' in the card. The absence of the card for a given retrieval indicates that the cross section locator is not to be considered in selecting daily value records for retrieval. The format of the cross section locator card is given below:

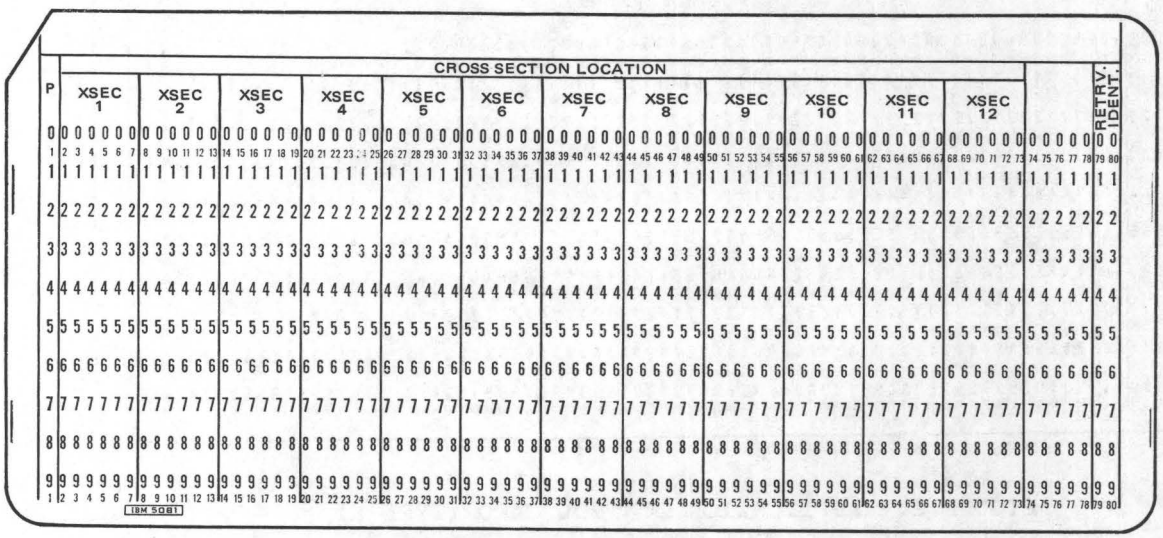

FIGURE 3. CROSS SECTION LOCATOR LIST CARD (TYPE P)

Col. 1	Enter a P
Col. 2-7, 8-13, 14-19, 20-25, 26-31, 32-37, 38-43, 44-49, 50-55, 56-61, 62-67, 68-73	Cross Section Locator -- The cross section locator should be entered within the field with decimal point, if applicable.
Col. 74-78	Blank
Col. 79-80	Retrieval identifier

■ IV.B.3.d.(4) Sampling Depth List Card

The sampling depth list card (Figure 4) specifies as many as 12 sampling depths (see Section II.E.) for a given retrieval. This list is checked against the sampling depth stored with each daily values record. If a match is found and the record meets the other specified options, it is retrieved. This card need be coded only if the retrieval is to be restricted to a given set of sampling depths. The sampling depths are to be coded beginning in the left most field. If records for which sampling depths are not applicable (have not been reported) are to be retrieved, properly code '999999' in the card. The absence of the card for a given retrieval indicates that the sampling depth is not to be considered in selecting daily values records for retrieval. The format of the sampling depth card is given below:

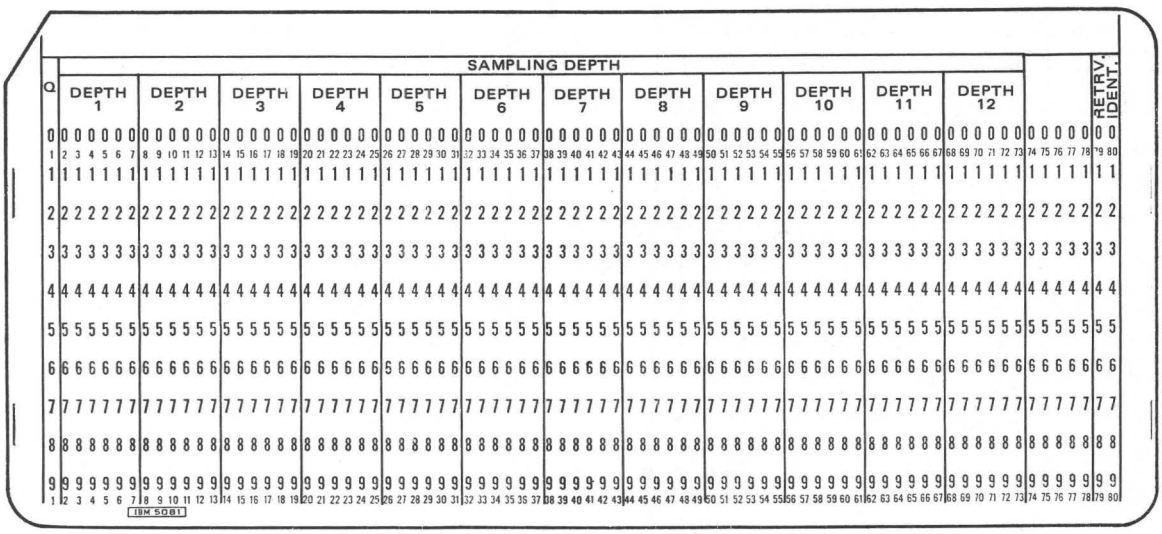

FIGURE 4. SAMPLING DEPTH LIST CARD (TYPE Q)

Col. 1	Enter a Q
Col. 2-7, 8-13, 14-19, 20-25, 26-31, 32-37, 38-43, 44-49, 50-55, 56-61, 62-67, 68-73	The sampling depth should be entered within the field with decimal point, if applicable.
Col. 74-78	Blank
Col. 79-80	Retrieval identifier

■ IV.B.3.d.(5) Parameter Code List Card

The parameter list card (Figure 5) specifies as many as 15 five-digit parameter codes (see Appendix D) for a given retrieval. This card need be coded only if the retrieval is to be restricted to a given set of parameter codes. The parameter codes are to be coded beginning in the left most field. The absence of the card for a given retrieval indicates that the parameter card is not to be considered in selecting daily values records and that daily values data for all parameters will be retrieved. The format of the parameter code list card is given below:

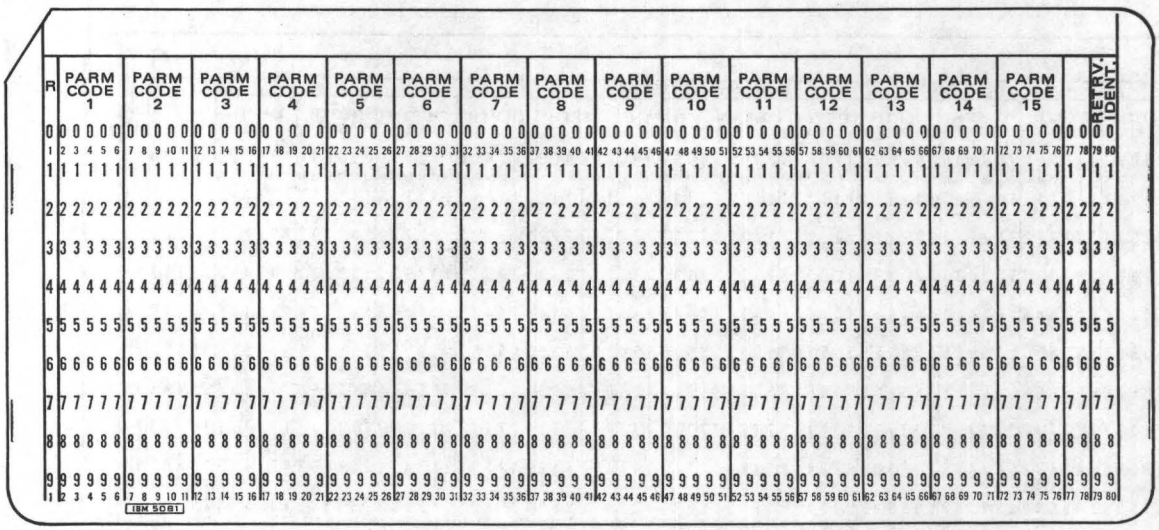

FIGURE 5. PARAMETER CODE LIST CARD (TYPE R)

Col. 1	Enter an R
Col. 2-6, 7-11, 12-16, 17-21, 22-26, 27-31, 32-36, 37-41, 42-46, 47-51, 52-56, 57-61, 62-66, 67-71, 72-76	Five-digit parameter codes. See Appendix D for list of parameter codes.
Col. 77-78	Blank
Col. 79-80	Retrieval identifier

■ IV.B.3.d.(6) Statistic Code List Card

The statistic code list card (Figure 6) specifies as many as 15 five-digit statistic codes (see Appendix E) for a given retrieval. This card need be coded only if the retrieval is to be restricted to a given set of statistic codes. The statistic codes are to be coded beginning in the left most field. The absence of this card indicates that the statistic code is not to be considered in selecting daily values records for retrieval. The format of the statistic list card is given below:

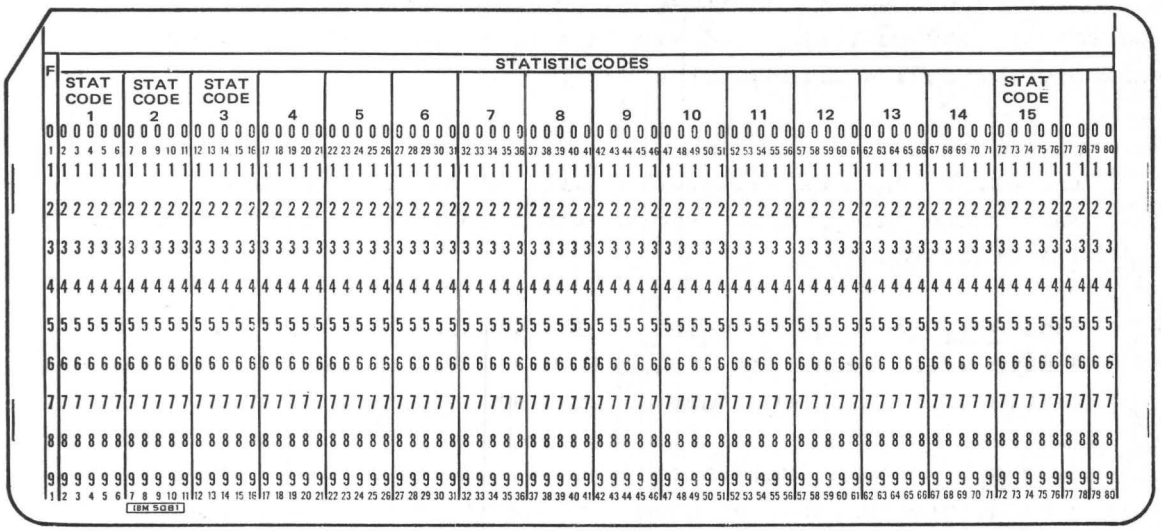

FIGURE 6. STATISTIC CODE LIST CARD (TYPE F)

Col. 1	Enter an F
Col. 2-6, 7-11, 12-16, 17-21, 22-26, 27-31, 32-36, 37-41, 42-46, 47-51, 52-56, 57-61, 62-66, 67-71, 72-76	Five-digit statistic codes. See Appendix E for list of statistic codes.
Col. 77-78	Blank
Col. 78-80	Retrieval identifier

■ IV.B.3.d.(7) Control Values Card

The control values card (Figure 7) is used for specifying a maximum and minimum daily value for specific parameters. If the parameter codes are to be retrieved within specific ranges of values, these values are to be defined on the control values card. The parameter codes specified on the control values card need not be specified on the parameter code list card. However, only fifteen parameters may be specified for a given retrieval using the control values card and/or the parameter code list card. The control values card is to be submitted only when the retrieval is to be restricted to a range of data values. The control values card specifies the restriction of a retrieval based upon the ranges of data values for three parameters. A maximum of five control values cards may be submitted for one retrieval, i.e., a maximum of 15 parameters may be restricted within a retrieval. Three options are available for coding a range of values.

1. Code both the maximum and minimum field -- This defines an inclusive range of values that will allow for the retrieval of only those daily values records that contain a data within the specified range.

2. Code only the maximum value -- Daily values records containing a data value less than or equal to the maximum value will be retrieved. All other records will be rejected.

3. Code only the minimum value -- Daily values records containing a value greater than or equal to the minimum value will be retrieved. All other records will be rejected.

For all control fields, a decimal point must be entered if a fractional portion of a value is coded. The control values may be entered anywhere within the specified input fields. The format is shown below:

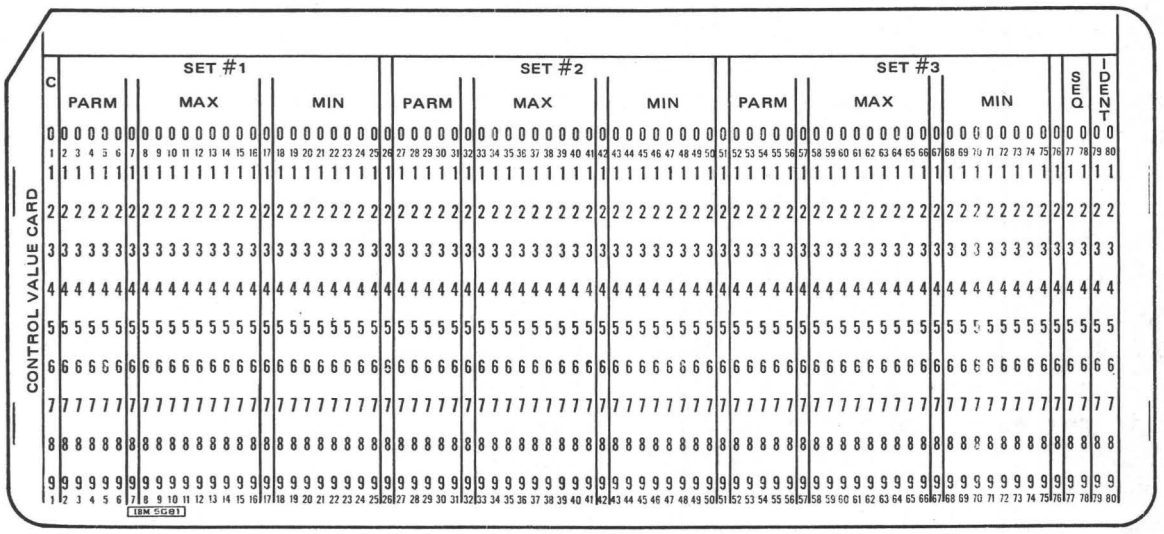

FIGURE 7. CONTROL VALUES CARD (TYPE C)

Col. 1	Enter a C
Col. 2-6, 27-32, 52-56	The five-digit parameter code specified on the retrieval list card
Col. 7, 32, 57	Always blank
Col. 8-16, 33-41, 58-66	Maximum daily value for each corresponding parameter code
Col. 17, 42, 67	Always blank
Col. 18-25, 43-50, 68-75	Minimum daily value for each corresponding parameter code

Col. 26, 51, 76 — Always blank

Col. 77-78 — Card sequence number of the control values card. A maximum of five cards per retrieval.

Col. 79-80 — Retrieval identifier

IV.B.3.d.(8) Password-Agency Identification Card

The password-agency identification card (Figure 8) is used to, (1) identify the agency that is associated with one or more collection sites, and (2) supply one of the two passwords stored in the station header record in the event the security retrieval flag stored in the daily values records indicates password checking is required. When required, the password-agency identification card (Z card) must be positioned in the job deck immediately ahead of a station selection card. Station selection cards are discussed in Section III.B.2.j. If a station selection card is not preceded by a Z card, the agency code for the sites will be taken from the AGENCY symbolic parameter and the password to be used for password checking, if required, will be taken from the PASSWRD symbolic parameter, assuming both symbolic parameters were coded on the EXEC card (see Section II.A.). When the Z card is used, the association with station selection cards (D, S, V cards) is as follows:

- Station List Card (D Card) -- One Z card preceding each D card.
- Station Range Card (S Card) -- One Z card preceding each S card.
- Polygon Vertex Cards (V cards) -- From one to five Z cards (up to five agencies, but only one password) preceding each set of V cards (each V card has one or two latitude-longitude identifiers on it) that define a polygon. (Polygon Retrieval is discussed in Section III.B.2.j.(3)).

An example is given below to illustrate the association of agency codes with station selection cards. (Cards beginning with a slash "/" are job control language (JCL) cards.) The D, V, and S cards are station selection cards. The numbers in parentheses are reference numbers for this discussion only.

```
Col. 1                  Col. 12

•                       •
//wxxyyzz               JOB (aaaaaaaaa,bbbbb)'your name'
/*PROCLIB               WRD.PROCLIB
//Stepname              EXEC DVRETR,AGENCY=USAG,PASSWRD=AAAA
//HRD.SYSIN              DD  *
M       (master control card)
D       (station list card)                (1)
D                                          (2)
Z  (password/agency identification card)
D                                          (3)
Z
S       (station range card)               (4)
S                                          (5)
Z
Z
V                                          (6)
V                                          (7)
V                                          (8)
/*      (delimiter card)
//      (null card)
```

In this example, station selection cards (1), (2), and (5) will be associated with the agency coded in the symbolic parameter AGENCY=USAG on the EXEC card, and the password used for password checking, if required, will be that coded in the symbolic parameter PASSWRD=AAAA on the EXEC card. The agency code on the first Z card will be associated with the site on station selection card (3), and the password specified on the first Z card will be used for password checking. The agency code specified on the second Z card will be used to retrieve all sites that are within the station range defined on the station range card (4), and the password specified on the second Z card will be used for password checking. Cards (6), (7), and (8) define a polygon. The polygon retrieval will include all sites within that polygon that are associated with the agencies specified on the two Z cards preceding cards (6), (7), and (8); and the password on the last Z card will be used for password checking. Note that if five Z cards preceded a set of V cards that define a polygon, only the last password read would be used for password checking. The format of the Z card as it applies to the retrieval of daily values records is described below.

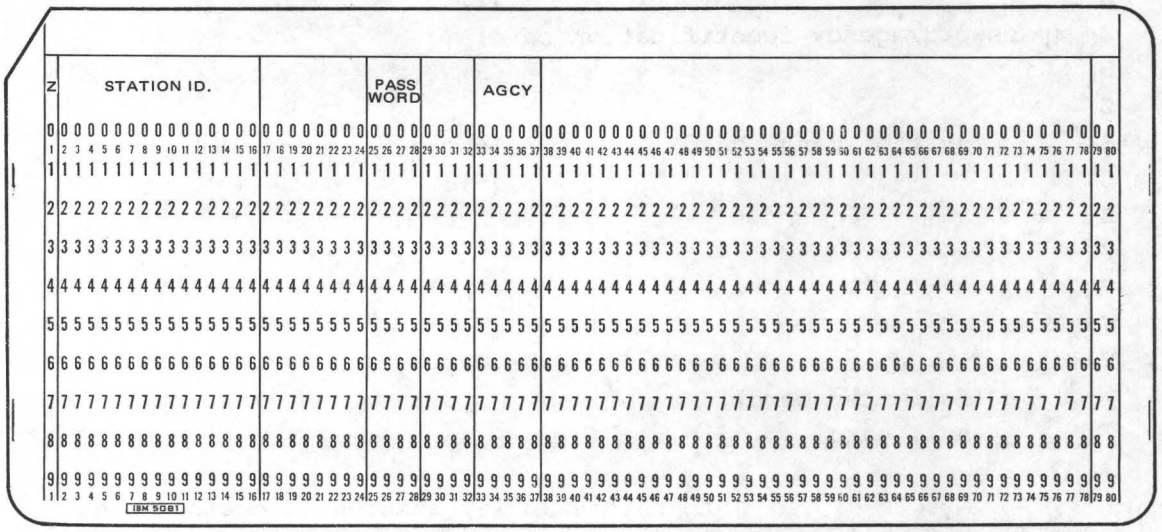

FIGURE 8. PASSWORD/AGENCY IDENTIFICATION CARD (TYPE Z)

Col. 1	Enter a Z
Col. 2-16	Station identification number. This field is left blank when the Z card precedes an S card or a set of V cards.
Col. 17-24	Blank
Col. 25-28	Retrieval password. Used for password checking, if the security retrieval flag in the daily values record indicates checking is required for the sites defined on the station selection card immediately following the Z card.
Col. 29-32	Blank
Col. 33-37	Agency code. The agency code which is to be associated with the site(s) defined on the selection card immediately following the Z card.
Col. 38-78	Blank
Col. 79-80	Retrieval identifier

IV.B.3.d.(9) Organization of Control Cards

The master control card (M card) must be the first control card for each retrieval. The station selection cards must be the last control cards submitted for each retrieval. If application cards (X cards) are required, they immediately follow the master control card. If a password-agency identification card (Z card) is required, it immediately precedes the station selection card with which it is associated. All other control cards are optional for each retrieval and may appear anywhere between the master control card (or last application control card if required) and the first station selection card (or the password-agency identification card associated with the first station selection card).

```
Col. 1          Col. 12              Col. 25              Col. 50

•               •                    •                    •
//jobname       JOB (----),'your name'
/*PROCLIB       WRD.PROCLIB
//  EXEC        DVRETR,AGENCY=ALLAG
//HDR.SYSIN      DD  *
M1 197210       197409               (Retrieval no. 1)    ASP
XH474 (Refer to Section IV.C)
R00060000100095
F00003
L34
S               01405230             01463500
M1 197210       197409               (Retrieval no. 2)    ASP
XH474
R00010
F0000100002
L34
Z                                    AAA   USGS
S               01405230             01463500
/*
//  EXEC        DVTABLES (refer to Section IV.C.)
//
```

The above examples show two retrievals submitted for a given execution of the retrieval procedure. Note that the sort codes specified for Retrieval No. 1 are identical to those specified for Retrieval No. 2. Any number of retrievals may be submitted for a given execution of the retrieval procedure. For multiple retrievals, columns 79-80 of the control cards may be coded with a retrieval identifier. The retrieval program does not process these card columns.

IV.B.3.e. Restrictions

The following restrictions apply to program G490:

1. For each execution of the cataloged procedure (see Section IV.B.5.), the number of retrievals is governed only by the space allocated to the output file.

2. Each retrieval must begin with a master control card (Figure 1).

3. Only station identification numbers can be used in a station number list or range.

4. Station locators may be used only in polygon retrievals.

5. Each retrieval set must end with a station selection card.

IV.B.4. Output

Output may be requested in one of the following formats:

1. A printout listing of daily values records.

2. Daily values records in a punch card format with or without station header records in card-image format.

3. Monthly character format as a permanent data set on a magnetic device.

4. Standard daily values record format, as either a permanent or temporary data set on a magnetic device, which may be processed by selected daily-values applications programs.

In addition, diagnostic messages will be printed to aid the user.

IV.B.4.a. Computer Printout Listing

A computer printout listing is requested by coding column 44 of the master control card with a non-blank character. The listing consists of all data in each water year of record and may be requested with any other form of output. An example listing is shown in Table 2. An R is always printed under the heading 'FILE TYPE'. The R indicates daily values records and station header records have been merged prior to output. The number printed under the heading 'BEG MO' indicates the first month of the 12-month period, and the left most data printed is for that month. The value '999999' in the data table indicates no value stored.

IV.B.4.b. Punch Card Format

Daily values punch cards are requested by coding column 48 of the master control card with any non-blank character.

FILE TYPE	STATE CODE	AGENCY CODE	STATION IDENTIFICATION NUMBER	CROSS SECTION	SAMPLING DEPTH	PARAMETER CODE	WATER YEAR	STAT CODE	NO VALUE INDICATOR	DIST CODE	COUNTY CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
R	34	USGS	01463500	999999.000	999999.000	00060	1974	00003	999999.0000	34	021	6780.00	0.00

STATION NAME OR LOCAL WELL NUMBER	WELL DEPTH	DATUM	HYDROLOGIC UNIT CODE	RTV SEQ NO	BEG MO	SITE CODE	STATION LOCATOR LATITUDE	STATION LOCATOR LONGITUDE	STATION LOCATOR SEQ NO	GEOLOGIC UNIT CODE
DELAWARE R AT TRENTON NJ	-99999.00	7.77	000000000	01	10	SW	401318	0744642	00	

DAY	10	11	12	01	02	03	04	05	06	07	08	09
1	5770.00	12300	11300	30100	28800	15900	24200	9870.00	8520.00	6430.00	9560.00	9230.00
2	5070.00	10300	9520.00	26900	25600	15400	24300	10100	9770.00	7030.00	8740.00	13500
3	5670.00	8470.00	8390.00	24700	22900	14900	26200	11700	13000	8110.00	8630.00	18400
4	6200.00	7350.00	7660.00	24000	20100	13900	31900	12000	11700	7310.00	6800.00	26400
5	5860.00	6760.00	8080.00	20700	18200	13200	40200	11400	9830.00	6720.00	6910.00	24900
6	5060.00	6330.00	16400	17600	16500	14900	44800	11200	9300.00	6080.00	6570.00	20400
7	6290.00	5700.00	19400	16100	15100	18400	43700	11300	8410.00	6380.00	5600.00	18200
8	5380.00	5270.00	19800	15600	14500	19000	36200	11500	7840.00	5270.00	4880.00	17600
9	4270.00	5470.00	19900	16000	13700	20300	37300	11600	7230.00	4510.00	4460.00	15600
10	4250.00	5610.00	28000	14300	12800	22300	37600	13200	6330.00	4840.00	5000.00	13600
11	4840.00	5610.00	38000	13600	12200	21900	32900	12900	5690.00	5250.00	4270.00	11900
12	4560.00	5510.00	29300	15600	11600	19800	28500	13400	6070.00	4880.00	3740.00	10500
13	4000.00	5460.00	22900	14500	11400	18600	27900	26700	5890.00	3910.00	3610.00	9390.00
14	3520.00	5340.00	23400	12300	11300	16600	27700	40000	5350.00	3350.00	3730.00	10400
15	4230.00	5450.00	23600	10700	11100	14900	30800	32600	4720.00	3720.00	3810.00	10300
16	4250.00	5430.00	21500	12200	10800	13800	35900	25600	4210.00	3620.00	3740.00	8730.00
17	3850.00	5260.00	19400	12500	9930.00	18700	34400	21700	7880.00	3780.00	3940.00	7560.00
18	3760.00	5270.00	17000	12700	9480.00	22500	29000	19800	10500	4400.00	10300	7320.00
19	3920.00	5440.00	14700	10800	9230.00	21100	25300	17600	10100	3350.00	7670.00	6830.00
20	3830.00	5370.00	13500	11200	11600	19000	23900	15000	8100.00	2990.00	6790.00	6440.00
21	3760.00	5030.00	53900	11600	13200	20400	21400	13500	6650.00	3770.00	6070.00	6410.00
22	3800.00	4780.00	107000	17200	12300	26200	18800	12500	6240.00	3900.00	5460.00	6880.00
23	3730.00	4680.00	77300	21600	18800	29300	17500	11600	6150.00	3500.00	5110.00	6270.00
24	3850.00	4080.00	50200	23500	31200	25500	15900	11900	7830.00	3560.00	5370.00	6280.00
25	4110.00	3970.00	39400	22900	26400	22900	14700	11100	7290.00	3680.00	4820.00	7200.00
26	4140.00	5020.00	35900	21600	22800	21000	13800	10700	6750.00	3890.00	4310.00	6590.00
27	3780.00	5560.00	42500	20900	19500	19700	12800	9590.00	6140.00	4100.00	4200.00	6050.00
28	3660.00	7430.00	52800	23500	17100	18100	11900	8880.00	6240.00	4090.00	4570.00	5560.00
29	4930.00	9230.00	54400	35400	999999	16600	11200	8480.00	6440.00	4030.00	5020.00	16500
30	13000	11700	42900	38600	999999	17000	10700	7850.00	7640.00	4400.00	5580.00	15900
31	15100	999999	35000	33800	999999	25100	999999	7840.00	999999	8740.00	8340.00	999999

Table 2. SAMPLE PRINTOUT OF DAILY VALUES RECORD

The output will consist of a daily values code card (type 2), and a maximum of 48 daily values data cards (type 3) for each water year of data retrieved (see Section IV.A. for description of the daily values code and data cards). If column 47 also is coded with a non-blank character, the password/agency card (type Z), the station header card (type H) and the station name card (type N) also will be punched (see Section III.A. for description of H and N cards). The H card will immediately follow the Z card and the N card will follow the H card. All daily values code and data cards associated with the station will follow the N card.

If column 47 of the M card is coded with a non-blank character and column 48 is left blank, a diagnostic message will be printed and all processing of the retrieval will be deleted.

Card-images on a magnetic tape may be specified by coding a DD card as discussed in Section IV.B.5.

IV.B.4.c. Monthly Character Format

The monthly character format is requested for output by coding column 46 of the M card with any non-blank character. The record length (LRECL) is 408 bytes and is divisible by 4, 6, and 8, suitable for most word lengths. The cataloged procedure has been designed to write the data on a 7-channel (DDNAME=TAPE7), 556 bpi, tape recorded as even parity with six bit BDC (binary coded decimal characters). The format is given below:

Byte Position	Number of Characters	Identifier
1	1	Reserved.
2-6	5	Agency Code (Appendix A).
7-8	2	State Code (Appendix B).
9-23	15	Station identification number.
24-30	7	Cross-section location -- distance in feet from left bank (as determined by facing downstream). Blank field indicates that the cross section locator was not stored.

Byte Position	Number of Characters	Identifier
31-37	7	Sampling depth -- The depth in feet at which observation was made. A blank field indicates that the sampling depth was not stored. In the case where USGS publication tables of top and bottom samples are required (e.g., water temperature), a value of 111111 indicates top samples and a value of 888888 indicates bottom samples (refer to Section IV.C. for discussion of top and bottom data table). Sampling depth values are measured down from water surface.
38-42	5	Parameter Code (Appendix D).
43-46	4	Calendar year.
47-48	2	Month number.
49-53	5	Statistic Code (Appendix E).
54-60	7	Reserved.
61-277	217	Daily values (31). Thirty-one daily values (7 characters each). Decimal point is included when applicable. A blank field indicates no value stored.
278-279	2	District Code. For USGS sites, this code represents the state code of the district office or the project code of the Regional office responsible for collecting and storing the data.
280-282	3	County Code (Appendix C).

Byte Position	Number of Characters	Identifier
283-330	48	Station name or local well number.
331-337	7	Drainage area -- reported in sq. mi. Decimal point is included if applicable.
338-344	7	Contributing drainage area -- If only a portion of the stream's total drainage area contributes to the streamflow then this value is stored here in sq. miles.
345-352	8	The depth of ground-water site wells reported to one-hundredth of a foot.
353-359	7	Datum -- elevation of the station in feet above mean sea level.
360-367	8	Hydrologic unit code -- refer to Office of Water Data Coordination (OWDC) states basic hydrologic unit maps.
368	1	Aquifer type -- refer to Section III.A. for definition and available codes.
369-370	2	Site Code -- refer to Section III.A. for defintion and available codes.
371-376	6	Latitude of the site location DDMMSS, where D is degrees, M is minutes, and S is seconds.

Byte Position	Number of Characters	Identifier
377-383	7	Longitude of the site location DDDMMSS.
384-385	2	Sequence number within quadrant with a leading zero for values less than 10.
386-393	8	Geologic Unit (Appendix F).
394-408	15	Reserved.

IV.B.4.d. Standard Daily Values Record Format

The daily values records are written in the standard daily values record format if columns 46 through 48 on the master control card are left blank. The user may request the output data set to be permanent (i.e., not deleted upon completion of job) by the use of symbolic parameters within the cataloged procedure (see Section IV.B.5.). Each record contains daily values data for a 12-month period. The record length is 1656 bytes and the format is described below:

Byte Position	Data Type	Identifier
1-2	CHAR(2)	Blank.
3-4	CHAR(2)	State Code (Appendix B).
5-9	CHAR(5)	Agency Code (Appendix A).
10-24	CHAR(15)	Station identification number.
25-28	FLOAT(6)	Cross section locator -- Distance in feet from left bank (as determined by facing downstream). A value of 999999 indicates that the cross section locator was not stored.

Byte Position	Data Type	Identifier
29-32	FLOAT(6)	Sampling depth -- The depth in feet at which observation was made. A value of 999999 indicates that the sampling depth was not stored. In the case where USGS publication tables of top and bottom samples are required (e.g., water temperature) a value of 111111 indicates top samples and a value of 888888 indicates bottom samples (refer to Section IV.C. for discussion of top and bottom publication tables). Sampling depth values are measured down from water surface.
33-36	FIXED BIN(31)	Parameter Code (Appendix D).
37-38	FIXED BIN(15)	Four-digit calendar year of the last month (chronological) in the record. This is water year for water year records (default).
39-40	FIXED BIN(15)	Statistic Code (Appendix E).
41-44	FLOAT(6)	No value indicator -- value that is stored in place of a missing daily value. A value of 999999 is stored for most data. Some sediment data may have a value of -1 stored. The no value indicator is stored for existing days for which no data were reported and for false days such as February 30.
45-1532	FLOAT(6)	Two-dimensional array (12,31) containing all of the daily values data for a 12-month

Byte Position	Data Type	Identifier
		period. The first dimension of array represents the month number - 01 (Jan.) to 12 (Dec.). The beginning month number (bytes 1611-1612) indicates the chronologically earliest month in the data record. The second dimension of the values array represents the day number within the month--1 to 31. (See Section IV.B.4.d.(1) below for discussion of organization of data in the record).
1533-1535	CHAR(3)	Blank
1536-1537	CHAR(2)	District Code. For USGS sites, the district (numerical state code) or the alpha project code of the regional office responsible for collecting and storing the data.
1538-1540	CHAR(3)	County Code (See Appendix C).
1541-1588	CHAR(48)	Station name or local well number.
1589-1592	FLOAT(6)	Drainage area. Reported in square miles (sq. miles). A zero indicates no value stored.
1593-1596	FLOAT(6)	Contributing drainage area. Reported in sq. mi. A zero indicates no value stored.
1597-1600	FLOAT(6)	Well depth. Reported to one-hundredths of a foot. A -99999 indicates no value stored.

Byte Position	Data Type	Identifier
1602-1604	FIXED DEC(7,2)	Datum. Elevation of the station datum in feet above mean sea level. Null value = -99999.99.
1605-1608	FIXED BIN(31)	Hydrologic Unit Code. See USGS publication "State Hydrologic Unit Maps."
1609-1610	FIXED BIN(15)	Retrieval sequence number. Date control for batched retrievals.
1611-1612	FIXED BIN(15)	Month number that contains the chronologically beginning date of the 12-month period of record. Value ranges from 1 (Jan.) to 12 (Dec.). For example, if the value equals 10 then October is the first month chronologically and September is last month and daily values array begins chronologically with (10,1) and ends with 9,31).
1613-1614	CHAR(2)	Site Code (See Section III.A.).
1615-1620	CHAR(6)	Latitude. Site location, DDMMSS where DD is degrees, MM is in minutes, and SS is in seconds.
1621-1627	CHAR(7)	Longitude. Site location, DDDMMSS where DDD is in degrees, MM is in minutes, and SS is in seconds.
1628-1629	CHAR(2)	Sequence Number. Latitude-Longitude Sequence number within quadrant with a leading zero for value less than 10 (See Section III.A.).

Byte Position	Data Type	Identifiers
1630-1637	CHAR(8)	Geologic Unit Code (see Appendix F).
1638-1656	CHAR(9)	Blank.

■ IV.B.4.d.(1) Organization of Daily Values Data Array

Each daily values data array in the Daily Values File comprises a water year of data, i.e., the 12-month period, October 1 through September 30, spanning two calendar years. The water year is designated by the calendar year in which the 12-month period ends. The daily values data array is always represented as a two-dimensional array (12,31) with month as the first dimension and day as the second dimension. The data is physically stored in the array such that the first data value (01,01) is for January 1, the second data value (01,02) is for January 2, on through December 31, (12,31) regardless of the chronologic order.

For example, data for the 1974 water year would be physically stored in the data array such that the first data value (01,01) would be for January 1, 1974, the 280th data value (10,01) would be for the chronologically first data value for October 1, 1973, and the last data value would be for December 31, 1973.

The data within each daily values array may be chronologically ordered for output to comprise a calendar year, fiscal year, or climatic year. However, the physical order will always begin with the values for January, and end with those for December, even when two calendar years are spanned.

Each data array will comprise a water year of data, unless a different type of year is requested by means of the master control card.

Columns 23-24 of the master control card are coded with a two-digit number representing the chronologically beginning month of the 12-month period each data array is to comprise for output. For example, if columns 23-24 on the master control card were coded with 01, then each data array retrieved would comprise a calendar year; if columns 23-24 contain 07, each data array retrieved

would comprise a fiscal year. If columns 23-24 on the master control card are left blank, each daily values data array retrieved will comprise a water year. To identify the type of year (12-month period) the data array comprises, the value coded in columns 23-24 is stored in the daily values record in byte positions 1611-1612, and the calendar year in which the last month of the 12-month period falls, is stored in byte positions 37-38. If the columns 23-24 on the M card are blank, then the value stored in byte position 1611-1612 of each daily values record retrieved will be 10.

IV.B.4.e. Diagnostic Messages

The diagnostic messages are printed to aid in determining the status of processing and the action required to correct errors. Diagnostic messages printed from program number G745 can be identified by a HRxxx preceding the message, where HR is a unique abbreviation for program number G745 and xxx is a sequence number. The diagnostic messages printed from program number G745 are listed sequentially in Section III.B.

The diagnostic messages printed from program number G490 can be identified by a DRxxx which precedes the message, where DR represents a unique abbreviation for the program and xxx represents a sequence number. The diagnostic messages printed from program G490 are listed sequentially below:

DR001 ERRONEOUS DATE SPECIFICATION ON MASTER CONTROL CARD FOR RETRIEVAL REQUEST NUMBER xx - ALL PROCESSING OF THIS REQUEST DELETED.

An invalid begin or end date was specified on the master control card for retrieval request number xx. Make correction and resubmit control cards.

DR002 ERRONEOUS INPUT FILE SPECIFICATION ON MASTER CONTROL CARD FOR RETRIEVAL REQUEST NUMBER xx - ALL PROCESSING OF THIS REQUEST DELETED.

An invalid code, which indicates the input file, has been specified on the master control card for retrieval request number xx. Code must be 1, 2, or 3. Make correction and resubmit control cards.

DR003 INVALID PARAMETER CODE SPECIFIED ON PARAMETER CODE LIST CARD FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST DELETED.

An invalid parameter code was specified on the parameter code list card for retrieval request number xx. Make correction and resubmit control cards.

DR004 ERROR IN REQUEST CARDS FOLLOWING MASTER CONTROL CARD FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST DELETED.

Either an X type card was not preceded by an M type card or a Z type card was not followed by an S type card for retrieval request number xx. Make correction and resubmit control cards.

DR005 CONVERSION ERROR OCCURRED IN CARD TYPE ? FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST DELETED.

Either an alpha-code or an intermittant blank was found instead of numeric digit on card type indicated by ?. Make correction and resubmit control cards.

DR006 END STATION NUMBER LESS THAN BEGIN STATION NUMBER FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST IS DELETED.

An S type card was submitted with an end station less than the begin station number. Make correction and resubmit control cards.

DR007 MORE THAN ONE R CARD SUBMITTED FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST IS DELETED.

More than one parameter code list card was submitted for request retrieval number xx. Make corrections and resubmit control cards.

DR008 MORE THAN ONE F CARD SUBMITTED FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST IS DELETED.

More than one statistic code list card was submitted for retrieval request number xx. Make correction and resubmit control card.

DR009 MORE THAN ONE P CARD SUBMITTED FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST IS DELETED.

More than one cross section locator card was submitted for retrieval number xx. Make correction and resubmit control cards.

DR010 MORE THAN ONE Q CARD SUBMITTED FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF REQUEST IS DELETED.

More than one sampling depth card was submitted for retrieval request number xx. Make correction and resubmit control cards.

DR011 MORE THAN FIVE C CARDS SUBMITTED FOR RETRIEVAL REQUEST NUMBER xx - ALL FURTHER PROCESSING OF THIS REQUEST IS DELETED.

More than five control values cards were submitted for retrieval request number xx. Make corrections and resubmit control cards.

DR012 ERRONEOUS OUTPUT SPECIFICATION ON MASTER CONTROL CARD FOR RETRIEVAL REQUEST NUMBER xx - ALL PROCESSING OF THIS REQUEST DELETED.

Either station header cards were requested without daily values cards or monthly character format was requested with daily values cards. Check columns 46 through 48 of master control card, make correction, and resubmit.

DR013 ERRONEOUS DATA ARRAY SPECIFICATION ON MASTER CONTROL CARD FOR RETRIEVAL REQUEST NUMBER xx - ALL PROCESSING OF THIS REQUEST IS DELETED.

Columns 23-24 of the master control card must be coded with a value between 01 and 12, or left blank. Make correction and resubmit.

DR014 DATA ARRAY ORDERING FAILED FOR RETRIEVAL REQUEST NUMBER xx - FURTHER PROCESSING OF THIS REQUEST IS DELETED.

An attempt to order the data array as requested in retrieval request number xx. Retain printout and input deck and notify the WATSTORE ADP section.

DR015 INVALID PARAMETER CODE ppppp SPECIFIED ON C CARD FOR RETRIEVAL REQUEST NUMBER xx - FURTHER PROCESSING OF THIS REQUEST IS DELETED.

'ppppp' is the invalid parameter code specified on the C card for retrieval request number xx. Make correction and resubmit.

DR016 MORE THAN 15 PARAMETER CODES SPECIFIED FOR RETRIEVAL REQUEST NUMBER xx - FURTHER PROCESSING OF THIS REQUEST IS DELETED.

More than 15 different parameter codes were specified on the P and C cards. Make correction and resubmit.

DR017 NO AGENCY CODE SPECIFIED FOR A STATION RANGE RETRIEVAL IN RETRIEVAL REQUEST NUMBER xx - FURTHER PROCESSING OF THIS REQUEST IS DELETED.

No agency code was specified by means of a symbolic parameter or by means of a Z card preceding the S card. Make correction and resubmit.

DR018 INVALID PASSWORD SPECIFICATION. ENTIRE RETRIEVAL DELETED.

The password specified by means of symbolic parameter PASSWRD exceeded four characters. Make correction and resubmit.

DR201 AGENCY = aaaaa, STATION = sssssssssssssss, yy RECORDS NOT RETRIEVED FOR RETRIEVAL REQUEST NUMBER xx - DUE TO PASSWORD PROTECTION.

'yy' indicates the number of records which meet all retrieval specifications for station sssssssssssssss and agency aaaaa; but were not retrieved because they were protected at the data record level and either a password was not submitted or the one submitted did not match one of the passwords in the station header record.

DR202 yyyyy RECORD HAVE BEEN RETRIEVED FOR RETRIEVAL NUMBER xx - nnnn STATION(S) HAVE RECORDS.

The indicated number of records have been retrieved for the indicated number of sites.

DR203 yyyyy MONTHLY CHARACTER FORMAT RECORDS HAVE BEEN WRITTEN FOR RETRIEVAL REQUEST NUMBER xx.

The indicated number of monthly character record formats have been written on a magnetic device for the indicated retrieval request.

DR204 yyyy CARDS PUNCHED OR WRITTEN ON A MAGNETIC DEVICE FOR RETRIEVAL REQUEST NUMBER xx.

The indicated number of cards have been punched or written on a magnetic device for retrieval request number xx.

DR205 EITHER NO AGENCY SPECIFIED OR AN INVALID ONE SPECIFIED BY MEANS OF THE SYMBOLIC PARAMETER AGENCY - ATTEMPT TO PROCESS WILL CONTINUE.

No action required for above message.

DR206 DATA LEVEL RETRIEVAL SPECIFICATIONS FOR RETRIEVAL REQUEST NUMBER xx ARE AS FOLLOWS:

This message is followed by a list of parameter cards, statistic codes, control values, cross sections, and sampling depths specified for retrieval request number xx.

DR207 NO STATION HEADER ENTRY FOR AGENCY aaaaa STATION sssssssssssssss

Data for agency "aaaaa" and station id. "sssssssssssssss" could not be retrieved due to no station header entry.

IV.B.5. Cataloged Procedure

A cataloged procedure for the retrieval of data from the daily values current file and the magnetic tape daily value historical file has been stored in the WATSTORE procedure library (WRD.PROCLIB). The procedure includes program G745, program G490, and the system sort routine. Options are (1) to retrieve, sort, and store the data in the standard daily values record format, either permanently or temporarily,

for use by one or more application programs; (2) retrieve the data for permanent storage in a monthly format on a 7-channel tape; (3) retrieve data in punch card format; and (4) printout a table of daily values. On any particular execution of the procedure, only one of the first three options may be used. Option 4 may be specified with either one of the first three options. The sort step is invoked by coding the sort fields on the master control card (col. 50-65) for program number G490. The procedure name is DVRETR and may be executed for the above mentioned options using the following cards:

1. For retrieval of data from the current file for use by application program:

```
Col. 1                  Col. 12

•                       •
//xxxxxxxx              JOB (----)
/*PROCLIB               WRD.PROCLIB
//                      EXEC DVRETR,AGENCY=agency,PASSWRD=password
//HDR.SYSIN             DD *
                        •
                        •
Retrieval cards for     program G490
                        •
                        •
/*                      EXEC DVTABLES
//                      EXEC DVPLOTS
//
//
```

   Where agency is the code assigned to the agency responsible for the data to be retrieved and password is the user-supplied password for checking, if required.

   The procedure execution cards for DVTABLES and DVPLOTS are shown above to illustrate the use of procedure DVRETR. DVTABLES and DVPLOTS are discussed in Section IV.C. and IV.E. respectively.

2. For retrieval from a magnetic tape backfile (with or without current file) for use by an application program: If data is to be retrieved from the magnetic tape historical file (with current or without current file) then a SETUP card is required after the JOB card and PROCLIB card shown above, the the EXEC card must read as shown below:

```
Col. 1          Col. 12

•               •
/*SETUP         tape1/9
// EXEC DVRETR,VOL1=tape1,AGENCY=agency
```

Where tape1 is the six-alphanumeric volume serial number of the historical magnetic tape. If concatenation of historical tapes is required, then the SETUP and EXEC cards should read,

```
/*SETUP         tape1/9,tape2/9
// EXEC DVRETR,VOL1=tape1,VOL2=tape2,AGENCY=agency
```

Where tape2 is the six-alphanumeric volume serial number of the second historical tape required for concatenation. The sequential ordering of the data on the tapes determines which tape is first and second.

3. For retrieval of data for permanent storage on a magnetic device in the standard daily values record format from a historical tape (with or without current file):

```
Col. 1              Col. 12

•                   •
//xxxxxxxx          JOB (----)
/*PROCLIB           WRD.PROCLIB
/*SETUP             tape1/9,tape4/9R
// EXEC DVRETR,AGENCY=agency,VOL1=tape1,
// VOL4=tape4,NAME4=dataset4,UNIT4=2400
//HDR.SYSIN         DD *
                    •
                    •
                    Retrieval cards for program G490
                    •
                    •
/*
//
```

Where tape4 is the volume serial number of the output tape, dataset4 is the data set name (DSNAME) of the output tape, tape1 is the volume serial number of the input backfile tape, and agency is the code assigned to the agency responsible for the data being retrieved.

If the data are to be permanently stored on a private disk then the SETUP and EXEC cards should read,

```
/*SETUP tape1/9,disk4/DISK
// EXEC DVRETR,AGENCY=agency,VOL1=tape1,
// VOL4=disk4,NAME4=dataset4,
// UNIT4=2314
```

Where disk4 is the volume serial number of the output disk.

If retrievals are from the current file only, then the VOL1 symbolic parameters should not be specified on the EXEC card, nor tape1/9 on the SETUP card.

4. For retrieval of data for permanent storage on a 7-channel tape in the monthly character format from a historical tape:

```
Col. 1                  Col. 12

•                       •
//xxxxxxxx              JOB (----)
/*PROCLIB               WRD.PROCLIB
/*SETUP                 tape1/9,tape3/7N
// EXEC DVRETR,AGENCY=agency code,
// VOL1=tape1,VOL3=tape3,NAME3=dataset3
//HDR.SYSIN             DD *
                        •
                        •
                        Retrieval cards for program G490
                        •
                        •
/*
//
```

Where tape3 is the 7-channel output tape and tape1 is the input backfile tape. If data are retrieved only from the current disk file, then VOL1 should not be specified on the EXEC card.

5. To punch out cards, use the following EXEC card:

```
// EXEC DVRETR,AGENCY=agency
```

If the retrieval is from a historical tape, specify the VOL1 symbolic parameter on the EXEC card and use a SETUP card for a historical tape as shown on item 1 above.

To write card images on a magnetic device, code the following DD card to follow the retrieval cards for program G490 and the /* card:

```
/*
//DVR.CDPUNCH DD (required disk or tape parameters)
```

The complete list of symbolic parameters that may be used with procedure DVRETR and the respective default value assigned are listed below in respective categories of use.

1. Parameters for specifying agency code and password.

Parameter	Description
AGENCY	The agency code stored with the data records. Must be specified.
PASSWRD	The password associated with each station to be retrieved. The update/retrieval password or the retrieval only password may be specified. The default is no password checking. To specify a password code, PASSWRD=your password code.

2. Parameters which describe input historical tapes.

Parameter	Description
VOL1	Volume serial number of the historical file input tape. Code VOL1=xxxxxx, if backfile input is required.
VOL2	Volume serial number of a second historical file input tape if concatenation is required. Code VOL2=xxxxxx.

3. Parameters which describe output in 408-byte monthly character format.

Parameter	Description
VOL3	Volume serial number of the output magnetic device on which the monthly character format data is to be stored.
UNIT3	Device type for the output dataset on magnetic disk in the monthly character format. The default value is for a 7-channel tape. For a 9-channel tape, code UNIT3=2400. For a disk output code UNIT3=2314 or UNIT3=3330 which ever is appropriate.
FILE3	Data set sequence number which specifies the relative position of the output data set in monthly character format on a tape volume. The default value is 1.
LB3	The label type subparameter which tells the system what type of tape label is associated with the output data set containing the monthly character format data. The default value is NL - the tape has no label.
BLK3	The blocksize or number of bytes per block of data stored on the magnetic device in the monthly character format. This value must be an even multiple of 408. The default value is 8160.
DEN3	The magnetic tape density in number of bits-per-inch (bpi) used to write a data set in monthly character format. The default value is 1 which indicates 556 bpi.
TCH3	The recording technique for the 7-channel tape on which the data set is to be written in monthly character format. The default value is ET which means parity and no conversion, with EBCDIC to BCD translation.
SP3	The space (tracks) for the output data set in monthly character format on disk. Default value is 10 tracks with incremental value of 1

track (possible 25 tracks) which is sufficient to store 500 records. If more than 500 monthly character formatted records are to be stored then code SP3=xxx.

NAME3 — The data set name (DSNAME) of the output data set in monthly character format on a magnetic device. This symbolic parameter must be coded each time data is being retrieved in a monthly character format, otherwise the file will be a DUMMY file and no data stored. Code NAME3=data set name.

4. Parameters which describe output in 1656-byte standard daily values record format.

Parameter	Description
VOL4	Volume serial number of the output magnetic tape or disk on which data is to be permanently stored in the standard daily values record format.
UNIT4	Device type for the permanent output data set on magnetic tape or disk in the standard daily values record format. The default value is for temporary storage on a systems pack which will be deleted at end of job. If output is on a 9-channel tape, code UNIT4=2400. If output is on a disk, code UNIT4=2314 or UNIT4=3330 whichever is appropriate.
FILE4	Data set sequence number which specifies the relative position of an output data set in standard daily values format on a tape volume. The default value is 1.
LB4	The label type subparameter which tells the system what type of tape label is associated with the data set containing the standard daily values formatted data. The default value is SL - The tape is standard label.

BLK4	The blocksize or number of bytes per block of data stored on a magnetic device in the standard daily values format. The value must be an even multiple of 1656. The default value is 11592 bytes.
DEN4	The magnetic tape density in number of bits-per-inch (bpi) used to write a data set in standard daily values format. The default value is 3 which indicates 1600 bpi.
SP4	The space (tracks) for the output data set in standard daily values format on disk. Default value is 100 tracks with incremental value of 5 tracks (possible 175 tracks) which is sufficient to store 1225 records. If more tracks are required, then code SP4=xxx.
NAME4	The data set name (DSNAME) of the output data set in standard daily values format for permanent storage on a private tape or disk. The default is for a temporary data set on a systems disk to be deleted at end of job.

5. Parameters which describe space for the temporary disk file of station header records and space for sorting.

Parameter	Description
SP1	The space (tracks) for the temporary disk file of station header records. Default value is 10 tracks with incremental value of 5 tracks (possible 85 tracks) sufficient to store 5100 records.
SP2	Space (cylinders) for sorting the temporary disk file of station header records. Default value is 10 cylinders.
SP5	Space (cylinders) for sorting the output of data in the standard daily values format and reordering the daily values data array. The default value is 10 cylinders.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION C. Daily Values Table (Program H474)

by Terry A. Wilson

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.C. Daily Values Tables (Program H474)

IV.C.1. Introduction

This section contains instructions for the printing of publication tables from the Daily Values File. The daily values table program (H474) is used to print all tables for data stored in the Daily Values File. Program H474 is used to produce tables from data that have been retrieved by the daily values retrieval procedure (DVRETR) in a prior job step. Procedure DVRETR is described in Section IV.B. The daily tables will be edited and printed according to the publication standards of the USGS. Five different table formats with eight possible column headings are available and are described in detail in Section IV.C.3. A calendar year table is available with each table format and will be printed automatically when a calendar year retrieval of data is requested as explained in Section IV.B. Sample table formats may be found in Figures 1-5. Program H474 was written in PL/I for the IBM 360 or 370 computer series by Terry A. Wilson, USGS, Reston, Virginia.

IV.C.2. Data Retrieval

The Daily Values Retrieval Procedure (DVRETR) will always be invoked prior to the execution of H474. Procedure DVRETR will control all record selection from the Daily Values File and determine the sorted sequence of the data records. The data records for a suspended sediment discharge table must be sorted by state, agency, station identifier, year, and parameter code at the time of retrieval. The sort control field as explained in Section IV.B.3.d. should be coded SAPYR to obtain the required sort for a suspended sediment discharge table. No other table types require the data to be sorted prior to processing. In order to initiate table options it is necessary to submit one type X control card during retrieval processing. The X card will be passed on to the table program (H474) and the appropriate options will be applied. In order to print more than one type of table it is necessary to submit a complete set of retrieval control cards for each table type that is to be printed. Instructions for coding retrieval cards for input to the retrieval program may be found in Section IV.B. A complete list of parameter codes that may be retrieved from the daily values file appears in Appendix D, and Appendix E is a list of statistic codes. A general description of cataloged procedures may be found in Section II.A.1. A cataloged procedure containing the JCL cards for program H474 is described in Section IV.C.5.

IV.C.3. Table Formats

Program H474 provides the capability to select five different table formats with eight possible column headings. Selection and control of the various table formats is determined by the program control card (X card) as described in Section IV.C.4. The table formats and the options that are associated with the X card are described in detail in the following paragraphs. The number of significant figures printed for each parameter is determined from the table in Appendix D, with the exception that provision is made on input to specify a different number of significant figures to be stored in the file. When data has been stored to a greater precision than specified in Appendix D, provision is made to suppress rounding these records on output.

IV.C.3.a. One-Item Table (Type 1)

A type 1 table is a table of once-daily values (see Figure 1) consisting of twelve months of data per page. Any record in the Daily Values File may be printed in this format.

IV.C.3.a.(1) Type 1 Table for Stream Discharge

The control options described below apply only to a type 1 table for parameter code 00060 (Discharge).

A type 1 table must be specified with parameter code 00060 to obtain the monthly and yearly summaries described below. Four types of monthly and yearly summaries are available for stream discharge records:

(a) Total, mean, maximum, minimum

(b) Total, mean, maximum, minimum, cfsm, inches

(c) Total, mean, maximum, minimum, acre-feet

(d) Total, mean, maximum, minimum, cfsm, inches, acre-feet

The type of summary for discharge will be determined by coding the X card as explained in Section IV.C.4. The monthly summaries are printed below the corresponding column of daily values. Additional spacing between monthly and yearly summary lines is available as a coded option in the X card to provide space for typing adjusted monthly figures.

PROCESS DATE IS 07-14-75

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY

STATION NUMBER 13336500 SELWAY RIVER NEAR LOWELL, IDAHO SOURCE AGENCY USGS
LATITUDE 460512 LONGITUDE 1153046 DRAINAGE AREA 1910.00 DATUM 1540.00 STATE 16 COUNTY 049

DISCHARGE, IN CUBIC FEET PER SECOND , WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	606	926	1310	845	2620	1390	4910	10900	14100	13200	1930	869
2	613	818	1380	624	2500	1600	4560	11200	15700	11700	1840	853
3	596	637	1320	1130	2310	1630	4170	10700	19800	10200	1990	841
4	575	548	1300	1240	2380	1570	3850	10900	25600	9590	1950	820
5	560	655	1200	1350	2360	1750	3640	12000	32000	9410	1780	800
6	548	801	1040	1290	2130	2230	4170	14200	27300	8630	1700	785
7	560	785	1260	1420	1970	2010	4310	15000	22300	8270	1820	767
8	566	798	---	1650	1890	1850	4210	17000	17400	7690	1700	749
9	552	1060	1370	1950	1750	1610	4270	19300	15900	7120	1620	735
10	535	1730	1130	2160	1710	1550	4470	16800	16200	7230	1560	829
11	529	2640	1300	2240	1630	1600	4370	14000	18600	8200	1470	999
12	552	4010	1310	2690	1590	1680	4500	12500	24000	6860	1370	971
13	570	3860	1220	2640	1620	1980	4200	11000	29400	6020	1320	880
14	707	2740	1170	---	1590	1970	4100	9820	33200	5730	1280	817
15	817	2310	1130	2600	1550	1890	4400	9040	36500	5590	1260	782
16	749	2090	1240	7100	1530	2050	5030	8140	---	5200	1220	756
17	663	2050	1820	7680	1600	4160	5120	7580	---	4810	1160	733
18	622	1930	2300	5720	1560	5410	5810	7130	---	4470	1120	718
19	594	1690	1960	5090	1590	4510	6940	6770	---	4250	---	704
20	574	1740	1730	4550	1580	3680	6760	6840	34600	4550	2030	696
21	567	1580	1740	3890	1470	3360	6220	7060	29800	4060	1990	675
22	554	1470	1670	3460	1480	3070	6030	7260	26200	3630	1450	664
23	545	1400	1670	3150	1440	2800	7070	8010	25900	3360	1270	654
24	559	1350	1600	2940	1300	2650	10300	9290	25100	3100	1180	646
25	704	1270	---	3080	1300	2520	13300	11700	24200	2870	1120	634
26	684	1250	1510	3040	1390	2600	14900	16300	21600	2650	1060	622
27	617	1210	1500	2790	1350	3220	12400	17900	17500	2500	1020	611
28	608	1190	1470	2690	1310	4050	10300	19100	15800	2350	988	610
29	737	1220	1420	2540	---	4510	9050	17500	14400	2220	958	605
30	752	1250	1340	2540	---	4530	8930	15700	13600	2130	930	599
31	873	---	1210	2610	---	5130	---	14200	---	2040	894	---
TOTAL	19290	47010			48500	84560	192300	374800		179600		22420
MEAN	622	1567			1732	2728	6410	12090		5795		747
MAX	873	4010			2620	5410	14900	19300		13200		999
MIN	529	548			1300	1390	3640	6770		2040		599

FIGURE 1. TABLE OF ONCE-DAILY VALUES (TYPE 1)

A calendar year summary is also available for water year tables of discharge. When data for the previous January to September (9-month summary) period are needed to complete the calendar year summary, the data record for the water year preceding the first water year table to be printed must be requested of the retrieval procedure (DVRETR) and the preceding year must also be specified on the X card. When tables for several successive water years are requested, the 9-month summary will be computed from the period January-September in each water year and passed on to the following water year table to complete the calendar year summary. If any data record containing required 9-month summary data resides only on magnetic tape, then provision must be made to have the appropriate tape mounted during the retrieval step.

IV.C.3.a.(2) Type 1 Table for All Other Daily Value Records

All parameters contained in the Daily Values File except discharge may be printed as a type 1 table with the following provisions for monthly and yearly summaries. A monthly and yearly maximum or minimum value will be printed for those records identified with a statistic code of 00001 (maximum) or 00002 (minimum). A monthly and yearly total will be printed for records containing a statistic code of 00006 (sum). Monthly summaries for all other records will be a monthly mean. A yearly summary consisting of maximum, mininum, and mean values will be printed for all records other than maximums (00001), minimums (00002), and sum (00006). There is no provision to specify the type of summaries that will be printed for these records since they are determined by the statistic code of the record.

IV.C.3.b. Two-Item Table (Type 2)

A type 2 table is a two-item table of extreme daily values (see Figure 2) consisting of two pages of print with six months of data on each page. A type 2 table is produced by combining two daily values data records with the following descriptions:

Maximum-minimum (statistic codes 00001 and 00002).

AM-PM (statistic codes 00004 and 00005).

Tidal high-Tidal low (statistic codes 00021 and 00024).

Low high-High low (statistic codes 00022 and 00023).

Top-Bottom (depth codes 111111 and 888888).

PROCESS DATE IS 07-14-75

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY

STATION NUMBER 13342500 CLEARWATER RIVER AT SPALDING IDAHO SOURCE AGENCY USGS
LATITUDE 462655 LONGITUDE 1164935 DRAINAGE AREA 9570.00 DATUM 770.50 STATE 16 COUNTY 069

TEMPERATURE (DEG. C) OF WATER , WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	6.0	5.5	8.5	8.0	9.5	9.0	13.5	13.0	18.5	18.0	19.0	17.0
2	5.5	5.0	8.5	8.0	10.0	9.5	13.5	13.0	18.5	18.0	19.0	16.0
3	5.5	5.0	8.5	7.0	10.0	9.5	13.5	13.5	18.5	18.0	18.5	16.5
4	5.5	4.5	8.5	7.0	10.0	9.0	13.5	13.5	18.5	18.0	19.0	16.5
5	5.5	5.0	9.0	8.0	9.0	8.0	14.0	13.5	18.5	17.0	18.0	16.5
6	6.0	5.5	8.5	8.5	8.0	8.0	14.0	14.0	18.5	18.0	16.5	15.5
7	6.0	5.5	8.5	8.0	8.5	8.0	14.0	14.0	19.0	17.0	16.5	15.5
8	6.0	5.5	8.5	8.0	9.0	8.0	14.5	14.0	18.0	16.5	16.5	15.5
9	5.5	5.5	8.5	8.5	10.0	9.0	14.0	13.0	18.0	15.5	16.0	15.5
10	6.0	5.5	8.5	7.0	10.5	9.5	13.5	11.5	18.0	16.0	16.0	15.0
11	5.5	5.0	8.0	7.0	10.5	10.0	13.5	11.5	18.5	16.5	15.5	14.5
12	5.0	5.0	8.0	8.0	10.5	10.0	14.0	11.5	18.0	16.0	16.0	15.0
13	6.5	5.0	8.5	7.0	10.0	9.5	15.0	13.5	17.0	15.5	16.0	14.5
14	8.0	5.5	8.0	7.0	10.0	9.0	17.0	15.0	17.0	15.5	15.5	14.5
15	8.0	6.0	8.5	7.0	9.5	9.0	18.5	16.5	18.0	15.5	15.5	14.0
16	8.0	6.5	8.5	7.0	10.0	9.5	18.0	16.5	19.0	15.5	15.5	14.5
17	8.0	6.0	8.5	8.0	10.0	9.5	18.0	16.0	19.5	16.5	15.5	14.0
18	7.0	7.0	9.0	8.5	10.0	9.5	18.5	16.5	18.5	16.5	15.0	14.0
19	7.0	7.0	9.5	8.5	10.0	9.5	18.5	17.0	18.0	16.0	15.5	14.0
20	7.0	6.5	9.5	9.5	10.0	9.5	18.5	17.0	18.0	15.5	15.5	14.0
21	8.0	6.5	10.5	9.5	9.5	9.5	18.5	17.0	17.0	15.5	15.5	14.0
22	7.0	7.0	11.0	9.5	10.5	9.5	18.5	17.0	16.5	16.0	15.0	14.0
23	9.0	7.0	11.0	10.5	11.0	10.5	18.5	16.5	16.5	15.5	15.0	13.5
24	9.0	8.5	10.5	10.0	11.5	11.0	18.5	16.0	18.5	15.5	15.0	13.5
25	9.0	8.5	10.5	10.0	12.0	11.0	18.5	16.0	19.5	16.5	14.5	13.5
26	8.5	7.0	10.5	10.0	12.0	11.0	18.0	16.0	20.0	16.5	14.5	13.5
27	7.0	6.0	10.0	9.5	11.5	11.0	18.0	16.0	19.5	17.0	13.5	12.0
28	6.5	6.0	9.5	9.0	11.5	11.0	18.5	16.0	19.5	18.0	13.0	11.5
29	8.0	6.0	9.5	8.5	12.0	11.5	18.5	18.0	19.5	18.0	13.0	11.5
30	8.5	8.0	9.5	8.5	13.0	12.0	19.0	17.0	19.5	18.0	13.0	11.5
31	---	---	9.5	9.0	---	---	19.0	18.0	19.5	17.0	---	---
MONTH	9.0	4.5	11.0	7.0	13.0	8.0	19.0	11.5	20.0	15.5	19.0	11.5
YEAR	20.0	2.0										

FIGURE 2. TABLE OF DAILY MAXIMUM AND MINIMUM VALUES (TYPE 2)

Column headings will be determined by the statistic code that is stored in the data record, with the exception of top-bottom tables which are determined by a value of 111111 stored in the sampling depth field of the top data record and a value of 888888 stored in the depth field of the bottom record. A monthly summary of the maximum and minimum values for each month will be printed below the respective columns for a maximum-minimum table. A monthly summary of both maximum and minimum values will be printed below both columns for all other two-item tables. On the last page of the two-page table a yearly summary of maximum, minimum, and mean values will be printed.

IV.C.3.c. Table of Daily Maximum, Minimum, and Mean Values (Type 3)

A type 3 table is a table of daily maximum, minimum, and mean data values (see Figure 3). Each table will be printed on three pages with four months of data on each page. A type 3 table is limited to only those data records containing the statistic codes 00001 (maximum), 00002 (minimum), and 00003 (mean). A monthly summary of the maximum, minimum, and mean values will be printed on each page below the respective columns and a yearly summary of maximum, minimum, and mean values will be on the last page of the table.

IV.C.3.d. Daily Sediment Table (Type 4)

A type 4 table is a suspended sediment discharge table (see Figure 4) of mean values of stream discharge, sediment concentration, and sediment discharge for a single year. Monthly totals of stream discharge and sediment discharge will be printed at the bottom of each page below the respective columns. The table will be printed four pages to a year, three months of data on each page. During retrieval from the Daily Values file, records to be printed in a type 4 format must first be sorted by state, agency, station identifier, year and parameter code (code SAPYR in sort control field) as explained in Section IV.B.3.d. Monthly stream discharge and sediment discharge totals will be printed below each respective column. A yearly summary consisting of total stream discharge (cfs-days) and total sediment discharge (tons) will be printed on the last page of the table.

IV.C.3.e. Skeleton Table (Type 5)

A skeleton table format is a table consisting of every fifth day of the month and the last day of the month (see

PROCESS DATE IS 07-14-75

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY

STATION NUMBER 03378900 LITTLE WABASH RIVER AT LOUISVILLE, IL SOURCE AGENCY USGS
LATITUDE 384632 LONGITUDE 0882926 DRAINAGE AREA 745.00 DATUM 420.51 STATE 17 COUNTY 025

TEMPERATURE (DEG. C) OF WATER , WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	JUNE			JULY			AUGUST			SEPTEMBER		
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
1	21.0	19.5	20.0	24.0	21.5	23.0	24.5	23.0	23.5	22.5	21.5	22.0
2	22.0	19.5	20.5	25.0	23.0	24.0	23.0	20.5	22.0	22.0	19.5	21.0
3	23.0	21.0	23.5	26.5	24.0	25.0	22.0	19.0	20.5	20.0	19.5	20.0
4	22.5	21.5	22.0	26.5	24.5	25.5	20.5	18.5	20.0	19.5	18.5	---
5	22.0	21.0	21.5	26.5	24.5	25.5	20.0	18.0	18.5	19.0	18.5	---
6	22.0	21.0	21.5	26.0	24.5	25.5	19.5	18.0	18.5	20.0	18.5	---
7	21.5	21.0	21.0	27.5	25.0	26.0	20.0	18.0	19.0	20.5	18.5	---
8	21.5	20.5	20.5	28.0	26.0	27.0	20.0	19.0	19.5	20.0	18.5	---
9	22.0	20.5	21.5	28.0	25.5	27.0	20.5	19.5	20.0	20.0	19.0	---
10	21.5	21.0	21.0	28.0	26.0	27.0	20.0	19.5	20.0	21.0	19.5	---
11	21.0	20.0	20.5	29.0	26.0	27.0	20.5	19.0	19.5	21.0	19.5	---
12	21.5	19.5	20.5	28.5	26.0	27.5	21.0	19.0	20.0	21.5	20.0	---
13	21.0	19.5	20.5	27.5	25.5	26.5	21.5	20.0	20.5	21.5	20.5	---
14	21.5	19.5	20.5	28.0	26.0	27.0	21.5	20.5	21.0	20.5	18.0	---
15	22.0	20.0	21.0	28.5	26.5	27.5	21.5	19.5	20.5	18.5	18.0	---
16	21.0	20.0	20.5	28.0	25.0	26.5	22.0	20.0	21.0	18.0	17.5	---
17	21.0	19.5	20.0	28.5	25.0	26.5	23.0	21.0	22.0	18.0	17.0	---
18	21.5	19.0	20.5	28.0	25.5	27.0	22.5	20.0	21.0	18.5	17.5	---
19	21.5	20.0	21.0	28.0	26.5	27.5	21.0	20.0	20.5	18.5	17.5	---
20	23.0	20.5	22.0	28.5	27.0	27.5	23.5	20.0	21.5	19.0	18.0	---
21	23.0	22.0	22.5	28.5	27.5	28.0	24.5	22.5	23.5	18.5	18.0	---
22	24.0	22.5	23.0	28.5	25.0	26.5	25.0	22.5	23.5	18.0	16.5	---
23	22.5	21.0	21.5	26.0	25.0	25.5	23.0	22.0	22.5	16.5	15.0	---
24	20.5	19.5	20.0	26.0	24.5	25.0	23.0	22.5	23.0	15.0	14.0	---
25	20.5	18.5	19.5	25.5	23.5	24.5	23.5	22.5	23.0	15.5	14.0	---
26	20.5	19.5	20.0	26.0	24.0	25.0	23.5	22.5	23.0	15.5	14.0	---
27	21.0	19.5	20.5	26.0	25.0	25.5	24.0	22.0	23.0	15.0	14.0	---
28	22.5	20.0	21.0	27.5	25.5	26.5	22.5	21.5	22.0	15.5	15.0	---
29	22.5	20.5	21.5	26.5	25.0	27.5	22.0	21.0	21.5	16.0	14.5	---
30	23.0	21.0	22.0	25.0	24.0	24.5	21.5	20.0	20.5	16.0	14.0	---
31	---	---	---	25.0	23.5	24.5	22.0	21.0	21.5	---	---	---
MONTH	24.0	18.5	21.0	29.0	21.5	26.0	25.0	18.0	21.0	22.5	14.0	---
YEAR	29.0	0.0	13.5									

FIGURE 3. TABLE OF DAILY MAXIMUM, MEAN, AND MINIMUM VALUES (TYPE 3)

PROCESS DATE IS 07-27-75

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY

STATION NUMBER 09180500 COLORADO RIVER NEAR CISCO, UTAH STREAM SOURCE AGENCY USGS
LATITUDE 384838 LONGITUDE 1091734 DRAINAGE AREA 24100.00 DATUM 4090.00 STATE 49 COUNTY 019

SUSPENDED-SEDIMENT DISCHARGE , WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	8700	126	2960	3440	66	613	1820	32	157
2	7690	136	2820	3250	185	1620	1920	34	176
3	6980	147	2770	3100	181	1510	2010	42	228
4	5830	146	2300	3100	177	1480	1990	29	156
5	5320	144	2070	3120	222	1870	2020	42	229
6	4730	133	1700	3000	213	1730	2060	56	311
7	5100	122	1680	2900	330	2580	2140	56	324
8	5150	111	1540	2800	300	2270	2180	55	324
9	4800	110	1430	2900	271	2120	2150	63	366
10	4000	114	1230	3100	339	2840	2180	58	341
11	3930	118	1250	3800	407	4180	2120	54	309
12	3880	84	880	3680	475	4720	2150	42	244
13	3660	80	791	3400	462	4240	2210	44	263
14	3410	77	709	3100	300	2510	2360	47	299
15	3340	99	893	2800	238	1800	2630	50	355
16	3460	127	1190	2500	175	1180	3110	83	697
17	3550	320	3070	2300	166	1030	3540	112	1070
18	4280	1900	22000	2300	157	975	3560	179	1720
19	5900	5400	86000	2250	106	644	3510	350	3320
20	6030	5700	92800	2200	81	481	3430	283	2620
21	5600	6800	03000	2160	67	391	3360	216	1960
22	5490	4500	66700	2090	58	327	3260	149	1310
23	6080	2430	39900	2280	54	332	3220	134	1160
24	6620	3130	55900	2040	50	275	3210	166	1440
25	6450	1600	27900	2020	46	251	3030	150	1230
26	5920	1800	28800	1980	42	225	2900	163	1280
27	5110	1700	23500	1970	41	218	2920	138	1090
28	4650	600	7530	1930	42	219	2850	125	962
29	4310	510	5930	1830	44	217	2870	112	868
30	4230	347	3960	1880	37	188	2890	92	718
31	3820	388	4000	1800	30	146	---	---	---
MONTH	158020	---	97200	81020	---	43180	79600	---	25530
YEAR	2275770	42310							

FIGURE 4. SUSPENDED-SEDIMENT DISCHARGE TABLE (TYPE 4)

PROCESS DATE IS 04-24-75

UNITED STATES DEPARTMENT OF INTERRIOR - GEOLOGICAL SURVEY

STATION NUMBER 12301300 TOBACCO RIVER NEAR EUREKA, MT. SOURCE AGENCY USGS
LATITUDE 485337 LONGITUDE 1150513 DRAINAGE AREA 440.00 DATUM 2519.85 STATE 30 COUNTY 053

TEMPERATURE (DEG. C) OF WATER , WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
5	6.0	3.5	9.5	7.0	8.5	6.5	10.0	9.5	19.5	16.0	17.0	13.5
10	7.0	4.5	7.5	6.5	10.0	6.5	12.5	10.5	16.0	14.0	13.5	12.5
15	9.0	4.5	7.0	6.0	9.5	6.5	15.0	13.0	16.0	12.5	14.5	11.0
20	6.5	5.0	9.5	6.5	8.5	8.0	17.0	14.0	17.0	15.5	14.0	11.0
25	9.0	7.0	8.0	7.0	11.0	8.5	18.0	13.5	18.0	15.0	14.0	10.0
EOM	7.5	6.5	9.0	6.5	12.0	9.0	19.5	16.0	17.0	14.5	10.5	8.0
MONTH	9.0	3.5	9.5	6.0	12.0	6.5	19.5	9.5	19.5	12.5	17.0	8.0
YEAR	19.5	0.0										

FIGURE 5. SKELETON TABLE (TYPE 5)

Figure 5). Any of the table types 1 through 4 may also incorporate all features of the type 5 table by requesting this option. An option is provided to scan the 72 values contained in a skeleton table and revert to the standard complete month table format when less than 80 percent of the skeleton year data is available. The monthly and yearly summary printed will be the same as requested for types 1 through 4 tables, except that the special options available for surface water tables cannot be requested.

IV.C.3.f. Page Restriction Option

When a complete year is not needed or the data are not available for a multi-page table (types 2 through 5) an option is provided to restrict all tables to one page. A begin month code (01-12) may be specified and the tables will begin with the specified month, printing one page per table consisting of either six, four, or three months of data depending upon the type of table requested.

IV.C.4. Coding the X Card

One program control card (X card) is used by program H474 to control table format selection and print and summary options. The X card (see Figure 6) is submitted to the retrieval procedure DVRETR to be subsequently passed on to program H474 and is coded as follows:

Col. 1	Always code an X
Col. 2-5	Code H474. This is the program number that identifies the program that is to be associated with this X card.
Col. 6-9	Reserved
Col. 10	The number of copies of each table to be printed. Up to nine original printouts of each table may be obtained by coding the desired number in this field. Default is one.
Col. 11-14	Reserved
Col. 15	Type of table to be printed: 1 - Type 1 table 2 - Type 2 table 3 - Type 3 table 4 - Type 4 table

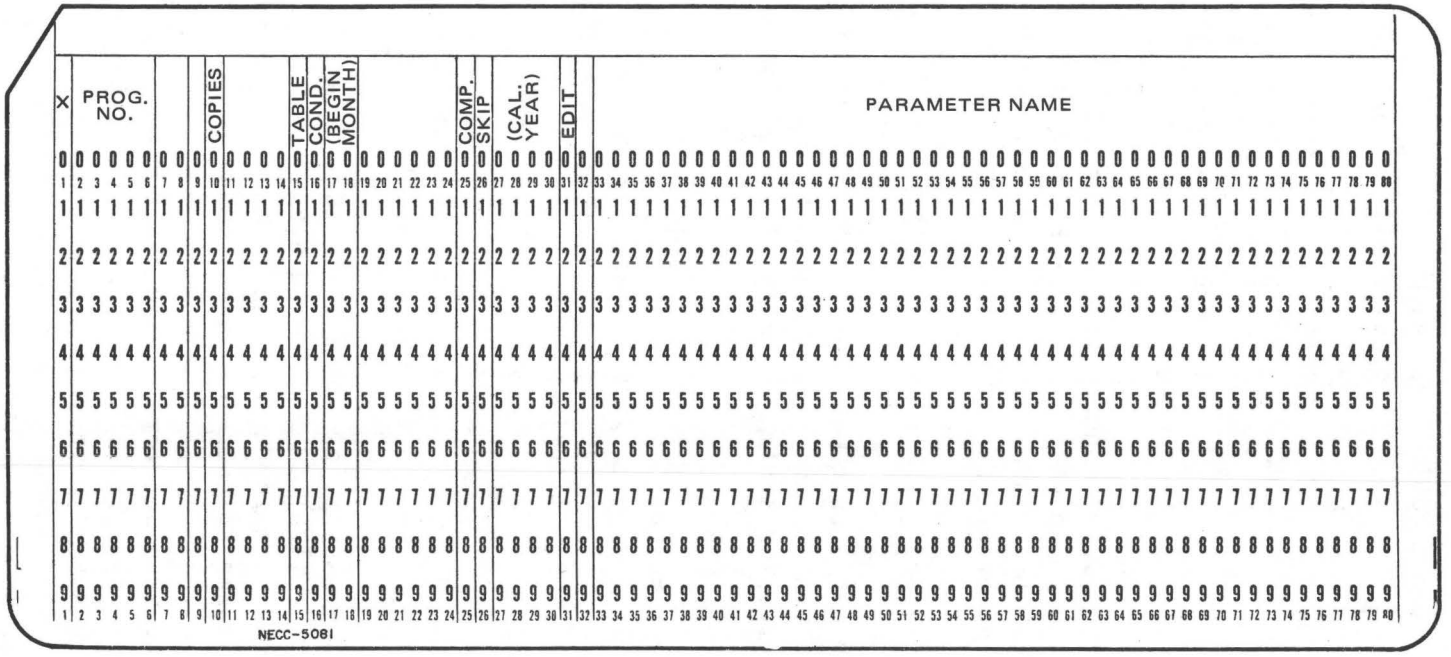

FIGURE 6. SAMPLE FORMAT OF PROGRAM OPTION CARD (X CARD)

Default is a type 1 table

Col. 16 Skeleton table (type 5):

- 1 - All tables will be printed as a skeleton table.
- 2 - Same as 1 unless there is less than 80 percent of the skeleton year available in which case the standard daily format as coded in column 15 is printed.

Col. 17-18 Begin print month. Code the month code (01-12). January is month 01. All printing will begin with this month and all table types are restricted to one page of print.

Col. 19-24 Reserved

Col. 25 Computation code. This code will determine the type of monthly and yearly summaries that will be computed for tables of daily discharge (parameter code 00060).

Code as follows:

- 0 - Total, mean, max, minimum
- 1 - Total, mean, maximum, minimum, cfsm, inches
- 2 - Total, mean, maximum, minimum, acre-feet
- 3 - Total, mean, maximum, minimum, cfsm, inches, acre-feet

Col. 26 Line skip code. Code the number of extra blank lines (1-5) desired between the monthly and yearly summaries for manual insertion of adjusted monthly figures for surface water tables.

Col. 27-30 Previous water year required for a calendar year summary. Enter in this field the water year immediately preceding the first water year to be printed when a calendar year summary is needed for a water year table of daily discharge (parameter 00060).

Col. 31 Data edit code. To suppress rounding of daily values and have printed as stored in the file, code 1 in this field. Default option is to round all parameter values according to table in Appendix D.

Col. 32 Reserved

Col. 33-80 Parameter name. A parameter name coded in this field will override the internally stored parameter name on every table printed during any one retrieval step.

IV.C.5. Cataloged (JCL) Procedure

The job control language cards needed to print tables using program H474 have been stored in a procedure library. The cataloged procedure name is DVTABLES and is executed following the Daily Values Retrieval Procedure (DVRETR). Instructions for the use of the DVRETR procedure are contained in Section IV.B. The card necessary to invoke the DVTABLES procedure is coded as follows:

```
//  EXEC  DVTABLES,TIME=nn
```

Where nn is the amount of CPU time needed to process all requested tables. Allow approximately one second for each table. When nn is not coded, CPU time will default to one minute. The complete JCL card deck for a retrieval from the current file on disk and the printing of daily tables using procedure DVRETR and DVTABLES is illustrated below:

```
Col. 1                Col. 12

•                     •
//xxxxxxxxx           JOB (-----)
/*PROCLIB             WRD.PROCLIB
//  EXEC  DVRETR
//HDR.SYSIN           DD  *
                      •
 --Input cards for program G490 including X card for program H474
                      •
/*
//  EXEC  DVTABLES
//
```

IV.C.6. Diagnostic Messages

DVT01: END OF H474 PROCESSING FOR RETRIEVAL NUMBER nn, NUMBER OF TABLES PRINTED nnn.

Explanation -- The indicated retrieval has reached a satisfactory conclusion. The indicated number of tables were printed and the program will proceed to the next retrieval if present.

DVT02: END OF H474 PROCESSING, TOTAL NUMBER OF TABLES PRINTED nnnn.

Explanation -- The program has reached a satisfactory conclusion after all retrievals have been processed.

DVT03: STATION ID nnnnnnnn YEAR nnnn PARM CODE nnnnn DID NOT MATCH AVAILABLE PARAMETER CODES.

Explanation -- The requested parameter code is not contained in the Daily Values File. The program will proceed to the next table request.

DVT04: INVALID REQUEST CODE IN X CARD (name of card field) FIELD. PROCESSING TERMINATED FOR RETRIEVAL nnn.

Explanation -- An improper code was detected in the X card (name of field) field during processing of the indicated retrieval. That retrieval will be bypassed.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION D. Daily Values Inventory Listing (Program H483)

by Neil G. Stuthmann and
Roger E. Booker

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.D. Daily Values Inventory Listing (Program H483)

IV.D.1. Introduction

Program H483 is used to produce a data inventory of selected portions of the WATSTORE Daily Values File. The selection of data to be inventoried is controlled through the execution of the Daily Values Retrieval Procedure (see Section IV.B.).

Instructions are given in this chapter which allow the user to (1) request the inventory, and (2) to order (sort) the inventory listings.

The inventory listings include for each data collection site, a summary by parameter and statistic code of the maximum, minimum, second high, and non-zero low values for each contiguous period of record. The period of record is considered contiguous if there is at least one data value per month. In addition to the inventory information, the listing for each data collection site includes the station identification number, station name, drainage area, state code, district code, county code, site code, and agency code.

IV.D.2. Preparation of the Input

The only user-defined control to the daily values summary program (H483) is the program control card (X card). This card should be placed with the input cards for the Daily Values Retrieval Program (G490).

IV.D.2.a. Program Control Card

The format of the program control cards is as follows:

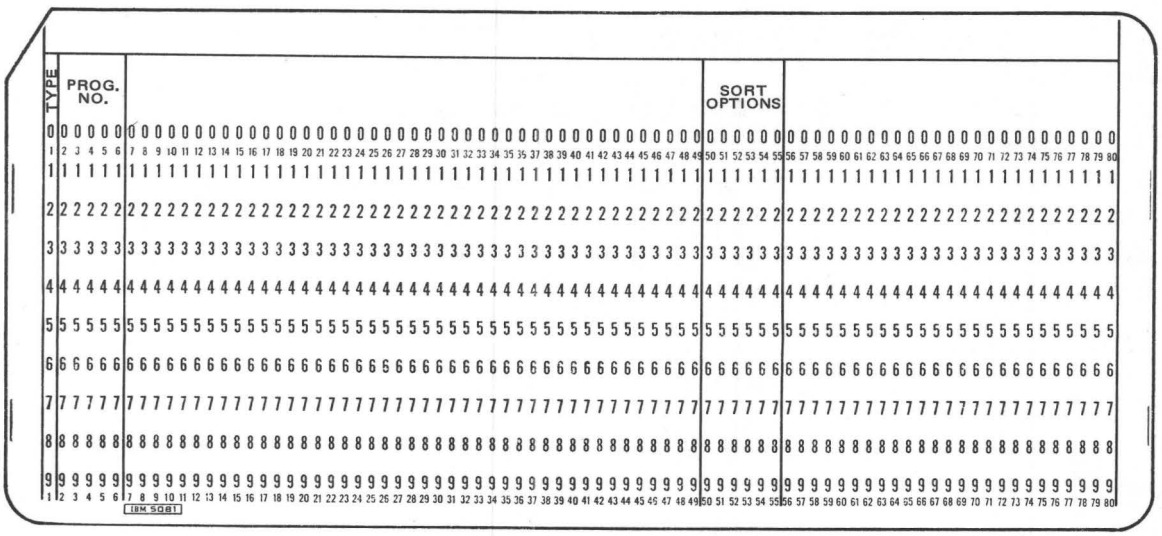

FIGURE 1. PROGRAM CONTROL CARD (X CARD)

Col. 1 The letter X

Col. 2-5 H483, the program number

Col. 6-49 Blank

Col. 50-55 Inventory list sort control options. This field consists of a set of 0 to 6 single character entries. Each character corresponds to a data item in the retrieved daily values records. The sorted order of the inventory list, with respect to these data items, will be equivalent to the order in which the user codes the corresponding characters within this field. The allowed sort keys are as follows:

A Agency code
S State code
P Station identification number
D District code
I Site code
C County codes

The characters should be left justified in the field with no embedded blanks. The left most character should correspond to the highest ranking data item. The sort control options specified here are independent of sort requests made on the M card. If this field is left blank the program will assume a sorting order of state code, agency code, and station identification number. In the case of multiple retrievals in one execution of the retrieval program, the sorting order on the first X card will apply to all retrievals.

IV.D.3. Cataloged JCL Procedure

A cataloged procedure for printing inventory listings from the Daily Values Retrieval output has been stored in a system library. The procedure includes program H483 to inventory the data, a system sort program, and program H484 to print the inventory lists. The procedure name is DVLISTA and may be executed using the following cards.

```
//xxxxxxxx      JOB  (yyy---)
/*PROCLIB       WRD.PROCLIB
//  EXEC        DVRETR
//HDR.SYSIN     DD *
```

Control cards for the retrieval of Daily Values Data Records. The X card for H483 follows the Master (M) control card.

```
/*
//  EXEC  DVLISTA
//
```

This procedure must be executed following the Daily Values retrieval procedure DVRETR. All retrieval options are specified on the input cards for the Daily Values Retrieval Procedure (see Section IV.B). An X card for program H483 must be included with the card input to procedure DVRETR.

IV.D.4. Output

The only output are the inventory listings, which inventories data for each collection site, and a list of diagnostic messages.

IV.D.4.a. Inventory List

The inventory list is an inventory of data in the Daily Values File for each collection site by parameter code and statistic code. A line is printed for each contiguous period of record showing the begin and end date of the contiguous period, maximum value, minimum value, second high value, and lowest non-zero value. A record is considered to be contiguous if there is at least one data value per month of record. The station name, drainage area, state code, district code, county code, and site code are obtained from the Station Header File and printed above the summary for each station. The agency code is also printed in the summary for each station. A sample inventory list is shown in Figure 2.

IV.D.4.b. Diagnostic Messages

DL001 PROCESSING TERMINATED DUE TO INVALID SORT OPTIONS - ERRONEOUS CARD: (program control card)

This message appears when the program cannot interpret the sort control options on the program control card. Invalid

characters, embedded blanks, or duplicate characters used as sort control options might be the cause of this error.

DL002 NO RECORDS ARE AVAILABLE TO THE INVENTORY PROGRAM. PROCESSING OF THE INVENTORY IS HALTED.

This message appears if no data is passed from the retrieval program.

STATION NUMBER	CROSS SEC LOCATION	DEPTH	PARM CODE	STAT CODE	BEGIN YEAR	BEGIN MO	END YEAR	END MO	NO. DAYS	YEARS	MAXIMUM	MINIMUM	SECOND HIGH	NONZERO LOW	
DELAWARE R AT TORRESDALE INTAKE, PHILA., PA.					AGENCY USGS		STATE 42		DISTRICT 42		COUNTY 101		SITE SW DR AREA =		7781 SQ MI
01467030			00010	00001	1973	10	1974	9	352	1	28.50	1.50	28.00	1.50	
01467030			00010	00002	1973	10	1974	9	352	1	26.50	0.50	26.50	0.50	
01467030			00010	00003	1973	10	1974	9	344	1	27.30	1.00	27.09	1.00	
01467030			00095	00001	1973	10	1974	9	351	1	591.00	138.00	523.00	138.00	
01467030			00095	00002	1973	10	1974	9	351	1	309.00	90.00	279.00	90.00	
01467030			00095	00003	1973	10	1974	9	340	1	328.00	111.00	295.00	111.00	
01467030			00300	00001	1973	10	1973	11	50	1	11.09	5.69	11.09	5.69	
01467030			00300	00001	1974	1	1974	1	5	0	14.40	12.90	14.00	12.90	
01467030			00300	00001	1974	3	1974	9	199	0	13.09	1.90	12.80	1.90	
01467030			00300	00002	1973	10	1973	11	50	1	10.30	3.00	10.19	3.00	
01467030			00300	00002	1974	1	1974	1	5	0	13.50	12.40	13.30	12.40	
01467030			00300	00002	1974	3	1974	9	199	0	11.50	0.69	11.40	0.69	
01467030			00300	00003	1973	10	1973	11	49	1	10.69	4.59	10.50	4.59	
01467030			00300	00003	1974	1	1974	1	4	0	13.80	12.80	13.69	12.80	
01467030			00300	00003	1974	3	1974	9	189	0	12.40	1.69	12.19	1.69	
01467030			00400	00001	1973	10	1974	9	342	1	7.80	6.19	7.59	6.19	
01467030			00400	00002	1973	10	1974	9	342	1	7.19	6.00	7.19	6.00	
01467030			00400	00003	1973	10	1974	9	325	1	7.50	6.09	7.30	6.09	
WOODEN BRIDGE RUN AT GRANT AVE, PHILA., PA.					AGENCY USGS		STATE 42		DISTRICT 42		COUNTY 101		SITE SW DR AREA =		1.060 SQ MI
01467049			00060	00003	1973	9	1974	11	377	3	22.00	0.17	19.00	0.17	
TACONY CR NR JENKINTOWN, PA.					AGENCY USGS		STATE 42		DISTRICT 42		COUNTY 091		SITE SW DR AREA =		5.250 SQ MI
01467083			00060	00003	1973	9	1975	2	475	3	296.00	2.30	168.00	2.30	
ROCK CR ABV CURTIS ARBORETUM NR PHILA., PA.					AGENCY USGS		STATE 42		DISTRICT 42		COUNTY 091		SITE SW DR AREA =		1.150 SQ MI
01467084			00060	00003	1973	10	1974	12	432	2	47.00	0.00	36.00	0.75	
JENKINTOWN CR AT ELKINS PARK, PA.					AGENCY USGS		STATE 42		DISTRICT 42		COUNTY 091		SITE SW DR AREA =		1.170 SQ MI
01467085			00060	00003	1973	9	1975	2	478	3	38.00	0.36	21.00	0.36	
DELAWARE R AT PHILA. (BEN FRANKLIN BRIDGE), PA.					AGENCY USGS		STATE 42		DISTRICT 42		COUNTY 101		SITE SW DR AREA =		7993 SQ MI
01467200			00010	00001	1973	10	1973	10	15	1	21.50	20.00	21.50	20.00	
01467200			00010	00001	1974	4	1974	9	125	0	27.00	14.50	27.00	14.50	
01467200			00010	00002	1973	10	1973	10	15	1	21.00	19.50	21.00	19.50	
01467200			00010	00002	1974	4	1974	9	125	0	26.50	14.00	26.50	14.00	
01467200			00010	00003	1973	10	1973	10	14	1	21.30	20.00	21.19	20.00	
01467200			00010	00003	1974	5	1974	9	104	0	26.59	17.80	26.59	17.80	
01467200			00095	00001	1973	10	1974	9	314	1	370.00	123.00	365.00	123.00	
01467200			00095	00002	1973	10	1974	9	314	1	326.00	100.00	321.00	100.00	
01467200			00095	00003	1973	10	1974	9	282	1	349.00	115.00	344.00	115.00	
01467200			00300	00001	1973	10	1974	7	227	1	13.69	0.40	13.30	0.40	
01467200			00300	00001	1974	9	1974	9	26	0	5.69	0.50	5.30	0.50	
01467200			00300	00002	1973	10	1974	7	227	1	13.09	0.00	11.69	0.09	
01467200			00300	00002	1974	9	1974	9	26	0	2.69	0.00	2.30	0.09	
01467200			00300	00003	1973	10	1974	7	201	1	13.50	0.30	12.19	0.30	
01467200			00300	00003	1974	9	1974	9	21	0	4.09	0.09	3.50	0.09	
01467200			00400	00001	1973	10	1974	9	257	1	7.69	6.00	7.59	6.00	
01467200			00400	00002	1973	10	1974	9	257	1	7.50	5.90	7.40	5.90	
01467200			00400	00003	1973	10	1974	9	226	1	7.59	6.00	7.50	6.00	

END OF PROCESSING

FIGURE 2. SAMPLE INVENTORY LISTING

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION E. Daily Values Plots (Program A967)

by Terry A. Wilson

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.E. Daily Values Plots (Program A967)

IV.E.1. Introduction

This section contains instructions for producing plots from data stored in the WATSTORE Daily Values file. Daily Values Plot program (A967) is used to produce constituent versus time (days) plots on the Calcomp 763 drum plotter. Daily Values data are plotted on pre-printed graph paper of either a semi-logarithmic or rectangular form with each plot frame measuring 24.35 inches (time axis) by 15 inches (constituent axis). Each plot represents one water year (October through September) of data. Calendar year plots are not available. The maximum number of points allowed in each plot line is 365. Because the plots are drawn on pre-printed graph paper, February 29 cannot be plotted. Program A967 was written in PL/I for the IBM 360 or 370 computer series by Terry A. Wilson, USGS, Reston, Virginia.

IV.E.2. Data Retrieval

The Daily Values Retrieval Procedure (DVRETR) must always be invoked prior to the execution of program A967. The retrieval procedure will control all record selection from the Daily Values file and will pass the selected records to program A967 for plotting in a subsequent job step. Instructions for the use of retrieval procedure DVRETR are given in Section IV.B. Control codes to specify the type of plots that are to be produced must be coded on an application control card (X card) and submitted with the retrieval control cards. The X card is to be placed immediately following the Master Control Card. The X card format is explained in detail in Section IV.E.4. Cataloged procedures containing the necessary job control cards to execute the Daily Values Retrieval procedure and program A967 have been stored in a procedure library and instructions for their operation may be found in Section IV.E.5. A general description of cataloged procedures may be found in Section II.A.1.

IV.E.3. Description of Plots

Plotting is performed on pre-printed graph paper of either a five cycle semi-logarithmic form or a rectangular form. The X-axis of the plot has a range of 365 days. The rectangular plot form is divided into 15 one-inch squares along the Y-axis while the semi-logarithmic form consists of 5 three-inch logarithmic cycles. Up to

five parameters may be plotted on the same plot frame. When a plot request involves more than one parameter, the plot program will automatically switch to a different plot symbol for each constituent that is plotted on the frame.

Descriptive information will be obtained from the appropriate WATSTORE information files and placed on the plot borders. A parameter name, the current date, the plot frame sequence number, and an optional user plot identification name will be placed on the left border of the plot. The station name, station identification number, and the water year date will appear on the top margin. The rectangular plot will place a computed scale of the data value range along the Y-axis. The starting value for a logarithmic plot will appear at the lower left corner of the frame. Figure 1 is a sample logarithmic plot, Figure 2 is a rectangular plot, and Figure 3 is a multiple-record plot.

IV.E.4. Preparation of Input

IV.E.4.a. Plot Options

Seven plot options are available to determine the type of plots that will be produced and are requested by coding the proper codes on an application control card (X card) as specified in Section IV.E.4.b. Only one X card for program A967 may be submitted for each retrieval. The options selected through the use of an X card apply to all plots generated from a given retrieval. In order to vary the options specified on the X card, additional retrievals must be executed. The following options apply to program A967:

(1) Plots may be requested for either semi-logarithmic or rectangular graph paper. For a rectangular plot, a request may be made to have the Y-axis scale reversed and move the plot origin to the upper left corner of the plot frame so that all plotting is processed in a top to bottom direction.

(2) Three different types of plot lines may be requested.

   (a) Lines will be drawn between existing consecutive data points only. Lines will not be drawn where data points do not exist. This is the standard line that will be used unless another option is specified on the X card.

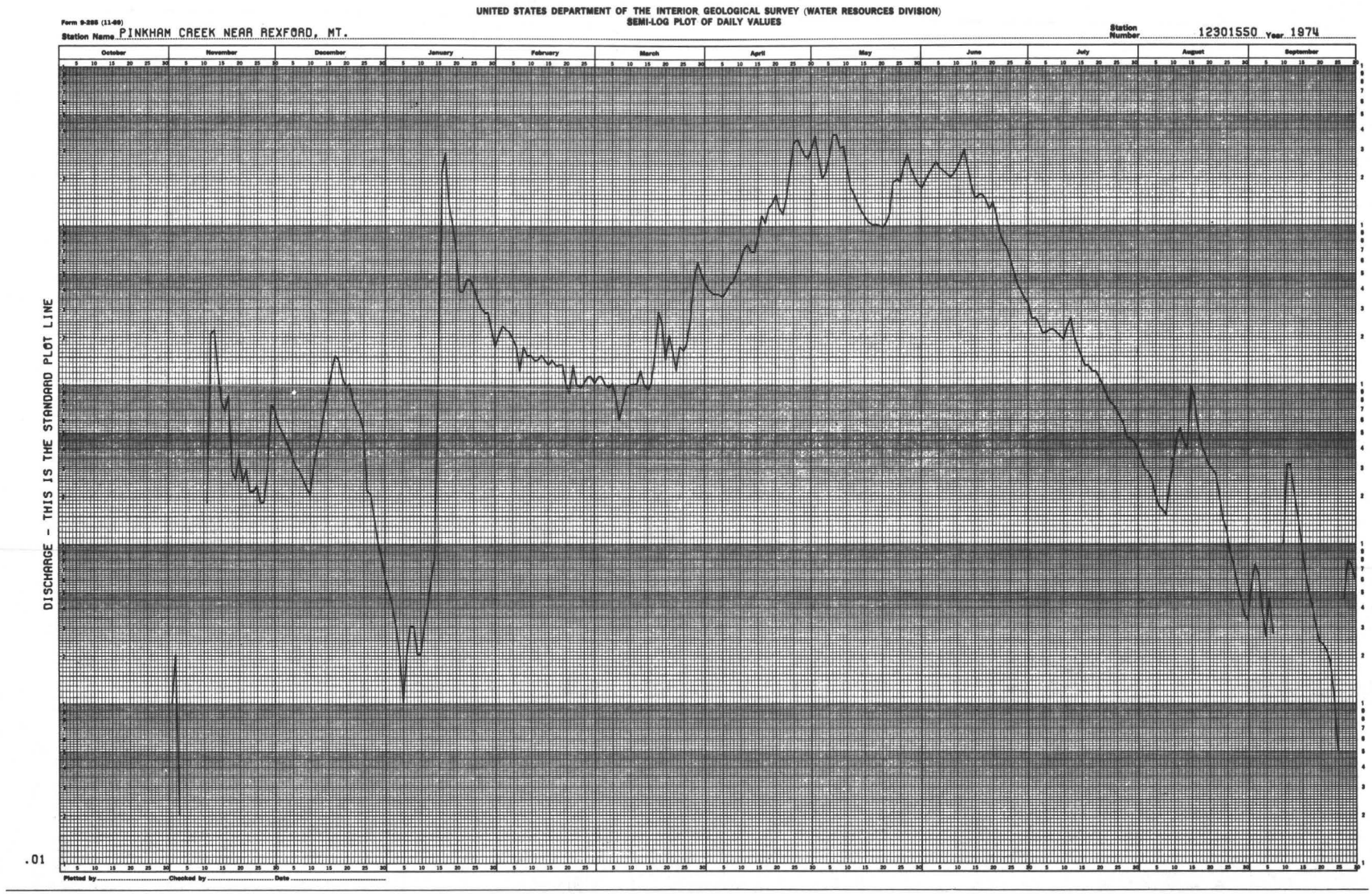


FIGURE 1. SAMPLE SEMI-LOGARITHMIC PLOT

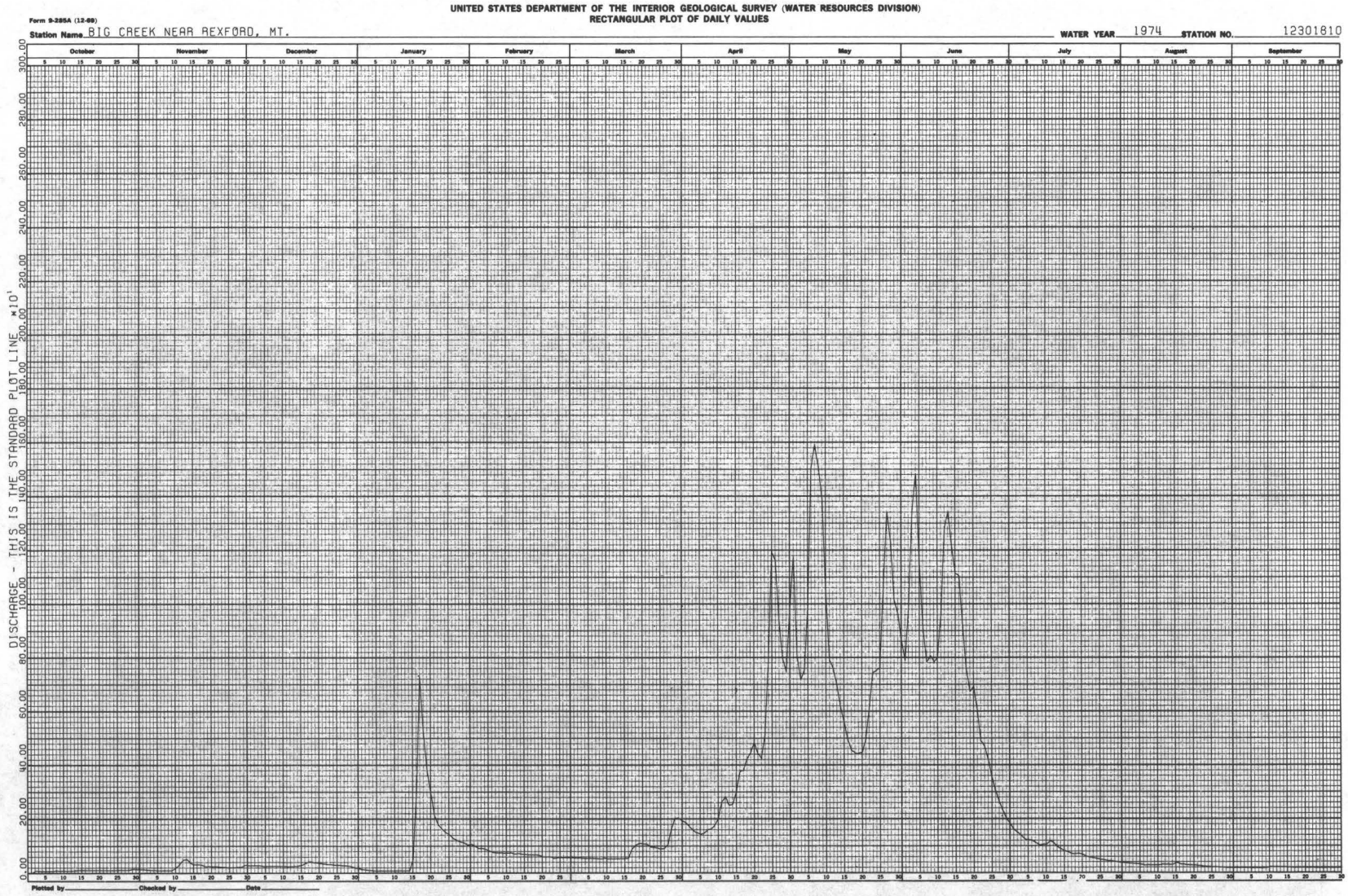


FIGURE 2. SAMPLE RECTANGULAR PLOT

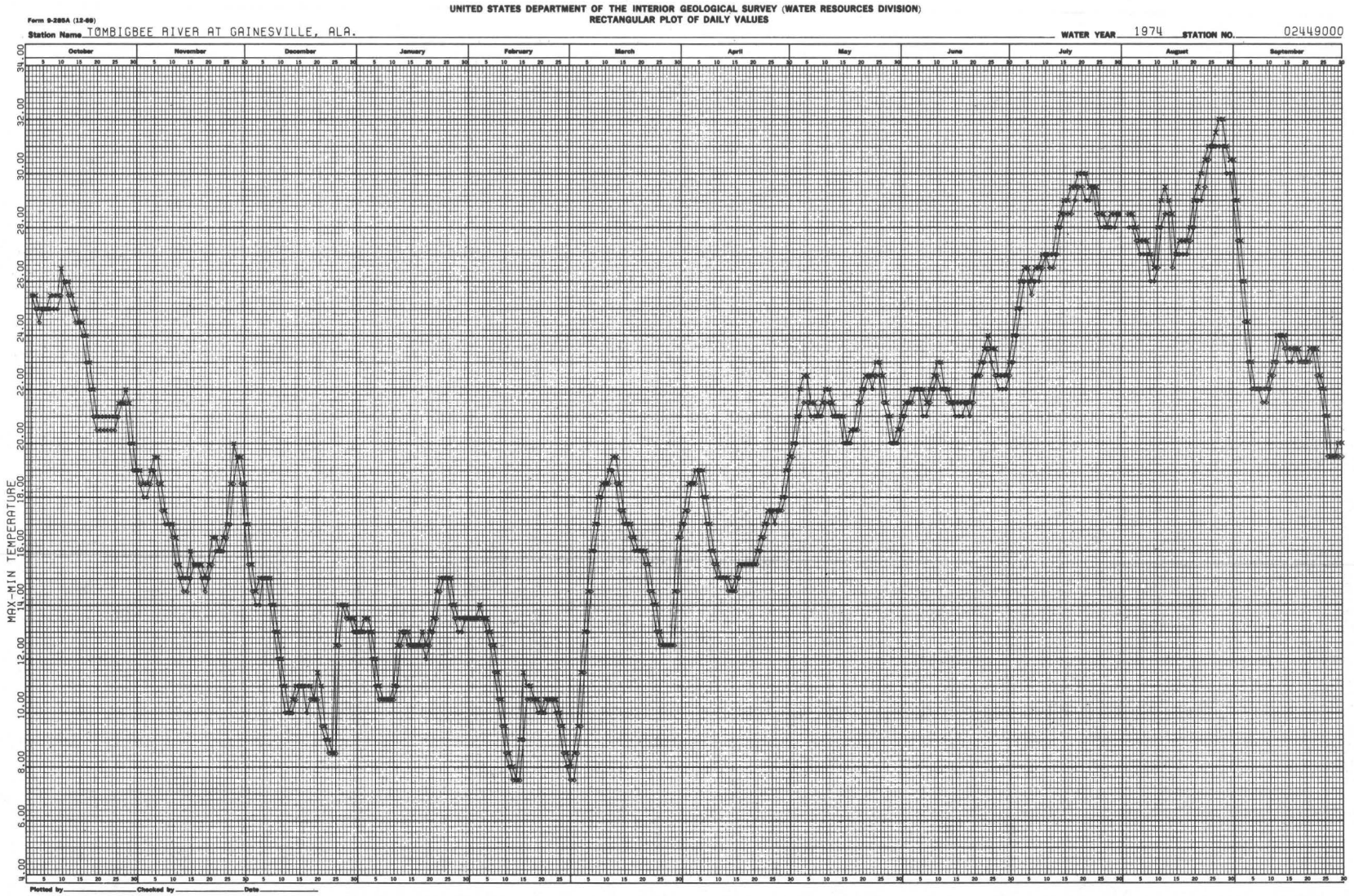


FIGURE 3. SAMPLE MULTI-RECORD PLOT

(b) A continuous line will be drawn for the entire plot range with a straight line interpolation between all existing data points.

(c) Symbols will be placed at existing data points. No connecting lines will be drawn. A symbol code must be specified in the appropriate field.

Symbols will be plotted for all three of the plot lines when a symbol code is specified in the appropriate field.

(3) A parameter name may be coded on the X card to override the internally stored parameter name. This name will be taken from the X card and placed on each plot. When this option is not specified on the X card, the parameter name is taken from the WATSTORE parameter name file.

(4) A range of data values may be specified by coding a bottom (minimum) and top (maximum) data value limitation on the X card. A top limitation value is ignored by the logarithmic plot procedure becuase a five cycle range will always be used. When a data range is specified on the X card, it will apply to every record within the retrieval group. When a data range is not specified on the X card, the top and bottom values to be used will be computed from the maxium and minimum values contained in each data record.

(5) A symbol code (see Section IV.E.4.b.) may be specified on the X card and the associated plot symbol will be used for each plot. When this option is not coded, the program will not print a symbol and lines only will be drawn as requested in item (2) above.

(6) A twelve character user ID field may be coded on the X card to specify any special plot identification that the user may require. This information will be placed on the left margin of each plot in the retrieval group. The office name or location is usually coded in this field.

(7) Up to five data records may be plotted on the same plot frame. All descriptive information to be placed on the plot page, will be taken from the first record to be plotted on the frame unless the X card option to enter a parameter name (item 3)

has been coded. In this case, the X card field will have priority over any information contained in the data record. Unless a user supplied data range is submitted, a plot data range will be computed from the first data record and this range will be used for every record contained in the plot frame group. The user should either code a data range on the X card that is large enough to contain the data range of every record in the retrieval or take steps to insure that the first record encountered in each plot frame group will compute a data range large enough to accommodate all records. If any data value exceeds a designated plot range, a warning message will be printed indicating the nature of the problem, the data value will be reset to the value of the range limitation, and plotting will continue. When a symbol is requested for a multi-record plot frame, the designated symbol code will be incremented by 1 after each record is plotted. When a multi-record plot is requested, each plot frame will always contain the same number of records. Unless a multi-parameter name is specified on the X card, one parameter name, taken from the first data record encountered in the plot frame group, will be drawn on the frame. In order to verify that the requested parameters were plotted on the proper plot frames, diagnostic message DVPLT01 (see Section IV.E.6.b.) may be referenced on the associated computer printout.

IV.E.4.b. Coding the X Card

One A967 X card is permitted for each Daily Values retrieval. The X card is submitted following the Master Control card (M card). The plotting options that have been coded in the X card and the retrieved data records will be passed to program A967 by the Retrieval Procedure for subsequent processing. The X card format is shown in Figure 4 and is coded as follows:

Option Code	Field Description
Col. 1	Always code an X.
Col. 2-5	Always code A967.
Col. 6	Reserved.

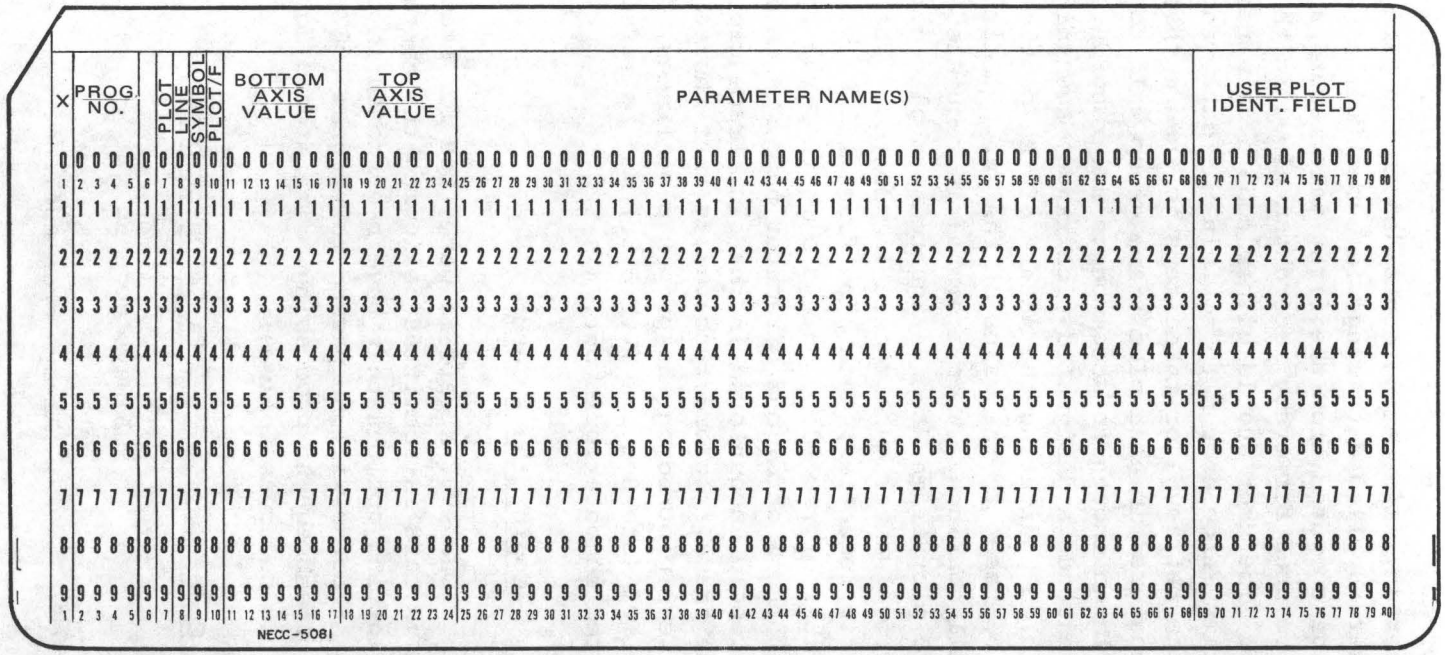
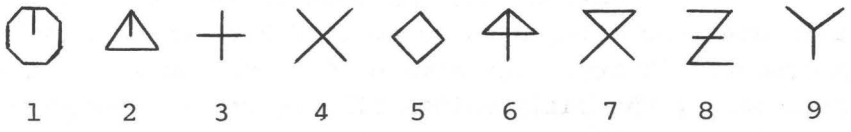


FIGURE 4. SAMPLE X CARD FOR PROGRAM A967

Col. 7		Type of Plot.
	1	A semi-logarithmic plot will be produced.
	2	A rectangular plot will be produced.
	3	A rectangular plot with reversed scale and plot lines drawn in a downward direction.
Col. 8		Type of plot line to be drawn.
	Blank	When this field is not coded, the standard plot line will be drawn between consecutive data points only. Lines will not be drawn where consecutive data points do not exist.
	1	A continuous line over the entire plot range with straight line interpolation between existing data points.
	2	No connecting lines between data points. Symbols only will be plotted if specified in Column 9.
Col. 9		Type of symbol to be plotted. Code one of the following numbers to have the corresponding symbol printed at each data point. If this field is not coded, no symbol will be printed.



Where VOL1 is the volume serial number of the magnetic tape that will receive the plot output. A symbolic parameter TIME may be coded to assign a larger value for execution time (minutes) than the default value (1 minute). Estimate about two seconds for each plot. The TIME parameter is coded as follows:

```
//  EXEC  DVPLOT,VOL1=nnnnnn,TIME=n
```

The complete job setup illustrating the execution of DVPLOT following procedure DVRETR is shown below:

```
Col. 1                Col. 12

•                     •
//xxxxxxxx            JOB (-----)
/*PROCLIB             WRD.PROCLIB
//  EXEC  DVRETR,AGENCY=agency
//HDR.SYSIN           DD  *
                      •
 --Retrieval cards for program G490 including X card for A967
                      •
/*
//  EXEC  DVPLOT,VOL1=nnnnnn
//
```

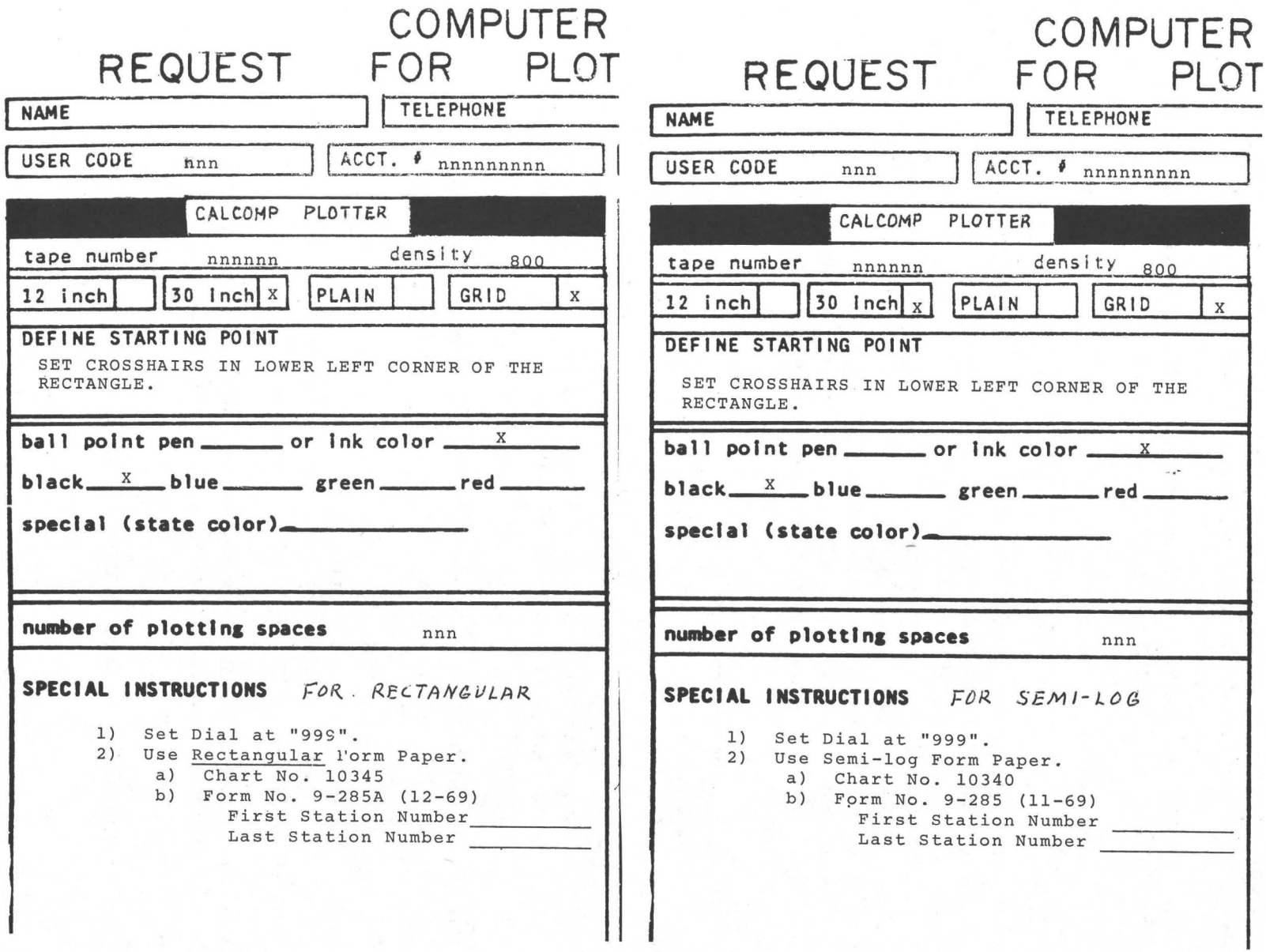
IV.E.6. Output

IV.E.6.a. Request for Plotting

After satisfactory termination of A967 processing, a plot request form must be submitted to have the output plot tape mounted on the Calcomp tape reader where the actual plotting is done. This may be accomplished by telephoning the Computer Center Division at the USGS National Center, Reston, Virginia (telephone 703-860-7171) and providing the necessary request form information to the Production Control Unit. The finished plots will be mailed to the address specified by the requester. A sample request form is shown in Figure 6.

IV.E.6.b. Diagnostic Messages

Numerous diagnostic messages may be printed on the line printer during A967 processing. Some are routine explanatory



COMPUTER REQUEST FOR PLOT

NAME | TELEPHONE

USER CODE nnn | ACCT. # nnnnnnnnn

CALCOMP PLOTTER

tape number nnnnnn density 800

12 inch [ ] | 30 inch [x] | PLAIN [ ] | GRID [x]

DEFINE STARTING POINT

SET CROSSHAIRS IN LOWER LEFT CORNER OF THE RECTANGLE.

ball point pen _____ or ink color ___x___

black ___x___ blue _____ green _____ red _____

special (state color) _____

number of plotting spaces nnn

SPECIAL INSTRUCTIONS FOR RECTANGULAR

1) Set Dial at "999".
2) Use Rectangular Form Paper.
   a) Chart No. 10345
   b) Form No. 9-285A (12-69)
      First Station Number _____
      Last Station Number _____

COMPUTER REQUEST FOR PLOT

NAME | TELEPHONE

USER CODE nnn | ACCT. # nnnnnnnnn

CALCOMP PLOTTER

tape number nnnnnn density 800

12 inch [ ] | 30 inch [x] | PLAIN [ ] | GRID [x]

DEFINE STARTING POINT

SET CROSSHAIRS IN LOWER LEFT CORNER OF THE RECTANGLE.

ball point pen _____ or ink color ___x___

black ___x___ blue _____ green _____ red _____

special (state color) _____

number of plotting spaces nnn

SPECIAL INSTRUCTIONS FOR SEMI-LOG

1) Set Dial at "999".
2) Use Semi-log Form Paper.
   a) Chart No. 10340
   b) Form No. 9-285 (11-69)
      First Station Number _____
      Last Station Number _____

FIGURE 6. REQUEST FORM FOR PLOTTING

messages, some are warnings that certain plots may have a data exception, and others are error messages indicating that certain records were not plotted and a possible abnormal program termination may occur. The following is a list of diagnostic messages that may appear:

DVPLT01: STATION xxxxxxxx, PARM CODE = xxxxx, YEAR = xxxx, PLOTTED FOR LOG/LINEAR VERSION ON PLOT FRAME NUMBER xxx.

Explanation -- The indicated data record was successfully plotted on the indicated plot frame.

DVPLT02: END OF A967 PROCESSING FOR STEP # xxx. nnn RECORDS WERE PLOTTED ON xxx FRAMES.

Explanation -- A retrieval data group with the indicated sequence number has been processed. nnn records were successfully plotted on the indicated number of plot frames. The program will now search for a retrieval data group with a different sequence number that has been marked for plot program A967.

DVPLT03: END OF A967 PROCESSING.
TOTAL NUMBER OF RECORDS PLOTTED = xxx - TOTAL NUMBER OF PLOTS FRAMES = xxx.

Explanation -- All retrieval data groups marked for A967 processing have been processed. The indicated totals are for all records and plot frames in all data groups. The program will now terminate normally.

DVPLT04: A LOGARITHMIC DATA VALUE WAS NOT WITHIN THE SPECIFIED RANGE LIMINATION ON PLOT FRAME NUMBER xxx, STATION xxxxxxxx PARM CODE xxxxx YEAR xxxx.

Explanation -- A logarithmic data point fell outside the specified plot limitations. The data point will be set to a null point and plotting will continue.

DVPLT05: A LINEAR DATA VALUE WAS NOT WITHIN THE SPECIFIED RANGE LIMITATION ON PLOT FRAME NUMBER xxx, STATION xxxxxxx PARM CODE xxxxx YEAR xxxx.

Explanation -- Same as DVPLT04 during rectangular plotting.

DVPLT06: A LINEAR DATA VALUE WAS NOT WITHIN THE RANGE LIMITATIONS SPECIFIED ON THE X CARD ON PLOT FRAME NUMBER xxx, STATION xxxxxxx PARM CODE xxxxx YEAR xxxx.

Explanation -- The data point in question will be set to a null value.

DVPLT07: A CODING ERROR WAS DETECTED IN THE X CARD (name of field) FIELD, RETRIEVAL STEP xxx NOT PROCESSED.

Explanation -- An invalid code was encountered in the named X-card field and no processing will be performed on data associated with the indicated retrieval sequence number. The program will search for the next sequence number

DVPLT08: AN INVALID LOG/LINEAR PLOT REQUEST WAS ENCOUNTERED DURING LOGARITHMIC/LINEAR PLOTTING, NO RECORDS ASSOCIATED WITH RETRIEVAL SEQUENCE NUMBER xxx WILL BE PLOTTED.

Explanation -- It is an invalid operation to request both a logarithmic and a rectangular plot during any one job. No retrieved data associated with the X card in question will be processed. The program will search for the next request.

DVPLT09: NO VALID DATA POINTS WERE FOUND IN STATION xxxxxxxx PARM CODE xxxxx YEAR xxxx. RECORD NOT PLOTTED.

Explanation -- All values in the data record were null values and the indicated record was not plotted.

DVPLT10: A967 PROCESSING IS BEING TERMINATED AT THIS POINT, UNABLE TO OBTAIN NEXT RECORD

Explanation -- An input error occurred while program A967 was attempting to read in another record from the retrieved data set. Probable system error.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION F. Daily Values Monthly and Annual Statistics (Program W4422)

by William E. Price, Jr.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.F. Daily Values Monthly and Annual Statistics (Program W4422)

IV.F.1. Introduction

Program W4422 computes eight groups of monthly and annual statistics based on data retrieved from the Daily Values magnetic tape backfile and/or current disk file. The statistics are computed for specified water years, and may be put out on a printer, magnetic tape or disk, or punched cards.

The eight groups of statistics are: (1) a summary of zero-value and no-value time units, (2) monthly mean values for each water year retrieved, (3) the median, and the first and third quartiles of the monthly mean values, (4) the mean, variance, standard deviation, skewness, coefficient of variation, and percentage of average value of the monthly mean values, (5) the correlation between the mean value of a given month and every other month, (6) the serial correlation for a 1-year lag of each month, (7) the annual mean value for each year retrieved, and (8) the mean, variance, standard deviation, skewness, coefficient of variation, and serial correlation of the annual mean values. The statistics in groups 2-8 may be computed on the basis of all the days of record including zero values, or only on non-zero values. The statistics also may be computed on the data as retrieved (untransformed), or a $\log_{10}$ transform of the data.

Statistics are computed for periods comprised of complete water years. A minimum of five years and up to a maximum of 100 years of record may be processed.

Program W4422, originally written in Fortran IV by Ray Hughes, was revised and rewritten in PL/1 by W.E. Price, Jr., USGS, Reston, Virginia. Included in the program is a procedure to compute quartiles of monthly and annual means, written by Wanda Meeks, USGS, Reston, Virginia.

IV.F.2. Program Options

Four program options are available in W4422.

- Selection of any or all of eight statistical options. See Section IV.F.2.a. for a detailed discussion.

- Selection of computational options that will cause the program to compute sets of statistics based on:

  - All daily values
  - Only non-zero daily values
  - Untransformed daily values
  - Log_{10} transformed daily values

  See Section IV.F.2.b. for a detailed discussion.

- Selection of the output media for the computed statistics. See Section IV.F.3.b. for the selection procedure and Section IV.F.4.b. for the output formats.

- Selection of the maximum number of no-value days permitted within a month prior to the exclusion of that month from the statistical computations. See Section IV.F.2.c. for a detailed discussion.

The first three program options are summarized in Tables 1 and 2. An application control card (see Section IV.F.3.b.) is used for specifying these options, which are described in the following paragraphs.

IV.F.2.a. Statistical and Output Options

Each of the eight statistical options is described below. Examples of printed output, and formats for data written on magnetic devices and punched on cards are given in Section IV.F.4.

The default condition is to provide no output for statistical options that have not been requested. Details on requesting these options are given in Section IV.F.3.b.

IV.F.2.a.(1) Statistical Option 1 - Summary of Zero-Value and No-Value Time Units

The first option is a summary of zero-value and no-value time units expressed as a percent of days, months, or years. A zero-value time unit is a day, month, or year during which the variable was measured and found to be zero. A no-value time unit is one in which the value of the variable is not known. An example of printed

TABLE 1. SUMMARY OF STATISTICAL AND OUTPUT OPTIONS IN PROGRAM W4422

Output Options		Statistical Options
Option 1 - printer		
Option 2 - magnetic device		
Option 3 - cards		
X		Option 1 - Zero-value summary
X X		Option 2 - Monthly mean values
X		Option 3 - Quartiles, monthly mean values
X X		Option 4 - Statistics on month values
X		Option 5 - Serial correlation, k-month lag
X		Option 6 - Serial correlation, 12-month lag
X X		Option 7 - Annual mean values
X X		Option 8 - Statistics on annual values

Computational options	Type of data on which statistics computed: All daily values	Only non-zero daily values	Untransformed daily values	Log-transformed daily values
Options 1 and 2	X	X	X	X
Option 1	X	X	X	
Option 2	X		X	
Neither option (default)	X		X	

TABLE 2. SUMMARY OF COMPUTATION OPTIONS AND TYPES OF OUTPUT IN PROGRAM W4422

output for this option is shown in Figure 3 in Section IV.F.4. No provision is made for putting out this summary data on a magnetic device or cards.

IV.F.2.a.(2) Statistical Option 2 - Monthly Mean Values

The second option is an output of monthly mean values for each year of record retrieved. An example of printed output for this option is shown in Figure 4 in Section IV.F.4. Output from Option 2 may be written on a magnetic device in the format described in Table 3 or punched on cards in the formats described in Table 4 and Figures 11 and 12 in Section IV.F.4.b.

IV.F.2.a.(3) Statistical Option 3 - Median and First and Third Quartiles of Ranked Monthly and Annual Means

The third option is the ranking of monthly and annual means by order of magnitude and determination of the median and first and third quartiles of these values. In the set of ranked monthly or annual means the first quartile is that value such that 25 percent of the values are less than that value and 75 percent of the values are greater. The median is the middle value in a ranked data set. The third quartile is the value such that 75 percent of the values are smaller and 25 percent are larger. The first and third quartiles and median divide the ranked data set into four equal parts. The position of the quartiles and the median are computed as follows:

$$Q_1 = \frac{N + 1}{4} \qquad Q_2 = \frac{2(N + 1)}{4} \qquad Q_3 = \frac{3(N + 1)}{4}$$

where N is the number of items in the data set. The monthly means are printed in ranked order along with the year number which designates chronological order. Quartiles and median are printed for each of these sets of months for a period of years. The ranked annual means with the year number are followed by quartiles and median for the period of years. An example of printed output for this option is shown in Figure 5 in Section IV.F.4.a.

IV.F.2.a.(4) Statistical Option 4 - Statistics of Monthly Mean Values

The fourth option is an output of statistics computed from monthly mean values. The statistics are:

Mean:

$$\bar{x} = \frac{1}{N} \sum_{i=1}^{N} x_i$$

Variance:

$$s^2 = \frac{\left(\sum_{i=1}^{N} x_i^2 - \frac{1}{N} \left(\sum_{i=1}^{N} x_i \right)^2 \right)}{N-1}$$

Standard deviation: $s = \sqrt{s^2}$

Coefficient of skewness:

$$g = \frac{N^2 \sum_{i=1}^{N} x_i^3 - 3N \sum_{i=1}^{N} x_i \sum_{i=1}^{N} x^2 + 2\left(\sum_{i=1}^{N} x_i\right)^3}{N(N-1)\quad(N-2)s^3}$$

Coefficient of variation: $C_v = \frac{s}{\bar{X}}$

Percentage of average value: $PA_k = \frac{\bar{x}_k}{\sum_{k=1}^{12} \bar{x}_k} (100)$

where N = number of years,
i = year index,
k = month index,
x_i and y_i = monthly means

An example of printed output for this option is shown in Figure 6 in Section IV.F.4.a. When the data are written on a magnetic device or punched on cards, only the values for the mean, standard deviation, and skewness are reproduced, as shown in Tables 6, 7, and 8 and Figures 11 and 12 in Section IV.F.4.b.

■ IV.F.2.a.(5) Statistical Option 5 - Correlation Matrix

The fifth option is a printout of the upper half of a symmetric correlation coefficient matrix. The correlation coefficient is a measure of the strength of the linear relationship between two variables--in this case the mean values of data from two months, x_i, y_i, for the period of record retrieved. The correlation coefficient is computed by the product-moment formula and is as follows:

$$r = \frac{N\sum_{i=1}^{N} x_i y_i - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i}{\sqrt{\left\{N\sum_{i=1}^{N} x_i^2 - \left(\sum_{i=1}^{N} x_i\right)^2\right\}\left\{N\sum_{i=1}^{N} y_i^2 - \left(\sum_{i=1}^{N} y_i\right)^2\right\}}}$$

An example of printed output for this option is shown in Figure 7 in Section IV.F.4.a. No provision is made for putting out the values in the correlation matrix on a magnetic device or punched cards.

■ IV.F.2.a.(6) Statistical Option 6 - Serial Correlation For 1-Year Lag

The sixth option is a printout of the 1-1-year lag serial correlation for each month. The serial correlation coefficient is analagous to the correlation coefficient computed by the product-moment formula except that the same series is divided into two sets of data, x_i and x_{i+k}, one lagging behind the other by k time units. In the case of a one-year lag, the serial correlation coeffient is computed from the following formula:

$$r_1 = \frac{(N-1)\sum_{i=1}^{N-1} x_i x_{i+1} - \sum_{i=1}^{N-1} x_i \sum_{i=1}^{N-1} x_{i+1}}{\sqrt{\left\{(N-1)\sum_{i=1}^{N-1} x_i^2 - \left(\sum_{i=1}^{N-1} x_i\right)^2\right\}\left\{(N-1)\sum_{i=1}^{N-1} x_{i+1}^2 - \left(\sum_{i=1}^{N-1} x_{i+1}\right)^2\right\}}}$$

An example of printed output for this option is shown in Figure 8 in Section IV.F.4.a. No provision is made for putting out the serial correlation coefficients on a magnetic device or punched cards.

IV.F.2.a.(7) Option 7 - Annual Mean Values

The seventh option gives a printout of annual mean values for the years of record retrieved. An example of printed output for this option is shown in Figure 9 in Section IV.F.4.a. Output from Option 7 may be written on a magnetic device in the format described in Table 9, or punched on cards in the formats described in Tables 10 and 11 and Figures 11 and 12 in Section IV.F.4.b.

IV.F.2.a.(8) Option 8 - Statistics of Annual Mean Values

The eighth option gives a printout of statistics computed on annual mean values. The statistics are the mean, variance, standard deviation, skewness, coefficient of variation, and coefficient of serial correlation. An example of printout for this option is shown in Figure 10 in Section IV.F.4.a. When the data are written on a magnetic device or punched on cards, only values for the mean, standard deviation, and skewness are recorded, as shown in Tables 12 and 13 and Figure 11.

The relation between the statistical and output options is summarized in Table 1.

IV.F.2.b. Computational Options

The two computational options determine whether or not computation of the statistics described in Section IV.F.2.a. are to be based on (1) all the days of record retrieved or only on the days on which the data have a non-zero value, (2) the daily values as they are stored in the file, or on daily values which have been transformed to $\log_{10}$. If computational option 1 is selected, two sets of statistics are computed and placed into an output file. Each set will include the selected statistical options (Section IV.F.2.a.). In the first set, labeled "all days" on the printout, the monthly mean values are computed by dividing the sum of daily values for the month by the number of days (excluding no-value days) in the month, or, in the case of a year, by dividing the sum of daily values by the number of days (excluding no-value days) in the year. In the second set, labeled "only non-zero days" on the printout, the mean value for a month is determined by dividing the sum of daily values for the month by the number of non-zero value days, or, in the case of a year, by dividing the sum of values for the year by the number of non-zero value days. If the first computational option is not specified, only the first set of statistics ("all days") will be computed.

Computational option 2 determines whether or not a $\log_{10}$ transform of the data is to be made. If option 2 is selected, two sets of statistics will again be computed and put out for each statistical option. The first set will be based on the raw data and will be labeled as "normal" on the printout. The second set will be based on a $\log_{10}$ transform of the data, and will be labeled as "log" on the printout. If computational option 2 is not selected, computations will be put out only for the untransformed data (normal data).

If both computational options 1 and 2 are selected, four sets of statistics will be produced. Table 2 summarizes the relation between the computational options selected and the type of data on which the statistics are computed.

IV.F.2.c. No-Value Option

The fourth option allows the user to select the maximum number of no-value days that are permitted within a month prior to the exclusion of that month from the statistical computations. If no number is given, the option will default to one day per month. If the maximum number of no-value days is exceeded, the monthly mean will not be computed, and the year in which that month occurs will not be included in the annual computations. (See Diagnostic Message DF006).

IV.F.3. Preparation of Input

In order to use program W4422, data must first be retrieved from the Daily Values File. Both the retrieval of data (see Section IV.B.) and processing of retrieved data by W4422 are accomplished by using cataloged procedures (DVRETR and DVMASTAT) stored in the WATSTORE JCL procedure library (WRD.PROCLIB).

IV.F.3.a. Retrieval of Data from Daily Values File

Information on coding the retrieval control cards are given in Section IV.B. (Instructions for the Retrieval of Data from the Daily Values File). The data retrieved for use by program W4422 must be in the water year format (Oct. through Sept.). If the beginning month is not coded as 10, or the beginning day not 01, a diagnostic message will be issued and execution of the program halted (see section under Messages). Program W4422 will only process data for periods comprised of complete water years, and the length of record retrieved must be at least five years but not greater than 100. If data for fewer

years than five are retrieved, a diagnostic message will be issued and execution of the program halted (see section under Messages). Each retrieval must be limited to one parameter code (Appendix D) and one statistic code (Appendix E) for one site. If multiple sites and/or multiple codes for one site are to be processed, multiple retrievals may be made for each execution of the DVRETR and DVMASTAT JCL procedure (Section IV.F.3.).

IV.F.3.b. Application Control Card

Instructions are given for coding the Application Control Card (X card). The format of this card is shown in Figure 1. Only one X card can be submitted per retrieval. At least one option must be selected from Columns 25-32. If no option is selected from these columns, a diagnostic message will be issued and execution of the program halted. Only one magnetic device (disk or tape) may be selected for output.

Col. 1	X
Col. 2-6	W4422
Col. 7-12	Blank
Col. 13-17	Parameter code
Col. 18-22	Statistic code
Col. 23-24	Blank
Col. 25	Statistical Option 1 (on printer) -- Zero-value, no-value summary. Code a 1 if this option desired.
Col. 26	Statistical Option 2 (on printer) -- Monthly mean values. Code a 1 if this option desired.
Col. 27	Statistical Option 3 (on printer) -- Quartiles of monthly mean values. Code a 1 if this option desired.
Col. 28	Statistical Option 4 (on printer) -- Statistics on monthly mean values. Code a 1 is this option desired.

FIGURE 1. APPLICATION CONTROL CARD FOR PROGRAM W4422

Col. 29 Statistical Option 5 (on printer) -- Correlation of monthly values. Code a 1 if this option desired.

Col. 30 Statistical Option 6 (on printer) -- Serial correlation of monthly values with a 1-year lag. Code a 1 if this option desired.

Col. 31 Statistical Option 7 (on printer) -- Annual mean values. Code a 1 if this option desired.

Col. 32 Statistical Option 8 (on printer) -- Statistics on annual mean values. Code a 1 if this option desired.

Col. 33 Statistical Option 2 (on magnetic device) -- Monthly mean values. Code a 1 if this option desired.

Col. 34 Statistical Option 3 (on magnetic device) -- Statistics on monthly mean values. Code a 1 if this option desired.

Col. 35 Statistical Option 7 (on magnetic device) -- Annual mean values. Code a 1 if this option desired.

Col. 36 Statistical Option 8 (on magnetic device) -- Statistics on monthly mean values. Code a 1 if this option desired.

Col. 37 Statistical Option 2 (on cards) -- Monthly mean values. Code a 1 if this option desired.

Col. 38 Statistical Option 3 (on cards) -- Statistics on monthly mean values. Code a 1 if this option desired.

Col. 39 Statistical Option 7 (on cards) -- Annual mean values. Code a 1 if this option desired.

Col. 40 Statistical Option 8 (on cards) -- Statistics on monthly mean values. Code a 1 if this option desired.

Col. 41 Computational Option 1 -- Code a 1 if computations for both "all days" and "only non-zero days" are desired. If the column is left blank, computations will be made only for "all days."

Col. 42 Computational Option 2 -- Code a 1 if computations based on both log transformed and untransformed data are desired. If the column is left blank, computations will be based only on untransformed data.

Col. 43-44 Maximum number of no-value days to be used in compilation of a monthly mean.

Col. 45-80 Blank

A sample coded deck of cards used to produce the printouts in Figures 3-10 of Section IV.F.4., is shown in Figure 2.

■ IV.F.3.c. Cataloged Procedure

The following cataloged procedures illustrate the retrieval of data from the Daily Values historical tape with or without data from the current file, processing of this data by W4422, and the storing of this processed data on an output tape.

Col. 1	Col. 12
//xxxxxxxx	JOB(----)
/*PROCLIB	WRD.PROCLIB
/*SETUP	tape1/9,tape2/9R

```
// EXEC DVRETR,AGENCY=agency,VOL1=tape1
//HDR.SYSIN DD *
```

•
•

Retrieval cards, including application control card (X card) for W4422. These cards may include specifications for several retrievals. In which case, there will be an W4422 X card following the Master Control Card for each retrieval.

•
•

```
/*
// EXEC DVMASTAT,NAME2=xxxxxxxx,VOL2=xxxxxx,UNIT2=xxxxx
/*
//
```

FIGURE 2. EXAMPLE OF CARD DECK USED TO PRODUCE PRINTOUTS IN FIGURES 3-10

Tape 1 is the volume serial number of the input Daily Values historical tape, and tape2 is the volume serial number of the output tape from program W4422. If output is on a disk, the setup card should be changed to read as follows:

```
/*SETUP tape1/9,disk1/DISK
```

The parameters NAME2, VOL2, and UNIT2 are the data set name, volume serial number, and the device type, respectively, and are to be coded only if W4422 output on a magnetic device is requested. If this option is not requested, the JCL statement is simply coded:

```
// EXEC DVMASTAT
/*
//
```

The execution time (3 minutes) given in the cataloged procedures is sufficient to process 500 station years of record. If this execution time is not sufficient, the time for a given job may be increased by coding the EXEC card as follows:

```
// EXEC DVMASTAT,TIME=time
```

"time" is the desired execution time in minutes.

Other examples of the cataloged JCL procedure to be used when retrieving from the current file, or from concatenated historical tapes are given in Section IV.B.

IV.F.4. Output

IV.F.4.a. Printouts

All statistical and computational options can be printed on the line printer. The printouts shown on the following pages (Figures 3-10) were produced from the card deck shown in Figure 2.

IV.F.4.b. Magnetic Device and Card Output Formats

The following tables give the magnetic device and card output formats for statistical options 2, 4, 7, and 8. Also included in this section are examples of Card Types 2 (Figure 11) and 3 (Figure 12) on which the data are punched.

STATION 1606000 SOUTH FORK WAILUA RIVER NR LIHUE KAUAI

DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	TOTAL NO. OF DAYS	NO. OF 0-VALUE DAYS	PRCT. OF 0-VALUE DAYS	NO. OF NO-VALUE DAYS	PRCT. OF NO-VALUE DAYS
1918	365	0	0.0	0	0.0
1919	365	0	0.0	212	58.1
1920	366	0	0.0	0	0.0
1921	365	0	0.0	30	8.2
1922	365	0	0.0	0	0.0
1923	365	0	0.0	0	0.0
1924	366	0	0.0	0	0.0
1925	365	0	0.0	61	16.7
1926	365	0	0.0	0	0.0
1927	365	0	0.0	0	0.0
1928	366	0	0.0	0	0.0
1929	365	0	0.0	0	0.0
1930	365	0	0.0	0	0.0
1931	365	0	0.0	0	0.0
1932	366	0	0.0	0	0.0
1933	365	0	0.0	0	0.0
1934	365	0	0.0	0	0.0
1935	365	0	0.0	0	0.0
1936	366	0	0.0	0	0.0
1937	365	0	0.0	0	0.0
1938	365	0	0.0	0	0.0
1939	365	0	0.0	0	0.0
1940	366	0	0.0	0	0.0
1941	365	0	0.0	0	0.0
1942	365	0	0.0	0	0.0
1943	365	0	0.0	0	0.0
1944	366	0	0.0	0	0.0
1945	365	0	0.0	0	0.0
1946	365	0	0.0	0	0.0
1947	365	0	0.0	0	0.0
1948	366	0	0.0	0	0.0
1949	365	0	0.0	0	0.0
1950	365	0	0.0	0	0.0
1951	365	0	0.0	0	0.0
1952	366	0	0.0	0	0.0
1953	365	0	0.0	0	0.0
1954	365	0	0.0	0	0.0
1955	365	0	0.0	0	0.0
1956	366	0	0.0	0	0.0
1957	365	0	0.0	92	25.2
1958	365	0	0.0	273	74.8
1959	365	0	0.0	0	0.0
1960	366	0	0.0	0	0.0

FIGURE 3. EXAMPLE OF PRINTED OUTPUT FOR STATISTICAL OPTION 1 - ZERO-ZALUE AND NO-VALUE SUMMARY

STATION 1606000 SOUTH FORK WAILUA RIVER NR LIHUE KAUAI

DISCHARGE, IN CUBIC FEET PER SECOND

MONTH	TOTAL NO. OF DAYS	NO. OF 0-VALUE DAYS	PRCT. OF 0-VALUE DAYS	NO. OF NO-VALUE DAYS	PRCT. OF NO-VALUE DAYS
OCT	1333	0	0.0	31	2.3
NOV	1290	0	0.0	60	4.7
DEC	1333	0	0.0	62	4.7
JAN	1333	0	0.0	62	4.7
FEB	1215	0	0.0	56	4.6
MARCH	1333	0	0.0	93	7.0
APRIL	1290	0	0.0	120	9.3
MAY	1333	0	0.0	62	4.7
JUNE	1290	0	0.0	30	2.3
JULY	1333	0	0.0	31	2.3
AUG	1333	0	0.0	31	2.3
SEPT	1290	0	0.0	30	2.3
TOTAL	15706	0	0.0	668	4.3

MONTH	TOTAL NO. OF MONTHS	NO. OF 0-VALUE MONTHS	PRCT. OF 0-VALVE MONTHS	NO. OF NO-VALUE MONTHS	PRCT. OF NO-VALUE MONTHS
OCT	43	0	0.0	1	2.3
NOV	43	0	0.0	2	4.7
DEC	43	0	0.0	2	4.7
JAN	43	0	0.0	2	4.7
FEB	43	0	0.0	2	4.7
MARCH	43	0	0.0	3	7.0
APRIL	43	0	0.0	4	9.3
MAY	43	0	0.0	2	4.7
JUNE	43	0	0.0	1	2.3
JULY	43	0	0.0	1	2.3
AUG	43	0	0.0	1	2.3
SEPT	43	0	0.0	1	2.3
TOTAL	516	0	0.0	22	4.3

NO. OF YEARS	NO. OF 0-VALUE YEARS	PRCT. OF 0-VALUE YEARS	NO. OF NO-VALUE YEARS	PRCT. OF NO-VALUE YEARS
43	0	0.0	0	0.0

FIGURE 3, Continued

STATION 16060000 SOUTH FORK WAILUA RIVER NR LIHUE KAUAI

DISCHARGE, IN CUBIC FEET PER SECOND
NORMAL MONTHLY MEANS(ALL DAYS)

YEAR	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1918	87.	95.	134.	89.	231.	765.	413.	218.	133.	185.	178.	49.
1919	25.	*	*	*	*	*	*	*	29.	65.	60.	44.
1920	59.	54.	124.	431.	62.	117.	125.	59.	61.	65.	99.	161.
1921	193.	172.	362.	1480.	151.	64.	*	55.	36.	49.	76.	57.
1922	67.	31.	301.	153.	160.	156.	96.	86.	59.	21.	36.	334.
1923	110.	230.	59.	439.	154.	289.	167.	38.	10.	31.	15.	73.
1924	57.	23.	202.	50.	33.	11.	262.	68.	21.	62.	31.	12.
1925	169.	48.	45.	112.	120.	*	*	57.	54.	65.	65.	75.
1926	47.	93.	52.	48.	21.	25.	4.2	3.3	50.	6.8	22.	60.
1927	8.9	6.9	74.	166.	60.	264.	292.	467.	119.	68.	87.	114.
1928	15.	118.	529.	112.	52.	24.	272.	140.	8.7	71.	116.	97.
1929	31.	334.	121.	43.	19.	56.	61.	95.	26.	274.	72.	28.
1930	94.	174.	90.	237.	103.	84.	99.	12.	15.	48.	170.	253.
1931	198.	203.	75.	25.	6.0	7.4	3.8	4.0	4.2	13.	152.	235.
1932	203.	140.	57.	161.	716.	116.	86.	219.	46.	12.	12.	12.
1933	11.	185.	165.	441.	219.	333.	26.	48.	103.	39.	19.	6.9
1934	4.3	3.1	87.	45.	5.1	3.5	65.	33.	80.	73.	6.5	95.
1935	162.	161.	75.	138.	140.	124.	16.	7.3	16.	32.	79.	198.
1936	113.	107.	131.	137.	43.	149.	8.7	65.	7.8	109.	208.	87.
1937	172.	141.	211.	376.	253.	345.	84.	350.	9.7	78.	174.	21.
1938	84.	180.	90.	107.	289.	208.	122.	60.	125.	56.	106.	35.
1939	23.	173.	28.	91.	233.	261.	276.	183.	100.	68.	19.	9.4
1940	152.	161.	48.	65.	12.	26.	53.	287.	12.	39.	235.	74.
1941	116.	38.	15.	30.	16.	23.	6.3	8.1	11.	35.	52.	109.
1942	139.	97.	34.	22.	70.	116.	161.	84.	69.	21.	65.	107.
1943	7.8	76.	443.	394.	76.	93.	51.	64.	147.	40.	59.	77.
1944	16.	8.2	46.	46.	162.	307.	23.	45.	30.	91.	6.7	8.5
1945	11.	18.	60.	11.	9.5	64.	335.	57.	9.3	23.	24.	9.5
1946	82.	63.	145.	68.	295.	72.	240.	34.	16.	64.	31.	75.
1947	82.	220.	388.	32.	3.1	19.	17.	20.	19.	77.	125.	105.
1948	11.	226.	161.	167.	48.	201.	257.	165.	103.	84.	321.	70.
1949	34.	175.	341.	578.	453.	140.	30.	40.	9.0	15.	28.	3.4
1950	5.3	12.	149.	272.	179.	58.	236.	151.	16.	6.1	180.	13.
1951	7.0	5.8	7.7	90.	94.	423.	112.	6.8	3.3	4.8	33.	64.
1952	172.	254.	336.	336.	96.	152.	56.	27.	65.	87.	7.7	37.
1953	33.	130.	80.	64.	43.	105.	6.5	7.4	5.3	3.3	7.0	2.6
1954	2.6	18.	32.	35.	106.	143.	39.	15.	65.	176.	168.	41.
1955	54.	137.	242.	132.	218.	49.	67.	58.	15.	35.	92.	12.
1956	31.	545.	228.	383.	480.	167.	59.	65.	61.	15.	50.	17.
1957	175.	157.	159.	394.	359.	10.	16.	26.	2.8	*	*	*
1958	*	*	*	*	*	*	*	*	*	117.	221.	60.
1959	131.	70.	54.	92.	33.	7.8	71.	31.	4.5	13.	214.	42.
1960	5.9	73.	89.	141.	27.	222.	77.	103.	22.	29.	43.	32.

* INDICATES A NO-VALUE MONTH

FIGURE 4. EXAMPLE OF PRINTED OUTPUT FOR STATISTICAL OPTION 2 - MONTHLY MEAN VALUES

STATION 16060000 SF WAILUA RIVER NR LIHUE,KAUAI, HI

DISCHARGE, IN CUBIC FEET PER SECOND
NORMAL MONTHLY MEANS(ALL DAYS)

APRIL		MAY		JUNE		JULY		AUG		SEPT	
	1919		1919		1958		1957		1957		1957
	1921		1958	2.80	1957	3.30	1953	6.50	1934	2.60	1953
	1925	3.30	1926	3.30	1951	4.80	1951	6.70	1944	3.40	1949
	1958	4.00	1931	4.20	1931	6.10	1950	7.00	1953	6.90	1933
3.80	1931	6.80	1951	4.50	1959	6.80	1926	7.70	1952	8.50	1944
4.20	1926	7.30	1935	5.30	1953	11.90	1932	12.40	1932	9.40	1939
6.30	1941	7.40	1953	7.80	1936	13.30	1959	15.20	1923	9.50	1945
6.50	1953	8.10	1941	8.70	1928	13.50	1931	19.20	1939	11.50	1924
8.70	1936	12.30	1930	9.00	1949	15.40	1949	19.30	1933	12.00	1955
15.60	1935	15.10	1954	9.30	1945	15.40	1956	22.30	1926	12.40	1932
15.70	1957	20.10	1947	9.70	1937	20.80	1922	24.00	1945	13.10	1950
17.50	1947	25.70	1957	10.50	1923	21.20	1942	28.00	1949	17.10	1956
23.20	1944	27.50	1952	10.80	1941	23.20	1945	30.60	1924	21.30	1937
26.20	1933	31.40	1959	12.30	1940	29.30	1960	31.10	1946	27.80	1929
29.90	1949	33.30	1934	15.10	1955	31.20	1923	33.50	1951	31.60	1960
39.40	1954	34.10	1946	15.20	1930	31.70	1935	35.60	1922	34.50	1938
50.60	1943	37.70	1923	15.60	1935	34.60	1941	42.60	1960	36.50	1952
53.10	1940	40.10	1949	15.70	1950	35.00	1955	49.80	1956	41.10	1954
56.40	1952	45.40	1944	16.40	1946	39.00	1940	51.60	1941	41.70	1959
58.90	1956	48.20	1933	19.20	1947	39.40	1933	58.80	1943	44.20	1919
60.70	1929	54.70	1921	20.90	1924	39.70	1943	59.70	1919	48.60	1918
64.90	1934	57.00	1945	21.60	1960	47.50	1930	64.90	1942	57.30	1921
67.50	1955	57.40	1925	26.40	1929	49.00	1921	65.20	1925	60.00	1926
70.70	1959	58.40	1955	28.80	1919	55.60	1938	71.50	1929	60.30	1958
76.90	1960	58.60	1920	30.10	1944	61.50	1924	76.20	1921	64.10	1951
83.90	1937	60.20	1938	36.30	1921	64.40	1946	78.60	1935	70.00	1948
85.90	1932	63.70	1943	46.10	1932	64.60	1920	86.70	1927	73.00	1923
95.60	1922	64.80	1956	49.80	1926	65.10	1919	92.30	1955	73.70	1940
99.10	1930	65.40	1936	53.70	1925	65.20	1925	98.90	1920	75.10	1925
112.00	1951	68.00	1924	58.70	1922	67.90	1939	106.00	1938	75.40	1946
122.00	1938	84.10	1942	60.50	1920	68.10	1927	116.00	1928	76.90	1943
125.00	1920	86.50	1922	60.60	1956	70.80	1928	125.00	1947	87.40	1936
161.00	1942	94.70	1929	64.70	1952	73.30	1934	152.00	1931	95.20	1934
167.00	1923	103.00	1960	65.30	1954	76.60	1947	168.00	1954	97.30	1928
236.00	1950	140.00	1928	68.50	1942	78.20	1937	170.00	1930	105.00	1947
240.00	1946	151.00	1950	80.30	1934	83.90	1948	174.00	1937	107.00	1942
257.00	1948	165.00	1948	100.00	1939	87.10	1952	178.00	1918	109.00	1941
262.00	1924	183.00	1939	103.00	1933	91.10	1944	180.00	1950	114.00	1927
272.00	1928	218.00	1918	103.00	1948	109.00	1936	208.00	1936	161.00	1920
276.00	1939	219.00	1932	119.00	1927	117.00	1958	214.00	1959	198.00	1935
292.00	1927	287.00	1940	125.00	1938	176.00	1954	221.00	1958	235.00	1931
335.00	1945	350.00	1937	133.00	1918	185.00	1918	235.00	1940	253.00	1930
413.00	1918	467.00	1927	147.00	1943	274.00	1929	321.00	1948	334.00	1922

FIGURE 5. EXAMPLE OF PRINTOUT FOR STATISTICAL OPTION 3 - MEDIAN AND FIRST AND THIRD QUARTILES OF MONTHLY AND ANNUAL MEAN VALUES

STATION 16060000 SF WAILUA RIVER NR LIHUE,KAUAI, HI

DISCHARGE, IN CUBIC FEET PER SECOND
NORMAL MONTHLY MEANS(ALL DAYS)

APRIL	MAY	JUNE	JULY	AUG	SEPT
		TWENTY FIFTH PERCENTILE			
26.20	26.60	10.30	21.10	27.00	16.10
		FIFTIETH PERCENTILE			
70.70	57.40	24.00	48.30	65.10	58.70
		SEVENTY FIFTH PERCENTILE			
167.00	98.90	64.80	74.10	156.00	95.70

Figure 5, Continued

STATION 16060000 SF WAILUA RIVER NR LIHUE,KAUAI, HI

DISCHARGE, IN CUBIC FEET PER SECOND
NORMAL ANNUAL MEANS(ALL DAYS)

36.00	1926
38.30	1941
40.60	1953
41.90	1934
44.60	1919
52.60	1945
63.20	1944
64.10	1959
69.30	1924
70.20	1954
71.10	1951
72.40	1960
77.40	1931
80.90	1925
81.80	1942
92.00	1955
93.00	1947
95.20	1935
97.10	1929
97.20	1946
97.80	1940
97.90	1936
106.00	1950
115.00	1930
118.00	1920
118.00	1939
121.00	1938
125.00	1922
128.00	1943
130.00	1928
131.00	1933
133.00	1958
135.00	1923
136.00	1952
143.00	1957
145.00	1927
148.00	1932
152.00	1948
153.00	1949
173.00	1956
185.00	1937
215.00	1918
248.00	1921

STATION 16060000 SF WAILUA RIVER NR LIHUE,KAUAI, HI

DISCHARGE, IN CUBIC FEET PER SECOND
NORMAL ANNUAL MEANS(ALL DAYS)

TWENTY FIFTH PERCENTILE

71.10

FIFTIETH PERCENTILE

97.90

SEVENTY FIFTH PERCENTILE

135.00

Figure 5, Continued

STATION 16060000 SOUTH FORK WAILUA RIVER NR LIHUE KAUAI

DISCHARGE, IN CUBIC FEET PER SECOND
STATISTICS ON NORMAL MONTHLY MEANS(ALL DAYS)

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY ROWS(MEAN,VARIANCE,STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION,PERCENTAGE OF AVERAGE FLOW)											
76.	126.	148.	199.	143.	145.	113.	87.	43.	59.	90.	72.
4290.	10950.	16040.	64550.	22880.	21720.	11630.	9920.	1660.	2840.	6010.	5220.
66.	105.	127.	254.	151.	147.	108.	100.	41.	53.	78.	72.
0.57	1.7	1.4	3.5	1.9	2.2	1.1	2.2	1.1	2.2	1.0	1.9
0.86	0.83	0.86	1.3	1.1	1.0	0.96	1.1	0.95	0.91	0.87	1.0
5.9	9.7	11.	15.	11.	11.	8.7	6.7	3.3	4.5	6.9	5.5

FIGURE 6. EXAMPLE OF PRINTED OUTPUT FOR STATISTICAL OPTION 4 - STATISTICS OF MONTHLY MEAN VALUES

CORRELATION MATRIX

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1.000	0.188	-0.060	0.252	0.209	-0.151	-0.278	0.004	-0.267	-0.127	0.153	0.258
*	1.000	0.245	0.254	0.325	-0.021	-0.222	-0.063	0.017	0.115	0.064	-0.104
*	*	1.000	0.444	0.082	-0.163	0.011	-0.016	0.065	0.025	-0.003	0.040
*	*	*	1.000	0.274	0.013	-0.147	-0.012	0.029	-0.134	-0.059	-0.070
*	*	*	*	1.000	0.220	-0.010	0.147	0.091	-0.158	-0.226	-0.280
*	*	*	*	*	1.000	0.375	0.343	0.426	0.264	0.019	-0.170
*	*	*	*	*	*	1.000	0.464	0.309	0.160	0.127	-0.122
*	*	*	*	*	*	*	1.000	0.300	0.158	0.306	-0.123
*	*	*	*	*	*	*	*	1.000	0.240	-0.002	-0.042
*	*	*	*	*	*	*	*	*	1.000	0.265	-0.127
*	*	*	*	*	*	*	*	*	*	1.000	0.152
*	*	*	*	*	*	*	*	*	*	*	1.000

CORRELATION BETWEEN(OCT,NOV)AND (SEPT,AUG) OF SAME CAL YEAR
AUG -OCT 0.076
SEPT-OCT 0.432
SEPT-NOV 0.208

***** IN CORRELATION MATRIX SIGNIFIES A COMPUTED VALUE GREATER THAN .9995 OR LESS THAN -.9995

FIGURE 7. EXAMPLE OF PRINTED OUTPUT FOR STATISTICAL OPTION 5 - CORRELATION MATRIX

SERIAL CORRELATION FOR 1-YEAR LAG

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
0.098	0.093	-0.059	0.126	0.118	-0.178	0.055	-0.032	0.007	-0.037	0.102	0.171

FIGURE 8. EXAMPLE OF PRINTED OUTPUT FOR STATISTICAL OPTION 6 - SERIAL CORRELATION FOR 1-YEAR LAG

STATION 16060000 SOUTH FORK WAILUA RIVER NR LIHUE KAUAI

DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	NORMAL ANNUAL MEANS(ALL DAYS)
1918	215.
1919	*
1920	118.
1921	*
1922	125.
1923	135.
1924	69.
1925	*
1926	36.
1927	145.
1928	130.
1929	97.
1930	115.
1931	77.
1932	148.
1933	131.
1934	42.
1935	95.
1936	98.
1937	185.
1938	121.
1939	118.
1940	98.
1941	38.
1942	82.
1943	128.
1944	63.
1945	53.
1946	97.
1947	93.
1948	152.
1949	153.
1950	106.
1951	71.
1952	136.
1953	41.
1954	70.
1955	92.
1956	173.
1957	*
1958	*
1959	64.
1960	72.

* INDICATES A NO-VALUE YEAR

FIGURE 9. EXAMPLE OF PRINTOUT FOR STATISTICAL OPTION 7 - ANNUAL MEAN VALUES

STATION 16060000 SOUTH FORK WAILUA RIVER NR LIHUE KAUAI

DISCHARGE, IN CUBIC FEET PER SECOND
STATISTICS ON NORMAL ANNUAL MEANS(ALL DAYS)

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
105.	1780.	42.	0.40	0.40	0.039

FIGURE 10. EXAMPLE OF PRINTOUT FOR STATISTICAL OPTION 8 - STATISTICS OF ANNUAL MEAN VALUES

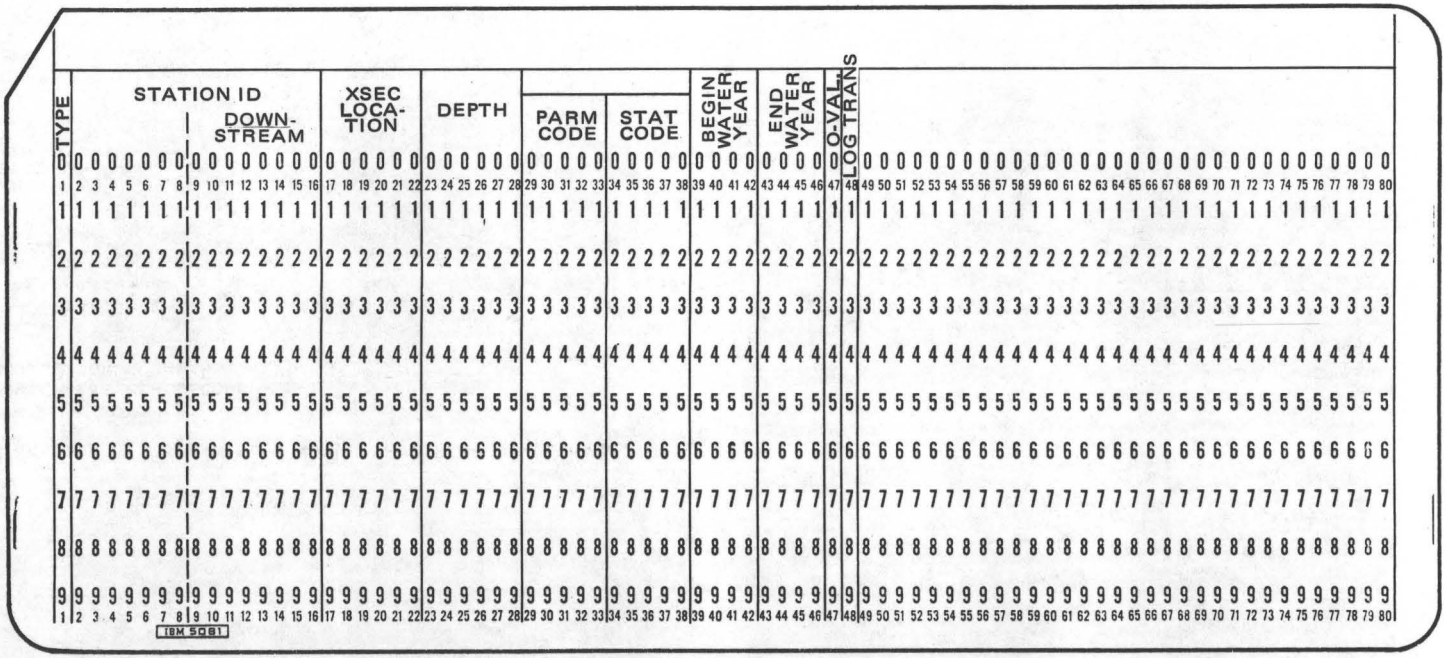

FIGURE 11. CARD TYPE 2 FOR STATISTICAL OPTIONS 2, 4, 7, AND 8

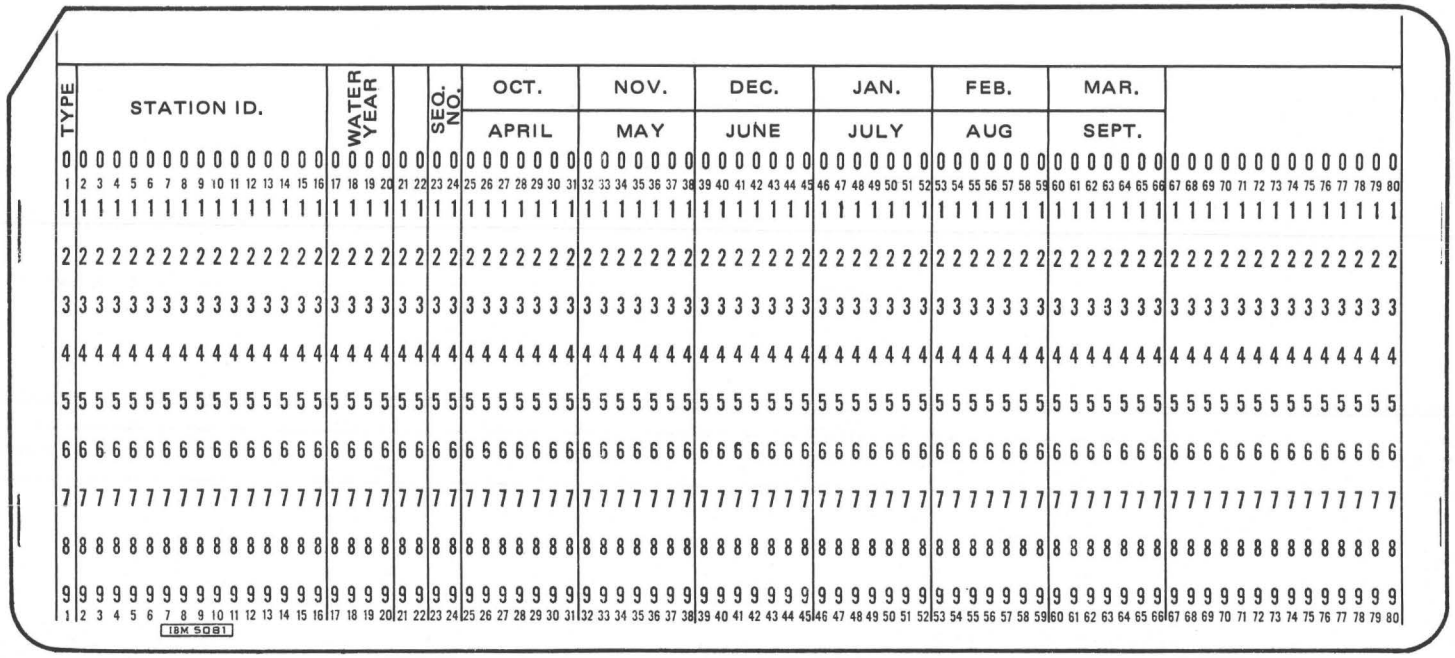

FIGURE 12. CARD TYPE 3 FOR STATISTICAL OPTIONS 2, 4, AND 7

Byte(s)	Data Type	Item
1	CHAR(1)	Reserved
2-16	CHAR(15)	Station identification
17-20	CHAR(4)	Beginning water year
21-24	CHAR(4)	Ending water year
25-29	CHAR(5)	Parameter code
30-34	CHAR(5)	Statistics code
35	CHAR(1)	Reserved
36	CHAR(1)	M, indicating monthly data. A, indicating annual data.
36	CHAR(1)	O, indicating calculations based on total number of days, 1, indicating calculations based on days for which there was non-zero value.
37	CHAR(1)	O, indicating calculations based on untransformed data, 1, indicating calculations based on $\log_{10}$ transformed data.
38	BIN FIXED(31)	Number of years of data retrieved. Adjustable length array:
39-42	CHAR(4)	Year 1
43-51	CHAR(9)	Monthly mean value for Oct.
52-60	CHAR(9)	Monthly mean value for Nov.
•	•	•
•	•	•
•	•	•
142-150	CHAR(9)	Monthly mean value for Dec.
151-154	CHAR(4)	Year 2
153-163	CHAR(9)	Monthly mean value for Oct.

TABLE 3. MAGNETIC DEVICE OUTPUT FORMAT FOR STATISTICAL OPTION 2

Card Column(s)	Item
Col. 1	Card type, 2
Col. 2-16	Station identification
Col. 17-22	Cross-section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code, 00003
Col. 39-42	Beginning water year
Col. 43-46	Ending water year
Col. 47	0 if computations are to be based on all the days of record. 1 if computations are based only on days with non-zero values.
Col. 48	0 if computations are based on untransformed data. 1 if computations are based on $\log_{10}$ transformed data.
Col. 49-80	Blank

TABLE 4. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 2 (CARD TYPE 2)

Card Column(s)	Item
Col. 1	Card type, 3
Col. 2-16	Station identification
Col. 17-20	Water year for which data is punched
Col. 21-22	Blank
Col. 23-24	Card sequence number 01 -- for October-March 02 -- for April-September
Col. 25-31	October/April value
Col. 32-38	November/May value
Col. 39-45	December/June value
Col. 46-52	January/July value
Col. 53-59	February/August value
Col. 60-66	March/September value
Col. 67-80	Blank

TABLE 5. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 2 (CARD TYPE 3)

Byte(s)	Data Type	Item
1	CHAR(1)	Reserved
2-16	CHAR(15)	Station identification
17-20	CHAR(4)	Beginning water year
21-24	CHAR(4)	Ending water year
25-29	CHAR(5)	Parameter code
30-34	CHAR(5)	Statistics code
35	CHAR(1)	Reserved
36	CHAR(1)	M, monthly data. A, annual data.
36	CHAR(1)	0 if calculations based on total number of days; 1 if calculations based only on days for which there were non-zero values.
37	CHAR(1)	0 if calculations based on untransformed data; 1 if calculations based on $\log_{10}$ transformed data.
38-145	CHAR(9)	Monthly mean values (12) for all years of data retrieval.
146-253	CHAR(9)	Standard deviation of monthly mean values (12)
254-361	CHAR(9)	Skewness of monthly mean values (12)

TABLE 6. MAGNETIC DEVICE OUTPUT FORMAT FOR STATISTICAL OPTION 4

Card Column(s)	Item
Col. 1	Card type, 2
Col. 2-16	Station identification
Col. 17-22	Cross-section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code 00003 for mean 00009 for standard deviation 00013 for skewness
Col. 39-42	Beginning water year
Col. 43-46	Ending water year
Col. 47	0 if computations are to be based on all the days of record; 1 if computations are based only on days with non-zero values.
Col. 48	0 if computations are based on untransformed data; 1 if computations are based on $\log_{10}$ transformed data.
Col. 49-80	Blank

TABLE 7. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 4 (CARD TYPE 2)

Card Column(s)	Item
Col. 1	Card type, 3
Col. 2-16	Station identification
Col. 17-20	Water year for which data is punched
Col. 21-22	Blank
Col. 23-24	Card sequence number 01 -- for October-March 02 -- for April-September
Col. 25-31	October/April value
Col. 32-38	November/May value
Col. 39-45	December/June value
Col. 46-52	January/July value
Col. 53-59	February/August value
Col. 60-66	March/September value
Col. 67-80	Blank

TABLE 8. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 4 (CARD TYPE 3)

Byte(s)	Data Type	Item
1	CHAR(1)	Reserved
2-16	CHAR(15)	Station identification
17-20	CHAR(4)	Beginning water year
21-24	CHAR(4)	Ending water year
25-29	CHAR(5)	Parameter code
30-34	CHAR(5)	Statistics code
35	CHAR(1)	Reserved
36	CHAR(1)	M, monthly data. A, annual data.
36	CHAR(1)	0 if calculations based on total number of days; 1 if calculations based only on days for which there were non-values.
37	CHAR(1)	0 if calculations based on untransformed data; 1 if calculations based on $\log_{10}$ transformed data.
38	BIN FIXED(31)	Number of years of data retrieved. Ajustable length array:
39-42	CHAR(4)	Year 1
43-50	CHAR(8)	Annual mean value
51-54	CHAR(4)	Year 2
55-62	CHAR(8)	Annual mean value
63-66	CHAR(4)	Year 3
•	•	•
•	•	•
•	•	•

TABLE 9. MAGNETIC DEVICE OUTPUT FORMAT FOR STATISTICAL OPTION 7

Card Column(s)	Item
Col. 1	Card type, 2
Col. 2-16	Station identification
Col. 17-22	Cross-section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code, 00003
Col. 39-42	Beginning water year
Col. 43-46	Ending water year
Col. 47	0 if computations are to be based on all the days of record; 1 if computations are based only on days with non-zero values.
Col. 48	0 if computations are based on untransformed data; 1 if computations are based on $\log_{10}$ transformed data.
Col. 49-80	Blank

TABLE 10. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 7 (CARD TYPE 2)

Card Column(s)	Item
Col. 1	Card type, 3
Col. 2-16	Station identification
Col. 17-22	Blank
Col. 23-24	Sequence number
Col. 25-31	Annual mean
•	•
Col. 74-80.	Annual mean

TABLE 11. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 7 (CARD TYPE 3)

Byte(s)	Data Type	Item
1	CHAR(1)	Reserved
2-16	CHAR(15)	Station identification
17-20	CHAR(4)	Beginning water year
21-24	CHAR(4)	Ending water year
25-29	CHAR(5)	Parameter code
30-34	CHAR(5)	Statistics code
35	CHAR(1)	Reserved
36	CHAR(1)	M, monthly data. A, annual data.
36	CHAR(1)	0 if calculations based on total number of days; 1 if calculations based only on days for which there were non-zero values.
37	CHAR(1)	0 if calculations based on untransformed data; 1 if calculations based on $\log_{10}$ transformed data.
38	BIN FIXED(31)	Number of years of data retrieved.
39-45	CHAR(7)	Mean of annual values
46-52	CHAR(7)	Standard deviation of annual values
53-59	CHAR(7)	Skewness of annual values

TABLE 12. MAGNETIC DEVICE OUTPUT FORMAT FOR STATISTICAL OPTION 8

Card Column(s)	Item
Col. 1	Card type, 2
Col. 2-16	Station identification
Col. 17-22	Cross-section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code, 00003
Col. 39-42	Beginning water year
Col. 43-46	Ending water year
Col. 47	0 if computations are based on all the days of record; 1 if computations are based only on days with a non-zero value.
Col. 48	0 if computations are based on untransformed data; 1 if computations are based on $\log_{10}$ transformed data.
Col. 49-55	Mean of annual values
Col. 56-62	Standard deviation of annual values
Col. 63-69	Skewness of annual values

TABLE 13. CARD OUTPUT FORMAT FOR STATISTICAL OPTION 8 - CARD TYPE 2

IV.F.5. Diagnostic Messages

The following diagnostic messages are issued by program W4422:

DF0001 DATA NOT RETRIEVED BY WATER YEAR. EXECUTION OF PROGRAM HALTED.

Explanation: Data retrieved for use by program W4422 was not in the water-year format (Oct.-Sept.).

Response: Retrieve data in water-year format.

DF0002 INSUFFICIENT DATA BASE. EXECUTION OF PROGRAM HALTED.

Explanation: The period of record retrieved is less than five years.

Response: Increase number of years of data retrieved.

DF0003 ERROR CONDITION FOUND? STOP PROCESSING.

Explanation: Retrieval from Daily Values File not successful.

Response: Check data control cards to see if they are properly coded.

DF0004 NO OPTIONS SPECIFIED. EXECUTION OF PROGRAM HALTED.

Explanations: No statistical options were coded on the Application Control Card (X card).

Response: Code at least one statistical option on the X card.

DF0005 MISSING X CARD. EXECUTION OF PROGRAM HALTED.

Explanation: The application control card (X card) was not included in the set of retrieval cards.

Response: Put an X card in the set of retrieval cards.

DF0006 INSUFFICIENT DATA FOR MONTH ___ YEAR ___. PROCESSING CONTINUED.

Explanation: The maximum allowable number of no-value days (Section IV.F.2.c.) has been exceeded for the month identified in the error message. This month will not be included in the monthly computations and the year in whih the month occurs will not be included in the annual computations.

Response: If this month is to be included in the computations at the selected tolerance for no-value days, then no-value days in the Daily Values Record must be updated.

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

SECTION G. Daily Values Statistics (Program A969)

by Wanda C. Meeks

CHAPTER IV. INSTRUCTIONS FOR DAILY VALUES FILE

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IV.G. Daily Values Statistics (Program A969)

IV.G.1. Introduction

Computer program A969 is used for statistical analysis of data stored in the Daily Values File. The program produces duration tables, low and high value tables, and fits the data from the low and high value tables to a log-Pearson Type III frequency distribution.

The duration table is a frequency analysis of daily values which includes determination of the number of daily values in each of a maximum of 35 magnitude classes for each year and for a period of years. The low-value table is derived from daily values within a year based on ten selective periods of n-consecutive days. The table contains the lowest n-day mean value for each year. The high-value table is similar to the low-value table except that the highest n-day mean value is printed for each year. Two references are listed in Section IV.G.9. that contain additional information on duration tables and the log-Pearson frequency distribution.

The computations are performed on data from Daily Values records retrieved from the Daily Values magnetic tape backfile and/or current disk file. Program options are specified on input control cards. Machine-readable output may also be obtained.

Program A969 was written by Wanda C. Meeks, U.S. Geological Survey, Reston, Virginia.

IV.G.2. Data Retrieval

Data processed by program A969 must be retrieved from the Daily Values File using procedure DVRETR (program G490). Instructions for coding retrieval cards for procedure DVRETR are given in Section IV.B. The option cards for program A969 must be submitted with the retrieval request for program G490.

The data item to be treated by program A969 is selected by station identification, parameter code, statistic code, and year. As a result, if more than one statistic code is requested per parameter, sorting of the output from program G490 is required, and the user must request that data be sorted by statistic code within parameter code. The sort is requested by coding the sort codes 'SAPRFY' for program G490. Specifications for this sorting procedure are contained in Section IV.B. If only one statistic code is requested, then a sort is not required.

Note that the option in program G490 relating to the reformatting of output records to a different type of year does not apply to program A969. The type of year, complete or partial, to be treated is specified on the X cards for program A969.

IV.G.3. General Specifications

Program A969 allows a maximum of eleven forms of output. They are a duration table with percentiles which may be punched on cards; a high-value and low-value table, both of which may be recorded on magnetic device or punch cards; log-Pearson statistics, parts of which may be punched on cards and provided as a log-Pearson plot. The duration table is independent of the other forms of output and must be specifically requested. Both low- and high-value tables are standard output of the program, and in order to omit them an indication must be made to suppress their output.

The log-Pearson output is dependent on the high and low-value tables. The log-Pearson statistics and plot require the low or high-value tables to be printed. The first three forms of output, duration table and high and low-value tables, are independent, and may be requested or suppressed independently. Any request for machine readable output automatically causes the printing of the table from which the output is taken.

Options for this program include selecting a specific parameter from the Daily Values File, a beginning and ending date and a type of year or set of months to be used in the computation. The years may be complete or partial. Although the low and high-value tables may be computed on a different set of consecutive months, these partial years must contain the same number of months. Partial year analysis may begin with any month. Class limit values for the duration table may be either computed by the program or entered on cards.

Monthly durations or monthly low and high-value tables may be obtained by simply requesting a single month of each year to be processed.

IV.G.4. Duration Analysis

IV.G.4.a. Duration Table

The duration table is a magnitude frequency analysis of daily values. It includes tabulation of the number of daily

values in each of a maximum of 35 magnitude classes for each year, the total yearly parameter value (sum), and a summary for the period of years showing the value of each class limit, the number of days in the period in each class, the total number of days having a value greater than or equal to each class limit, and the percent of all days in which a class limit was equaled or exceeded. This summary is followed by seven percentiles computed on the period of years: 95th, 90th, 75th, 70th, 50th, 25th, and 10th percentiles are computed.

Specifications for computation of the duration table consist of begin and end dates, type of year, and designation of class limit values. The table is based on the water year beginning October 1 unless different beginning and ending months or a partial year is specified. The period of years to be tabulated may be chosen by beginning and ending dates, or the entire period available in the file will be processed if the dates are not given. The years to be processed may be complete or partial.

Any number of months may be chosen for the partial year. The duration table will be computed on the available data regardless of the number of missing daily values.

The class limit values may be either computed by the program or entered by punch cards as input into program G490. If class limits are to be produced by the program, they are computed from a relationship between the lowest positive non-zero and the second highest daily value of the period being processed. These values are obtained from the data records by the retrieval program (G490) for the period of record processed, and are passed to program A969. The class limit values computed by program A969 range from zero to the second highest value. This set of class limit values is designed to fit each parameter and the period of record requested.

A maximum of 35 class limit values may be entered from cards. Negative values may be entered, and it is not required that a value of zero be included in this range, or that the range begin with zero when no negative values are present.

The duration table is optional and must be requested by a positive indication on the request cards. An example of a duration table is shown in Table 1.

IV.G.4.b. Duration Data Card Output

The option is available to request seven percentiles on card output. They are punched in the format shown in Table 2. A type 2 card (see Figure 1) is punched containing parameter and statistic code identification, the period of years, and type of year for which the percentiles were computed. The seven percentile values are punched on a type 3 data card (see Figure 2) immediately following the type 2 card.

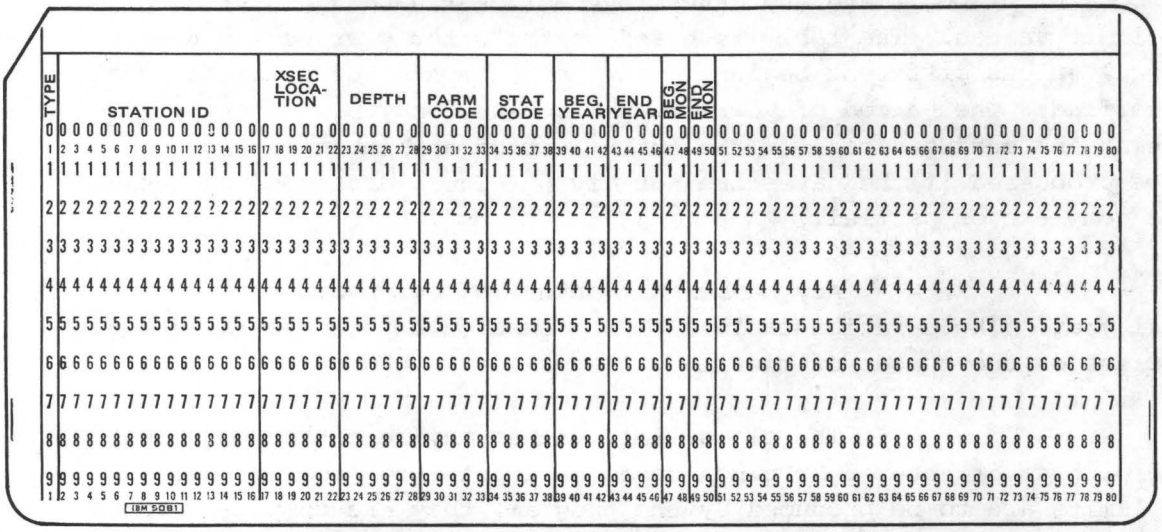


FIGURE 1. OUTPUT TYPE 2 CARD TO IDENTIFY DURATION DATA

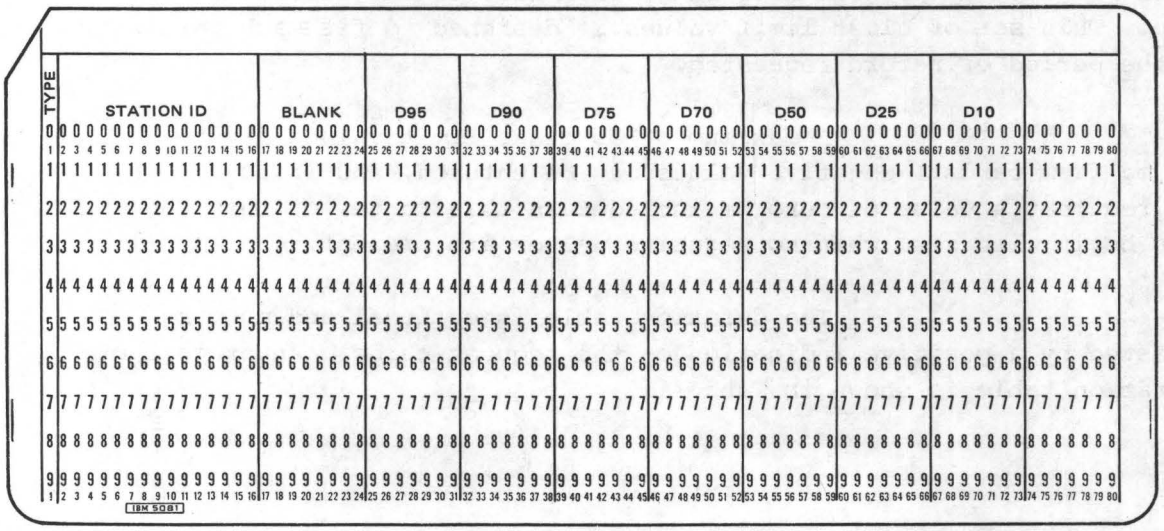


FIGURE 2. DATA CARD TYPE 3 FOR DURATION TABLE

STATION NUMBER 13254500

DURATION TABLE OF DAILY VALUES FOR YEAR ENDING SEPTEMBER 30

DISCHARGE, IN CUBIC FEET PER SECOND
MEAN
LOST CREEK NR TAMARACK IDA

CLASS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
YEAR	NUMBER OF DAYS IN CLASS																																			SUM OF VALUES
1931									87	4	1	1	70	73	4	2	3	23	3		16	21	40	17												4862.3
1932											2	27	103	7		8	8	10	69	15	13	18	2	20	26	5	3	5	2	7	10	6				16338.4
1933												5	2	14	6	40	28	41	88	23	18	9	15	25	25	1	2	8	10	5						12726.0
1934	31												1		33	6	48	21	40	45	28	19	15	50	14	6	7	1								9953.0
1935													7	10	2	39	174	1	13	16	13	15	9	14	23	13	13	3								9425.0
1936	116													9	7	2	4	3	7	17	56	23	24	59	9	16	7	4	3							11620.0
1937	77								29				15	5	68	12	9	5	3	12	19	4	49	52	6											7051.0
1938									12		36		22	11	22	31	51	15	3	7	37	5	57		8		1	3	12	16	14	2				19119.0
1939															30	79	25	26	19	6	10	10	81	31	29	11	5	3								11953.0
1940									31		28		11	69	21	2	7	10	21	4	16	12	41	10	18	32	4	13	12	3	1					14831.0
1941	2										20		8		5101		4	4	3	52	3	10	61	47	13	10	14	6	2							12366.0
1942											3		83	59	3	6	12	5	9	13	19	2	7	56	38	11	18	7	2	11	1					15945.0
1943											2				49126			3	12	3	35	15	13	25	26	8	10	12	4	14	6	2				18085.0
1944															12146		16	8	12	10	49	45	4	19	45											9099.0
1945															143	27	2	11	10	8	34				5	6	1	8	4	12	5					
1946													1		3126	72	3																			
															40	22																					

CLASS	VALUE	TOTAL	ACCUM	PERCT	CLASS	VALUE	TOTAL	ACCUM	PERCT	CLASS	VALUE	TOTAL	ACCUM	PERCT	CLASS	VALUE	TOTAL	ACCUM	PERCT
0	0.00	263	14245	100.0	9	1.30	51	13269	93.1	18	14.0	657	7142	50.1	27	140	283	876	6.1
1	0.10	286	13982	98.2	10	1.70	182	13218	92.8	19	18.0	437	6485	45.5	28	180	236	593	4.1
2	0.20	44	13696	96.1	11	2.20	114	13036	91.5	20	23.0	725	6048	42.5	29	240	191	357	2.5
3	0.30	44	13652	95.8	12	2.90	611	12922	90.7	21	30.0	654	5323	37.4	30	310	108	166	1.1
4	0.40	38	13608	95.5	13	3.80	554	12311	86.4	22	39.0	848	4669	32.8	31	400	55	58	.4
5	0.50	21	13570	95.3	14	4.90	1524	11757	82.5	23	50.0	1515	3821	26.8	32	520	3	3	
6	0.60	31	13549	95.1	15	6.30	1500	10233	71.8	24	65.0	843	2306	16.2	33				
7	0.80	10	13518	94.9	16	8.20	965	8733	61.3	25	84.0	343	1463	10.3	34				
8	1.00	239	13508	94.8	17	11.00	626	7768	54.5	26	110.0	244	1120	7.9					

NINETY-FIFTH PERCENTILE = 180.00
NINETIETH PERCENTILE = 110.00
SEVENTY-FIFTH PERCENTILE = 63.00
SEVENTIETH PERCENTILE = 49.00
FIFTIETH PERCENTILE = 18.00
TWENTY-FIFTH PERCENTILE = 6.20
TENTH PERCENTILE = 3.80

TABLE 1. DURATION TABLE OF DAILY VALUES

Type 2 Card

Col. 1	2
Col. 2-16	Station identification
Col. 17-22	Cross Section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code
Col. 39-43	Blank
Col. 44-47	Begin year of period processed
Col. 48-51	End year of period processed
Col. 52-53	Begin month of type of year (complete or partial) being processed.
Col. 54-55	End month of type of year (complete or partial) being processed.
Col. 56-80	Blank

Type 3 Card

Col. 1	3
Col. 2-16	Station identification
Col. 17	1
Col. 18-24	Blank
Col. 25-31	95th percentile
Col. 32-38	90th percentile
Col. 39-45	75th percentile
Col. 46-52	70th percentile
Col. 53-59	50th percentile
Col. 60-66	25th percentile
Col. 67-73	10th percentile

TABLE 2. FORMAT OF CARD OUTPUT OF DURATION DATA

IV.G.4.c. Coding of X Card (MAIN)

The duration table and options are requested by using the X cards called MAIN and DURA. Columns 1-22, 25, 26, 32, and 37-40 of the MAIN card apply to the duration table. The format for the MAIN card is shown in Figure 3 and is coded as follows:

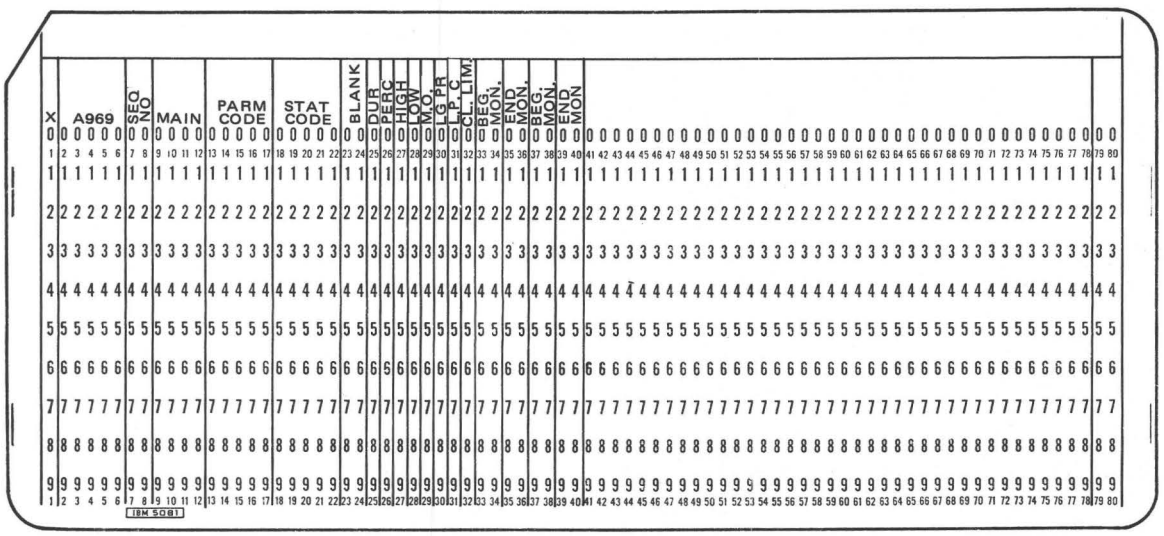


FIGURE 3. SAMPLE TYPE X CARD (MAIN)

Col. 1 Punch X

Col. 2-6 A969

Col. 7-8 Blank

Col. 9-12 MAIN

Col. 13-17 5-digit parameter code

Col. 18-22 5-digit statistic code

Col. 23-24 Blank

Col. 25 Code a non-blank character to print duration table

Col. 26 Code a non-blank character if percentiles from duration table are to be punched on card.

Col. 27 Code a non-blank character to suppress printing of high value table.

Col. 28 Code a non-blank character to suppress printing of low value table.

Col. 29 Machine-readable output of high and low value tables.

Code C if data is to be punched on cards.
Code T if data is to be written on magnetic device.

Col. 30 Code a non-blank character to request that log-Pearson statistics be computed.

Col. 31 Code a non-blank character if computed values from log-Pearson distribution are to be punched on cards.

Col. 32 Code a non-blank character if class limits for the duration table are to be read from card.

Col. 33-34 Beginning month of low value table if different from climatic year. Default value is the beginning of the climatic year which is April (04).

Col. 35-36 Ending month of low value table if different from climatic year. Default value is ending of the climatic year which is March (03). If low value summary is to be made on a single month for each year, columns 35-36 are left blank.

Col. 37-38 Beginning month of high value and duration table if different from water year. Default value is October (10). Column 27 must also be coded to obtain duration table.

Col. 39-40 Ending month of high value and duration table if different from water year. Default value is September (09). If high value and duration tables are to be made on a single month for each year, columns 39-40 are left blank.

Col. 41-78 Blank

Col. 79-80 Retrieval identifier (optional). The same two characters which appear on the M card for this retrieval.

■ IV.G.4.d. Coding the X Card (DURA)

This card is omitted if the duration table is not to be printed or if class limit values are to be computed by the program. The DURA card is shown in Figure 4 and is coded as follows:

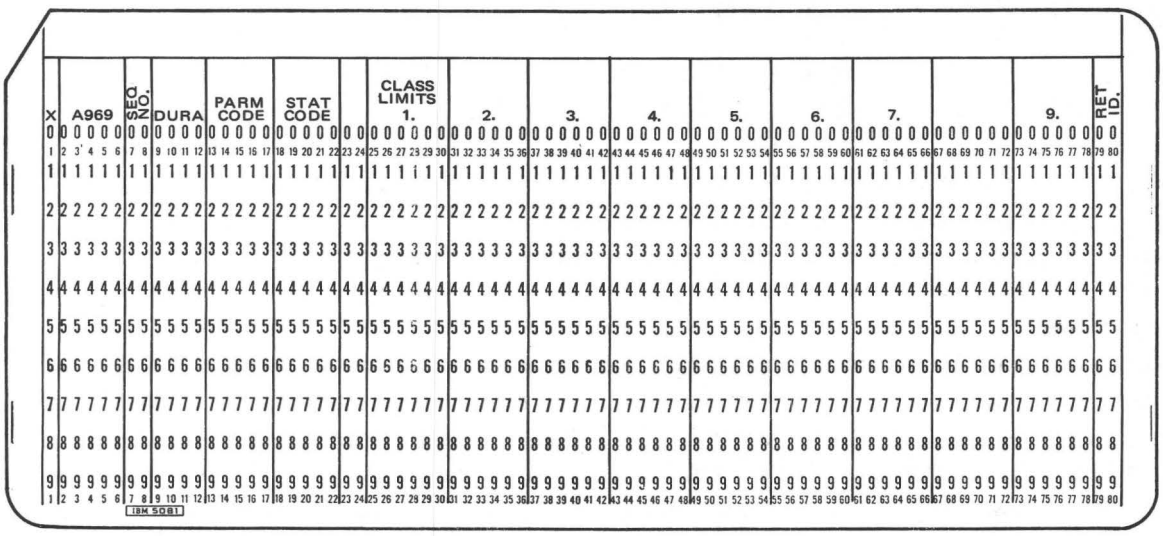


FIGURE 4. SAMPLE TYPE X CARD (DURA)

Col. 1 X

Col. 2-6 A969

Col. 7-8 Card sequence number

Col. 9-12 DURA

Col. 13-17 5-digit parameter code

Col. 18-22 5-digit statistic code

Col. 23-24 Blank

Col. 25-78 Nine class limit values, each occupying a 6-character field. Integer values are right justified in the field and no decimal point is punched. For all other values, the value and decimal point are punched right justified in the field (i.e., bbl.5). A maximum of 35 values may be entered (4 cards).

Col. 79-80 Retrieval identifier

IV.G.5. Low and High Value Sequence Summaries

IV.G.5.a. Low Value Table

The low value table is derived from daily values within a year based on ten selective periods of n consecutive days. These ten periods of n consecutive days and 1, 3, 7, 14, 30, 60, 90, 120, 183, and 365 days. The table contains the lowest n-day mean value for each period of consecutive days in each year. Printed immediately following each mean value is a number which gives the rank of this value according to magnitude in the period of years. The low value table is based on the climatic year beginning April 1 unless other beginning and ending months are specified. The same requirements exist for requesting dates for the low value table as for the duration table. The years may be complete or partial, and the partial year may be any number of months. The low value table will be made only if all days of the reqeusted year or partial year are present. An example of the low value table is shown in Table 3. Options concerning the low value table are coded on the MAIN card. As shown in Section IV.G.4., columns 1-22, 28, 29, and 33-36 of X Card (MAIN) are concerned with options for the low value table.

IV.G.5.b. High Value Table

The high value table is based on daily values for ten selective periods of n consecutive days, as in the computation

STATION NUMBER 13254500

LOWEST MEAN VALUE AND RANKING FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

DISCHARGE, IN CUBIC FEET PER SECOND
MEAN
LOST CREEK NR TAMARACK IDA

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1931	1.00 11	1.00 10	1.00 10	1.00 9	1.00 9	1.30 8	1.80 7	2.10 7	2.80 2	17.70 2
1932	1.00 12	1.00 11	1.00 11	1.00 10	1.00 10	2.80 12	2.90 10	2.90 8	5.30 6	14.70 1
1933	4.20 28	4.20 26	5.20 33	6.00 32	6.60 31	7.70 32	8.80 33	9.90 35	11.80 30	47.80 31
1934	0.00 1	0.00 1	0.00 1	0.00 1	0.00 1	5.10 23	9.00 34	9.00 32	10.40 26	34.20 14
1935	5.00 30	7.00 36	7.00 36	8.20 36	8.90 35	9.00 35	9.10 35	9.10 33	9.40 22	26.80 6
1936	0.00 2	0.00 2	0.00 2	0.00 2	0.00 2	0.00 1	0.00 1	0.60 3	9.10 20	25.90 5
1937	0.00 3	0.00 3	0.00 3	0.00 3	0.00 3	0.00 2	0.10 2	0.80 4	6.30 11	30.00 10
1938	1.00 13	1.00 12	1.00 12	1.10 13	1.60 13	2.70 11	4.10 15	5.20 17	9.80 23	21.00 3
1939	2.00 20	2.00 19	3.00 22	3.20 20	3.20 19	6.50 28	6.80 27	7.20 26	15.00 37	55.00 38
1940	1.00 14	1.00 13	1.00 13	1.00 11	1.20 12	1.90 9	2.60 8	2.90 9	6.00 9	28.90 8
1941	0.00 4	1.30 17	2.00 17	2.00 14	2.40 14	3.70 16	4.60 16	8.00 30	8.50 18	41.20 25
1942	2.00 21	2.00 20	2.60 21	2.80 18	2.90 16	3.00 14	3.40 13	3.50 12	12.60 33	35.80 16
1943	4.00 27	5.00 28	5.00 27	5.00 25	5.50 27	5.90 25	6.30 26	6.50 24	7.80 17	41.30 27
1944	2.00 22	6.00 35	6.00 34	6.30 33	7.00 32	7.40 31	7.50 30	7.50 28	11.80 31	51.50 32
1945	5.00 31	5.00 29	5.00 28	5.00 26	5.00 24	5.00 21	5.10 20	5.30 18	10.60 27	24.20 4
1946	5.00 32	5.00 30	5.10 31	5.60 30	5.90 28	6.00 26	6.10 25	6.30 23	6.30 10	37.80 18
1947	1.00 15	1.00 14	1.00 14	1.00 12	1.00 11	2.00 10	3.50 14	15.50 39	16.90 39	52.60 33
1948	5.00 33	5.00 31	5.00 29	5.00 27	5.00 25	5.00 22	5.10 21	5.30 19	5.40 7	33.80 13
1949	5.00 34	5.30 34	6.10 35	6.90 34	7.00 33	7.00 30	7.00 28	7.00 25	7.20 15	53.70 35
1950	2.00 23	2.00 21	2.00 18	2.20 15	3.50 20	4.60 17	4.90 17	5.10 16	10.10 25	47.60 30
1951	7.70 38	7.70 37	7.70 37	7.70 35	7.80 34	7.80 33	7.80 31	7.80 29	12.10 32	39.60 22
1952	7.40 37	8.50 38	8.80 38	8.90 37	9.00 36	9.00 36	9.20 36	9.40 34	9.90 24	39.00 21
1953	1.20 16	1.20 15	1.40 15	2.30 16	2.90 17	3.20 15	3.30 12	3.40 11	5.70 8	56.80 39
1954	3.40 25	3.40 23	3.40 23	6.00 31	6.00 29	6.00 27	6.00 24	6.00 21	9.00 19	47.40 29
1955	3.60 26	3.90 24	4.10 24	4.20 21	4.40 21	4.60 18	4.90 18	5.00 15	14.60 36	45.40 28
1956	5.00 35	5.10 33	5.10 32	5.20 29	5.40 26	5.40 24	5.50 22	5.50 20	9.30 21	32.60 12
1957	0.10 9	0.10 7	0.10 6	0.10 6	0.10 6	0.70 6	2.70 9	3.80 13	11.70 29	53.20 34
1958	0.00 5	0.00 4	0.00 4	0.00 4	0.00 4	0.00 3	0.50 5	1.40 5	3.80 4	41.20 26
1959	5.00 36	5.00 32	5.00 30	5.00 28	10.00 37	10.50 38	10.60 38	10.70 37	14.10 35	54.90 37
1960	0.10 6	0.10 5	0.10 5	0.10 5	0.10 5	0.10 4	0.10 3	0.10 1	0.10 1	30.00 11
1961	0.10 7	0.10 6	0.20 7	2.80 19	2.90 18	2.90 13	3.00 11	3.00 10	4.80 5	36.20 17
1962	1.20 17	1.20 16	1.70 16	4.70 23	6.30 30	6.90 29	7.10 29	7.30 27	7.60 16	40.60 24
1963	1.90 19	1.90 18	2.40 19	9.50 38	13.70 39	14.00 39	14.70 39	15.00 38	16.10 38	38.30 19
1964	4.60 29	4.60 27	4.70 26	4.80 24	4.90 23	4.90 19	4.90 19	4.90 14	6.60 13	34.50 15
1965	0.10 8	0.20 8	0.20 8	0.20 7	0.20 7	0.20 5	0.30 4	0.30 2	6.40 12	38.60 20
1966	1.30 18	4.20 25	4.30 25	4.40 22	4.50 22	4.90 20	5.80 23	6.20 22	6.80 14	54.80 36
1967	0.30 10	0.60 9	0.70 9	0.80 8	0.90 8	1.10 7	1.30 6	1.40 6	3.00 3	28.40 7
1968	2.30 24	2.30 22	2.40 20	2.50 17	2.50 15	8.00 34	8.20 32	8.30 31	11.60 28	40.30 23
1969	8.90 39	9.90 39	9.90 39	9.90 39	10.00 38	10.20 37	10.40 37	10.60 36	13.90 34	29.10 9

TABLE 3. LOW-VALUE TABLE

of low value tables with the exception that the 14-day period is changed to 15. The table contains the highest n-day mean value for each period of consecutive days in each year, and within each period of years the mean values are ranked according to magnitude. The rank value is printed immediately following each mean value.

All specifications concerning the period of record to be treated are the same as those for the duration table. The high value table is always computed on the same set of months and period of years as the duration table, while the low value table is computed on a different set of months but the same period of years. The high value table will be computed only if all days of the requested year or partial year are in the file. If a partial year is requested, the same number of months must be requested for the low and high value tables, although they may be a different set of months. An example of the high value table is shown in Table 4.

Options for the high value table are coded on the MAIN card. As shown in Section IV.G.4., columns 1-22, 27, 29, and 37-40 of X card (MAIN) are concerned with options for the high value table.

IV.G.5.c. Machine Readable Output

Data in the low and high value tables may be recorded on a magnetic device or punched on cards. Output will be written by columns from the table. A single column representing n consecutive-day mean values will comprise a logical record on a magnetic device. The values within the logical record will be in chronological order.

This form of output is optional and must be requested by a positive indication on the X card MAIN by coding a non-blank character in column 29. The option applies to all columns on both low and high value tables. The format of machine readable output is shown in Tables 5 and 6.

Each logical record is composed of a column from the high or low value table. Each record is identified by the station identification number and parameter and statistic codes from the Daily Values File. The second statistic code (output) identifies the data as to high or low value data, and also describes the number of days on which the mean value was computed. For data from the low value

STATION NUMBER 13254500

HIGHEST MEAN VALUE AND RANKING FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING SEPTEMBER 30
DISCHARGE, IN CUBIC FEET PER SECOND
MEAN
LOST CREEK NR TAMARACK IDA

YEAR	1	3	7	15	30	60	90	120	183	ANNUAL
1931	61.0 39	60.7 39	59.7 39	53.2 39	47.8 39	43.7 39	39.8 39	33.5 39	23.8 39	13.3 39
1932	484.0 4	471.0 4	439.0 4	388.0 4	313.0 4	183.0 8	127.0 9	111.0 8	83.6 10	44.6 12
1933	259.0 23	249.0 22	244.0 21	225.0 20	176.0 20	111.0 24	91.8 22	81.5 22	57.8 29	34.9 27
1934	147.0 33	140.0 34	129.0 35	114.0 35	84.0 35	57.6 36	49.4 36	46.3 37	44.1 35	27.3 35
1935	147.0 34	144.0 33	132.0 34	115.0 34	91.2 34	59.3 35	52.2 35	56.7 34	42.2 36	25.8 36
1936	212.0 25	210.0 25	175.0 26	150.0 27	123.0 30	85.0 29	65.6 31	63.1 31	53.9 31	31.7 32
1937	69.0 38	68.7 38	67.4 38	55.5 38	52.4 38	51.6 38	48.5 37	40.7 38	32.4 38	19.3 38
1938	444.0 5	413.0 6	390.0 6	365.0 6	317.0 3	235.0 2	162.0 2	124.0 4	94.9 5	52.4 4
1939	158.0 32	154.0 32	138.0 32	120.0 33	93.3 33	64.4 33	54.9 34	57.2 33	50.6 33	32.7 31
1940	322.0 15	303.0 17	251.0 20	212.0 21	197.0 17	138.0 17	100.0 19	86.8 18	75.4 15	40.5 17
1941	184.0 29	181.0 27	170.0 28	146.0 28	126.0 28	92.3 27	77.5 26	67.5 29	59.1 28	33.9 29
1942	318.0 16	308.0 16	287.0 16	257.0 16	171.0 21	142.0 16	102.0 17	85.4 20	74.8 16	43.7 14
1943	417.0 7	408.0 7	378.0 7	321.0 8	269.0 9	190.0 6	144.0 6	115.0 6	91.2 7	49.5 7
1944	83.0 37	81.3 37	79.3 37	72.3 37	70.0 37	60.2 34	48.4 38	46.4 36	38.0 37	24.9 37
1945	382.0 11	367.0 11	335.0 10	309.0 10	243.0 12	146.0 14	105.0 15	91.3 16	69.2 19	39.9 19
1946	350.0 12	343.0 12	317.0 13	305.0 11	280.0 7	181.0 10	126.0 10	107.0 10	82.4 11	44.2 13
1947	222.0 24	220.0 24	212.0 23	189.0 23	166.0 22	123.0 22	89.6 23	72.5 27	68.0 22	42.7 15
1948	441.0 6	436.0 5	428.0 5	396.0 3	305.0 6	230.0 3	161.0 3	136.0 2	100.0 3	52.7 3
1949	340.0 14	326.0 14	302.0 15	291.0 13	278.0 8	174.0 11	119.0 11	99.5 12	85.3 9	46.4 8
1950	301.0 18	294.0 18	270.0 18	243.0 17	196.0 18	129.0 20	97.8 20	86.8 19	67.2 24	38.5 23
1951	264.0 21	250.0 21	211.0 24	197.0 22	188.0 19	123.0 21	87.9 24	81.3 23	68.2 21	40.1 18
1952	560.0 1	550.0 1	496.0 1	451.0 1	396.0 1	254.0 1	180.0 1	145.0 1	108.0 1	58.8 1
1953	401.0 9	382.0 9	319.0 12	266.0 14	237.0 13	182.0 9	131.0 8	111.0 9	85.6 8	45.7 10
1954	272.0 20	267.0 20	257.0 19	237.0 19	215.0 15	147.0 13	110.0 13	93.0 14	76.0 14	42.6 16
1955	260.0 22	247.0 23	228.0 22	175.0 24	117.0 31	76.8 32	72.5 29	73.6 26	55.9 30	35.3 26
1956	388.0 10	381.0 10	355.0 9	329.0 7	262.0 10	190.0 7	138.0 7	115.0 7	94.6 6	51.9 5
1957	348.0 13	339.0 13	325.0 11	312.0 9	261.0 11	160.0 12	113.0 12	100.0 11	78.5 12	45.1 11
1958	497.0 3	480.0 3	441.0 3	384.0 5	306.0 5	205.0 5	148.0 5	124.0 5	95.6 4	49.8 6
1959	172.0 31	169.0 31	156.0 31	139.0 29	128.0 27	80.5 30	74.7 27	75.0 25	60.3 27	37.1 24
1960	173.0 30	170.0 30	161.0 30	138.0 30	125.0 29	109.0 25	81.4 25	77.4 24	67.5 23	33.8 30
1961	185.0 27	181.0 28	172.0 27	164.0 25	137.0 25	117.0 23	91.9 21	85.2 21	73.2 17	39.0 21
1962	191.0 26	191.0 26	181.0 25	161.0 26	138.0 24	91.4 28	74.1 28	70.7 28	60.5 26	34.2 28
1963	138.0 35	137.0 35	133.0 33	125.0 32	103.0 32	94.6 26	72.1 30	66.1 30	62.5 25	39.3 20
1964	284.0 19	281.0 19	274.0 17	238.0 18	165.0 23	133.0 19	101.0 18	88.7 17	70.9 18	38.8 22
1965	517.0 2	495.0 2	451.0 2	431.0 2	323.0 2	219.0 4	160.0 4	131.0 3	103.0 2	54.5 2
1966	184.0 28	180.0 29	166.0 29	136.0 31	129.0 26	77.3 31	61.4 32	62.4 32	53.8 32	30.3 33
1967	416.0 8	394.0 8	366.0 8	302.0 12	208.0 16	136.0 18	107.0 14	95.9 13	69.1 20	36.1 25
1968	109.0 36	107.0 36	103.0 36	99.0 36	76.4 36	56.2 37	57.7 33	55.3 35	44.4 34	28.0 34
1969	314.0 17	314.0 15	303.0 14	265.0 15	221.0 14	142.0 15	103.0 16	91.6 15	77.8 13	45.9 9

TABLE 4. HIGH-VALUE TABLE

Byte	Item	Data Format
1-15	Station identification	Character(15)
16-20	Parameter code	Character(5)
21-25	Statistic code (input)	Character(5)
26-30	Statistic code (output)	Character(5)
31-32	Begin month	Character(2)
33-34	End month	Character(2)
35-36	Blank	Character(2)
37-40	Number of years	Fixed Binary(31)
41-*	Data Array	
	Year	Character(4)
	Value	Character(8)

TABLE 5. RECORD FORMAT FOR MAGNETIC DEVICE OUTPUT FOR LOW AND HIGH VALUES

Type 2 Card

Col. 1	2
Col. 2-16	Station identifier
Col. 17-22	Cross section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code
Col. 39-43	Output statistic code
Col. 44-47	Begin year of period being punched.
Col. 48-50	Blank

Type 3 Card

Col. 1	3
Col. 2-16	Station identification
Col. 17	2
Col. 18-22	Blank
Col. 23-24	Sequence number
Col. 25-31	Eight 7-character
Col. 32-38	Data items
Col. 39-45	
Col. 46-52	
Col. 53-59	
Col. 60-66	
Col. 67-73	
Col. 74-80	

TABLE 6. FORMAT OF CARD OUTPUT FOR LOW AND HIGH VALUES

table, the statistic code will be 2000 plus the n-day, i.e., 7-day low value would have statistic code 2007. For high value data, the code will be 3000 plus the n-day, i.e., the 15-day high would have statistic code 3015. The begin and end months contained in the record describe the year, complete or partial, on which the computations are based. Following is the number of years processed which is the number of data items contained in the array of the record. The last item in the record is a variable length array. Each member of the array contains a year number and the value corresponding to that year. The records are written in variable blocked format.

Table 6 is the format for data punched on cards. One type 2 card is generated for each column of data on the high or low value table. A break in years for the period processed will cause a new type 2 card to be punched with the new beginning year followed by the remaining data cards for the column. The type 2 card contains station identification, cross section location, depth, parameter code, input and output statistic codes, and begin year. The output statistic code describes the data that follows on type 3 cards. It is the same statistic code as the output statistic code written in the magnetic device format. The begin year is the first year of the period being processed. Figure 5 is a sample output type 2 card to identify low and high values. The type 2 card is followed by as many type 3 cards as are necessary to contain the data items. Each type 3 card contains a station identification number, a code 2 to identify the card as being high or low value data, and 8 data values, one value for each consecutive year processed. Figure 6 is a sample type 3 card for low and high values.

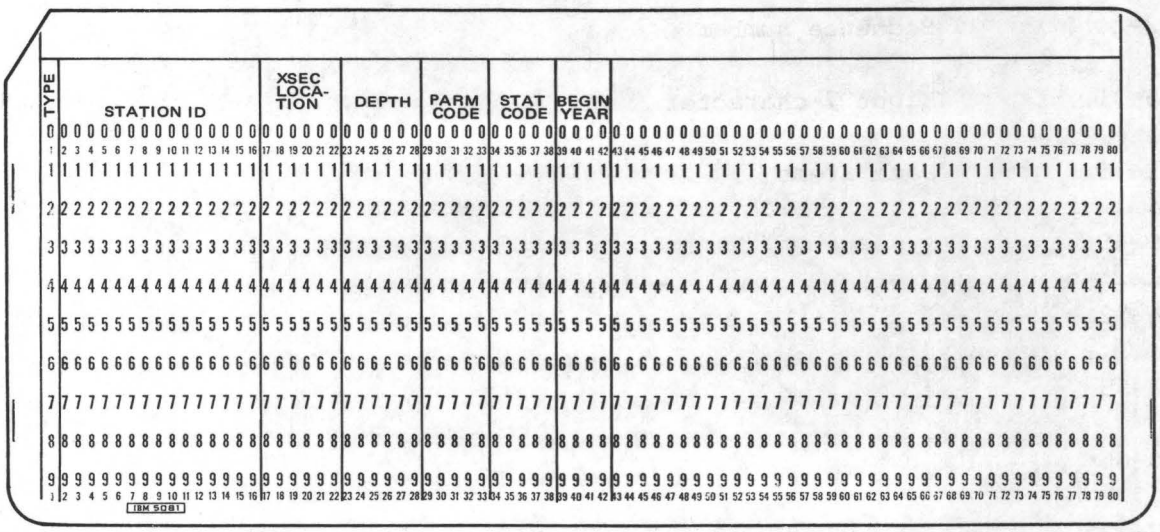


FIGURE 5. OUTPUT TYPE 2 CARD TO IDENTIFY LOW AND HIGH VALUES

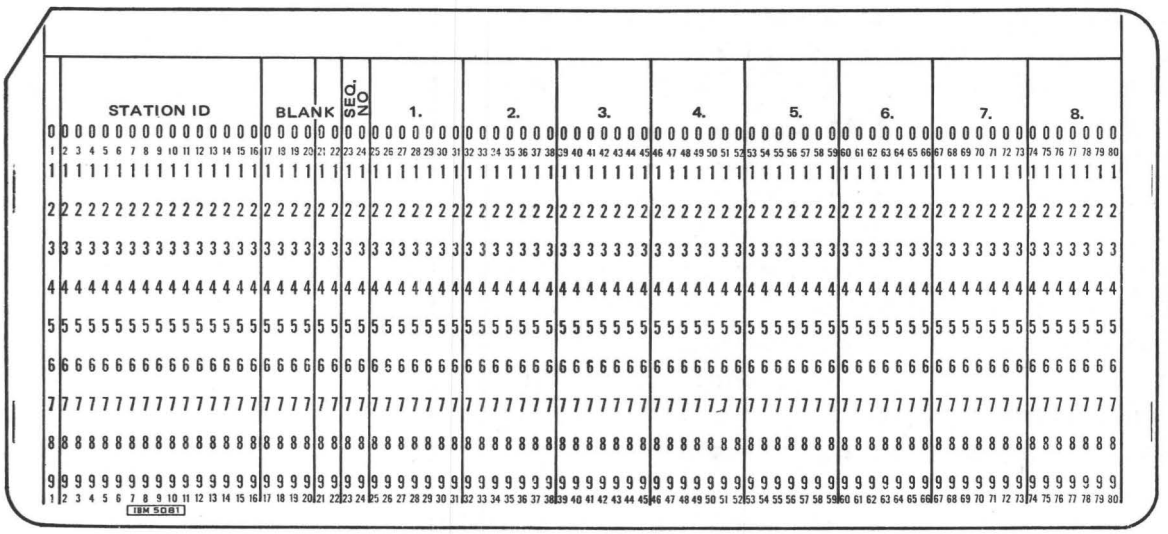


FIGURE 6. DATA CARD TYPE 3 CONTAINING LOW AND HIGH VALUES

IV.G.6. Log-Pearson Frequency Distribution

IV.G.6.a. Log-Pearson Table

Log-Pearson type III statistics may be computed from the mean parameter values in the low and high value tables. The log-Pearson type III program was adapted from a program written by G.I. Selner and Ivan C. James. All positive non-zero values for a specific period (a set of consecutive days, i.e., a column of values) comprise a set of data to be fitted to the log-Pearson distribution. Negative values will be treated as zero values. The data set (column) must contain at least three years of data, i.e., three values. If fewer than ten years are available, a warning message will be printed. The parameter values for each set of days are treated separately so that there may be a maximum of 20 data sets (columns) per station, ten low and ten high value sets.

Several standard statistics and those essential to fitting the distribution are computed for each set of data. These

statistics are the mean, variance, standard deviation, and coefficient of variation. Each of the preceding are computed from base 10 logarithm of the values. If the absolute value of skewness is greater than 3, or if the variance is negative or zero, no further calculations will be made for that data set; otherwise the mean, standard deviation, and coefficient of skewness in logarithms along with the coordinates of the log-Pearson type III distribution table are used to evaluate theoretical values corresponding to selected exceedence probabilities and recurrence intervals. For low value data non-exceedence probabilities and corresponding recurrent intervals are printed. If zero values are in the data set, adjusted parameter values, which will include the effect of zero values, will be computed.

Printout of these statistics consists of the number of non-zero values in the data set, a list of these values, the computed statistics of parameter values and of logarithms, a list of eleven exceedence or non-exceedence probabilities with corresponding recurrence intervals and theoretical values, or if zero values are present, the adjusted parameter values.

All, none, or any combination of data sets may be selected from the high and low value tables for log-Pearson statistics. The log-Pearson table is optional and must be specifically requested upon retrieval. An example of the log-Pearson table is shown in Table 7.

IV.G.6.b. Log-Pearson Card Output

If theoretical parameter values are to be punched on cards, the format shown in Table 8 is used. This option punches on cards theoretical values for various recurrence intervals for the 1-day, 3-day, 7-day, 14-day, 30-day, and 90-day low mean values, and the 1-day, 3-day, 7-day, 15-day, and 30-day high mean values. Theoretical values for various combinations for the 2-year, 5-year, 10-year, 20-year, 25-year, 50-year, and 100-year recurrence intervals are punched for each n-day low and high value data set listed above. Figure 7 is a sample type 2 card identifying log-Pearson data, and Figure 8 is a sample type 3 data card for log-Pearson data.

For the 1-day and 3-day low values, theoretical parameter values are punched that correspond to the 2-year, 10-year, and 20-year recurrence intervals. For the 7-day low value data, the recurrence

N = 39 STATION 13254500

1931-1969, 12 MON PERIOD ENDING SEPTEMBER 30

365 DAY HIGH VALUE

INPUT DATA (ZERO VALUES OMITTED)

13.300	44.600	34.900	27.300	25.800	31.700	19.300	52.400	32.700	40.500
33.900	43.700	49.500	24.900	39.900	44.200	42.700	52.700	46.400	38.500
40.100	58.800	45.700	42.600	35.300	51.900	45.100	49.800	37.100	33.800
39.000	34.200	39.300	38.800	54.500	30.300	36.100	28.000	45.900	

MEAN = 39.108

VARIANCE = 96.196

STANDARD DEVIATION = 9.808

SKEWNESS = -0.378

STANDARD ERROR OF SKEWNESS = 0.378

SERIAL CORRELATION COEFFICIENT = 0.013

COEFFICIENT OF VARIATION = 0.251

MEAN LOGS = 1.576

VARIANCE LOGS = 0.016

STANDARD DEVIATION LOGS = 0.127

SKEWNESS LOGS = -1.436

STANDARD ERROR OF SKEWNESS LOGS = 0.378

SERIAL CORRELATION COEFFICIENT LOGS = -0.002

COEFFICIENT OF VARIATION LOGS = 0.081

EXCEEDENCE PROB	RECURRENCE INTERVAL	PARAMETER VALUE
0.9900	1.01	14.354
0.9500	1.05	21.320
0.9000	1.11	25.476
0.8000	1.25	30.694
0.5000	2.00	40.321
0.2000	5.00	48.064
0.1000	10.00	51.018
0.0400	25.00	53.319
0.0200	50.00	54.386
0.0100	100.00	55.107
0.0050	200.00	55.599

TABLE 7. LOG-PEARSON TABLE

Col. 1	2
Col. 2-16	Station identification
Col. 17-22	Cross section location
Col. 23-28	Depth
Col. 29-33	Parameter code
Col. 34-38	Statistic code
Col. 39-43	Output statistic code
Col. 44-47	Begin year of period
Col. 48-51	End year of period
Col. 52-53	Begin month of period
Col. 54-55	End month of period
Col. 56-80	Blank

Type 3 Card

Col. 1	3
Col. 2-16	Station identification
Col. 17	3
Col. 18-24	Blank
Col. 25-31	Value for 2 year recurrence interval
Col. 32-38	Value for 5 year recurrence interval
Col. 39-45	Value for 10 year recurrence interval
Col. 46-52	Value for 20 year recurrence interval
Col. 53-59	Value for 25 year recurrence interval
Col. 60-66	Value for 50 year recurrence interval
Col. 67-73	Value for 100 year recurrence interval

TABLE 8. FORMAT OF LOG-PEARSON STATISTICS ON CARD

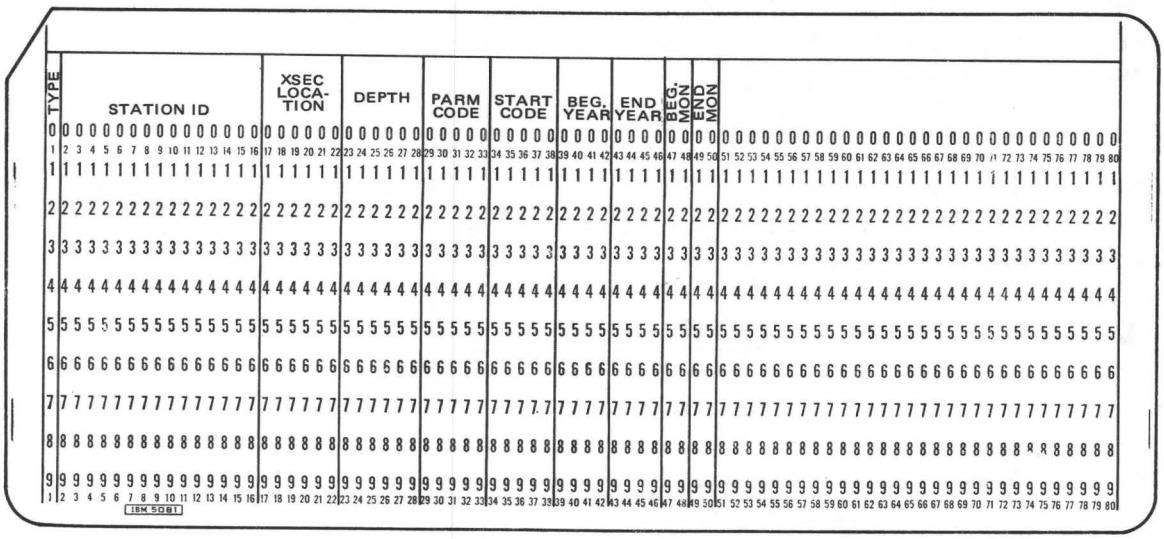


FIGURE 7. OUTPUT TYPE 2 CARD TO IDENTIFY LOG-PEARSON DATA

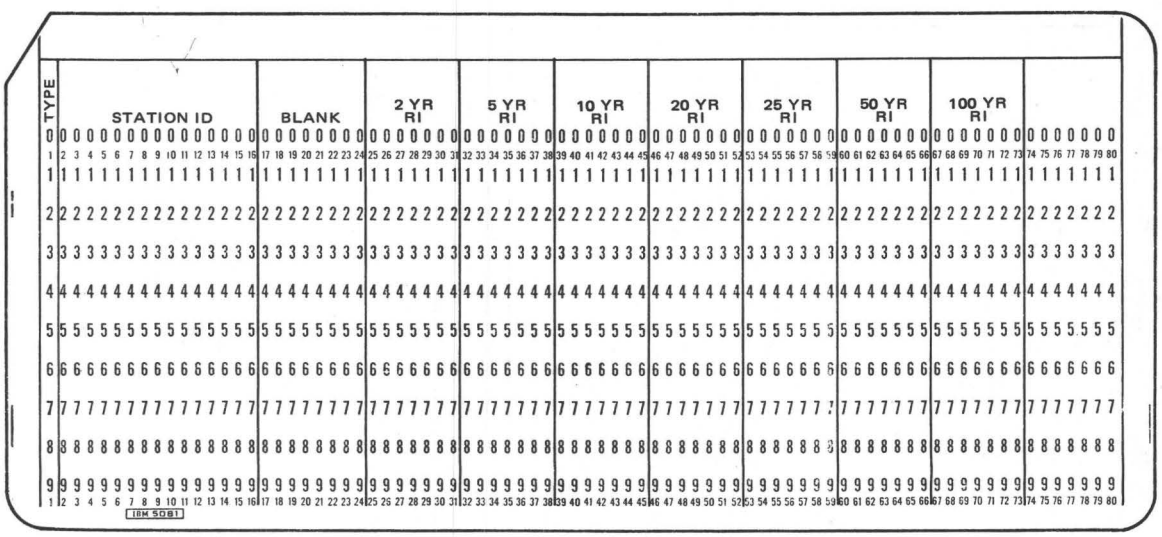


FIGURE 8. DATA CARD TYPE 3 FOR LOG-PEARSON DATA

intervals used are 2 years, 5 years, 10 years, and 20 years. For the 14-day, 30-day, and the 90-day low values, the recurrence intervals used are 2-years, 10-years, and 20-years. For the 1-day high value data, the recurrence intervals used are 2 years, 5 years, 10 years, 20 years, 25 years, and 50 years. For the 3-day, 7-day, and 15-day high value data, the recurrence intervals are the same as for the 1-day high but with the 100-year interval added. For the 30-day high value, the 2-year, 10-year, 25-year, and 50-year recurrence intervals are used.

One type 2 card is punched for each column of data from the low or high value table for which log-Pearson statistics were requested. Following the type 2 card will be one type 3 card with theoretical parameter values.

■ IV.G.6.c. Coding of X Card (LGPR)

Options concerning the log-Pearson curve fitting are coded on the MAIN card and the LGPR card. The MAIN card is described in Section IV.G.4. and only columns 1-22, 30, and 31 of this card are used to request the statistics. The card (LGPR) to request which columns of data from the high and low value tables are to be fitted is coded as shown below. The LGPR card is required only if data are to be fitted to the log-Pearson distribution. See Figure 9 for sample LGPR card.

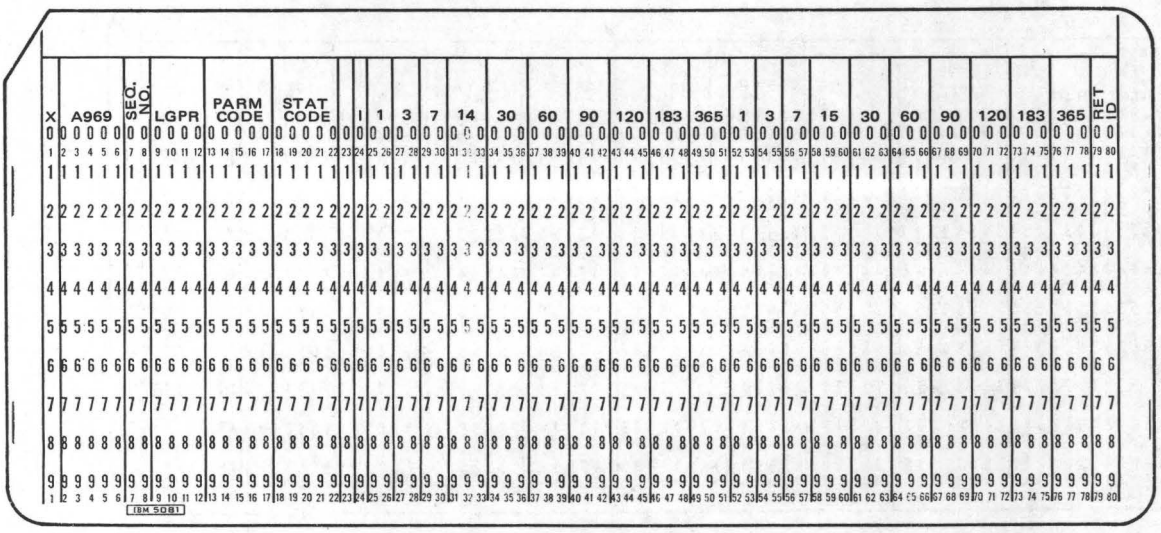


FIGURE 9. SAMPLE TYPE X CARD (LGPR)

Col. 1	X
Col. 2-6	A969
Col. 7-8	Card sequence number
Col. 9-12	LGPR
Col. 13-17	5-digit parameter code
Col. 18-22	5-digit statistic code
Col. 23	A non-blank character to request that all low-value data be plotted
Col. 24	A non-blank character to request that all high-value data be plotted
Col. 25-78	Twenty sets of from one to three-digit numbers that identify a column on the low or high value table. The number is punched if that particular set of data is requested for a log-Pearson fit. The field is left blank if that data set is not to have log-Pearson statistics computed.

The numbers to designate the low value data data sets are 1, 3, 7, 14, 30, 60, 90, 120, 183, and 365 and are coded in columns 25-51. The numbers are the same for the high value data sets except that 14 is changed to 15 in the series of numbers and are coded in columns 52-78. If the value does not require the entire field it may be coded left or right justified.

For low value data sets:

25-26	b1
27-28	b3
29-30	b7
31-33	b14
34-36	b30
37-39	b60
40-42	b90
43-45	120
46-48	183
49-51	365

For high value data sets:

52-53	b1
54-55	b3
56-57	b7
58-60	b15
61-63	b30
64-66	b60
67-69	b90
70-72	120
73-75	183
76-78	365

Col. 79-80 Retrieval identifier

IV.G.6.d. Log-Pearson Plot

The plot is a magnitude-frequency graph in which the parameter value is the ordinate and an exceedence or non-exceedence probability is the abscissa. Actual parameter values are plotted against their corresponding computed recurrence intervals. Plotted on the same graph are the theoretical parameter values versus exceedence or non-exceedence probabilities. The plot consists of 3-inch log cycles for the vertical axis covering the magnitude of both theoretical and actual values; and probabilities of .995 to .005, also expressed as recurrence intervals, as the horizontal axis. Input data values and twenty-one theoretical values are plotted. The plots are produced on the line printer and contain one symbol in each space measuring 1/6 by 1/10 inches.

The log-Pearson table may be requested without the plot, but if the plot is requested, statistics also will be printed. The option to plot applies to all requested data sets of either high or low values. Columns 1-22, 23, or 24, and at least one field in columns 25-78 of the LGPR card must be coded to obtain the plots. Table 9 is an example of a log-Pearson plot.

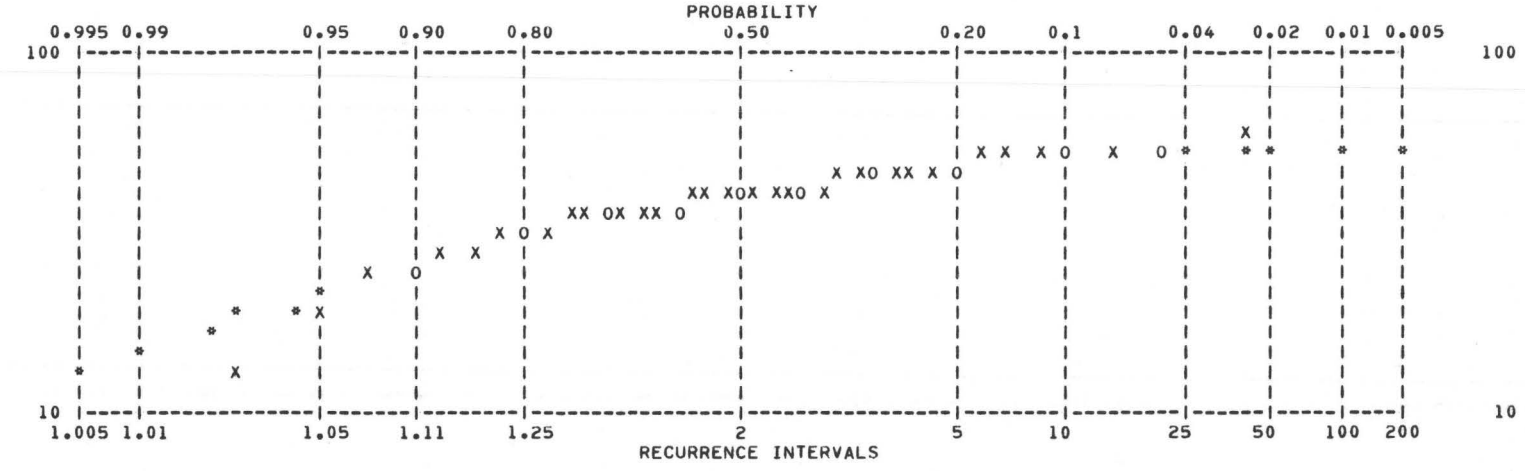
IV.G.7. Cataloged JCL Procedure

A cataloged procedure containing the required job control language (JCL) to obtain various statistics from data stored in the Daily Values File is in a system library. The procedure name is DVSTAT

N = 39 STATION 13254500

1931-1969, 12 MON PERIOD ENDING SEPTEMBER 30

365 DAY HIGH VALUE



THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT
X - AN INPUT DATA VALUE
* - A CALCULATED VALUE
O - A CALCULATED VALUE AND ONE DATA VALUE AT SAME POSITION
2 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION
3 - THREE INPUT DATA VALUES PLOTTED AT SAME POSITION
A - A CALCULATED VALUE AND TWO DATA VALUES AT SAME POSITION
B - A CALCULATED VALUE AND THREE DATA VALUES AT SAME POSITION

TABLE 9. LOG-PEARSON PLOT

and must be executed immediately following procedure DVRETR described in Section IV.B. All retrieval specifications, including the X cards for program A969, are entered through procedure DVRETR. Procedure DVSTAT includes program A969 which computes a high value summary, low value summary and duration table, and program A193 which computes the log-Pearson type III statistics. A card setup is shown below to retrieve records from the current disk file and execute procedure DVSTAT.

```
Col. 1                  Col. 12

•                       •
//xxxxxxxx              JOB  (----)
/*PROCLIB               WRD.PROCLIB
//  EXEC                DVRETR,AGENCY=agency
//HRD.SYSIN             DD *
                        •
Retrieval cards for program G490 including X cards for A969
                        •
/*
//  EXEC                DVSTAT,NAME1=name,VOL1=volume,UNIT1=unit
/*
//
```

For execution of DVSTAT the parameters NAME1, VOL1, and UNIT1, are the data set name, volume serial number, and the device type respectively and are to be coded only if magnetic device output is requested. If magnetic device output is not requested the JCL statement is coded simply:

```
//  EXEC  DVSTAT
```

The execution time coded in the procedure for program A969 (3 minutes) and program A193 (2 minutes) is sufficient to process 25 stations each with 20 years of data. If the execution time coded is not sufficient, the time may be increased for a particular job for program A969 by coding the EXEC card as follows:

```
//  EXEC  DVSTAT,TIME1=time
```

where time is the desired execution time in minutes. To increase the execution time for program A193, code TIME2=time on the EXEC card.

IV.G.8. Diagnostic Messages

DS001 INVALID MONTH NUMBER REQUESTED ON X CARD MAIN FOR RETRIEVAL NUMBER xx.

DS002 MISSING X CARD DURA IN RETRIEVAL NUMBER xx.

DS003 NUMBER OF MONTHS REQUESTED FOR LOW VALUE SEQUENCE SUMMARY DOES NOT MATCH NUMBER REQUESTED FOR HIGH VALUE SEQUENCE SUMMARY IN RETRIEVAL NUMBER xx.

DS004 MISSING X CARD LGPR IN RETRIEVAL NUMBER xx.

DS005 ERROR OCCURRED IN COMPUTATION OF CLASS LIMIT VALUES FOR RETRIEVAL xx. (This error occurs when values passed to program A969 from G490 are not usable for producing a set of numbers to be used as class limits).

DS006 NO HIGH OR LOW VALUE PERIOD IN DATA SET FOR RETRIEVAL NUMBER xx.

This message occurs when no data exists in the file for the specific partial or complete period for each year requested.

DS007 LOG-PEARSON STATISTICS REQUESTED FOR PERIOD WHICH EXCEEDS LOW OR HIGH VALUE PERIOD FOR RETRIEVAL NUMBER xx.

This message occurs when log-Pearson statistics have been requested for one of the data sets which contain more days than the partial year requested.

DS008 ABSOLUTE VALUE OF SKEWNESS IN LOG-PEARSON STATISTICS IS GREATER THAN 3.0 FOR RETRIEVAL NUMBER xx.

DS009 ERROR IN INTERPOLATION SUBROUTINES FOR LOG-PEARSON STATISTICS FOR RETRIEVAL NUMBER xx.

DS010 VARIANCE IS NEGATIVE OR EQUAL TO ZERO IN LOG-PEARSON STATISTICS FOR RETRIEVAL NUMBER xx.

DS011 MORE THAN 35 CLASS LIMITS ENTERED ON CARDS FOR STATION NUMBER.

DS012 THE FOLLOWING YEARS HAVE BEEN OMITTED FROM THE HIGH AND LOW VALUE SEQUENCE SUMMARIES BECAUSE THEY ARE MISSING AT LEAST ONE DAILY VALUE FOR RETRIEVAL xx.

DS013 WARNING--LESS THAN TEN INPUT DATA ITEMS HAVE BEEN USED FOR COMPUTATION OF LOG-PEARSON STATISTICS FOR xxx HIGH OR LOW VALUE DATA SET FOR RETRIEVAL NUMBER xx.

The first eleven diagnostic messages will cause termination of the program. No further calculations will be attempted for that retrieval.

The messages numbered DS012 - DS013 are descriptive or warning messages.

IV.G.9. References

Searcy, J.K.,·1959, Flow-Duration Curves: U.S. Geological Survey Water Supply Paper 1542-A, 33 p.

Water Resources Council, Hydrology Committee, 1967, A Uniform Technique for Determining Flood Flow Frequencies: Bulletin No. 15.

WATSTORE APPENDIX

Overview

This appendix contains lists of standard codes used for the identification of water data stored in the files of the National Water Data Storage and Retrieval System (WATSTORE) of the U.S. Geological Survey. Among the various types of data stored are: (1) Daily values, either measured or computed from continuous observations, for items such as stream discharge, specific conductance, temperature, suspended-sediment concentrations, suspended-sediment discharge, and ground-water levels; (2) physical, hydrologic, and geologic data about sites where ground water is, or can be, withdrawn from the aquifer, or sites where potential aquifers are exposed; (3) multiparameter data, such as results of physical, chemical, radiochemical, and biological determinations or analyses of either a single or composite water sample; (4) annual maximum (peak) streamflow (discharge) and gage height (stage) values at surface-water sites; and (5) instantaneous values for items continuously measured at predetermined time intervals, such as gage heights recorded at hourly intervals on a digital recorder.

Standard codes are used to identify the State and county in which the data collection point is located, the agency that collected the data, the frequency of measurement or statistical reduction of the data stored in the file, and the actual parameter stored in the data file.

If codes other than those listed in this appendix are needed, a written request must be submitted to: Chief, Automatic Data Section, WRD, U.S. Geological Survey, 437 National Center, Reston, Virginia, 22092.

An explanation of each code follows.

Agency codes (Appendix A) represent recognized members of WATSTORE, and are assigned at the time an agency's request to use WATSTORE is approved, or when data is furnished by an agency to be entered into WATSTORE Files.

State codes (Appendix B) identify the State in which the data are collected. All State codes conform to the Federal Information Processing Standards (FIPS) issued by the National Bureau of Standards in 1970.

County codes (Appendix C) identify the count in which the data are collected, and are also standard FIPS codes.

Parameter codes (Appendix D) uniquely identify each parameter placed into the data files. These codes are assigned by the Environmental Protection Agency, and are used to identify data exchanged among agencies.

Statistic codes (Appendix E) identify each set of daily or instantaneous data placed into the data files as to frequency of measurement or statistical reduction of the data. Examples of this code are maximum, minimum, and mean values for data stored.

Aquifer name and geologic unit codes (Appendix F), used for processing ground-water data, are based on the stratigraphic coding system proposed by the American Association of Petroleum Geologists.

Automated updated lists of agency codes (Appendix A) and parameter codes (Appendix D) may be obtained by executing cataloged procedures described on the introductory pages of those appendixes.

APPENDIX A

AGENCY CODES

APPENDIX A
AGENCY CODES

A list of agency codes for authorized members of WATSTORE may be obtained by executing the procedure below.[1] Agency codes are assigned at the time an agency's request to use WATSTORE is approved. Additional information on requesting authorization to use WATSTORE and the assignment of agency codes is contained in volume 1, chapter I, section A.1. As new members are approved, this computerized listing is updated and is available to all users of WATSTORE.

Sample Agency Codes

Federal Government Agencies	Agency Code
U.S. Geological Survey	USGS
State and Local Government Agencies	
Kentucky Dept. of Natural Resources	KY001

A procedure is available to allow users to print all or a portion of the current WATSTORE agency codes. Several examples of the use of this procedure are given below.

```
Col. 1     Col. 12
●          ●
//xxxxxxxx JOB (----)
/*PROCLIB  WRD.PROCLIB
//  EXEC  LAGENCY
//  EXEC  LAGENCY,GROUP=US
//  EXEC  LAGENCY,GROUP=KY
```

This job would produce three listings of agency codes. The first EXEC card causes all WATSTORE agency codes to be listed. The second EXEC card produces a list of all agency codes that are related to Federal agencies.

[1] A more complete listing of organizations that have water data is contained in the NAWDEX publication, "Identification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey," by Melvin D. Edwards and Margery O. Drilleau, U.S. Geological Survey Open-File Report 78-398.

The third EXEC card requests a list of all agency codes that have been assigned to the State of Kentucky. A listing of the agency codes assigned to any given State may be requested by setting the GROUP symbolic JCL parameter equal to the two-character FIPS alphabetic State code.

APPENDIX B

STATE CODES

APPENDIX B

STATE CODES

This appendix has been divided into two sections in order to differentiate the codes contained in Federal Information Processing Standards (FIPS) Publication 5-1 dated June 15, 1970, and the temporary codes assigned by WATSTORE.

1. The following codes are contained in FIPS Publication 5-1, "States and Outlying Areas of the United States."

STATES	CODE	STATES	CODE
ALABAMA	01	MISSOURI	29
ALASKA	02	MONTANA	30
ARIZONA	04	NEBRASKA	31
ARKANSAS	05	NEVADA	32
CALIFORNIA	06	NEW HAMPSHIRE	33
COLORADO	08	NEW JERSEY	34
CONNECTICUT	09	NEW MEXICO	35
DELAWARE	10	NEW YORK	36
DISTRICT OF COLUMBIA	11	NORTH CAROLINA	37
FLORIDA	12	NORTH DAKOTA	38
GEORGIA	13	OHIO	39
HAWAII	15	OKLAHOMA	40
IDAHO	16	OREGON	41
ILLINOIS	17	PENNSYLVANIA	42
INDIANA	18	RHODE ISLAND	44
IOWA	19	SOUTH CAROLINA	45
KANSAS	20	SOUTH DAKOTA	46
KENTUCKY	21	TENNESSEE	47
LOUISIANA	22	TEXAS	48
MAINE	23	UTAH	49
MARYLAND	24	VERMONT	50
MASSACHUSETTS	25	VIRGINIA	51
MICHIGAN	26	WASHINGTON	53
MINNESOTA	27	WEST VIRGINIA	54
MISSISSIPPI	28	WISCONSIN	55
		WYOMING	56

CODES FOR OUTLYING AREAS OF THE UNITED STATES

AREA	CODE	AREA	CODE
AMERICAN SAMOA	60	SWAN ISLANDS	74
CANAL ZONE	61	TRUST TERRITORIES OF THE PACIFIC ISLANDS	75
CANTON AND ENDERBURY ISLANDS	62	U.S. MISCELLANEOUS CARIBBEAN ISLANDS	76
GUAM	66	U.S. MISCELLANEOUS PACIFIC ISLANDS	77
JOHNSTON ATOLL	67	VIRGIN ISLANDS	78
MIDWAY ISLANDS	71	WAKE ISLAND	79
PUERTO RICO	72		
RYUKYU ISLANDS, SOUTHERN	73		

2. The following codes have been assigned by WATSTORE for use in identifying data that is stored in the WATSTORE computer files. Additional codes may be requested by members as required.

STATES	CODE
MEXICO	80
TAMAULIPAS	81
NUEVO LEON	82
COAHUILA	83
CHIHUAHUA	84
SONORA	85
BAJA CALIFORNIA NORTE	86
CANADA	
NEW BRUNSWICK	90
QUEBEC	91
ONTARIO	92
MANITOBA	93
SASKATCHEWAN	94
ALBERTA	95
BRITISH COLUMBIA	96
YUKON	97

APPENDIX C

COUNTY CODES

APPENDIX C

COUNTY CODES

The county codes presented in this appendix appear in the Federal Information Processing Standards Publication (FIPS PUB) 6-2, Counties and County Equivalents to the States of the United States.

	Alabama
	County
001	Autauga
003	Baldwin
005	Barbour
007	Bibb
009	Blount
011	Bullock
013	Butler
015	Calhoun
017	Chambers
019	Cherokee
021	Chilton
023	Choctaw
025	Clarke
027	Clay
029	Cleburne
031	Coffee
033	Colbert
035	Conecuh
037	Coosa
039	Covington
041	Crenshaw
043	Cullman
045	Dale
047	Dallas
049	De Kalb
051	Elmore
053	Escambia
055	Etowah
057	Fayette
059	Franklin
061	Geneva
063	Greene
065	Hale
067	Henry
069	Houston
071	Jackson
073	Jefferson
075	Lamar
077	Lauderdale
079	Lawrence
081	Lee
083	Limestone
085	Lowndes
087	Macon
089	Madison
091	Marengo
093	Marion
095	Marshall
097	Mobile
099	Monroe
101	Montgomery
103	Morgan
105	Perry
107	Pickens
109	Pike
111	Randolph
113	Russell
115	St. Clair
117	Shelby
119	Sumter
121	Talladega
123	Tallapoosa

	Con.
125	Tuscaloosa
127	Walker
129	Washington
131	Wilcox
133	Winston
	Arkansas
	County
001	Arkansas
003	Ashley
005	Baxter
007	Benton
009	Boone
011	Bradley
013	Calhoun
015	Carroll
017	Chicot
019	Clark
021	Clay
023	Cleburne
025	Cleveland
027	Columbia
029	Conway
031	Craighead
033	Crawford
035	Crittenden
037	Cross
039	Dallas
041	Desha
043	Drew
045	Faulkner
047	Franklin
049	Fulton
051	Garland
053	Grant
055	Greene
057	Hempstead
059	Hot Spring
061	Howard
063	Independence
065	Izard
067	Jackson
069	Jefferson
071	Johnson
073	Lafayette
075	Lawrence
077	Lee
079	Lincoln
081	Little River
083	Logan
085	Lonoke
087	Madison
089	Marion
091	Miller
093	Mississippi
095	Monroe
097	Montgomery
099	Nevada
101	Newton
103	Ouachita
105	Perry
107	Phillips
109	Pike
111	Poinsett
113	Polk

	Con.
115	Pope
117	Prairie
119	Pulaski
121	Randolph
123	St. Francis
125	Saline
127	Scott
129	Searcy
131	Sebastian
133	Sevier
135	Sharp
137	Stone
139	Union
141	Van Buren
143	Washington
145	White
147	Woodruff
149	Yell
	Arizona
	County
001	Apache
003	Cochise
005	Coconino
007	Gila
009	Graham
011	Greenlee
013	Maricopa
015	Mohave
017	Navajo
019	Pima
021	Pinal
023	Santa Cruz
025	Yavapai
027	Yuma
	California
	County
001	Alameda
003	Alpine
005	Amador
007	Butte
009	Calaveras
011	Colusa
013	Contra Costa
015	Del Norte
017	El Dorado
019	Fresno
021	Glenn
023	Humboldt
025	Imperial
027	Inyo
029	Kern
031	Kings
033	Lake
035	Lassen
037	Los Angeles
039	Madera
041	Marin
043	Mariposa
045	Mendocino
047	Merced
049	Modoc
051	Mono
053	Monterey

	Con.
055	Napa
057	Nevada
059	Orange
061	Placer
063	Plumas
065	Riverside
067	Sacramento
069	San Benito
071	San Bernardino
073	San Diego
075	San Francisco
077	San Joaquin
079	San Luis Obispo
081	San Mateo
083	Santa Barbara
085	Santa Clara
087	Santa Cruz
089	Shasta
091	Sierra
093	Siskiyou
095	Solano
097	Sonoma
099	Stanislaus
101	Sutter
103	Tehama
105	Trinty
107	Tulare
109	Tuolumne
111	Ventura
113	Yolo
115	Yuba
	Colorado
	County
001	Adams
003	Alamosa
005	Arapahoe
007	Archuleta
009	Baca
011	Bent
013	Boulder
015	Chaffee
017	Cheyenne
019	Clear Creek
021	Conejos
023	Costilla
025	Crowley
027	Custer
029	Delta
031	Denver
033	Dolores
035	Douglas
037	Eagle
039	Elbert
041	El Paso
043	Fremont
045	Garfield
047	Gilpin
049	Grand
051	Gunnison
053	Hinsdale
055	Huerfano
057	Jackson
059	Jefferson
061	Kiowa

	Con.
063	Kit Carson
065	Lake
067	La Plata
069	Larimer
071	Las Animas
073	Lincoln
075	Logan
077	Mesa
079	Mineral
081	Moffat
083	Montezuma
085	Montrose
087	Morgan
089	Otero
091	Ouray
093	Park
095	Phillips
097	Pitkin
099	Prowers
101	Pueblo
103	Rio Blanco
105	Rio Grande
107	Routt
109	Saguache
111	San Juan
113	San Miguel
115	Sedgwick
117	Summit
119	Teller
121	Washington
123	Weld
125	Yuma
	Connecticut
	County
001	Fairfield
003	Hartford
005	Litchfield
007	Middlesex
009	New Haven
011	New London
013	Tolland
015	Windham
	District of Columbia
001	Washington
	Delaware
	County
001	Kent
003	New Castle
005	Sussex
	Florida
	County
001	Alachua
003	Baker
005	Bay
007	Bradford
009	Brevard
011	Broward
013	Calhoun
015	Charlotte
017	Citrus
019	Clay

	Con.
021	Collier
023	Columbia
025	Dade
027	De Soto
029	Dixie
031	Duval
033	Escambia
035	Flagler
037	Franklin
039	Gadsden
041	Gilchrist
043	Glades
045	Gulf
047	Hamilton
049	Hardee
051	Hendry
053	Hernando
055	Highlands
057	Hillsborough
059	Holmes
061	Indian River
063	Jackson
065	Jefferson
067	Lafayette
069	Lake
071	Lee
073	Leon
075	Levy
077	Liberty
079	Madison
081	Manatee
083	Marion
085	Martin
087	Monroe
089	Nassau
091	Okaloosa
093	Okeechobee
095	Orange
097	Osceola
099	Palm Beach
101	Pasco
103	Pinellas
105	Polk
107	Putnam
109	St. Johns
111	St. Lucie
113	Santa Rosa
115	Sarasota
117	Seminole
119	Sumter
121	Suwannee
123	Taylor
125	Union
127	Volusia
129	Wakulla
131	Walton
133	Washington
	Georgia
	County
001	Appling
003	Atkinson
005	Bacon
007	Baker
009	Baldwin

Con.	
011	Banks
013	Barrow
015	Bartow
017	Ben Hill
019	Berrien
021	Bibb
023	Bleckley
025	Brantley
027	Brooks
029	Bryan
031	Bulloch
033	Burke
035	Butts
037	Calhoun
039	Camden
043	Candler
045	Carroll
047	Catoosa
049	Charlton
051	Chatham
053	Chattahoochee
055	Chattooga
057	Cherokee
059	Clarke
061	Clay
063	Clayton
065	Clinch
067	Cobb
069	Coffee
071	Colquitt
073	Columbia
075	Cook
077	Coweta
079	Crawford
081	Crisp
083	Dade
085	Dawson
087	Decatur
089	De Kalb
091	Dodge
093	Dooly
095	Dougherty
097	Douglas
099	Early
101	Echols
103	Effingham
105	Elbert
107	Emanuel
109	Evans
111	Fannin
113	Fayette
115	Floyd
117	Forsyth
119	Franklin
121	Fulton
123	Gilmer
125	Glascock
127	Glynn
129	Gordon
131	Grady
133	Greene
135	Gwinnett
137	Habersham
139	Hall
141	Hancock
143	Haralson
145	Harris
147	Hart
149	Heard
151	Henry
153	Houston
155	Irwin
157	Jackson
159	Jasper
161	Jeff Davis
163	Jefferson
165	Jenkins
167	Johnson
169	Jones
171	Lamar
173	Lanier
175	Laurens
177	Lee
179	Liberty
181	Lincoln
183	Long
185	Lowndes
187	Lumpkin
189	McDuffie
191	McIntosh
193	Macon
195	Madison
197	Marion
199	Meriwether
201	Miller
205	Mitchell
207	Monroe
209	Montgomery
211	Morgan
213	Murray
215	Muscogee
217	Newton
219	Oconee
221	Oglethorpe
223	Paulding
225	Peach
227	Pickens
229	Pierce
231	Pike
233	Polk
235	Pulaski
237	Putnam
239	Quitman
241	Rabun
243	Randolph
245	Richmond
247	Rockdale
249	Schley
251	Screven
253	Seminole
255	Spalding
257	Stephens
259	Stewart
261	Sumter
263	Talbot
265	Taliaferro
267	Tattnall
269	Taylor
271	Telfair
273	Terrell
275	Thomas
277	Tift
279	Toombs
281	Towns
283	Treutlen
285	Troup
287	Turner
289	Twiggs
291	Union
293	Upson
295	Walker
297	Walton
299	Ware
301	Warren
303	Washington
305	Wayne
307	Webster
309	Wheeler
311	White
313	Whitfield
315	Wilcox
317	Wilkes
319	Wilkinson
321	Worth

Hawaii

County

001	Hawaii
003	Honolulu
005	Kalawao
007	Kauai
009	Maui

Iowa

County

001	Adair
003	Adams
005	Allamakee
007	Appanoose
009	Audubon
011	Benton
013	Black Hawk
015	Boone
017	Bremer
019	Buchanan
021	Buena Vista
023	Butler
025	Calhoun
027	Carroll
029	Cass
031	Cedar
033	Cerro Gordo
035	Cherokee
037	Chickasaw
039	Clarke
041	Clay
043	Clayton
045	Clinton
047	Crawford
049	Dallas
051	Davis
053	Decatur
055	Delaware
057	Des Moines
059	Dickinson
061	Dubuque
063	Emmet
065	Fayette
067	Floyd
069	Franklin
071	Fremont
073	Greene
075	Grundy
077	Guthrie
079	Hamilton
081	Hancock
083	Hardin
085	Harrison
087	Henry
089	Howard
091	Humboldt
093	Ida
095	Iowa
097	Jackson
099	Jasper
101	Jefferson
103	Johnson
105	Jones
107	Keokuk
109	Kossuth
111	Lee
113	Linn
115	Louisa
117	Lucas
119	Lyon
121	Madison
123	Mahaska
125	Marion
127	Marshall
129	Mills
131	Mitchell
133	Monona
135	Monroe
137	Montgomery
139	Muscatine
141	O'Brien
143	Osceola
145	Page
147	Palo Alto
149	Plymouth
151	Pocahontas
153	Polk
155	Pottawattamie
157	Poweshiek
159	Ringgold
161	Sac
163	Scott
165	Shelby
167	Sioux
169	Story
171	Tama
173	Taylor
175	Union
177	Van Buren
179	Wapello
181	Warren
183	Washington
185	Wayne
187	Webster
189	Winnebago
191	Winneshiek
193	Woodbury
195	Worth
197	Wright

Idaho

County

001	Ada
003	Adams
005	Bannock
007	Bear Lake
009	Benewah
011	Bingham
013	Blaine
015	Boise
017	Bonner
019	Bonneville
021	Boundary
023	Butte
025	Camas
027	Canyon
029	Caribou
031	Cassia
033	Clark
035	Clearwater
037	Custer
039	Elmore
041	Franklin
043	Fremont
045	Gem
047	Gooding
049	Idaho
051	Jefferson
053	Jerome
055	Kootenai
057	Latah
059	Lemhi
061	Lewis
063	Lincoln
065	Madison
067	Minidoka
069	Nez Perce
071	Oneida
073	Owyhee
075	Payette
077	Power
079	Shoshone
081	Teton
083	Twin Falls
085	Valley
087	Washington

Illinois

County

001	Adams
003	Alexander
005	Bond
007	Boone
009	Brown
011	Bureau
013	Calhoun
015	Carroll
017	Cass
019	Champaign
021	Christian
023	Clark
025	Clay
027	Clinton
029	Coles
031	Cook
033	Crawford
035	Cumberland
037	De Kalb
039	De Witt
041	Douglas
043	Du Page
045	Edgar
047	Edwards
049	Effingham
051	Fayette
053	Ford
055	Franklin
057	Fulton
059	Gallatin
061	Greene
063	Grundy
065	Hamilton
067	Hancock
069	Hardin
071	Henderson
073	Henry
075	Iroquois
077	Jackson
079	Jasper
081	Jefferson
083	Jersey
085	Jo Daviess
087	Johnson
089	Kane
091	Kankakee
093	Kendall
095	Knox
097	Lake
099	La Salle
101	Lawrence
103	Lee
105	Livingston
107	Logan
109	McDonough
111	McHenry
113	McLean
115	Macon
117	Macoupin
119	Madison
121	Marion
123	Marshall
125	Mason
127	Massac
129	Menard
131	Mercer
133	Monroe
135	Montgomery
137	Morgan
139	Moultrie
141	Ogle
143	Peoria
145	Perry
147	Piatt
149	Pike
151	Pope
153	Pulaski
155	Putnam
157	Randolph
159	Richland
161	Rock Island
163	St. Clair
165	Saline
167	Sangamon
169	Schuyler
171	Scott
173	Shelby
175	Stark
177	Stephenson
179	Tazewell
181	Union
183	Vermilion
185	Wabash
187	Warren
189	Washington
191	Wayne
193	White
195	Whiteside
197	Will
199	Williamson
201	Winnebago
203	Woodford

Indiana

County

001	Adams
003	Allen
005	Bartholomew
007	Benton
009	Blackford
011	Boone
013	Brown
015	Carroll
017	Cass
019	Clark
021	Clay
023	Clinton
025	Crawford
027	Daviess
029	Dearborn
031	Decatur
033	De Kalb
035	Delaware
037	Dubois
039	Elkhart
041	Fayette
043	Floyd
045	Fountain
047	Franklin
049	Fulton
051	Gibson
053	Grant
055	Greene
057	Hamilton
059	Hancock
061	Harrison
063	Hendricks
065	Henry
067	Howard
069	Huntington
071	Jackson
073	Jasper
075	Jay
077	Jefferson
079	Jennings
081	Johnson
083	Knox
085	Kosciusko
087	Lagrange
089	Lake
091	La Porte
093	Lawrence
095	Madison
097	Marion
099	Marshall
101	Martin
103	Miami
105	Monroe
107	Montgomery
109	Morgan
111	Newton
113	Noble
115	Ohio
117	Orange
119	Owen
121	Parke
123	Perry
125	Pike
127	Porter
129	Posey
131	Pulaski
133	Putnam
135	Randolph
137	Ripley
139	Rush
141	St. Joseph
143	Scott
145	Shelby
147	Spencer
149	Starke
151	Steuben
153	Sullivan
155	Switzerland
157	Tippecanoe
159	Tipton
161	Union
163	Vanderburgh
165	Vermillion
167	Vigo
169	Wabash
171	Warren
173	Warrick
175	Washington
177	Wayne
179	Wells
181	White
183	Whitley

Kansas

County

001	Allen
003	Anderson
005	Atchison
007	Barber
009	Barton
011	Bourbon
013	Brown
015	Butler
017	Chase
019	Chautauqua
021	Cherokee
023	Cheyenne
025	Clark
027	Clay
029	Cloud
031	Coffey
033	Comanche
035	Cowley
037	Crawford
039	Decatur
041	Dickinson
043	Doniphan
045	Douglas
047	Edwards
049	Elk
051	Ellis

Con.	
053	Ellsworth
055	Finney
057	Ford
059	Franklin
061	Geary
063	Gove
065	Graham
067	Grant
069	Gray
071	Greeley
073	Greenwood
075	Hamilton
077	Harper
079	Harvey
081	Haskell
083	Hodgeman
085	Jackson
087	Jefferson
089	Jewell
091	Johnson
093	Kearny
095	Kingman
097	Kiowa
099	Labette
101	Lane
103	Leavenworth
105	Lincoln
107	Linn
109	Logan
111	Lyon
113	McPherson
115	Marion
117	Marshall
119	Meade
121	Miami
123	Mitchell
125	Montgomery
127	Morris
129	Morton
131	Nemaha
133	Neosho
135	Ness
137	Norton
139	Osage
141	Osborne
143	Ottawa
145	Pawnee
147	Phillips
149	Pottawatomie
151	Pratt
153	Rawlins
155	Reno
157	Republic
159	Rice
161	Riley
163	Rooks
165	Rush
167	Russell
169	Saline
171	Scott
173	Sedgwick
175	Seward
177	Shawnee
179	Sheridan
181	Sherman
183	Smith
185	Stafford
187	Stanton
189	Stevens
191	Sumner
193	Thomas
195	Trego
197	Wabaunsee
199	Wallace
201	Washington
203	Wichita
205	Wilson
207	Woodson
209	Wyandotte

	Kentucky
	County
001	Adair
003	Allen
005	Anderson
007	Ballard
009	Barren
011	Bath
013	Bell
015	Boone
017	Bourbon
019	Boyd

Con.	
021	Boyle
023	Bracken
025	Breathitt
027	Breckinridge
029	Bullitt
031	Butler
033	Caldwell
035	Calloway
037	Campbell
039	Carlisle
041	Carroll
043	Carter
045	Casey
047	Christian
049	Clark
051	Clay
053	Clinton
055	Crittenden
057	Cumberland
059	Daviess
061	Edmonson
063	Elliott
065	Estill
067	Fayette
069	Fleming
071	Floyd
073	Franklin
075	Fulton
077	Gallatin
079	Garrard
081	Grant
083	Graves
085	Grayson
087	Green
089	Greenup
091	Hancock
093	Hardin
095	Harlan
097	Harrison
099	Hart
101	Henderson
103	Henry
105	Hickman
107	Hopkins
109	Jackson
111	Jefferson
113	Jessamine
115	Johnson
117	Kenton
119	Knott
121	Knox
123	Larue
125	Laurel
127	Lawrence
129	Lee
131	Leslie
133	Letcher
135	Lewis
137	Lincoln
139	Livingston
141	Logan
143	Lyon
145	McCracken
147	McCreary
149	McLean
151	Madison
153	Magoffin
155	Marion
157	Marshall
159	Martin
161	Mason
163	Meade
165	Menifee
167	Mercer
169	Metcalfe
171	Monroe
173	Montgomery
175	Morgan
177	Muhlenberg
179	Nelson
181	Nicholas
183	Ohio
185	Oldham
187	Owen
189	Owsley
191	Pendleton
193	Perry
195	Pike
197	Powell
199	Pulaski
201	Robertson
203	Rockcastle

Con.	
205	Rowan
207	Russell
209	Scott
211	Shelby
213	Simpson
215	Spencer
217	Taylor
219	Todd
221	Trigg
223	Trimble
225	Union
227	Warren
229	Washington
231	Wayne
233	Webster
235	Whitley
237	Wolfe
239	Woodford

	Louisiana
	County
001	Acadia
003	Allen
005	Ascension
007	Assumption
009	Avoyelles
011	Beauregard
013	Bienville
015	Bossier
017	Caddo
019	Calcasieu
021	Caldwell
023	Cameron
025	Catahoula
027	Claibourne
029	Concordia
031	De Soto
033	East Baton Rouge
035	East Carroll
037	East Feliciana
039	Evangeline
041	Franklin
043	Grant
045	Iberia
047	Iberville
049	Jackson
051	Jefferson
053	Jefferson Davis
055	Lafayette
057	Lafourche
059	La Salle
061	Lincoln
063	Livingston
065	Madison
067	Morehouse
069	Natchitoches
071	Orleans
073	Ouachita
075	Plaquemines
077	Pointe Coupee
079	Rapides
081	Red River
083	Richland
085	Sabine
087	St. Bernard
089	St. Charles
091	St. Helena
093	St. James
095	St. John The Baptist
097	St. Landry
099	St. Martin
101	St. Mary
103	St. Tammany
105	Tangipahoa
107	Tensas
109	Terrebonne
111	Union
113	Vermilion
115	Vernon
117	Washington
119	Webster
121	West Baton Rouge
123	West Carroll
125	West Feliciana
127	Winn

	Massachusetts
	County
001	Barnstable
003	Berkshire
005	Bristol
007	Dukes

Con.	
009	Essex
011	Franklin
013	Hampden
015	Hampshire
017	Middlesex
019	Nantucket
021	Norfolk
023	Plymouth
025	Suffolk
027	Worcester

	Maryland
	County
001	Allegany
003	Anne Arundel
005	Baltimore
009	Calvert
011	Caroline
013	Carroll
015	Cecil
017	Charles
019	Dorchester
021	Frederick
023	Garrett
015	Harford
027	Howard
029	Kent
031	Montgomery
033	Prince Georges
035	Queen Annes
037	St. Marys
039	Somerset
041	Talbot
043	Washington
045	Wicomico
047	Worcester
	Independent City
510	Baltimore City

	Maine
	County
001	Androscoggin
003	Aroostook
005	Cumberland
007	Franklin
009	Hancock
011	Kennebec
013	Knox
015	Lincoln
017	Oxford
019	Penobscot
021	Piscataquis
023	Sagadahoc
025	Somerset
027	Waldo
029	Washington
031	York

	Michigan
	County
001	Alcona
003	Alger
005	Allegan
007	Alpena
009	Antrim
011	Arenac
013	Baraga
015	Barry
017	Bay
019	Benzie
021	Berrien
023	Branch
025	Calhoun
027	Cass
029	Charlevoix
031	Cheboygan
033	Chippewa
035	Clare
037	Clinton
039	Crawford
041	Delta
043	Dickinson
045	Eaton
047	Emmet
049	Genesee
051	Gladwin
053	Gogebic
055	Grand Traverse
057	Gratiot
059	Hillsdale
061	Houghton
063	Huron

Con.	
065	Ingham
067	Ionia
069	Iosco
071	Iron
073	Isabella
075	Jackson
077	Kalamazoo
079	Kalkaska
081	Kent
083	Keweenaw
085	Lake
087	Lapeer
089	Leelanau
091	Lenawee
093	Livingston
095	Luce
097	Mackinac
099	Macomb
101	Manistee
103	Marquette
105	Mason
107	Mecosta
109	Menominee
111	Midland
113	Missaukee
115	Monroe
117	Montcalm
119	Montmorency
121	Muskegon
123	Newaygo
125	Oakland
127	Oceana
129	Ogemaw
131	Ontonagon
133	Osceola
135	Oscoda
137	Otsego
139	Ottawa
141	Presque Isle
143	Roscommon
145	Saginaw
147	St. Clair
149	St. Joseph
151	Sanilac
153	Schoolcraft
155	Shiawassee
157	Tuscola
159	Van Buren
161	Washtenaw
163	Wayne
165	Wexford

	Minnesota
	County
001	Aitkin
003	Anoka
005	Becker
007	Beltrami
009	Benton
011	Big Stone
013	Blue Earth
015	Brown
017	Carlton
019	Carver
021	Cass
023	Chippewa
025	Chisago
027	Clay
029	Clearwater
031	Cook
033	Cottonwood
035	Crow Wing
037	Dakota
039	Dodge
041	Douglas
043	Faribault
045	Fillmore
047	Freeborn
049	Goodhue
051	Grant
053	Hennepin
055	Houston
057	Hubbard
059	Isanti
061	Itasca
063	Jackson
065	Kanabec
067	Kandiyohi
069	Kittson
071	Koochiching
073	Lac Qui Parle
075	Lake

Con.	
077	Lake of the Woods
079	Le Sueur
081	Lincoln
083	Lyon
085	McLeod
087	Mahnomen
089	Marshall
091	Martin
093	Meeker
095	Mille Lacs
097	Morrison
099	Mower
101	Murray
103	Nicollet
105	Nobles
107	Norman
109	Olmsted
111	Otter Tail
113	Pennington
115	Pine
117	Pipestone
119	Polk
121	Pope
123	Ramsey
125	Red Lake
127	Redwood
129	Renville
131	Rice
133	Rock
135	Roseau
137	St. Louis
139	Scott
141	Sherburne
143	Sibley
145	Stearns
147	Steele
149	Stevens
151	Swift
153	Todd
155	Traverse
157	Wabasha
159	Wadena
161	Waseca
163	Washington
165	Watonwan
167	Wilkin
169	Winona
171	Wright
173	Yellow Medicine

	Missouri
	County
001	Adair
003	Andrew
005	Atchison
007	Audrain
009	Barry
011	Barton
013	Bates
015	Benton
017	Bollinger
019	Boone
021	Buchanan
023	Butler
025	Caldwell
027	Callaway
029	Camden
031	Cape Girardeau
033	Carroll
035	Carter
037	Cass
039	Cedar
041	Charlton
043	Christian
045	Clark
047	Clay
049	Clinton
051	Cole
053	Cooper
055	Crawford
057	Dade
059	Dallas
061	Daviess
063	De Kalb
065	Dent
067	Douglas
069	Dunklin
071	Franklin
073	Gasconade
075	Gentry
077	Greene
079	Grundy

Con.	
081	Harrison
083	Henry
085	Hickory
087	Holt
089	Howard
091	Howell
093	Iron
095	Jackson
097	Jasper
099	Jefferson
101	Johnson
103	Knox
105	Laclede
107	Lafayette
109	Lawrence
111	Lewis
113	Lincoln
115	Linn
117	Livingston
119	McDonald
121	Macon
123	Madison
125	Maries
127	Marion
129	Mercer
131	Miller
133	Mississippi
135	Moniteau
137	Monroe
139	Montgomery
141	Morgan
143	New Madrid
145	Newton
147	Nodaway
149	Oregon
151	Osage
153	Ozark
155	Pemiscot
157	Perry
159	Pettis
161	Phelps
163	Pike
165	Platte
167	Polk
169	Pulaski
171	Putnam
173	Ralls
175	Randolph
177	Ray
179	Reynolds
181	Ripley
183	St. Charles
185	St. Clair
187	St. Francois
189	St. Louis
193	Ste Genevieve
195	Saline
197	Schuyler
199	Scotland
201	Scott
203	Shannon
205	Shelby
207	Stoddard
209	Stone
211	Sullivan
213	Taney
215	Texas
217	Vernon
219	Warren
221	Washington
223	Wayne
225	Webster
227	Worth
229	Wright
	Independent City
510	St. Louis City
	Mississippi
	County
001	Adams
003	Alcorn
005	Amite
007	Attala
009	Benton
011	Bolivar
013	Calhoun
015	Carroll
017	Chickasaw
019	Choctaw
021	Claiborne
023	Clarke
025	Clay

Con.	
027	Coahoma
029	Copiah
031	Covington
033	De Soto
035	Forrest
037	Franklin
039	George
041	Greene
043	Grenada
045	Hancock
047	Harrison
049	Hinds
051	Holmes
053	Humphreys
055	Issaquena
057	Itawamba
059	Jackson
061	Jasper
063	Jefferson
065	Jefferson Davis
067	Jones
069	Kemper
071	Lafayette
073	Lamar
075	Lauderdale
077	Lawrence
079	Leake
081	Lee
083	Leflore
085	Lincoln
087	Lowndes
089	Madison
091	Marion
093	Marshall
095	Monroe
097	Montgomery
099	Neshoba
101	Newton
103	Noxubee
105	Oktibbeha
107	Panola
109	Pearl River
111	Perry
113	Pike
115	Pontotoc
117	Prentiss
119	Quitman
121	Rankin
123	Scott
125	Sharkey
127	Simpson
129	Smith
131	Stone
133	Sunflower
135	Tallahatchie
137	Tate
139	Tippah
141	Tishomingo
143	Tunica
145	Union
147	Walthall
149	Warren
151	Washington
153	Wayne
155	Webster
157	Wilkinson
159	Winston
161	Yalobusha
163	Yazoo
	Montana
	County
001	Beaverhead
003	Big Horn
005	Blaine
007	Broadwater
009	Carbon
011	Carter
013	Cascade
015	Chouteau
017	Custer
019	Daniels
021	Dawson
023	Deer Lodge
025	Fallon
027	Fergus
029	Flathead
031	Gallatin
033	Garfield
035	Glacier
037	Golden Valley
039	Granite

Con.	
041	Hill
043	Jefferson
045	Judith Basin
047	Lake
049	Lewis and Clark
051	Liberty
053	Lincoln
055	McCone
057	Madison
059	Meagher
061	Mineral
063	Missoula
065	Musselshell
067	Park
069	Petroleum
071	Phillips
073	Pondera
075	Powder River
077	Powell
079	Prairie
081	Ravalli
083	Richland
085	Roosevelt
087	Rosebud
089	Sanders
091	Sheridan
093	Silver Bow
095	Stillwater
097	Sweet Grass
099	Teton
101	Toole
103	Treasure
105	Valley
107	Wheatland
109	Wibaux
111	Yellowstone
113	Yellowstone Natl Park–Part
	Nebraska
	County
001	Adams
003	Antelope
005	Arthur
007	Banner
009	Blaine
011	Boone
013	Box Butte
015	Boyd
017	Brown
019	Buffalo
021	Burt
023	Butler
025	Cass
027	Cedar
029	Chase
031	Cherry
033	Cheyenne
035	Clay
037	Colfax
039	Cuming
041	Custer
043	Dakota
045	Dawes
047	Dawson
049	Deuel
051	Dixon
053	Dodge
055	Douglas
057	Dundy
059	Fillmore
061	Franklin
063	Frontier
065	Furnas
067	Gage
069	Garden
071	Garfield
073	Gosper
075	Grant
077	Greeley
079	Hall
081	Hamilton
083	Harlan
085	Hayes
087	Hitchcock
089	Holt
091	Hooker
093	Howard
095	Jefferson
097	Johnson
099	Kearney
101	Keith

Con.	
103	Keya Paha
105	Kimball
107	Knox
109	Lancaster
111	Lincoln
113	Logan
115	Loup
117	McPherson
119	Madison
121	Merrick
123	Morrill
125	Nance
127	Nemaha
129	Nuckolls
131	Otoe
133	Pawnee
135	Perkins
137	Phelps
139	Pierce
141	Platte
143	Polk
145	Red Willow
147	Richardson
149	Rock
151	Saline
153	Sarpy
155	Saunders
157	Scotts Bluff
159	Seward
161	Sheridan
163	Sherman
165	Sioux
167	Stanton
169	Thayer
171	Thomas
173	Thurston
175	Valley
177	Washington
179	Wayne
181	Webster
183	Wheeler
185	York
	North Carolina
	County
001	Alamance
003	Alexander
005	Alleghany
007	Anson
009	Ashe
011	Avery
013	Beaufort
015	Bertie
017	Bladen
019	Brunswick
021	Buncombe
023	Burke
025	Cabarrus
027	Caldwell
029	Camden
031	Carteret
033	Caswell
035	Catawba
037	Chatham
039	Cherokee
041	Chowan
043	Clay
045	Cleveland
047	Columbus
049	Craven
051	Cumberland
053	Currituck
055	Dare
057	Davidson
059	Davie
061	Duplin
063	Durham
065	Edgecombe
067	Forsyth
069	Franklin
071	Gaston
073	Gates
075	Graham
077	Granville
079	Greene
081	Guilford
083	Halifax
085	Harnett
087	Haywood
089	Henderson
091	Hertford
093	Hoke

Con.	
095	Hyde
097	Iredell
099	Jackson
101	Johnston
103	Jones
105	Lee
107	Lenoir
109	Lincoln
111	McDowell
113	Macon
115	Madison
117	Martin
119	Mecklenburg
121	Mitchell
123	Montgomery
125	Moore
127	Nash
129	New Hanover
131	Northampton
133	Onslow
135	Orange
137	Pamlico
139	Pasquotank
141	Pender
143	Perquimans
145	Person
147	Pitt
149	Polk
151	Randolph
153	Richmond
155	Robeson
157	Rockingham
159	Rowan
161	Rutherford
163	Sampson
165	Scotland
167	Stanly
169	Stokes
171	Surry
173	Swain
175	Transylvania
177	Tyrrell
179	Union
181	Vance
183	Wake
185	Warren
187	Washington
189	Watauga
191	Wayne
193	Wilkes
195	Wilson
197	Yadkin
199	Yancey
	North Dakota
	County
001	Adams
003	Barnes
005	Benson
007	Billings
009	Bottineau
011	Bowman
013	Burke
015	Burleigh
017	Cass
019	Cavalier
021	Dickey
023	Divide
025	Dunn
027	Eddy
029	Emmons
033	Golden Valley
035	Grand Forks
037	Grant
039	Griggs
041	Hettinger
043	Kidder
045	La Moure
047	Logan
049	McHenry
051	McIntosh
053	McKenzie
055	McLean
057	Mercer
059	Morton
061	Mountrail
063	Nelson
065	Oliver
067	Pembina
069	Pierce
071	Ransey
073	Ransom

Con.	
075	Renville
077	Richland
079	Rolette
081	Sargent
083	Sheridan
085	Sioux
087	Slope
089	Stark
091	Steele
093	Stutsman
095	Towner
097	Traill
099	Walsh
101	Ward
103	Wells
105	Williams
	New Hampshire
	County
001	Belknap
003	Carroll
005	Cheshire
007	Coos
009	Grafton
011	Hillsboro
013	Merrimack
015	Rockingham
017	Strafford
019	Sullivan
	New Jersey
	County
001	Atlantic
003	Bergen
005	Burlington
007	Camden
009	Cape May
011	Cumberland
013	Essex
015	Gloucester
017	Hudson
019	Hunterdon
021	Mercer
023	Middlesex
025	Monmouth
027	Morris
029	Ocean
031	Passaic
033	Salem
035	Somerset
037	Sussex
039	Union
041	Warren
	New Mexico
	County
001	Bernalillo
003	Catron
005	Chaves
007	Colfax
009	Curry
011	De Baca
013	Dona Ana
015	Eddy
017	Grant
019	Guadalupe
021	Harding
023	Hidalgo
025	Lea
027	Lincoln
028	Los Alamos
029	Luna
031	McKinley
033	Mora
035	Otero
037	Quay
039	Rio Arriba
041	Roosevelt
043	Sandoval
045	San Juan
047	San Miguel
049	Santa Fe
051	Sierra
053	Socorro
055	Taos
057	Torrance
059	Union
061	Valencia
	Nevada
	County
001	Churchill

Con.	
003	Clark
005	Douglas
007	Elko
009	Esmeralda
011	Eureka
013	Humboldt
015	Lander
017	Lincoln
019	Lyon
021	Mineral
023	Nye
027	Pershing
029	Storey
031	Washoe
033	White Pine
	Independent City
510	Carson City
	New York
	County
001	Albany
003	Allegany
005	Bronx
007	Broome
009	Cattaraugus
011	Cayuga
013	Chautauqua
015	Chemung
017	Chenango
019	Clinton
021	Columbia
023	Cortland
025	Delaware
027	Dutchess
029	Erie
031	Essex
033	Franklin
035	Fulton
037	Genesee
039	Greene
041	Hamilton
043	Herkimer
045	Jefferson
047	Kings
049	Lewis
051	Livingston
053	Madison
055	Monroe
057	Montgomery
059	Nassau
061	New York
063	Niagara
065	Oneida
067	Onondaga
069	Ontario
071	Orange
073	Orleans
075	Oswego
077	Otsego
079	Putnam
081	Queens
083	Rensselaer
085	Richmond
087	Rockland
089	St. Lawrence
091	Saratoga
093	Schenectady
095	Schoharie
097	Schuyler
099	Seneca
101	Steuben
103	Suffolk
105	Sullivan
107	Tioga
109	Tompkins
111	Ulster
113	Warren
115	Washington
117	Wayne
119	Westchester
121	Wyoming
123	Yates
	Ohio
	County
001	Adams
003	Allen
005	Ashland
007	Ashtabula
009	Athens
011	Auglaize
013	Belmont

Con.	
015	Brown
017	Butler
019	Carroll
021	Champaign
023	Clark
025	Clermont
027	Clinton
029	Columbiana
031	Coshocton
033	Crawford
035	Cuyahoga
037	Darke
039	Defiance
041	Delaware
043	Erie
045	Fairfield
047	Fayette
049	Franklin
051	Fulton
053	Gallia
055	Geauga
057	Greene
059	Guernsey
061	Hamilton
063	Hancock
065	Hardin
067	Harrison
069	Henry
071	Highland
073	Hocking
075	Holmes
077	Huron
079	Jackson
081	Jefferson
083	Knox
085	Lake
087	Lawrence
089	Licking
091	Logan
093	Lorain
095	Lucas
097	Madison
099	Mahoning
101	Marion
103	Medina
105	Meigs
107	Mercer
109	Miami
111	Monroe
113	Montgomery
115	Morgan
117	Morrow
119	Muskingum
121	Noble
123	Ottawa
125	Paulding
127	Perry
129	Pickaway
131	Pike
133	Portage
135	Preble
137	Putnam
139	Richland
141	Ross
143	Sandusky
145	Scioto
147	Seneca
149	Shelby
151	Stark
153	Summit
155	Trumbull
157	Tuscarawas
159	Union
161	Van Wert
163	Vinton
165	Warren
167	Washington
169	Wayne
171	Williams
173	Wood
175	Wyandot
	Oklahoma
	County
001	Adair
003	Alfalfa
005	Atoka
007	Beaver
009	Beckham
011	Blaine
013	Bryan
015	Caddo

Con.	
017	Canadian
019	Carter
021	Cherokee
023	Choctaw
025	Cimarron
027	Cleveland
029	Coal
031	Comanche
033	Cotton
035	Craig
037	Creek
039	Custer
041	Delaware
043	Dewey
045	Ellis
047	Garfield
049	Garvin
051	Grady
053	Grant
055	Greer
057	Harmon
059	Harper
061	Haskell
063	Hughes
065	Jackson
067	Jefferson
069	Johnston
071	Kay
073	Kingfisher
075	Kiowa
077	Latimer
079	Le Flore
081	Lincoln
083	Logan
085	Love
087	McClain
089	McCurtain
091	McIntosh
093	Major
095	Marshall
097	Mayes
099	Murray
101	Muskogee
103	Noble
105	Nowata
107	Okfuskee
109	Oklahoma
111	Okmulgee
113	Osage
115	Ottawa
117	Pawnee
119	Payne
121	Pittsburg
123	Pontotoc
125	Pottawatomie
127	Pushmataha
129	Roger Mills
131	Rogers
133	Seminole
135	Sequoyah
137	Stephens
139	Texas
141	Tillman
143	Tulsa
145	Wagoner
147	Washington
149	Washita
151	Woods
153	Woodward
	Oregon
	County
001	Baker
003	Benton
005	Clackamas
007	Clatsop
009	Columbia
011	Coos
013	Crook
015	Curry
017	Deschutes
019	Douglas
021	Gilliam
023	Grant
025	Harney
027	Hood River
029	Jackson
031	Jefferson
033	Josephine
035	Klamath
037	Lake
039	Lane

Con.	
041	Lincoln
043	Linn
045	Malheur
047	Marion
049	Morrow
051	Multnomah
053	Polk
055	Sherman
057	Tillamook
059	Umatilla
061	Union
063	Wallowa
065	Wasco
067	Washington
069	Wheeler
071	Yamhill
	Pennsylvania
	County
001	Adams
003	Allegheny
005	Armstrong
007	Beaver
009	Bedford
011	Berks
013	Blair
015	Bradford
017	Bucks
019	Butler
021	Cambria
023	Cameron
025	Carbon
027	Centre
029	Chester
031	Clarion
033	Clearfield
035	Clinton
037	Columbia
039	Crawford
041	Cumberland
043	Dauphin
045	Delaware
047	Elk
049	Erie
051	Fayette
053	Forest
055	Franklin
057	Fulton
059	Greene
061	Huntington
063	Indiana
065	Jefferson
067	Juniata
069	Lackawanna
071	Lancaster
073	Lawrence
075	Lebanon
077	Lehigh
079	Luzerne
081	Lycoming
083	McKean
085	Mercer
087	Mifflin
089	Monroe
091	Montgomery
093	Montour
095	Northampton
097	Northumberland
099	Perry
101	Philadelphia
103	Pike
105	Potter
107	Schuylkill
109	Snyder
111	Somerset
113	Sullivan
115	Susquehanna
117	Tioga
119	Union
121	Venango
123	Warren
125	Washington
127	Wayne
129	Westmoreland
131	Wyoming
133	York
	Rhode Island
	County
001	Bristol
003	Kent
005	Newport

Con.	
007	Providence
009	Washington
	South Carolina
	County
001	Abbeville
003	Aiken
005	Allendale
007	Anderson
009	Bamberg
011	Barnwell
013	Beaufort
015	Berkeley
017	Calhoun
019	Charleston
021	Cherokee
023	Chester
025	Chesterfield
027	Clarendon
029	Colleton
031	Darlington
033	Dillon
035	Dorchester
037	Edgefield
039	Fairfield
041	Florence
043	Georgetown
045	Greenville
047	Greenwood
049	Hampton
051	Horry
053	Jasper
055	Kershaw
057	Lancaster
059	Laurens
061	Lee
063	Lexington
065	McCormick
067	Marion
069	Marlboro
071	Newberry
073	Oconee
075	Orangeburg
077	Pickens
079	Richland
081	Saluda
083	Spartanburg
085	Sumter
087	Union
089	Williamsburg
091	York
	South Dakota
	County
003	Aurora
005	Beadle
007	Bennett
009	Bon Homme
011	Brookings
013	Brown
015	Brule
017	Buffalo
019	Butte
021	Campbell
023	Charles Mix
025	Clark
027	Clay
029	Codington
031	Corson
033	Custer
035	Davison
037	Day
039	Deuel
041	Dewey
043	Douglas
045	Edmunds
047	Fall River
049	Faulk
051	Grant
053	Gregory
055	Haakon
057	Hamlin
059	Hand
061	Hanson
063	Harding
065	Hughes
067	Hutchinson
069	Hyde
071	Jackson
073	Jerauld
075	Jones
077	Kingsbury

Con.	
079	Lake
081	Lawrence
083	Lincoln
085	Lyman
087	McCook
089	McPherson
091	Marshall
093	Meade
095	Mellette
097	Miner
099	Minnehaha
101	Moody
103	Pennington
105	Perkins
107	Potter
109	Roberts
111	Sanborn
113	Shannon
115	Spink
117	Stanley
119	Sully
121	Todd
123	Tripp
125	Turner
127	Union
129	Walworth
131	Washabaugh
135	Yankton
137	Ziebach
	Tennessee
	County
001	Anderson
003	Bedford
005	Benton
007	Bledsoe
009	Blount
011	Bradley
013	Campbell
015	Cannon
017	Carroll
019	Carter
021	Cheatham
023	Chester
025	Claiborne
027	Clay
029	Cocke
031	Coffee
033	Crockett
035	Cumberland
037	Davidson
039	Decatur
041	De Kalb
043	Dickson
045	Dyer
047	Fayette
049	Fentress
051	Franklin
053	Gibson
055	Giles
057	Grainger
059	Greene
061	Grundy
063	Hamblen
065	Hamilton
067	Hancock
069	Hardeman
071	Hardin
073	Hawkins
075	Haywood
077	Henderson
079	Henry
081	Hickman
083	Houston
085	Humphreys
087	Jackson
089	Jefferson
091	Johnson
093	Knox
095	Lake
097	Lauderdale
099	Lawrence
101	Lewis
103	Lincoln
105	Loudon
107	McMinn
109	McNairy
111	Macon
113	Madison
115	Marion
117	Marshall
119	Maury

APPENDIX D

PARAMETER CODES

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Water-Quality File Parameter Codes - - - - - - - - -	D-9

APPENDIX D
Daily Values File Parameter Codes

The codes presented in this section are the STORET EPA parameter codes used for identifying data stored in the WATSTORE Daily Values File. Parameter names, comment codes, and significant figure levels are assigned by WATSTORE. Additional codes may be obtained through written request to:

Chief, Automatic Data Section, WRD
U.S. Geological Survey
437 National Center
Reston, Virginia 22092

A procedure is available to allow users to print all or a portion of the current WATSTORE Daily Values File parameter codes. Several examples of the use of this procedure are given below.

```
//xxxxxxxx JOB (---
/*PROCLIB  WRD.PROCLIB
//  EXEC  LPARM
//  EXEC  LPARM,NAME='TEMPERATURE'
//  EXEC  LPARM,NAME='F MG/L'
//
```

This job would produce three listings of parameter codes. The first EXEC card would cause all WATSTORE parameter codes to be listed. The second EXEC card will produce a list of all parameter codes whose names contain the term 'TEMPERATURE'. This term may appear anywhere within the name field for the selected parameters. The third EXEC card will produce a one-item table for parameter code 00950 [DISSOLVED FLOURIDE (F MG/L)]. The format of the tables produced by the LPARM procedure is identical to the parameter code listings shown on the following pages. It is expected that the number of modifications to Appendix D may be quite high, and therefore it is recommended that WATSTORE users periodically update the parameter list through the use of the LPARM procedure.

APPENDIX D - WATSTORE PARAMETER CODES

THE FOLLOWING FIVE-DIGIT PARAMETER CODES ARE USED TO UNIQUELY IDENTIFY THE TYPES OF DATA THAT ARE STORED IN THE WATSTORE FILES.

CONSTITUENTS	PARAM-ETER CODE	COM-MENT	SIGNIFICANT FIGURES 0 TO <1.0	1.0 TO <10	10 TO <100	100 TO <1000	>= 1000
TEMPERATURE (DEG. C) OF WATER	00010	C	.X	X.X	XX.X	----	----
EVAPORATION TEMPERATURE (48 IN. PAN DEG. C)	00012	C	.X	X.X	XX.X	----	----
EVAPORATION TEMPERATURE (24 IN. PAN DEG. C)	00013	C	.X	X.X	XX.X	----	----
WET BULB TEMPERATURE (DEG. C)	00014	C	.X	X.X	XX.X	----	----
TEMPERATURE (DEG. C) OF AIR	00020	C	.X	X.X	XX.X	----	----
LIGHT, INCIDENT, SUNLT. RADIATION INT.(C/SQCM/D)	00030		.X	X.X	XX	XXX	XXXX
WIND VELOCITY (MPH)	00035		.X	X.X	XX	XXX	----
WIND DIRECTION (DEGREES FROM TRUE NORTH)	00036		----	X	XX	XXX	----
ACCUMULATED RAINFALL (IN.)	00045		.XX	X.XX	XX.XX	XXX.XX	----
TOTAL EVAPORATION (INCHES PER DAY)	00050		.XX	X.XX	XX.XX	XXX.XX	XXXX.XX
HUMIDITY, RELATIVE (PERCENT)	00052		.X	X.X	XX.X	XXX	----
CONTENTS, IN ACRE-FEET	00054		.XX	X.X	XX	XXX	XXX0
DISCHARGE, IN CUBIC FEET PER SECOND	00060		.XX	X.X	XX	XXX	XXX0
GAGE HEIGHT, IN FEET	00065		.XX	X.XX	XX.XX	XXX.XX	XXXX.XX
TURBIDITY (JTU)	00070	D	----	X	XX	XX0	XX00
TURBIDITY (NTU)	00076	D	----	X	XX	XX0	XX00

C REPORT TO NEAREST 0.5 DEG. CENTIGRADE.
D REPORT 1-10 TO NEAREST 1; 11-100 TO NEAREST 5; 101-500 TO NEAREST 10; 501-1000 TO NEAREST 50; > 1000 TO NEAREST 100.
I REPORT 1-50 TO NEAREST 1; 51-100 TO NEAREST 5; 101-250 TO NEAREST 10; 251-500 TO NEAREST 20.

APPENDIX D - CONTINUED - WATSTORE PARAMETER CODES

CONSTITUENTS	PARAM-ETER CODE	COM-MENT	SIGNIFICANT FIGURES 0 TO <1.0	1.0 TO <10	10 TO <100	100 TO <1000	>= 1000
COLOR (PLATINUM-COBALT UNITS)	00080	I	----	X	XX	XX0	XX00
OXIDATION REDUCTION POTENTIAL (MILLIVOLTS)	00090		.X	X	XX	XXX	XXXX
SPECIFIC CONDUCTANCE (MICROMHOS/CM AT 25 DEG. C)	00095		----	X	XX	XXX	XXX0
DISSOLVED OXYGEN (DO), MG/L	00300		.X	X.X	XX.X	XXX	XXX0
PH (UNITS)	00400		.X	X.X	XX.X	----	----
BICARBONATE (HCO3), MG/L	00440		----	X	XX	XX0	XXX0
TOTAL KJELDAHL NITROGEN (N) (MG/L)	00625		.XX	X.X	XX	XX0	XX00
TOTAL NITRITE PLUS NITRATE (N) (MG/L)	00630		.XX	X.X	XX	XX0	XX00
DISSOLVED PHOSPHATE (PO4), MG/L	00650		.XX	X.X	XX	XX0	XX00
TOTAL PHOSPHORUS (P) (MG/L)	00665		.XX	X.X	XX	XX0	XX00
TOTAL ORGANIC CARBON (C) (MG/L)	00680		.X	X.X	XX	XX0	XX00
DISSOLVED ORGANIC CARBON (C) (MG/L)	00681		.X	X.X	XX	XX0	XX00
SUSPENDED ORGANIC CARBON (C) (MG/L)	00689		.X	X.X	XX	XX0	XX00
DISSOLVED CALCIUM (CA), MG/L	00915		.X	X.X	XX	XX0	XX00
DISSOLVED MAGNESIUM (MG), MG/L	00925		.X	X.X	XX	XX0	XX00
DISSOLVED SODIUM (NA), MG/L	00930		.X	X.X	XX	XX0	XX00
DISSOLVED POTASSIUM (K), MG/L	00935		.X	X.X	XX	XX0	XX00
DISSOLVED CHLORIDE (CL), MG/L	00940		.X	X.X	XX	XX0	XX00

APPENDIX D - CONTINUED - WATSTORE PARAMETER CODES

CONSTITUENTS	PARAM-ETER CODE	COM-MENT	SIGNIFICANT FIGURES 0 TO <1.0	1.0 TO <10	10 TO <100	100 TO <1000	>= 1000
DISSOLVED SULFATE (SO4), MG/L	00945		.X	X.X	XX	XX0	XX00
DISSOLVED FLUORIDE (F), MG/L	00950		.X	X.X	XX	XX0	XX00
DISSOLVED SILICA (SIO2), MG/L	00955		.X	X.X	XX	XX0	XX00
DISSOLVED CHLORIDE (CL), TONS PER DAY	70290		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED SULFATE (SO4), TONS PER DAY	70291		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED SOLIDS (RESIDUE AT 180 DEG. C), MG/L	70300		----	X	XX	XXX	XXX0
DISSOLVED SOLIDS (SUM OF CONSTITUENTS), MG/L	70301		----	X	XX	XXX	XXX0
DISSOLVED SOLIDS (TONS PER DAY)	70302		.XX	X.XX	XX.X	XXX	XXX0
SUS-SEDIMENT, SIEVE DIAM, % FINER THAN .062 MM	70331		----	X	XX	XXX	XXX0
PHOSPHORUS, TOTAL, ORTHO AS P (MG/L)	70507		.XX	X.X	XX	XX0	----
BATTERY VOLTAGE (VOLTS)	70969		.X	X.X	XX	XX0	XX00
WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM	72019		.XX	X.XX	XX.XX	XXX.XX	XXXX.XX
ELEVATION, IN FEET NGVD	72020		.XX	X.XX	XX.XX	XXX.XX	XXXX.XX
CONTENTS, IN CFS-DAYS	72021		.XX	X.X	XX	XXX	XXX0
CONTENTS, IN MILLIONS OF GALLONS	72022		.X	X	XX	XXX	XXX0
CONTENTS, IN MILLIONS OF CUBIC FEET	72023		.X	X	XX	XXX	XXX0
CONTENTS, IN THOUSANDS OF ACRE-FEET	72036		.XX	X.X	XX	XXX	XXX0
SUSPENDED-SEDIMENT CONCENTRATION (MG/L)	80154		----	X	XX	XXX	XXX0

APPENDIX D - CONTINUED - WATSTORE PARAMETER CODES

CONSTITUENTS	PARAM-ETER CODE	COM-MENT	SIGNIFICANT FIGURES 0 TO <1.0	1.0 TO <10	10 TO <100	100 TO <1000	>= 1000
SUSPENDED-SEDIMENT DISCHARGE (TONS/DAY)	80155		.XX	X.X	XX	XXX	XXX0
SUSPENDED-SEDIMENT DISCHARGE, TOTAL PLUS BED	80156		.XX	X.X	XX	XXX	XXX0
SEDIMENT CONCENTRATION, TOTAL (MG/L)	80180		----	X	XX	XXX	XXX0
WATER CONTENT OF SNOW (IN.)	81026		.XX	X.XX	XX.XX	XXX.XX	----
TEMPERATURE (DEG. C) OF SOIL	81027		.X	X.X	XX.X	----	----
GROUNDWATER WITHDRAWAL (MGPD)	81028		.XX	X.X	XX	XX0	----
SNOW TEMPERATURE (DEG C)	81029		.X	X.X	XX.X	----	----
DISSOLVED SILICA (SIO2), TONS PER DAY	81200		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED CALCIUM (CA), TONS PER DAY	81201		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED MAGNESIUM (MG), TONS PER DAY	81202		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED SODIUM (NA), TONS PER DAY	81203		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED POTASSIUM (K), TONS PER DAY	81204		.XX	X.XX	XX.X	XXX	XXX0
DISSOLVED BICARBONATE (HCO3), TONS PER DAY	81205		.XX	X.XX	XX.X	XXX	XXX0

Water-Quality File Parameter Codes
(Formerly part of v. 3, chap. IV, sec. A)

The codes presented in this section are the STORET EPA parameter codes used to identify data stored in the WATSTORE Water-Quality File. Additional codes may be obtained through written request to:

Chief, Automatic Data Section, WRD
U.S. Geological Survey
437 National Center
Reston, Virginia 22092

Cataloged procedure QPARM is available to allow users to obtain updated copies of QW parameter codes in alphabetical and numerical order. The most current list of QW parameter codes is stored on disk and may be obtained by executing the following procedure:

```
//xxxxxxxx JOB (----)
/*PROCLIB  WRD.PROCLIB
//  EXEC  QPARM
//
```

This procedure produces approximately 3000 lines of printout.

PARAMETER CODES FOR WATER DATA

IN ALAPHABETICAL ORDER

PHYSICAL PARAMETERS (OBSERVED)

CODE	PARAMETER
01325	ALGAE, FLOATING MATS (SEVERITY)
00032	CLOUD COVER (PERCENT)
01345	DEBRIS, FLOATING (SEVERITY)
01305	DETERGENT SUDS (SEVERITY)
01340	FISH, DEAD (SEVERITY)
01320	GARBAGE, FLOATING (SEVERITY)
01310	GAS BUBBLES (SEVERITY)
01355	ICE COVER, FLOATING OR SOLID (SEVERITY)
00022	LENGTH OF EXPOSURE (DAYS)
70971	LIGHT, ATTENUATION COEFFICIENT (ALPHA/M)
00074	LIGHT TRANSMISSION, 1 METER PATHLENGTH (PERCENT)
01330	ODOR, ATMOSPHERIC (SEVERITY)
01300	OIL-GREASE (SEVERITY)
01335	SEWAGE SOLIDS, FRESH, FLOATING (SEVERITY)
01315	SLUDGE, FLOATING (SEVERITY)
01351	STREAMFLOW (SEVERITY)
	VALUES FOR PARAMETER CODE 01351: (1=DRY, 2=LOW, 3=NORMAL, 4=FLOOD, 5=ABOVE NORMAL)
01350	TURBIDITY (SEVERITY)

CODE PARAMETER

VALUES FOR SEVERITY: 0-NONE, 1-MILD, 2-MODERATE, 3-SERIOUS, 4-EXTREME

00041 WEATHER

VALUES FOR PARAMETER CODE 00041:

00 - CLOUDLESS
01 - PARTLY CLOUDY
02 - CLOUDY
03 - OVERCAST
10 - PRECIPITATION WITHIN SIGHT
13 - UGLY, THREATENING SKY
40 - FOG
50 - DRIZZLE
51 - SLIGHT DRIZZLE, INTERMITTENT
52 - SLIGHT DRIZZLE, CONTINUOUS
53 - MODERATE DRIZZLE, INTERMITTENT
54 - MODERATE DRIZZLE, CONTINUOUS
55 - THICK DRIZZLE, INTERMITTENT
56 - THICK DRIZZLE, CONTINUOUS
57 - DRIZZLE AND FOG
58 - SLIGHT OR MODERATE DRIZZLE AND RAIN
59 - THICK DRIZZLE AND RAIN
60 - RAIN
61 - SLIGHT RAIN, INTERMITTENT
62 - SLIGHT RAIN, CONTINUOUS
63 - MODERATE RAIN, INTERMITTENT
64 - MODERATE RAIN, CONTINUOUS
65 - HEAVY RAIN, INTERMITTENT
66 - HEAVY RAIN, CONTINUOUS
67 - RAIN AND FOG
68 - SLIGHT OR MODERATE MIXED RAIN AND SNOW
69 - HEAVY MIXED RAIN AND SNOW
70 - SNOW OR SLEET
71 - SLIGHT SNOW IN FLAKES, INTERMITTENT
72 - SLIGHT SNOW IN FLAKES, CONTINUOUS
73 - MODERATE SNOW IN FLAKES, INTERMITTENT
74 - MODERATE SNOW IN FLAKES, CONTINUOUS
75 - HEAVY SNOW IN FLAKES, INTERMITTENT
76 - HEAVY SNOW IN FLAKES, CONTINUOUS
77 - SNOW AND FOG
78 - GRANULAR SNOW (FROZEN DRIZZLE)
79 - ICE CRYSTALS
80 - SHOWER(S)

CODE	PARAMETER

VALUES FOR PARAMETER CODE 00041 - CONTINUED:

81 - SLIGHT OR MODERATE RAIN SHOWER(S)
82 - HEAVY RAIN SHOWER(S)
83 - SLIGHT OR MODERATE SNOW SHOWER(S)
84 - HEAVY SNOW SHOWER(S)
85 - SLIGHT OR MODERATE RAIN AND SNOW SHOWER(S)
86 - HEAVY RAIN AND SNOW SHOWER(S)
87 - GRANULAR SNOW SHOWER(S)
88 - SLIGHT OR MODERATE HAIL OR RAIN AND HAIL SHOWER(S)
89 - HEAVY HAIL OR RAIN AND HAIL SHOWER(S)
90 - THUNDERSTORM
93 - SLIGHT THUNDERSTORM WITH RAIN OR SNOW
94 - SLIGHT THUNDERSTORM WITH HAIL
95 - MODERATE THUNDERSTORM WITH RAIN OR SNOW
96 - MODERATE THUNDERSTORM WITH HAIL
97 - HEAVY THUNDERSTORM WITH RAIN OR SNOW
99 - HEAVY THUNDERSTORM WITH HAIL

PHYSICAL PARAMETERS (MEASURED)

00042	ALTITUDE ABOVE MEAN SEA LEVEL (TEST)
72027	AZIMUTH FROM OUTLET (DEGREES)
72028	AZIMUTH FROM SOUTHERNMOST POINT (DEGREES)
00025	BAROMETRIC PRESSURE (MM OF HG)
70969	BATTERY VOLTAGE (VOLTS)
00080	COLOR (PLATINUM COBALT UNITS)
00081	COLOR, TOTAL (PLATINUM - COBALT UNITS)
00009	CROSS-SECTION LOCATION, FEET FROM LEFT BANK LOOKING DOWNSTREAM
00001	CROSS-SECTION LOCATION, FEET FROM RIGHT BANK LOOKING UPSTREAM
00002	CROSS-SECTION LOCATION, PERCENT FROM RIGHT BANK LOOKING UPSTREAM
00003	CROSS-SECTION LOCATION, VERTICAL (FEET FROM SURFACE)

	CODE	PARAMETER
	00005	CROSS-SECTION LOCATION, VERTICAL (PERCENT OF TOTAL DEPTH)
	71820	DENSITY (GM/ML AT 20 DEG C)
	72019	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET)
	00003	DEPTH OF COLLECTION (FEET)
	72001	DEPTH OF HOLE, TOTAL (FEET)
	72025	DEPTH OF RESERVOIR (FEET)
	00064	DEPTH OF STREAM, MEAN (FEET)
	72008	DEPTH OF WELL, TOTAL (FEET)
	72016	DEPTH TO BOTTOM OF SAMPLE INTERVAL (FEET BELOW LSD)
	72003	DEPTH TO BOTTOM OF WATER-BEARING ZONE SAMPLED (FEET)
	72015	DEPTH TO TOP OF SAMPLE INTERVAL (FEET BELOW LSD)
	72002	DEPTH TO TOP OF WATER-BEARING ZONE SAMPLED (FEET)
	00061	DISCHARGE, INSTANTANEOUS STREAM (CUBIC FEET PER SECOND)
	00060	DISCHARGE, STREAM (CUBIC FEET PER SECOND)
*	99998	DISCHARGE, STREAM (MILLIONS OF GALLONS PER DAY) (00060)
	72029	DISTANCE FROM OUTLET OR SOUTHERNMOST POINT (FEET)
	81024	DRAINAGE AREA (SQUARE MILES)
	81025	DRAINAGE AREA, CONTRIBUTING (SQUARE MILES)
	72020	ELEVATION (FEET NGVD)
X	90000	ELEVATION (INCHES)

X - TEMPORARY CODE TO BE USED WITH THE DAILY VALUES FILE ONLY.

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

	CODE	PARAMETER
*	99995	ELEVATION IN HUNDREDTHS OF FEET (NO DECIMAL) (72020)
	72000	ELEVATION OF LAND SURFACE DATUM (LSD) (FEET NGVD)
	00050	EVAPORATION, TOTAL (INCHES PER DAY)
	50050	FLOW IN CONDUIT OR THROUGH A TREATMENT PLANT (MGD)
	00056	FLOW RATE (YIELD OF WELL) (GALLONS PER DAY)
	00058	FLOW RATE (YIELD OF WELL) (GALLONS PER MINUTE)
	00059	FLOW RATE, INSTANTANEOUS (YIELD OF WELL AT TIME OF SAMPLE) (GALLONS PER MINUTE)
	00065	GAGE HEIGHT (FEET ABOVE DATUM)
	00052	HUMIDITY, RELATIVE (PERCENT)
	00085	ODOR (THRESHOLD NUMBER AT ROOM TEMPERATURE)
	00086	ODOR (THRESHOLD NUMBER AT 60 DEG C)
	00090	OXIDATION REDUCTION POTENTIAL (MILLIVOLTS)
	00400	PH (STANDARD UNITS)
	85560	PRESSURE, HIGH SATURATION (POUNDS PER SQUARE INCH)
	85559	PRESSURE, LOW SATURATION (POUNDS PER SQUARE INCH)
	72004	PUMP OR FLOW PERIOD PRIOR TO SAMPLING (MIN)
	00045	RAINFALL, ACCUMULATED (INCHES)
	00062	RESERVOIR ELEVATION, WATER SURFACE (FEET ABOVE DATUM)
	00054	RESERVOIR STORAGE (AC-FT)
	72021	RESERVOIR STORAGE (CFS DAYS)

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

	CODE	PARAMETER
	72023	RESERVOIR STORAGE (MILLIONS OF CUBIC FEET)
	72022	RESERVOIR STORAGE (MILLIONS OF GALLONS)
*	99994	RESERVOIR STORAGE (THOUSANDS OF AC-FT) (00054)
	72010	RESISTIVITY (OHM-METERS)
	72014	RESISTIVITY, TEMPERATURE (DEG. C)
	32001	SAMPLE SIZE (GALLONS)
	32002	SAMPLE SIZE (MILLILITRES)
	00098	SAMPLING DEPTH (METERS)
	81029	SNOW TEMPERATURE (DEG C)
	74207	SOIL MOISTURE (PERCENT OF TOTAL VOLUME)
	46516	SOLAR RADIATION, NET - LANGLEYS (CAL/CM2/MIN)
	00095	SPECIFIC CONDUCTANCE (MICROMHOS PER CM AT 25 DEG C)
	72013	SPECIFIC GRAVITY
	72012	SPECIFIC GRAVITY, TEMPERATURE (DEG. C)
	80110	SPECIFIC GRAVITY, WATER, UNITY AT 4 DEG. C
	00065	STAGE (FEET ABOVE DATUM)
	00060	STREAMFLOW (CUBIC FEET PER SECOND)
	00061	STREAMFLOW, INSTANTANEOUS (CUBIC FEET PER SECOND)
*	99998	STREAMFLOW (MILLIONS OF GALLONS PER DAY) (00060)
	00055	STREAM VELOCITY (FEET PER SECOND)

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

	CODE	PARAMETER
	00004	STREAM WIDTH (FEET)
	00053	SURFACE AREA (ACRES)
	00049	SURFACE AREA (SQUARE MILES)
	00020	TEMPERATURE, AIR (DEG. C)
*	00021	TEMPERATURE, AIR (DEG. F) (00020)
	00013	TEMPERATURE, EVAPORATION, 24 INCH PAN (DEG. C)
	00012	TEMPERATURE, EVAPORATION, 48 INCH PAN (DEG. C)
	85558	TEMPERATURE, HIGH SATURATION (DEG. C)
	85557	TEMPERATURE, LOW SATURATION (DEG. C)
	72014	TEMPERATURE, RESISTIVITY (DEG. C)
	81027	TEMPERATURE, SOIL (DEG. C)
	72012	TEMPERATURE, SPECIFIC GRAVITY (DEG. C)
	00010	TEMPERATURE, WATER (DEG. C)
*	00011	TEMPERATURE, WATER (DEG. F) (00010)
X	90006	TEMPERATURE, WATER, INFLOW (DEG. C)
	00014	TEMPERATURE, WET BULB (DEG. C)
	00067	TIDE STAGE CODE
	00077	TRANSPARENCY, SECCHI DISK (INCHES)
	00078	TRANSPARENCY, SECCHI DISK (METERS)

X - TEMPORARY CODE TO BE USED WITH THE DAILY VALUES FILE ONLY.

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

CODE	PARAMETER
00070	TURBIDITY (JTU)
00075	TURBIDITY, HELLIGE (MG/L AS SILICON DIOXIDE)
00076	TURBIDITY (NTU)
00055	VELOCITY, STREAM (FEET PER SECOND)
81026	WATER CONTENT OF SNOW (INCHES)
72019	WATER LEVEL (DEPTH BELOW LAND SURFACE) (FEET)
00004	WIDTH, STREAM (FT)
00036	WIND DIRECTION IN DEGREES FROM TRUE NORTH (CLOCKWISE)
00035	WIND VELOCITY (MILES PER HOUR)
81028	WITHDRAWAL OF GROUND WATER (MILLIONS OF GALLONS/DAY)
72050	WITHDRAWAL OF GROUND WATER (MILLIONS OF GALLONS PER MONTH)
72051	WITHDRAWAL OF GROUND WATER (MILLIONS OF GALLONS PER YEAR)
00056	YIELD OF WELL (FLOW RATE) (GALLONS PER DAY)
00058	YIELD OF WELL (FLOW RATE) (GALLONS PER MINUTE)
00059	YIELD OF WELL AT TIME OF SAMPLE (INSTANTANEOUS FLOW RATE) (GALLONS PER MINUTE)

GENERAL INORGANIC PARAMETERS

00437	ACIDITY, CO2 (PHENOLPTHALEIN) (MG/L AS CACO3)
00436	ACIDITY, MINERAL (METHYL ORANGE)(MG/L AS CACO3)
00435	ACIDITY, TOTAL (MG/L AS CACO3)
70508	ACIDITY, TOTAL, HEATED (MG/L AS CACO3)
71825	ACIDITY, TOTAL, HEATED (MG/L AS H)

CODE	PARAMETER
85540	AIR, VOLUME PERCENT OF DISSOLVED GASES
00410	ALKALINITY (MG/L AS CACO3)
00430	ALKALINITY, CARBONATE (MG/L AS CACO3)
01106	ALUMINUM, DISSOLVED (UG/L AS AL)
01107	ALUMINUM, SUSPENDED RECOVERABLE (UG/L AS AL)
01105	ALUMINUM, TOTAL (UG/L AS AL)
01108	ALUMINUM, TOTAL IN BOTTOM MATERIAL (UG/G AS AL)
01095	ANTIMONY, DISSOLVED (UG/L AS SB)
01096	ANTIMONY, SUSPENDED TOTAL (UG/L AS SB)
01097	ANTIMONY, TOTAL (UG/L AS SB)
01098	ANTIMONY, TOTAL IN BOTTOM MATERIAL (UG/G AS SB)
01000	ARSENIC, DISSOLVED (UG/L AS AS)
00997	ARSENIC, INORGANIC, TOTAL (UG/L AS AS)(NOT FOR WRD USE)
01001	ARSENIC, SUSPENDED TOTAL (UG/L AS AS)
01002	ARSENIC, TOTAL (UG/L AS AS)
01003	ARSENIC, TOTAL IN BOTTOM MATERIAL (UG/G AS AS)
01005	BARIUM, DISSOLVED (UG/L AS BA)
01006	BARIUM, SUSPENDED RECOVERABLE (UG/L AS BA)
01007	BARIUM, TOTAL (UG/L AS BA)
01008	BARIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS BA)
01010	BERYLLIUM, DISSOLVED (UG/L AS BE)
01011	BERYLLIUM, SUSPENDED RECOVERABLE (UG/L AS BE)
01012	BERYLLIUM, TOTAL (UG/L AS BE)

CODE	PARAMETER
01013	BERYLLIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS BE)
81205	BICARBONATE (TONS/DAY)
00440	BICARBONATE ION (MG/L AS HCO3)
00349	BIOCHEMICAL OXYGEN DEMAND (MG/L, 30 DAY-20 DEG C)
01015	BISMUTH, DISSOLVED (UG/L AS BI)
01016	BISMUTH, SUSPENDED TOTAL (UG/L AS BI)
01017	BISMUTH, TOTAL (UG/L AS BI)
01020	BORON, DISSOLVED (UG/L AS B)
01021	BORON, SUSPENDED RECOVERABLE (UG/L AS B)
01022	BORON, TOTAL (UG/L AS B)
01023	BORON, TOTAL IN BOTTOM MATERIAL (UG/G AS B)
71870	BROMIDE, DISSOLVED (MG/L AS BR)
01025	CADMIUM, DISSOLVED (UG/L AS CD)
01026	CADMIUM, SUSPENDED RECOVERABLE (UG/L AS CD)
01027	CADMIUM, TOTAL (UG/L AS CD)
01028	CADMIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS CD)
00915	CALCIUM, DISSOLVED (MG/L AS CA)
00910	CALCIUM, DISSOLVED (MG/L AS CACO3)
81201	CALCIUM, DISSOLVED (TONS/DAY)
00917	CALCIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS CA)
00916	CALCIUM, TOTAL (MG/L AS CA)
00405	CARBON DIOXIDE, DISSOLVED (MG/L AS CO2)
00693	CARBON, INORGANIC PLUS ORGANIC, BOTTOM MATERIAL (G/KG)

CODE	PARAMETER
00682	CARBON, INORGANIC PLUS ORGANIC, DISSOLVED (MG/L AS C)
00694	CARBON, INORGANIC PLUS ORGANIC, SUSPENDED (MG/L AS C)
00686	CARBON, INORGANIC, BOTTOM MATERIAL (G/KG)
00691	CARBON, INORGANIC, DISSOLVED (MG/L AS C)
00688	CARBON, INORGANIC, SUSPENDED TOTAL (MG/L AS C)
00685	CARBON, INORGANIC, TOTAL (MG/L AS C)
00690	CARBON, TOTAL (MG/L AS C)
00445	CARBONATE ION (MG/L AS CO3)
01115	CESIUM, DISSOLVED (UG/L AS CS)
01116	CESIUM, SUSPENDED TOTAL (UG/L AS CS)
01117	CESIUM, TOTAL (UG/L AS CS)
50066	CHLORINE, COMBINED AVAILABLE (MG/L)
00940	CHLORIDE, DISSOLVED (MG/L AS CL)
70290	CHLORIDE, DISSOLVED (TONS/DAY)
50064	CHLORINE, FREE AVAILABLE (MG/L)
50060	CHLORINE, TOTAL RESIDUAL (MG/L)
01030	CHROMIUM, DISSOLVED (UG/L AS CR)
01032	CHROMIUM, HEXAVALENT, DISSOLVED (UG/L AS CR)
01031	CHROMIUM, SUSPENDED RECOVERABLE (UG/L AS CR)
01034	CHROMIUM, TOTAL (UG/L AS CR)
01029	CHROMIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS CR)
01035	COBALT, DISSOLVED (UG/L AS CO)
01036	COBALT, SUSPENDED RECOVERABLE (UG/L AS CO)

CODE	PARAMETER
01037	COBALT, TOTAL (UG/L AS CO)
01038	COBALT, TOTAL IN BOTTOM MATERIAL (UG/G AS CO)
01040	COPPER, DISSOLVED (UG/L AS CU)
01041	COPPER, SUSPENDED RECOVERABLE (UG/L AS CU)
01042	COPPER, TOTAL (UG/L AS CU)
01043	COPPER, TOTAL IN BOTTOM MATERIAL (UG/G AS CU)
00723	CYANIDE, DISSOLVED (MG/L AS CN)
00720	CYANIDE, TOTAL (MG/L AS CN)
00721	CYANIDE, TOTAL IN BOTTOM MATERIAL, DRY WT (UG/G AS CN)
00325	DEOXYGENATION CONSTANT K1 TO BASE E (PER DAY)
00300	DISSOLVED OXYGEN (MG/L)
00301	DISSOLVED OXYGEN (PERCENT OF SATURATION)
70301	DISSOLVED SOLIDS (SUM OF CONSTITUENTS)
70303	DISSOLVED SOLIDS (TONS PER ACRE-FOOT)
70302	DISSOLVED SOLIDS (TONS PER DAY)
00950	FLUORIDE, DISSOLVED (MG/L AS F)
00951	FLUORIDE, TOTAL (MG/L AS F)
01120	GALLIUM, DISSOLVED (UG/L AS GA)
01121	GALLIUM, SUSPENDED TOTAL (UG/L AS GA)
01122	GALLIUM, TOTAL (UG/L AS GA)
85542	GAS, ARGON, VOLUME PERCENT OF DISSOLVED GASES
85543	GAS, BUTANE, VOLUME PERCENT OF DISSOLVED GASES
85544	GAS, CARBON DIOXIDE, VOLUME PERCENT OF DISSOLVED GASES

CODE	PARAMETER
85545	GAS, ETHANE, VOLUME PERCENT OF DISSOLVED GASES
85546	GAS, HYDROGEN, VOLUME PERCENT OF DISSOLVED GASES
85541	GAS, INERT, VOLUME PERCENT OF DISSOLVED GASES
85547	GAS, METHANE, VOLUME PERCENT OF DISSOLVED GASES
85548	GAS, NITROGEN AND CARBON MONOXIDE, VOLUME PERCENT OF DISSOLVED GASES
85549	GAS, OCTANE, VOLUME PERCENT OF DISSOLVED GASES
85550	GAS, OXYGEN, VOLUME PERCENT OF DISSOLVED GASES
85551	GAS, PENTANE, VOLUME PERCENT OF DISSOLVED GASES
85552	GAS, PROPANE, VOLUME PERCENT OF DISSOLVED GASES
85555	GAS-WATER RATIO (CUBIC FEET PER BARREL)
01125	GERMANIUM, DISSOLVED (UG/L AS GE)
01126	GERMANIUM, SUSPENDED TOTAL (UG/L AS GE)
01127	GERMANIUM, TOTAL (UG/L AS GE)
00902	HARDNESS, NONCARBONATE (MG/L AS CACO3)
00900	HARDNESS, TOTAL (MG/L AS CACO3)
71875	HYDROGEN SULFIDE (MG/L AS H2S)
71830	HYDROXIDE ION (MG/L AS OH)
00302	IMMEDIATE OXYGEN DEMAND (MG/L)
71865	IODIDE, DISSOLVED (MG/L AS I)
71885	IRON (UG/L AS FE)
01046	IRON, DISSOLVED (UG/L AS FE)
01048	IRON, DISSOLVED FERRIC AND FERROUS (UG/L)
01047	IRON, FERROUS (UG/L AS FE)

CODE	PARAMETER
01044	IRON, SUSPENDED RECOVERABLE (UG/L AS FE)
74010	IRON, TOTAL (MG/L AS FE) (NOT FOR WRD USE)
01045	IRON, TOTAL (UG/L AS FE)
01170	IRON, TOTAL IN BOTTOM MATERIAL (UG/G AS FE)
01049	LEAD, DISSOLVED (UG/L AS PB)
01050	LEAD, SUSPENDED RECOVERABLE (UG/L AS PB)
01051	LEAD, TOTAL (UG/L AS PB)
01052	LEAD, TOTAL IN BOTTOM MATERIAL (UG/G AS PB)
01130	LITHIUM, DISSOLVED (UG/L AS LI)
01133	LITHIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WEIGHT (UG/G AS LI)
01131	LITHIUM, SUSPENDED RECOVERABLE (UG/L AS LI)
01132	LITHIUM, TOTAL (UG/L AS LI)
00496	LOSS ON IGNITION, BOTTOM MATERIAL (MG/KG)
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)
81202	MAGNESIUM, DISSOLVED (TONS/DAY)
00926	MAGNESIUM, SUSPENDED TOTAL (MG/L AS MG)
00924	MAGNESIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS MG)
00927	MAGNESIUM, TOTAL (MG/L AS MG)
71883	MANGANESE (UG/L AS MN)
01056	MANGANESE, DISSOLVED (UG/L AS MN)
01054	MANGANESE, SUSPENDED RECOVERABLE (UG/L AS MN)
01055	MANGANESE, TOTAL (UG/L AS MN)

CODE	PARAMETER
01053	MANGANESE, TOTAL IN BOTTOM MATERIAL (UG/G AS MN)
71890	MERCURY, DISSOLVED (UG/L AS HG)
71895	MERCURY, SUSPENDED RECOVERABLE (UG/L AS HG)
71900	MERCURY, TOTAL (UG/L AS HG)
71921	MERCURY, TOTAL IN BOTTOM MATERIAL (UG/G AS HG)
01060	MOLYBDENUM, DISSOLVED (UG/L AS MO)
01061	MOLYBDENUM, SUSPENDED RECOVERABLE (UG/L AS MO)
01062	MOLYBDENUM, TOTAL (UG/L AS MO)
01063	MOLYBDENUM, TOTAL IN BOTTOM MATERIAL (UG/G AS MO)
01065	NICKEL, DISSOLVED (UG/L AS NI)
01066	NICKEL, SUSPENDED RECOVERABLE (UG/L AS NI)
01067	NICKEL, TOTAL (UG/L AS NI)
01068	NICKEL, TOTAL IN BOTTOM MATERIAL (UG/G AS NI)
00639	NITROGEN, ALBUMINOID (MG/L AS N)
00608	NITROGEN, AMMONIA, DISSOLVED (MG/L AS N)
71846	NITROGEN, AMMONIA, DISSOLVED (MG/L AS NH4)
00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)
71845	NITROGEN, AMMONIA, TOTAL (MG/L AS NH4)
00611	NITROGEN, AMMONIA, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS N)
00636	NITROGEN, AMMONIA + ORGANIC, DISSOLVED, ONE DETERMINATION (MG/L AS N)
00635	NITROGEN, AMMONIA + ORGANIC, TOTAL, ONE DETERMINATION (MG/L AS N)
00623	NITROGEN, AMMONIA PLUS ORGANIC, DISSOLVED (MG/L AS N)

CODE	PARAMETER
00624	NITROGEN, AMMONIA PLUS ORGANIC, SUSPENDED TOTAL (MG/L AS N)
00625	NITROGEN, AMMONIA PLUS ORGANIC, TOTAL (MG/L AS N)
00626	NITROGEN, AMMONIA PLUS ORGANIC, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS N)
00602	NITROGEN, DISSOLVED (MG/L AS N)
00618	NITROGEN, NITRATE, DISSOLVED (MG/L AS N)
71851	NITROGEN, NITRATE, DISSOLVED (MG/L AS NO3)
00620	NITROGEN, NITRATE, TOTAL (MG/L AS N)
71850	NITROGEN, NITRATE, TOTAL (MG/L AS NO3)
00621	NITROGEN, NITRATE, TOTAL IN BOTTOM MATERIAL (MG/KG AS N)
00613	NITROGEN, NITRITE, DISSOLVED (MG/L AS N)
71856	NITROGEN, NITRITE, DISSOLVED (MG/L AS NO2)
00615	NITROGEN, NITRITE, TOTAL (MG/L AS N)
71855	NITROGEN, NITRITE, TOTAL (MG/L AS NO2)
00616	NITROGEN, NITRITE, TOTAL IN BOTTOM MATERIAL (MG/KG AS N)
00631	NITROGEN, NITRITE PLUS NITRATE, DISSOLVED (MG/L AS N)
00630	NITROGEN, NITRITE PLUS NITRATE, TOTAL (MG/L AS N)
00633	NITROGEN, NITRITE PLUS NITRATE, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS N)
00607	NITROGEN, ORGANIC, DISSOLVED (MG/L AS N)
00605	NITROGEN, ORGANIC, TOTAL (MG/L AS N)
00600	NITROGEN, TOTAL (MG/L AS N)
71887	NITROGEN, TOTAL (MG/L AS NO3)

CODE	PARAMETER
00603	NITROGEN, TOTAL IN BOTTOM MATERIAL (MG/KG AS N)
71835	OXYGEN CONSUMED - FILTERED (MG/L)
71840	OXYGEN CONSUMED - UNFILTERED (MG/L)
00310	OXYGEN DEMAND, BIOCHEMICAL 5-DAY AT 20 DEG C (MG/L)
00320	OXYGEN DEMAND, BIOCHEMICAL ULTIMATE CARBONACEOUS (MG/L)
00335	OXYGEN DEMAND, CHEMICAL, 0.025N DICHROMATE (MG/L)
00340	OXYGEN DEMAND, CHEMICAL, 0.25N DICHROMATE (MG/L)
00339	OXYGEN DEMAND, CHEMICAL, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG)
00660	PHOSPHATE, ORTHO, DISSOLVED (MG/L AS PO4)
00650	PHOSPHATE, TOTAL (MG/L AS PO4)
00653	PHOSPHATE, TOTAL SOLUBLE (MG/L AS PO4)
00666	PHOSPHORUS, DISSOLVED (MG/L AS P)
71888	PHOSPHORUS, DISSOLVED (MG/L AS PO4)
00677	PHOSPHORUS, HYDROLYZABLE PLUS ORTHO, DISSOLVED (MG/L AS P)
00678	PHOSPHORUS, HYDROLYZABLE PLUS ORTHO, TOTAL (MG/L AS P)
00672	PHOSPHORUS, HYDROLYZABLE, DISSOLVED (MG/L AS P)
00669	PHOSPHORUS, HYDROLYZABLE, TOTAL (MG/L AS P)
00673	PHOSPHORUS, ORGANIC, DISSOLVED (MG/L AS P)
00670	PHOSPHORUS, ORGANIC, TOTAL (MG/L AS P)
70507	PHOSPHORUS, ORTHOPHOSPHATE, TOTAL (MG/L AS P)
00671	PHOSPHORUS, ORTHOPHOSPHATE, DISSOLVED (MG/L AS P)
00665	PHOSPHORUS, TOTAL (MG/L AS P)
71886	PHOSPHORUS, TOTAL (MG/L AS PO4)

CODE	PARAMETER
00668	PHOSPHORUS, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS P)
00935	POTASSIUM, DISSOLVED (MG/L AS K)
81204	POTASSIUM, DISSOLVED (TONS/DAY)
00938	POTASSIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS K)
00937	POTASSIUM, TOTAL (MG/L AS K)
00330	REOXYGENATION CONSTANT K2 TO BASE E (PER DAY)
71860	RESIDUAL SODIUM CARBONATE
00548	RESIDUE, FIXED NONSETTLEABLE (MG/L) (LOSS ON IGNITION ASH)
00545	RESIDUE, SETTLEABLE (ML/L)
00500	RESIDUE, TOTAL (MG/L AT 105 DEG. C)
00520	RESIDUE, VOLATILE FILTRABLE (MG/L)
00535	RESIDUE, VOLATILE NONFILTRABLE (MG/L)
01135	RUBIDIUM, DISSOLVED (UG/L AS RB)
01136	RUBIDIUM, SUSPENDED TOTAL (UG/L AS RB)
01137	RUBIDIUM, TOTAL (UG/L AS RB)
00480	SALINITY (PARTS PER THOUSAND)
01145	SELENIUM, DISSOLVED (UG/L AS SE)
01146	SELENIUM, SUSPENDED TOTAL (UG/L AS SE)
01147	SELENIUM, TOTAL (UG/L AS SE)
01148	SELENIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS SE)
50086	SETTLEABLE MATTER (ML/L/HR)
00955	SILICA, DISSOLVED (MG/L AS SIO2)

CODE	PARAMETER
81200	SILICA, DISSOLVED (TONS/DAY)
01075	SILVER, DISSOLVED (UG/L AS AG)
01076	SILVER, SUSPENDED RECOVERABLE (UG/L AS AG)
01077	SILVER, TOTAL (UG/L AS AG)
01078	SILVER, TOTAL IN BOTTOM MATERIAL (UG/G AS AG)
00931	SODIUM ADSORPTION RATIO
00930	SODIUM, DISSOLVED (MG/L AS NA)
81203	SODIUM, DISSOLVED (TONS/DAY)
00932	SODIUM, PERCENT
00933	SODIUM PLUS POTASSIUM, DISSOLVED (MG/L AS NA)
00934	SODIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS NA)
00929	SODIUM, TOTAL (MG/L AS NA)
00525	SOLIDS, NONVOLATILE ON IGNITION, DISSOLVED (MG/L)
00540	SOLIDS, NONVOLATILE ON IGNITION, SUSPENDED (MG/L)
00510	SOLIDS, NONVOLATILE ON IGNITION, TOTAL (MG/L)
70299	SOLIDS, RESIDUE AT 110 DEG. C, SUSPENDED TOTAL (MG/L)
00515	SOLIDS, RESIDUE ON EVAPORATION AT 105 DEG C, DISSOLVED (MG/L)
70300	SOLIDS, RESIDUE ON EVAPORATION AT 180 DEG C, DISSOLVED (MG/L)
00530	SOLIDS, RESIDUE AT 105 DEG C, SUSPENDED (MG/L)
00500	SOLIDS, RESIDUE ON EVAPORATION AT 105 DEG C, TOTAL (MG/L)
70299	SOLIDS, SUSPENDED (MG/L AT 110 DEG. C)

CODE	PARAMETER
00549	SOLIDS, VOLATILE, NONSETTLEABLE (MG/L)
01080	STRONTIUM, DISSOLVED (UG/L AS SR)
01081	STRONTIUM, SUSPENDED RECOVERABLE (UG/L AS SR)
01082	STRONTIUM, TOTAL (UG/L AS SR)
01083	STRONTIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS SR)
00945	SULFATE, DISSOLVED (MG/L AS SO4)
70291	SULFATE, DISSOLVED (TONS/DAY)
00746	SULFIDE, DISSOLVED (MG/L AS S)
00745	SULFIDE, TOTAL (MG/L AS S)
00740	SULFITE (MG/L AS SO3)
00731	THIOCYANATE, DISSOLVED (MG/L AS SCN)
00730	THIOCYANATE, TOTAL (MG/L AS SCN)
01100	TIN, DISSOLVED (UG/L AS SN)
01101	TIN, SUSPENDED RECOVERABLE (UG/L AS SN)
01102	TIN, TOTAL (UG/L AS SN)
01150	TITANIUM, DISSOLVED (UG/L AS TI)
01151	TITANIUM, SUSPENDED TOTAL (UG/L AS TI)
01152	TITANIUM, TOTAL (UG/L AS TI)
01153	TITANIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS TI)
01085	VANADIUM, DISSOLVED (UG/L AS V)
01086	VANADIUM, SUSPENDED TOTAL (UG/L AS V)
01087	VANADIUM, TOTAL (UG/L AS V)
01088	VANADIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS V)

CODE	PARAMETER
01090	ZINC, DISSOLVED (UG/L AS ZN)
01091	ZINC, SUSPENDED RECOVERABLE (UG/L AS ZN)
01092	ZINC, TOTAL (UG/L AS ZN)
01093	ZINC, TOTAL IN BOTTOM MATERIAL (UG/G AS ZN)
01160	ZIRCONIUM, DISSOLVED (UG/L AS ZR)
01161	ZIRCONIUM, SUSPENDED TOTAL (UG/L AS ZR)
01162	ZIRCONIUM, TOTAL (UG/L AS ZR)

GENERAL ORGANIC PARAMETERS

85556	ACIDS, ORGANIC AS PROPIONIC (MG/L)
39499	AROCLOR, TOTAL IN BOTTOM MATERIAL, 1242 PCB SERIES, DRY WT (UG/KG)
39496	AROCLOR, TOTAL, 1242 PCB SERIES (UG/L)
39503	AROCLOR IN BOTTOM MATERIAL, 1248 PCB SERIES (UG/KG DRY SOLIDS)
39501	AROCLOR, DISSOLVED, 1248 PCB SERIES (UG/L)
39502	AROCLOR, SUSPENDED TOTAL, 1248 PCB SERIES (UG/L)
39500	AROCLOR, TOTAL, 1248 PCB SERIES (UG/L)
39507	AROCLOR IN BOTTOM MATERIAL, 1254 PCB SERIES (UG/KG DRY SOLIDS)
39505	AROCLOR, DISSOLVED, 1254 PCB SERIES (UG/L)
39506	AROCLOR, SUSPENDED TOTAL, 1254 PCB SERIES (UG/L)
39504	AROCLOR, TOTAL, 1254 PCB SERIES (UG/L)
39511	AROCLOR IN BOTTOM MATERIAL, 1260 PCB SERIES (UG/KG DRY SOLIDS)
39509	AROCLOR, DISSOLVED, 1260 PCB SERIES (UG/L)

CODE	PARAMETER
39510	AROCLOR, SUSPENDED TOTAL, 1260 PCB SERIES (UG/L)
39508	AROCLOR, TOTAL, 1260 PCB SERIES (UG/L)
32004	CARBON ALCOHOL EXTRACTABLES (UG/L)
32003	CARBON CHLOROFORM AND ALCOHOL EXTRACTABLES, TOTAL (UG/L)
32005	CARBON CHLOROFORM EXTRACTABLES (UG/L)
00682	CARBON, INORGANIC PLUS ORGANIC, DISSOLVED (MG/L AS C)
00694	CARBON, INORGANIC PLUS ORGANIC, SUSPENDED TOTAL (MG/L AS C)
00693	CARBON, INORGANIC PLUS ORGANIC, TOTAL IN BOTTOM MATERIAL, DRY WT (G/KG)
00681	CARBON, ORGANIC, DISSOLVED (MG/L AS C)
00692	CARBON, ORGANIC, IMMISCIBLE (MG/L AS C)
00683	CARBON, ORGANIC, SUSPENDED TOTAL (MG/L AS C)
00689	CARBON, ORGANIC, SUSPENDED TOTAL (MG/L AS C)
00680	CARBON, ORGANIC, TOTAL (MG/L AS C)
00687	CARBON, ORGANIC, TOTAL IN BOTTOM MATERIAL, DRY WT (G/KG)
71880	FORMALDEHYDE (MG/L)
38260	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
39250	NAPHTHALENES, POLYCHLORINATED (UG/L)
00636	NITROGEN, AMMONIA + ORGANIC, DISSOLVED, ONE DETERMINATION (MG/L AS N)
00635	NITROGEN, AMMONIA + ORGANIC, TOTAL, ONE DETERMINATION (MG/L AS N)
00607	NITROGEN, ORGANIC, DISSOLVED (MG/L AS N)
00605	NITROGEN, ORGANIC, TOTAL (MG/L AS N)
00553	OIL-GREASE IN BOTTOM MATERIAL (MG/KG)

CODE	PARAMETER
00550	OIL-GREASE, TOTAL (MG/L)
00561	OIL-GREASE, TOTAL IN BOTTOM MATERIAL, ELECTROMETRIC, INFRARED-FREON EXTRACTABLE,DRY WT., (MG/KG)
00557	OIL-GREASE, TOTAL IN BOTTOM MATERIAL, GRAVIMETRIC, FREON EXTRACTABLE, DRY WT., (MG/KG)
00560	OIL-GREASE, TOTAL RECOVERABLE, ELECTROMETRIC, INFRARED-FREON EXTRACTABLE, (MG/L)
00556	OIL-GREASE, TOTAL RECOVERABLE, GRAVIMETRIC, FREON EXTRACTABLE (MG/L)
39519	PCB IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39517	PCB, DISSOLVED (UG/L)
39518	PCB, SUSPENDED TOTAL (UG/L)
39516	PCB, TOTAL (UG/L)
32730	PHENOLS (UG/L)
46002	PHENOLS, DIRECT PHOTOMETRIC, NO DISTILLATION (UG/L)
00673	PHOSPHORUS, ORGANIC, DISSOLVED (MG/L AS P)
00670	PHOSPHORUS, ORGANIC, TOTAL (MG/L AS P)
71876	RESIN ACID SOAP (MG/L)
07080	RHODAMINE WT, DISSOLVED (UG/L)
07082	RHODAMINE WT, SUSPENDED (UG/L)
07084	RHODAMINE WT, TOTAL (UG/L)
32240	TANNIN AND LIGNIN (MG/L)
39053	ALDICARB, TOTAL (UG/L)

CODE	PARAMETER
39333	ALDRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39331	ALDRIN, DISSOLVED (UG/L)
39332	ALDRIN, SUSPENDED TOTAL (UG/L)
39330	ALDRIN, TOTAL (UG/L)
39900	ALLETHRIN, TOTAL (UG/L)
39630	ATRAZINE, TOTAL (UG/L)
39631	ATRAZINE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39351	CHLORDANE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39352	CHLORDANE, DISSOLVED (UG/L)
39353	CHLORDANE, SUSPENDED TOTAL (UG/L)
39350	CHLORDANE, TOTAL (UG/L)
39460	CHLOROBENZILATE, TOTAL (UG/L)
39550	CHLOROTHION, TOTAL (UG/L)
39910	CINERIN, TOTAL (UG/L)
39770	DACTHAL (DCPA), TOTAL (UG/L)
39780	DICOFOL, TOTAL (UG/L)
39363	DDD IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39316	O,P' DDD, TOTAL IN BOTTOM MATERIAL, DRY WT (UG/KG)
39311	P,P' DDD IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39315	O,P' DDD, TOTAL (UG/L)
39361	DDD, DISSOLVED (UG/L)
39362	DDD, SUSPENDED TOTAL (UG/L)
39360	DDD, TOTAL (UG/L)

CODE	PARAMETER
39310	P,P' DDD, TOTAL (UG/L)
39368	DDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39321	P,P' DDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39320	P,P' DDE, TOTAL (UG/L)
39366	DDE, DISSOLVED (UG/L)
39367	DDE, SUSPENDED TOTAL (UG/L)
39365	DDE, TOTAL (UG/L)
39327	O,P' DDE, TOTAL (UG/L)
39328	O,P' DDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39373	DDT IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39306	O,P' DDT IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39301	P,P' DDT IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39371	DDT, DISSOLVED (UG/L)
39372	DDT, SUSPENDED TOTAL (UG/L)
39370	DDT, TOTAL (UG/L)
39305	O,P' DDT, TOTAL (UG/L)
39300	P,P' DDT, TOTAL (UG/L)
39040	DEF, TOTAL (UG/L)
39050	DEF IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39560	DEMETON, TOTAL (UG/L)
39571	DIAZINON IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39572	DIAZINON, DISSOLVED (UG/L)
39573	DIAZINON, SUSPENDED TOTAL (UG/L)

CODE	PARAMETER
39570	DIAZINON, TOTAL (UG/L)
39383	DIELDRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39381	DIELDRIN, DISSOLVED (UG/L)
39382	DIELDRIN, SUSPENDED TOTAL (UG/L)
39380	DIELDRIN, TOTAL (UG/L)
39470	DILAN, TOTAL (UG/L)
39920	DNOC, TOTAL (UG/L)
39388	ENDOSULFAN, TOTAL (UG/L)
39389	ENDOSULFANE, TOTAL IN BOTTOM MATERIAL, DRY WT (UG/KG)
39393	ENDRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39391	ENDRIN, DISSOLVED (UG/L)
39392	ENDRIN, SUSPENDED TOTAL (UG/L)
39390	ENDRIN, TOTAL (UG/L)
39399	ETHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39398	ETHION, TOTAL (UG/L)
39810	GAMMA CHLORDANE, TOTAL (UG/L)
39811	GAMMA CHLORDANE IN BOTTOM MAT. (UG/KG DRY SOLIDS)
39580	GUTHION, TOTAL (UG/L)
39593	HEPT (UG/L)
39413	HEPTACHLOR IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39411	HEPTACHLOR, DISSOLVED (UG/L)
39412	HEPTACHLOR, SUSPENDED TOTAL (UG/L)
39410	HEPTACHLOR, TOTAL (UG/L)

CODE	PARAMETER
39423	HEPTACHLOR EPOXIDE IN BOTTOM MATERIAL
39421	HEPTACHLOR EPOXIDE, DISSOLVED (UG/L)
39422	HEPTACHLOR EPOXIDE, SUSPENDED TOTAL (UG/L)
39420	HEPTACHLOR EPOXIDE, TOTAL (UG/L)
39701	HEXACHLOROBENZENE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS) (UG/KG DRY SOLIDS)
39800	IMIDAN, TOTAL (UG/L)
39433	ISODRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39431	ISORDIN, DISSOLVED (UG/L)
39432	ISODRIN, SUSPENDED TOTAL (UG/L)
39430	ISODRIN, TOTAL (UG/L)
39343	LINDANE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39341	LINDANE, DISSOLVED (UG/L)
39342	LINDANE, SUSPENDED TOTAL (UG/L)
39340	LINDANE, TOTAL (UG/L)
39782	LINDANE, TOTAL (UG/L)(TO BE USED ONLY AT THE REQUEST OF THE ENVIRONMENTAL PROTECTION AGENCY)
39531	MALATHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39532	MALATHION, DISSOLVED (UG/L)
39533	MALATHION, SUSPENDED TOTAL (UG/L)
39530	MALATHION, TOTAL (UG/L)
39051	METHOMYL, TOTAL (UG/L)
39481	METHOXYCHLOR IN BOTTOM MATERIALS (UG/KG DRY SOLIDS)
39480	METHOXYCHLOR, TOTAL (UG/L)

CODE	PARAMETER
39601	METHYL PARATHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39602	METHYL PARATHION, DISSOLVED (UG/L)
39603	METHYL PARATHION, SUSPENDED TOTAL (UG/L)
39600	METHYL PARATHION, TOTAL (UG/L)
39791	METHYL TRITHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39790	METHYL TRITHION, TOTAL (UG/L)
39758	MIREX, TOTAL IN BOTTOM MATERIALS, DRY WT (UG/KG)
39756	MIREX, DISSOLVED (UG/L)
39757	MIREX, SUSPENDED TOTAL (UG/L)
39755	MIREX, TOTAL (UG/L)
39541	PARATHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39542	PARATHION, DISSOLVED (UG/L)
39543	PARATHION, SUSPENDED TOTAL (UG/L)
39540	PARATHION, TOTAL (UG/L)
39251	PCN,TOTAL IN BOTTOM MATERIAL, DRY WT (UG/KG)
39034	PERTHANE, TOTAL (UG/L)
39610	PHOSDRIN, TOTAL (UG/L)
39056	PROMETONE, TOTAL (UG/L)
39057	PROMETRYNE, TOTAL (UG/L)
39052	PROPHAM, TOTAL (UG/L)
39930	PYRETHRIN, TOTAL (UG/L)
39750	SEVIN, TOTAL (UG/L)
39761	SILVEX IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)

CODE	PARAMETER
39762	SILVEX, DISSOLVED (UG/L)
39763	SILVEX, SUSPENDED TOTAL (UG/L)
39760	SILVEX, TOTAL (UG/L)
39025	SIMAZINE, TOTAL, COULSON COND. (UG/L)
39055	SIMAZINE, TOTAL (UG/L)
39046	SIMAZINE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39054	SIMETRYNE, TOTAL (UG/L)
39620	TEPP, TOTAL (UG/L)
39403	TOXAPHENE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39401	TOXAPHENE, DISSOLVED (UG/L)
39402	TOXAPHENE, SUSPENDED TOTAL (UG/L)
39400	TOXAPHENE, TOTAL (UG/L)
39787	TRITHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39786	TRITHION, TOTAL (UG/L)
39731	2,4-D IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39732	2,4-D, DISSOLVED (UG/L)
39733	2,4-D, SUSPENDED TOTAL (UG/L)
39730	2,4-D, TOTAL (UG/L)
39741	2,4,5-T IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39742	2,4,5-T, DISSOLVED (UG/L)
39743	2,4,5-T, SUSPENDED TOTAL (UG/L)
39740	2,4,5-T, TOTAL (UG/L)

CODE	PARAMETER
	RADIOCHEMICAL PARAMETERS
01503	ALPHA, DISSOLVED (PCI/L)
01504	ALPHA, DISSOLVED, COUNTING ERROR (PCI/L)
01515	GROSS ALPHA RADIOACTIVITY, DISSOLVED (PCI/L AS U NATURAL)
80030	ALPHA, GROSS, DISSOLVED AS U NATURAL (UG/L)
80040	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (UG/L AS U NATURAL)
01505	ALPHA, SUSPENDED TOTAL (PCI/L)
01506	ALPHA, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
01516	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (PCI/L AS U NATURAL)
01517	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (PCI/G AS U NATURAL)
01518	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (UG/G AS U NATURAL)
01501	ALPHA, TOTAL (PCI/L)
01502	ALPHA, TOTAL, COUNTING ERROR (PCI/L)
03503	BETA, DISSOLVED (PCI/L)
03504	BETA, DISSOLVED, COUNTING ERROR (PCI/L)
03515	GROSS BETA RADIOACTIVITY, DISSOLVED (PCI/L AS CS-137)
80050	BETA, GROSS, DISSOLVED AS STRONTIUM/YTTRIUM-90 (PCI/L)
80060	GROSS BETA RADIOACTIVITY, SUSPENDED TOTAL (PCI/L AS SR/YT-90)
03505	BETA, SUSPENDED TOTAL (PCI/L)
03506	BETA, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)

CODE	PARAMETER
03516	GROSS BETA RADIOACTIVITY, SUSPENDED TOTAL (PCI/L AS CS-137)
03518	GROSS BETA RADIOACTIVITY, SUSPENDED TOTAL (PCI/G AS CS-137) (PCI/G AS SR/YT-90)
03501	BETA, TOTAL (PCI/L)
03502	BETA, TOTAL, COUNTING ERROR (PCI/L)
07050	CALCIUM 45, DISSOLVED (PCI/L)
07051	CALCIUM 45, DISSOLVED, COUNTING ERROR (PCI/L)
07052	CALCIUM 45, SUSPENDED TOTAL (PCI/L)
07053	CALCIUM 45, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07054	CALCIUM 45, TOTAL (PCI/L)
07055	CALCIUM 45, TOTAL, COUNTING ERROR (PCI/L)
28901	CERIUM 144, TOTAL (PCI/L)
28902	CERIUM 144, TOTAL, COUNTING ERROR (PCI/L)
28410	CESIUM 134, DISSOLVED (PCI/L)
28411	CESIUM 134, DISSOLVED, COUNTING ERROR (PCI/L)
28412	CESIUM 134, SUSPENDED TOTAL (PCI/L)
28413	CESIUM 134, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
28414	CESIUM 134, TOTAL (PCI/L)
28415	CESIUM 134, TOTAL, COUNTING ERROR (PCI/L)
28403	CESIUM 137, DISSOLVED (PCI/L)
28406	CESIUM 137, DISSOLVED, COUNTING ERROR (PCI/L)
28404	CESIUM 137, SUSPENDED TOTAL (PCI/L)
28405	CESIUM 137,SUSPENDED TOTAL, COUNTING ERROR (PCI/L)

CODE	PARAMETER
28401	CESIUM 137, TOTAL (PCI/L)
28402	CESIUM 137, TOTAL, COUNTING ERROR (PCI/L)
29601	COBALT 60, TOTAL (PCI/L)
29602	COBALT 60, TOTAL, COUNTING ERROR (PCI/L)
07060	IRON 59, DISSOLVED (PCI/L)
07061	IRON 59, DISSOLVED, COUNTING ERROR (PCI/L)
07062	IRON 59, SUSPENDED TOTAL (PCI/L)
07063	IRON 59, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07064	IRON 59, TOTAL (PCI/L)
07065	IRON 59, TOTAL, COUNTING ERROR (PCI/L)
17503	LEAD - 210, DISSOLVED (PCI/L)
17504	LEAD - 210, DISSOLVED, COUNT ERROR (PCI/L)
29501	MANGANESE 54, TOTAL (PCI/L)
29502	MANGANESE 54, TOTAL, COUNTING ERROR (PCI/L)
75038	POTASSIUM 40, TOTAL (PCI/L)
75037	POTASSIUM 40, TOTAL, COUNTING ERROR (PCI/L)
09503	RADIUM 226, DISSOLVED (PCI/L)
09510	RADIUM 226, DISSOLVED, PLANCHET COUNT (PCI/L)
09511	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)
09505	RADIUM 226, SUSPENDED TOTAL (PCI/L)
09501	RADIUM 226, TOTAL (PCI/L)
11501	RADIUM 228, TOTAL (PCI/L AS RA-228)
11502	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L AS RA-228)

CODE	PARAMETER
07082	RHODAMINE WT, SUSPENDED TOTAL (UG/L)
28001	RUTHENIUM 106, TOTAL (PCI/L)
28002	RUTHENIUM 106, TOTAL, COUNTING ERROR (PCI/L)
29631	SCANDIUM 46, DISSOLVED (PCI/L)
29632	SCANDIUM 46, DISSOLVED, COUNTING ERROR (PCI/L)
29633	SCANDIUM 46, SUSPENDED TOTAL (PCI/L)
29634	SCANDIUM 46, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
29635	SCANDIUM 46, TOTAL (PCI/L)
29636	SCANDIUM 46, TOTAL, COUNTING ERROR (PCI/L)
07100	SELENIUM 75, DISSOLVED (PCI/L)
07101	SELENIUM 75, DISSOLVED, COUNTING ERROR (PCI/L)
07102	SELENIUM 75, SUSPENDED TOTAL (PCI/L)
07103	SELENIUM 75, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07104	SELENIUM 75, TOTAL (PCI/L)
07105	SELENIUM 75, TOTAL, COUNTING ERROR (PCI/L)
07120	SILVER 110, DISSOLVED (PCI/L)
07121	SILVER 110, DISSOLVED, COUNTING ERROR (PCI/L)
07122	SILVER 110, SUSPENDED TOTAL (PCI/L)
07123	SILVER 110, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07124	SILVER 110, TOTAL (PCI/L)
07125	SILVER 110, TOTAL, COUNTING ERROR (PCI/L)
15501	STRONTIUM 89, TOTAL (PCI/L)
15502	STRONTIUM 89, TOTAL, COUNTING ERROR (PCI/L)

CODE	PARAMETER
13503	STRONTIUM 90, DISSOLVED (PCI/L)
13504	STRONTIUM 90, DISSOLVED, COUNTING ERROR (PCI/L)
13505	STRONTIUM 90, SUSPENDED TOTAL (PCI/L)
13506	STRONTIUM 90, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
13501	STRONTIUM 90, TOTAL (PCI/L)
13502	STRONTIUM 90, TOTAL, COUNTING ERROR (PCI/L)
07140	SULFUR 35, DISSOLVED (PCI/L)
07141	SULFUR 35, DISSOLVED, COUNTING ERROR (PCI/L)
07142	SULFUR 35, SUSPENDED TOTAL (PCI/L)
07143	SULFUR 35, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07144	SULFUR 35, TOTAL (PCI/L)
07145	SULFUR 35, TOTAL, COUNTING ERROR (PCI/L)
22501	THORIUM 232, TOTAL (PCI/L)
22502	THORIUM 232, TOTAL, COUNTING ERROR (PCI/L)
07012	TRITIUM IN WATER MOLECULES (TRITIUM UNITS)
07013	TRITIUM IN WATER MOLECULES, COUNTING ERROR (TRITIUM UNITS)
07005	TRITIUM, DISSOLVED (PCI/L)
07018	TRITIUM, DISSOLVED (TRITIUM UNITS)
07006	TRITIUM, DISSOLVED, COUNTING ERROR (PCI/L)
07015	TRITIUM, DISSOLVED, COUNTING ERROR (TRITIUM UNITS)
07010	TRITIUM, SUSPENDED TOTAL (PCI/L)
07011	TRITIUM, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07016	TRITIUM, SUSPENDED TOTAL (TRITIUM UNITS)

CODE	PARAMETER
07014	TRITIUM, SUSPENDED TOTAL, COUNTING ERROR (TRITIUM UNITS)
07000	TRITIUM, TOTAL (PCI/L)
07017	TRITIUM, TOTAL (TRITIUM UNITS)
07001	TRITIUM, TOTAL, COUNTING ERROR (PCI/L)
07019	TRITIUM, TOTAL, COUNTING ERROR (TRITIUM UNITS)
80010	URANIUM, DISSOLVED, DIRECT FLUOROMETRIC (PCI/L)
80015	URANIUM, DISSOLVED, EXTRACTION FLUOROMETRIC (PCI/L)
80020	URANIUM, DISSOLVED, EXTRACTION FLUOROMETRIC (UG/L)
22703	URANIUM, NATURAL, DISSOLVED (UG/L)
22705	URANIUM, NATURAL, SUSPENDED TOTAL (UG/L AS U NATURAL)
29301	ZINC 65, TOTAL (PCI/L)
29302	ZINC 65, TOTAL, COUNTING ERROR (PCI/L)
75031	ZIRCONIUM, NIOBIUM 95, TOTAL (PCI/L)
75031	ZIRCONIUM, NIOBIUM 95, TOTAL, COUNTING ERROR (PCI/L)

BIOLOGICAL PARAMETERS

70998	ADENOSINE TRIPHOSPHATE (UG/L)
70988	ALGAL GROWTH POTENTIAL (MG/L)
85209	ALGAL GROWTH POTENTIAL USGS MOD. BOTTLE TEST (MG/L)
85209	ALGAL GROWTH POTENTIAL, BOTTLE TEST (MG/L)
31854	BACTERIA, NITRIFYING (MPN)
31855	BACTERIA, SULFATE REDUCING (MPN)
70950	BIOMASS-CHLOROPHYLL RATIO, PERIPHYTON (UNITS)
70949	BIOMASS-CHLOROPHYLL RATIO, PLANKTON (UNITS)

CODE	PARAMETER
70957	CHLOROPHYLL-A, PERIPHYTON, CHROMOTOGRAPHIC-FLUOROMETRIC (MG/SQ M)
70955	CHLOROPHYLL-A, PERIPHYTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (MG/SQ M)
32223	CHLOROPHYLL A, PERIPHYTON, SPECTROPHOTOMETRIC, CORRECTED (MG/SQ M)
32228	CHLOROPHYLL A, PERIPHYTON, SPECTROPHOTOMETRIC, FLUOROMETRIC (UG/L)
70951	CHLOROPHYLL-A, PHYTOPLANKTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (UG/L)
32211	CHLOROPHYLL A, PHYTOPLANKTON, SPECTROPHOTOMETRIC, CORRECTED (UG/L)
32230	CHLOROPHYLL A, PHYTOPLANKTON, SPECTROPHOTOMETRIC, UNCORRECTED (UG/L)
70958	CHLOROPHYLL-B, PERIPHYTON, CHROMOTOGRAPHIC-FLUOROMETRIC (MG/SQ M)
70956	CHLOROPHYLL-B, PERIPHYTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (MG/SQ M)
32226	CHLOROPHYLL B, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)
70954	CHLOROPHYLL-B, PHYTOPLANKTON, CHROMOTOGRAPHIC-FLUOROMETRIC (UG/L)
70952	CHLOROPHYLL-B, PHYTOPLANKTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (UG/L)
32231	CHLOROPHYLL B, PHYTOPLANKTON, SPECTROPHOTOMETRIC (UG/L)
32227	CHLOROPHYLL C, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)
32232	CHLOROPHYLL C, PHYTOPLANKTON, SPECTROPHOTOMETRIC (UG/L)
32225	CHLOROPHYLL, TOTAL, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)

CODE	PARAMETER
32234	CHLOROPHYLL, TOTAL, PHYTOPLANKTON, SPECTROPHOTOMETRIC, UNCORRECTED (UG/L)
31507	COLIFORM, COMPLETE (MPN)
31619	COLIFORM, FECAL, BORIC ACID LACTOSE BROTH AT 43 DEG. C (MPN)
31615	COLIFORM, FECAL, EC BROTH AT 44.5 DEG. C (MPN)
31617	COLIFORM, FECAL, EIJKMAN TEST AT 44.5 DEG. C (MPN)
31616	COLIFORM, FECAL, MEMBRANE FILTER M-FC MEDIA AT 44.5 DEG. C (COLONIES/100 ML)
31625	COLIFORM, FECAL, 0.7UM-MF, IMMEDIATE, M-FC MEDIA
31503	COLIFORM, MEMBRANE FILTER, DELAYED M-ENDO MEDIUM (COLONIES/100 ML)
31501	COLIFORM, MEMBRANE FILTER, IMMEDIATE M-ENDO MEDIUM (COLONIES/100 ML)
31505	COLIFORM, CONFIRMED (MPN)
70942	INVERTEBRATES, BENTHIC, ASH WEIGHT (G/SQ METER
70941	INVERTEBRATES, BENTHIC, DRY WEIGHT (G/SQ METER)
70943	INVERTEBRATES, BENTHIC, TOTAL (ORGANISMS/SQ M)
70940	INVERTEBRATES, BENTHIC, WET WEIGHT (G/SQ METER)
70944	MACROPHYTES, TOTAL (NUMBER/SQ METER)
00573	PERIPHYTON, BIOMASS, DRY WEIGHT, TOTAL (G/SQ M)
00572	PERIPHYTON, BIOMASS, ASH WEIGHT (G/SQ M)
70945	PERIPHYTON, TOTAL (CELLS/SQ MILLIMETER)
32224	PHEOPHYTIN, PERIPHYTON, SPECTROPHOTOMETRIC, CORRECTED (MG/SQ M)

CODE	PARAMETER
32218	PHEOPHYTIN, PHYTOPLANKTON, SPECTROPHOTOMETRIC, CORRECTED (UG/L)
60050	PHYTOPLANKTON, TOTAL (CELLS/ML)
70961	PRODUCTIVITY, PRIMARY, GROSS (MG C/CU METER/DAY)
70962	PRODUCTIVITY, PRIMARY, GROSS (MG C/SQ METER/DAY)
70959	PRODUCTIVITY, PRIMARY, GROSS (MG O2/CU METER/DAY)
70960	PRODUCTIVITY, PRIMARY, GROSS (MG O2/SQ METER/DAY)
70965	PRODUCTIVITY, PRIMARY, NET (MG C/CU METER/DAY)
70966	PRODUCTIVITY, PRIMARY, NET (MG C/SQ METER/DAY)
70963	PRODUCTIVITY, PRIMARY, NET (MG O2/CU METER/DAY)
70964	PRODUCTIVITY, PRIMARY, NET (MG O2/SQ METER/DAY)
70967	RESPIRATION (MG O2/CU METER/DAY)
70968	RESPIRATION (MG O2/SQ METER/DAY)
71200	SALMONELLA, MEMBRANE FILTER (COLONIES/100 ML)
71101	SESTON, ASH WEIGHT (MG/L)
71100	SESTON, TOTAL (MG/L)
31677	STREPTOCOCCI, FECAL (MPN)
31673	STREPTOCOCCI, FECAL, MEMBRANE FILTER, KF AGAR (COLONIES/100 ML)
31679	STREPTOCOCCI, FECAL, MEMBRANE FILTER, M-ENTEROCOCCUS AGAR (COLONIES/100 ML)
31678	STREPTOCOCCI, FECAL, TUBE CONFIGURATION

CODE	PARAMETER
	VALUES FOR PARAMETER CODE 31678: 1 - FIVE 10-ML TUBES 2 - FIVE 10-ML, FIVE 1-ML AND FIVE 0.1-ML TUBES 3 - FIVE 10-ML, ONE 1-ML AND ONE 0.1-ML TUBES 4 - ONE 50-ML AND FIVE 10-ML TUBES 5 - ONE 50-ML, FIVE 10-ML AND FIVE 1-ML TUBES 6 - FIVE 50-ML, FIVE 10-ML AND FIVE 1-ML TUBES 7 - THREE 10-ML, THREE 1-ML AND THREE 0.1-ML TUBES 8 - FIVE 100-ML, FIVE 10-ML AND FIVE 1-ML TUBES
31751	TOTAL PLATE COUNT, TPC AGAR, 35 DEG C., 24 HOURS (COLONIES/ML)
70948	ZOOPLANKTON, ASH WEIGHT (G/CU METER)
70947	ZOOPLANKTON, DRY WEIGHT (G/CU METER)
70916	ZOOPLANKTON, TOTAL (ORGANISMS/CU METER)

SEDIMENT PARAMETERS

80226	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .062 MM
80227	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .125 MM
80228	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .250 MM
80229	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .500 MM
80230	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 1.00 MM
80231	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 2.00 MM
80232	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 4.00 MM
80233	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 8.00 MM

CODE	PARAMETER
80234	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 16.0 MM
80235	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 32.0 MM
80236	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 64.0 MM
80237	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 76.0 MM
80238	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 128.0 MM
80157	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .004 MM
80158	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .062 MM
80159	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .125 MM
80160	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .250 MM
80161	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .500 MM
80162	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN 1.00 MM
80163	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN 2.00 MM
80164	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .062 MM
80165	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .125 MM
80166	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .250 MM
80167	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .500 MM

CODE	PARAMETER
80168	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 1.00 MM
80169	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 2.00 MM
80170	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 4.00 MM
80171	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 8.00 MM
80172	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 16.0 MM
80173	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 32.0 MM
80174	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 64.0 MM
80175	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 128.0 MM
80225	SEDIMENT DISCHARGE, BEDLOAD (TONS/DAY)
80155	SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY)
80156	SEDIMENT DISCHARGE, TOTAL, SUSPENDED PLUS BED MATERIAL (TONS/DAY)
00495	SEDIMENT, MOISTURE IN SAMPLES (PERCENT)
80154	SEDIMENT, SUSPENDED, CONCENTRATION (MG/L)
70337	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .002 MM
70338	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .004 MM
70339	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .008 MM
70340	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .016 MM

CODE	PARAMETER
70341	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .031 MM
70342	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .062 MM
70343	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .125 MM
70344	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .250 MM
70345	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .500 MM
70346	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN 1.00 MM
70347	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN 2.00 MM
70326	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .002 MM
70327	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .004 MM
70328	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .008 MM
70329	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .016 MM
70330	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .031 MM
70331	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .062 MM
70332	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .125 MM
70333	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .250 MM
70334	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .500 MM

CODE	PARAMETER
70335	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN 1.00 MM
70336	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN 2.00 MM
80180	SEDIMENT, TOTAL, CONCENTRATION (MG/L)
80181	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .002 MM
80182	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .004 MM
80183	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .008 MM
80184	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .016 MM
80185	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .031 MM
80186	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .062 MM
80187	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .125 MM
80188	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .250 MM
80189	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .500 MM
80190	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN 1.00 MM
80191	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN 2.00 MM
80192	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .002 MM
80193	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .004 MM

CODE	PARAMETER
80194	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .008 MM
80195	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .016 MM
80196	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .031 MM
80197	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .062 MM
80198	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .125 MM
80199	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .250 MM
80200	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .500 MM
80201	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN 1.00 MM
80202	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN 2.00 MM
80203	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .062 MM
80204	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .125 MM
80205	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .250 MM
80206	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .500 MM
80207	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 1.00 MM
80208	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 2.00 MM
80209	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 4.00 MM

CODE	PARAMETER
80210	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 8.00 MM
80211	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 16.0 MM
80212	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 32.0 MM

MISCELLANEOUS PARAMETERS

00027 CODE NUMBER FOR AGENCY COLLECTING SAMPLE

00028 CODE NUMBER FOR AGENCY ANALYZING SAMPLE

VALUES FOR PARAMETER CODES 00027 AND 00028:

- 500 - DEPARTMENT OF AGRICULTURE
- 504 - AGRICULTURAL RESEARCH SERVICE
- 520 - SOIL CONSERVATION SERVICE
- 596 - FOREST SERVICE
- 600 - DEPARTMENT OF COMMERCE
- 642 - NATIONAL INDUSTRIAL POLLUTION CONTROL COUNCIL
- 648 - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
- 655 - NATIONAL BUREAU OF STANDARDS
- 700 - DEPARTMENT OF DEFENSE - MILITARY
- 701 - AIR FORCE
- 702 - ARMY
- 703 - MARINES
- 704 - NAVY
- 800 - DEPARTMENT OF DEFENSE - CIVIL
- 810 - CORPS OF ENGINEERS
- 900 - DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
- 910 - FOOD AND DRUG ADMINISTRATION
- 915 - ENVIRONMENTAL HEALTH SERVICE
- 930 - NATIONAL INSTITUTE OF HEALTH
- 1000 - DEPARTMENT OF THE INTERIOR
- 1004 - BUREAU OF LAND MANAGEMENT
- 1008 - BUREAU OF INDIAN AFFAIRS
- 1016 - BUREAU OF OUTDOOR RECREATION
- 1028 - GEOLOGICAL SURVEY

CODE PARAMETER

VALUES FOR PARAMETER CODES 00027 AND 00028 - CONTINUED:

1032 - BUREAU OF MINES
1050 - BUREAU OF SPORT FISHERIES AND WILDLIFE
1053 - NATIONAL PARK SERVICE
1060 - BUREAU OF RECLAMATION
1062 - ALASKA POWER ADMINISTRATION
1064 - BONNEVILLE POWER ADMINISTRATION
1068 - SOUTHEASTERN POWER ADMINISTRATION
1072 - SOUTHWESTERN POWER ADMINISTRATION
1076 - OFFICE OF SALINE WATER
1086 - OFFICE OF WATER RESOURCES RESEARCH
1800 - ATOMIC ENERGY COMMISSION
2000 - ENVIRONMENTAL PROTECTION AGENCY
2100 - DEPARTMENT OF TRANSPORTATION
2300 - GENERAL SERVICES ADMINISTRATION
2500 - DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
2700 - NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
3315 - TENNESSEE VALLEY AUTHORITY
3335 - WATER RESOURCES COUNCIL
6001 - ASSOCIATION OF BAY AREA GOVERNMENTS, CALIFORNIA
97XX - STATE HEALTH LABORATORY
XX = STATE CODE
9801 - PRIVATE LABORATORY
9802 - SALT RIVER VALLEY USERS ASSOCIATION
9803 - METROPOLITIAN WATER DISTRICT OF SOUTHERN CALIFORNIA
9804 - FLORIDA DEPARTMENT OF POLLUTION CONTROL
9805 - CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT
9806 - FLORIDA GAME AND FRESH WATER FISH COMMISSION
9807 - FLORIDA DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES
9808 - SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
9809 - CITY OF JACKSONVILLE, FLORIDA
9810 - REEDY CREEK IMPROVEMENT DISTRICT, FLORIDA
9811 - ORANGE COUNTY POLLUTION CONTROL DEPARTMENT, FLORIDA
9812 - BREVARD COUNTY POLLUTION CONTROL DEPARTMENT, FLORIDA
9813 - PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

CODE PARAMETER

VALUES FOR PARAMETER CODES 00027 AND 00028 - CONTINUED:

9814 - ALASKA DEPARTMENT OF FISH AND GAME
9815 - ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
9816 - CALIFORNIA DEPARTMENT OF WATER RESOURCES
9817 - ORANGE COUNTY WATER DISTRICT, CALIF.
9818 - HILLSBOROUGH COUNTY ENVIRONMENTAL PROTECTION COMMISION, FL
9819 - NASSAU COUNTY DEPARTMENT OF HEALTH, NY
9820 - SUFFOLK COUNTY DEPARTMENT OF HEALTH, NY
9821 - SUFFOLK COUNTY DEPARTMENT OF ENVIRONMENTAL CONTROL, NY
9822 - SUFFOLK COUNTY WATER AUTHORITY, NY
9823 - ALAMEDA COUNTY WATER DISTRICT, CA
9824 - ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, ZONE NO. 7, CA
9825 - VALLEY COMMUNITY SERVICES DISTRICT (LIVERMORE), CA
9826 - CITY OF LIVERMORE WASTE TREATMENT PLANT, CA
9827 - ARKANSAS DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
9828 - ARKANSAS GAME AND FISH COMMISSION
9829 - NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS
9830 - INDUSTRY LABORATORY
9831 - UNIVERSITY OF IOWA, STATE HYGENIC LABORATORY
9901 - EDUCATIONAL
9902 - UNIVERSITY OF ARIZONA
9903 - UNIVERSITY OF FLORIDA
9904 - FLORIDA STATE UNIVERSITY
9905 - FLORIDA TECHNOLOGICAL UNIVERSITY
9906 - UNIVERSITY OF ALASKA
9999 - OTHER
06010 - CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD NORTH COAST REGION
12001 - CITY OF TAMPA, FLORIDA
12010 - PALM BEACH COUNTY ENGINEER
12020 - PALM BEACH COUNTY HEALTH DEPT.
12030 - DADE COUNTY DEPT. OF ENV. RESOURCES MAN.
16001 - IDAHO DEPARTMENT OF WATER RESOURCES
16002 - IDAHO DEPARTMENT OF HEALTH AND WELFARE
17001 - METROPOLITAN SANITARY DIST. OF GREATER CHICAGO(MSD)
17002 - ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)
17003 - ILLINOIS STATE WATER SURVEY (ISWS)
20001 - KANSAS STATE GEOLOGICAL SURVEY

CODE PARAMETER

VALUES FOR PARAMETER CODES 00027 AND 00028 - CONTINUED:

20002 - KANSAS STATE DEPT. OF HEALTH AND ENVIRONMENT
28001 - MISSISSIPPI AIR AND WATER POLLUTION CONTROL COMMISSION
28002 - MISSISSIPPI GEOLOGICAL SURVEY
30010 - MONTANA BUREAU OF MINES AND GEOLOGY
32001 - DIVISION OF ENVIRONMENTAL PROTECTION
32003 - NEVADA DIVISION OF WATER RESOURCES
32005 - UNIV. OF NEV., DIV. OF RENEW. NAT. RESOURCES
32006 - NEVADA BUREAU OF ENVIRONMENTAL HEALTH
32007 - NEVADA BUREAU OF MINES & GEOLOGY
32009 - NEVADA DEPARTMENT OF FISH & GAME
32010 - NEVADA DIVISION OF FORESTRY
32011 - NEVADA DIVISION OF PARKS
32012 - NEVADA CONSUMER HEALTH PROTECTION SERVICE
32013 - UNIV. OF NEV., DESERT RESEARCH INSTITUTE
32014 - UNIV. OF NEV., COLLEGE OF AGRICULTURE
32015 - CLARK COUNTY DISTRICT HEALTH DEPARTMENT
32016 - WASHOE COUNTY DISTRICT HEALTH DEPARTMENT
32017 - LAS VEGAS VALLEY WATER DISTRICT
32018 - SIERRA PACIFIC POWER CO.
32019 - NEVADA BUREAU OF LABORATORIES AND RESEARCH
32091 - WASHOE COUNTY COG
32092 - CLARK COUNTY COG
32093 - MUNICIPAL WATER COMPANY
34001 - NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
38001 - NORTH DAKOTA GEOLOGICAL SURVEY
38002 - NORTH DAKOTA STATE WATER COMMISSION
47001 - UNIVERSITY OF TENNESSEE AT KNOXVILLE

85554 DATE, LATEST WELL WORKOVER (MONTH/YEAR)(CODE TWO DIGITS FOR MONTH AND LAST TWO DIGITS OF THE YEAR.)

85553 DATE, WELL COMPLETION (MONTH/YEAR)(CODE TWO DIGITS FOR MONTH AND LAST TWO DIGITS OF THE YEAR.)

00063 NUMBER OF SAMPLING POINTS

00008 NUMBER USED IN SAMPLE ACCOUNTING PROCEDURE

00029 PROJECT NUMBER

72036 RESERVOIR STORAGE, IN THOUSANDS OF ACRE-FEET

72005 SAMPLE SOURCE CODE

CODE PARAMETER

VALUES FOR PARAMETER CODE 72005:

1 - WELL HEAD
2 - DRILL STEM TEST
3 - SEPERATOR
4 - BOILER
5 - FLOW LINE
6 - BATTERY
7 - UNDESIGNATED
8 - TANK
9 - PRODUCTION TEST
10 - HEATER TREATER
11 - GUN BARREL
12 - SWAB
13 - PIT
14 - MANIFOLD TEST
15 - GAS LINE DRIP
16 - CASING LEAK
17 - WIRE LINE TEST
18 - HEADER
19 - FILTER
20 - TEST TOOL
21 - LTX UNIT
22 - KNOCKOUT
23 - WELL BLEEDER
24 - FRACTURE TEST
25 - TEST WAGON
26 - PUMP
27 - TAP NEAR WELL
28 - TAP AWAY FROM WELL
29 - BUCKET
30 - PRESSURE TANK
31 - DISCHARGE PIPE
32 - FOERST SAMPLER
33 - BAILER
34 - DRAIN LINE
35 - INJECTION PUMP
36 - SPOT SAMPLE IN FLUID COLUMN
37 - TANK BATTERY INCLUDING GUN BARREL
38 - WINDMILL
39 - WATER SIPHON
40 - SPECIAL
41 - MUNICIPAL AND DOMESTIC WASTE
42 - INDUSTRIAL WASTE
43 - STORM WATER (PRIOR TO ENTERING NATURAL CHANNELS)

CODE PARAMETER

VALUES FOR PARAMETER CODE 72005 - CONTINUED:

44 - PUBLIC WATER SUPPLIES (TREATED WATER)
45 - MINE WATER
46 - PUBLIC WATER SUPPLIES (UNTREATED WATER)
47 - WATER WELL
48 - MULTIPLE WATER WELLS
49 - OIL WELL
50 - MULTI-OIL WELL
51 - GAS WELL
52 - MULTI-GAS WELL
53 - OIL AND GAS WELL
54 - MULTI-OIL AND GAS WELL
55 - DRILLED AND ABANDONED WELL
56 - PLUGGED AND ABANDONED WELL
57 - JUNKED AND ABANDONED WELL
59 - ABANDONED OIL WELL
60 - ABANDONED GAS WELL
61 - SALT-WATER SUPPLY WELL
62 - SALT-WATER DISPOSAL WELL
63 - INJECTION WELL
64 - SERVICE WELL
65 - WETLAND ECOSYSTEM
66 - DREDGE WAKE
67 - MAINSTREAM
68 - OVERBANK
69 - COMPOSITED PUBLIC WATER SUPPLY(UNTREATED WATER)
70 - COMPOSITED PUBLIC WATER SUPPLY(TREATED WATER)

00115 SAMPLE TREATMENT

VALUES FOR PARAMETER CODE 00115:

1 - RAW
2 - TREATED

72006 SAMPLING CONDITION CODE

VALUES FOR PARAMETER CODE 72006:

1 - TESTING
2 - UNDESIGNATED
3 - SWABBING
4 - FLOWING
5 - REVERSING OUT

CODE	PARAMETER

VALUES FOR PARAMETER CODE 72006 - CONTINUED:

6 - FLOWING ON GAS LIFT
7 - AFTER ACIDIZING
8 - PUMPING
9 - MILLIPORE FILTER
10 - OPEN HOLE
11 - FLOWING ON DRILL STEM TEST
12 - AFTER DRILL STEM TEST
15 - BAILING
16 - AFTER PERFORATION
17 - TUBING FLOW
18 - PRODUCING
19 - CIRCULATING
20 - FLOWING ON PRODUCTION TEST
21 - FLOWING ON POTENTIAL TEST
22 - LIFTING
23 - FLOWING TO PIT
24 - WATER FLOODING
25 - JETTING
26 - PRODUCTION AND DEVELOPMENT TEST
27 - PRODUCTION BY UNKNOWN METHOD

71995 WATER USE (PRIMARY)

71996 WATER USE (SECONDARY)

71997 WATER USE (TERTIARY)

71998 WATER USE (QUATERNARY)

PARAMETER CODES FOR WATER DATA

IN NUMERIC ORDER

	CODE	PARAMETER
	00001	CROSS-SECTION LOCATION, FEET FROM RIGHT BANK LOOKING UPSTREAM
	00002	CROSS-SECTION LOCATION, PERCENT FROM RIGHT BANK LOOKING UPSTREAM
	00003	DEPTH OF COLLECTION (FEET)
	00004	STREAM WIDTH (FEET)
	00005	CROSS-SECTION LOCATION, VERTICAL (PERCENT OF TOTAL DEPTH)
	00008	NUMBER USED IN SAMPLE ACCOUNTING PROCEDURE
	00009	CROSS-SECTION LOCATION, FEET FROM LEFT BANK LOOKING DOWNSTREAM
	00010	TEMPERATURE, WATER (DEG. C)
*	00011	TEMPERATURE, WATER (DEG. F) (00010)
	00012	TEMPERATURE, EVAPORATION, 48 INCH PAN (DEG. C)
	00013	TEMPERATURE, EVAPORATION, 24 INCH PAN (DEG. C)
	00014	TEMPERATURE, WET BULB (DEG. C)
	00020	TEMPERATURE, AIR (DEG. C)
*	00021	TEMPERATURE, AIR (DEG. F) (00020)
	00022	LENGTH OF EXPOSURE (DAYS)
	00025	BAROMETRIC PRESSURE (MM OF HG)

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

CODE	PARAMETER
00027	CODE NUMBER FOR AGENCY COLLECTING SAMPLE
00028	CODE NUMBER FOR AGENCY ANALYZING SAMPLE

VALUES FOR PARAMETER CODES 00027 AND 00028:

- 500 - DEPARTMENT OF AGRICULTURE
- 504 - AGRICULTURAL RESEARCH SERVICE
- 520 - SOIL CONSERVATION SERVICE
- 596 - FOREST SERVICE
- 600 - DEPARTMENT OF COMMERCE
- 642 - NATIONAL INDUSTRIAL POLLUTION CONTROL COUNCIL
- 648 - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
- 655 - NATIONAL BUREAU OF STANDARDS
- 700 - DEPARTMENT OF DEFENSE - MILITARY
- 701 - AIR FORCE
- 702 - ARMY
- 703 - MARINES
- 704 - NAVY
- 800 - DEPARTMENT OF DEFENSE - CIVIL
- 810 - CORPS OF ENGINEERS
- 900 - DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
- 910 - FOOD AND DRUG ADMINISTRATION
- 915 - ENVIRONMENTAL HEALTH SERVICE
- 930 - NATIONAL INSTITUTE OF HEALTH
- 1000 - DEPARTMENT OF THE INTERIOR
- 1004 - BUREAU OF LAND MANAGEMENT
- 1008 - BUREAU OF INDIAN AFFAIRS
- 1016 - BUREAU OF OUTDOOR RECREATION
- 1028 - GEOLOGICAL SURVEY
- 1032 - BUREAU OF MINES
- 1050 - BUREAU OF SPORT FISHERIES AND WILDLIFE
- 1053 - NATIONAL PARK SERVICE
- 1060 - BUREAU OF RECLAMATION
- 1062 - ALASKA POWER ADMINISTRATION
- 1064 - BONNEVILLE POWER ADMINISTRATION
- 1068 - SOUTHEASTERN POWER ADMINISTRATION
- 1072 - SOUTHWESTERN POWER ADMINISTRATION
- 1076 - OFFICE OF SALINE WATER
- 1086 - OFFICE OF WATER RESOURCES RESEARCH
- 1800 - ATOMIC ENERGY COMMISSION
- 2000 - ENVIRONMENTAL PROTECTION AGENCY

CODE PARAMETER

VALUES FOR PARAMETER CODES 00027 AND 00028 - CONTINUED:

2100 - DEPARTMENT OF TRANSPORTATION
2300 - GENERAL SERVICES ADMINISTRATION
2500 - DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
2700 - NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
3315 - TENNESSEE VALLEY AUTHORITY
3335 - WATER RESOURCES COUNCIL
6001 - ASSOCIATION OF BAY AREA GOVERNMENTS, CALIFORNIA
97XX - STATE HEALTH LABORATORY
XX = STATE CODE
9801 - PRIVATE LABORATORY
9802 - SALT RIVER VALLEY USERS ASSOCIATION
9803 - METROPOLITIAN WATER DISTRICT OF SOUTHERN CALIFORNIA
9804 - FLORIDA DEPARTMENT OF POLLUTION CONTROL
9805 - CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT
9806 - FLORIDA GAME AND FRESH WATER FISH COMMISSION
9807 - FLORIDA DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES
9808 - SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
9809 - CITY OF JACKSONVILLE, FLORIDA
9810 - REEDY CREEK IMPROVEMENT DISTRICT, FLORIDA
9811 - ORANGE COUNTY POLLUTION CONTROL DEPARTMENT, FLORIDA
9812 - BREVARD COUNTY POLLUTION CONTROL DEPARTMENT, FLORIDA
9813 - PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
9814 - ALASKA DEPARTMENT OF FISH AND GAME
9815 - ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
9816 - CALIFORNIA DEPARTMENT OF WATER RESOURCES
9817 - ORANGE COUNTY WATER DISTRICT, CALIF.
9818 - HILLSBOROUGH COUNTY ENVIRONMENTAL PROTECTION COMMISION, FL
9819 - NASSAU COUNTY DEPARTMENT OF HEALTH, NY
9820 - SUFFOLK COUNTY DEPARTMENT OF HEALTH, NY
9821 - SUFFOLK COUNTY DEPARTMENT OF ENVIRONMENTAL CONTROL, NY
9822 - SUFFOLK COUNTY WATER AUTHORITY, NY

CODE PARAMETER

VALUES FOR PARAMETER CODES 00027 AND 00028 - CONTINUED:

9823 - ALAMEDA COUNTY WATER DISTRICT, CA
9824 - ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, ZONE NO. 7, CA
9825 - VALLEY COMMUNITY SERVICES DISTRICT (LIVERMORE), CA
9826 - CITY OF LIVERMORE WASTE TREATMENT PLANT, CA
9827 - ARKANSAS DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
9828 - ARKANSAS GAME AND FISH COMMISSION
9829 - NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS
9830 - INDUSTRY LABORATORY
9831 - UNIVERSITY OF IOWA, STATE HYGENIC LABORATORY
9901 - EDUCATIONAL
9902 - UNIVERSITY OF ARIZONA
9903 - UNIVERSITY OF FLORIDA
9904 - FLORIDA STATE UNIVERSITY
9905 - FLORIDA TECHNOLOGICAL UNIVERSITY
9906 - UNIVERSITY OF ALASKA
9999 - OTHER
06010 - CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD NORTH COAST REGION
12001 - CITY OF TAMPA, FLORIDA
12010 - PALM BEACH COUNTY ENGINEER
12020 - PALM BEACH COUNTY HEALTH DEPT.
12030 - DADE COUNTY DEPT. OF ENV. RESOURCES MAN.
16001 - IDAHO&DEPARTMENT OF WATER RESOURCES
16002 - IDAHO DEPARTMENT OF HEALTH AND WELFARE
17001 - METROPOLITAN SANITARY DIST. OF GREATER CHICAGO(MSD)
17002 - ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)
17003 - ILLINOIS STATE WATER SURVEY (ISWS)
20001 - KANSAS STATE GEOLOGICAL SURVEY
20002 - KANSAS STATE DEPT. OF HEALTH AND ENVIRONMENT
28001 - MISSISSIPPI AIR AND WATER POLLUTION CONTROL COMMISSION
28002 - MISSISSIPPI GEOLOGICAL SURVEY
30010 - MONTANA BUREAU OF MINES AND GEOLOGY
32001 - DIVISION OF ENVIRONMENTAL PROTECTION
32003 - NEVADA DIVISION OF WATER RESOURCES
32005 - UNIV. OF NEV., DIV. OF RENEW. NAT. RESOURCES
32006 - NEVADA BUREAU OF ENVIRONMENTAL HEALTH
32007 - NEVADA BUREAU OF MINES & GEOLOGY
32009 - NEVADA DEPARTMENT OF FISH & GAME
32010 - NEVADA DIVISION OF FORESTRY

CODE PARAMETER

VALUES FOR PARAMETER CODES 00027 AND 00028 - CONTINUED:

32011 - NEVADA DIVISION OF PARKS
32012 - NEVADA CONSUMER HEALTH PROTECTION SERVICE
32013 - UNIV. OF NEV., DESERT RESEARCH INSTITUTE
32014 - UNIV. OF NEV., COLLEGE OF AGRICULTURE
32015 - CLARK COUNTY DISTRICT HEALTH DEPARTMENT
32016 - WASHOE COUNTY DISTRICT HEALTH DEPARTMENT
32017 - LAS VEGAS VALLEY WATER DISTRICT
32018 - SIERRA PACIFIC POWER CO.
32019 - NEVADA BUREAU OF LABORATORIES AND RESEARCH
32091 - WASHOE COUNTY COG
32092 - CLARK COUNTY COG
32093 - MUNICIPAL WATER COMPANY
34001 - NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
38001 - NORTH DAKOTA GEOLOGICAL SURVEY
38002 - NORTH DAKOTA STATE WATER COMMISSION
47001 - UNIVERSITY OF TENNESSEE AT KNOXVILLE

00029 PROJECT NUMBER

00032 CLOUD COVER (PERCENT)

00035 WIND VELOCITY (MILES PER HOUR)

00036 WIND DIRECTION IN DEGREES FROM TRUE NORTH (CLOCKWISE)

00041 WEATHER

VALUES FOR PARAMETER CODE 00041:

00 - CLOUDLESS
01 - PARTLY CLOUDY
02 - CLOUDY
03 - OVERCAST
10 - PRECIPITATION WITHIN SIGHT
13 - UGLY, THREATENING SKY
40 - FOG
50 - DRIZZLE
51 - SLIGHT DRIZZLE, INTERMITTENT
52 - SLIGHT DRIZZLE, CONTINUOUS
53 - MODERATE DRIZZLE, INTERMITTENT
54 - MODERATE DRIZZLE, CONTINUOUS
55 - THICK DRIZZLE, INTERMITTENT
56 - THICK DRIZZLE, CONTINUOUS

CODE	PARAMETER

VALUES FOR PARAMETER CODE 00041 - CONTINUED:

57 - DRIZZLE AND FOG
58 - SLIGHT OR MODERATE DRIZZLE AND RAIN
59 - THICK DRIZZLE AND RAIN
60 - RAIN
61 - SLIGHT RAIN, INTERMITTENT
62 - SLIGHT RAIN, CONTINUOUS
63 - MODERATE RAIN, INTERMITTENT
64 - MODERATE RAIN, CONTINUOUS
65 - HEAVY RAIN, INTERMITTENT
66 - HEAVY RAIN, CONTINUOUS
67 - RAIN AND FOG
68 - SLIGHT OR MODERATE MIXED RAIN AND SNOW
69 - HEAVY MIXED RAIN AND SNOW
70 - SNOW OR SLEET
71 - SLIGHT SNOW IN FLAKES, INTERMITTENT
72 - SLIGHT SNOW IN FLAKES, CONTINUOUS
73 - MODERATE SNOW IN FLAKES, INTERMITTENT
74 - MODERATE SNOW IN FLAKES, CONTINUOUS
75 - HEAVY SNOW IN FLAKES, INTERMITTENT
76 - HEAVY SNOW IN FLAKES, CONTINUOUS
77 - SNOW AND FOG
78 - GRANULAR SNOW (FROZEN DRIZZLE)
79 - ICE CRYSTALS
80 - SHOWER(S)
81 - SLIGHT OR MODERATE RAIN SHOWER(S)
82 - HEAVY RAIN SHOWER(S)
83 - SLIGHT OR MODERATE SNOW SHOWER(S)
84 - HEAVY SNOW SHOWER(S)
85 - SLIGHT OR MODERATE RAIN AND SNOW SHOWER(S)
86 - HEAVY RAIN AND SNOW SHOWER(S)
87 - GRANULAR SNOW SHOWER(S)
88 - SLIGHT OR MODERATE HAIL OR RAIN AND HAIL SHOWER(S)
89 - HEAVY HAIL OR RAIN AND HAIL SHOWER(S)
90 - THUNDERSTORM
93 - SLIGHT THUNDERSTORM WITH RAIN OR SNOW
94 - SLIGHT THUNDERSTORM WITH HAIL
95 - MODERATE THUNDERSTORM WITH RAIN OR SNOW
96 - MODERATE THUNDERSTORM WITH HAIL
97 - HEAVY THUNDERSTORM WITH RAIN OR SNOW
99 - HEAVY THUNDERSTORM WITH HAIL

00042 ALTITUDE ABOVE MEAN SEA LEVEL (TEST)

00045 RAINFALL, ACCUMULATED (INCHES)

CODE	PARAMETER
00049	SURFACE AREA (SQUARE MILES)
00050	EVAPORATION, TOTAL (INCHES PER DAY)
00052	HUMIDITY, RELATIVE (PERCENT)
00053	SURFACE AREA (ACRES)
00054	RESERVOIR STORAGE (AC-FT)
00055	STREAM VELOCITY (FEET PER SECOND)
00056	FLOW RATE (YIELD OF WELL) (GALLONS PER DAY)
00058	FLOW RATE (YIELD OF WELL) (GALLONS PER MINUTE)
00059	FLOW RATE, INSTANTANEOUS (YIELD OF WELL AT TIME OF SAMPLE) (GALLONS PER MINUTE)
00060	STREAMFLOW (CUBIC FEET PER SECOND)
00061	STREAMFLOW, INSTANTANEOUS (CUBIC FEET PER SECOND)
00062	RESERVOIR ELEVATION, WATER SURFACE (FEET ABOVE DATUM)
00063	NUMBER OF SAMPLING POINTS
00064	DEPTH OF STREAM, MEAN (FEET)
00065	STAGE (FEET ABOVE DATUM)
00067	TIDE STAGE CODE
00070	TURBIDITY (JTU)
00074	LIGHT TRANSMISSION, 1 METER PATHLENGTH (PERCENT)
00075	TURBIDITY, HELLIGE (MG/L AS SILICON DIOXIDE)
00076	TURBIDITY (NTU)
00077	TRANSPARENCY, SECCHI DISK (INCHES)
00078	TRANSPARENCY, SECCHI DISK (METERS)
00080	COLOR (PLATINUM COBALT UNITS)

CODE	PARAMETER
00081	COLOR, TOTAL (PLATINUM - COBALT UNITS)
00085	ODOR (THRESHOLD NUMBER AT ROOM TEMPERATURE)
00086	ODOR (THRESHOLD NUMBER AT 60 DEG C)
00090	OXIDATION REDUCTION POTENTIAL (MILLIVOLTS)
00095	SPECIFIC CONDUCTANCE (MICROMHOS PER CM AT 25 DEG C)
00098	SAMPLING DEPTH (METERS)
00115	SAMPLE TREATMENT
	VALUES FOR PARAMETER CODE 00115: 1 - RAW 2 - TREATED
00300	DISSOLVED OXYGEN (MG/L)
00301	DISSOLVED OXYGEN (PERCENT OF SATURATION)
00302	IMMEDIATE OXYGEN DEMAND (MG/L)
00310	OXYGEN DEMAND, BIOCHEMICAL 5-DAY AT 20 DEG C (MG/L)
00320	OXYGEN DEMAND, BIOCHEMICAL ULTIMATE CARBONACEOUS (MG/L)
00325	DEOXYGENATION CONSTANT K1 TO BASE E (PER DAY)
00330	REOXYGENATION CONSTANT K2 TO BASE E (PER DAY)
00335	OXYGEN DEMAND, CHEMICAL, 0.025N DICHROMATE (MG/L)
00339	OXYGEN DEMAND, CHEMICAL, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG)
00340	OXYGEN DEMAND, CHEMICAL, 0.25N DICHROMATE (MG/L)
00405	CARBON DIOXIDE, DISSOLVED (MG/L AS CO2)
00410	ALKALINITY (MG/L AS CACO3)
00430	ALKALINITY, CARBONATE (MG/L AS CACO3)

CODE	PARAMETER
00435	ACIDITY, TOTAL (MG/L AS CACO3)
00436	ACIDITY, MINERAL (METHYL ORANGE)(MG/L AS CACO3)
00437	ACIDITY, CO2 (PHENOLPTHALEIN) (MG/L AS CACO3)
00440	BICARBONATE ION (MG/L AS HCO3)
00445	CARBONATE ION (MG/L AS CO3)
00480	SALINITY (PARTS PER THOUSAND)
00495	SEDIMENT, MOISTURE IN SAMPLES (PERCENT)
00496	LOSS ON IGNITION, BOTTOM MATERIAL (MG/KG)
00500	SOLIDS, RESIDUE ON EVAPORATION AT 105 DEG C, TOTAL (MG/L)
00505	RESIDUE, TOTAL VOLATILE (MG/L) (LOSS ON IGNITION)
00510	SOLIDS, NONVOLATILE ON IGNITION, TOTAL (MG/L)
00515	SOLIDS, RESIDUE ON EVAPORATION AT 105 DEG C, DISSOLVED (MG/L)
00520	RESIDUE, VOLATILE FILTRABLE (MG/L)
00525	SOLIDS, NONVOLATILE ON ICNITION, DISSOLVED (MG/L)
00530	SOLIDS, RESIDUE AT 105 DEG C, SUSPENDED (MG/L)
00535	RESIDUE, VOLATILE NONFILTRABLE (MG/L)
00540	SOLIDS, NONVOLATILE ON IGNITION, SUSPENDED (MG/L)
00545	RESIDUE, SETTLEABLE (ML/L)
00548	RESIDUE, FIXED NONSETTLEABLE (MG/L) (LOSS ON IGNITION ASH)
00549	SOLIDS, VOLATILE, NONSETTLEABLE (MG/L)
00550	OIL-GREASE, TOTAL (MG/L)
00553	OIL-GREASE IN BOTTOM MATERIAL (MG/KG)

CODE	PARAMETER
00556	OIL-GREASE, TOTAL RECOVERABLE, GRAVIMETRIC, FREON EXTRACTABLE (MG/L)
00557	OIL-GREASE, TOTAL IN BOTTOM MATERIAL, GRAVIMETRIC, FREON EXTRACTABLE, DRY WT., (MG/KG)
00560	OIL-GREASE, TOTAL RECOVERABLE, ELECTROMETRIC, INFRARED-FREON EXTRACTABLE, (MG/L)
00561	OIL-GREASE, TOTAL IN BOTTOM MATERIAL, ELECTROMETRIC, INFRARED-FREON EXTRACTABLE,DRY WT., (MG/KG)
00572	PERIPHYTON, BIOMASS, ASH WEIGHT (G/SQ M)
00573	PERIPHYTON, BIOMASS, DRY WEIGHT, TOTAL (G/SQ M)
00600	NITROGEN, TOTAL (MG/L AS N)
00602	NITROGEN, DISSOLVED (MG/L AS N)
00603	NITROGEN, TOTAL IN BOTTOM MATERIAL (MG/KG AS N)
00605	NITROGEN, ORGANIC, TOTAL (MG/L AS N)
00607	NITROGEN, ORGANIC, DISSOLVED (MG/L AS N)
00608	NITROGEN, AMMONIA, DISSOLVED (MG/L AS N)
00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)
00611	NITROGEN, AMMONIA, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS N)
00613	NITROGEN, NITRITE, DISSOLVED (MG/L AS N)
00615	NITROGEN, NITRITE, TOTAL (MG/L AS N)
00616	NITROGEN, NITRITE, TOTAL IN BOTTOM MATERIAL (MG/KG AS N)
00618	NITROGEN, NITRATE, DISSOLVED (MG/L AS N)
00620	NITROGEN, NITRATE, TOTAL (MG/L AS N)
00621	NITROGEN, NITRATE, TOTAL IN BOTTOM MATERIAL (MG/KG AS N)

CODE	PARAMETER
00623	NITROGEN, AMMONIA PLUS ORGANIC, DISSOLVED (MG/L AS N)
00624	NITROGEN, AMMONIA PLUS ORGANIC, SUSPENDED TOTAL (MG/L AS N)
00625	NITROGEN, AMMONIA PLUS ORGANIC, TOTAL (MG/L AS N)
00626	NITROGEN, AMMONIA PLUS ORGANIC, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS N)
00630	NITROGEN, NITRITE PLUS NITRATE, TOTAL (MG/L AS N)
00631	NITROGEN, NITRITE PLUS NITRATE, DISSOLVED (MG/L AS N)
00633	NITROGEN, NITRITE PLUS NITRATE, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS N)
00635	NITROGEN, AMMONIA + ORGANIC, TOTAL, ONE DETERMINATION (MG/L AS N)
00636	NITROGEN, AMMONIA + ORGANIC, DISSOLVED, ONE DETERMINATION (MG/L AS N)
00639	NITROGEN, ALBUMINOID (MG/L AS N)
00650	PHOSPHATE, TOTAL (MG/L AS PO4)
00653	PHOSPHATE, TOTAL SOLUBLE (MG/L AS PO4)
00660	PHOSPHATE, ORTHO, DISSOLVED (MG/L AS PO4)
00665	PHOSPHORUS, TOTAL (MG/L AS P)
00666	PHOSPHORUS, DISSOLVED (MG/L AS P)
00668	PHOSPHORUS, TOTAL IN BOTTOM MATERIAL, DRY WT (MG/KG AS P)
00669	PHOSPHORUS, HYDROLYZABLE, TOTAL (MG/L AS P)
00670	PHOSPHORUS, ORGANIC, TOTAL (MG/L AS P)
00671	PHOSPHORUS, ORTHOPHOSPHATE, DISSOLVED (MG/L AS P)
00672	PHOSPHORUS, HYDROLYZABLE, DISSOLVED (MG/L AS P)

CODE	PARAMETER
00673	PHOSPHORUS, ORGANIC, DISSOLVED (MG/L AS P)
00677	PHOSPHORUS, HYDROLYZABLE PLUS ORTHO, DISSOLVED (MG/L AS P)
00678	PHOSPHORUS, HYDROLYZABLE PLUS ORTHO, TOTAL (MG/L AS P)
00680	CARBON, ORGANIC, TOTAL (MG/L AS C)
00681	CARBON, ORGANIC, DISSOLVED (MG/L AS C)
00682	CARBON, INORGANIC PLUS ORGANIC, DISSOLVED (MG/L AS C)
00683	CARBON, ORGANIC, SUSPENDED TOTAL (MG/L AS C)
00685	CARBON, INORGANIC, TOTAL (MG/L AS C)
00686	CARBON, INORGANIC, BOTTOM MATERIAL (G/KG)
00687	CARBON, ORGANIC, TOTAL IN BOTTOM MATERIAL, DRY WT (G/KG)
00688	CARBON, INORGANIC, SUSPENDED TOTAL (MG/L AS C)
00689	CARBON, ORGANIC, SUSPENDED TOTAL (MG/L AS C)
00690	CARBON, TOTAL (MG/L AS C)
00691	CARBON, INORGANIC, DISSOLVED (MG/L AS C)
00692	CARBON, ORGANIC, IMMISCIBLE (MG/L AS C)
00693	CARBON, INORGANIC PLUS ORGANIC, TOTAL IN BOTTOM MATERIAL, DRY WT (G/KG)
00694	CARBON, INORGANIC PLUS ORGANIC, SUSPENDED TOTAL (MG/L AS C)
00720	CYANIDE, TOTAL (MG/L AS CN)
00721	CYANIDE, TOTAL IN BOTTOM MATERIAL, DRY WT (UG/G AS CN)
00723	CYANIDE, DISSOLVED (MG/L AS CN)
00730	THIOCYANATE, TOTAL (MG/L AS SCN)
00731	THIOCYANATE, DISSOLVED (MG/L AS SCN)
00740	SULFITE (MG/L AS SO3)

CODE	PARAMETER
00745	SULFIDE, TOTAL (MG/L AS S)
00746	SULFIDE, DISSOLVED (MG/L AS S)
00900	HARDNESS, TOTAL (MG/L AS CACO3)
00902	HARDNESS, NONCARBONATE (MG/L AS CACO3)
00910	CALCIUM, DISSOLVED (MG/L AS CACO3)
00915	CALCIUM, DISSOLVED (MG/L AS CA)
00916	CALCIUM, TOTAL (MG/L AS CA)
00917	CALCIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS CA)
00924	MAGNESIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS MG)
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)
00926	MAGNESIUM, SUSPENDED TOTAL (MG/L AS MG)
00927	MAGNESIUM, TOTAL (MG/L AS MG)
00929	SODIUM, TOTAL (MG/L AS NA)
00930	SODIUM, DISSOLVED (MG/L AS NA)
00931	SODIUM ADSORPTION RATIO
00932	SODIUM, PERCENT
00933	SODIUM PLUS POTASSIUM, DISSOLVED (MG/L AS NA)
00934	SODIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS NA)
00935	POTASSIUM, DISSOLVED (MG/L AS K)
00937	POTASSIUM, TOTAL (MG/L AS K)
00938	POTASSIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WT (MG/KG AS K)

CODE	PARAMETER
00940	CHLORIDE, DISSOLVED (MG/L AS CL)
00945	SULFATE, DISSOLVED (MG/L AS SO4)
00950	FLUORIDE, DISSOLVED (MG/L AS F)
00951	FLUORIDE, TOTAL (MG/L AS F)
00955	SILICA, DISSOLVED (MG/L AS SIO2)
00997	ARSENIC, INORGANIC, TOTAL (UG/L AS AS)(NOT FOR WRD USE)
01000	ARSENIC, DISSOLVED (UG/L AS AS)
01001	ARSENIC, SUSPENDED TOTAL (UG/L AS AS)
01002	ARSENIC, TOTAL (UG/L AS AS)
01003	ARSENIC, TOTAL IN BOTTOM MATERIAL (UG/G AS AS)
01005	BARIUM, DISSOLVED (UG/L AS BA)
01006	BARIUM, SUSPENDED RECOVERABLE (UG/L AS BA)
01007	BARIUM, TOTAL (UG/L AS BA)
01008	BARIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS BA)
01010	BERYLLIUM, DISSOLVED (UG/L AS BE)
01011	BERYLLIUM, SUSPENDED RECOVERABLE (UG/L AS BE)
01012	BERYLLIUM, TOTAL (UG/L AS BE)
01013	BERYLLIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS BE)
01015	BISMUTH, DISSOLVED (UG/L AS BI)
01016	BISMUTH, SUSPENDED TOTAL (UG/L AS BI)
01017	BISMUTH, TOTAL (UG/L AS BI)
01020	BORON, DISSOLVED (UG/L AS B)
01021	BORON, SUSPENDED RECOVERABLE (UG/L AS B)

CODE	PARAMETER
01022	BORON, TOTAL (UG/L AS B)
01023	BORON, TOTAL IN BOTTOM MATERIAL (UG/G AS B)
01025	CADMIUM, DISSOLVED (UG/L AS CD)
01026	CADMIUM, SUSPENDED RECOVERABLE (UG/L AS CD)
01027	CADMIUM, TOTAL (UG/L AS CD)
01028	CADMIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS CD)
01029	CHROMIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS CR)
01030	CHROMIUM, DISSOLVED (UG/L AS CR)
01031	CHROMIUM, SUSPENDED RECOVERABLE (UG/L AS CR)
01032	CHROMIUM, HEXAVALENT, DISSOLVED (UG/L AS CR)
01034	CHROMIUM, TOTAL (UG/L AS CR)
01035	COBALT, DISSOLVED (UG/L AS CO)
01036	COBALT, SUSPENDED RECOVERABLE (UG/L AS CO)
01037	COBALT, TOTAL (UG/L AS CO)
01038	COBALT, TOTAL IN BOTTOM MATERIAL (UG/G AS CO)
01040	COPPER, DISSOLVED (UG/L AS CU)
01041	COPPER, SUSPENDED RECOVERABLE (UG/L AS CU)
01042	COPPER, TOTAL (UG/L AS CU)
01043	COPPER, TOTAL IN BOTTOM MATERIAL (UG/G AS CU)
01044	IRON, SUSPENDED RECOVERABLE (UG/L AS FE)
01045	IRON, TOTAL (UG/L AS FE)
01046	IRON, DISSOLVED (UG/L AS FE)
01047	IRON, FERROUS (UG/L AS FE)

CODE	PARAMETER
01048	IRON, DISSOLVED FERRIC AND FERROUS (UG/L)
01049	LEAD, DISSOLVED (UG/L AS PB)
01050	LEAD, SUSPENDED RECOVERABLE (UG/L AS PB)
01051	LEAD, TOTAL (UG/L AS PB)
01052	LEAD, TOTAL IN BOTTOM MATERIAL (UG/G AS PB)
01053	MANGANESE, TOTAL IN BOTTOM MATERIAL (UG/G AS MN)
01054	MANGANESE, SUSPENDED RECOVERABLE (UG/L AS MN)
01055	MANGANESE, TOTAL (UG/L AS MN)
01056	MANGANESE, DISSOLVED (UG/L AS MN)
01060	MOLYBDENUM, DISSOLVED (UG/L AS MO)
01061	MOLYBDENUM, SUSPENDED RECOVERABLE (UG/L AS MO)
01062	MOLYBDENUM, TOTAL (UG/L AS MO)
01063	MOLYBDENUM, TOTAL IN BOTTOM MATERIAL (UG/G AS MO)
01065	NICKEL, DISSOLVED (UG/L AS NI)
01066	NICKEL, SUSPENDED RECOVERABLE (UG/L AS NI)
01067	NICKEL, TOTAL (UG/L AS NI)
01068	NICKEL, TOTAL IN BOTTOM MATERIAL (UG/G AS NI)
01075	SILVER, DISSOLVED (UG/L AS AG)
01076	SILVER, SUSPENDED RECOVERABLE (UG/L AS AG)
01077	SILVER, TOTAL (UG/L AS AG)
01078	SILVER, TOTAL IN BOTTOM MATERIAL (UG/G AS AG)
01080	STRONTIUM, DISSOLVED (UG/L AS SR)
01081	STRONTIUM, SUSPENDED RECOVERABLE (UG/L AS SR)

CODE	PARAMETER
01082	STRONTIUM, TOTAL (UG/L AS SR)
01083	STRONTIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS SR)
01085	VANADIUM, DISSOLVED (UG/L AS V)
01086	VANADIUM, SUSPENDED TOTAL (UG/L AS V)
01087	VANADIUM, TOTAL (UG/L AS V)
01088	VANADIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS V)
01090	ZINC, DISSOLVED (UG/L AS ZN)
01091	ZINC, SUSPENDED RECOVERABLE (UG/L AS ZN)
01092	ZINC, TOTAL (UG/L AS ZN)
01093	ZINC, TOTAL IN BOTTOM MATERIAL (UG/G AS ZN)
01095	ANTIMONY, DISSOLVED (UG/L AS SB)
01096	ANTIMONY, SUSPENDED TOTAL (UG/L AS SB)
01097	ANTIMONY, TOTAL (UG/L AS SB)
01098	ANTIMONY, TOTAL IN BOTTOM MATERIAL (UG/G AS SB)
01100	TIN, DISSOLVED (UG/L AS SN)
01101	TIN, SUSPENDED RECOVERABLE (UG/L AS SN)
01102	TIN, TOTAL (UG/L AS SN)
01105	ALUMINUM, TOTAL (UG/L AS AL)
01106	ALUMINUM, DISSOLVED (UG/L AS AL)
01107	ALUMINUM, SUSPENDED RECOVERABLE (UG/L AS AL)
01108	ALUMINUM, TOTAL IN BOTTOM MATERIAL (UG/G AS AL)
01115	CESIUM, DISSOLVED (UG/L AS CS)
01116	CESIUM, SUSPENDED TOTAL (UG/L AS CS)

CODE	PARAMETER
01117	CESIUM, TOTAL (UG/L AS CS)
01120	GALLIUM, DISSOLVED (UG/L AS GA)
01121	GALLIUM, SUSPENDED TOTAL (UG/L AS GA)
01122	GALLIUM, TOTAL (UG/L AS GA)
01125	GERMANIUM, DISSOLVED (UG/L AS GE)
01126	GERMANIUM, SUSPENDED TOTAL (UG/L AS GE)
01127	GERMANIUM, TOTAL (UG/L AS GE)
01130	LITHIUM, DISSOLVED (UG/L AS LI)
01131	LITHIUM, SUSPENDED RECOVERABLE (UG/L AS LI)
01132	LITHIUM, TOTAL (UG/L AS LI)
01133	LITHIUM, RECOVERABLE FROM BOTTOM MATERIAL, DRY WEIGHT (UG/G AS LI)
01135	RUBIDIUM, DISSOLVED (UG/L AS RB)
01136	RUBIDIUM, SUSPENDED TOTAL (UG/L AS RB)
01137	RUBIDIUM, TOTAL (UG/L AS RB)
01145	SELENIUM, DISSOLVED (UG/L AS SE)
01146	SELENIUM, SUSPENDED TOTAL (UG/L AS SE)
01147	SELENIUM, TOTAL (UG/L AS SE)
01148	SELENIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS SE)
01150	TITANIUM, DISSOLVED (UG/L AS TI)
01151	TITANIUM, SUSPENDED TOTAL (UG/L AS TI)
01152	TITANIUM, TOTAL (UG/L AS TI)
01153	TITANIUM, TOTAL IN BOTTOM MATERIAL (UG/G AS TI)
01160	ZIRCONIUM, DISSOLVED (UG/L AS ZR)

CODE	PARAMETER
01161	ZIRCONIUM, SUSPENDED TOTAL (UG/L AS ZR)
01162	ZIRCONIUM, TOTAL (UG/L AS ZR)
01170	IRON, TOTAL IN BOTTOM MATERIAL (UG/G AS FE)
01300	OIL-GREASE (SEVERITY)
01305	DETERGENT SUDS (SEVERITY)
01310	GAS BUBBLES (SEVERITY)
01315	SLUDGE, FLOATING (SEVERITY)
01320	GARBAGE, FLOATING (SEVERITY)
01325	ALGAE, FLOATING MATS (SEVERITY)
01330	ODOR, ATMOSPHERIC (SEVERITY)
01335	SEWAGE SOLIDS, FRESH, FLOATING (SEVERITY)
01340	FISH, DEAD (SEVERITY)
01345	DEBRIS, FLOATING (SEVERITY)
01350	TURBIDITY (SEVERITY) 3=NORMAL, 4=FLOOD, 5=ABOVE NORMAL)
01355	ICE COVER, FLOATING OR SOLID (SEVERITY)
01501	ALPHA, TOTAL (PCI/L)
01502	ALPHA, TOTAL, COUNTING ERROR (PCI/L)
01503	ALPHA, DISSOLVED (PCI/L)
01504	ALPHA, DISSOLVED, COUNTING ERROR (PCI/L)
01505	ALPHA, SUSPENDED TOTAL (PCI/L)
01506	ALPHA, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
01515	GROSS ALPHA RADIOACTIVITY, DISSOLVED (PCI/L AS U NATURAL)
01516	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (PCI/L AS U NATURAL)

CODE	PARAMETER
01517	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (PCI/G AS U NATURAL)
01518	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (UG/G AS U NATURAL)
03501	BETA, TOTAL (PCI/L)
03502	BETA, TOTAL, COUNTING ERROR (PCI/L)
03503	BETA, DISSOLVED (PCI/L)
03504	BETA, DISSOLVED, COUNTING ERROR (PCI/L)
03505	BETA, SUSPENDED TOTAL (PCI/L)
03506	BETA, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
03515	GROSS BETA RADIOACTIVITY, DISSOLVED (PCI/L AS CS-137)
03516	GROSS BETA RADIOACTIVITY, SUSPENDED TOTAL (PCI/L AS CS-137) (PCI/G AS SR/YT-90)
03518	GROSS BETA RADIOACTIVITY, SUSPENDED TOTAL (PCI/G AS CS-137)
07000	TRITIUM, TOTAL (PCI/L)
07001	TRITIUM, TOTAL, COUNTING ERROR (PCI/L)
07005	TRITIUM, DISSOLVED (PCI/L)
07006	TRITIUM, DISSOLVED, COUNTING ERROR (PCI/L)
07010	TRITIUM, SUSPENDED TOTAL (PCI/L)
07011	TRITIUM, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07012	TRITIUM IN WATER MOLECULES (TRITIUM UNITS)
07013	TRITIUM IN WATER MOLECULES, COUNTING ERROR (TRITIUM UNITS)
07014	TRITIUM, SUSPENDED TOTAL, COUNTING ERROR (TRITIUM UNITS)
07015	TRITIUM, DISSOLVED, COUNTING ERROR (TRITIUM UNITS)

CODE	PARAMETER
07016	TRITIUM, SUSPENDED TOTAL (TRITIUM UNITS)
07017	TRITIUM, TOTAL (TRITIUM UNITS)
07018	TRITIUM, DISSOLVED (TRITIUM UNITS)
07019	TRITIUM, TOTAL, COUNTING ERROR (TRITIUM UNITS)
07050	CALCIUM 45, DISSOLVED (PCI/L)
07051	CALCIUM 45, DISSOLVED, COUNTING ERROR (PCI/L)
07052	CALCIUM 45, SUSPENDED TOTAL (PCI/L)
07053	CALCIUM 45, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07054	CALCIUM 45, TOTAL (PCI/L)
07055	CALCIUM 45, TOTAL, COUNTING ERROR (PCI/L)
07060	IRON 59, DISSOLVED (PCI/L)
07061	IRON 59, DISSOLVED, COUNTING ERROR (PCI/L)
07062	IRON 59, SUSPENDED TOTAL (PCI/L)
07063	IRON 59, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07064	IRON 59, TOTAL (PCI/L)
07065	IRON 59, TOTAL, COUNTING ERROR (PCI/L)
07080	RHODAMINE WT, DISSOLVED (UG/L)
07100	SELENIUM 75, DISSOLVED (PCI/L)
07101	SELENIUM 75, DISSOLVED, COUNTING ERROR (PCI/L)
07102	SELENIUM 75, SUSPENDED TOTAL (PCI/L)
07103	SELENIUM 75, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07104	SELENIUM 75, TOTAL (PCI/L)
07105	SELENIUM 75, TOTAL, COUNTING ERROR (PCI/L)

CODE	PARAMETER
07120	SILVER 110, DISSOLVED (PCI/L)
07121	SILVER 110, DISSOLVED, COUNTING ERROR (PCI/L)
07122	SILVER 110, SUSPENDED TOTAL (PCI/L)
07123	SILVER 110, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07124	SILVER 110, TOTAL (PCI/L)
07125	SILVER 110, TOTAL, COUNTING ERROR (PCI/L)
07140	SULFUR 35, DISSOLVED (PCI/L)
07141	SULFUR 35, DISSOLVED, COUNTING ERROR (PCI/L)
07142	SULFUR 35, SUSPENDED TOTAL (PCI/L)
07143	SULFUR 35, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
07144	SULFUR 35, TOTAL (PCI/L)
07145	SULFUR 35, TOTAL, COUNTING ERROR (PCI/L)
09501	RADIUM 226, TOTAL (PCI/L)
09503	RADIUM 226, DISSOLVED (PCI/L)
09505	RADIUM 226, SUSPENDED TOTAL (PCI/L)
09510	RADIUM 226, DISSOLVED, PLANCHET COUNT (PCI/L)
09511	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)
11501	RADIUM 228, TOTAL (PCI/L AS RA-228)
11502	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L AS RA-228)
13501	STRONTIUM 90, TOTAL (PCI/L)
13502	STRONTIUM 90, TOTAL, COUNTING ERROR (PCI/L)
13503	STRONTIUM 90, DISSOLVED (PCI/L)
13504	STRONTIUM 90, DISSOLVED, COUNTING ERROR (PCI/L)

CODE	PARAMETER
13505	STRONTIUM 90, SUSPENDED TOTAL (PCI/L)
13506	STRONTIUM 90, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
15501	STRONTIUM 89, TOTAL (PCI/L)
15502	STRONTIUM 89, TOTAL, COUNTING ERROR (PCI/L)
17503	LEAD - 210, DISSOLVED (PCI/L)
17504	LEAD - 210, DISSOLVED, COUNT ERROR (PCI/L)
22501	THORIUM 232, TOTAL (PCI/L)
22502	THORIUM 232, TOTAL, COUNTING ERROR (PCI/L)
22703	URANIUM, NATURAL, DISSOLVED (UG/L)
22705	URANIUM, NATURAL, SUSPENDED TOTAL (UG/L AS U NATURAL)
28001	RUTHENIUM 106, TOTAL (PCI/L)
28002	RUTHENIUM 106, TOTAL, COUNTING ERROR (PCI/L)
28401	CESIUM 137, TOTAL (PCI/L)
28402	CESIUM 137, TOTAL, COUNTING ERROR (PCI/L)
28403	CESIUM 137, DISSOLVED (PCI/L)
28404	CESIUM 137, SUSPENDED TOTAL (PCI/L)
28405	CESIUM 137,SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
28406	CESIUM 137, DISSOLVED, COUNTING ERROR (PCI/L)
28410	CESIUM 134, DISSOLVED (PCI/L)
28411	CESIUM 134, DISSOLVED, COUNTING ERROR (PCI/L)
28412	CESIUM 134, SUSPENDED TOTAL (PCI/L)
28413	CESIUM 134, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
28414	CESIUM 134, TOTAL (PCI/L)

CODE	PARAMETER
28415	CESIUM 134, TOTAL, COUNTING ERROR (PCI/L)
28901	CERIUM 144, TOTAL (PCI/L)
28902	CERIUM 144, TOTAL, COUNTING ERROR (PCI/L)
29301	ZINC 65, TOTAL (PCI/L)
29302	ZINC 65, TOTAL, COUNTING ERROR (PCI/L)
29501	MANGANESE 54, TOTAL (PCI/L)
29502	MANGANESE 54, TOTAL, COUNTING ERROR (PCI/L)
29601	COBALT 60, TOTAL (PCI/L)
29602	COBALT 60, TOTAL, COUNTING ERROR (PCI/L)
29631	SCANDIUM 46, DISSOLVED (PCI/L)
29632	SCANDIUM 46, DISSOLVED, COUNTING ERROR (PCI/L)
29633	SCANDIUM 46, SUSPENDED TOTAL (PCI/L)
29634	SCANDIUM 46, SUSPENDED TOTAL, COUNTING ERROR (PCI/L)
29635	SCANDIUM 46, TOTAL (PCI/L)
29636	SCANDIUM 46, TOTAL, COUNTING ERROR (PCI/L)
31501	COLIFORM, MEMBRANE FILTER, IMMEDIATE M-ENDO MEDIUM (COLONIES/100 ML)
31503	COLIFORM, MEMBRANE FILTER, DELAYED M-ENDO MEDIUM (COLONIES/100 ML)
31505	COLIFORM, CONFIRMED (MPN)
31507	COLIFORM, COMPLETE (MPN)
31615	COLIFORM, FECAL, EC BROTH AT 44.5 DEG. C (MPN)
31616	COLIFORM, FECAL, MEMBRANE FILTER M-FC MEDIA AT 44.5 DEG. C (COLONIES/100 ML)

CODE	PARAMETER
31617	COLIFORM, FECAL, EIJKMAN TEST AT 44.5 DEG. C (MPN)
31619	COLIFORM, FECAL, BORIC ACID LACTOSE BROTH AT 43 DEG. C (MPN)
31625	FECAL COLIFORM .7 UM-MF (COL./ 100 ML)
31625	FECAL COLIFORM .7 UM-MF (COL./ 100 ML)
31673	STREPTOCOCCI, FECAL, MEMBRANE FILTER, KF AGAR (COLONIES/100 ML)
31677	STREPTOCOCCI, FECAL (MPN)
31678	STREPTOCOCCI, FECAL, TUBE CONFIGURATION

VALUES FOR PARAMETER CODE 31678:

1 - FIVE 10-ML TUBES
2 - FIVE 10-ML, FIVE 1-ML AND FIVE 0.1-ML TUBES
3 - FIVE 10-ML, ONE 1-ML AND ONE 0.1-ML TUBES
4 - ONE 50-ML AND FIVE 10-ML TUBES
5 - ONE 50-ML, FIVE 10-ML AND FIVE 1-ML TUBES
6 - FIVE 50-ML, FIVE 10-ML AND FIVE 1-ML TUBES
7 - THREE 10-ML, THREE 1-ML AND THREE 0.1-ML TUBES
8 - FIVE 100-ML, FIVE 10-ML AND FIVE 1-ML TUBES

31679	STREPTOCOCCI, FECAL, MEMBRANE FILTER, M-ENTEROCOCCUS AGAR (COLONIES/100 ML)
31751	TOTAL PLATE COUNT, TPC AGAR, 35 DEG C., 24 HOURS (COLONIES/ML)
31854	BACTERIA, NITRIFYING (MPN)
31855	BACTERIA, SULFATE REDUCING (MPN)
32001	SAMPLE SIZE (GALLONS)
32002	SAMPLE SIZE (MILLILITRES)
32003	CARBON CHLOROFORM AND ALCOHOL EXTRACTABLES, TOTAL (UG/L)
32004	CARBON ALCOHOL EXTRACTABLES (UG/L)

CODE	PARAMETER
32005	CARBON CHLOROFORM EXTRACTABLES (UG/L)
32211	CHLOROPHYLL A, PHYTOPLANKTON, SPECTROPHOTOMETRIC, CORRECTED (UG/L)
32218	PHEOPHYTIN, PHYTOPLANKTON, SPECTROPHOTOMETRIC, CORRECTED (UG/L)
32223	CHLOROPHYLL A, PERIPHYTON, SPECTROPHOTOMETRIC, CORRECTED (MG/SQ M)
32224	PHEOPHYTIN, PERIPHYTON, SPECTROPHOTOMETRIC, CORRECTED (MG/SQ M)
32225	CHLOROPHYLL, TOTAL, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)
32226	CHLOROPHYLL B, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)
32227	CHLOROPHYLL C, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)
32228	CHLOROPHYLL A, PERIPHYTON, SPECTROPHOTOMETRIC, UNCORRECTED (MG/SQ M)
32230	CHLOROPHYLL A, PHYTOPLANKTON, SPECTROPHOTOMETRIC, UNCORRECTED (UG/L)
32231	CHLOROPHYLL B, PHYTOPLANKTON, SPECTROPHOTOMETRIC (UG/L)
32232	CHLOROPHYLL C, PHYTOPLANKTON, SPECTROPHOTOMETRIC (UG/L)
32234	CHLOROPHYLL, TOTAL, PHYTOPLANKTON, SPECTROPHOTOMETRIC, UNCORRECTED (UG/L)
32240	TANNIN AND LIGNIN (MG/L)
32730	PHENOLS (UG/L)
38260	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
39025	SIMAZINE, TOTAL, COULSON COND. (UG/L)
39034	PERTHANE, TOTAL (UG/L)

CODE	PARAMETER
39040	DEF, TOTAL (UG/L)
39046	SIMAZINE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39050	DEF IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39051	METHOMYL, TOTAL (UG/L)
39052	PROPHAM, TOTAL (UG/L)
39053	ALDICARB, TOTAL (UG/L)
39054	SIMETRYNE, TOTAL (UG/L)
39055	SIMAZINE, TOTAL (UG/L)
39056	PROMETONE, TOTAL (UG/L)
39057	PROMETRYNE, TOTAL (UG/L)
39250	NAPHTHALENES, POLYCHLORINATED (UG/L)
39251	PCN,TOTAL IN BOTTOM MATERIAL, DRY WT (UG/KG)
39300	P,P' DDT, TOTAL (UG/L)
39301	P,P' DDT IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39305	O,P' DDT, TOTAL (UG/L)
39306	O,P' DDT IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39310	P,P' DDD, TOTAL (UG/L)
39311	P,P' DDD IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39315	O,P' DDD, TOTAL (UG/L)
39316	O,P' DDD, TOTAL IN BOTTOM MATERIAL, DRY WT (UG/KG)
39320	P,P' DDE, TOTAL (UG/L)
39321	P,P' DDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39327	O,P' DDE, TOTAL (UG/L)

CODE	PARAMETER
39328	O,P' DDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39330	ALDRIN, TOTAL (UG/L)
39331	ALDRIN, DISSOLVED (UG/L)
39332	ALDRIN, SUSPENDED TOTAL (UG/L)
39333	ALDRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39340	LINDANE, TOTAL (UG/L)
39341	LINDANE, DISSOLVED (UG/L)
39342	LINDANE, SUSPENDED TOTAL (UG/L)
39343	LINDANE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39350	CHLORDANE, TOTAL (UG/L)
39351	CHLORDANE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39352	CHLORDANE, DISSOLVED (UG/L)
39353	CHLORDANE, SUSPENDED TOTAL (UG/L)
39360	DDD, TOTAL (UG/L)
39361	DDD, DISSOLVED (UG/L)
39362	DDD, SUSPENDED TOTAL (UG/L)
39363	DDD IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39365	DDE, TOTAL (UG/L)
39366	DDE, DISSOLVED (UG/L)
39367	DDE, SUSPENDED TOTAL (UG/L)
39368	DDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39370	DDT, TOTAL (UG/L)
39371	DDT, DISSOLVED (UG/L)

CODE	PARAMETER
39372	DDT, SUSPENDED TOTAL (UG/L)
39373	DDT IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39380	DIELDRIN, TOTAL (UG/L)
39381	DIELDRIN, DISSOLVED (UG/L)
39382	DIELDRIN, SUSPENDED TOTAL (UG/L)
39383	DIELDRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39388	ENDOSULFAN, TOTAL (UG/L)
39389	ENDOSULFANE, TOTAL IN BOTTOM MATERIAL, DRY WT (UG/KG)
39390	ENDRIN, TOTAL (UG/L)
39391	ENDRIN, DISSOLVED (UG/L)
39392	ENDRIN, SUSPENDED TOTAL (UG/L)
39393	ENDRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39398	ETHION, TOTAL (UG/L)
39399	ETHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39400	TOXAPHENE, TOTAL (UG/L)
39401	TOXAPHENE, DISSOLVED (UG/L)
39402	TOXAPHENE, SUSPENDED TOTAL (UG/L)
39403	TOXAPHENE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39410	HEPTACHLOR, TOTAL (UG/L)
39411	HEPTACHLOR, DISSOLVED (UG/L)
39412	HEPTACHLOR, SUSPENDED TOTAL (UG/L)
39413	HEPTACHLOR IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39420	HEPTACHLOR EPOXIDE, TOTAL (UG/L)

CODE	PARAMETER
39421	HEPTACHLOR EPOXIDE, DISSOLVED (UG/L)
39422	HEPTACHLOR EPOXIDE, SUSPENDED TOTAL (UG/L)
39423	HEPTACHLOR EPOXIDE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39430	ISODRIN, TOTAL (UG/L)
39431	ISORDIN, DISSOLVED (UG/L)
39432	ISODRIN, SUSPENDED TOTAL (UG/L)
39433	ISODRIN IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39460	CHLOROBENZILATE, TOTAL (UG/L)
39470	DILAN, TOTAL (UG/L)
39480	METHOXYCHLOR, TOTAL (UG/L)
39481	METHOXYCHLOR IN BOTTOM MATERIALS (UG/KG DRY SOLIDS)
39496	AROCLOR, TOTAL, 1242 PCB SERIES (UG/L)
39499	AROCLOR, TOTAL IN BOTTOM MATERIAL, 1242 PCB SERIES, DRY WT (UG/KG)
39500	AROCLOR, TOTAL, 1248 PCB SERIES (UG/L)
39501	AROCLOR, DISSOLVED, 1248 PCB SERIES (UG/L)
39502	AROCLOR, SUSPENDED TOTAL, 1248 PCB SERIES (UG/L)
39503	AROCLOR IN BOTTOM MATERIAL, 1248 PCB SERIES (UG/KG DRY SOLIDS)
39504	AROCLOR, TOTAL, 1254 PCB SERIES (UG/L)
39505	AROCLOR, DISSOLVED, 1254 PCB SERIES (UG/L)
39506	AROCLOR, SUSPENDED TOTAL, 1254 PCB SERIES (UG/L)
39507	AROCLOR IN BOTTOM MATERIAL, 1254 PCB SERIES (UG/KG DRY SOLIDS)

CODE	PARAMETER
39508	AROCLOR, TOTAL, 1260 PCB SERIES (UG/L)
39509	AROCLOR, DISSOLVED, 1260 PCB SERIES (UG/L)
39510	AROCLOR, SUSPENDED TOTAL, 1260 PCB SERIES (UG/L)
39511	AROCLOR IN BOTTOM MATERIAL, 1260 PCB SERIES (UG/KG DRY SOLIDS)
39516	PCB, TOTAL (UG/L)
39517	PCB, DISSOLVED (UG/L)
39518	PCB, SUSPENDED TOTAL (UG/L)
39519	PCB IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39530	MALATHION, TOTAL (UG/L)
39531	MALATHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39532	MALATHION, DISSOLVED (UG/L)
39533	MALATHION, SUSPENDED TOTAL (UG/L)
39540	PARATHION, TOTAL (UG/L)
39541	PARATHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39542	PARATHION, DISSOLVED (UG/L)
39543	PARATHION, SUSPENDED TOTAL (UG/L)
39550	CHLOROTHION, TOTAL (UG/L)
39560	DEMETON, TOTAL (UG/L)
39570	DIAZINON, TOTAL (UG/L)
39571	DIAZINON IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39572	DIAZINON, DISSOLVED (UG/L)
39573	DIAZINON, SUSPENDED TOTAL (UG/L)
39580	GUTHION, TOTAL (UG/L)

CODE	PARAMETER
39593	HEPT (UG/L)
39600	METHYL PARATHION, TOTAL (UG/L)
39601	METHYL PARATHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39602	METHYL PARATHION, DISSOLVED (UG/L)
39603	METHYL PARATHION, SUSPENDED TOTAL (UG/L)
39610	PHOSDRIN, TOTAL (UG/L)
39620	TEPP, TOTAL (UG/L)
39630	ATRAZINE, TOTAL (UG/L)
39631	ATRAZINE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39701	HEXACHLOROBENZENE IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39730	2,4-D, TOTAL (UG/L)
39731	2,4-D IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39732	2,4-D, DISSOLVED (UG/L)
39733	2,4-D, SUSPENDED TOTAL (UG/L)
39740	2,4,5-T, TOTAL (UG/L)
39741	2,4,5-T IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39742	2,4,5-T, DISSOLVED (UG/L)
39743	2,4,5-T, SUSPENDED TOTAL (UG/L)
39750	SEVIN, TOTAL (UG/L)
39755	MIREX, TOTAL (UG/L)
39756	MIREX, DISSOLVED (UG/L)
39757	MIREX, SUSPENDED TOTAL (UG/L)
39758	MIREX, TOTAL IN BOTTOM MATERIALS, DRY WT (UG/KG)

CODE	PARAMETER
39760	SILVEX, TOTAL (UG/L)
39761	SILVEX IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39762	SILVEX, DISSOLVED (UG/L)
39763	SILVEX, SUSPENDED TOTAL (UG/L)
39770	DACTHAL (DCPA), TOTAL (UG/L)
39780	DICOFOL, TOTAL (UG/L)
39782	LINDANE, TOTAL (UG/L)(TO BE USED ONLY AT THE REQUEST OF THE ENVIRONMENTAL PROTECTION AGENCY)
39786	TRITHION, TOTAL (UG/L)
39787	TRITHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39790	METHYL TRITHION, TOTAL (UG/L)
39791	METHYL TRITHION IN BOTTOM MATERIAL (UG/KG DRY SOLIDS)
39800	IMIDAN, TOTAL (UG/L)
39810	GAMMA CHLORDANE, TOTAL (UG/L)
39811	GAMMA CHLORDANE IN BOTTOM MAT. (UG/KG DRY SOLIDS)
39900	ALLETHRIN, TOTAL (UG/L)
39910	CINERIN, TOTAL (UG/L)
39920	DNOC, TOTAL (UG/L)
39930	PYRETHRIN, TOTAL (UG/L)
46002	PHENOLS, DIRECT PHOTOMETRIC, NO DISTILLATION (UG/L)
46516	SOLAR RADIATION, NET - LANGLEYS (CAL/CM2/MIN)
50050	FLOW IN CONDUIT OR THROUGH A TREATMENT PLANT (MGD)
50060	CHLORINE, TOTAL RESIDUAL (MG/L)
50064	CHLORINE, FREE AVAILABLE (MG/L)

CODE	PARAMETER
50066	CHLORINE, COMBINED AVAILABLE (MG/L)
50086	SETTLEABLE MATTER (ML/L/HR)
60050	PHYTOPLANKTON, TOTAL (CELLS/ML)
70290	CHLORIDE, DISSOLVED (TONS/DAY)
70291	SULFATE, DISSOLVED (TONS/DAY)
70299	SOLIDS, RESIDUE AT 110 DEG. C, SUSPENDED TOTAL (MG/L)
70300	SOLIDS, RESIDUE ON EVAPORATION AT 180 DEG C, DISSOLVED (MG/L)
70301	DISSOLVED SOLIDS (SUM OF CONSTITUENTS)
70302	DISSOLVED SOLIDS (TONS PER DAY)
70303	DISSOLVED SOLIDS (TONS PER ACRE-FOOT)
70326	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .002 MM
70327	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .004 MM
70328	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .008 MM
70329	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .016 MM
70330	SEDIMENT, SUSPENDED, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .031 MM
70331	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .062 MM
70332	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .125 MM
70333	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .250 MM
70334	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN .500 MM

CODE	PARAMETER
70335	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN 1.00 MM
70336	SEDIMENT, SUSPENDED, SIEVE DIAMETER, PERCENT FINER THAN 2.00 MM
70337	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .002 MM
70338	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .004 MM
70339	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .008 MM
70340	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .016 MM
70341	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .031 MM
70342	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .062 MM
70343	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .125 MM
70344	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .250 MM
70345	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .500 MM
70346	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER,
70347	SEDIMENT, SUSPENDED, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN 2.00 MM
70507	PHOSPHORUS, ORTHOPHOSPHATE, TOTAL (MG/L AS P)
70508	ACIDITY, TOTAL, HEATED (MG/L AS CACO3)
70916	ZOOPLANKTON, TOTAL (ORGANISMS/CU METER)
70940	INVERTEBRATES, BENTHIC, WET WEIGHT (G/SQ METER)

CODE	PARAMETER
70941	INVERTEBRATES, BENTHIC, DRY WEIGHT (G/SQ METER)
70942	INVERTEBRATES, BENTHIC, ASH WEIGHT (G/SQ METER
70943	INVERTEBRATES, BENTHIC, TOTAL (ORGANISMS/SQ M)
70944	MACROPHYTES, TOTAL (NUMBER/SQ METER)
70945	PERIPHYTON, TOTAL (CELLS/SQ MILLIMETER)
70947	ZOOPLANKTON, DRY WEIGHT (G/CU METER)
70948	ZOOPLANKTON, ASH WEIGHT (G/CU METER)
70949	BIOMASS-CHLOROPHYLL RATIO, PLANKTON (UNITS)
70950	BIOMASS-CHLOROPHYLL RATIO, PERIPHYTON (UNITS)
70951	CHLOROPHYLL-A, PHYTOPLANKTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (UG/L)
70952	CHLOROPHYLL-B, PHYTOPLANKTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (UG/L)
70953	CHLOROPHYLL-A, PHYTOPLANKTON, CHROMOTOGRAPHIC-FLUOROMETRIC (UG/L)
70954	CHLOROPHYLL-B, PHYTOPLANKTON, CHROMOTOGRAPHIC-FLUOROMETRIC (UG/L)
70955	CHLOROPHYLL-A, PERIPHYTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (MG/SQ M)
70956	CHLOROPHYLL-B, PERIPHYTON, CHROMOTOGRAPHIC-SPECTROPHOTOMETRIC (MG/SQ M)
70957	CHLOROPHYLL-A, PERIPHYTON, CHROMOTOGRAPHIC-FLUOROMETRIC (MG/SQ M)
70958	CHLOROPHYLL-B, PERIPHYTON, CHROMOTOGRAPHIC-FLUOROMETRIC (MG/SQ M)
70959	PRODUCTIVITY, PRIMARY, GROSS (MG O2/CU METER/DAY)
70960	PRODUCTIVITY, PRIMARY, GROSS (MG O2/SQ METER/DAY)

CODE	PARAMETER
70961	PRODUCTIVITY, PRIMARY, GROSS (MG C/CU METER/DAY)
70962	PRODUCTIVITY, PRIMARY, GROSS (MG C/SQ METER/DAY)
70963	PRODUCTIVITY, PRIMARY, NET (MG O2/CU METER/DAY)
70964	PRODUCTIVITY, PRIMARY, NET (MG O2/SQ METER/DAY)
70965	PRODUCTIVITY, PRIMARY, NET (MG C/CU METER/DAY)
70966	PRODUCTIVITY, PRIMARY, NET (MG C/SQ METER/DAY)
70967	RESPIRATION (MG O2/CU METER/DAY)
70968	RESPIRATION (MG O2/SQ METER/DAY)
70969	BATTERY VOLTAGE (VOLTS)
70971	LIGHT, ATTENUATION COEFFICIENT (ALPHA/M)
70988	ALGAL GROWTH POTENTIAL (MG/L)
70998	ADENOSINE TRIPHOSPHATE (UG/L)
71100	SESTON, TOTAL (MG/L)
71101	SESTON, ASH WEIGHT (MG/L)
71200	SALMONELLA, MEMBRANE FILTER (COLONIES/100 ML)
71820	DENSITY (GM/ML AT 20 DEG C)
71825	ACIDITY, TOTAL, HEATED (MG/L AS H)
71830	HYDROXIDE ION (MG/L AS OH)
71835	OXYGEN CONSUMED - FILTERED (MG/L)
71840	OXYGEN CONSUMED - UNFILTERED (MG/L)
71845	NITROGEN, AMMONIA, TOTAL (MG/L AS NH4)
71846	NITROGEN, AMMONIA, DISSOLVED (MG/L AS NH4)
71850	NITROGEN, NITRATE, TOTAL (MG/L AS NO3)

CODE	PARAMETER
71851	NITROGEN, NITRATE, DISSOLVED (MG/L AS NO3)
71855	NITROGEN, NITRITE, TOTAL (MG/L AS NO2)
71856	NITROGEN, NITRITE, DISSOLVED (MG/L AS NO2)
71860	RESIDUAL SODIUM CARBONATE
71865	IODIDE, DISSOLVED (MG/L AS I)
71870	BROMIDE, DISSOLVED (MG/L AS BR)
71875	HYDROGEN SULFIDE (MG/L AS H2S)
71876	RESIN ACID SOAP (MG/L)
71880	FORMALDEHYDE (MG/L)
71883	MANGANESE (UG/L AS MN)
71885	IRON (UG/L AS FE)
71886	PHOSPHORUS, TOTAL (MG/L AS PO4)
71887	NITROGEN, TOTAL (MG/L AS NO3)
71888	PHOSPHORUS, DISSOLVED (MG/L AS PO4)
71890	MERCURY, DISSOLVED (UG/L AS HG)
71895	MERCURY, SUSPENDED RECOVERABLE (UG/L AS HG)
71900	MERCURY, TOTAL (UG/L AS HG)
71921	MERCURY, TOTAL IN BOTTOM MATERIAL (UG/G AS HG)
71995	WATER USE (PRIMARY)
71996	WATER USE (SECONDARY)
71997	WATER USE (TERTIARY)
71998	WATER USE (QUATERNARY)
72001	DEPTH OF HOLE, TOTAL (FEET)

CODE	PARAMETER
72002	DEPTH TO TOP OF WATER-BEARING ZONE SAMPLED (FEET)
72003	DEPTH TO BOTTOM OF WATER-BEARING ZONE SAMPLED (FEET)
72004	PUMP OR FLOW PERIOD PRIOR TO SAMPLING (MIN)
72005	SAMPLE SOURCE CODE

VALUES FOR PARAMETER CODE 72005:

1 - WELL HEAD
2 - DRILL STEM TEST
3 - SEPERATOR
4 - BOILER
5 - FLOW LINE
6 - BATTERY
7 - UNDESIGNATED
8 - TANK
9 - PRODUCTION TEST
10 - HEATER TREATER
11 - GUN BARREL
12 - SWAB
13 - PIT
14 - MANIFOLD TEST
15 - GAS LINE DRIP
16 - CASING LEAK
17 - WIRE LINE TEST
18 - HEADER
19 - FILTER
20 - TEST TOOL
21 - LTX UNIT
22 - KNOCKOUT
23 - WELL BLEEDER
24 - FRACTURE TEST
25 - TEST WAGON
26 - PUMP
27 - TAP NEAR WELL
28 - TAP AWAY FROM WELL
29 - BUCKET
30 - PRESSURE TANK
31 - DISCHARGE PIPE
32 - FOERST SAMPLER
33 - BAILER
34 - DRAIN LINE
35 - INJECTION PUMP

CODE PARAMETER

VALUES FOR PARAMETER CODE 72005 - CONTINUED:

36 - SPOT SAMPLE IN FLUID COLUMN
37 - TANK BATTERY INCLUDING GUN BARREL
38 - WINDMILL
39 - WATER SIPHON
40 - SPECIAL
41 - MUNICIPAL AND DOMESTIC WASTE
42 - INDUSTRIAL WASTE
43 - STORM WATER (PRIOR TO ENTERING NATURAL CHANNELS)
44 - PUBLIC WATER SUPPLIES (TREATED WATER)
45 - MINE WATER
46 - PUBLIC WATER SUPPLIES (UNTREATED WATER)
47 - WATER WELL
48 - MULTIPLE WATER WELLS
49 - OIL WELL
50 - MULTI-OIL WELL
51 - GAS WELL
52 - MULTI-GAS WELL
53 - OIL AND GAS WELL
54 - MULTI-OIL AND GAS WELL
55 - DRILLED AND ABANDONED WELL
56 - PLUGGED AND ABANDONED WELL
57 - JUNKED AND ABANDONED WELL
58 - TEMPORARILY ABANDONED WELL
59 - ABANDONED OIL WELL
60 - ABANDONED GAS WELL
61 - SALT-WATER SUPPLY WELL
62 - SALT-WATER DISPOSAL WELL
63 - INJECTION WELL
64 - SERVICE WELL
65 - WETLAND ECOSYSTEM
66 - DREDGE WAKE
67 - MAINSTREAM
68 - OVERBANK
69 - COMPOSITED PUBLIC WATER SUPPLY(UNTREATED WATER)
70 - COMPOSITED PUBLIC WATER SUPPLY(TREATED WATER)

72006 SAMPLING CONDITION CODE

VALUES FOR PARAMETER CODE 72006:

1 - TESTING
2 - UNDESIGNATED
3 - SWABBING

CODE	PARAMETER
	VALUES FOR PARAMETER CODE 72006 - CONTINUED:
	4 - FLOWING
	5 - REVERSING OUT
	6 - FLOWING ON GAS LIFT
	7 - AFTER ACIDIZING
	8 - PUMPING
	9 - MILLIPORE FILTER
	10 - OPEN HOLE
	11 - FLOWING ON DRILL STEM TEST
	12 - AFTER DRILL STEM TEST
	15 - BAILING
	16 - AFTER PERFORATION
	17 - TUBING FLOW
	18 - PRODUCING
	19 - CIRCULATING
	20 - FLOWING ON PRODUCTION TEST
	21 - FLOWING ON POTENTIAL TEST
	22 - LIFTING
	23 - FLOWING TO PIT
	24 - WATER FLOODING
	25 - JETTING
	26 - PRODUCTION AND DEVELOPMENT TEST
	27 - PRODUCTION BY UNKNOWN METHOD
72008	DEPTH OF WELL, TOTAL (FEET)
72010	RESISTIVITY (OHM-METERS)
72012	TEMPERATURE, SPECIFIC GRAVITY (DEG. C)
72013	SPECIFIC GRAVITY
72014	TEMPERATURE, RESISTIVITY (DEG. C)
72015	DEPTH TO TOP OF SAMPLE INTERVAL (FEET BELOW LSD)
72016	DEPTH TO BOTTOM OF SAMPLE INTERVAL (FEET BELOW LSD)
72019	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET)
72020	ELEVATION (FEET NGVD)
72021	RESERVOIR STORAGE (CFS DAYS)
72022	RESERVOIR STORAGE (MILLIONS OF GALLONS)

CODE	PARAMETER
72023	RESERVOIR STORAGE (MILLIONS OF CUBIC FEET)
72025	DEPTH OF RESERVOIR (FEET)
72027	AZIMUTH FROM OUTLET (DEGREES)
72028	AZIMUTH FROM SOUTHERNMOST POINT (DEGREES)
72029	DISTANCE FROM OUTLET OR SOUTHERNMOST POINT (FEET)
72036	RESERVOIR STORAGE, IN THOUSANDS OF ACRE-FEET
72050	WITHDRAWAL OF GROUND WATER (MILLIONS OF GALLONS PER MONTH)
72051	WITHDRAWAL OF GROUND WATER (MILLIONS OF GALLONS PER YEAR)
74010	IRON, TOTAL (MG/L AS FE) (NOT FOR WRD USE)
74207	SOIL MOISTURE (PERCENT OF TOTAL VOLUME)
75031	ZIRCONIUM, NIOBIUM 95, TOTAL, COUNTING ERROR (PCI/L)
75032	ZIRCONIUM, NIOBIUM 95, TOTAL (PCI/L)
75037	POTASSIUM 40, TOTAL, COUNTING ERROR (PCI/L)
75038	POTASSIUM 40, TOTAL (PCI/L)
80010	URANIUM, DISSOLVED, DIRECT FLUOROMETRIC (PCI/L)
80015	URANIUM, DISSOLVED, EXTRACTION FLUOROMETRIC (PCI/L)
80020	URANIUM, DISSOLVED, EXTRACTION FLUOROMETRIC (UG/L)
80030	ALPHA, GROSS, DISSOLVED AS U NATURAL (UG/L)
80040	GROSS ALPHA RADIOACTIVITY, SUSPENDED TOTAL (UG/L AS U NATURAL)
80050	BETA, GROSS, DISSOLVED AS STRONTIUM/YTTRIUM-90 (PCI/L)
80060	GROSS BETA RADIOACTIVITY, SUSPENDED TOTAL (PCI/L AS SR/YT-90)

CODE	PARAMETER
80110	SPECIFIC GRAVITY, WATER, UNITY AT 4 DEG. C
80154	SEDIMENT, SUSPENDED, CONCENTRATION (MG/L)
80155	SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY)
80156	SEDIMENT DISCHARGE, TOTAL, SUSPENDED PLUS BED MATERIAL (TONS/DAY)
80157	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .004 MM
80158	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .062 MM
80159	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .125 MM
80160	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .250 MM
80161	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN .500 MM
80162	SEDIMENT, BED MATERIAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THAN 1.00 MM
80164	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .062 MM
80165	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .125 MM
80166	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .250 MM
80167	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN .500 MM
80168	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 1.00 MM
80169	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 2.00 MM
80170	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 4.00 MM

CODE	PARAMETER
80171	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 8.00 MM
80172	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 16.0 MM
80173	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 32.0 MM
80174	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 64.0 MM
80175	SEDIMENT, BED MATERIAL, SIEVE DIAMETER, PERCENT FINER THAN 128.0 MM
80180	SEDIMENT, TOTAL, CONCENTRATION (MG/L)
80181	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .002 MM
80182	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .004 MM
80183	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .008 MM
80184	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .016 MM
80185	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .031 MM
80186	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .062 MM
80187	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .125 MM
80188	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .250 MM
80189	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN .500 MM
80190	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN 1.00 MM

CODE	PARAMETER
80191	SEDIMENT, TOTAL, FALL DIAMETER, DISTILLED WATER, PERCENT FINER THEN 2.00 MM
80192	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .002 MM
80193	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .004 MM
80194	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .008 MM
80195	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .016 MM
80196	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .031 MM
80197	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .062 MM
80198	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .125 MM
80199	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .250 MM
80200	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN .500 MM
80201	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN 1.00 MM
80202	SEDIMENT, TOTAL, FALL DIAMETER, NATIVE WATER, PERCENT FINER THEN 2.00 MM
80203	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .062 MM
80204	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .125 MM
80205	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .250 MM
80206	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN .500 MM

CODE	PARAMETER
80207	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 1.00 MM
80208	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 2.00 MM
80209	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 4.00 MM
80210	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 8.00 MM
80211	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 16.0 MM
80212	SEDIMENT, TOTAL, SIEVE DIAMETER, PERCENT FINER THEN 32.0 MM
80225	SEDIMENT DISCHARGE, BEDLOAD (TONS/DAY)
80226	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .062 MM
80227	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .125 MM
80228	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .250 MM
80229	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN .500 MM
80230	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 1.00 MM
80231	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 2.00 MM
80232	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 4.00 MM
80233	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 8.00 MM
80234	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 16.0 MM

CODE	PARAMETER
80235	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 32.0 MM
80236	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 64.0 MM
80237	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 76.0 MM
80238	SEDIMENT, BEDLOAD, SIEVE DIAMETER, PERCENT FINER THAN 128.0 MM
81024	DRAINAGE AREA (SQUARE MILES)
81025	DRAINAGE AREA, CONTRIBUTING (SQUARE MILES)
81026	WATER CONTENT OF SNOW (INCHES)
81027	TEMPERATURE, SOIL (DEG. C)
81028	WITHDRAWAL OF GROUND WATER (MILLIONS OF GALLONS/DAY)
81029	SNOW TEMPERATURE (DEG C)
81200	SILICA, DISSOLVED (TONS/DAY)
81201	CALCIUM, DISSOLVED (TONS/DAY)
81202	MAGNESIUM, DISSOLVED (TONS/DAY)
81203	SODIUM, DISSOLVED (TONS/DAY)
81204	POTASSIUM, DISSOLVED (TONS/DAY)
81205	BICARBONATE (TONS/DAY)
85209	ALGAL GROWTH POTENTIAL USGS MOD. BOTTLE TEST (MG/L)
85540	AIR, VOLUME PERCENT OF DISSOLVED GASES
85541	GAS, INERT, VOLUME (PERCENT OF DISSOLVED GASES)
85542	GAS, ARGON, VOLUME PERCENT OF DISSOLVED GASES
85543	GAS, BUTANE, VOLUME PERCENT OF DISSOLVED GASES

	CODE	PARAMETER
	85544	GAS, CARBON DIOXIDE, VOLUME PERCENT OF DISSOLVED GASES
	85545	GAS, ETHANE, VOLUME PERCENT OF DISSOLVED GASES
	85546	GAS, HYDROGEN, VOLUME PERCENT OF DISSOLVED GASES
	85547	GAS, METHANE, VOLUME PERCENT OF DISSOLVED GASES
	85548	GAS, NITROGEN AND CARBON MONOXIDE, VOLUME PERCENT OF DISSOLVED GASES
	85549	GAS, OCTANE, VOLUME PERCENT OF DISSOLVED GASES
	85550	GAS, OXYGEN, VOLUME PERCENT OF DISSOLVED GASES
	85551	GAS, PENTANE, VOLUME PERCENT OF DISSOLVED GASES
	85552	GAS, PROPANE, VOLUME PERCENT OF DISSOLVED GASES
	85553	DATE, WELL COMPLETION (MONTH/YEAR)(CODE TWO DIGITS FOR MONTH AND LAST TWO DIGITS OF THE YEAR.)
	85554	DATE, LATEST WELL WORKOVER (MONTH/YEAR)(CODE TWO DIGITS FOR MONTH AND LAST TWO DIGITS OF THE YEAR.)
	85555	GAS-WATER RATIO (CUBIC FEET PER BARREL)
	85556	ACIDS, ORGANIC AS PROPIONIC (MG/L)
	85557	TEMPERATURE, LOW SATURATION (DEG. C)
	85558	TEMPERATURE, HIGH SATURATION (DEG. C)
	85559	PRESSURE, LOW SATURATION (POUNDS PER SQUARE INCH)
	85560	PRESSURE, HIGH SATURATION (POUNDS PER SQUARE INCH)
X	90000	ELEVATION (INCHES)
*	99995	ELEVATION IN HUNDREDTHS OF FEET (NO DECIMAL) (72020)

X - TEMPORARY CODE TO BE USED WITH THE DAILY VALUES FILE ONLY.

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

CODE	PARAMETER
* 99998	STREAMFLOW (MILLIONS OF GALLONS PER DAY) (00060)

* - CODE TO BE USED AS INPUT TO THE DAILY VALUES FILE ONLY. THE INPUT DATA WILL BE CONVERTED TO THE PROPER UNITS AND STORED WITH THE CODE SHOWN IN PARENTHESES.

APPENDIX E

STATISTIC CODES

APPENDIX E
STATISTIC CODES

The following codes have been assigned by WATSTORE for use in identifying data that is stored in the WATSTORE computer files. These unique five digit codes identify the frequency of the measurement or statistical reduction of the data. Additional codes may be requested as required.

STATISTIC	CODE
MAXIMUM [1]	00001
MINIMUM [1]	00002
MEAN	00003
AM (sample taken between 0000-1200 hrs.)	00004
PM (sample taken between 1200-2400 hrs.)	00005
SUM	00006
MODE	00007
MEDIAN	00008
STANDARD DEVIATION	00009
VARIANCE	00010
RANDOM INSTANTANEOUS	00011
EQUIVALENT MEAN [2]	00012
SKEWNESS	00013
RESERVED FOR FUTURE USE	00014-00020
TIDAL HIGH (Daily)	00021
TIDAL LOW-HIGH (Daily)	00022
TIDAL HIGH-LOW (Daily)	00023
TIDAL LOW (Daily)	00024
RESERVED FOR FUTURE USE	00025-00999

The codes listed below have been reserved for identification of output from the WATSTORE Statistical Summary Programs.

PERCENTILE CODE=
(1000 + (PERCENTILE X 10))

---

[1] When used in combination with parameter code 72019 (distance below LSD), the maximum value is the maximum value for this parameter but will be the minimum elevation, and the minimum value for this parameter will be the maximum elevation.

[2] Commonly used with gage height (Parameter code 00065) values that represent an equivalent mean that corresponds to the calculated mean discharges (Parameter code 00060).

Examples are given below.

0.5 PERCENTILE	01005
1.0 PERCENTILE	01010
67.0 PERCENTILE	01670
99.9 PERCENTILE	01999

n DAY LOW MEAN FOR A YEAR
Where n = statistic code-2000
Examples are given below.

7 DAY LOW MEAN	2007
60 DAY LOW MEAN	2060
183 DAY LOW MEAN	2183

m DAY HIGH MEAN FOR A YEAR
Where m = statistic code-3000
Examples are given below.

7 DAY HIGH MEAN	3007
60 DAY HIGH MEAN	3060
183 DAY HIGH MEAN	3183

INSTANTANEOUS OBSERVATION (SAMPLING TIME REPORTED)
CODE = 30000 + (HOUR)
Examples are given below.

12:30 AM	30030
6:00 AM	30600
12:30 PM	31230
9:45 PM	32145

APPENDIX F

AQUIFER NAMES AND GEOLOGIC UNIT CODES

APPENDIX F. AQUIFER NAMES AND GEOLOGIC UNIT CODES

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APPENDIX F

AQUIFER NAMES AND GEOLOGIC UNIT CODES

INTRODUCTION

This appendix lists the aquifer names and geologic unit codes used by WATSTORE for the computer processing of ground-water data. These codes are based on the stratigraphic coding system proposed by the American Association of Petroleum Geologists. The stratigraphic names in this appendix are from many sources and do not necessarily follow U.S. Geological Survey usage. The names and codes presented in this appendix were collected and edited by J. R. Rollo, W. E. Price, Jr., C. B. Davidson, and C. H. Baker, Jr., of the U.S. Geological Survey.

UPDATE PROCEDURES

This appendix will be periodically revised to reflect additions, deletions, or revisions in the aquifer names or geologic unit codes. Requests for the addition of new codes, or the correction or deletion of old codes, must be made by memorandum to the Chief, Automatic Data Section, WRD, U.S. Geological Survey, 437 National Center, Reston, Virginia, 22092. Although it is necessary to include in this appendix aquifer names that are used only locally and informally, stratigraphic terminology should conform whenever possible to nomenclature approved for used in reports of the U.S. Geological Survey.

When requesting new codes, the following information must be provided.

1. State(s) in which name is used.

2. Name of unit for which code is being requested. If the unit is a member of a formation, include the formation name also.

3. Geologic age of unit; if more than one age is represented, provide a list of all ages involved.

When requesting correction of codes, the following information must be provided.

1. The listing of the code and stratigraphic name exactly as it appears in the catalog of names.

2. The correction(s) to be made.

3. Reason for the change and verification that the requested change is acceptable to any other States that may be affected.

DESCRIPTION OF CODE DERIVATION PROCEDURE

The coding instructions which follow have been adapted from the original instructions which appeared in the October 1967 AAPG Bulletin. These adaptations allow for the use of numeric characters in the mnemonic portion of the code, provide a code for rock units of unknown age, and clarify some of the instructions in the original article. No other changes have been made. These are the rules by which the WATSTORE catalog was developed and new code assignments will be made.

The codes are eight characters long and consist of three parts. The first part contains three numeric characters and identifies the Era, System, and Series of the rock unit (See Table 1). The numbers 1, 4, and 7 have been pre-empted in column three for use with the formal series terms Upper, Middle, and Lower, respectively. If a rock unit extends across more than one time unit, the youngest age is coded in the numeric data field.

The second part, or next four characters of the code, is an alphanumeric mnemonic for the name of the rock-stratigraphic unit. The mnemonic code is developed by eliminating letters from the originial term until only four remain. The order of letter elimination is listed in Table 2.

The third part of the code is a single character and denotes a qualifying term such as Upper, Middle, or Lower. Rules for coding are:

1. Prior to eliminating letters, the following should be dropped from the rock-stratigraphic name:

   A. The rank of the unit; such as group, formation, member.
   B. Any lithologic descriptors; such as sandstone, shale, limestone.
   C. Insignigicant words: such as the, on, a, an.
   D. Qualifying terms (discussed later).

2. Replace all non-alpha characters with blanks except in the case of aquifers or other rock units named by their depth of occurrence at some geographic locality; such as the "500-foot" sand of the Memphis area. In this case, the first two digits of the four-digit mnemonic field are to be used for the numeric identifier and the geographic locality is reduced to two alpha characters for the last two digits. For example:

500-foot sand of the Memphis area	05MP
2000-foot sand of the Baton Rouge area	20BR

TABLE 1. NUMERIC CODES FOR GEOLOGIC AGE IDENTIFICATION

	CODE
Unknown Age	000
Cenozoic	100
Quaternary	110
Holocene	111
Pleistocene	112
Tertiary	120
Pliocene	121
Miocene	122
Oligocene	123
Eocene	124
Paleocene	125
Mesozoic	200
Cretaceous	210
Upper	211
Gulfian	212
Lower	217
Comanchean	218
Coahuilan	219
Jurassic	220
Upper	221
Middle	224
Lower	227
Triassic	230
Upper	231
Middle	234
Lower	237
Paleozoic	300
Permian	310
Upper	311
Ochoan	312
Guadalupian	313
Lower	317
Leonardian	318
Wolfcampian	319
Pennsylvanian	320
Upper	321
Virgilian	322
Missourian	323
Middle	324
Des Moinesian	325
Atokan	326
Lower	327
Morrowan	328
Mississippian	330
Upper	331
Chesterian	332
Meramecian	333
Lower	337
Osagean	338
Kinderhookian	339
Devonian	340
Upper	341
Middle	344
Lower	347
Silurian	350
Upper	351
Cayugan	352
Middle	354
Niagaran	355
Lower	357
Alexandrian	358
Ordovician	360
Upper	361
Cincinnatian	362
Middle	364
Champlainian	365
Lower	367
Canadian	368
Cambrian	370
Upper	371
St. Croixan	372
Middle	374
Lower	377
Precambrian	400
Precambrian Z	410
Precambrian Y	420
Precambrian X	430
Precambrian W	440

TABLE 2. ORDER OF LETTER ELIMINATION

1. A	10. T	19. G
2. E	11. N	20. P
3. I	12. S	21. K
4. O	13. R	22. B
5. U	14. L	23. V
6. W	15. D	24. X
7. H	16. C	25. J
8. Y	17. M	26. Q
9. Double letters (Delete one)	18. F	27. Z

3. The first letter of each of the remaining words is not to be deleted. The only exception to this rule of "first letter remains" is in the case of qualifying terms which are coded in column 8. If the word to be coded in column 8 is Upper, Middle, or Lower, use the letters U, M, or L for the respective code. If any other word is to be coded in column 8 and the first letter is U, M, or L, use the last letter of the word which would remain after following the elimination order in Table 2, other than U, M, or L.

4. Deletion of letters proceeds from right to left in the order given in Table 2.

5. Deletion is continued until the mnemonic is reduced to four characters.

6. Only one letter of a double letter occurrence is deleted. Exceptions to this rule are:

   A. Vowels and the letters W, H, and Y are eliminated completely even though they may occur as double letters before the elimination of any other double letter combination, unless they are the first letter of the word or so doing reduces the mnemonic to less than four characters.

   B. After elimination of double letters, further letter removal is based on Table 2 without regard to whether or not the letter removed was previously part of a double letter sequence.

   C. In the rare instances where the mnemonic reduces to a first letter and two sets of double letters (as FTTRR) eliminate the first letter on the right without regard for the letter sequence shown in Table 2.

7. If the original word is smaller than four characters it is entered in the data field left justified. Do not add any characters to fill up the data field, leave unused spaces blank.

8. If duplicate codes appear some alteration of the code will be made by the Ground Water Branch. This must be done to insure system-wide uniqueness. The rule to be followed with formal names will be to retain the correct mnemonic code with the name which has priority in time. The second name will be coded retaining the first vowel. If more than two names reduce to the same mnemonic, it may be necessary to make some arbitrary code adjustment for the third and any subsequent names. These same rules will be used, where possible, with informal names.

9. Column 8 may be used for modifiers of the rock-stratigraphic unit. The code may be any computer character with the exception of those pre-empted for specific modifiers; such as; U, M, and L for upper, middle, and lower.

10. Rock names such as McGregor, St. Lawrence, and Van Allen are to be considered as two words.

CATALOG OF AQUIFER NAMES AND GEOLOGIC UNIT CODES

BY STATES AND OTHER AREAS

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR
QUATERNARY-TERTIARY SYSTEMS..... 110QRRT

HOLOCENE

ALLUVIUM..... 111ALVM
COASTAL DEPOSITS..... 111CSTL
HOLOCENE-PLEISTOCENE SERIES..... 111HCPC
HOLOCENE SERIES..... 111HLCN
LOW TERRACE DEPOSITS,ALLUVIUM..... 111LTAV
REGOLITH..... 111RGLT
RESIDUUM-NORTH ALABAMA..... 111RSDM
SAPROLITE..... 111SPRL

PLEISTOCENE

HIGH TERRACE DEPOSITS..... 112HGTC
INTERMEDIATE TERRACE DEPOSITS..... 112IMTC
LOW TERRACE DEPOSITS..... 112LTRC
PLEISTOCENE SERIES..... 112PLSC
TERRACE DEPOSITS..... 112TRRC

TERTIARY

TERTIARY-CRETACEOUS SYSTEMS..... 120TRCC
TERTIARY SYSTEM..... 120TRTR

PLIOCENE

CITRONELLE FORMATION..... 121CRNL
PLIOCENE SERIES..... 121PLCN

MIOCENE

CATAHOULA SANDSTONE..... 122CTHL
MIOCENE-EOCENE SERIES..... 122MCEC
MIOCENE SERIES..... 122MOCN
PAYNES HAMMOCK SAND..... 122PHMK
RESIDUUM-SOUTH ALABAMA..... 122RSDM

OLIGOCENE

BUCATUNNA CLAY MEMBER OF BYRAM FORMATION..... 123BCTN
BYRAM FORMATION..... 123BYRM
CHICKASAWHAY LIMESTONE..... 123CCKS
FOREST HILL SAND..... 123FRHL
GLENDON LIMESTONE MEMBER OF BYRAM FORMATION..... 123GLND
MARIANNA LIMESTONE..... 123MRNN

OLIGOCENE SERIES..... 123OLGC
RED BLUFF CLAY..... 123RDBF
VICKSBURG GROUP..... 123VKBG

EOCENE

BELLS LANDING MARL MEMBER OF TUSCAHOMA SAND..... 124BLDG
BASHI MARL MEMBER OF HATCHETIGBEE FORMATION..... 124BSHI
CLAIBORNE GROUP..... 124CLBR
COCOA SAND MEMBER OF YAZOO CLAY..... 124COCO
EOCENE SERIES..... 124EOCN
GREGGS LANDING MARL MEMBER OF TUSCAHOMA SAND..... 124GGLG
GRAMPIAN HILLS MEMBER OF NANAFALIA FORMATION..... 124GMPH
GOSPORT SAND..... 124GSPR
GRAVEL CREEK SAND MEMBER OF NANAFALIA FORMATION..... 124GVCK
HATCHETIGBEE FORMATION..... 124HCGB
JACKSON GROUP..... 124JCKS
LISBON FORMATION..... 124LSBN
MOODYS BRANCH FORMATION..... 124MDBC
MERIDIAN SAND MEMBER OF TALLAHATTA FORMATION..... 124MRDN
NESHOBA SAND MEMBER OF TALLAHATTA FORMATION..... 124NSHB
NORTH TWISTWOOD CREEK MEMBER OF YAZOO CLAY..... 124NTCK
OCALA LIMESTONE..... 124OCAL
PACHUTA MARL MEMBER OF YAZOO CLAY..... 124PCHT
SHUBUTA MEMBER OF YAZOO CLAY..... 124SHBT
TALLAHATTA FORMATION..... 124TLLT
WILCOX GROUP..... 124WLCX
YAZOO CLAY..... 124YZOO

PALEOCENE

COAL BLUFF MARL MEMBER OF NAHEOLA FORMATION..... 125CLBF
CLAYTON FORMATION..... 125CLTN
MC BRYDE LIMESTONE MEMBER OF CLAYTON FORMATION..... 125MCBD
MIDWAY GROUP..... 125MDWY
MATTHEWS LANDING MARL MEMBER OF PORTERS CREEK CLAY..... 125MLDG
NAHEOLA FORMATION..... 125NHOL
NANAFALIA FORMATION..... 125NNFL
OAK HILL MEMBER OF NAHEOLA FORMATION..... 125OKHL
PALEOCENE SERIES..... 125PLCN
PINE BARREN MEMBER OF CLAYTON FORMATION..... 125PNBR
PORTERS CREEK FORMATION..... 125PRCK
SALT MOUNTAIN LIMESTONE..... 125SLMN
TUSCAHOMA SAND..... 125TSCM
WILCOX GROUP..... 125WLCX

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS-JURASSIC SYSTEMS..... 210CCJC
CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

ARCOLA LIMESTONE MEMBER OF MOOREVILLE CHALK	211ARCL
BLUFFTOWN FORMATION	211BLFN
BLUFFPORT MARL MEMBER	211BLFP
COKER FORMATION	211COKR
UPPER CRETACEOUS SERIES	211CRCSU
CUSSETA SAND MEMBER OF RIRLEY FORMATION	211CSST
DEMOPOLIS CHALK	211DMPL
EUTAW-MC SHAN FORMATIONS,UNDIFFERENTIATED	211EMCS
EOLINE MEMBER OF COKER FORMATION	211EOLN
EUTAW FORMATION	211EUTW
GORDO FORMATION	211GORD
MC SHAN FORMATION	211MCSN
MOOREVILLE CHALK	211MRVL
MASSIVE SAND	211MSSV
PRAIRIE BLUFF CHALK	211PBLF
PEROTE MEMBER OF PROVIDENCE SAND	211PROT
PROVIDENCE SAND	211PVDC
RIPLEY FORMATION	211RPLY
SELMA GROUP	211SELM
STRINGER SAND	211SRGR
TOMBIGBEE SAND MEMBER OF EUTAW FORMATION	211TBGB
TUSCALOOSA GROUP	211TSCL
TUSCALOOSA GROUP,LOWER	211TSCLL
TUSCALOOSA GROUP,MIDDLE	211TSCLM
TUSCALOOSA GROUP,UPPER	211TSCLU

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES	217CRCSL
VICK FORMATION	217VICK

JURASSIC

JURASSIC-TRIASSIC SYSTEMS	220JCTC
JURASSIC SYSTEM	220JRSC

TRIASSIC

TRIASSIC-PERMIAN SYSTEMS	230TCPM
TRIASSIC SYSTEM	230TRSC

PALEOZOIC

PALEOZOIC ERATHEM	300PLZC

PERMIAN

PERMIAN-PENNSYLVANIAN SYSTEMS	310PMPV
PERMIAN SYSTEM	310PRMN

PENNSYLVANIAN

PARKWOOD FORMATION	320PRKD
PENNSYLVANIAN SYSTEM	320PSLV

PENNSYLVANIAN-MISSISSIPPIAN SYSTEMS..... 320PVMP

MIDDLE PENNSYLVANIAN

MIDDLE-LOWER PENNSYLVANIAN SERIES..... 324PSLVL
POTTSVILLE FORMATION..... 324PSVL

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

BANGOR LIMESTONE..... 331BNGR
FLOYD SHALE..... 331FLYD
HARTSELLE SANDSTONE..... 331HRSL
MONTEAGLE LIMESTONE..... 331MNGL
MISSISSIPPIAN, UPPER..... 331MSSPU
PENNINGTON FORMATION..... 331PNNG
PRIDE MOUNTAIN FORMATION..... 331PRDM
TUSCUMBIA LIMESTONE..... 331TCMB

LOWER MISSISSIPPIAN

FORT PAYNE CHERT..... 337FRPN
MISSISSIPPIAN-DEVONIAN SYSTEM..... 337MPDV
MISSISSIPPIAN, LOWER..... 337MSSPL
MAURY FORMATION..... 337MURY

DEVONIAN

DEVONIAN SYSTEM..... 340DVNM

UPPER DEVONIAN

CHATTANOOGA SHALE..... 341CTNG
DEVONIAN, UPPER..... 341DVNNU

MIDDLE DEVONIAN

DEVONIAN, MIDDLE..... 344DVNNM
DEVONIAN-SILURIAN SYSTEMS..... 344DVSL
FROG MOUNTAIN SANDSTONE..... 344FRGM

SILURIAN

RED MOUNTAIN FORMATION..... 350RDMN
SILURIAN SYSTEM..... 350SLRN

MIDDLE SILURIAN

WAYNE GROUP..... 354WYNE

LOWER SILURIAN

BRASSFIELD LIMESTONE..... 357BFLD

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

FERNVALE LIMESTONE..... 361FRVL
INMAN FORMATION..... 361INMN
LEIPERS LIMESTONE..... 361LPRS
MANNIE SHALE..... 361MNNI
ORDOVICIAN, UPPER..... 3610DVCU
SEQUATCHIE FORMATION..... 361SQTC

MIDDLE ORDOVICIAN

ATHENS SHALE..... 364ATNS
ATTALLA CHERT CONGLOMERATE MEMBER OF CHICKAMAUGA LIMESTONE..... 364ATTL
BIGBY AND CANNON LIMESTONES..... 364BGBC
CHICKAMAUGA LIMESTONE..... 364CKMG
COLVIN MOUNTAIN SANDSTONE..... 364CLVM
CARTERS LIMESTONE..... 364CRRS
CATHEYS LIMESTONE..... 364CTYS
GREENSPORT FORMATION..... 364GEPR
HERMITAGE FORMATION..... 364HRMG
LITTLE OAK LIMESTONE..... 364LLOK
LENOIR LIMESTONE..... 364LNOR
NASHVILLE GROUP..... 364NSVL
ORDOVICIAN, MIDDLE..... 3640DVCM
STONES RIVER GROUP..... 364SRVR

LOWER ORDOVICIAN

CHEPULTEPEC DOLOMITE..... 367CPPC
KNOX GROUP..... 367KNOX
LONGVIEW LIMESTONE..... 367LNGV
NEWALA LIMESTONE..... 367NEWL
ORDOVICIAN, LOWER..... 3670DVCL
ODENVILLE LIMESTONE..... 3670DVL
ORDOVICIAN-CAMBRIAN SYSTEMS..... 367OVCB

CAMBRIAN

CAMBRIAN SYSTEM-PRECAMBRIAN ERATHEM..... 370CBPB
CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

BIBB DOLOMITE..... 371BIBB
UPPER-MIDDLE CAMBRIAN SERIES..... 371CMBRD
CAMBRIAN, UPPER..... 371CMBRU
CONASAUGA FORMATION..... 371CNSG
COPPER RIDGE DOLOMITE..... 371CPRG
KNOX GROUP..... 371KNOX

MIDDLE CAMBRIAN

BRIERFIELD DOLOMITE	374BFLD
CAMBRIAN, MIDDLE	374CMBRM
CONASAUGA FORMATION	374CNSG
KETONA DOLOMITE	374KTON

LOWER CAMBRIAN

LOWER CAMBRIAN SERIES	377CMBRL
ROME FORMATION	377ROME
SHADY DOLOMITE	377SHDY
WEISNER QUARTZITE	377WSNR

PRECAMBRIAN

PRECAMBRIAN ERATHEM	400PCMB

UNKNOWN

MOUNT CRILLON GABBRO..... 000MCRL
ST ELIAS SCHIST..... 000SELS
UNION BAY ULTRAMAFIC COMPLEX..... 000UNNB

CENOZOIC

ILYIRAK GRAVEL..... 100ILRK
NELLIE JUAN GRANITE..... 100NLJN
SALIGVIK GRAVEL..... 100SGVK
WILLIWAW COVE FORMATION..... 100WLCV

QUATERNARY

ARCH POINT BASALT..... 110ARCP
ASHISHIK BASALT..... 110ASSK
BLACK POINT BASALT..... 110BCKP
BULDIR VOLCANICS..... 110BLDR
BARROW UNIT,GUBIK FORMATION..... 110BRRW
BISHOP POINT VOLCANIC MUDFLOW..... 110BSPP
CHARIOT GRAVEL..... 110CHRT
CRATER CREEK BASALT..... 110CRCK
DUSHKIN BASALT..... 110DSKN
EIDER POINT BASALT..... 110EDRP
EDGECUMBE VOLCANICS..... 110EGMB
KANATON BASALTS..... 110KNTN
LITTLE SITKIN DACITE..... 110LLSK
LITTLE PAVLOF AGGLOMERATE..... 110LPVF
MEAD RIVER UNIT OF GUBIK FORMATION..... 110MDRV
MOUNT EDGECUMBE ASH BED OF FOREST CREEK FORMATION..... 110MEGB
MOUNT EMMONS VOLCANICS..... 110MEMS
MOUNT GRIGGS VOLCANICS..... 110MGRG
MOUNT HAGUE VOLCANICS..... 110MNHG
NEW JERSEY CREEK LAVA..... 110NJCK
POCHNOI VOLCANICS..... 110PCHN
PRATT POINT DACITE MEMBER,LITTLE SITKIN DACITE..... 110PRPN
PATTERSON POINT FORMATION..... 110PRSP
PAVLOF SISTERS VOLCANICS..... 110PVFS
PAVLOF VOLCANICS..... 110PVLF
READY BULLION FORMATION..... 110RDBL
ROUND HEAD BASALTS..... 110RDHD
SUGARLOAF LAVA FLOWS..... 110SGLF
SKULL CLIFF UNIT,GUBIK FORMATION..... 110SKCF
SITKIN POINT FORMATION..... 110SKNP
TLEVAK BASALT..... 110TLVK
VOLCANO BAY BASALT FLOW OF MOUNT HAGUE VOLCANICS..... 110VLCB
WRANGELL LAVA..... 110WRGL
WEST COVE MEMBER,LITTLE SITKIN DACITE..... 110WSCV

HOLOCENE

ADAMS FORMATION..... 111ADMS
BERG FORMATION..... 111BERG

BLACK RAPIDS DRIFT..... 111BKRP
CHENA ALLUVIUM..... 111CHEN
CLEAR CREEK DRIFT..... 111CLCK
CIRQUE DRIFT..... 111CRQU
DOUBLE POINT DACITE..... 111DBLP
ENGINEER LOESS..... 111ENGR
FAN MOUNTAIN DRIFT..... 111FNMN
FAIRBANKS LOESS..... 111FRBK
FOREST CREEK FORMATION..... 111FRCK
FOX HILL FLOW..... 111FXHL
GLACIER BAY TILL..... 111GLCB
JARVIS ASH BED OF ENGINEER LOESS..... 111JRVS
KATMAI RIVER TUFF FLOW..... 111KMRV
LOST JIM LAVA FLOW..... 111LSJM
MOUNT TRIDENT ANDESITE..... 111MTRD
MUIR TILL..... 111MUIR
OKMOK VOLCANICS..... 111OKMK
SEAL RIVER FORMATION..... 111SLRV
TUNNEL DRIFT..... 111TNNL
TUSTUMENA DRIFT..... 111TSMN
WILBUR ASH BED OF ENGINEER LOESS..... 111WLBR
WHITE RIVER ASH BED OF ENGINEER LOESS..... 111WRVR

PLEISTOCENE

ADAGDAK VOLCANICS..... 112ADGK
ANAYAKNAURAK DRIFT..... 112AKRK
ANAKTUVUK RIVER DRIFT..... 112AKVK
ALAPAH MOUNTAIN DRIFT..... 112ALPM
ANTLER VALLEY DRIFT..... 112ALVL
ANVIL FORMATION..... 112ANAL
ANDREW VOLCANICS..... 112ANDR
ANUK SAND..... 112ANUK
ANIVAK LAKE DRIFT..... 112AVKL
BANDED MOUNTAIN DRIFT..... 112BDDM
BOOTLEGGER COVE CLAY..... 112BGCV
BROOKS LAKE DRIFT..... 112BKLK
BRISTOL BAY GRAVEL..... 112BRLB
BERING FORMATION..... 112BRNG
BROWNE DRIFT..... 112BRWN
CARIBOU HILLS DRIFT..... 112CBHL
CHAGVAN DRIFT..... 112CGVN
COOK INLET GRAVEL..... 112CKIL
CLARA CREEK DRIFT..... 112CLCK
CHAMBERLIN DRIFT..... 112CMBL
CAMILLE LAVA FLOW..... 112CMLL
COPPER RIVER GRAVEL..... 112CPRV
CARLO TILL..... 112CRLO
CRIPPLE GRAVEL..... 112CRPL
CRATER CREEK BASALT..... 112CRTR
CHATANIKA ASH BED OF GOLDSTREAM FORMATION..... 112CTNK
DELTA DRIFT..... 112DELT
DRIFTWOOD BAY LAVAS..... 112DFDB
DARLING CREEK DRIFT..... 112DGCK
DENALI DRIFT..... 112DNLI
DONNELLY DRIFT..... 112DNLL

DOME ASH BED OF GOLD HILL LOESS..... 112DONE
DRY CREEK DRIFT..... 112DRCK
DAWSON CUT FORMATION..... 112DSNC
EIGHT LAKE DRIFT..... 112EGLK
EKLUTNA DRIFT..... 112EKLN
ESTER ASH BED OF GOLD HILL LOESS..... 112ESTR
EVA FORMATION..... 112EVA
FLUORITE CREEK GRAVEL..... 112FLCK
FLAXMAN FORMATION..... 112FLXM
FANETO FORMATION..... 112FNTO
FOX GRAVEL..... 112FOX
FAREWELL DRIFT..... 112FRLL
FROSTY PEAK VOLCANICS..... 112FRPK
GOLD HILL LOESS..... 112GLDH
GOLDSTREAM FORMATION..... 112GLDM
GRANITE CANYON TILL..... 112GRNC
GOSLING VOLCANICS..... 112GSLG
GUBIK FORMATION..... 112GUBK
HEALY DRIFT..... 112HELY
HUME RIVER DRIFT..... 112HMRV
ITKILLIK DRIFT..... 112IKLK
IMURUK VOLCANICS..... 112IMRK
IRON CREEK DRIFT..... 112IRCK
JOHNSTON HILL DRIFT..... 112JSHL
KOBUK DRIFT..... 112KBUK
KEMUK DRIFT..... 112KMUK
KNIK DRIFT..... 112KNIK
KANEKTUK GRAVELS..... 112KNKK
KOWAK CLAY..... 112KOWK
MASSACRE BAY FORMATION..... 112MCRB
MAK HILL DRIFT..... 112MKHL
MAKUSHIN VOLCANICS..... 112MKSN
MORZHOVOI VOLCANICS..... 112MRZV
NUME RIVER DRIFT..... 112NMRV
NUNIVAK FLOWS..... 112NNVK
NAPTOWNE DRIFT..... 112NPTN
PETERS DRIFT..... 112PTRS
RILEY CREEK DRIFT..... 112RLCK
SCHRADER DRIFT..... 112SCRD
SLOW FORK DRIFT..... 112SLFK
SELATNA DRIFT..... 112SLTN
SALMON LAKE DRIFT..... 112SMLK
SIRUK CREEK DRIFT..... 112SRUK
SAGAVANIRKTOK RIVER DRIFT..... 112SVKK
TANANA FORMATION..... 112TANN
TOGIAK GRAVELS..... 112TOGK
UNALUK DRIFT..... 112UNLK
VAN HORN FORMATION..... 112VNHR
WELLER DRIFT..... 112WLLR
YAKATAGA FORMATION..... 112YKTG

TERTIARY

ANDREW BAY VOLCANICS..... 120ADRB
AGATTU BEDS..... 120AGTT
AMCHITKA FORMATION..... 120AMCK

ATTU FORMATION..... 120ATTU
BELKOFSKI TUFF..... 120BKFK
BELUGA FORMATION..... 120BLUG
BEAVERHEAD VALLEY VOLCANICS..... 120BVDV
CHICKALOON FORMATION..... 120CCKL
CATHEDRAL VALLEY AGGLOMERATE..... 120CDLV
CHAPIN BED..... 120CHPN
CHULTNA MEMBER OF TYONEK FORMATION..... 120CHTN
CHITKA POINT FORMATION..... 120CKPN
CHUNIKSAK FORMATION..... 120CKSK
COOPER BED OF KENAI FORMATION..... 120COPR
CHIRIKOF FORMATION..... 120CRKF
CURTIS SEAM OF KENAI FORMATION..... 120CRTS
DUKE ISLAND ULTRAMAFIC COMPLEX..... 120DKID
FINGER BAY VOLCANICS..... 120FGRB
FREDERIKA FORMATION..... 120FRDK
FAIRPLAY SYENITE..... 120FRPL
GAKONA FORMATION..... 120GKON
GETMUNA RHYOLITE GROUP..... 120GTMN
HOLOKUK BASALT..... 120HLKK
HEMLOCK FORMATION..... 120HMCK
HAYES RIVER BEDS..... 120HRVR
JONESVILLE COAL GROUP,CHICKALOON FORMATION..... 120JSVL
KENAI FORMATION..... 120KENI
KUGRUK VOLCANICS..... 120KGRK
KISKA HARBOR FORMATION..... 120KKHB
KIRILOF POINT UNIT,AMCHITKA FORMATION..... 120KLFP
KRUGLOI FORMATION..... 120KRGL
MIDDLE GROUND SHOAL MEMBER,TYONEK FORMATION..... 120MDGS
NUSHAGAK FORMATION..... 120NSGK
NUWOK FORMATION..... 120NUWK
NEVIDISKOV FORMATION..... 120NVKV
ORCA GROUP..... 120ORCA
PALISADES CONGLOMERATE..... 120PLSD
RAT FORMATION..... 120RAT
SAND BAY VOLCANICS..... 120SNDB
STERLING FORMATION..... 120SRLG
SAGAVANIRKTOK FORMATION..... 120SVKK
TWELVEMILE BEDS..... 120TLVM
TOK SANDSTONE..... 120TOK
TOPSY FORMATION..... 120TPSY
TYONEK FORMATION..... 120TYNK
VEGA BAY FORMATION..... 120VGBY
WEST FORELAND FORMATION..... 120WFLD
ZETO POINT BASALT PORPHYRY..... 120ZRPN

PLIOCENE

ALBERT RIM LAVAS..... 121ABRM
NENANA GRAVEL..... 121NENN
NELROY FORMATION..... 121NLRY
TACHILNI FORMATION..... 121TCLN
TUGIDAK FORMATION..... 121TGDK
WATERBOOT BASALT..... 121WTRB

MIOCENE

BEAVER PLUTON..... 122BEVR
BELKOFSKI TUFF..... 122BKFK
BEAR LAKE FORMATION..... 122BRLK
CENOTAPH VOLCANICS..... 122CNTP
CAPTAINS PLUTON..... 122CPNS
GRUBSTAKE FORMATION..... 122GRBK
HEALY CREEK FORMATION..... 122HLCK
KATALLA FORMATION..... 122KTLL
KOOTZNAHOO FORMATION..... 122KTZN
LIGNITE CREEK FORMATION..... 122LGCK
MESHIK FORMATION..... 122MSHK
NARROW CAPE FORMATION..... 122NRCP
PUFFY MEMBER,KATALLA FORMATION..... 122PFFY
POUL CREEK FORMATION..... 122PLCK
SHALER PLUTON..... 122SHLR
SHEMYA INTRUSIVE COMPLEX..... 122SHMY
SANCTUARY FORMATION..... 122SNCR
SUNTRANA FORMATION..... 122SNRN
UNALASKA FORMATION..... 122ULSK
UNGA CONGLOMERATE MEMBER,BEAR LAKE FORMATION..... 122UNGA

OLIGOCENE

ADMIRALTY ISLAND VOLCANICS..... 123ADMI
BASIN CREEK MEMBER,KATALLA FORMATION..... 123BCRK
BURLS CREEK SHALE MEMBER OF KATALLA FORMATION..... 123BLCK
BANJO POINT FORMATION..... 123BNJP
BEAVER BAY GROUP..... 123BVRB
GUNNERS COVE FORMATION..... 123GRCV
KULTHIETH FORMATION..... 123KLTT
KUSHTAKA FORMATION..... 123KSTK
POINT HEY MEMBER,KATALLA FORMATION..... 123PNTH
REDWOOD FORMATION..... 123RDWD
SITKALIDAK FORMATION..... 123SKDK
SITKINAK FORMATION..... 123SKNK
SPLIT CREEK SANDSTONE MEMBER,KATALLA FORMATION..... 123SPCK
STEPOVAK FORMATION OF BEAVER BAY GROUP..... 123SPVK
TOKUN FORMATION..... 123TKUM
TSADAKA FORMATION..... 123TSDK

EOCENE

ANDREW LAKE FORMATION..... 124ADRL
BOUNDARY GRANODIORITE..... 124BNDR
GHOST ROCKS FORMATION..... 124GRCK
HYDER QUARTZ MONZONITE..... 124HYDR
PREMIER COAL GROUP,CHICKALOON FORMATION..... 124PRMR
SHAW COAL BED,CHICKALOON FORMATION..... 124SHAW
STILLWATER FORMATION..... 124STLR
TOLSTOI FORMATION OF BEAVER BAY GROUP..... 124TLST
WISHBONE FORMATION..... 124WSBN

PALEOCENE

CANTWELL FORMATION..... 125CNTL
DAVID COAL BED OF CHICKALOON FORMATION..... 125DVID
EMERY COAL BED OF CHICKALOON FORMATION..... 125EMRY
LITTLE ESKA COAL OF CHICKALOON FORMATION..... 125LLEK
MAITLAND COAL BED OF CHICKALOON FORMATION..... 125MLND
MARTIN COAL BED OF CHICKALOON FORMATION..... 125MRTN

MESOZOIC

AMERICAN CREEK GRANITE..... 200AMCK
APEX VEIN..... 200APEX
ASSES EARS GRANITE..... 200ASER
BOULDER CREEK QUARTZ MONZONITE..... 200BDCK
CEDAR BAY GRANITE..... 200CDRB
COPPER MOUNTAIN AMPHIBOLIT SCHIST..... 200CPRM
ESHAMY GRANITE..... 200ESMY
GAKONA DIORITE..... 200GKON
GEMUK GROUP..... 200GMUK
JUDD HARBOR DUNITE-PERIDOTITE..... 200JDHB
LANDSLIDE CREEK GRANODIORITE..... 200LDCK
MONTE CHRISTO DIORITE..... 200MCRS
MIDDLE FORK GRANITE..... 200MDFK
SLATE CREEK GRANODIORITE..... 200SLCK
WEST FORK GRANODIORITE..... 200WFRK

CRETACEOUS

BRINE CREEK FORMATION..... 210BRCK
BROTHERS VOLCANICS..... 210BRTR
GYPSUM CREEK QUARTZ MONZONITE..... 210GPCK
HALL COVE PERIDOTITE..... 210HLCV
HAZLETON GROUP..... 210HZLN
JUALIN DIORITE..... 210JULN
KUSKOKWIM GROUP..... 210KKKM
KLEIN CREEK BATHOLITH..... 210KLCK
KLUKWAN MAGNETITE PYROXENITE..... 210KLKN
KALTAG FORMATION..... 210KLTG
KANE PEAK ULTRAMAFIC COMPLEX..... 210KNPK
KODIAK FORMATION..... 210KODK
MC HUGH COMPLEX..... 210MCHG
MOONSHINE CREEK FORMATION..... 210MCRK
MELOZI FORMATION..... 210MLOZ
NULATO FORMATION..... 210NULT
NATZOTIN MOUNTAIN SERIES..... 210NZNM
OKPILAK GRANITE..... 210OKPK
ROMANZOF GRANITE..... 210RMZF
VALDEZ GROUP..... 210VLDZ

UPPER CRETACEOUS

ARKOSE RIDGE FORMATION..... 211AKRG
AYIYAK MEMBER,SEABEE FORMATION..... 211AYYK
BARROW TRAIL MEMBER,SCHRADER BLUFF FORMATION..... 211BRTL
CHANDLER FORMATION..... 211CDLR

CHIGNIK FORMATION..... 211CGNK
COAL VALLEY MEMBER,CHIGNIK FORMATION..... 211CLVL
CORWIN FORMATION..... 211CRWN
HOODOO FORMATION..... 211HOOD
IDITAROD BASALT..... 211IDRD
KUGOSUKRUK TONGUE,PRINCE CREEK FORMATION..... 211KGKK
KAGUYAK FORMATION..... 211KGYK
KUSKOKWIM GROUP..... 211KKKM
MAC COLL RIDGE FORMATION..... 211MCRG
NIAKOGON TONGUE,CHANDLER FORMATION..... 211NKGN
NINULUK FORMATION..... 211NNLK
NANUSHUK GROUP..... 211NNSK
PRINCE CREEK FORMATION..... 211PCCK
ROGERS CREEK MEMBER OF SCHRADER BLUFF FM..... 211RGCK
SCHRADER BLUFF FORMATION..... 211SCBF
SCHULZE FORMATION..... 211SCLZ
SEABEE FORMATION..... 211SEBE
SENTINEL HILL MEMBER SCHRADER BLUFF FORMATION..... 211SLHL
SHALE WALL MEMBER,SEABEE FORMATION..... 211SLWL
SHUMAGIN FORMATION..... 211SMGN
TULUVAK TONGUE,PRINCE CREEK FORMATION..... 211TLVK
UNGALIK CONGLOMERATE..... 211UGLK

LOWER CRETACEOUS

BIEDERMAN ARGILLITE..... 217BDRM
BLASHKE ISLANDS ULTRAMAFIC COMPLEX..... 217BKID
BONANZA CREEK VOLCANICS..... 217BZCK
CHITITU FORMATION..... 217CHTT
DOUGLAS ISLAND VOLCANICS..... 217DGID
FORTRESS MOUNTAIN FORMATION..... 217FRRM
GLENN SHALE..... 217GLNN
GRANDSTAND FORMATION..... 217GROD
HERENDEEN LIMESTONE..... 217HRND
IPEVIK FORMATION..... 217IPVK
KASAAN GREENSTONE..... 217KASN
KEENAN QUARTZITE..... 217KENN
KUKPOWRUK FORMATION..... 217KKPK
KUPARUK RIVER SANDSTONE..... 217KKRV
KILLIK TONGUE OF CHANDLER FORMATION..... 217KLLK
KEMIK SANDSTONE MEMBER,OKPIKRUAK FORMATION..... 217KMIK
KISIMILOK FORMATION..... 217KMLK
KENNICOTT FORMATION..... 217KNCT
KANDIK FORMATION..... 217KNDK
KATHUL GRAYWACKE..... 217KTHL
KOYUKUK GROUP..... 217KYKK
NELCHINA LIMESTONE..... 217NLCN
OGOTORUK FORMATION..... 217OGRK
OKPIKRUAK FORMATION..... 217OKKK
OUMALIK FORMATION..... 217OMLK
SITKA GRAYWACKE..... 217SITK
STANIUKOVICH FORMATION..... 217SKVC
SHELTER FORMATION..... 217SLTR
SEYMOUR CANAL FORMATION..... 217SMCL
STEPHENS PASSAGE GROUP..... 217SPPG
TINGMERKPUK FORMATION..... 217TKPK

TELAVIRAK FORMATION..... 217TLVK
TOROK FORMATION..... 217TORK
TOPAGORUK FORMATION..... 217TPGK
TREADWELL FORMATION..... 217TRDL
TUKTU FORMATION..... 217TUKT
YAKUTAT GROUP..... 217YKTK

JURASSIC

BITTER CREEK FORMATION..... 220BCRK
KHAZ FORMATION OF KELP BAY GROUP..... 220KHAZ
KELP BAY GROUP..... 220KLPB
KINGAK SHALE..... 220KNGK
KOTSINA CONGLOMERATE..... 220KTSN
OUTLET RIDGE ULTRAMAFIC GABBRO COMPLEX..... 220ORDG
TEXAS CREEK GRANODIORITE..... 220TXCK
VETA FORMATION..... 220VETA

UPPER JURASSIC

CHISIK CONGLOMERATE MEMBER OF NAKNEK FORMATION..... 221CHSK
CHINITNA FORMATION..... 221CNTN
GRAVINA ISLAND FORMATION..... 221GVID
NAKNEK LAKE GRANITE..... 221NKKL
NAKNEK FORMATION..... 221NKNK
NIZINA MOUNTAIN FORMATION..... 221NZNM
POMEROY ARKOSE MEMBER,NAKNEK FORMATION..... 221PMRY
PAVELOFF SILTSTONE MEMBER,CHINITA FORMATION..... 221PVLF
ROOT GLACIER FORMATION..... 221RGLC
SNUG HARBOR SILTSTONE MEMBER,NAKNEK FORMATION..... 221SGHB
SHELIKOF FORMATION..... 221SLKF
TONNIE SILTSTONE MEMBER,CHINITNA FORMATION..... 221TONN

MIDDLE JURASSIC

ALEUTS MEMBER OF KIALAGVIK FORMATION..... 224ALTS
BLANKENSHIP FORMATION..... 224BLKP
BOWSER FORMATION OF TUXEDNI GROUP..... 224BWSR
CYNTHIA FALLS SANDSTONE OF TUXEDNI GROUP..... 224CNFL
FITZ CREEK SILTSTONE OF TUXEDNI GROUP..... 224FZCK
GAIKEMA SANDSTONE..... 224GIKM
HAZELTON GROUP..... 224HZLN
KIALAGVIK FORMATION..... 224KGVK
KOLOSH MEMBER,KIALAGVIK FORMATION..... 224KLSH
RED GLACIER FORMATION OF TUXEDNI GROUP..... 224RDGC
TWIST CREEK SILTSTONE OF TUXEDNI GROUP..... 224TCRK
THANE VOLCANIC GROUP..... 224THNE
TWIST CREEK SILTSTONE..... 224TRCK
TORDRILLO FORMATION..... 224TRDL
TUXEDNI GROUP..... 224TXDN

LOWER JURASSIC

BIDARKA FORMATION..... 227BDRK
BOKAN MOUNTAIN GRANITE..... 227BKNM
HORN MOUNTAIN TUFF MEMBER,TALKEETNA FORMATION..... 227HRNM

LUBBE CREEK FORMATION..... 227LBCK
MC CARTHY FORMATION..... 227MCCR
MARSH CREEK BRECCIA MEMBER,TALKEETNA FORMATION..... 227MRCK
PORTAGE CREEK AGGLOMERATE MEMBER,TALKEETNA FORMATION..... 227PGCK
SAG RIVER SANDSTONE OF PRUDHOE BAY GROUP..... 227SGRV
SKWENTNA GROUP..... 227SKNN
TALKEETNA FORMATION..... 227TKLN

TRIASSIC

AMPHITHEATRE BASALT..... 230AMPR
BARLOW COVE FORMATION..... 230BLCV
GOON DIP GREENSTONE..... 230GNDP
GASTINEAU VOLCANIC GROUP..... 230GSTN
JACK LIMESTONE..... 230JACK
PINNACLE PEAK PHYLLITE..... 230PCPK
PERSEVERANCE SLATE..... 230PRVC
SHUBLIK FORMATION..... 230SBLK
TAYLOR MOUNTAIN GRANODIORITE..... 230TLRM
UYAK FORMATION..... 230UYAK
WATERFALL GREENSTONE..... 230WRFL
WHITESTRIPE MARBLE..... 230WSRP

UPPER TRIASSIC

BURNT ISLAND CONGLOMERATE..... 231BILD
CHAPIN PEAK FORMATION..... 231CPPK
CORNWALLIS LIMESTONE..... 231CRLS
CHITISTONE LIMESTONE..... 231CTSN
HOUND ISLAND VOLCANICS..... 231HDID
HAMILTON ISLAND LIMESTONE..... 231HMID
HYD GROUP..... 231HYD
KEKU VOLCANICS..... 231KEKU
KAMISHAK FORMATION..... 231KMSK
KAREN CREEK SANDSTONE..... 231KRCK
KUSKULANA FORMATION..... 231KSKL
NABESNA LIMESTONE..... 231NBSN
NEHENTA FORMATION..... 231NHNT
NIZINA LIMESTONE..... 231NIZN
NIKOLAI GREENSTONE..... 231NKOL

LOWER TRIASSIC

IVISHAK MEMBER,SADLEROCHIT FORMATION..... 237IVSK
SADLEROCHIT FORMATION..... 237SDLC

PALEOZOIC

CACHE MOUNTAIN QUARTZ MONZONITE..... 300CCMN
CASADEPAGA SCHIST..... 300CDPG
CHISNA FORMATION..... 300CHSN
CLARK PEAK SCHIST..... 300CLPK
ESTHER GRANITE..... 300ESTR
KATAKTURUK DOLOMITE..... 300KKRK
KLUTINA GROUP..... 300KLTN
KANUTI GROUP..... 300KNUT

KEEVY PEAK FORMATION..... 300KVPK
NIKOKA GROUP..... 300NKOK
NERUOKPUK FORMATION..... 300NKPK
PUPPETS FORMATION..... 300PPTS
SHEEP BAY GRANITE..... 300SPBY
WALES GROUP..... 300WLES
WILLIAM HENRY BAY MARBLE..... 300WMHB

PERMIAN

CIRCLE VOLCANICS..... 310CRCL
ECHOOKA MEMBER,SADLEROCHIT FORMATION..... 310ECHK
HASEN CREEK FORMATION..... 310HCRK
MANKOMEN FORMATION..... 310MNKM
NUKA FORMATION..... 310NUKA
NOUKEEN FORMATION..... 310NUKN
PYBUS FORMATION..... 310PYBS
STATION CREEK FORMATION..... 310SCRK
SIKSIKPUK FORMATION..... 310SKKK
SKOLAI GROUP..... 310SKOL
STEP CONGLOMERATE..... 310STEP
TAHKANDIT LIMESTONE..... 310TKND

LOWER PERMIAN

CANNERY FORMATION..... 317CNNR
GULKANA GLACIER FORMATION..... 317GKGC
GOLDEN HORN LIMESTONE LENTIL,HASEN CREEK FORMATION..... 317GLDH
HALLECK FORMATION..... 317HLCK

PENNSYLVANIAN

ALAPAH LIMESTONE OF LISBURNE GROUP..... 320ALPH
KOGRUK FORMATION OF LISBURNE GROUP..... 320KGRK
LISBURNE GROUP..... 320LSBR
NASORAK FORMATION OF LISBURNE GROUP..... 320NSRK
RAINY CREEK BASALT..... 320RCRK
RAMPART GROUP..... 320RMPR
RAINBOW MOUNTAIN SEQUENCE..... 320RNBM
SAGINAW BAY FORMATION..... 320SGNB
TETELNA VOLCANICS..... 320TTLN
TUPIK FORMATION OF LISBURNE GROUP..... 320TUPK
WACHSMUTH LIMESTONE OF LISBURNE GROUP..... 320WCSM
WAHOO LIMESTONE OF LISBURNE GROUP..... 320WHOO

MIDDLE PENNSYLVANIAN

LADRONES LIMESTONE..... 324LDRS

LOWER PENNSYLVANIAN

KLAWAK FORMATION..... 327KLWK

MISSISSIPPIAN

CALICO BLUFF FORMATION OF ENDICOTT GROUP..... 330CCBF

CHUTE CREEK MEMBER OF TOTATLANIKA SCHIST..... 330CCRK
CALIFORNIA CREEK MEMBER,TOTATLANIKA SCHIST..... 330CFCK
ECHO MOUNTAIN FORMATION..... 330ECMN
ENDICOTT GROUP..... 330ENDC
FORD LAKE SHALE..... 330FDLK
HUNT FORK SHALE OF ENDICOTT GROUP..... 330HFRK
ITKILYARIAK FORMATION..... 330IKLK
IVIAGIK FORMATION..... 330IVGK
IYOUKEEN FORMATION..... 330IYKN
KEKIKTUK CONGLOMERATE..... 330KKKK
KANAYUT CONGLOMERATE OF ENDICOTT GROUP..... 330KNYT
LIVENGOOD CHERT..... 330LVGD
MC CALLUM CREEK SEQUENCE..... 330MCCK
MOOSE CREEK MEMBER,TOTATLANIKA SCHIST..... 330MCRK
SHEEP CREEK MEMBER,TOTATLANIKA SCHIST..... 330SPCK
STRELNA FORMATION..... 330SRLN
TOTATLANIKA SCHIST..... 330TLNK
WELLESLEY FORMATION..... 330WLSL

UPPER MISSISSIPPIAN

KAYAK SHALE OF ENDICOTT GROUP..... 331KAYK
PERATROVICH FORMATION..... 331PRVC

LOWER MISSISSIPPIAN

CAPE THOMPSON MEMBER OF NASORAK FORMATION..... 337CPTP
KAPALOAK FORMATION..... 337KPLK
NOATAK SANDSTONE..... 337NOTK
UTUKOK FORMATION..... 337UTKK

DEVONIAN

BAIRD GROUP..... 340BIRD
CEDAR COVE FORMATION..... 340CDCV
CLEARY CREEK SERPENTINITE..... 340CLCK
ELI LIMESTONE OF BAIRD GROUP..... 340ELI
FRESHWATER BAY FORMATION..... 340FRRB
GAMBIER BAY FORMATION..... 340GMBR
HOLITNA GROUP..... 340HLTN
KENNEL CREEK LIMESTONE..... 340KLCK
MC CANN HILL CHERT..... 340MCCH
MIKADO PHYLLITE..... 340MKDO
RETREAT GROUP..... 340RTRT
ST JOSEPH ISLAND VOLCANICS..... 340SJPI
SKAJIT LIMESTONE..... 340SKJT
TIGARAHA SCHIST..... 340TGRH
TOLOVANA LIMESTONE..... 340TLVN
TONZONA GROUP..... 340TNZN
WOODCHOPPER VOLCANICS..... 340WDCP

UPPER DEVONIAN

HOOD BAY FORMATION..... 341HDBY
KUGURUROK FORMATION..... 341KGRK
NATIONAL RIVER FORMATION..... 341NRVR

PORT REFUGIO FORMATION..... 341PRFG
STUVER MEMBER,KANAYUT CONGLOMERATE..... 341STVR
WADELEIGH LIMESTONE..... 341WDLG

MIDDLE DEVONIAN

AMY DOME METABASALT..... 344AMDMB
AMY DOME METADIORITE..... 344AMDMD
AMY DOME METAPERIDOTITE..... 344AMDMP
BLACK CAP LIMESTONE..... 344BLCP
CORONADOS VOLCANICS..... 344CRND
NANOOK LIMESTONE..... 344NNOK
SALMONTROUT LIMESTONE..... 344SLMR
TAKOTNA FORMATION..... 344TKTN
VALLENAR FORMATION..... 344VLNR

LOWER DEVONIAN

KARHEEN FORMATION..... 347KRHN
ROAD RIVER FORMATION..... 347RDRV

SILURIAN

ANNE HE PLUTON..... 350ANNH
TATINA GROUP..... 350TTIN

UPPER SILURIAN

BAY OF PILLARS FORMATION..... 351BPLR
HECETA LIMESTONE..... 351HECT
KUIU LIMESTONE..... 351KUIU
PYRAMID PEAK LIMESTONE..... 351PMPK
RENDU FORMATION..... 351RNDU
TIDAL FORMATION..... 351TIDL
WILLOUGHBY LIMESTONE..... 351WLGB

LOWER SILURIAN

DESCON FORMATION..... 357DSCN

ORDOVICIAN

UPPER ORDOVICIAN

JONES RIDGE LIMESTONE..... 361JRDG

LOWER ORDOVICIAN

FOSSIL CREEK VOLCANICS..... 367FLCK
HILLARD LIMESTONE..... 367HLRD

CAMBRIAN

SOLOMON SCHIST..... 370SLMN

LOWER CAMBRIAN

ADAMS ARGILLITE..... 377ADMS
FUNNEL CREEK LIMESTONE..... 377FLCK

PRECAMBRIAN

FORTYMILE GRANITE..... 400FRML
HURRAH SLATE..... 400HRRH
KIGLUAIK GROUP..... 400KGLK
NOME GROUP..... 400NOME
PUCKMUMMIE SCHIST..... 400PKMM
PELLY GNEISS..... 400PLLY
TINDIR GROUP..... 400TNDR

ARIZONA

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM

PLEISTOCENE

BASALTIC FLOWS..... 112BLCF
BASIN FILL,UPPER AND LOWER,UNDIFFERENTIATED..... 112BSFL
BASIN FILL,UPPER..... 112BSFLU
SAND AND GRAVEL,UPPER..... 112SDGVU
TERRACE (AND SURFICIAL) DEPOSITS..... 112TRRC

TERTIARY

CONSOLIDATED SEDIMENTARY ROCKS,TERTIARY AND MESOZOIC UNDIFFERENTIATED. 120CDSM
DATIL FORMATION..... 120DATL
FELSIC VOLCANIC ROCKS..... 120FCVC
INTRUSIVE ROCKS..... 120IRSV
MAFIC VOLCANIC ROCKS..... 120MFCV
MAFIC AND FELSIC VOLCANIC ROCKS..... 120MFFV
SEDIMENTARY ROCKS..... 120SDMR
VOLCANIC ROCKS..... 120VLCC

PLIOCENE

BIDAHOCHI FORMATION..... 121BDHC
BIDAHOCHI FORMATION,LOWER..... 121BDHCL
BIDAHOCHI FORMATION,MIDDLE..... 121BDHCM
BIDAHOCHI FORMATION,UPPER..... 121BDHCU
BASALTIC FLOWS..... 121BLCF
BASIN FILL,LOWER..... 121BSFLL
CHUSKA SANDSTONE..... 121CHSK
LOWER BASIN FILL AND MIOCENE SEDIMENTARY ROCKS,UNDIFFERENTIATED..... 121LBFM
MUDDY CREEK FORMATION..... 121MDCK
VERDE FORMATION..... 121VERD

MIOCENE

BASALT-ANDISITE FLOWS..... 122BLAD
SEDIMENTARY ROCKS..... 122SDMR
VOLCANIC BRECCIAS,AGGLOMERATES OR TUFFS..... 122VBAT

OLIGOCENE

FELSIC FLOWS OR WELDED TUFFS..... 123FFWT
SEDIMENTARY ROCKS..... 123KDMR
MAFIC FLOWS..... 123MFCF
VOLCANIC BRECCIAS,AGGLOMERATES OR TUFFS..... 123VBAT
VOLCANIC ROCKS..... 123VLCC

EOCENE

FELSIC VOLCANIC ROCKS..... 124FCVC
MAFIC VOLCANIC ROCKS..... 124MFCV
SEDIMENTARY ROCKS..... 124SDMR

PALEOCENE

NACIMIENTO FORMATION..... 125NCMN
OJO ALAMO SANDSTONE..... 125OJAM

MESOZOIC

FELSIC INTRUSIVE ROCKS..... 200FCIV
FELSIC VOLCANIC ROCKS..... 200FCVC
MAFIC VOLCANIC ROCKS..... 200MFCV
MAFIC INTRUSIVE ROCKS..... 200MFIV
SEDIMENTARY ROCKS..... 200SDMR
VOLCANIC ROCKS..... 200VLCC

CRETACEOUS

UPPER CRETACEOUS

ALLISON MEMBER OF MENEFEE FORMATION OF MESAVERDE GROUP..... 211ALSN
BARTLETT BARREN MEMBER OF CREVASSE CANYON FORMATION OF MESAVERDE GROUP 211BRLB
CLIFF HOUSE SANDSTONE OF MESAVERDE GROUP..... 211CLFH
CLEARY COAL MEMBER OF MENEFEE FORMATION OF MESAVERDE GROUP..... 211CLRY
CREVASSE CANYON FORMATION OF MESAVERDE GROUP..... 211CRVC
DILCO COAL MEMBER OF CREVASSE CANYON FORMATION OF MESAVERDE GROUP..... 211DLCO
DALTON SANDSTONE MEMBER CREVASSE CANYON FORMATION OF MESAVERDE GROUP.. 211DLTN
DAKOTA SANDSTONE..... 211DOKT
FRUITLAND FORMATION..... 211FRLD
FARMINGTON SANDSTONE MEMBER OF KIRTLAND SHALE..... 211FRMG
GALLUP SANDSTONE..... 211GLLP
HOSTA TONGUE OF POINT LOOKOUT SANDSTONE OF MESAVERDE GROUP..... 211HOST
JUANA LOPEZ MEMBER OF MANCOS SHALE..... 211JLPZ
KIRTLAND SHALE,UPPER..... 211KRLDU
LEWIS SHALE..... 211LWIS
MENEFEE FORMATION..... 211MENF
MULATTO TONGUE OF MANCOS SHALE..... 211MLTT
MANCOS SHALE..... 211MNCS
PICTURED CLIFFS SANDSTONE..... 211PCCF
POINT LOOKOUT SANDSTONE..... 211PNLK
PESCADO TONGUE OF MANCOS SHALE..... 211PSCD
SATAN TONGUE OF MANCOS SHALE..... 211SATN
SEDIMENTARY ROCKS, UNDIFFERENTIATED..... 211SDMR
TOREVA FORMATION..... 211TORV
WEPO FORMATION..... 211WEPO
YALE POINT SANDSTONE..... 211YLPN

LOWER CRETACEOUS

BURRO CANYON FORMATION..... 217BRCN

JURASSIC

NAVAJO SANDSTONE..... 220NVJO

UPPER JURASSIC

BLUFF SANDSTONE..... 221BLFF
BRUSHY BASIN SHALE MEMBER OF MORRISON FORMATION..... 221BRSB
CARMEL FORMATION..... 221CRML
COW SPRINGS SANDSTONE..... 221CSPG
ENTRADA SANDSTONE..... 221ENRD
ENTRADA SANDSTONE,LOWER..... 221ENRDL
ENTRADA SANDSTONE,MIDDLE..... 221ENRDM
ENTRADA SANDSTONE,UPPER..... 221ENRDU
MORRISON FORMATION..... 221MRSN
RECAPTURE SHALE MEMBER OF MORRISON FORMATION..... 221RCPR
SALT WASH SANDSTONE MEMBER OF MORRISON FORMATION..... 221SLWS
SUMMERVILLE FORMATION..... 221SMVL
TODILTO LIMESTONE..... 221TDLT
WESTWATER CANYON SANDSTONE MEMBER OF MORRISON FORMATION..... 221WSRC

TRIASSIC

HOSKINNINI MEMBER OF MOENKOPI FORMATION..... 230HSKN
MOENKOPI FORMATION..... 230MNKP

UPPER TRIASSIC

CHURCH ROCK MEMBER OF CHINLE FORMATION..... 231CCRK
CHINLE FORMATION..... 231CHNL
CORREO SANDSTONE BED OF PETRIFIED FOREST MEMBER OF CHINLE FORMATION... 231CORR
DINOSAUR CANYON SANDSTONE MEMBER OF MOENAVE FORMATION..... 231DSRC
KAYENTA FORMATION..... 231KYNT
LUKACHUKAI MEMBER OF WINGATE SANDSTONE..... 231LKCK
MONITOR BUTTE MEMBER OF CHINLE FORMATION..... 231MNRB
MOENAVE FORMATION..... 231MONV
MESA REDONDO MEMBER OF CHINLE FORMATION..... 231MRDD
OWL ROCK MEMBER OF CHINLE FORMATION..... 231ORCK
PETRIFIED FOREST MEMBER,LOWER,OF CHINLE FORMATION..... 231PFDFL
PETRIFIED FOREST MEMBER,UPPER,OF CHINLE FORMATION..... 231PFDFU
ROCK POINT MEMBER OF WINGATE SANDSTONE..... 231RCKP
SUNSELA SANDSTONE BED OF PETRIFIED FOREST MEMBER OF CHINLE FORMATION.. 231SNSL
SPRINGDALE SANDSTONE MEMBER OF MOENAVE FORMATION..... 231SPGD
SHINARUMP MEMBER OF CHINLE FORMATION..... 231SRMP
WINGATE SANDSTONE..... 231WNGT

MIDDLE TRIASSIC

HOLBROOK SANDSTONE MEMBER OF MOENKOPI FORMATION..... 234HLBK

LOWER TRIASSIC

MOQUI MEMBER OF MOENKOPI FORMATION..... 237MOQU
WUPATKI MEMBER OF MOENKOPI FORMATION..... 237WPTK

PALEOZOIC

LIMESTONE..... 300LMSN
QUARTZITE..... 300QRTZ
SANDSTONE..... 300SNDS

PERMIAN

ABO FORMATION..... 310ABO
COCONINO SANDSTONE..... 310CCNN
CEDAR MESA SANDSTONE MEMBER OF CUTLER FORMATION..... 310CDRM
CUTLER FORMATION..... 310CTLR
DE CHELLY SANDSTONE..... 310DCLL
GLORIETA SANDSTONE..... 310GLRT
HALGAITO TONGUE OF CUTLER FORMATION..... 310HLGT
HERMIT SHALE..... 310HRMT
KAIBAB LIMESTONE..... 310KIBB
MESETA BLANCA SANDSTONE MEMBER OF YESO FORMATION..... 310MBLC
NACO FORMATION..... 310NACO
ORGAN ROCK TONGUE OF CUTLER FORMATION..... 310OGRK
RICO FORMATION..... 310RICO
SUPAI FORMATION..... 310SUPI
SUPAI FORMATION,LOWER..... 310SUPIL
SUPAI FORMATION,MIDDLE..... 310SUPIM
SUPAI FORMATION,UPPER..... 310SUPIU
SAN YSIDRO MEMBER OF YESO FORMATION..... 310SYDR
TOROWEAP FORMATION..... 310TRWP
YESO FORMATION..... 310YESO

GUADALUPIAN

SAN ANDRES LIMESTONE..... 313SADR

PENNSYLVANIAN

HERMOSA FORMATION..... 320HRMS
MOLAS FORMATION..... 320MOLS

MISSISSIPPIAN

REDWALL LIMESTONE..... 330RDLL

DEVONIAN

UPPER DEVONIAN

MARTIN LIMESTONE..... 341MRTN

CAMBRIAN

MIDDLE CAMBRIAN

BRIGHT ANGEL SHALE..... 374BGAG
MUAV LIMESTONE..... 374MUAV
TAPEATS SANDSTONE..... 374TPTS

PRECAMBRIAN

GRANITIC GNEISS	400GRCG
PRECAMBRIAN GRANITE	400GRNT
SCHIST	400SCST
PRECAMBRIAN SEDIMENTARY ROCKS	400SDMR

ARKANSAS

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
QUATERNARY SYSTEM..... 110QRNR
TERRACE DEPOSITS..... 110TRRC

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN
TERRACE DEPOSITS..... 111TRRC

PLEISTOCENE

ALLUVIUM..... 112ALVM
PLEISTOCENE SERIES..... 112PLSC
TERRACE DEPOSITS..... 112TRRC

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

PLIOCENE SERIES..... 121PLCN

EOCENE

COCKFIELD FORMATION..... 124CCKF
COOK MOUNTAIN FORMATION..... 124CKMN
CLAIBORNE GROUP..... 124CLBR
CARRIZO SAND..... 124CRRZ
CANE RIVER FORMATION..... 124CRVR
EOCENE SERIES..... 124EOCN
JACKSON GROUP..... 124JCKS
REDFIELD FORMATION..... 124RDFD
SPARTA SAND..... 124SPRT
WHITE BLUFF FORMATION..... 124WBLF
WILCOX GROUP..... 124WLCX
500-FOOT SAND (MEMPHIS AQUIFER)..... 12405MP
1400-FOOT SAND (LOWER WILCOX AQUIFER)..... 12414WX

PALEOCENE

CLAYTON FORMATION..... 125CLTN
MIDWAY GROUP..... 125MDWY
PALEOCENE SERIES..... 125PLCN
PORTERS CREEK CLAY..... 125PRCK

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

ARKADELPHIA MARL..... 211AKDP
ANNONA CHALK..... 211ANNN
UPPER CRETACEOUS SERIES..... 211CRCSU
MARLBROOK MARL..... 211MLBK
NACATOCH SAND..... 211NCTC
NEPHELINE SYENITE..... 211NPLS
SARATOGA CHALK..... 211SRTG

GULFIAN

BROWNSTOWN MARL..... 212BRNS
OZAN FORMATION..... 212OZAN
TOKIO FORMATION..... 212TOKO
WOODBINE FORMATION..... 212WDBN

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL
DELIGHT SAND..... 217DLGT
DE QUEEN LIMESTONE..... 217DQUN
DIERKS LIMESTONE..... 217DRKS
PIKE GRAVEL..... 217PIKE
ULTIMA THULE GRAVEL MEMBER OF HOLLY CREEK FORMATION..... 217ULMT

COMANCHEAN

GOODLAND LIMESTONE..... 218GDLD
HOLLY CREEK FORMATION..... 218HLCK
PALUXY SAND..... 218PLXY
TRINITY GROUP..... 218TRNT

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

DES MOINESIAN

BUGGY SHALE..... 325BGGY
DES MOINESIAN SERIES..... 325DSMS
HARTSHORNE SANDSTONE..... 325HRSR
MCALESTER SHALE..... 325MCAL
SAVANNA SANDSTONE..... 325SVNN

ATOKAN

ATOKAN SERIES..... 326ATKN
ATOKA FORMATION..... 326ATOK

MORROWAN

BLOYD SHALE..... 328BLVD
BRENTWOOD LIMESTONE MEMBER OF BLOYD SHALE..... 328BRND
CANE HILL MEMBER OF HALE FORMATION..... 328CNHL
HALE FORMATION..... 328HALE
JACKFORK SANDSTONE..... 328JKFK
JOHNS VALLEY SHALE..... 328JSVL
KESSLER LIMESTONE MEMBER OF BLOYD SHALE..... 328KSLR
MORROWAN SERIES..... 328MRRW
PRAIRIE GROVE MEMBER OF HALE FORMATION..... 328PRGV
WOOLSEY SANDSTONE MEMBER OF BLOYD SHALE..... 328WLSY

MISSISSIPPIAN

ARKANSAS NOVACULITE..... 330ARKS
BOONE FORMATION..... 330BOON
CHATTANOOGA SHALE..... 330CTNG
HATTON TUFF LENTIL OF STANLEY SHALE..... 330HNTF
HOT SPRINGS SANDSTONE..... 330HSPG
MISSISSIPPIAN SYSTEM..... 330MSSP
STANLEY SHALE..... 330STNL

UPPER MISSISSIPPIAN

BATESVILLE SANDSTONE..... 331BSVL
HINDSVILLE LIMESTONE..... 331HDVL
MOOREFIELD FORMATION..... 331MFLD
MISSISSIPPIAN, UPPER..... 331MSSPU
PITKIN LIMESTONE..... 331PTKN
RUDDELL SHALE..... 331RDDL
WEDINGTON SANDSTONE MEMBER OF FAYETTEVILLE SHALE..... 331WDNG

CHESTERIAN

FAYETTEVILLE SHALE..... 332FTVL

LOWER MISSISSIPPIAN

MISSISSIPPIAN, LOWER..... 337MSSPL
ST JOE LIMESTONE MEMBER OF BOONE FORMATION..... 337STJO

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

DEVONIAN, UPPER..... 341DVNNU
SYLAMORE SANDSTONE MEMBER OF CHATTANOOGA SHALE..... 341SLMR

MIDDLE DEVONIAN

CLIFTY LIMESTONE..... 344CLFT
DEVONIAN, MIDDLE..... 344DVNNM

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL
PENTERS CHERT..... 347PNRS

SILURIAN

BLAYLOCK SANDSTONE..... 350BLCK
MISSOURI MOUNTAIN SLATE..... 350MSRM
ST CLAIR LIMESTONE..... 350SCLR
SILURIAN SYSTEM..... 350SLRN

LOWER SILURIAN

BRASSFIELD LIMESTONE..... 357BFLD
LAFFERTY LIMESTONE..... 357LFRT
SILURIAN, LOWER..... 357SLRNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

CASON SHALE..... 361CSON
FERNVALE LIMESTONE..... 361FRVL
ORDOVICIAN, UPPER..... 361ODVCU
POLK CREEK SHALE..... 361PKCK

MIDDLE ORDOVICIAN

BIGFORK CHERT..... 364BGFK
EVERTON FORMATION..... 364EVRN
JOACHIM DOLOMITE..... 364JCHM
KIMMSWICK LIMESTONE..... 364KMCK
ORDOVICIAN, MIDDLE..... 364ODVCM
PLATTIN LIMESTONE..... 364PLTN
ST PETER SANDSTONE..... 364STPR

LOWER ORDOVICIAN

BLACK ROCK FORMATION..... 367BKRK
BLAKELY SANDSTONE..... 367BLKL
CRYSTAL MOUNTAIN SANDSTONE..... 367CRLM
COTTER DOLOMITE..... 367CTTR
GUNTER SANDSTONE MEMBER OF VAN BUREN FORMATION..... 367GNTR
GASCONADE DOLOMITE..... 367GSCD
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SMITHVILLE FORMATION..... 367SMVL

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ALLUVIAL FAN DEPOSITS..... 110ALVF
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HOLOCENE ALLUVIUM..... 111ALVM
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LACUSTRINE AND MARSH DEPOSITS (HOLOCENE-PLIOCENE)..... 111LCRM
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RIVER CHANNEL DEPOSITS..... 111RVCL
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SAND,LAKESHORE DEPOSITS..... 111SDLK
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ALLUVIAL FAN DEPOSITS,OLDER..... 112ALVFO
ALLUVIUM..... 112ALVM
ALLUVIUM,OLDER..... 112ALVMO
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ARROYO SECO GRAVEL..... 112ARSC
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BISHOP TUFF..... 112BSHP
BASALT..... 112BSLT
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CACHE FORMATION..... 112CCHE
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HOOKTON FORMATION..... 112HKTN
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LACUSTRINE DEPOSITS,OLDER..... 112LCSRO
LA HABRA FORMATION..... 112LHBR
LAKESHORE DEPOSITS,OLDER..... 112LKSRO
LIVERMORE GRAVEL..... 112LVRM
MILLERTON FORMATION..... 112MLRN
MONTEZUMA FORMATION..... 112MNZM
MERCED FORMATION..... 112MRCD
MARINE TERRACE DEPOSITS..... 112MRTC
MANIX LAKE BEDS..... 112MXLK
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PACKWOOD GRAVEL..... 112PCKD
PLEISTOCENE-PLIOCENE SERIES..... 112PCPC
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PALOS VERDES SAND..... 112PLVD
PASO ROBLES FORMATION..... 112PRBL
PUMICE CONES (PLEISTOCENE-PLIOCENE)..... 112PUMC
SANTA BARBARA FORMATION..... 112SBRB
SANTA CLARA FORMATION..... 112SCLR
SAND DUNE DEPOSITS,OLDER..... 112SDDSO
SAN DIMAS FORMATION..... 112SDMS
SALINE DEPOSITS..... 112SLIN
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SAN BENITO GRAVELS..... 112SNBN
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SAUGUS FORMATION..... 112SUGS
TEMECULA ARKOSE..... 112TMCL
TIMMS POINT SILT..... 112TMSP
TULARE FORMATION,LOWER..... 112TUCRL
TULARE FORMATION,UPPER..... 112TUCRU

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VICTOR FORMATION..... 112VCTR
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TERTIARY

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MARINE DEPOSITS..... 120MRIN
SEDIMENTARY ROCKS OF VOLCANIC ORIGIN..... 120SVCC
TERTIARY SYSTEM..... 120TRTR
VOLCANIC ROCKS,WESTERN CASCADES..... 120VCWC
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CHANAC FORMATION..... 121CHNC
CAREAGA FORMATION..... 121CREG
DUARTE CONGLOMERATE..... 121DURT
ETCHEGOIN FORMATION..... 121ECGN
FOXEN MUDSTONE..... 121FOXN
FERNANDO FORMATION..... 121FRND
HUNGRY VALLEY FORMATION..... 121HGVL
KERN RIVER FORMATION..... 121KRRV
LAKE DEPOSITS..... 121LAKE
LAGUNA FORMATION..... 121LGUN
LOS MEDANOS FORMATION..... 121LSMD
LAWLOR TUFF..... 121LWLR
MIOCENE-OLIGOCENE SERIES..... 121MCOG
MULHOLLAND FORMATION..... 121MLLD
MIOCENE SERIES..... 121MOCN
MERTEN FORMATION (PLIOCENE-MIOCENE)..... 121MRTN
NIGUEL FORMATION..... 121NGUL
NOMLAKI TUFF MEMBER OF TEHAMA AND TUSCAN FORMATIONS..... 121NMLK
ORINDA FORMATION..... 121ORND
PLIOCENE-MIOCENE SERIES..... 121PCMC
PICO FORMATION,UPPER..... 121PICOU
PLIOCENE SERIES..... 121PLCN
PINOLE TUFF..... 121PNOL
PURISIMA FORMATION..... 121PRSM
PURISIMA FORMATION,LOWER MEMBER..... 121PRSML
PURISIMA FORMATION,MIDDLE MEMBER..... 121PRSMM
PURISIMA FORMATION,UPPER MEMBER..... 121PRSMU
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RICARDO FORMATION (PLIOCENE-MIOCENE)..... 121RCRD
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SANTA CRUZ MUDSTONE..... 121SCRZ
ST GEORGE FORMATION..... 121SGRG
SANDSTONE,UNNAMED..... 121SNDS
SAN JOAQUIN FORMATION..... 121SNJQ
SAN MATEO FORMATION..... 121SNMT
SAN TIMOTEO BEDS..... 121SNTM
SONOMA VOLCANICS..... 121SONM
SISQUOC FORMATION..... 121SSQC
TEHAMA FORMATION..... 121TEHM
TUSCAN FORMATION..... 121TSCN

MIOCENE

BENA GRAVEL	122BENA
BOPESTA FORMATION	122BPST
BRIONES SANDSTONE	122BRNS
CLAREMONT SHALE	122CLRM
CONTINENTAL DEPOSITS	122CNTL
CAPISTRANO FORMATION	122CPSR
CIERBO SANDSTONE	122CRBO
EL MODENA VOLCANICS	122EMDN
ESCUDO SANDSTONE	122ESCD
FISS FANGLOMERATE	122FISS
FREEMAN SILT-JEWETT SAND	122FRMJ
GEM HILL FORMATION	122GMHL
HAMBRE FORMATION	122HMBR
ILMON BASALT	122ILMN
LOMPICO SANDSTONE	122LMPC
LA VIDA MEMBER OF PUENTA FORMATION	122LVID
MIOCENE-OLIGOCENE SERIES	122MCOG
MEGANOS FORMATION	122MGNS
MONTEREY SHALE	122MNTR
MIOCENE SERIES	122MOCN
MODELO FORMATION	122MODL
NEROLY FORMATION	122NRLY
OLCESE SAND	122OLCS
OURSAN FORMATION	122ORSN
PAGE MILL BASALT	122PGML
PLEITO FORMATION	122PLTO
PYRAMID HILL SAND MEMBER OF JEWETT SAND	122PMDH
POTATO SANDSTONE OF VAUGHN	122POTT
PUENTE FORMATION	122PUNT
QUIEN SABE VOLCANICS	122QNSB
REEF RIDGE SHALE	122RFRG
ROUND MOUNTAIN SILT	122RNDM
RODEO SHALE	122RODO
SOBRANTE SANDSTONE	122SBRN
SYCAMORE CANYON MEMBER OF PUENTE FORMATION	122SCMC
SESPE FORMATION	122SESP
SIMMLER FORMATION	122SMLR
SANTA MARGARITA FORMATION	122SMRG
SAN RAMON SANDSTONE	122SNRM
SAN ONOFRE BRECCIA	122SOFR
SAN PABLO GROUP	122SPBL
SOQUEL MEMBER OF PUENTE FORMATION	122SQUL
TICE FORMATION	122TICE
TEMBLOR FORMATION	122TMBL
TOPANGA FORMATION	122TPNG
TROPICO GROUP	122TRPC
VEDDER SANDS	122VDDR
VOLCANIC ROCKS	122VLCC
VAQUEROS FORMATION OR SANDSTONE	122VQRS
VALLEY SPRINGS FORMATION	122VSPG
VASQUEZ FORMATION (MIOCENE-OLIGOCENE)	122VSQZ
YORBA MEMBER OF PUENTE FORMATION	122YORB
ZAYANTE SANDSTONE	122ZYNT

OLIGOCENE

INGALLS FORMATION..... 123IGLS
KIRKER TUFF..... 123KRKR
KREYENHAGEN SHALE OR FORMATION..... 123KRNG
OLIGOCENE-EOCENE SERIES..... 123OGCE
OLIGOCENE SERIES..... 123OLGC
PINECATE FORMATION..... 123PNCT
REEDS CREEK ANDESITE..... 123RDCK
SAN JUAN BAUTISTA FORMATION..... 123SJBS
SAN LORENZO FORMATION..... 123SLRZ
TUMEY FORMATION..... 123TUMY
WHEATLAND FORMATION..... 123WLND
WEAVERVILLE FORMATION..... 123WVVL

EOCENE

AVENAL SANDSTONE..... 124AVNL
BUTANO SANDSTONE..... 124BUTN
CAPAY SHALE..... 124CAPY
COZY DELL FORMATION..... 124CZDL
DOMENGINE SANDSTONE..... 124DMNG
EOCENE-PALEOCENE SERIES..... 124ECPC
EOCENE SERIES..... 124EOCN
FRANCISCAN FORMATION..... 124FRCC
INDART SANDSTONE..... 124INDR
IONE FORMATION..... 124IONE
LA JOLLA FORMATION..... 124JOLL
LAGUNA SECA FORMATION..... 124LGSC
LAMBERT SHALE..... 124LMBR
LODO FORMATION..... 124LODO
MONTGOMERY CREEK FORMATION..... 124MGCK
MINDEGO BASALT..... 124MNDG
MARKLEY FORMATION..... 124MRKL
NORTONVILLE SHALE..... 124NRVL
POWAY GROUP..... 124POWY
SANTIAGO FORMATION..... 124SNTG
TESLA FORMATION..... 124TESL
TEJON FORMATION..... 124TJON
TOLMAN FORMATION..... 124TLMN
THE ROCKS SANDSTONE..... 124TRCK
UMPQUA FORMATION..... 124UMPQ
YOKUT SANDSTONE..... 124YKUT

PALEOCENE

GOLEX FORMATION..... 125GOLX
LOCATELLI FORMATION..... 125LCTL
MARTINEZ FORMATION..... 125MRNZ
PALEOCENE SERIES..... 125PLCN
SILVERADO FORMATION..... 125SLVD

MESOZOIC

BASEMENT COMPLEX OF PRETERTIARY AGE..... 200BMCX
MULE MOUNTAIN GRANITE..... 200MLMN

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

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CRETACEOUS-JURASSIC SYSTEMS..... 210CCJC
CHICO FORMATION..... 210CHCO
CONSOLIDATED CRETACEOUS ROCKS UNDIVIDED..... 210CLDD
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LAKEVIEW MOUNTAIN TONALITE..... 210LKVM
SCOTT VALLEY GRANODIORITE..... 210SCVG
SAN MARCOS GABBRO..... 210SMRC
TRABUCO FORMATION..... 210TRBC
WOODSON MOUNTAIN GRANODIORITE..... 210WDSM

UPPER CRETACEOUS

CHICO FORMATION..... 211CHCO
UPPER CRETACEOUS SERIES..... 211CRCSU
DEL VALLE FORMATION..... 211DLVL
DEER VALLEY SANDSTONE..... 211DRVL
JOAQUIN RIDGE SANDSTONE MEMBER OF PANOCHE FORMATION..... 211JQRG
MORENO GRANDE FORMATION..... 211MRGD
MARLIFF SHALE..... 211MRLF
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PIGEON POINT FORMATION..... 211PGNP
PANOCHE FORMATION..... 211PNCH

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HORSETOWN FORMATION..... 217HRSN
NILES CANYON FORMATION..... 217NLSC
ONO FORMATION..... 217ONO
RECTOR FORMATION..... 217RCTR
SHASTA SERIES..... 217SHST
SERPENTINE AND ULTRAMAFIC ROCK UNDIVIDED..... 217SPUF
SERPENTINE..... 217SRPN
WISENOR FORMATION..... 217WSNR

JURASSIC

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JURASSIC SYSTEM..... 220JRSC
SHASTA BALLY QUARTZ DIORITE..... 220SSBL

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UPPER JURASSIC SERIES..... 221JRSCU
MARIPOSA FORMATION..... 221MRPS
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MIDDLE JURASSIC

MIDDLE JURASSIC SERIES..... 224JRSCM

LOWER JURASSIC

LOWER JURASSIC SERIES..... 227JRSCL

TRIASSIC

TRIASSIC SYSTEM..... 230TRSC

PALEOZOIC

ABRAMS MICA SCHIST..... 300ABRM
CALAVERAS GROUP..... 300CLVR
METAMORPHIC PALEOZOIC ROCKS UNDIVIDED..... 300MMPC
PALEOZOIC ERATHEM..... 300PLZC
SALMON HORNBLENDE SCHIST..... 300SLMN

PERMIAN

PERMIAN SYSTEM..... 310PRMN

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

MISSISSIPPIAN

BRAGDON FORMATION..... 330BRGD
MISSISSIPPIAN SYSTEM..... 330MSSP

DEVONIAN

CHANCHELULLA FORMATION..... 340CCLL
COPLEY GREENSTONE..... 340CPLY
DEVONIAN SYSTEM..... 340DVNN
SCOTT VALLEY GREENSTONE..... 340SCVG

UPPER DEVONIAN

DEVONIAN, UPPER..... 341DVNNU

MIDDLE DEVONIAN

BALAKLALA RHYOLITE..... 344BLKL
DEVONIAN, MIDDLE..... 344DVNNM

PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB

COLORADO

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC
CENOZOIC-MESOZOIC ERATHEMS..... 100CZMZ

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

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ALLUVIUM,TERRACE..... 111AVMT
DUNE SAND....H..... 111DUNE
HOLOCENE SERIES..... 111HLCN
VALLEY-FILL DEPOSITS..... 111VLFL

PLEISTOCENE

GLACIAL DEPOSITS..... 112GLCL
PLEISTOCENE SERIES..... 112PLSC
SANTA FE FORMATION..... 112SNTF
TERRACE DEPOSITS..... 112TERC

TERTIARY

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TERTIARY SYSTEM..... 120TRTR
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DRY UNION FORMATION..... 121DRUN
NORTH PARK FORMATION..... 121NRPK
OGALLALA FORMATION..... 121OGLL
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PLIOCENE SERIES..... 121PLCN

MIOCENE

ARIKAREE FORMATION..... 122ARKR
BROWNS PARK FORMATION..... 122BRPK
MIOCENE SERIES..... 122MOCN

OLIGOCENE

BRULE FORMATION OF WHITE RIVER GROUP..... 123BRUL
CHADRON FORMATION OF WHITE RIVER GROUP..... 123CDRN
CASTLE ROCK CONGLOMERATE..... 123CRCK
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EOCENE

CUCHARA FORMATION	124CCHR
DEVILS HOLE FORMATION	124DVLH
DAWSON ARKOSE	124DWSN
EOCENE-PALEOCENE SERIES	124ECPC
EOCENE SERIES	124EOCN
FARASITA CONGLOMERATE	124FRST
GREEN RIVER FORMATION	124GRRV
HUERFANO FORMATION	124HRFN
INTRUSIVE ROCKS	124IRSV
SAN JOSE AND NACIMIENTO FORMATIONS,UNDIFFERENTIATED (EOCENE-PALEOCENE)	124SJNM
SAN JOSE FORMATION	124SNJS
WASATCH FORMATION	124WSTC

PALEOCENE

ANIMAS FORMATION (PALEOCENE-UPPER CRETACEOUS)	125ANMS
DENVER FORMATION	125DNVR
KIRTLAND SHALE	125KRLD
MIDDLE PARK FORMATION	125MDPK
NACIMIENTO FORMATION	125NCMN
OJO ALAMO SANDSTONE	125OJAM
PALEOCENE SERIES	125PLCN
POISON CANYON FORMATION	125PSNC
RATON FORMATION	125RTON

MESOZOIC

MESOZOIC ERATHEM	200MSZC
MESOZOIC-PALEOZOIC ERATHEMS	200MZPZ

CRETACEOUS

CRETACEOUS SYSTEM	210CRCS
DAKOTA GROUP	210DKOT

UPPER CRETACEOUS

A SANDSTONE MEMBER OF LARAMIE FORMATION	211A
ARAPAHOE CONGLOMERATE MEMBER OF LARAMIE FORMATION	211ARPH
BRIDGE CREEK LIMESTONE MEMBER OF GREENHORN LIMESTONE	211BGCK
BLUE HILL SHALE MEMBER OF CARLILE SHALE	211BLHL
B SANDSTONE MEMBER OF LARRIMIE FORMATION	211BLRM
BENTON SHALE	211BNTN
CODELL SANDSTONE MEMBER OF CARLILE SHALE	211CDLL
CLIFF HOUSE SANDSTONE OF MESAVERDE GROUP	211CLFH
UPPER CRETACEOUS SERIES	211CRCSU
CARLILE SHALE	211CRLL
FORT HAYS LIMESTONE MEMBER OF NIOBRARA FORMATION	211FRHS
FRUITLAND FORMATION	211FRLD
FAIRPORT CHALKY SHALE MEMBER OF CARLILE SHALE	211FRPR
FOX HILLS SANDSTONE	211FXHL
GREENHORN LIMESTONE	211GRNR
GRANEROS SHALE	211GRRS
HARTLAND SHALE MEMBER OF GREENHORN LIMESTONE	211HRLD

HYGIENE SANDSTONE MEMBER OF PIERRE SHALE..... 211HYGN
LINCOLN MEMBER OF GREENHORN LIMESTONE..... 211LNCL
LARAMIE FORMATION..... 211LRMI
LARIMER SANDSTONE MEMBER OF PIERRE SHALE..... 211LRMR
LEWIS SHALE..... 211LWIS
MCDERMOTT MEMBER OF ANIMAS FORMATION..... 211MCDM
MENEFEE FORMATION OF MESAVERDE GROUP..... 211MENF
MILLIKEN SANDSTONE MEMBER OF FOX HILLS SANDSTONE..... 211MLKN
MANCOS SHALE..... 211MNCS
MESAVERDE GROUP..... 211MVRD
NIOBRARA FORMATION..... 211NBRR
PICTURED CLIFFS SANDSTONE..... 211PCCF
PIERRE SHALE..... 211PIRR
POINT LOOKOUT SANDSTONE MEMBER OF MESAVERDE GROUP..... 211PNLK
RICHARD SANDSTONE MEMBER OF PIERRE SHALE..... 211RCRD
ROCKY RIDGE SANDSTONE MEMBER OF PIERRE SHALE..... 211RKRG
SMOKY HILL MARL MEMBER OF NIOBRARA FORMATION..... 211SMKH
TRINIDAD SANDSTONE..... 211TRDD
TRANSITION ZONE..... 211TRNS
TERRY SANDSTONE MEMBER OF PIERRE SHALE..... 211TRRY
VERMEJO FORMATION..... 211VRMJ

LOWER CRETACEOUS

BURRO CANYON FORMATION..... 217BRCN
LOWER CRETACEOUS SERIES..... 217CRCSL
CHEYENNE SANDSTONE MEMBER OF PURGATORIE FORMATION..... 217CYNN
KIOWA SHALE MEMBER OF PURGATORIE FORMATION..... 217KIOW
LYTLE FORMATION OF DAKOTA GROUP..... 217LYTL
MOWRY SHALE..... 217MWRY
PLAINVIEW SANDSTONE MEMBER OF SOUTH PLATTE FORMATION..... 217PLNV
PURGATORIE FORMATION..... 217PRGR
SOUTH PLATTE FORMATION OF DAKOTA GROUP..... 217STPL

JURASSIC

GLEN CANYON GROUP..... 220GLNC
JURASSIC-TRIASSIC SYSTEMS..... 220JCTC
JURASSIC SYSTEM..... 220JRSC
NAVAJO SANDSTONE OF GLEN CANYON GROUP..... 220NVJO

UPPER JURASSIC

BRUSHY BASIN SHALE MEMBER OF MORRISON FORMATION..... 221BRSB
CURTIS FORMATION OF SAN RAFAEL GROUP..... 221CRTS
ENTRADA SANDSTONE..... 221ENRD
JUNCTION CREEK SANDSTONE OF SAN RAFAEL GROUP..... 221JCCK
UPPER JURASSIC SERIES..... 221JRSCU
MOAB MEMBER OF ENTRADA SANDSTONE..... 221MOAB
MORRISON FORMATION..... 221MRSN
RECAPTURE SHALE MEMBER OF MORRISON FORMATION..... 221RCPR
RALSTON CREEK FORMATION..... 221RLCK
SLICK ROCK MEMBER OF ENTRADA SANDSTONE..... 221SKRK
SALT WASH SANDSTONE MEMBER OF MORRISON FORMATION..... 221SLWS
SUMMERVILLE FORMATION OF SAN RAFAEL GROUP..... 221SMVL
SAN RAFAEL GROUP..... 221SRFL

WESTWATER CANYON SANDSTONE MEMBER OF MORRISON FORMATION..... 221WSRC

MIDDLE JURASSIC

MIDDLE JURASSIC SERIES..... 224JRSCM

LOWER JURASSIC

LOWER JURASSIC SERIES..... 227JRSCL

TRIASSIC

LYKINS FORMATION..... 230LKNS
TRIASSIC-PERMIAN SYSTEMS..... 230TCPM
TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

CHINLE FORMATION OF DOCKUM GROUP..... 231CHNL
DOCKUM GROUP..... 231DCKM
JELM FORMATION..... 231JELM
KAYENTA FORMATION OF GLEN CANYON GROUP..... 231KYNT
UPPER TRIASSIC SERIES..... 231TRSCU
WINGATE SANDSTONE OF GLEN CANYON GROUP..... 231WNGT

MIDDLE TRIASSIC

MIDDLE TRIASSIC SERIES..... 234TRSCM

LOWER TRIASSIC

LOWER TRIASSIC SERIES..... 237TRSCL

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

LYONS FORMATION..... 310LYNS
PERMIAN-PENNSYLVANIAN SYSTEMS..... 310PMPV
PERMIAN SYSTEM..... 310PRMN
SANGRE DE CRISTO FORMATION..... 310SGRC
SATANKA SHALE..... 310STNK
WEBER FORMATION..... 310WBER

UPPER PERMIAN

BIG BASIN FORMATION..... 311BGBS
UPPER PERMIAN SERIES..... 311PRMNU
TALOGA FORMATION OF CRAGIN..... 311TOLG

LOWER PERMIAN

FOUNTAIN FORMATION..... 317FNTN
INGLESIDE FORMATION..... 3171GLD

MAROON FORMATION..... 317MROR
LOWER PERMIAN SERIES..... 317PRMNL

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

UPPER PENNSYLVANIAN

UPPER PENNSYLVANIAN SERIES..... 321PSLVU

MIDDLE PENNSYLVANIAN

MINTURN FORMATION..... 324MNRN
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM

LOWER PENNSYLVANIAN

BELDEN FORMATION..... 327BLDN
LOWER PENNSYLVANIAN SERIES..... 327PSLVL

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

LEADVILLE LIMESTONE..... 331LDVL
MISSISSIPPIAN, UPPER..... 331MSSPU

LOWER MISSISSIPPIAN

MISSISSIPPIAN, LOWER..... 337MSSPL

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

CHAFFEE FORMATION..... 341CHFF
DEVONIAN, UPPER..... 341DVNNU
PARTING QUARTZITE MEMBER OF CHAFFEE FORMATION..... 341PRTG

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL

SILURIAN

SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

SILURIAN, UPPER..... 351SLRNU

MIDDLE SILURIAN

SILURIAN, MIDDLE..... 354SLRNM

LOWER SILURIAN

SILURIAN, LOWER..... 357SLRNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

ORDOVICIAN, UPPER..... 361ODVCU

MIDDLE ORDOVICIAN

ORDOVICIAN, MIDDLE..... 364ODVCM

LOWER ORDOVICIAN

MANITOU FORMATION..... 367MNTU
ORDOVICIAN, LOWER..... 367ODVCL

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

CAMBRIAN, UPPER..... 371CMBRU
SAWATCH SANDSTONE FORMATION..... 371SWCH

MIDDLE CAMBRIAN

CAMBRIAN, MIDDLE..... 374CMBRM

LOWER CAMBRIAN

LOWER CAMBRIAN SERIES..... 377CMBRL

PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB
PRECAMBRIAN CRYSTALLINE ROCKS..... 400PCMBC

CONNECTICUT

CENOZOIC

QUATERNARY

ALLUVIUM,TERRACE,NON-GLACIAL..... 110AVTN

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
SWAMP DEPOSITS..... 111SWMP

PLEISTOCENE

DRIFT,STRATIFIED..... 112DFSF
TILL..... 112TILL

MESOZOIC

TRIASSIC

UPPER TRIASSIC

EAST BERLIN FORMATION..... 231EBRL
HOLYOKE BASALT..... 231HLYK
HAMPDEN BASALT..... 231HMPD
IGNEOUS EXTRUSIVES..... 231IGNSE
IGNEOUS INTRUSIVES..... 231IGNSI
NEW HAVEN ARKOSE..... 231NHVN
PORTLAND FORMATION..... 231PRLD
SEDIMENTARY BEDROCK..... 231SDMN
SHUTTLE MEADOW FORMATION..... 231SLMD
TALCOTT BASALT..... 231TLCT

PALEOZOIC

CARBONATE CRYSTALLINE BEDROCK..... 300CBCL
CRYSTALLINE BEDROCK TYPE UNKNOWN..... 300CRSL
NON-CARBONATE CRYSTALLINE BEDROCK..... 300NCBC

PRECAMBRIAN

NON-CARBONATE CRYSTALLINE BEDROCK..... 400NCBC

DELAWARE

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE-PLEISTOCENE SERIES..... 111HCPC
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

BEAVERDAM SAND..... 112BVDM
COLUMBIA GROUP..... 112CLMB
OMAR FORMATION..... 112OMAR
PLEISTOCENE-PLIOCENE SERIES..... 112PCPC
PENNSAUKEN FORMATION..... 112PNSK

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

BRYN MAWR FORMATION..... 121BRMR
BRANDYWINE FORMATION..... 121BRND
CHESAPEAKE GROUP..... 121CSPK
PLIOCENE SERIES..... 121PLCN
YORKTOWN FORMATION..... 121YRKN

MIOCENE

CALVERT FORMATION..... 122CLVR
CHOPTANK FORMATION..... 122CPNK
CHESWOLD AQUIFER..... 122CSLD
FEDERALSBURG AQUIFER..... 122FDBG
FREDERICA AQUIFER..... 122FRDC
MANOKIN AQUIFER..... 122MNKN
MIOCENE SERIES..... 122MOCN
POCOMOKE AQUIFER..... 122PCMK
ST MARYS FORMATION..... 122SMRS

OLIGOCENE

OLIGOCENE SERIES..... 123OLGC

EOCENE

EOCENE-PALEOCENE SERIES..... 124ECPC
EOCENE SERIES..... 124EOCN

NANJEMOY FORMATION..... 124NNJM
PAMUNKEY GROUP..... 124PMNK
PINEY POINT FORMATION..... 124PNPN

PALEOCENE

AQUIA AND RANCOCAS AQUIFER..... 125AQRC
HORNERSTOWN FORMATION..... 125HRRS
PALEOCENE SERIES..... 125PLCN
RANCOCAS FORMATION..... 125RCCS
VINCENTOWN FORMATION..... 125VNCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU
ENGLISHTOWN FORMATION..... 211EGLS
MERCHANTVILLE FORMATION..... 211MCVL
MAGOTHY FORMATION..... 211MGTY
MOUNT LAUREL SAND..... 211MLRL
MONMOUTH FORMATION..... 211MNMT
MARSHALLTOWN FORMATION..... 211MRSL
MATAWAN FORMATION..... 211MTWN
RARITAN FORMATION..... 211RRTN

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL
NONMARINE CRETACEOUS AQUIFER..... 217NNMR
POTOMAC FORMATION..... 217PTMC

PALEOZOIC

COCKEYSVILLE MARBLE..... 300CCKV
GLENARM SERIES..... 300GLRM
PALEOZOIC ERATHEM..... 300PLZC
PORT DEPOSIT GNEISS..... 300PRDP
WILMINGTON COMPLEX..... 300WLMG
WISSAHICKON FORMATION..... 300WSCK

DISTRICT OF COLUMBIA

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
QUATERNARY SYSTEM..... 110QRNR
TERRACE DEPOSITS..... 110TRRC

HOLOCENE

HOLOCENCE-PLEISTOCENE SERIES..... 111HCPC
HOLOCENE SERIES..... 111HLCN
LOWLAND DEPOSITS..... 111LLND

PLEISTOCENE

PLEISTOCENE-PLIOCENE SERIES..... 112PCPC
PLEISTOCENE SERIES..... 112PLSC
PAMLICO FORMATION..... 112PMLC
SUNDERLAND FORMATION..... 112SDLD
UPLAND DEPOSITS..... 112UPLD

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

BRYN MAWR GRAVEL..... 121BRMR
BRANDYWINE FORMATION..... 121BRND
PLIOCENE SERIES..... 121PLCN

MIOCENE

CALVERT FORMATION..... 122CLVR
CHESAPEAKE GROUP..... 122CSPK
MIOCENE SERIES..... 122MOCN

MESOZOIC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

LOWER CRETACEOUS

ARUNDEL FORMATION..... 217ARDL
LOWER CRETACEOUS SERIES..... 217CRCSL
PATAPSCO FORMATION..... 217PPSC
POTOMAC GROUP..... 217PTMC
PATUXENT FORMATION..... 217PTXN

PALEOZOIC

BOULDER GNEISS..... 300BLDR
GEORGETOWN MAFIC COMPLEX..... 300GRGN
LOWER PELITIC SCHIST..... 300LPLC
PALEOZOIC ERATHEM..... 300PLZC

PRECAMBRIAN

KENSINGTON QUARTZ DIORITE..... 400KNSG

FLORIDA

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

NONARTESIAN SAND AQUIFER..... 110NRSD
QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE-PLEISTOCENE SERIES..... 111HCPC
HOLOCENE SERIES..... 111HLCN
LAKE FLIRT MARL..... 111LKFL
NONARTESIAN SAND AQUIFER..... 111NRSD
TERRACE DEPOSITS,LOWER,MARINE AND ESTUARINE..... 111TLME

PLEISTOCENE

AYERS LANDING MARL MEMBER OF CALOOSAHATCHEE FORMATION..... 112ALDG
ANASTASIA FORMATION..... 112ANSS
BEE BRANCH MEMBER OF CALOOSAHATCHEE FORMATION..... 112BBRC
BRANDYWINE FORMATION..... 112BRDN
BISCAYNE LIMESTONE AQUIFER..... 112BSCNN
BISCAYNE SANDY LIMESTONE AQUIFER..... 112BSCNS
COFFEE MILL HAMMOCK MARL MEMBER OF FT. THOMPSON FORMATION..... 112CEMH
CALOOSAHATCHEE AQUIFER..... 112CLSC
CALOOSAHATCHEE FORMATION..... 112CLSCR
COHARIE FORMATION..... 112COHR
COQUINA AQUIFER..... 112CQUN
FORT DENAUD MEMBER OF CALOOSAHATCHEE FORMATION..... 112FDND
FORT THOMPSON FORMATION..... 112FTMP
KEY LARGO LIMESTONE..... 112KLRG
LA BELLE CLAY MEMBER OF TAMIAMI FORMATION..... 112LBLL
LIMESTONE AQUIFER..... 112LMSN
MIAMI OOLITE..... 112MIMI
MELBOURNE BED OF PAMLICO FORMATION..... 112MLBR
NONARTESIAN SAND AQUIFER..... 112NRSD
OKALOAKOOCHEE MEMBER OF FT. THOMPSON FORMATION..... 112OKKC
PLEISTOCENE SERIES..... 112PLSC
PAMLICO FORMATION..... 112PMLC
PENHOLOWAY FORMATION..... 112PNLY
SAND AQUIFER..... 112SAND
SAND AND GRAVEL AQUIFER..... 112SDGV
SUNDERLAND FORMATION..... 112SDLD
SANDSTONE AQUIFER..... 112SNDS
SILVER BLUFF FORMATION..... 112SVBF
TERRACE DEPOSITS,MARINE..... 112TCMR
TALBOT FORMATION..... 112TLBT
WICOMICO FORMATION..... 112WCMC

TERTIARY

FLORIDAN AQUIFER..... 120FLRD

NORTHWESTERN FLORIDA SAND-AND-GRAVEL AQUIFER..... 120NFSG
NONARTESIAN SAND AQUIFER..... 120NRSD
TERTIARY SYSTEM..... 120TRTR

PLIOCENE

ALLUVIUM AND DELTAIC DEPOSITS,HIGH LEVEL..... 121ADHL
CITRONELLE FORMATION..... 121CRNL
DUPLIN MARL..... 121DPLN
PLEISTOCENE-PLIOCENE SERIES..... 121PCPC
PLIOCENE SERIES..... 121PLCN

MIOCENE

ALACHUA FORMATION..... 122ALCH
ALVA CLAY MEMBER OF TAMIAMI FORMATION..... 122ALVA
ALUM BLUFF GROUP..... 122AMBF
BUCKINGHAM LIMESTONE OF TAMIAMI FORMATION..... 122BKGM
BONE VALLEY FORMATION..... 122BNVL
BAY SHORE MEMBER OF TAMIAMI FORMATION..... 122BYSR
CHIPOLA FORMATION..... 122CHPL
CHARLTON FORMATION..... 122CRLN
CHATTAHOOCHEE FORMATION..... 122CTTC
ESCAMBIA SAND MEMBER OF PENSACOLA CLAY..... 122ECMB
FORT PRESTON FORMATION..... 122FRPR
HAWTHORN FORMATION..... 122HTRN
HAWTHORN LIMESTONE AQUIFER..... 122HTRNN
HAWTHORN SAND AND GRAVEL AQUIFER..... 122HTRNS
JACKSON BLUFF FORMATION..... 122JKBF
LIMESTONE AQUIFER..... 122LMSN
MURDOCK STATION MEMBER OF TAMIAMI FORMATION..... 122MCKS
MICCOSUKEE FORMATION..... 122MCSK
MIOCENE SERIES..... 122MOCN
MIOCENE COARSE CLASTICS..... 122MOCNC
OCHOPEE LIMESTONE MEMBER OF TAMIAMI FORMATION..... 122OCHP
OAK GROVE SAND MEMBER OF SHOAL RIVER FORMATION..... 122OKGV
ORTONA SAND MEMBER OF TAMIAMI FORMATION..... 122ORTN
PINECREST SAND..... 122PCRS
PENSACOLA CLAY..... 122PSCL
PENSACOLA CLAY,LOWER MEMBER..... 122PSCLL
PENSACOLA CLAY,UPPER MEMBER..... 122PSCLU
RED BAY FORMATION..... 122RDBY
SAND AND GRAVEL AQUIFER..... 122SDGV
SHELL-MARL AQUIFER..... 122SLML
SHOAL RIVER FORMATION..... 122SLRV
ST. MARKS FORMATION..... 122SMRK
SANDSTONE AQUIFER..... 122SNDS
TAMPA LIMESTONE..... 122TAMP
TAMIAMI FORMATION..... 122TMIM
TAMIAMI FORMATION,LIMESTONE AQUIFER..... 122TMIMN
TAMIAMI FORMATION,SHELL-MARL AQUIFER..... 122TMIMR
TORREYA FORMATION..... 122TRRY
YELLOW RIVER FORMATION..... 122YLRV

OLIGOCENE

BUCATUNNA CLAY MEMBER OF BYRAM FORMATION..... 123BCTN
BYRAM FORMATION..... 123BYRM
CHICKASAWHAY LIMESTONE AND TAMPA FORMATION,UNDIFFERENTIATED..... 123CKTP
DUNCAN CHURCH BEDS MEMBER OF SUWANNEE LIMESTONE..... 123DCCC
LIMESTONE AQUIFER..... 123LMSN
MARIANNA LIMESTONE..... 123MRNN
OLIGOCENE SERIES..... 123OLGC
SUWANNEE LIMESTONE..... 123SWNN
VICKSBURG GROUP..... 123VKBG

EOCENE

AVON PARK LIMESTONE..... 124AVPK
BASHI MARL MEMBER OF HATCHETIGBEE FORMATION..... 124BSHI
CLAIBORNE GROUP..... 124CLBR
CRYSTAL RIVER FORMATION..... 124CLRV
EOCENE SERIES..... 124EOCN
HATCHETIGBEE FORMATION..... 124HCGB
INGLIS FORMATION..... 124IGLS
JACKSON GROUP..... 124JCKS
LAKE CITY LIMESTONE..... 124LKCT
LISBON FORMATION..... 124LSBN
OCALA GROUP..... 124OCAL
OCALA LIMESTONE,LOWER MEMBER..... 124OCALL
OCALA LIMESTONE..... 124OCALN
OCALA LIMESTONE,UPPER MEMBER..... 124OCALU
OLDSMAR LIMESTONE..... 124OLDM
OLDSMAR LIMESTONE AQUIFER..... 124OLDMN
STEINHATCHEE DOLOMITE MEMBER OF CRYSTAL RIVER FORMATION..... 124STNC
TALLAHASSEE LIMESTONE..... 124TLLS
TALLAHATTA FORMATION..... 124TLLT
WILCOX GROUP..... 124WLCX
WILLISTON FORMATION..... 124WLSN

PALEOCENE

CEDAR KEYS LIMESTONE..... 125CDRK
CEDAR KEYS LIMESTONE AQUIFER..... 125CDRKN
MIDWAY FORMATION..... 125MDWY
PALEOCENE SERIES..... 125PLCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS-JURASSIC SYSTEMS..... 210CCJC
FORT PIERCE FORMATION..... 210FPRC

UPPER CRETACEOUS

ATKINSON FORMATION..... 211AKNS
AUSTIN GROUP..... 211ASTN

CARD SOUND DOLOMITE..... 211CDSD
UPPER CRETACEOUS SERIES..... 211CRCSU
EUTAW FORMATION..... 211EUTW
LA CROSSE SANDSTONE..... 211LCRS
LAWSON LIMESTONE..... 211LWSN
NAVARRO GROUP..... 211NVRR
PILOT SANDSTONE MEMBER OF TUSCALOOSA FORMATION..... 211PLOT
SELMA GROUP..... 211SELM
TUSCALOOSA GROUP..... 211TSCL
TUSCALOOSA FORMATION,LOWER MEMBER..... 211TSCLL
TUSCALOOSA FORMATION,MIDDLE MEMBER..... 211TSCLM
MASSIVE SANDSTONE MEMBER OF LOWER TUSCALOOSA FORMATION..... 211TSCLS
TUSCALOOSA FORMATION,UPPER MEMBER..... 211TSCLU
TAYLOR GROUP..... 211TYLR

LOWER CRETACEOUS

BIG CYPRESS GROUP..... 217BGCP
LOWER CRETACEOUS SERIES..... 217CRCSL
DOLLAR BAY FORMATION..... 217DLRB
FREDERICKSBURG GROUP..... 217FKBG
FERRY LAKE ANHYDRITE..... 217FRLK
GLADES GROUP..... 217GLDS
HUSSTON FORMATION..... 217HSTN
LAKE TRAFFORD FORMATION..... 217LKTF
NAPLES BAY GROUP..... 217NPLB
OCEAN REEF GROUP..... 217OCRF
PUNTA GORDA ANHYDRITE..... 217PGRD
RODESSA FORMATION..... 217RDSS
SANDS AND GRAVELS,UNDIFFERENTIATED..... 217SDGV
SUNNILAND LIMESTONE..... 217SNLD
TRINITY GROUP..... 217TRNT
LOWER TRINITY..... 217TRNTL
UPPER TRINITY..... 217TRNTU
WASHITA GROUP..... 217WSHT

JURASSIC

UPPER JURASSIC

COTTON VALLEY GROUP..... 221CNVL
DENKMAN SANDSTONE..... 221DNKM
HAYNESVILLE FORMATION..... 221HSVL
UPPER CRETACEOUS SERIES..... 221JRSCU
LOUANN SALT..... 221LUNN
NORPHLET SANDSTONE..... 221NRPL
SMACKOVER FORMATION..... 221SMKV
WERNER ANHYDRITE..... 221WRNR

TRIASSIC

BASALT..... 230BSLT
DIABASE..... 230DIBS
RHYOLITE..... 230RYLT
TRIASSIC SYSTEM..... 230TRSC
TUFF..... 230TUFF

UPPER TRIASSIC

NEWARK GROUP..... 231NWRK
UPPER TRIASSIC SERIES..... 231TRSCU

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

SILURIAN

SILURIAN SYSTEM..... 350SLRN

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

LOWER ORDOVICIAN

ORDOVICIAN, LOWER..... 367ODVCL

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

PRECAMBRIAN

BIOTITIC GRANITE..... 400BCGR
PRECAMBRIAN GRANITE..... 400GRNT
HORNBLENDE DIORITE..... 400HBDD
PRECAMBRIAN ERATHEM..... 400PCMB

CENOZOIC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

COLUMBIA GROUP..... 112CLMB
PLEISTOCENE SERIES..... 112PLSC

TERTIARY

CHANNEL SAND..... 120CNNL
PRINCIPAL ARTESIAN AQUIFER..... 120PCPA

PLIOCENE

CHARLTON FORMATION..... 121CRLN
DUPLIN MARL..... 121DPLN
PLIOCENE SERIES..... 121PLCN

MIOCENE

ALUM BLUFF GROUP..... 122AMBF
HAWTHORN FORMATION..... 122HTRN
MIOCENE SERIES..... 122MOCN
TAMPA LIMESTONE EQUIVALENT..... 122TAMP

OLIGOCENE

BYRAM FORMATION..... 123BYRM
COOPER MARL..... 123COPR
FLINT RIVER FORMATION..... 123FLRV
MARIANNA LIMESTONE EQUIVALENT..... 123MRNN
OLIGOCENE SERIES..... 123OLGC
SUWANNEE LIMESTONE..... 123SWNN
VICKSBURG GROUP..... 123VKBG

EOCENE

AVON PARK LIMESTONE..... 124AVPK
BARNWELL FORMATION..... 124BRNL
CLINCHFIELD SAND..... 124CCFD
CLAIBORNE GROUP..... 124CLBR
EOCENE SERIES..... 124EOCN
HATCHETIGBEE FORMATION..... 124HCGB
IRWINTON SANDSTONE MEMBER OF BARNWELL FORMATION..... 124IRNN
JACKSON GROUP..... 124JCKS

LAKE CITY LIMESTONE..... 124LKCT
LISBON FORMATION..... 124LSBN
MC BEAN FORMATION..... 124MCBN
NANAFALIA FORMATION..... 124NNFL
OCALA LIMESTONE..... 124OCAL
OLDSMAR LIMESTONE..... 124OLDM
SANDERSVILLE LIMESTONE MEMBER OF BARNWELL FORMATION..... 124SDVL
TWIGGS CLAY MEMBER OF BARNWELL FORMATION..... 124TGGS
TALLAHATTA FORMATION..... 124TLLT
TUSCAHOMA FORMATION..... 124TSCM
WILCOX GROUP..... 124WLCX

PALEOCENE

CEDAR KEYS FORMATION..... 125CDRK
CLAYTON FORMATION..... 125CLTN
MIDWAY GROUP..... 125MDWY
PALEOCENE SERIES..... 125PLCN
PORTERS CREEK FORMATION..... 125PRCK
TAMESI EQUIVALENT..... 125TMSI

MESOZOIC

CRETACEOUS

UPPER CRETACEOUS

ATKINSON FORMATION..... 211AKNS
BLUFFTOWN FORMATION..... 211BLFN
COUSETA SAND..... 211CSST
EUTAW FORMATION..... 211EUTW
LAWSON LIMESTONE..... 211LWSN
PEROTE MEMBER OF PROVIDENCE SAND..... 211PROT
PROVIDENCE SAND..... 211PVDC
RIPLEY FORMATION..... 211RPLY
TUSCALOOSA FORMATION..... 211TSCL
TUSCALOOSA FORMATION,LOWER MEMBER..... 211TSCLL
TUSCALOOSA FORMATION,MIDDLE MEMBER..... 211TSCLM
TUSCALOOSA FORMATION,UPPER MEMBER..... 211TSCLU

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL

COMANCHEAN

COMANCHEAN SERIES..... 218CMNC

TRIASSIC

NEWARK GROUP..... 230NWRK

PALEOZOIC

PENNSYLVANIAN

TALLADEGA FORMATION..... 320TLDG

LOWER PENNSYLVANIAN

CRAB ORCHARD MOUNTAINS FORMATION..... 327CBOM
GIZZARD FORMATION..... 327GZRD
NEWTON SANDSTONE MEMBER OF CRAB ORCHARD MOUNTAINS FORMATION..... 327NWTN
RACCOON MOUNTAIN MEMBER OF GIZZARD FORMATION..... 327RCNM
SEWANEE MEMBER OF CRAB ORCHARD MOUNTAINS FORMATION..... 327SEWN
SIGNAL POINT SHALE MEMBER OF GIZZARD FORMATION..... 327SGLP
VANDEVER MEMBER OF CRAB ORCHARD MOUNTAINS FORMATION..... 327VDVR
WARREN POINT SANDSTONE MEMBER OF GIZZARD FORMATION..... 327WRNP
WHITWELL SHALE MEMBER OF CRAB ORCHARD MOUNTAINS FORMATION..... 327WTLL

MISSISSIPPIAN

UPPER MISSISSIPPIAN

BANGOR LIMESTONE..... 331BNGR
FLOYD SHALE..... 331FLYD
GOLCONDA FORMATION..... 331GLCD
HARTSELLE SANDSTONE..... 331HRSL
PENNINGTON SHALE..... 331PNNG
STE GENEVIEVE LIMESTONE..... 331SGVV
ST LOUIS LIMESTONE..... 331STLS

LOWER MISSISSIPPIAN

FORT PAYNE FORMATION..... 337FRPN
LAVENDER SHALE MEMBER..... 337LVDR
MAURY FORMATION..... 337MURY

DEVONIAN

MIDDLE DEVONIAN

ARMUCHEE CHERT..... 344ARMC
FROG MOUNTAIN SANDSTONE..... 344FRGM

ERIAN

CHATTANOOGA SHALE..... 345CTNG

SILURIAN

RED MOUNTAIN FORMATION..... 350RDMN

ORDOVICIAN

UPPER ORDOVICIAN

SEQUATCHIE FORMATION..... 361SQTC

MIDDLE ORDOVICIAN

CHICKAMAUGA LIMESTONE..... 364CKMG
ROCKMART SLATE..... 364RCKM

LOWER ORDOVICIAN

KNOX DOLOMITE OR GROUP..... 367KNOX
NEWALA LIMESTONE..... 367NEWL

CAMBRIAN

UPPER CAMBRIAN

CONASAUGA FORMATION..... 371CNSG
MAYNARDVILLE LIMESTONE..... 371MDVL

MIDDLE CAMBRIAN

MARYVILLE LIMESTONE..... 374MRVL

LOWER CAMBRIAN

ROME FORMATION..... 377ROME
SHADY FORMATION..... 377SHDY
WEISNER FORMATION..... 377WSNR

PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB

HAWAII

CENOZOIC

CORALLINE RUBBLE DEPOSITS	100CLRB
CENOZOIC ERATHEM	100CNZC
LIMESTONE	100LMSN
VOLCANIC ROCK	100VLCC

QUATERNARY

KAU VOLCANIC SERIES,UNDIFFERENTIATED	110KAU
PUNA VOLCANIC SERIES,UNDIFFERENTIATED	110PUNA
QUATERNARY SYSTEM	110QRNR

HOLOCENE

ARTIFICIAL FILL	111AFCF
ALLUVIUM AND LANDSLIDE DEPOSITS,UNCONSOLIDATED	111ALVD
HOLOCENE ALLUVIUM	111ALVM
ALLUVIAL AND LANDSLIDE DEPOSITS,UNCONSOLIDATED	111AVLD
BEACH DEPOSITS	111BECH
DUNE SAND,CALCAREOUS,UNCONSOLIDATED	111DUNC
DUNE SAND,NONCALCAREOUS,UNCONSOLIDATED	111DUNN
HOLOCENE SERIES	111HLCN
HUALALAI VOLCANIC SERIES,HISTORIC VOLCANIC ROCKS	111HULLH
HISTORIC VOLCANIC ROCKS (LAVA FLOWS OF 1750?)	111HV75
KAU VOLCANIC SERIES,HISTORIC VOLCANIC ROCKS	111KUAV
LAKE DEPOSIT,UNCONSOLIDATED CALCAREOUS SAND	111LKUC
LAUPAHOEHOE VOLCANIC SERIES,LAVA FLOWS AND CINDER OF UPPER MEMBER	111LPHHU
PUNA VOLCANIC SERIES,HISTORIC CINDER CONES	111PNCCH
PUNA VOLCANIC SERIES,HISTORIC LITTORAL CONES	111PNLCH
PUNA VOLCANIC SERIES,HISTORIC LAVA FLOWS	111PNLFH
UNCONSOLIDATED CALCAREOUS DUNE SAND	111UCCD

PLEISTOCENE

ALLUVIUM,OLDER	112ALVM
AINONI VOLCANICS	112ANON
ALLUVIUM AND LANDSLID DEPOSITS,CONSOLIDATED	112AVLD
BLACK POINT BASALT	112BCKP
BIG FALLS PICRITIC BASALTS, HANA VOLCANIC SERIES	112BGFL
CALCAREOUS MARINE DEPOSITS (LIMESTONE),CONSOLIDATED	112CCCM
CALCAREOUS DEPOSITS (LIMESTONE),CONSOLIDATED	112CDCC
MARINE DEPOSITS (LIMESTONE),CONSOLIDATED	112CDDM
CASTLE VOLCANICS	112CSTL
DIAMOND HEAD TUFF	112DMHD
DUNE SAND,CALCAREOUS,CONSOLIDATED	112DUNC
FLUVIAL,PERIGLACIAL,AND GLACIAL CONGLOMERATES	112FVPG
HANA VOLCANIC SERIES,UNDIFFERENTIATED	112HANA
HAWI VOLCANIC SERIES,UNDIFFERENTIATED	112HAWI
HAIKU VOLCANICS	112HIKU
HILINA VOLCANIC SERIES,LAVA FLOWS	112HILN
HAMAKUA VOLCANIC SERIES,CINDER CONES	112HKCC
HAMAKUA VOLCANIC SERIES,LAVA FLOWS	112HKLF
HUALALAI VOLCANIC SERIES,PREHISTORIC ASH AND CINDER DEPOSITS	112HLAC

HUALALAI VOLCANIC SERIES,PREHISTORIC CINDER CONES..... 112HLCC
HUALALAI VOLCANIC SERIES,PREHISTORIC LAVA FLOWS..... 112HLLF
HAMAKUA VOLCANIC SERIES,UNDIFFERENTIATED..... 112HMKU
HANA VOLCANIC SERIES,CINDER CONES..... 112HNCC
HANA VOLCANIC SERIES,DIKE COMPARTMENTS..... 112HNDC
HANA VOLCANIC SERIES,FIREFOUNTAIN DEPOSITS OF ASH AND PUMICE..... 112HNFF
HANA VOLCANIC SERIES,IN KIPAHULU VALLEY..... 112HNKV
HANA VOLCANIC SERIES,LAVA FLOWS,UNDIFFERENTIATED..... 112HNLF
HONOLULU VOLCANIC SERIES, UNDIFFERENTIATED..... 112HNLL
HANAWI BASALTIC ANDESITE,HANA VOLCANIC SERIES..... 112HNWI
HUALALAI VOLCANIC SERIES,PREHISTORIC VOLCANIC ROCKS,UNDIFFERENTIATED.. 112HULL
HAWI VOLCANIC SERIES,CINDER CONES..... 112HWCC
HAWI VOLCANIC SERIES,DIKE COMPARTMENTS..... 112HWDC
HAWI VOLCANIC SERIES,LAVA FLOWS..... 112HWLF
HAWAIILOA VOLCANICS..... 112HWLO
KAAU VOLCANICS..... 112KAAU
KEANAE BASALT,HANA VOLCANIC SERIES..... 112KENE
KAHUKU VOLCANIC SERIES, CINDER CONES..... 112KHCC
KAHUKU VOLCANIC SERIES, LITTORAL CONES..... 112KHLC
KAHUKU VOLCANIC SERIES, LAVA FLOWS..... 112KHLF
KAHUKU VOLCANIC SERIES,UNDIFFERENTIATED..... 112KHUK
KIEKIE VOLCANIC SERIES,UNDIFFERENTIATED..... 112KIKI
KOKO VOLCANICS,FIREFOUNTAIN DEPOSITS..... 112KKFF
KIEKIE VOLCANIC SERIES,LAVA FLOWS..... 112KKLF
KIEKIE VOLCANIC SERIES,TUFFACEOUS DEPOSITS..... 112KKTF
KULA VOLCANIC SERIES,CINDER CONES..... 112KLCC
KULA VOLCANIC SERES,DIKE COMPARTMENTS..... 112KLDC
KALIHI VOLCANICS..... 112KLIH
KULA VOLCANIC SERIES,LAVA FLOWS..... 112KLLF
KALAUPAPA BASALT (LAVA FLOWS)..... 112KLPP
KULA VOLCANIC SERIES,TUFF DEPOSITS..... 112KLTF
KAMANAIKI BASALT..... 112KMNK
KAIMUKI BASALT..... 112KMUK
KANEOHE VOLCANICS..... 112KNOH
KOLOA VOLCANIC SERIES,ASH AND TUFFACEOUS SOIL BEDS..... 112KOAT
KOLOA VOLCANIC SERIES,CINDER CONES..... 112KOCC
KOKO VOLCANICS,UNDIFFERENTIATED..... 112KOKO
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KOLOA VOLCANIC SERIES,UNDIFFERENTIATED..... 112KOLO
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KUHIWA BASALTIC ANDESITE,HANA VOLCANIC SERIES..... 112KUHW
KULA VOLCANIC SERIES,UNDIFFERENTIATED..... 112KULA
KAU VOLCANIC SERIES,PREHISTORIC LITTORAL CONES..... 112KULC
KAU VOLCANIC SERIES,PREHISTORIC LAVA FLOWS..... 112KULF
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LAHAINA VOLCANIC SERIES, LAVA FLOWS..... 112LNLF
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LAUPAHOEHOE VOLCANIC SERIES,LOWER MEMBER,CINDER CONES..... 112LPCC
LAUPAHOEHOE VOLCANIC SERIES,LOWER MEMBER UNDIFFERENTIATED..... 112LPHHL
LAUPAHOEHOE VOLCNNIC SERIES,LOWER MEMBER,LAVA FLOWS..... 112LPLF
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MAKAPIPI BASALTS,HANA VOLCANIC SERIES..... 112MKPP
MOKAPU BASALT..... 112MKPU
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MOKOLEA BASALT..... 112MOKL
MOSSMAN PICRITIC BASALT,HANA VOLCANIC SERIES..... 112MSMN
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OHIA BASALT,HANA VOLCANIC SERIES..... 112OHIA
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PUNCHBOWL VOLCANICS, TUFF DEPOSITS..... 112PBTF
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PUNA VOLCANIC SERIES,PREHISTORIC LITTORAL CONES..... 112PNLC
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TANTALUS-SUGAR LOAF VOLCANIC ROCKS,FIREFOUNTAIN DEPOSITS..... 112TSLF
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KOOLAU VOLCANIC SERIES,DIKE COMPLEX..... 120KLDK
KOOLAU VOLCANIC SERIES,LAVA FLOWS..... 120KLLF
KOOLAU VOLCANIC SERIES,TUFF..... 120KLTF
KANAPOU VOLCANIC SERIES,UNDIFFERENTIATED..... 120KNPU
KOOLAU VOLCANIC SERIES,UNDIFFERENTIATED..... 120KOLU
KANAPOU VOLCANIC SERIES,CALDERA-FILLING VOLCANICS..... 120KPCF
KANAPOU VOLCANIC SERIES,EXTRA-CALDERA VOLCANICS..... 120KPEC
KAILUA VOLCANIC SERIES,DIKE COMPLEX..... 12CKUDK
KAILUA VOLCANIC SERIES,LAVA FLOWS..... 120KULF

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WAIANAE VOLCANIC SERIES,UNDIFFERENTIATED..... 120WINE
WAIANAE VOLCANIC SERIES,BRECCIA..... 120WNBC
WAIANAE VOLCANIC SERIES,DIKE COMPLEX..... 120WNDK
WAIANAE VOLCANIC SERIES,LAVA FLOWS..... 120WNLF
WAIANAE VOLCANIC SERIES,PYROCLASTIC DEPOSITS..... 120WNPY

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EAST MOLOKAI VOLCANIC SERIES,CALDERA COMPLEX..... 121EMCD
EAST MOLOKAI VOLCANIC SERIES,DIKE COMPARTMENT..... 121EMDC
EAST MOLOKAI VOLCANIC SERIES,UPPER MEMBER,DOMES..... 121EMDMU
EAST MOLOKAI VOLCANIC SERIES,LOWER MEMBER,LAVA FLOWS..... 121EMLFL
EAST MOLOKAI VOLCANIC SERIES,UPPER MEMBER,LAVA FLOWS..... 121EMLFU
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HONOMANU VOLCANIC SERIES,DIKE COMPARTMENTS..... 121HMDC
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HONOMANU VOLCANIC SERIES,LAVA FLOWS..... 121HMLF
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LANAI VOLCANIC SERIES,UNDIFFERENTIATED..... 121LANI
LANAI VOLCANIC SERIES,DIKE COMPARTMENTS..... 121LNDC
LANAI VOLCANIC SERIES,LAVA FLOWS..... 121LNLF
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MAKAWELI FORMATION,WAIMEA CANYON VOLCANIC SERIES,LAVA FLOWS..... 121MKWL
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NAPALI FORMATION,WAIMEA CANYON VOLCANIC SERIES..... 121NPLI
OLOKELE FORMATION, WAIMEA CANYON VOLCANIC SERIES..... 121OLKL
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PANIAU VOLCANIC SERIES,UNDIFFERENTIATED..... 121PNIU
PANIAU VOLCANIC SERIES,LAVA FLOWS..... 121PNLF
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WAILUKU VOLCANIC SERIES,DIKE COMPARTMENT (NOT PART OF DIKE COMPLEX)... 121WKCD
WAILUKU VOLCANIC SERIES,DIKE COMPLEX..... 121WKDK
WAILUKU VOLCANIC SERIES,FIREFOUNTAIN DEPOSITS OF TUFF..... 121WKFF
WAILUKU VOLCANIC SERIES,LAVA FLOWS..... 121WKLF
WAILUKU VOLCANIC SERIES,LAVA CONES..... 121WKLV
WAILUKU VOLCANIC SERIES,PIT CRATER DEPOSITS,BRECCIA AND CONGLOMERATE.. 121WKPC
WAILUKU VOLCANIC SERIES,UNDIFFERENTIATED..... 121WLUK
WEST MOLOKAI VOLCANIC SERIES,BASALT CINDER CONES..... 121WMCC
WAIMEA CANYON VOLCANIC SERIES,UNDIFFERENTIATED..... 121WMCN
WEST MOLOKAI VOLCANIC SERIES,DIKE COMPARTMENT..... 121WMDC
WEST MOLOKAI VOLCANIC SERIES,BASALT LAVA FLOWS..... 121WMLF
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CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

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QUATERNARY SYSTEM..... 110QRNR
SEDIMENTS..... 110SDMS
TRAVERTINE..... 110TRVN
VOLCANICS..... 110VLCC

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HOLOCENE SERIES..... 111HLCN
SNAKE RIVER GROUP..... 111SKRV
TERRACE GRAVEL,YOUNGER..... 111TRRCY
TRAVERTINE..... 111TRVN

PLEISTOCENE

ALLUVIUM..... 112ALVM
AMERICAN FALLS LAKE BEDS..... 112AMCF
BLACK MESA GRAVEL OF IDAHO GROUP..... 112BCKM
BIG HOLE BASALT OF SNAKE RIVER GROUP..... 112BGHL
BURLEY LAKE BEDS..... 112BRLY
BRUNEAU FORMATION..... 112BRUN
BANCROFT SPRINGS BASALT OF SNAKE RIVER GROUP..... 112BSPG
CEDAR BUTTE BASALT..... 112CDRB
CROWSNEST GRAVEL OF SNAKE RIVER GROUP..... 112CRSS
FALLS RIVER BASALT..... 112FLRV
GLENNS FERRY FORMATION OF IDAHO GROUP..... 112GLFR
GERRIT BASALT..... 112GRRT
HUCKLEBERRY RIDGE TUFF..... 112HKBR
IDAHO GROUP..... 1121DHO
LITTLE CREEK FORMATION..... 112LLCK
LAVA CREEK TUFF..... 112LVCK
MALAD MEMBER OF THOUSAND SPRINGS BASALT..... 112MALD
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MCKINNEY BASALT OF SNAKE RIVER GROUP..... 112MCKN
MADISON BASALT OF SNAKE RIVER GROUP..... 112MDSN
MENAN TUFF..... 112MENN
MELON GRAVEL OF SNAKE RIVER GROUP..... 112MEON
MESA FALLS TUFF..... 112MFLS
MINIDOKA BASALT..... 112MNDK
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PLEISTOCENE SERIES..... 112PLSC
PLATEAU RHYOLITE..... 112PLTU
PALOUSE FORMATION..... 112PLUS
RAFT FORMATION..... 112RAFT
SUGAR BOWL GRAVEL OF SNAKE RIVER GROUP..... 112SGBL
SUNBEAM FORMATION..... 112SNBM
SAND SPRINGS BASALT OF SNAKE RIVER GROUP..... 112SSPG

TERRACE GRAVEL,OLDER..... 112TRRCO
TRAVERTINE..... 112TRVN
THOUSAND SPRINGS BASALT OF SNAKE RIVER GROUP..... 112TSPG
TUANA GRAVEL OF IDAHO GROUP..... 112TUAN
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TERTIARY

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TERTIARY SYSTEM..... 120TRTR
VOLCANICS..... 120VLCC

PLIOCENE

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COUGAR POINT WELDED TUFF..... 121CGRP
CHALK HILLS FORMATION OF IDAHO GROUP..... 121CLKH
DONKEY FANGLOMERATE..... 121DNKY
EAGLE ROCK TUFF..... 121EGRK
HAGERMAN LAKE BEDS..... 121HGRM
IDAVADE VOLCANICS..... 121IDVD
MASSACRE VOLCANICS..... 121MSCR
NEELEY FORMATION..... 121NELY
POISON CREEK FORMATION OF IDAHO GROUP..... 121PCRK
PLIOCENE SERIES..... 121PLCN
PAYETTE FORMATION..... 121PYTT
ROCKLAND VALLEY BASALT..... 121RCKV
SALT LAKE FORMATION..... 121SLLK
STARLIGHT FORMATION..... 121SRLG
WALCOTT TUFF..... 121WLCT

MIOCENE

COLUMBIA RIVER GROUP..... 122CBRV
CHALLIS VOLCANICS..... 122CLLS
GERMER TUFFACEOUS MEMBER OF CHALLIS VOLCANICS..... 122GRMR
LATAH FORMATION..... 122LATH
MIOCENE SERIES..... 122MOCN
OWYHEE BASALT..... 122OWYH
SUCCOR CREEK FORMATION..... 122SCCK
YANKEE FORK RHYOLITE MEMBER OF CHALLIS VOLCANICS..... 122YKFK

OLIGOCENE

OLIGOCENE SERIES..... 123OLGC

EOCENE

EOCENE SERIES..... 124EOCN
WASATCH FORMATION..... 124WSTC

PALEOCENE

PALEOCENE SERIES..... 125PLCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

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GRANITE CREEK GRANODIORITE..... 210GRCK
GRANITIC ROCKS..... 210GRNC
PACKSADDLE MOUNTAIN GRANODIORITE..... 210PCKM
TYGEE SANDSTONE OF GANNETT GROUP..... 210TYGE

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UPPER CRETACEOUS SERIES..... 211CRCSU
FRONTIER SANDSTONE..... 211FRNR
IDAHO BATHOLITH..... 211IDAH
WAYAN FORMATION..... 211WAYN

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ASPEN SHALE..... 217ASPN
BECHLER FORMATION OF GANNETT GROUP..... 217BCLR
BEAR RIVER FORMATION..... 217BRRV
LOWER CRETACEOUS SERIES..... 217CRCSL
DRANEY LIMESTONE OF GANNETT GROUP..... 217DRNY
EPHRAIM CONGLOMERATE OF GANNETT GROUP..... 217EPRM
GANNETT GROUP..... 217GNNT
HOMER LIMESTONE MEMBER OF WAYAN FORMATION..... 217HOMR
KOOTENAI FORMATION..... 217KOTN
PETERSON LIMESTONE OF GANNETT GROUP..... 217PRSN
THERMOPOLIS SHALE..... 217TMPL

JURASSIC

JURASSIC SYSTEM..... 220JRSC

UPPER JURASSIC

UPPER JURASSIC SERIES..... 221JRSCU
LEEDS CREEK MEMBER OF TWIN CREEK LIMESTONE..... 221LDCK
MORRISON FORMATION..... 221MRRS
PREUSS SANDSTONE OR REDBEDS..... 221PRSS
STUMP SANDSTONE..... 221STMP
TWIN CREEK LIMESTONE..... 221TCRK
WOLVERINE CANYON LIMESTONE MEMBER OF PREUSS SANDSTONE..... 221WLVC
WATTON CANYON MEMBER OF TWIN CREEK LIMESTONE..... 221WNCN

MIDDLE JURASSIC

BOUNDARY RIDGE MEMBER OF TWIN CREEK LIMESTONE..... 224BDRG
ELLIS GROUP..... 224ELLS
GIRAFFE CREEK MEMBER OF TWIN CREEK LIMESTONE..... 224GFCK
MIDDLE JURASSIC SERIES..... 224JRSCM
RICH MEMBER OF TWIN CREEK LIMESTONE..... 224RICH

SLIDEROCK MEMBER OF TWIN CREEK LIMESTONE..... 224SDCK

LOWER JURASSIC

LOWER JURASSIC SERIES..... 227JRSCL
NUGGET SANDSTONE..... 227NGGT

TRIASSIC

HIGHAM GRIT..... 230HGHM
LANES TONGUE OF ANKAREH FORMATION..... 230LNES
TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

ANKAREH FORMATION..... 231ANKR
DEADMAN LIMESTONE..... 231DDMN
LUCILE SLATE..... 231LULL
SEVEN DEVILS VOLCANICS..... 231SVDV
UPPER TRIASSIC SERIES..... 231TRSCU
WOOD SHALE TONGUE OF ANKAREH FORMATION..... 231WOOD

MIDDLE TRIASSIC

MIDDLE TRIASSIC SERIES..... 234TRSCM

LOWER TRIASSIC

DINWOODY FORMATION..... 237DNDY
FORT HALL FORMATION OF THAYNES GROUP..... 237FRHL
PORTNEUF LIMESTONE MEMBER OF THAYNES GROUP..... 237PRNF
ROSS FORK LIMESTONE OF THAYNES GROUP..... 237RFRK
TIMOTHY SANDSTONE..... 237TMTY
LOWER TRIASSIC SERIES..... 237TRSCL
THAYNES LIMESTONE FORMATION OR GROUP..... 237TYNS
WOODSIDE FORMATION OR SILTSTONE..... 237WDSD

PALEOZOIC

BERG CREEK AMPHIBOLITE OF RIGGINS GROUP..... 300BGCK
CLASTIC ROCKS..... 300CLSC
CARBONATE ROCKS..... 300CRBN
FIDDLE CREEK SCHIST OF RIGGINS GROUP..... 300FDCK
LIGHTNING CREEK SCHIST OF RIGGINS GROUP..... 300LGCK
PALEOZOIC ERATHEM..... 300PLZC
RIGGINS GROUP..... 300RGNS
RAMEY RIDGE COMPLEX..... 300RMRG
SQUAW CREEK SCHIST OF RIGGINS GROUP..... 300SQCK

PERMIAN

FRANSON MEMBER OR TONGUE OF PARK CITY FORMATION..... 310FRNS
GRANDEUR MEMBER OR TONGUE OF PARK CITY FORMATION..... 310GRDR
MEADE PEAK PHOSPHATIC SHALE MEMBER OR TONGUE OF PHOSPHORIA FORMATION.. 310MDPK
PARK CITY FORMATION..... 310PRKC
PERMIAN SYSTEM..... 310PRMN

PHOSPHORIA FORMATION..... 310PSPR
REX CHERT MEMBER OF PHOSPHORIA FORMATION..... 310REX
RETORT PHOSPHATIC SHALE MEMBER OR TONGUE OF PHOSPHORIA FORMATION..... 310RTRT
SHEDHORN SANDSTONE..... 310SDRN
WOOD RIVER FORMATION..... 310WDRV
WELLS FORMATION..... 310WLLS

UPPER PERMIAN

UPPER PERMIAN SERIES..... 311PRMNU

LOWER PERMIAN

OQUIRRH GROUP..... 317OQRR
LOWER PERMIAN SERIES..... 317PRMNL

PENNSYLVANIAN

AMSDEN FORMATION..... 320AMSD
PENNSYLVANIAN SYSTEM..... 320PSLV
QUADRANT SANDSTONE..... 320QDRN

UPPER PENNSYLVANIAN

UPPER PENNSYLVANIAN SERIES..... 321PSLVU

MIDDLE PENNSYLVANIAN

MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM

LOWER PENNSYLVANIAN

LOWER PENNSYLVANIAN SERIES..... 327PSLVL

MISSISSIPPIAN

BRAZER LIMESTONE OR DOLOMITE..... 330BRZR
DEEP CREEK FORMATION..... 330DPCK
MILLIGEN FORMATION..... 330MLGN
MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

CHESTERFIELD RANGE GROUP..... 331CFRG
GREAT BLUE LIMESTONE OR FORMATION..... 331GRBL
LITTLE FLAT FORMATION OF CHESTERFIELD RANGE GROUP..... 331LLFL
MADISON GROUP (UPPER AND LOWER MISSISSIPPIAN..... 331MDSN
MONROE CANYON LIMESTONE OF CHESTERFIELD RANGE GROUP..... 331MNRC
MISSION CANYON LIMESTONE..... 331MSNC
MISSISSIPPIAN, UPPER..... 331MSSPU
WHITE KNOB LIMESTONE..... 331WKNB

LOWER MISSISSIPPIAN

LODGEPOLE LIMESTONE OF MADISON GROUP..... 337LDGP
MISSISSIPPIAN, LOWER..... 337MSSPL

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

DARBY FORMATION..... 341DRBY
DEVONIAN, UPPER..... 341DVNNU
GRAND VIEW DOLOMITE..... 341GRDV
THREE FORKS SHALE..... 341TRFK

MIDDLE DEVONIAN

DEVONIAN, MIDDLE..... 344DVNNM
JEFFERSON FORMATION..... 344JFFR

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL

SILURIAN

SILURIAN SYSTEM..... 350SLRN
TRIAL CREEK FORMATION..... 350TLCK

UPPER SILURIAN

SILURIAN, UPPER..... 351SLRNU

MIDDLE SILURIAN

SILURIAN, MIDDLE..... 354SLRNM

LOWER SILURIAN

SILURIAN, LOWER..... 357SLRNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

BIGHORN DOLOMITE..... 361BGRN
FISH HAVEN DOLOMITE..... 361FSHV
ORDOVICIAN, UPPER..... 361ODVCU
SATURDAY MOUNTAIN FORMATION..... 361SRDM

MIDDLE ORDOVICIAN

GARDEN CITY FORMATION..... 364GRDC
ORDOVICIAN, MIDDLE..... 364ODVCM

LOWER ORDOVICIAN

ORDOVICIAN, LOWER..... 367ODVCL

PHI KAPPA FORMATION..... 367PKPP
RAMSHORN SLATE..... 367RMSR

CAMBRIAN

BAYHORSE DOLOMITE..... 370BYRS
CAMBRIAN SYSTEM..... 370CMBR
GARDEN CREEK PHYLLITE..... 370GDCK

UPPER CAMBRIAN

CAMBRIAN, UPPER..... 371CMBRU
GALLATIN LIMESTONE..... 371GLTN
GROVE CREEK LIMESTONE MEMBER OF SNOWY RANGE FORMATION..... 371GRVK
NOUNAN LIMESTONE..... 371NUNN
PILGRIM LIMESTONE..... 371PLGM
ST CHARLES LIMESTONE..... 371SCRL
SNOWY RANGE FORMATION..... 371SNRG
WORM CREEK QUARTZITE MEMBER OF ST CHARLES LIMESTONE..... 371WMCK

MIDDLE CAMBRIAN

BLOOMINGTON FORMATION..... 374BLMG
BRIGHAM QUARTZITE..... 374BRGM
CAMBRIAN, MIDDLE..... 374CMBRM
FLATHEAD LIMESTONE..... 374FLTD
GOLD CREEK QUARTZITE..... 374GDCK
GROS VENTRE FORMATION..... 374GRVR
LAKEVIEW LIMESTONE..... 374LKVW
LANGSTON LIMESTONE..... 374LNGS
MEAGHER LIMESTONE..... 374MGHR
PARK SHALE..... 374PARK
RENNIE SHALE..... 374RNNI
SPENCE SHALE MEMBER OF UTE LIMESTONE..... 374SPNC
UTE LIMESTONE..... 374UTE

LOWER CAMBRIAN

LOWER CAMBRIAN SERIES..... 377CMBRL

PRECAMBRIAN

ALBION RANGE GROUP..... 400ABRG
BELT SERIES..... 400BELT
BLACKTAIL FORMATION..... 400BLCK
BOEHLS BUTTE FORMATION OF BELT SERIES..... 400BLSB
BURKE FORMATION OF RAVALLI GROUP OF BELT SERIES..... 400BURK
EAST FORK FORMATION..... 400EFRK
HUCKLEBERRY FORMATION..... 400HCKB
HYNDMAN FORMATION..... 400HNDM
HOODOO QUARTZITE..... 400HOOD
LEOLA VOLCANICS..... 400LEOL
LEMHI QUARTZITE..... 400LMHI
MONK FORMATION..... 400MONK
PRECAMBIAN ERATHEM..... 400PCMB
PRICHARD SLATE FORMATION OF BELT SERIES..... 400PRCD

RAVALLI GROUP OF BELT SERIES..... 400RVLL
REVETT FORMATION OF RAVALLI GROUP OF BELT SERIES..... 400RVTT
ST REGIS FORMATION OF RAVALLI GROUP OF BELT SERIES..... 400SRGS
SWAUGER QUARTZITE..... 400SWGR
WALLACE FORMATION..... 400WLLC
YELLOWJACKET FORMATION..... 400YJCK

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

DUNE DEPOSIT..... 110DUNE
QUATERNARY SYSTEM..... 110QRNR
TERRACE DEPOSITS..... 110TRRC
VALLEY TRAIN DEPOSITS..... 110VLTR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
COLLUVIUM..... 111CLVM
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

ICE CONTACT DEPOSITS..... 112ICCC
LAKE DEPOSITS..... 112LAKE
LAFAYETTE GRAVEL..... 112LFTT
LOESS..... 112LOSS
OUTWASH..... 112OTWS
PLEISTOCENE SERIES..... 112PLSC
TILL..... 112TILL

TERTIARY

OHIO RIVER FORMATION..... 120ORVR
TERTIARY SYSTEM..... 120TRTR

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

UPPER PENNSYLVANIAN

BOND FORMATION..... 321BOND
MCLEANSBORO GROUP..... 321MCLB
MATTOON FORMATION..... 321MTTN
UPPER PENNSYLVANIAN SERIES..... 321PSLVU
PATOKA FORMATION..... 321PTOK
SHELBURN FORMATION..... 321SLBR

MIDDLE PENNSYLVANIAN

BRAZIL FORMATION..... 324BRZL
CARBONDALE FORMATION..... 324CBDL
DUGGER FORMATION..... 324DGGR

LINTON FORMATION..... 324LNTN
MANSFIELD FORMATION..... 324MFLD
PETERSBURG FORMATION..... 324PRBG
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM
RACCOON CREEK..... 324RCCK
STAUNTON FORMATION..... 324STNN

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

PAOLI LIMESTONE..... 331POLI

CHESTERIAN

BEECH CREEK LIMESTONE..... 332BCCK
BIG CLIFTY SANDSTONE MEMBER OF GOLCONDA FORMATION..... 332BGCF
BETHEL FORMATION..... 332BTHL
BEAVER BEND LIMESTONE..... 332BVBD
CLORE LIMESTONE..... 332CLOR
CHESTERIAN SERIES..... 332CSTR
DEGONIA SANDSTONE..... 332DGON
ELWREN FORMATION..... 332ELWR
GOLCONDA LIMESTONE..... 332GLCD
GLEN DEAN LIMESTONE..... 332GLND
HARDINSBURG SANDSTONE..... 332HDBG
KINKAID LIMESTONE..... 332KNKD
MENARD LIMESTONE..... 332MNRD
PALESTINE SANDSTONE..... 332PLSN
REELSVILLE LIMESTONE..... 332RLVL
SAMPLE SANDSTONE..... 332SMPL
STEPHENSPORT GROUP..... 332SPPR
TAR SPRINGS SANDSTONE..... 332TSPG
VIENNA LIMESTONE..... 332VINN
WEST BADEN GROUP..... 332WSBD

MERAMECIAN

BLUE RIVER GROUP..... 333BLRV
HARRODSBURG LIMESTONE..... 333HDBG
MERAMECIAN SERIES..... 333MRMC
SANDERS GROUP..... 333SDRS
STE GENEVIEVE LIMESTONE..... 333SGVV
SALEM LIMESTONE..... 333SLEM
ST LOUIS LIMESTONE..... 333STLS

LOWER MISSISSIPPIAN

MISSISSIPPIAN, LOWER..... 337MSSPL

OSAGEAN

BORDEN FORMATION..... 338BRDN
CARWOOD FORMATION..... 338CRWD

LOCUST POINT FORMATION..... 338LCSP
MULDRAUGH FORMATION..... 338MLDG
NEW PROVIDENCE SHALE..... 338NPVC
OSAGEAN SERIES..... 338OSGE

KINDERHOOKIAN

KINDERHOOKIAN SERIES..... 339KDRK
ROCKFORD LIMESTONE..... 339RCKF

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN
NORTH VERNON LIMESTONE..... 340NRVR

UPPER DEVONIAN

NEW ALBANY SHALE..... 341NALB

MIDDLE DEVONIAN

DEVONIAN, MIDDLE..... 344DVNNM
GENEVA DOLOMITE..... 344GENV
JEFFERSONVILLE LIMESTONE..... 344JFVL
PENDLETON SANDSTONE..... 344PNDL

SILURIAN

SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

SALINA FORMATION..... 351SLIN
SILURIAN, UPPER..... 351SLRNU

MIDDLE SILURIAN

LOUISVILLE LIMESTONE..... 354LSVL
SALAMONIE DOLOMITE..... 354SLMN
SILURIAN, MIDDLE..... 354SLRNM
WABASH FORMATION..... 354WBSH
WALDRON SHALE..... 354WLDR

LOWER SILURIAN

BRASSFIELD LIMESTONE..... 357BFLD
SILURIAN, LOWER..... 357SLRNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

DILLSBORO FORMATION..... 361DLBR
KOPE FORMATION..... 361KOPE

ORDOVICIAN, UPPER..... 361ODVCU
SALUDA FORMATION..... 361SLUD
WHITEWATER FORMATION..... 361WTTR

MIDDLE ORDOVICIAN

JOACHIM DOLOMITE..... 364JCHM
LEXINGTON LIMESTONE..... 364LXNG
ORDOVICIAN, MIDDLE..... 364ODVCM
ST PETER SANDSTONE..... 364STPR
TRENTON LIMESTONE..... 364TRNN

CHAMPLAINIAN

BLACK RIVER FORMATION..... 365BKRV

LOWER ORDOVICIAN

KNOX DOLOMITE..... 367KNOX

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR
MT SIMON SANDSTONE..... 370MSMN

UPPER CAMBRIAN

EAU CLAIR SANDSTONE..... 371ECLR
MOUNT SIMON SANDSTONE..... 371MSMN

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN
LOESS..... 111LOSS

PLEISTOCENE

AFTONIAN INTERGLACIAL DEPOSITS..... 112AFNN
BURIED CHANNEL AQUIFER..... 112BDCL
DRIFT..... 112DRFT
ILLINOIAN GLACIAL DEPOSITS..... 112ILNN
KANSAN GLACIAL DEPOSITS..... 112KNSN
NEBRASKAN GLACIAL DEPOSITS..... 112NBRK
OUTWASH..... 112OTSH
PLEISTOCENE SERIES..... 112PLSC
SANGAMON INTERGLACIAL DEPOSITS..... 112SNGM
WISCONSIN GLACIAL DEPOSITS..... 112WSCS
YARMOUTH INTERGLACIAL DEPOSITS..... 112YRMT

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

COLORADO GROUP..... 211CLRD
CARLILE SHALE..... 211CRLL
GREENHORN LIMESTONE..... 211GRNR
GRANEROS SHALE..... 211GRRS

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL
DAKOTA GROUP..... 217DKOT

JURASSIC

FORT DODGE FORMATION..... 220FDDG
JURASSIC SYSTEM..... 220JRSC

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

VIRGILIAN

DOUGLAS GROUP..... 322DGLS
SHAWNEE GROUP..... 322SHWN
VIRGILIAN SERIES..... 322VRGL
WABAUNSEE GROUP..... 322WBNS

MISSOURIAN

KANSAS CITY GROUP..... 323KSSC
LANSING GROUP..... 323LNSG
MISSOURIAN SERIES..... 323MSSR
PLEASANTON GROUP..... 323PLSN

DES MOINESIAN

CHEROKEE GROUP..... 325CHRK
DES MOINESIAN SERIES..... 325DSMS
MARMATON GROUP..... 325MRMN

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

MERAMECIAN

MERAMECIAN SERIES..... 333MRMC
STE GENEVIEVE LIMESTONE..... 333SGVV
SPERGEN FORMATION..... 333SPRG
ST LOUIS LIMESTONE..... 333STLS

OSAGEAN

BURLINGTON LIMESTONE..... 338BRLG
CEDAR FORK MEMBER OF BURLINGTON LIMESTONE..... 338CDFK
DOLBEE CREEK MEMBER OF BURLINGTON LIMESTONE..... 338DBCK
HAIGHT CREEK MEMBER OF BURLINGTON LIMESTONE..... 338HGCK
KEOKUK FORMATION..... 338KKUK
OSAGEAN SERIES..... 338OSGE
WARSAW FORMATION..... 338WRSW

KINDERHOOKIAN

CHAPIN MEMBER OF HAMPTON FORMATION..... 339CHPN
EAGLE CITY MEMBER OF HAMPTON FORMATION..... 339EGLC
GILMORE CITY LIMESTONE..... 339GLMC
HAMPTON FORMATION..... 339HMPN
IOWA FALLS MEMBER OF HAMPTON FORMATION..... 3391FLS

KINDERHOOKIAN SERIES..... 339KDRK
MCCRANEY LIMESTONE..... 339MCCR
MAYNE CREEK MEMBER OF HAMPTON FORMATION..... 339MCRK
NORTH HILL MEMBER OF HAMPTON FORMATION..... 339NRHL
PROSPECT HILL FORMATION..... 339PPCH
WASSONVILLE MEMBER OF HAMPTON FORMATION..... 339WSVL

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

APLINGTON FORMATION..... 341APLG
CERRO GORDO MEMBER OF LIME CREEK FORMATION..... 341CRGD
DEVONIAN, UPPER..... 341DVNNU
ENGLISH RIVER FORMATION..... 341EGRV
ENGLISH RIVER AND PROSPECT HILL FORMATIONS..... 341ERPH
INDEPENDENCE SHALE..... 341IDPC
JUNIPER HILL MEMBER OF LIME CREEK FORMATION..... 341JPHL
LIME CREEK FORMATION..... 341LMCK
MAPLE MILL SHALE..... 341MPLM
MASON CITY MEMBER OF SHELL ROCK FORMATION..... 341MSNC
NORA MEMBER OF SHELL ROCK FORMATION..... 341NORA
OWEN MEMBER OF SHELL ROCK FORMATION..... 341OWEN
ROCK GROVE MEMBER OF SHELL ROCK FORMATION..... 341RKGV
SHEFFIELD FORMATION..... 341SFLD
SHELL ROCK FORMATION..... 341SLCK
YELLOW SPRINGS GROUP..... 341YSPG

MIDDLE DEVONIAN

BERTRAM MEMBER OF WAPSIPINICON FORMATION..... 344BRRM
CEDAR VALLEY LIMESTONE..... 344CDVL
COGGON MEMBER OF WAPSIPINICON FORMATION..... 344CGGN
CORALVILLE MEMBER OF CEDAR VALLEY FORMATION..... 344CLVL
DEVONIAN, MIDDLE..... 344DVNNM
DAVENPORT MEMBER OF WAPSIPINICON FORMATION..... 344DVPR
KENWOOD MEMBER OF WAPSIPINICON FORMATION..... 344KNWD
OTIS MEMBER OF WAPSIPINICON FORMATION..... 344OTIS
RAPID MEMBER OF CEDAR VALLEY FORMATION..... 344RPID
SOLON MEMBER OF CEDAR VALLEY FORMATION..... 344SOLN
SPRING GROVE MEMBER OF WAPSIPINICON LIMESTONE..... 344SPGV
WAPSIPINICON FORMATION..... 344WPPC

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL
DEVONIAN-SILURIAN SYSTEMS..... 347DVSL
LA PORTE CITY CHERT..... 347LPRC

SILURIAN

SILURIAN SYSTEM..... 350SLRN

NIAGARAN

GOWER DOLOMITE..... 355GOWR
HOPKINTON DOLOMITE..... 355HPKN
NIAGARAN SERIES..... 355NIGR

ALEXANDRIAN

ALEXANDERIAN SERIES..... 358ALXD
EDGEWOOD FORMATION..... 358EDGD
KANKAKEE FORMATION..... 358KNKK

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

BRAINERD MEMBER OF MAQUOKETA FORMATION..... 361BRRD
CLERMONT SHALE MEMBER OF MAQUOKETA FORMATION..... 361CLRM
ELGIN MEMBER OF MAQUOKETA FORMATION..... 361ELGN
FORT ATKINSON MEMBER OF MAQUOKETA FORMATION..... 361FRAK
MAQUOKETA FORMATION..... 361MQKT
NEDA MEMBER OF MAQUOKETA FORMATION..... 361NEDA
ORDOVICIAN, UPPER..... 361ODVCU

MIDDLE ORDOVICIAN

DECORAH-PLATTEVILLE FORMATIONS..... 364DCPV
DECORAH FORMATION..... 364DCRH
DUBUQUE MEMBER OF GALENA FORMATION..... 364DUBQ
GUTTENBERG MEMBER OF DECORAH FORMATION..... 364GBRG
GALENA FORMATION..... 364GLEN
GLENWOOD SHALE MEMBER OF PLATTEVILLE FORMATION..... 364GLNDH
GLENWOOD SANDSTONE MEMBER OF PLATTEVILLE FORMATION..... 364GLNDS
ION MEMBER OF DECORAH FORMATION..... 364ION
MCGREGOR MEMBER OF PLATTEVILLE FORMATION..... 364MCGG
ORDOVICIAN, MIDDLE..... 364ODVCM
PECATONICA MEMBER OF PLATTEVILLE FORMATION..... 364PCNC
PLATTEVILLE FORMATION..... 364PLVL
PROSSER MEMBER OF GALENA FORMATION..... 364PRSR
SPECHTS FERRY MEMBER OF DECORAH FORMATION..... 364SPCF
STEWARTVILLE MEMBER OF GALENA FORMATION..... 364SRVL
ST PETER SANDSTONE..... 364STPR

LOWER ORDOVICIAN

ORDOVICIAN, LOWER..... 367ODVCL
ONEOTA MEMBER OF PRAIRIE DU CHIEN FORMATION..... 367ONOT
ORDOVICIAN-CAMBRIAN SYSTEMS..... 367OVCB
PRAIRIE DU CHIEN FORMATION..... 367PRDC
ROOT VALLEY MEMBER OF PRAIRIE DU CHIEN FORMATION..... 367RTVL
WILLOW RIVER MEMBER OF PRAIRIE DU CHIEN FORMATION..... 367WLRV

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

BAD AXE MEMBER OF FRANCONIA SANDSTONE..... 371BDAX
CAMBRIAN, UPPER..... 371CMBRU
DRESBACH GROUP..... 371DRBC
EAU CLAIR SANDSTONE..... 371ECLR
FRANCONIA SANDSTONE..... 371FRNC
GOODENOUGH MEMBER OF FRANCONIA SANDSTONE..... 371GDNG
GALESVILLE SANDSTONE..... 371GLVL
HUDSON MEMBER OF FRANCONIA SANDSTONE..... 371HDSN
IRONTON SANDSTONE MEMBER OF FRANCONIA SS.-GALESVILLE SS..... 371IGLV
IRONTON MEMBER OF FRANCONIA SANDSTONE..... 371IRNN
JORDAN SANDSTONE..... 371JRDN
MOUNT SIMON SANDSTONE..... 371MSMN
ST LAWRENCE FORMATION..... 371SLRC
TREMPEALEAU GROUP..... 371TMPL

PRECAMBRIAN

PRECAMBRIAN IGNEOUS ROCKS..... 400IGNS
PRECAMBRIAN METAMORPHIC ROCKS..... 400MMPC
PRECAMBRIAN ERATHEM..... 400PCMB
PRECAMBRIAN SEDIMENTARY ROCKS..... 400SDMR
SIOUX QUARTZITE..... 400SOUX

CENOZOIC

CENOZOIC ERATHEM..... 100CNCZ

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR
QUATERNARY-TERTIARY SYSTEMS..... 110QRRT

HOLOCENE

COLLUVIUM..... 111CLVM
HOLOCENE SERIES..... 111HLCN
RECENT STAGE..... 111RCNT

PLEISTOCENE

ATCHISON FORMATION..... 112ACSN
AFTONIAN STAGE..... 112AFNN
AFTON SOIL..... 112AFTN
EOLIAN-FLUVIAL DEPOSITS..... 112ALFV
ALLUVIUM..... 112ALVM
ANGELL MEMBER OF BALLARD FORMATION..... 112ANGL
ATWATER MEMBER OF CROOKED CREEK FORMATION..... 112ATTR
BIGNELL FORMATION..... 112BGNL
BUCKCREEK TERRACE DEPOSITS..... 112BKCK
BALLARD FORMATION..... 112BLRD
BRADYAN SANDSTONE..... 112BRDN
BRADY SOIL..... 112BRDY
CEDAR BLUFFS TILL..... 112CDBF
CROOKED CREEK FORMATION..... 112CKCK
CRETE FORMATION..... 112CRET
CARYAN SANDSTONE..... 112CRYN
DRIFT..... 112DRFT
DAVID CITY FORMATION..... 112DVDC
EOLIAN DEPOSITS..... 112EOLN
FULLERTON FORMATION..... 112FLRN
FLUVIAL DEPOSITS..... 112FLVL
GRAND ISLAND FORMATION..... 112GDID
HOLDREGE FORMATION..... 112HLDG
ILLINOISAN STAGE..... 112ILNN
IOWAN STAGE..... 112IOWN
IOWA POINT TILL..... 112IWPN
KANSAN GLACIOFLUVIAL DEPOSITS..... 112KGFV
KINGSDOWN FORMATION..... 112KGSD
KANSAN STAGE..... 112KNSN
KANSAN TILL..... 112KSTL
LOESS..... 112LOSS
LOVELAND FORMATION..... 112LVLD
MCPHERSON FORMATION..... 112MCPR
MEADE GROUP..... 112MEDE
MANKATOAN SUBSTAGE..... 112MNKN
MISSLER MEMBER OF BALLARD FORMATION..... 112MSLR
NEBRASKAN FLUVIOGLACIAL DEPOSITS..... 112NBFV

NEBRASKAN STAGE..... 112NBRK
NICKERSON TILL..... 112NCKR
NORTONVILLE CLAY..... 112NRVL
NEWMAN TERRACE DEPOSITS..... 112NWMN
OUTWASH..... 112OTSH
PLEISTOCENE-PLIOCENE SERIES..... 112PCPC
PLEISTOCENE SERIES..... 112PLSC
PLEISTOCENE SERIES,LOWER..... 112PLSCL
PLEISTOCENE SERIES,UPPER..... 112PLSCU
PEORIA FORMATION..... 112PORI
PEARLETTE ASH BED..... 112PRLT
RECENT-ILLINOISAN STAGES..... 112RCIS
REGOLITH,UNMAPPED..... 112RGLT
SAPPA FORMATION..... 112SAPP
STUMP ARROYO MEMBER OF CROOKED CREEK FORMATION..... 112SMPA
SANBORN GROUP..... 112SNBR
SANGAMON SOIL..... 112SNGM
TILL..... 112TILL
TERRACE DEPOSITS..... 112TRRC
TAZEWELLIAN SUBSTAGE..... 112TZLN
UPLAND CHERT GRAV..... 112UPCH
VANHEM FORMATION..... 112VNHM
WISCONSINAN STAGE..... 112WSCS
YARMOUTHIAN-NEBRASKAN STAGES..... 112YNBK
YARMOUTHIAN STAGE..... 112YRMN
YARMOUTH SOIL..... 112YRMT

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

ASH HOLLOW FORMATION..... 121ASHL
BLANCO FORMATION..... 121BLNC
CALVERT ASH BED OF VALENTINE MEMBER OF OGALLALA FORMATION..... 121CLVR
DELMORE FORMATION..... 121DLMR
DELLVALE ASH BED OF ASH HOLLOW MEMBER OF OGALLALA FORMATION..... 121DLVL
FORT WALLACE ASH BED OF ASH HOLLOW MEMBER OF OGALLALA FORMATION..... 121FWLC
GILMAN CANYON FORMATION..... 121GLMC
KIMBALL MEMBER OF OGALLALA FORMATION..... 121KMBL
LAVERNE FORMATION..... 121LVRN
NEOGENE-CRETACEOUS SYSTEMS..... 121NGCC
NEOGENE SYSTEM..... 121NOGN
OGALLALA-CHEYENNE-JURASSIC-TRIASSIC FORMATIONS AND SYSTEMS..... 121OCJT
OGALLALA-DAKOTA-CHEYENNE-JURASSIC-TRIASSIC FORMATIONS AND SYSTEMS..... 121ODCJ
OGALLALA-DAKOTA-CHEYENNE FORMATIONS..... 121ODKC
OGALLALA-DAKOTA FORMATIONS..... 121OGDK
OGALLALA-CHEYENNE FORMATIONS..... 121OGLC
OGALLALA FORMATION..... 121OGLL
PLIOCENE SERIES..... 121PCCN
REAGER ASH BED OF ASH HOLLOW MEMBER OF OGALLALA FORMATION..... 121REGR
RAWLINS ASH BED OF ASH HOLLOW MEMBER OF OGALLALA FORMATION..... 121RLNS
REAMSVILLE ASH BED OF ASH HOLLOW MEMBER OF OGALLALA FORMATION..... 121RMVL
REXROAD FORMATION..... 121RXRD
VALENTINE MEMBER OF OGALLALA FORMATION..... 121VLNN

XI MEMBER OF REXROAD FORMATION..... 121XI

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS
DAKOTA FORMATION..... 210DKOT

UPPER CRETACEOUS

BEECHER ISLAND SHALE MEMBER OF PIERRE SHALE..... 211BCID
BRIDGE CREEK LIMESTONE MEMBER OF GREENHORN LIMESTONE..... 211BGCK
BLUE HILL SHALE MEMBER OF CARLILE SHALE..... 211BLHL
CODELL SANDSTONE MEMBER OF CARLILE SHALE..... 211CDLL
COLORADO GROUP..... 211CLRD
UPPER CRETACEOUS SERIES..... 211CRCSU
CARLILE SHALE..... 211CRLL
FENCEPOST LIMESTONE BED OF PFEIFFER SHALE MEMBER OF GREEHORN LIMESTONE 211FCPS
FORT HAYS LIMESTONE MEMBER OF NIOBRARA FORMATION..... 211FRHS
FAIRPORT CHALKY SHALE MEMBER OF CARLILE SHALE..... 211FRPR
GREENHORN LIMESTONE..... 211GRNR
GRANEROS SHALE..... 211GRRS
HILLS POND PERIDOT..... 211HPDP
HARTLAND SHALE MEMBER OF GREENHORN LIMESTONE..... 211HRLD
JETMORE CHALK MEMBER OF GREENHORN LIMESTONE..... 211JTMR
LAKE CREEK SHALE MEMBER OF PIERRE SHALE..... 211LKCK
LINCOLN LIMESTONE MEMBER OF GREENHORN LIMESTONE..... 211LNCL
MONTANA GROUP..... 211MNTN
NIOBRARA CHALK..... 211NBRR
PFEIFER SHALE MEMBER OF GREENHORN LIMESTONE..... 211PFFR
PIERRE SHALE..... 211PIRR
SALT GRASS SHALE MEMBER OF PIERRE SHALE..... 211SLGR
SMOKY HILL CHALK MEMBER OF NIOBRARA CHALK..... 211SMKH
SHARON SPRINGS MEMBER OF PIERRE SHALE..... 211SSPG
WESKAN SHALE MEMBER OF PIERRE SHALE..... 211WSKN

GULFIAN

GULFIAN SERIES..... 212GLFN

LOWER CRETACEOUS

COCKRUM SANDSTONE..... 217CCKM
CHAMPION SHELL BED OF KIOWA SHALE..... 217CMPN
LOWER CRETACEOUS SERIES..... 217CRCSL
CRUISE SANDSTONE MEMBER OF OMADI FORMATION..... 217CRUS
CHEYENNE SANDSTONE..... 217CYNN
GURLEY SANDSTONE MEMBER OF OMADI FORMATION..... 217GRLY
HUNTSMAN SHALE MEMBER OF OMADI FORMATION..... 217HNSM
JANSSEN CLAY MEMBER OF DAKOTA FORMATION..... 217JNSN
KIOWA SHALE..... 217KIOW
OMADI FORMATION..... 217OMDI
TERRA COTTA CLAY MEMBER OF DAKOTA FORMATION..... 217TRCT

COMANCHEAN

COMANCHEAN SERIES..... 218CMNC

JURASSIC

JURASSIC-TRIASSIC SYSTEMS..... 220JCTC
JURASSIC SYSTEM..... 220JRSC

UPPER JURASSIC

UPPER JURASSIC SERIES..... 221JRSCU
MORRISON FORMATION..... 221MRSN

TRIASSIC

TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

DOCKUM GROUP..... 231DCKM
UPPER TRIASSIC SERIES..... 231TRSCU

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

JANESVILLE SHALE..... 310JSVL
MATFIELD SHALE..... 310MFLD
NOLANS LIMESTONE..... 310NLNS
NINNESCAH SHALE..... 310NNSC
ONAGA SHALE..... 310ONAG
PERMIAN SYSTEM..... 310PRMN
QUARTERMASTER FORMATION..... 310QRRM
WELLINGTON FORMATION..... 310WLNG
WHITEHORSE SANDSTONE OR GROUP..... 310WTRS

UPPER PERMIAN

BIG BASIN FORMATION..... 311BGBS
DAY CREEK DOLOMITE..... 311DCRK
KIGER SHALE MEMBER OF WHITEHORSE FORMATION..... 311KIGR
UPPER PERMIAN SERIES..... 311PRMNU
RELAY CREEK DOLOMITE MEMBER OF WHITEHORSE FORMATION..... 311RLCK
TALOGA FORMATION..... 311TLOG

GUADALUPIAN

BLAINE GYPSUM..... 313BLIN
DOG CREEK SHALE..... 313DGCK
FLOWERPOT SHALE..... 313FLRP
GUADALUPIAN SERIES..... 313GDLP
MARLOW FORMATION..... 313MRLW

LOWER PERMIAN

ADMIRE GROUP..... 317ADMR
AMERICUS LIMESTONE MEMBER OF FORAKER LIMESTONE..... 317AMRC
ASPINWALL LIMESTONE MEMBER OF ONAGA SHALE..... 317ASPL
BADER LIMESTONE..... 317BDER
BENNETT SHALE MEMBER OF RED EAGLE LIMESTONE..... 317BNNT
BARNESTON LIMESTONE..... 317BRNS
BLUE SPRINGS SHALE MEMBER OF MATFIELD SHALE..... 317BSPG
BEATTIE LIMESTONE..... 317BTTI
BURR LIMESTONE MEMBER OF GRENOLA LIMESTONE..... 317BURR
CRISFIELD SANDSTONE BED OF SALT PLAIN FORMATION..... 317CFLD
CHIKASKIA SANDSTONE MEMBER OF HARPER SANDSTONE..... 317CKSK
CIMARRONIAN STAGE..... 317CMRN
CARLTON LIMESTONE MEMBER OF WELLINGTON FORMATION..... 317CRLN
CRESSWELL LIMESTONE MEMBER OF WINFIELD LIMESTONE..... 317CRSL
CROUSE LIMESTONE..... 317CRUS
COTTONWOOD LIMESTONE MEMBER OF BEATTIE LIMESTONE..... 317CTTN
DOYLE SHALE..... 317DOYL
EISS LIMESTONE MEMBER OF BADER LIMESTONE..... 317EISS
EASLY CREEK SHALE..... 317ELCK
FLORENCE LIMESTONE MEMBER OF BARNESTOWN FORMATION..... 317FLRC
FLORENA SHALE MEMBER OF BEATTIE LIMESTONE..... 317FLRN
FALLS CITY LIMESTONE..... 317FLSC
FUNSTON LIMESTONE..... 317FNSN
FORT RILEY LIMESTONE MEMBER OF BARNESTON LIMESTONE..... 317FRRL
FIVE POINT LIMESTONE MEMBER OF JANESVILLE SHALE..... 317FVPN
GAGE SHALE MEMBER OF DOYLE SHALE..... 317GAGE
GLENROCK LIMESTONE MEMBER OF RED EAGLE LIMESTONE..... 317GLCK
GRANT SHALE MEMBER OF WINFIELD LIMESTONE..... 317GRNT
GEARYAN STAGE..... 317GRYN
HOUCHEN CREEK LIMESTONE MEMBER..... 317HCCK
HUTCHINSON SALT MEMBER OF WELLINGTON FORMATION..... 317HCNS
HUGHES CREEK SHALE MEMBER OF FORAKER LIMESTONE..... 317HGCK
HOLLENBERG LIMESTONE MEMBER OF WELLINGTON FORMATION..... 317HLBG
HOLMESVILLE SHALE MEMBER OF DOYLE SHALE..... 317HLMV
HAMLIN SHALE MEMBER OF JANESVILLE SHALE..... 317HMLN
HOOSER SHALE MEMBER OF BADER LIMESTONE..... 317HOSR
HOWE LIMESTONE MEMBER OF RED EAGLE LIMESTONE..... 317HOWE
HERINGTON LIMESTONE MEMBER OF NOLAN LIMESTONE..... 317HRNG
HARPER SANDSTONE..... 317HRPR
HASKEW GYPSUM MEMBER OF BLAINE GYPSUM..... 317HSKW
HAVENSVILLE SHALE MEMBER OF WREFORD LIMESTONE..... 317HVVL
HAWXBY SHALE MEMBER OF ONAGA SHALE..... 317HXBY
INDIAN CAVE SANDSTONE BED OF TOWLE SHALE MEMBER OF ONAGA SHALE..... 317IDCV
KINNEY LIMESTONE MEMBER OF MATFIELD SHALE..... 317KNNY
KRIDER LIMESTONE MEMBER NOLANS LIMESTONE..... 317KRDR
LONG CREEK LIMESTONE MEMBER OF FORAKER LIMESTONE..... 317LGCK
LEGION SHALE MEMBER OF GRENOLA LIMESTONE..... 317LGON
MEDICINE LODGE GYPSUM MEMBER OF BLAINE GYPSUM..... 317MCLG
MIDDLEBURG LIMESTONE MEMBER OF BADER LIMESTONE..... 317MDBG
MILAN DOLOMITE MEMBER OF WELLINGTON FORMATION..... 317MILN
MORRILL LIMESTONE MEMBER OF BEATTIE LIMESTONE..... 317MRRL
NEVA LIMESTONE MEMBER OF GRENOLA LIMESTONE..... 317NEVA
NIPPEWALLA GROUP..... 317NPPL
NESCATUNGA GYPSUM MEMBER OF BLAINE GYPSUM..... 317NSCG

OAKS SHALE BED OF HAMLIN MEMBER OF JANESVILLE SHALE..... 317OAKS
OKETA SHALE MEMBER OF BARNESTON LIMESTONE..... 317OKET
PADDOCK SHALE MEMBER OF NOLANS LIMESTONE..... 317PDCK
LOWER PERMIAN-UPPER PENNSYLVANIAN SERIES..... 317PMPV
LOWER PERMIAN SERIES..... 317PRMNL
RUNNYMEDE SANDSTONE MEMBER OF NINNESCAH SHALE..... 317RNMD
STONE CORRAL FORMATION..... 317SCRL
SCHROYER LIMESTONE MEMBER OF WREFORD LIMESTONE..... 317SCRR
SHIMER GYPSUM MEMBER OF BLAINE GYPSUM..... 317SHMR
SALEM POINT SHALE MEMBER OF GRENOLA LIMESTONE..... 317SLMP
SALLYARDS LIMESTONE MEMBER OF GRENOLA LIMESTONE..... 317SLRD
SUMNER GROUP..... 317SMNR
SPEISER SHALE..... 317SPSR
STEARNS SHALE..... 317SRNS
STINE SHALE BED OF HAMLIN SHALE MEMBER OF JANESVILLE SHALE..... 317STIN
STOVALL LIMESTONE MEMBER OF WINFIELD LIMESTONE..... 317STVL
TOWLE SHALE MEMBER OF ONAGA SHALE..... 317TOWL
THREEMILE LIMESTONE MEMBER OF WREFORD LIMESTONE..... 317TRML
TOWANDA LIMESTONE MEMBER OF DOYLE SHALE..... 317TWND
WEST BRANCH SHALE MEMBER OF JANESVILLE SHALE..... 317WBRC
WINFIELD LIMESTONE..... 317WFLD
WREFORD LIMESTONE..... 317WRFD
WYMORE SHALE MEMBER OF MATFIELD SHALE..... 317WYMR

LEONARDIAN

CEDAR HILLS SANDSTONE..... 318CDHL
KINGMAN SANDSTONE MEMBER OF HARPER SANDSTONE..... 318KNGM
LEONARDIAN SERIES..... 318LNRD
SALT PLAIN FORMATION..... 318SLPL

WOLFCAMPIAN

BLUE RAPIDS SHALE..... 319BRPD
COUNCIL GROVE GROUP..... 319CCGV
CHASE GROUP..... 319CHSE
ESKRIDGE SHALE..... 319EKDG
FORAKER LIMESTONE..... 319FRCK
GRENOLA LIMESTONE..... 319GRNL
JOHNSON SHALE..... 319JNSN
ODELL SHALE..... 319ODEL
RED EAGLE LIMESTONE..... 319RDEG
ROCA SHALE..... 319ROCA
WOLFCAMPIAN SERIES..... 319WFMP

PENNSYLVANIAN

GRANITE WASH..... 320GRWS
PENNSYLVANIAN SYSTEM..... 320PSLV
PENNSYLVANIAN-CAMBRIAN SYSTEMS..... 320PVCB

UPPER PENNSYLVANIAN

AMAZONIA LIMESTONE MEMBER OF LAWRENCE FORMATION..... 321AMZN
AARDE SHALE MEMBER OF HOWARD LIMESTONE..... 321ARDE
ARGENTINE LIMESTONE MEMBER OF WYANDOTTE LIMESTONE..... 321ARGN

AVOCA LIMESTONE MEMBER OF LECOMPTON LIMESTONE..... 321AVOC
BACHELOR CREEK LIMESTONE MEMBER OF HOWARD LIMESTONE..... 321BCCK
BEIL LIMESTONE MEMBER OF LECOMPTON LIMESTONE..... 321BEIL
BERN LIMESTONE..... 321BERN
BETHANY FALLS LIMESTONE MEMBER SWOPE FORMATION..... 321BFLS
BIG SPRINGS LIMESTONE MEMBER OF LECOMPTON LIMESTONE..... 321BGSP
BLOCK LIMESTONE MEMBER OF CHERRYVALE SHALE..... 321BLCK
BURLINGAME LIMESTONE MEMBER OF BERN LIMESTONE..... 321BLGM
BROWNVILLE LIMESTONE MEMBER OF WOOD SIDING FORMATION..... 321BRVL
CEDAR VALE SHALE MEMBER OF SCRANTON SHALE..... 321CDVL
COFFEYVILLE FORMATION..... 321CFVL
COTTAGE GROVE SANDSTONE OF CHANUTE SHALE..... 321CGGV
CHANUTE SHALE..... 321CHNT
CHURCH LIMESTONE MEMBER OF HOWARD LIMESTONE..... 321CHRC
CLAY CREEK LIMESTONE MEMBER OF KANWAKA SHALE..... 321CLCK
CEMENT CITY LIMESTONE MEMBER OF DRUM LIMESTONE..... 321CMNC
CANVILLE LIMESTONE MEMBER OF DENNIS LIMESTONE..... 321CNVL
CAPTAIN CREEK LIMESTONE MEMBER OF STANTON LIMESTONE..... 321CPCK
CORBIN CITY LIMESTONE MEMBER OF DRUM LIMESTONE..... 321CRBC
CHERRYVALE SHALE..... 321CRVL
CURZON LIMESTONE MEMBER OF TOPEKA LIMESTONE..... 321CRZN
CRITZER LIMESTONE MEMBER OF HERTHA LIMESTONE..... 321CRZR
DODDS CREEK SANDSTONE MEMBER OF GALESBURG SHALE..... 321DDCK
DEWEY LIMESTONE MEMBER OF DRUM LIMESTONE..... 321DEWY
DONIPHAN SHALE MEMBER OF LECOMPTON LIMESTONE..... 321DNPN
DOVER LIMESTONE MEMBER OF STOTLER LIMESTONE..... 321DOVR
DRY SHALE MEMBER OF STOTLER LIMESTONE..... 321DRY
DU BOIS LIMESTONE MEMBER OF TOPEKA LIMESTONE..... 321DUBS
ELMONT LIMESTONE MEMBER OF EMPORIA LIMESTONE..... 321ELMN
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EUDORA SHALE MEMBER OF STANTON LIMESTONE..... 321EUDR
ERVINE CREEK LIMESTONE MEMBER OF DEER CREEK LIMESTONE..... 321EVCK
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FRIEDRICH SHALE MEMBER OF ROOT SHALE..... 321FRDC
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FRISBIE LIMESTONE MEMBER WYANDOTTE LIMESTONE..... 321FRSB
GRANDHAVEN LIMESTONE MEMBER OF STOTLER LIMESTONE..... 321GRDV
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HOLT SHALE MEMBER OF TOPEKA LIMESTONE..... 321HOLT
HUSHPUCKNEY SHALE MEMBER OF SWOPE LIMESTONE..... 321HPCK
HAPPY HOLLOW LIMESTONE MEMBER OF SCRANTON SHALE..... 321HPHL
HEPLER SANDSTONE MEMBER OF SEMINOLE FORMATION..... 321HPLR
HARTFORD LIMESTONE MEMBER OF TOPEKA LIMESTONE..... 321HRFD
HASKELL LIMESTONE MEMBER OF LAWRENCE FORMATION..... 321HSKL
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ISLAND CREEK SHALE MEMBER OF WYANDOTTE LIMESTONE..... 321IDCK
IOWA POINT SHALE MEMBER OF TOPEKA LIMESTONE..... 321IPNT
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KEREFORD LIMESTONE MEMBER OF OREAD LIMESTONE..... 321KRFD
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MIDDLE CREEK LIMESTONE MEMBER OF SWOPE LIMESTONE..... 321MDCK
MOUND CITY SHALE MEMBER OF HERTHA LIMESTONE..... 321MNDC
MAPLE HILL LIMESTONE MEMBER OF ZEANDALE LIMESTONE..... 321MPLH
MERRIAM LIMESTONE MEMBER OF PLATTSBURG LIMESTONE..... 321MRRM
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QUEEN HILL SHALE MEMBER OF LECOMPTON LIMESTONE..... 321QNHL
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SHELDON LIMESTONE MEMBER OF TOPEKA LIMESTONE..... 321SLDN
SOUTH MOUND SHALE MEMBER OF SEMINOLE FORMATION..... 321SMND
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STULL SHALE MEMBER OF KANWAKA SHALE..... 321STLL
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VINLAND SHALE MEMBER OF STRANGER FORMATION..... 321VNLD
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WINTERSET LIMESTONE MEMBER OF DENNIS LIMESTONE..... 321WNRS
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WESTPHALIA LIMESTONE MEMBER OF STRANGER FORMATION..... 321WSPL
WESTON SHALE MEMBER OF STRANGER FORMATION..... 321WSTN
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LECOMPTON LIMESTONE..... 322LCMP
LAWRENCE SHALE..... 322LRNC
OREAD LIMESTONE..... 322ORED
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SACFOX SUBGROUP..... 322SCFX
SCRANTON SHALE..... 322SCRN
SHAWNEE GROUP..... 322SHWN
SPRING BRANCH LIMESTONE MEMBER OF LECOMPTON LIMESTONE..... 322SPGB
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STOTLER LIMESTONE..... 322STLR
SEVERY SHALE..... 322SVRY
TECUMSEH SHALE..... 322TCMS
TOPEKA LIMESTONE..... 322TOPK
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WABAUNSEE GROUP..... 322WBNS
WILLARD SHALE..... 322WLRD
ZEANDALE LIMESTONE..... 322ZNDL

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CHECKERBOARD LIMESTONE..... 323CCKB
DENNIS LIMESTONE..... 323DNNS
DRUM LIMESTONE..... 323DRUM
FONTANA SHALE MEMBER OF CHERRYVALE SHALE..... 323FNTN
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IATAN LIMESTONE..... 323IATN
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PLATTSBURG LIMESTONE..... 323PLBG
PLEASANTON GROUP..... 323PLSN
QUIVIRA SHALE MEMBER OF CHERRYVALE SHALE..... 323QUVR
SEMINOLE FORMATION..... 323SMNL
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SWOPE LIMESTONE..... 323SWOP
VILAS SHALE..... 323VILS
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AMORET LIMESTONE MEMBER OF ALTAMONT LIMESTONE..... 324AMRT
ANNA SHALE MEMBER OF PAWNEE LIMESTONE..... 324ANNA
BROKEN ARROW COAL..... 324BRKA
BEVIER COAL BED OF CABANICS FORMATION..... 324BVIR
BREEZY HILL LIMESTONE MEMBER OF CABANISS FORMATION..... 324BZHL
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EXCELLO SHALE..... 324EXCL
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HOLDENVILLE SHALE..... 324HLDV
HOUX LIMESTONE BED OF LITTLE OSAGE SHALE MEMBER OF FORT SCOTT LS..... 324HOUX
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KNIFETON COAL..... 324KNFN
LABERDIE LIMESTONE MEMBER OF PAWNEE LIMESTONE..... 324LBRD
LAKE NEOSHO SHALE MEMBER OF ALTAMOUNT LIMESTONE..... 324LKNS
MYRICK STATION LIMESTONE MEMBER OF PAWNEE LIMESTONE..... 324MCKS
MINE CREEK SHALE MEMBER OF PAWNEE LIMESTONE..... 324MCRK
MULBERRY COAL BED OF BANDERA SHALE..... 324MLBR
MULKY COAL BED OF CABANISS FORMATION..... 324MLKY
MINERAL COAL BED OF CABANISS FORMATION..... 324MNRL
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NEUTRAL COAL BED OF KREBS FORMATION..... 324NTRL
PERRY FARM SHALE MEMBER OF LENAPAH LIMESTONE..... 324PRFM
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RIVERTON COAL BED OF KREBS FORMATION..... 324RVRN
SCAMMON COAL BED OF CABANISS FORMATION..... 324SCMN
SUMMIT COAL BED OF LITTLE OSAGE SHALE MEMBER OF FORT SCOTT LIMESTONE.. 324SMMT
STICE COAL..... 324STIC
TEBO COAL BED OF CABANISS FORMATION..... 324TEBO
TINA LIMESTONE MEMBER OF ALTAMOUNT LIMESTONE..... 324TINA
TIAWAH LIMESTONE BED OF CABANISS FORMATION..... 324TIWH
WHEELER COAL OF VERDIGRIS FORMATION..... 324WHLR

WALT JOHNSON SANDSTONE MEMBER OF NOWATA SHALE..... 324WLRJ
WIER PITTSBURG COAL BED OF CABANISS FORMATION..... 324WPBG
WARRENSBURG SANDSTONE..... 324WRBG
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WARNER SANDSTONE MEMBER OF KREBS FORMATION..... 324WRNR

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BLACKJACK CREEK LIMESTONE MEMBER OF FORT SCOTT LIMESTONE..... 325BKJC
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CHELSEA SANDSTONE MEMBER OF CABANISS FORMATION..... 325CHLS
CHEROKEE GROUP..... 325CHRK
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HIGGINSVILLE LIMESTONE MEMBER OF FORT SCOTT LIMESTONE..... 325HGVL
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LABETTE SHALE..... 325LBTT
LITTLE OSAGE MEMBER OF FORT SCOTT LIMESTONE..... 325LLOG
LENAPAH LIMESTONE..... 325LNPH
MARMATON GROUP..... 325MRMN
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SEVILLE LIMESTONE MEMBER OF KREBS FORMATION..... 325SVLL
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MORROWAN SERIES..... 328MRRN

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COTTER DOLOMITE..... 367CTTR
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GASCONADE DOLOMITE..... 367GSCD
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ROUBIDOUX FORMATION..... 367RBDX
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CANADIAN

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CAMBRIAN, UPPER..... 371CMBRU
EMINENCE DOLOMITE..... 371EMNC
HONEY CREEK LIMESTONE..... 371HCRK
LAMOTTE-REAGAN SANDSTONE..... 371LMRG
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KENTUCKY

CENOZOIC

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OHIO RIVER DEPOSITS,LOWER TERRACE..... 112ORLT
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CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU
MC NAIRY FORMATION..... 211MCNR
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PALEOZOIC ERATHEM..... 300PLZC

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

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HENSHAW AND LISMAN FORMATIONS UNDIFFERENTIATED..... 321HSLM
LISMAN FORMATION..... 321LSMN
MONONGAHELA AND CONEMAUGH FORMATIONS..... 321MGCG
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BEDFORD SHALE..... 330BDFD
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MISSISSIPPIAN, UPPER..... 331MSSPU
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BIG CLIFTY LIMESTONE MEMBER OF GOLCONDA FORMATION..... 332BGCF
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BEAVER BEND LIMESTONE..... 332BVBD
BEAVER BEND LIMESTONE AND MOORETOWN (BETHEL) FORMATION..... 332BVBM
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HARDINSBURG SANDSTONE (JONES SAND)..... 332HDBG
HANEY LIMESTONE MEMBER OF GOLCONDA FORMATION..... 332HNEY
KINKAID LIMESTONE..... 332KNKD
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MENARD LIMESTONE..... 332MNRD
MAXON SANDSTONE..... 332MXON
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STE GENEVIEVE LIMESTONE..... 333SGVV
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ST LOUIS AND SALEM LIMESTONES UNDIFFERENTIATED..... 333SLSM
SALEM AND WARSAW FORMATIONS..... 333SMWR
ST LOUIS LIMESTONE..... 333STLS
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WEIR SAND..... 338WEIR
WAVERLY GROUP..... 338WVRL

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KNOB LICK AND HARDIN SANDSTONES..... 341KBLH
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CRAB ORCHARD FORMATION..... 354CBOC
CLINTON FORMATION..... 354CLNN
LAUREL DOLOMITE AND OSGOOD FORMATION..... 354LOGD
LOUISVILLE LIMESTONE AND LEGO LS MEMBER OF WAYNE FM(BIG SIX SAND)..... 354LVLG
LOUISVILLE LIMESTONE AND LAUREL DOLOMITE..... 354LVLL
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MURFREESBORO LIMESTONE..... 364MRFB
NEWALA-LONGVIEW DOLOMITE..... 364NLGV
OREGON AND CAMP NELSON LIMESTONES..... 3640CPN
ORDOVICIAN, MIDDLE..... 3640DVCM
STONES RIVER (BLACK RIVER) GROUP..... 364SRVR
ST PETER SANDSTONE..... 364STPR
TRENTON LIMESTONE..... 364TRNN
TYRONE LIMESTONE..... 364TYRN

LOWER ORDOVICIAN

KNOX DOLOMITE..... 367KNOX
ORDOVICIAN, LOWER..... 3670DVCL
ORDOVICIAN-CAMBRIAN SYSTEMS..... 3670VCB

CAMBRIAN

ANTIETAM-ERWIN QUARTZITES, UNDIFFERENTIATED..... 370AMER
CAMBRIAN SYSTEM..... 370CMBR
TOMSTOWN DOLOMITE..... 370TMSN

UPPER CAMBRIAN

CAMBRIAN, UPPER..... 371CMBRU
COPPER RIDGE DOLOMITE..... 371CPRG
MOUNT SIMON SANDSTONE..... 371MSMN

LOWER CAMBRIAN

LOWER CAMBRIAN SERIES..... 377CMBRL
ROME FORMATION..... 377ROME

LOUISIANA

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC
PONCHATOULA AQUIFER, UNDIFFERENTIATED..... 100PNCL

QUATERNARY

LE MOYEN FORMATION..... 110LMYN
QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

DELTAIC DEPOSITS,YOUNGER..... 111DLTCY
HOLOCENE SERIES..... 111HLCN
MERMENTAU MEMBER OF LE MOYEN FORMATION..... 111MRMN
NATURAL LEVEE DEPOSITS..... 111NLLV
POINT-BAR DEPOSITS..... 111PNBR
SHALLOW AQUIFERS OF NEW ORLEANS AREA..... 111SLNO

PLEISTOCENE

ATCHAFALAYA AQUIFER..... 112ACFL
ALLUVIAL AQUIFERS,UNDIFFERENTIATED..... 112ALVL
BENTLEY FORMATION..... 112BNTL
CHICOT AQUIFER..... 112CHCT
CHICOT AQUIFER,LOWER PART..... 112CHCTL
CHICOT AQUIFER,SHALLOW SAND..... 112CHCTS
CHICOT AQUIFER,UPPER SAND UNIT..... 112CHCTU
DELTAIC DEPOSITS OF MISSISSIPPIPPI RIVER VALLEY,OLDER..... 112DDMRD
GRAMERCY AQUIFER..... 112GRMC
GONZALES AQUIFER..... 112GZLS
GONZALES-NEW ORLEANS AQUIFER..... 112GZNO
LEBEAU MEMBER OF LE MOYEN FORMATION..... 112LEBU
MONTGOMERY FORMATION..... 112MGMR
MISSISSIPPI RIVER ALLUVIAL AQUIFER..... 112MRVA
NORCO AQUIFER..... 112NORC
OUACHITA RIVER ALLUVIAL AQUIFER..... 112ORVA
PLEISTOCENE SERIES..... 112PLSC
UPPER PONCHATOULA AQUIFER..... 112PNCLU
PRAIRIE FORMATION..... 112PRIR
RED RIVER ALLUVIAL AQUIFER..... 112RRVA
SHALLOW SANDS OF BATON ROUGE AREA..... 112SLBR
SHALLOW AQUIFER OF GONZALES AREA..... 112SLGZ
SABINE RIVER ALLUVIAL AQUIFER..... 112SRVA
UPLAND TERRACE DEPOSITS..... 112UPTC
WILLIANA FORMATION..... 112WLLN
200-FOOT SAND OF LAKE CHARLES AREA..... 11202LC
200-FOOT SAND OF NEW ORLEANS AREA..... 11202NO
400-FOOT SAND OF BATON ROUGE-GONZALES AREA..... 11204BR
400-FOOT SAND OF NEW ORLEANS AREA..... 11204NO
500-FOOT SAND OF LAKE CHARLES AREA..... 11205LC
600-FOOT SAND OF BATON ROUGE-GONZALES AREA..... 11206BR
700-FOOT SAND OF LAKE CHARLES AREA..... 11207LC
700-FOOT SAND OF NEW ORLEANS AREA..... 11207NO

1200-FOOT SAND OF NEW ORLEANS AREA..... 11212NO

TERTIARY

ABITA AQUIFER..... 120ABIT
COVINGTON AQUIFER..... 120CVGN
KENTWOOD AQUIFER..... 120KNTD
SLIDELL AQUIFER..... 120SLDL
TCHEFUNCTA AQUIFER..... 120TCFC
TERTIARY SYSTEM..... 120TRTR

PLIOCENE

BIG BRANCH AQUIFER..... 121BGBC
BLOUNTS CREEK MEMBER OF FLEMING FORMATION..... 121BLCK
EVANGELINE AQUIFER (PLIOCENE-MIOCENE)..... 121EVGL
FOLEY FORMATION..... 121FOLY
MAMOU MEMBER OF FOLEY FORMATION..... 121MMOU
PLIOCENE-MIOCENE SERIES..... 121PCMC
PLIOCENE SERIES..... 121PLCN
LOWER PONCHATOULA AQUIFER..... 121PNCLL
STEEP GULLY MEMBER OF FOLEY FORMATION..... 121SPGL
ZONE 1 FLORIDA PARISHES AND POINT COUPEE PARISH..... 12101FP
ZONE 2 FLORIDA PARISHES AND POINT COUPEE PARISH..... 12102FP
800-FOOT SAND OF BATON ROUGE AREA..... 12108BR
1000-FOOT SAND OF BATON ROUGE AREA..... 12110BR
1200-FOOT SAND OF BATON ROUGE AREA..... 12112BR
1500-FOOT SAND OF BATON ROUGE AREA..... 12115BR
1700-FOOT SAND OF BATON ROUGE AREA..... 12117BR

MIOCENE

AMITE AQUIFER..... 122AMIT
BLOUNTS CREEK MEMBER OF FLEMING FORMATION..... 122BLCK
CASTOR CREEK MEMBER OF FLEMING FORMATION..... 122CRCK
CARNAHAN BAYOU MEMBER OF FLEMING FORMATION..... 122CRNB
CATAHOULA FORMATION..... 122CTHL
DOUGH HILLS MEMBER OF FLEMING FORMATION..... 122DGHL
FLEMING FORMATION..... 122FLMG
FRANKLINTON AQUIFER..... 122FRKL
HAMMOND AQUIFER..... 122HMND
JASPER AQUIFER..... 122JSPR
LENA MEMBER OF FLEMING FORMATION..... 122LENA
MIOCENE SERIES..... 122MOCN
RAMSAY AQUIFER..... 122RMSY
WILLIAMSON CREEK MEMBER OF FLEMING FORMATION..... 122WMCK
ZONE 3 FLORIDA PARISHES AND POINT COUPEE PARISH..... 12203FP
2000-FOOT SAND OF BATON ROUGE AREA..... 12220BR
2400-FOOT SAND OF BATON ROUGE AREA..... 12224BR
2800-FOOT SAND OF BATON ROUGE AREA..... 12228BR

OLIGOCENE

OLIGOCENE-EOCENE SERIES..... 1230GCE
OLIGOCENE SERIES..... 1230LGC
SANDEL FORMATION..... 123SNDL

VICKSBURG GROUP..... 123VKBG
VICKSBURG-JACKSON GROUPS UNDIFFERENTIATED..... 123VKBJ

EOCENE

COCKFIELD FORMATION..... 124CCKF
COOK MOUNTAIN FORMATION..... 124CKMN
CLAIBORNE GROUP..... 124CLBR
CARRIZO SAND..... 124CRRZ
CANE RIVER FORMATION..... 124CRVR
DOLET HILLS FORMATION..... 124DLHL
EOCENE-PALEOCENE SERIES..... 124ECPC
EOCENE SERIES..... 124EOCN
JACKSON GROUP..... 124JCKS
NABORTON FORMATION..... 124NBRN
SPARTA SAND..... 124SPRT
WILCOX GROUP..... 124WLCX
WILCOX GROUP, UPPER..... 124WLCXU

PALEOCENE

CLAYTON FORMATION..... 125CLTN
MIDWAY GROUP..... 125MDWY
PORTERS CREEK CLAY..... 125PRCK

MAINE

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
BEACH DEPOSITS..... 111BECH
COASTAL DUNE AND BEACH DEPOSITS..... 111CDBC
EOLIAN DEPOSITS..... 111EOLN
SWAMP DEPOSITS..... 111SWMP

PLEISTOCENE

BEACH DEPOSITS..... 112BECH
DRIFT,STRATIFIED,EARLY..... 112DFSFE
ICE-CONTACT DEPOSITS..... 112ICCC
LAKE DEPOSITS,GLACIAL..... 112LKGC
MARINE DEPOSITS..... 112MRIN
OUTWASH..... 112OTSH
OUTWASH,VALLEY TRAIN..... 112OVTR
TILL..... 112TILL
TERMINAL MORAINE DEPOSITS..... 112TMLM

PALEOZOIC

BEDROCK UNDIFFERENTIATED..... 300BDRK

PENNSYLVANIAN

PENNSYLVANIAN(?)-CAMBRIAN(?) SYSTEMS,UNDIVIDED..... 320PVCB

DEVONIAN

BELL BROOK FORMATION..... 340BLBK
DEVONIAN SYSTEM..... 340DVNN
GRANITIC ROCKS..... 340GRNC

MIDDLE DEVONIAN

MAPLETON SANDSTONE..... 344MPLN

LOWER DEVONIAN

CHAPMAN SANDSTONE..... 347CPMN
DOCKENDORFF GROUP..... 347DCKF
EDMUNDS HILL ANDESITE..... 347EDMH
HEDGEHOG FORMATION..... 347HDGG

SILURIAN

PERHAM FORMATION..... 350PRHM
SILURIAN SYSTEM..... 350SLRN
SMYRNA MILLS FORMATION..... 350SMML

SPRAGUEVILLE FORMATION..... 350SPGV

MIDDLE SILURIAN

FRENCHVILLE FORMATION..... 354FCVL

LOWER SILURIAN

CARYS MILLS FORMATION..... 357CRML

ORDOVICIAN

CHANDLER RIDGE FORMATION..... 360CDRG
ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

PYLE MOUNTAIN ARGILLITE..... 361PLMN

PRECAMBRIAN

PRECAMBRIAN Y

ALGOMAN GRANITE..... 420ALGM
COPPER HARBOR CONGLOMERATE..... 420CPHB
FREDA SANDSTONE..... 420FRED
KEWEENAWAN SUPERGROUP..... 420KWNW
MELLEN GRANITE..... 420MLLN
NONESUCH SHALE..... 420NNSC
LATE PRECAMBRIAN ROCKS..... 420PCMB
PORTAGE LAKE VOLCANICS..... 420PGLK

ANIMIKIE

DELETE..... 422CRRY

LOWER PRECAMBRIAN Y

FERN CREEK FORMATION..... 427FRCK

PRECAMBRIAN X

AJIBIK QUARTZITE..... 430AJBK
AMASA FORMATION..... 430AMAS
ANVIL MEMBER OF IRONWOOD IRON-FORMATION..... 430ANVL
BARAGA GROUP..... 430BARG
BAD RIVER DOLOMITE..... 430BDRV
BIJIKI IRON-FORMATION MEMBER OF MICHIGAMME SLATE..... 430BIJK
BIRD IRON-BEARING MEMBER OF HEMLOCK FORMATION..... 430BIRD
BRIER SLATE MEMBER OF VULCAN IRON-FORMATION..... 430BRIR
CHOCOLAY GROUP..... 430CCLY
CLARKSBURG VOLCANICS MEMBER OF MICHIGAMME SLATE..... 430CKBG
CURRY IRON-BEARING MEMBER OF VULCAN IRON-FORMATION..... 430CRRY
FELCH FORMATION..... 430FLCH
FORTUNE LAKES SLATE..... 430FRLK
GOODRICH QUARTZITE..... 430GDRC

HEMLOCK FORMATION..... 430HMCK
HIAWATHA GRAYWACKE..... 430HWTH
IRONWOOD IRON FORMATION..... 430IRND
KNIFE LAKE GROUP..... 430KFLK
KONA DOLOMITE..... 430KONA
LORETTO SLATE MEMBER OF VULCAN IRON FORMATION..... 430LRTT
MICHIGAMME SLATE..... 430MCGM
MANSFIELD IRON-BEARING SLATE MEMBER OF HEMLOCK FORMATION..... 430MFLD
MENOMINEE GROUP..... 430MNMN
MARQUETTE RANGE SUPERGROUP..... 430MQRG
MESNARD QUARTZITE..... 430MSRD
NEGAUNEE IRON-FORMATION..... 430NGNE
NORRIE MEMBER OF IRONWOOD IRON FORMATION..... 430NORR
NORWAY LAKE GNEISS..... 430NRLK
PABST MEMBER OF TYLER FORMATION..... 430PBCP
PENCE MEMBER OF IRON-WOOD IRON FORMATION..... 430PENC
PYLMOUTH MEMBER OF IRONWOOD IRON-FORMATION..... 430PLMT
PAINT RIVER GROUP..... 430PRVR
PEAVEY POND COMPLEX..... 430PVPD
RANDVILLE DOLOMITE..... 430RDVL
RIVERTON IRON-FORMATION..... 430RVRN
SAUNDERS FORMATION..... 430SDRS
SIAMO SLATE..... 430SIMO
STAMBAUGH FORMATION..... 430SMBG
SUNDAY QUARTZITE..... 430SNDY
STURGEON QUARTZITE..... 430SRGN
TRADERS IRON-BEARING MEMBER OF VULCAN IRON-FORMATION..... 430TRDR
TYLER FORMATION..... 430TYLR
VULCAN IRON-FORMATION..... 430VLCN
WEWE SLATE..... 430WEWE
WAUSECA PYRITIC MEMBER OF DUNN CREEK SHALE..... 430WUSC
YALE MEMBER OF IRONWOOD IRON FORMATION..... 430YALE

PRECAMBRIAN W

KITCHI SCHIST..... 440KTCH
LAURENTIAN SERIES..... 440LRNN
MONA SCHIST..... 440MONA
PALMER GNEISS..... 440PLMR
PRESQUE ISLE GRANITE..... 440PQIL

KEEWATIN

DUNN CREEK SLATE..... 460DCRK
FENCE RIVER FORMATION..... 460FCRV

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
MOUNTAIN WASH..... 110MNWS
QUATERNARY SYSTEM..... 110QRNR
TERRACE DEPOSITS..... 110TRRC

HOLOCENE

HOLOCENE SERIES..... 111HLCN
LOWLAND DEPOSITS..... 111LLND

PLEISTOCENE

BRANDYWINE FORMATION..... 112BRND
BEAVERDAM SAND..... 112BVDM
COLUMBIA FORMATION..... 112CLMB
OMAR FORMATION..... 112OMAR
PLEISTOCENE-PLIOCENE SERIES..... 112PCPC
PLEISTOCENE SERIES..... 112PLSC
PAMLICO FORMATION..... 112PMLC
PARSONBURG FORMATION..... 112PRBG
RED GRAVELLY FACIES..... 112RDGV
SUNDERLAND FORMATION..... 112SDLD
SALISBURY AQUIFER..... 112SLBR
TALBOT FORMATION..... 112TLBT
UPLAND DEPOSITS..... 112UPLD
WICOMICO FORMATION..... 112WCML
WALSTON SILT..... 112WLSN

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

BRYN MAWR FORMATION..... 121BRMR
PLIOCENE SERIES..... 121PLCN

MIOCENE

CALVERT FORMATION..... 122CLVR
CHOPTANK FORMATION..... 122CPNK
CHESWOLD AQUIFER..... 122CSLD
CHESAPEAKE GROUP..... 122CSPK
FEDERALSBURG AQUIFER..... 122FDBG
FREDERICA AQUIFER..... 122FRDC
MANOKIN AQUIFER..... 122MNKN
MIOCENE SERIES..... 122MOCN
POCOMOKE AQUIFER..... 122PCMK

ST MARYS FORMATION..... 122SMRS
YORKTOWN FORMATION..... 122YRKN

OLIGOCENE

OLIGOCENE SERIES..... 123OLGC

EOCENE

EOCENE-PALEOCENE SERIES..... 124ECPC
EOCENE SERIES..... 124EOCN
NANJEMOY FORMATION..... 124NNJM
PAMUNKEY GROUP..... 124PMNK
PINEY POINT FORMATION..... 124PNPN

PALEOCENE

AQUIA AND RANCOCAS AQUIFER..... 125AQRC
AQUIA FORMATION..... 125AQUI
BRIGHTSEAT FORMATION..... 125BRGS
HORNERSTOWN FORMATION..... 125HRRS
PALEOCENE SERIES..... 125PLCN
RANCOCAS FORMATION..... 125RCCS
VINCENTOWN FORMATION..... 125VNCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU
ENGLISHTOWN FORMATION..... 211EGLS
MERCHANTVILLE FORMATION..... 211MCVL
MAGOTHY FORMATION..... 211MGTY
MOUNT LAUREL SAND..... 211MLRL
MONMOUTH FORMATION..... 211MNMT
MARSHALLTOWN FORMATION..... 211MRSL
MATAWAN FORMATION..... 211MTWN
RARITAN FORMATION..... 211RRTN

LOWER CRETACEOUS

ARUNDEL FORMATION..... 217ARDL
LOWER CRETACEOUS SERIES..... 217CRCSL
NONMARINE CRETACEOUS AQUIFER..... 217NNMR
PATAPSCO FORMATION..... 217PPSC
POTOMAC GROUP..... 217PTMC
PATUXENT FORMATION..... 217PTXN

TRIASSIC

TRIASSIC BASEMENT ROCKS, UNDIFFERENTIATED..... 230TCBM
TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

BALLS BLUFF SILTSTONE..... 231BLBF
BULL RUN FORMATION..... 231BLRN
DIABASE DIKES AND SILLS..... 231DIBS
GETTYSBURG SHALE..... 231GBRG
LEESBURG LIMESTONE CONGLOMERATE MEMBER OF BULL RUN FORMATION..... 231LBRG
MANASSASS SANDSTONE..... 231MNSS
NEW OXFORD FORMATION..... 231NOXF
NEW OXFORD FORMATION BASAL CONGLOMERATE..... 231NOXFB
UPPER TRIASSIC SERIES..... 231TRSCU

PALEOZOIC

AMPHIBOLITE LITHOFACIES OF THE WISSAHICKON FORMATION,UNDIVIDED..... 300AMPB
BACHMAN VALLEY FORMATION..... 300BCMV
BOULDER GNEISS OF WISSAHICKON FORMATION..... 300BLDR
BALTIMORE GABBRO COMPLEX..... 300BLMR
COCKEYSVILLE MARBLE..... 300CCKV
ELLICOTT CITY GRANODIORITE..... 300ELCC
GUILFORD QUARTZ MONZONITE..... 300GLFD
GLENARM SERIES..... 300GLRM
GUNPOWDER GRANITE..... 300GPDR
GEORGETOWN MAFIC COMPLEX..... 300GRGN
IJAMSVILLE FORMATION..... 300IJMV
IJAMESVILLE FORMATION-MARBURG SCHIST,UNDIFFERENTIATED..... 300IJVM
JAMES RUN GNEISS..... 300JMSR
KENSINGTON QUARTZ DIORITE..... 300KNSG
LIBERTYTOWN METARHYOLITE..... 300LBRN
LOCH RAVEN SCHIST..... 300LCRV
LOWER PELITIC SCHIST OF WISSAHICKON FORMATION..... 300LPLC
METAGABBRO AND AMPHIBOLITE..... 300MBAB
METACONGLOMERATE OF WISSAHICKON FORMATION..... 300MCGM
METAGRAYWACKE OF WISSAHICKON FORMATION..... 300MGCK
MUSCOVITE QUARTZ MONZONITE GNEISS..... 300MQMG
MARBURG FORMATION..... 300MRBG
MOUNT WASHINGTON AMPHIBOLITE..... 300MWSG
NORBECK QUARTZ DIORITE..... 300NBCK
OELLA FORMATION..... 300OELL
PEGMATITE DIKES..... 300PGMT
PLEASANT GROVE SCHIST..... 300PLGV
PELITIC SCHIST,LOWER..... 300PLTCL
PALEOZOIC ERATHEM..... 300PLZC
PINEY RUN FORMATION..... 300PNRN
PORT DEPOSIT GNEISS..... 300PRDP
PRETTYBOY SCHIST..... 300PRTB
EARLY PALEOZOIC-LATE PRECAMBRIAN ERATHEMS,UNDIFFERENTIATED..... 300PZPC
QUARTZ GABBRO AND QUARTZ DIORITE GNEISS..... 300QZQZ
RELAY QUARTZ DIORITE..... 300RELY
SUGARLOAF MOUNTAIN QUARTZITE..... 300SGFM
SYKESVILLE FORMATION..... 300SKVL

SILVER RUN LIMESTONE..... 300SLVR
SAMS CREEK METABASALT..... 300SMCK
SETTERS FORMATION..... 300STRS
ULTRAMAFIC AND GABBROIC ROCKS..... 300UFGB
ULTRAMAFIC ROCKS..... 300UMFC
UPPER PELITIC SCHIST OF WISSAHICKON FORMATION..... 300UPPC
URBANA FORMATION..... 300URBN
VOLCANIC COMPLEX OF CECIL COUNTY..... 300VLCC
WOODSTOCK QUARTZ MONZONITE..... 300WDCK
WAKEFIELD MARBLE..... 300WKFD
WISSAHICKON FORMATION..... 300WSCK

PERMIAN

DUNKARD GROUP..... 310DNKD
PERMIAN SYSTEM..... 310PRMN

LOWER PERMIAN

LOWER PERMIAN SERIES..... 317PRMNL

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

UPPER PENNSYLVANIAN

CONEMAUGH FORMATION..... 321CNMG
MONONGAHELA FORMATION..... 321MNGL
UPPER PENNSYLVANIAN SERIES..... 321PSLVU

MIDDLE PENNSYLVANIAN

ALLEGHENY FORMATION..... 324ALGN
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM
POTTSVILLE FORMATION..... 324PSVL
POTTSVILLE-ALLEGHENY FORMATIONS,UNDIFFERENTIATED..... 324PVAG

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

GREENBRIER FORMATION..... 331GRBR
MAUCH CHUNK FORMATION..... 331MCCK
MISSISSIPPIAN, UPPER..... 331MSSPU

LOWER MISSISSIPPIAN

MISSISSIPPIAN, LOWER..... 337MSSPL
POCONO GROUP..... 337POCN
PURSLANE SANDSTONE..... 337PRSL
ROCKWELL FORMATION..... 337RCKL

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

BRALLIER FORMATION..... 341BRLR
CHEMUNG FORMATION..... 341CMNG
DEVONIAN, UPPER..... 341DVNNU
HAMPSHIRE FORMATION..... 341HMPR
HARRELL SHALE..... 341HRRL
JENNINGS FORMATION..... 341JNGS
PARKHEAD SANDSTONE..... 341PRKD

MIDDLE DEVONIAN

DEVONIAN, MIDDLE..... 344DVNNM
HAMILTON GROUP..... 344HMLN
MAHANTANGO FORMATION..... 344MNNG
MARCELLUS SHALE..... 344MRCL
NEEDMORE SHALE..... 344NDMR
ROMNEY FORMATION..... 344RMNY
TIOGA METABENTONITE..... 344TIOG

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL
HELDERBERG GROUP..... 347HDBG
KEYSER LIMESTONE..... 347KYSR
ORISKANY GROUP..... 347ORSK
RIDGELEY SANDSTONE..... 347RDGL
SHRIVER CHERT..... 347SRVR

SILURIAN

SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

SILURIAN, UPPER..... 351SLRNU
TONOLOWAY LIMESTONE..... 351TNLY
WILLS CREEK SHALE..... 351WLCK

CAYUGAN

BLOOMSBURG FORMATION..... 352BMBG

MIDDLE SILURIAN

CLINTON GROUP..... 354CLNN
KEEFER SANDSTONE..... 354KEFR
MCKENZIE FORMATION..... 354MCKZ
ROCHESTER SHALE..... 354RCSR
ROSE HILL FORMATION..... 354RSHL
SILURIAN, MIDDLE..... 354SLRNM

LOWER SILURIAN

SILURIAN, LOWER..... 357SLRNL
TUSCARORA SANDSTONE..... 357TCRR

ORDOVICIAN

CARDIFF METACONGLOMERATE..... 360CRDF
ORDOVICIAN SYSTEM..... 360ODVC
PEACH BOTTOM SLATE..... 360PCBM

UPPER ORDOVICIAN

JUNIATA FORMATION..... 361JUNT
MARTINSBURG SHALE..... 361MRBG
ORDOVICIAN, UPPER..... 361ODVCU

MIDDLE ORDOVICIAN

CHAMBERSBURG LIMESTONE..... 364CBBG
NEW MARKET LIMESTONE..... 364NMRK
ORDOVICIAN, MIDDLE..... 364ODVCM
ROW PARK LIMESTONE..... 364RPRK
ST PAUL GROUP..... 364STPL

LOWER ORDOVICIAN

BEEKMANTOWN GROUP..... 367BKMN
GROVE LIMESTONE..... 367GROV
LOWER ORDOVICIAN SERIES..... 367ODVCL
PINESBURG STATION DOLOMITE..... 367PBGS
ROCKDALE RUN FORMATION..... 367RCKR
STONEHENGE LIMESTONE..... 367SNNG

CAMBRIAN

ARABY FORMATION..... 370ARBY
CAMBRIAN SYSTEM..... 370CMBR
GUNPOWDER GNEISS..... 370GPDR
PERRY HALL GNEISS..... 370PRHL
RASPEBURG AMPHIBOLITE..... 370RPBG

UPPER CAMBRIAN

CONOCOCHEAGUE LIMESTONE..... 371CCCG
CAMBRIAN, UPPER..... 371CMBRU
ELBROOK FORMATION..... 371ELBK

MIDDLE CAMBRIAN

CAMBRIAN, MIDDLE..... 374CMBRM

LOWER CAMBRIAN

ANTIETAM FORMATION..... 377ANTM
CHILHOWEE GROUP..... 377CHLH

LOWER CAMBRIAN SERIES..... 377CMBRL
FREDERICK LIMESTONE..... 377FDCK
HARPERS FORMATION..... 377HRPR
LOUDOUN FORMATION..... 377LUDN
TOMSTOWN DOLOMITE..... 377TMSN
WAYNESBORO FORMATION..... 377WSBR
WEVERTON FORMATION..... 377WVRN

PRECAMBRIAN

BALTIMORE GNEISS..... 400BLMR
CATOCTIN METABASALT..... 400CTCN
GRANODIORITE AND BIOTITE GRANITE GNEISS..... 400GBGG
METARHYOLITE AND ASSOCIATED PYROCLASTIC SEDIMENTS..... 400MTRL
PRECAMBRIAN ERATHEM..... 400PCMB
SWIFT RUN FORMATION..... 400SFRN
SLAUGHTERHOUSE GNEISS..... 400SGTS

MASSACHUSETTS

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
BEACH DEPOSITS,MARINE AND NON-MARINE	111BECH
COLLUVIUM	111CLVM
EOLIAN DEPOSITS	111EOLN
FILL	111FILL
MARINE DEPOSITS	111MRIN
SEDIMENTS, UNDIFFERENTIATED	111SDMN
SWAMP DEPOSITS	111SWMP

PLEISTOCENE

DELTA DEPOSITS	112DELT
ICE-CONTACT DEPOSITS, INCLUDING ESKERS AND KAMES	112ICCC
LACUSTRINE DEPOSITS	112LCSR
MORAINE DEPOSITS,EXCEPT GROUND MORAINE AND DRUMLINS	112MORN
MARINE DEPOSITS	112MRIN
OUTWASH DEPOSITS	112OTSH
STRATIFIED DEPOSITS, UNDIFFERENTIATED	112SRFD
TILL	112TILL

TERTIARY

SEDIMENTS,UNDIFFERENTIATED	120SDMS

MESOZOIC

CRYSTALLINE ROCKS	200CRSL

CRETACEOUS

SEDIMENTS,UNDIFFERENTIATED	210SDMS

TRIASSIC

IGNEOUS ROCKS,EXTRUSIVE	230IGNSE
IGNEOUS ROCKS,INTRUSIVE	230IGNSI
SEDIMENTARY ROCKS	230SDMR

UPPER TRIASSIC

EAST BERLIN FORMATION	231EBRL
HOLYOKE BASALT	231HLYK
HAMPDEN BASALT	231HMPD
NEW HAVEN FORMATION	231NHVN
PORTLAND FORMATION	231PRLD

PALEOZOIC

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 300CRSL
CRYSTALLINE ROCKS,CARBONATE..... 300CRSLN

PENNSYLVANIAN

CRYSTALLINE ROCKS..... 320CRSL
SEDIMENTARY ROCKS..... 320SDMR

MISSISSIPPIAN

CRYSTALLINE ROCKS..... 330CRSL
SEDIMENTARY ROCKS..... 330SDMR

DEVONIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 340CRSL
CRYSTALLINE ROCKS,NONCARBONATE..... 340CRSLN

SILURIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 350CRSL
CRYSTALLINE ROCKS,CARBONATE..... 350CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 350CRSLN

ORDOVICIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 360CRSL
CRYSTALLINE ROCKS,CARBONATE..... 360CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 360CRSLN

CAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 370CRSL
CRYSTALLINE ROCKS,CARBONATE..... 370CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 370CRSLN

PRECAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 400CRSL
CRYSTALLINE ROCKS,CARBONATE..... 400CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 400CRSLN

MICHIGAN

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

ALLUVIUM..... 111ALVM
COLLUVIUM..... 111CLVM
FILL..... 111FILL
HOLOCENE SERIES..... 111HLCN
SWAMP DEPOSITS..... 111SWMP

PLEISTOCENE

CLAY..... 112CLAY
DELTAIC DEPOSITS..... 112DLTC
DUNE SAND..... 112DNSD
DRUMLINS..... 112DRML
ESKERS..... 112ESKR
GLACIAL DEPOSITS,UNDIFFERENTIATED..... 112GLCL
GLACIAL DEPOSITS,REWORKED..... 112GLCLR
GROUND MORAINE..... 112GRDM
GRAVEL..... 112GRVL
HARDPAN..... 112HRDP
KAMES..... 112KAME
LAKE BEDS..... 112LKBD
LAKE BED CLAY..... 112LKBDC
LAKE BED SAND..... 112LKBDS
MORAINE..... 112MORN
MORAINE AND TILL..... 112MRTL
OUTWASH..... 112OTSH
PEAT..... 112PEAT
PLEISTOCENE SERIES..... 112PLSC
SAND..... 112SAND
SAND AND CLAY..... 112SDCL
SAND AND GRAVEL..... 112SDGV
SAND, GRAVEL, AND CLAY..... 112SGVC
SAND DUNE..... 112SNDD
SWAMP DEPOSITS..... 112SWMP
TILL..... 112TILL
WATERWORKED MORAINAL MATERIAL..... 112WKDM

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

JURASSIC

JURASSIC SYSTEM..... 220JRSC
JURASSIC RED BEDS..... 220RDBD

UPPER JURASSIC

KIMERIDGIAN SERIES..... 221KMDG

PALEOZOIC

PALEOZOIC DOLOMITE..... 300DLMT
PALEOZOIC EVAPORITES..... 300EVPR
PALEOZOIC LIMESTONE..... 300LMSN
PALEOZOIC LIMESTONE AND SHALE..... 300LNSL
PALEOZOIC ERATHEM..... 300PLZC
PALEOZOIC SANDSTONE AND SHALE..... 300SDSL
PALEOZOIC SHALE..... 300SHLE
PALEOZOIC SANDSTONE..... 300SNDS

PENNSYLVANIAN

PENNSYLVANIAN DOLOMITE..... 320DLMT
PENNSYLVANIAN EVAPORITES..... 320EVPR
PENNSYLVANIAN LIMESTONE..... 320LMSN
PENNSYLVANIAN LIMESTONE AND SHALE..... 320LNSL
PENNSYLVANIAN SYSTEM..... 320PSLV
PENNSYLVANIAN ROCKS..... 320PSLVR
SANDSTONE AND SHALE..... 320SDSL
PENNSYLVANIAN SHALE..... 320SHLE
PENNSYLVANIAN SANDSTONE..... 320SNDS

UPPER PENNSYLVANIAN

EATON SANDSTONE..... 321ETON
GRAND RIVER FORMATION..... 321GDRV
IONIA SANDSTONE MEMBER OF GRAND RIVER FORMATION..... 321IONI
UPPER PENNSYLVANIAN SERIES..... 321PSLVU
WOODVILLE SANDSTONE..... 321WDVL

MIDDLE PENNSYLVANIAN

PARMA SANDSTONE..... 324PARM
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM
SAGINAW-MICHIGAN FORMATIONS..... 324SGMG
SAGINAW-MARSHALL FORMATIONS..... 324SGML
SAGINAW FORMATION..... 324SGNW
VERNE LIMESTONE MEMBER OF SAGINAW FORMATION..... 324VERN

LOWER PENNSYLVANIAN

LOWER PENNSYLVANIAN SERIES..... 327PSLVL
PENNSYLVANIAN-MISSISSIPPIAN SERIES..... 327PVMP

MORROWAN

MORROWAN SERIES..... 328MRWN
PARMA SANDSTONE..... 328PARM
POTTSVILLE SERIES..... 328PSVL

MISSISSIPPIAN

MISSISSIPPIAN DOLOMITE..... 330DLMT
MISSISSIPPIAN EVAPORITES..... 330EVPR
MISSISSIPPIAN LIMESTONE..... 330LMSN
MISSISSIPPIAN LIMESTONE AND SHALE..... 330LNSL
MISSISSIPPIAN SYSTEM..... 330MSSP
MISSISSIPPIAN ROCKS..... 330MSSPR
MISSISSIPPIAN SANDSTONE AND SHALE..... 330SDSL
MISSISSIPPAIN SHALE..... 330SHLE
MISSISSIPPIAN SANDSTONE..... 330SNDS

UPPER MISSISSIPPIAN

MISSISSIPPIAN, UPPER..... 331MSSPU

MERAMECIAN

BAYPORT-MICHIGAN FORMATIONS..... 333BPMG
BAYPORT LIMESTONE..... 333BPRT
GRAND RAPIDS GROUP..... 333GDRP
MICHIGAN FORMATION..... 333MCGN
MERAMECIAN SERIES..... 333MRMC

LOWER MISSISSIPPIAN

ANTRIM SHALE..... 337ANRM
BEDFORD SHALE..... 337BDFD
BEREA SANDSTONE..... 337BERE
COLDWATER SHALE..... 337CLDR
ELLSWORTH SHALE..... 337ELSR
MISSISSIPPIAN-DEVONIAN SYSTEM..... 337MPDV
MARSHALL FORMATION..... 337MRSL
MARSHALL SANDSTONE,LOWER..... 337MRSLL
MISSISSIPPIAN, LOWER..... 337MSSPL
NAPOLEON SANDSTONE MEMBER OF MARSHALL FORMATION..... 337NPLN
RICHMONDVILLE SANDSTONE MEMBER OF COLDWATER SHALE..... 337RCMV
SUNBURY SHALE,BEREA AND BEDFORD FORMATIONS..... 337SBBB
SUNBURY SHALE..... 337SNBR

OSAGEAN

OSAGEAN SERIES..... 338OSGE

KINDERHOOKIAN

KINDERHOOKIAN SERIES..... 339KDRK

DEVONIAN

DEVONIAN DOLOMITE..... 340DLMT
DEVONIAN SYSTEM..... 340DVNN
DEVONIAN ROCKS..... 340DVNNR
DEVONIAN EVAPORITES..... 340EVPR
DEVONIAN LIMESTONE..... 340LMSN
DEVONIAN LIMESTONE AND SHALE..... 340LNSL

DEVONIAN SANDSTONE AND SHALE..... 340SDSL
DEVONIAN SHALE..... 340SHLE
DEVONIAN SANDSTONE..... 340SNDS

UPPER DEVONIAN

DEVONIAN, UPPER..... 341DVNNU
TRAVERSE GROUP..... 341TRVR

CHAUTAUQUAN

CHAUTAUQUAN SERIES..... 342CTQN

SENECAN

SENECAN SERIES..... 343SNCN
SQUAW BAY LIMESTONE..... 343SQBY

MIDDLE DEVONIAN

ALPENA LIMESTONE..... 344ALPN
BELL SHALE..... 344BELL
CHARLEVOIX LIMESTONE..... 344CLVX
DOCK STREET SHALE..... 344DCKS
DUNDEE FORMATION..... 344DUND
DEVONIAN, MIDDLE..... 344DVNNM
FOUR MILE DAM FORMATION..... 344FMDM
FERRON POINT FORMATION..... 344FRNP
GENSHAW FORMATION..... 344GNSH
GRAVEL POINT FORMATION..... 344GVLP
KOEHLER LIMESTONE..... 344KHLR
KILLIANS LIMESTONE..... 344KLNS
LONG LAKE LIMESTONE..... 344LGLK
LUCAS FORMATION..... 344LUCS
NEWTON CREEK LIMESTONE..... 344NNCK
NORWAY POINT FORMATION..... 344NRPN
PARTRIDGE POINT FORMATION..... 344PDGP
POTTER FARM FORMATION..... 344PRFM
PETOSKEY LIMESTONE..... 344PTSK
ROGERS CITY LIMESTONE..... 344RGRC
ROCKPORT QUARRY LIMESTONE..... 344RKPQ
SILICA FORMATION..... 344SILC
STONY POINT FORMATION..... 344SNPN
THUNDER BAY LIMESTONE..... 344TDRB
TEN MILE CREEK DOLOMITE..... 344TMCK

ERIAN

ERIAN SERIES..... 345ERIN

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL
DEVONIAN-SILURIAN SYSTEMS..... 347DVSL

ULSTERIAN

ANDERDON FORMATION..... 348ADRD
AMHERSTBURG FORMATION..... 348AMBG
BOIS BLANC FORMATION..... 348BBLC
DETROIT RIVER GROUP..... 348DRRV
FILER SANDSTONE LENTIL OF AMHERSTBURG FORMATION..... 348FILR
FLAT ROCK DOLOMITE..... 348FRCK
GARDEN ISLAND FORMATION..... 348GDID
MACKINAC BRECCIA..... 348MCKC
ONONDAGA LIMESTONE..... 348ONDG
RICHFIELD MEMBER OF LUCAS LIMESTONE..... 348RCFD
SYLVANIA SANDSTONE..... 348SLVN
ULSTERIAN SERIES..... 348ULSR

SILURIAN

SILURIAN DOLOMITE..... 350DLMT
SILURIAN EVAPORITES..... 350EVPR
SILURIAN LIMESTONE..... 350LMSN
SILURIAN LIMESTONE AND SHALE..... 350LNSL
SILURIAN SANDSTONE AND SHALE..... 350SDSL
SILURIAN SHALE..... 350SHLE
SILURIAN SYSTEM..... 350SLRN
SILURIAN ROCKS..... 350SLRNR
SILURIAN SANDSTONE..... 350SNDS

UPPER SILURIAN

SILURIAN, UPPER..... 351SLRNU

CAYUGAN

BASS ISLANDS DOLOMITE..... 352BILD
CAYUGAN SERIES..... 352CYGN
CAYUGA GROUP..... 352CYUG
GREENFIELD DOLOMITE..... 352GFLD
POINT AUX CHENES SHALE..... 352PAXC
PUT-IN-BAY DOLOMITE..... 352PINB
RAISIN RIVER DOLOMITE..... 352RRVR
ST IGNACE DOLOMITE..... 352SIGC
SALINA GROUP..... 352SLIN
SALINA GROUP C UNIT..... 352SLINC
SALINA GROUP D EVAPORITE..... 352SLIND
SALINA GROUP E UNIT..... 352SLINE
SALINA GROUP F EVAPORITES..... 352SLINF
SALINA GROUP G UNIT..... 352SLING
SALINA FORMATION..... 352SLINT
TYMOCHTEE SHALE..... 352TMCT

MIDDLE SILURIAN

SILURIAN, MIDDLE..... 354SLRNM

NIAGARAN

BURNT BLUFF GROUP..... 355BBLF
BLUFF FORMATION..... 355BURNT
BYRON DOLOMITE..... 355BYRN
CLINTON SHALE..... 355CLNN
CORDELL DOLOMITE..... 355CRDL
ENGADINE DOLOMITE..... 355ENGD
FIBORN LIMESTONE..... 355FBRN
GUELPH DOLOMITE..... 355GLPH
HENDRICKS DOLOMITE..... 355HDCK
LOCKPORT DOLOMITE..... 355LCKP
LIME ISLAND DOLOMITE..... 355LMID
MANISTIQUE DOLOMITE..... 355MNSQ
MAYVILLE DOLOMITE..... 355MVLL
NIAGARAN SERIES..... 355NGRN
BROWN NIAGARAN..... 355NGRNB
NIAGARA GROUP..... 355NGRNG
SALINA GROUP A-1 CARBONATE..... 355SA1C
SALINA GROUP A-1 EVAPORITE..... 355SA1E
SALINA GROUP A-2 CARBONATE..... 355SA2C
SALINA GROUP A-2 EVAPORITE..... 355SA2E
SCHOOLCRAFT DOLOMITE..... 355SCCF
SALINA GROUP B EVAPORITE..... 355SLINB

LOWER SILURIAN

SILURIAN-ORDOVICIAN SYSTEM..... 357SLOV
SILURIAN, LOWER..... 357SLRNL

ALEXANDRIAN

ALEXANDRIAN SERIES..... 358ALXD
CABOT HEAD SHALE..... 358CBHD
CATARACT FORMATION..... 358CTRC
MANITOULIN DOLOMITE..... 358MNLN

ORDOVICIAN

ORDOVICIAN DOLOMITE..... 360DLMT
ORDOVICIAN EVAPORITES..... 360EVPR
ORDOVICIAN LIMESTONE..... 360LMSN
ORDOVICIAN LIMESTONE AND SHALE..... 360LNSL
ORDOVICIAN SYSTEM..... 360ODVC
ORDOVICIAN ROCKS..... 360ODVCR
ORDOVICIAN SANDSTONE AND SHALE..... 360SDSL
ORDOVICIAN SHALE..... 360SHLE
ORDOVICIAN SANDSTONE..... 360SNDS

UPPER ORDOVICIAN

ORDOVICIAN, UPPER..... 361ODVCU

CINCINNATIAN

BAY DE NOC SHALY LIMESTONE..... 362BDNC

BIG HILL LIMESTONE..... 362BGHL
BILLS CREEK SHALE..... 362BLCK
COLLINGWOOD FORMATION..... 362CLGD
CINCINNATIAN SERIES..... 362CNCN
EDENIAN STAGE..... 362DEEN
EDEN GROUP..... 362EDEN
MAYSVILLIAN STAGE..... 362MSVL
OGONTZ CHERTY LIMESTONE..... 362OGNZ
QUEENSTON SHALE..... 362QNSN
RICHMONDIAN STAGE..... 362RCMD
STONINGTON FORMATION..... 362SNNG
UTICA SHALE..... 362UTIC

MIDDLE ORDOVICIAN

BONY FALLS MEMBER OF BLACK RIVER FORMATION..... 364BFLS
ORDOVICIAN, MIDDLE..... 364ODVCM

CHAMPLAINIAN

AU TRAIN FORMATION..... 365ATRN
BLACK RIVER FORMATION..... 365BKRV
CHANDLER FALLS FORMATION..... 365CDLF
CHAMPLAINIAN SERIES..... 365CMPL
GLENWOOD FORMATION..... 365GLND
GROOS QUARRY FORMATION..... 365GRQR
MOHAWKIAN SERIES..... 365MHKN
TRENTON-BLACK RIVER GROUP..... 365TBRV
TRENTON GROUP..... 365TRNN
TRENTON LIMESTONE..... 365TRNNL

LOWER ORDOVICIAN

CHAZYAN SERIES..... 367CHZN
ORDOVICIAN, LOWER..... 367ODVCL
ORDOVICIAN-CAMBRIAN SYSTEMS..... 367OVCB
STONES RIVER LIMESTONE..... 367SRVR
ST PETER SANDSTONE..... 367STPR

CANADIAN

CANADIAN SERIES..... 368CNDN
HERMANSVILLE LIMESTONE..... 368HMVL
NEW RICHMOND SANDSTONE..... 368NRCM
ONEOTA DOLOMITE..... 368ONOT
PRAIRIE DU CHIEN GROUP-TREMPEALEAU FORMATION..... 368PCTP
PRAIRIE DU CHIEN GROUP..... 368PRDC
SHAKOPEE DOLOMITE..... 368SHKP

CAMBRIAN

CAMBRIAN SYSTEM-PRECAMBRIAN ERATHEM..... 370CBPB
CAMBRIAN SYSTEM..... 370CMBR
CAMBRIAN ROCKS..... 370CMBRR
CAMBRIAN DOLOMITE..... 370DLMT
CAMBRIAN EVAPORITES..... 370EVPR

CAMBRIAN LIMESTONE..... 370LMSN
CAMBRIAN LIMESTONE AND SHALE..... 370LNSL
CAMBRIAN SANDSTONE AND SHALE..... 370SDSL
CAMBRIAN SHALE..... 370SHLE
CAMBRIAN SANDSTONE..... 370SNDS

UPPER CAMBRIAN

CAMBRIAN, UPPER..... 371CMBRU

ST. CROIXIAN

CHAPEL ROCK SANDSTONE..... 372CPRK
CROIXIAN SERIES..... 372CRXN
DRESBACH GROUP..... 372DRBC
EAU CLAIR SANDSTONE..... 372ECLR
FRANCONIA GROUP-DRESBACH SANDSTONE..... 372FDBC
FRANCONIA SANDSTONE..... 372FRNC
GALESVILLE SANDSTONE..... 372GLVL
JORDAN SANDSTONE..... 372JRDN
LAKE SUPERIOR SANDSTONE..... 372LKSP
LODI MEMBER..... 372LODI
MUNISING SANDSTONE..... 372MNSG
MOUNT SIMON SANDSTONE..... 372MNSM
MINERS CASTLE SANDSTONE..... 372MRCL
ST LAWRENCE FORMATION..... 372SLRC
TREMPEALEAU FORMATION..... 372TMPL
TREMPEALEAU-MUNISING FORMATIONS..... 372TPMG

MIDDLE CAMBRIAN

CAMBRIAN, LOWER..... 374CMBRL
CAMBRIAN, MIDDLE..... 374CMBRM

LOWER CAMBRIAN

CAMBRIAN-PRECAMBRIAN ROCKS..... 377CBPB

PRECAMBRIAN

PRECAMBRIAN BASEMENT..... 400BSMN
PRECAMBRIAN GRANITE..... 400GRNT
PRECAMBRIAN IGNEOUS ROCKS..... 400IGNS
PRECAMBRIAN IRON-BEARING UNIT..... 400IRBG
PRECAMBRIAN METAMORPHIC ROCKS..... 400MMPC
PRECAMBRIAN ERATHEM..... 400PCMB
PRECAMBRIAN ROCKS..... 400PCMBR
PROTEROZOIC..... 400PRZC
PRECAMBRIAN SEDIMENTARY ROCKS..... 400SDMR
PRECAMBRIAN VOLCANIC ROCKS..... 400VLCC

PRECAMBRIAN Y

ALGOMAN GRANITE..... 420ALGM
COPPER HARBOR CONGLOMERATE..... 420CPHB
FREDA SANDSTONE..... 420FRED

JACOBSVILLE SANDSTONE..... 420JCBV
KEWEENAWAN SUPERGROUP..... 420KWNW
MELLEN GRANITE..... 420MLLN
NONESUCH SHALE..... 420NNSC
PRECAMBRIAN Y..... 420PCMBY
PORTAGE LAKE VOLCANICS..... 420PGLK
PROTEROZOIC, MIDDLE..... 420PRZCM

PRECAMBRIAN X

AJIBIK FORMATION..... 430AJBK
AMASA FORMATION..... 430AMAS
ANVIL MEMBER OF IRONWOOD IRON-FORMATION..... 430ANVL
BARAGA GROUP..... 430BARG
BAD RIVER DOLOMITE..... 430BDRV
BIJIK IRON-FORMATION MEMBER OF MICHIGAMME SLATE..... 430BIJK
BIRD IRON-BEARING MEMBER OF HEMLOCK FORMATION..... 430BIRD
BRIER SLATE MEMBER OF VULCAN IRON-FORMATION..... 430BRIR
CHOCOLAY GROUP..... 430CCLY
CLARKSBURG VOLCANICS MEMBER OF MICHIGAMME SLATE..... 430CKBG
CURRY IRON-BEARING MEMBER OF VULCAN IRON-FORMATION..... 430CRRY
DUNN CREEK SLATE..... 430DCRK
FENCE RIVER FORMATION..... 430FCRV
FELCH FORMATION..... 430FLCH
FERN CREEK FORMATION..... 430FRCK
FORTUNE LAKES SLATE..... 430FRLK
GOODRICH QUARTZITE..... 430GDRC
HEMLOCK FORMATION..... 430HMCK
HIAWATHA GRAYWACKE..... 430HWTH
IRONWOOD IRON-FORMATION..... 430IRND
KNIFE LAKE GROUP..... 430KFLK
KONA DOLOMITE..... 430KONA
LORETTO SLATE MEMBER OF VULCAN IRON-FORMATION..... 430LRTT
MICHIGAMME SLATE..... 430MCGM
MANSFIELD IRON-BEARING SLATE MEMBER OF HEMLOCK FORMATION..... 430MFLD
MENOMINEE GROUP..... 430MNMN
MARQUETTE RANGE SUPERGROUP..... 430MQRG
MESNARD QUARTZITE..... 430MSRD
NEGAUNEE IRON-FORMATION..... 430NGNE
NORRIE MEMBER OF IRONWOOD IRON-FORMATION..... 430NORR
NORWAY LAKE GNEISS..... 430NRLK
PABST MEMBER OF TYLER FORMATION..... 430PBCP
PRECAMBRIAN X..... 430PCMBX
PENCE MEMBER OF IRONWOOD IRON-FORMATION..... 430PENC
PALMS FORMATION..... 430PLMS
PLYMOUTH MEMBER OF IRONWOOD IRON-FORMATION..... 430PLMT
PAINT RIVER GROUP..... 430PRVR
PROTEROZOIC, LOWER..... 430PRZCL
PEAVEY POND COMPLEX..... 430PVPD
RANDVILLE DOLOMITE..... 430RDVL
REPUBLIC GRANITE..... 430RPBC
RIVERTON IRON-FORMATION..... 430RVRN
SAUNDERS FORMATION..... 430SDRS
SIAMO SLATE..... 430SIMO
STAMBAUG FORMATION..... 430SMBG
SUNDAY QUARTZITE..... 430SNDY

STURGEON QUARTZITE..... 430SRGN
TRADER'S IRON-BEARING MEMBER OF VULCAN IRON-FORMATION..... 430TRDR
TYLER FORMATION..... 430TYLR
VULCAN IRON-FORMATION..... 430VLCN
WEWE SLATE..... 430WEWE
WAUSECA PYRITIC MEMBER OF DUNN CREEK SLATE..... 430WUSC
YALE MEMBER OF IRONWOOD IRON-FORMATION..... 430YALE

PRECAMBRIAN W

ARCHEAN..... 440ARCN
DICKINSON GROUP..... 440DCKS
EAST BRANCH ARKOSE..... 440EBRC
KITCHI SCHIST..... 440KTCH
LIGHTHOUSE POINT MEMBER OF MONA SCHIST..... 440LGSP
LAURENTIAN SERIES..... 440LRNN
MONA SCHIST..... 440MONA
PRECAMBRIAN W..... 440PCMBW
PALMER GNEISS..... 440PLMR
PRESQUE ISLE GRANITE..... 440PQIL
SOLBERG SCHIST..... 440SLBG
SIX MILE LAKE AMPHIBOLITE..... 440SXML

MINNESOTA

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

DES MOINES DRIFT..... 112DMDF
DES MOINES OUTWASH..... 112DSMO
LAKE AGASSIZ CLAY..... 112LKGZ
PLEISTOCENE SERIES..... 112PLSC
PRE-WISCONSIN DEPOSITS..... 112PRWC
RAINY DRIFT..... 112RNDF
RAINY OUTWASH..... 112RNOS
SUPERIOR DRIFT..... 112SPDF
SUPERIOR OUTWASH..... 112SPRO
WADENA DRIFT..... 112WDDF
WADENA OUTWASH..... 112WDNO
WISCONSINAN STAGE..... 112WSCS

TERTIARY

TERTIARY SYSTEM..... 120TRTR

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

BELLE FOURCHE FORMATION..... 211BLFC
COLERAINE FORMATION..... 211CLRN
UPPER CRETACEOUS SERIES..... 211CRCSU
CARLILE SHALE..... 211CRLL
GREENHORN FORMATION..... 211GRNR
IRON HILL MEMBER OF WINDROW FORMATION..... 211IRHL
NIOBRARA FORMATION..... 211NBRR
PIERRE SHALE..... 211PIRR
WINDROW FORMATION..... 211WNDR

LOWER CRETACEOUS

OSTRANDER MEMBER OF DAKOTA FORMATION..... 217ORDR

JURASSIC

JURASSIC SYSTEM..... 220JRSC

MIDDLE JURASSIC

AMARANTH FORMATION..... 224AMRN
MIDDLE JURASSIC SERIES..... 224JRSCM

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

DEVONIAN

CEDAR VALLEY-MAQUOKETA-DUBUQUE FORMATIONS..... 340CVMD
CEDAR VALLEY-MAQUOKETA-DUBUQUE-GALENA AQUIFER..... 340CVMDG
CEDAR VALLEY-MAQUOKETA FORMATIONS..... 340CVMQ
DEVONIAN SYSTEM..... 340DVNN
DEVONIAN-ORDOVICIAN SYSTEMS..... 340DVOV

UPPER DEVONIAN

DEVONIAN, UPPER..... 341DVNNU
SHELL ROCK FORMATION..... 341SRCK

MIDDLE DEVONIAN

CEDAR VALLEY LIMESTONE..... 344CDVL
CORALVILLE MEMBER OF CEDAR VALLEY FORMATION..... 344CRVL
DEVONIAN, MIDDLE..... 344DVNNM
RAPID MEMBER OF CEDAR VALLEY FORMATION..... 344RPID
SOLON MEMBER OF CEDAR VALLEY FORMATION..... 344SOLN

SILURIAN

LOWER SILURIAN

SILURIAN-ORDOVICIAN SYSTEMS..... 357SODV
STONEWALL FORMATION..... 357STNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

CLERMONT SHALE MEMBER OF MAQUOKETA FORMATION..... 361CLRM
ELGIN MEMBER OF MAQUOKETA FORMATION..... 361ELGN
MAQUOKETA SHALE-GALENA DOLOMITE..... 361MQKG
MAQUOKETA SHALE..... 361MQKT

CINCINNATIAN

CINCINNATIAN SERIES..... 362CNCN
DUBUQUE FORMATION-GALENA DOLOMITE..... 362DBUG

MIDDLE ORDOVICIAN

CUMMINGSVILLE MEMBER OF GALENA DOLOMITE..... 364CMGV
DECORAH FORMATION..... 364DCRH
DUBUQUE FORMATION..... 364DUBQ
GALENA DOLOMITE..... 364GLEN
GLENWOOD FORMATION..... 364GLND
PLATTEVILLE FORMATION..... 364PLVL
PROSSER MEMBER OF GALENA DOLOMITE..... 364PRSR
STEWARTVILLE MEMBER OF GALENA DOLOMITE..... 364SRVL
ST PETER SANDSTONE..... 364STPR

CHAMPLAINIAN

CHAMPLAINIAN SERIES..... 365CMPL
CARIMONA MEMBER OF PLATTEVILLE FORMATION..... 365CRMN
MCGREGOR MEMBER OF PLATTEVILLE FORMATION..... 365MCGG
PECATONICA MEMBER OF PLATTEVILLE FORMATION..... 365PCNC

LOWER ORDOVICIAN

NEW RICHMOND SANDSTONE..... 367NRCM
ONEOTA DOLOMITE..... 367ONOT
PRAIRIE DU CHIEN GROUP..... 367PRDC
SHAKOPEE DOLOMITE..... 367SHKP
WILLOW RIVER MEMBER OF SHAKOPEE FORMATION..... 367WLRV

CANADIAN

CANADIAN SERIES..... 368CNDN

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

BIRKMOSE MEMBER OF FRANCONIA FORMATION..... 371BRKM
CAMBRIAN SYSTEM-PRECAMBRIAN ERATHEM..... 371CBPB
CAMBRIAN, UPPER..... 371CMBRU
DRESBACH GROUP..... 371DRBC
EAU CLAIR SANDSTONE..... 371ECLR
EAU CLAIRE-MT. SIMON FORMATIONS..... 371ECMS
FRANCONIA-IRONTON-GALESVILLE FORMATIONS..... 371FIGV
FRANCONIA SANDSTONE..... 371FRNC
GALESVILLE SANDSTONE..... 371GLVL
IRONTON-GALESVILLE-EAU CLAIRE FORMATIONS..... 371IGEC
IRONTON SANDSTONE MEMBER OF FRANCONIA SS.-GALESVILLE SS..... 371IGLV
IRONTON SANDSTONE MEMBER OF FRANCONIA SANDSTONE..... 371IRNT
JORDAN-IRONTON-GALESVILLE SANDSTONES..... 371JIGV
JORDAN SANDSTONE..... 371JRDN

JORDAN-ST. LAWRENCE FORMATIONS..... 371JSLC
JORDAN-ST. LAWRENCE-FRANCONIA FORMATIONS..... 371JSTF
LODI MEMBER OF ST LAWRENCE FORMATION..... 371LODI
MT. SIMON-HINCKLEY AQUIFER..... 371MSHK
MOUNT SIMON SANDSTONE..... 371MSMN
MT. SIMON SANDSTONE-RED CLASTICS SERIES..... 371MSRC
MAZOMANIE SANDSTONE..... 371MZMN
MAZOMANIE-RENO MEMBERS OF FRANCONIA FORMATION..... 371MZMR
NORWALK MEMBER OF JORDAN SANDSTONE..... 371NRLK
RENO MEMBER OF FRANCONIA FORMATION..... 371RENO
ST LAWRENCE-FRANCONIA FORMATIONS..... 371SLCF
ST LAWRENCE FORMATION..... 371SLRC
SUNSET POINT MEMBER OF JORDAN SANDSTONE..... 371SNSP
TOMAH MEMBER OF FRANCONIA FORMATION..... 371TOMH
VAN OSER MEMBER OF JORDAN SANDSTONE..... 371VOSR

WAUCOBAN

PRAIRE DU CHIEN-JORDAN AQUIFER..... 378PDCJ

PRECAMBRIAN

ARGILLITE-GRAYWACKE..... 400AGGK
BIWABIK IRON FORMATION..... 400BBKF
BELLE PLAINE FORMATION..... 400BLPL
BASALT..... 400BSLT
DULUTH COMPLEX..... 400DCPX
ELY GREENSTONE..... 400ELY
FOND DU LAC FORMATION..... 400FDLC
PRECAMBRIAN GRANITE..... 400GRNT
GNEISS-SCHIST..... 400GSSC
HINCKLEY FORMATION..... 400HCKL
KNIFE LAKE GROUP..... 400KFLK
METASEDIMENTARY ROCKS..... 400MDMR
MINNESOTA VALLEY GRANITE SERIES..... 400MSVL
METAVOLCANIC ROCKS..... 400MVCC
NORTH SHORE VOLCANIC GROUP..... 400NRSR
PRECAMBRIAN ERATHEM..... 400PCMB
RED CLASTICS SERIES..... 400RDCC
SIOUX QUARTZITE..... 400SOUX
VOLCANIC ROCKS..... 400VLCC
VIRGINIA FORMATION..... 400VRGN

MISSISSIPPI

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
QUATERNARY SYSTEM..... 110QRNR
QUATERNARY-TERTIARY SYSTEMS..... 110QRRT
SAND..... 110SAND
SAND AND GRAVEL..... 110SDGV
TERRACE DEPOSITS,UNDIFFERENTIATED..... 110TRCS

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
COASTAL DEPOSITS..... 111CSTLP
HOLOCENE-PLEISTOCENE SERIES..... 111HCPC
HOLOCENE SERIES..... 111HLCN
LOW TERRACE DEPOSITS AND ALLUVIUM..... 111LTAVP
NATURAL LEVEE DEPOSITS OF MISSISSIPPI RIVER..... 111NLMR
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CATAHOULA FORMATION,MIDDLE..... 122CTHLM
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BUCATUNNA CLAY MEMBER OF BYRAM FORMATION..... 123BCTN
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CHICKASAWHAY LIMESTONE..... 123CCKS
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BASHI MARL MEMBER OF HATCHETIGBEE FORMATION..... 124BSHI
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FEARN SPRINGS MEMBER OF NANAFALIA FORMATION..... 124FSPG
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MINOR WILCOX AQUIFER..... 124MWCX
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NESHOBA SAND MEMBER OF TALLAHATTA FORMATION..... 124NSHB
NORTH TWISTWOOD CREEK MEMBER OF YAZOO CLAY..... 124NTCK
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SPARTA SAND,LOWER..... 124SPRTL
SPARTA SAND,MIDDLE..... 124SPRTM
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MESOZOIC

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COON CREEK TONGUE OF RIPLEY FORMATION..... 211CCRK
CHIWAPA MEMBER OF RIPLEY FORMATION..... 211CHWP
COFFEE SAND..... 211COFF
COKER FORMATION..... 211COKR
UPPER UNNAMED MEMBER OF COKER FORMATION..... 211COKRU
UPPER CRETACEOUS SERIES..... 211CRCSU
DEMOPOLIS CHALK..... 211DMPL
DEMOPOLIS CHALK,UNNAMED MEMBER..... 211DMPLN
EDLINE MEMBER..... 211EDLN
EUTAW FORMATION..... 211EUTW
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EUTAW FORMATION,UNNAMED MEMBER..... 211EUTWN
EUTAW FORMATION (RESTRICTED)..... 211EUTWR
GORDO FORMATION..... 211GURD

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MC SHAN FORMATION..... 211MCSN
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MOOREVILLE CHALK,UNNAMED MEMBER..... 211MRVLN
MASSIVE SAND..... 211MSSV
OWL CREEK FORMATION..... 211OLCK
PRAIRIE BLUFF CHALK..... 211PBLF
RIPLEY FORMATION..... 211RPLY
SELMA GROUP..... 211SELM
TOMBIGBEE SAND MEMBER OF EUTAW FORMATION..... 211TBGB
TRANSITIONAL CLAY OF RIPLEY FORMATION..... 211TRSL
TUSCALOOSA GROUP..... 211TSCL
TUSCALOOSA GROUP,LOWER..... 211TSCLL
TUSCALOOSA GROUP,MIDDLE..... 211TSCLM
TUSCALOOSA GROUP,UPPER..... 211TSCLU

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DANTZLER FORMATION..... 217DZLR
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COMANCHEAN

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BUCKNER MEMBER OF HAYNESVILLE FORMATION..... 221BCKR
COTTON VALLEY FORMATION..... 221CNVL
HAYNESVILLE FORMATION..... 221HSVL
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PALEOZOIC

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PERMIAN

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PERMIAN SYSTEM..... 310PRMN

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PARKWOOD FORMATION..... 320PRKD
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MOOREHOUSE FORMATION..... 324MRHS
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ALSOBROOK MEMBER OF PRIDE MOUNTAIN FORMATION..... 331ALBK
BANGOR LIMESTONE..... 331BNGR
GREEN HILL MEMBER OF PRIDE MOUNTAIN FORMATION..... 331GRHL
HARTSELLE SANDSTONE..... 331HRSL
MISSISSIPPIAN, UPPER..... 331MSSPU
MYNOT SANDSTONE MEMBER OF PRIDE MOUNTAIN FORMATION..... 331MYNT
PENNINGTON FORMATION..... 331PNNG
PRIDE MOUNTAIN FORMATION..... 331PRDM
SANDFALL MEMBER OF PRIDE MOUNTAIN FORMATION..... 331SDFL
SOUTHWARD SPRING SANDSTONE MEMBER OF PRIDE MOUNTAIN FORMATION..... 331SSPG
TUSCUMBIA LIMESTONE..... 331TCMB
TANYARD BRANCH MEMBER OF PRIDE MOUNTAIN FORMATION..... 331TDBC
WAGNON MEMBER OF PRIDE MOUNTAIN FORMATION..... 331WGNN

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SILURIAN

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QUATERNARY

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LAFAYETTE GRAVEL..... 112LFTT
NEBRASKAN DEPOSITS..... 112NBRK
PLEISTOCENE SERIES..... 112PLSC
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PLIOCENE

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EOCENE

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CLAIBORNE GROUP..... 124CLBR
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HOLLYSPRINGS FORMATION..... 124HLPG
WILCOX FORMATION..... 124WLCX

PALEOCENE

CLAYTON FORMATION..... 125CLTN
MIDWAY GROUP..... 125MDWY
PALEOCENE SERIES..... 125PLCN
PORTERS CREEK CLAY..... 125PRCK

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

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OWL CREEK FORMATION..... 211OLCK

GULFIAN

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PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

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LOWER PERMIAN

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PENNSYLVANIAN SYSTEM..... 320PSLV

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DOUGLAS GROUP..... 322DGLS
DEER CREEK FORMATION..... 322DRCK
EMPORIA LIMESTONE..... 322EMPR
HOWARD LIMESTONE..... 322HWRD
KANAWAKA FORMATION..... 322KNWK
LECOMPTON LIMESTONE..... 322LCMP
LAWRENCE SHALE..... 322LRNC
NEMAHA SUBGROUP OR FORMATION..... 322NEMH
OREAD LIMESTONE..... 322ORED
PILLSBURY SHALE..... 322PLBR
RICHARDSON SUBGROUP..... 322RCRD
SACFOX SUBGROUP..... 322SCFX
SCRANTON SHALE..... 322SCRN
SHAWNEE GROUP..... 322SHWN
STRANGER FORMATION..... 322SRGR
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SEVERY SHALE..... 322SVRY
TECUMSEH SHALE..... 322TCMS
TOPEKA FORMATION..... 322TOPK
VIRGILIAN SERIES..... 322VRGL
WABAUNSEE GROUP..... 322WBNS
WILLARD SHALE..... 322WLRD
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MISSOURIAN

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DENNIS FORMATION..... 323DNNS
DRUM FORMATION..... 323DRUM
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HERTHA LIMESTONE..... 323HRTH
IATAN LIMESTONE..... 323IATN
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LANE SHALE..... 323LANE
LADORE SHALE..... 323LDOR
LINN SUBGROUP..... 323LINN
LANSING GROUP..... 323LNSG
MISSOURIAN SERIES..... 323MSSR
PEDEE GROUP..... 323PEDE
PLATTSBURG LIMESTONE..... 323PLBG
PLEASANTON GROUP..... 323PLSN
STANTON LIMESTONE..... 323STNN
SWOPE FORMATION..... 323SWOP
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WESTON FORMATION..... 323WSTN
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APPANOOSE SUBGROUP..... 325APNS
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BLACKJACK CREEK FORMATION..... 325BJKC
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BANDERA SHALE..... 325BNDR
BEVIER FORMATION..... 325BVIR
CABANISS SUBGROUP..... 325CBNS
CHEROKEE GROUP..... 325CHRK
CROWEBURG FORMATION..... 325CRBG
DRYWOOD FORMATION..... 325DRYD
DES MOINESIAN SERIES..... 325DSMS
EXCELLO FORMATION..... 325EXCL
FLEMING FORMATION..... 325FLMG
FORT SCOTT LIMESTONE..... 325FRSC
HIGGINSVILLE LIMESTONE MEMBER OF FORT SCOTT LIMESTONE..... 325HGVL
HOLDENVILLE SHALE..... 325HLDV
HARTSHORNE SANDSTONE..... 325HRSR
KREBS GROUP..... 325KRBS
LABETTE SHALE..... 325LBTT
LAGONDA FORMATION..... 325LGND
LITTLE OSAGE MEMBER OF FORT SCOTT LIMESTONE..... 325LLOG
LENAPAH LIMESTONE..... 325LNPH
MULKY FORMATION..... 325MLKY
MINERAL FORMATION..... 325MNRL
MARMATON GROUP..... 325MRMN

NOWATA SHALE..... 325NOWT
PAWNEE LIMESTONE..... 325PWNE
ROBINSON BRANCH FORMATION..... 325RBBC
ROWE FORMATION..... 325ROWE
SCAMMON FORMATION..... 325SCMN
SEVILLE LIMESTONE MEMBER OF KREBS FORMATION..... 325SVLL
TEBO FORMATION..... 325TEBO
VERDIGRIS LIMESTONE MEMBER OF CABANISS FORMATION..... 325VRDG
WEIR FORMATION..... 325WEIR
WARNER SANDSTONE MEMBER OF KREBS FORMATION..... 325WRNR

ATOKAN

ATOKA FORMATION..... 326ATCK
ATOKAN SERIES..... 326ATOK
BURGNER FORMATION..... 326BRGR
CHELTENHAM FORMATION..... 326CLNM
MC LOUTH FORMATION..... 326MCLT
RIVERTON FORMATION..... 326RVRN

MORROWAN

HALE FORMATION..... 328HALE
MORROWAN SERIES..... 328MRRW

MISSISSIPPIAN

CHATTANOOGA SHALE..... 330CTNG
MISSISSIPPIAN SYSTEM..... 330MSSP

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HINDSVILLE LIMESTONE..... 331HDVL

CHESTERIAN

AUX VASES SANDSTONE..... 332AXVS
BATESVILLE FORMATION..... 332BSVL
CYPRESS FORMATION..... 332CPRS
CARTERVILLE FORMATION..... 332CRVL
CHESTERIAN SERIES..... 332CSTR
FAYETTEVILLE SHALE..... 332FTVL
GOLCONDA FORMATION..... 332GLCD
GLEN DEAN LIMESTONE..... 332GLND
HARDINSBURG SANDSTONE..... 332HDBG
PAINT CREEK FORMATION..... 332PNCK
RENAULT FORMATION..... 332RNLT
TAR SPRINGS SANDSTONE..... 332TSPG
VIENNA LIMESTONE..... 332VINN
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MERAMECIAN

MERAMECIAN SERIES..... 333MRMC
STE GENEVIEVE-ST LOUIS LIMESTONES,UNDIFFERENTIATED..... 333SGSL

STE GENEVIEVE LIMESTONE..... 333SGVV
SALEM FORMATION..... 333SLEM
ST LOUIS LIMESTONE..... 333STLS
WARSAW FORMATION..... 333WRSW

LOWER MISSISSIPPIAN

CHOUTEAU LIMESTONE..... 337CHUT
COMPTON FORMATION..... 337CMPN

OSAGEAN

BURLINGTON LIMESTONE..... 338BRLG
ELSEY FORMATION..... 338ELSY
FERN GLEN LIMESTONE..... 338FRGL
GRAND FALLS FORMATION..... 338GDFL
KEOKUK-BURLINGTON LIMESTONES,UNDIFFERENTIATED..... 338KKKB
KEOKUK LIMESTONE..... 338KKUK
OSAGEAN SERIES..... 338OSGE
PIERSON FORMATION..... 338PRSN
REEDS SPRING LIMESTONE..... 338RSPG
SHORT CREEK OOLITE..... 338SRCK

KINDERHOOKIAN

BACHELOR SANDSTONE..... 339BCLR
HANNIBAL FORMATION..... 339HNBL
KINDERHOOKIAN SERIES..... 339KDRK
NORTHVIEW SHALE..... 339NRTV
SEDALIA FORMATION..... 339SDLI

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

BUSHBERG SANDSTONE..... 341BBRG
CHATTANOOGA SHALE..... 341CTNG
DEVONIAN, UPPER..... 341DVNNU
GLEN PARK LIMESTONE..... 341GLPK
GRASSY CREEK SHALE..... 341GRCK
LOUISIANA FORMATION..... 341LUSN
SNYDER CREEK FORMATION..... 341SDCK
SULFUR SPRINGS GROUP..... 341SSPG
SAVERTON FORMATION..... 341SVRN

MIDDLE DEVONIAN

BEAUVAIS SANDSTONE..... 344BUVS
CLEAR CREEK CHERT..... 344CLCK
CALLAWAY FORMATION..... 344CLLY
DEVONIAN, MIDDLE..... 344DVNNM
FORTUNE FORMATION..... 344FRTN
GRAND TOWER LIMESTONE..... 344GRDT
ST LAURENT FORMATION..... 344SLRN

LOWER DEVONIAN

BAILEY LIMESTONE..... 347BILY
DEVONIAN, LOWER..... 347DVNNL
LITTLE SALINE LIMESTONE..... 347LLSL

SILURIAN

SILURIAN SYSTEM..... 350SLRN

NIAGARAN

BAINBRIDGE LIMESTONE..... 355BBDG
NIAGARAN SERIES..... 355NGRN

ALEXANDRIAN

ALEXANDRIAN SERIES..... 358ALXD
BOWLING GREEN DOLOMITE..... 358BLGG
CYRENE LIMESTONE MEMBER OF EDGEWOOD FORMATION..... 358CYRN
EDGEWOOD FORMATION..... 358EDGD
GIRARDEAU LIMESTONE..... 358GRRD
SEXTON CREEK LIMESTONE..... 358SXCK

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

MAQUOKETA SHALE..... 361MQKT

CINCINNATIAN

CAPE LIMESTONE..... 362CAPE
CINCINNATIAN SERIES..... 362CNCN
ORCHARD CREEK SHALE..... 362OCCK
THEBES SANDSTONE..... 362THBS

MIDDLE ORDOVICIAN

DECORAH FORMATION..... 364DCRH
EVERTON FORMATION..... 364EVRN
JOACHIM DOLOMITE..... 364JCHM
KIMMSWICK LIMESTONE..... 364KMCK
PLATTIN LIMESTONE..... 364PLTN
ST PETER SANDSTONE-EVERTON FORMATION,UNDIFFERENTIATED..... 364SPEV
ST PETER SANDSTONE..... 364STPR

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DUTCHTOWN FORMATION..... 365DTCN
ROCK LEVEE FORMATION..... 365RKLV

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COTTER-JEFFERSON CITY DOLOMITE..... 367CRJF
COTTER DOLOMITE..... 367CTTR
GUNTER SANDSTONE MEMBER OF GASCONADE DOLOMITE..... 367GNTR
GASCONADE DOLOMITE..... 367GSCD
GASCONADE DOLOMITE,LOWER..... 367GSCDL
GASCONADE DOLOMITE,UPPER..... 367GSCDU
ROUBIDOUX FORMATION..... 367RBDX
SMITHVILLE FORMATION..... 367SMVL
SMITHVILLE FORMATION-POWELL LIMESTONE..... 367SMVP

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JEFFERSON CITY DOLOMITE..... 368JFRC
POWELL-COTTER DOLOMITES..... 368PLCR
POWELL DOLOMITE..... 368PWLL
SWAN CREEK MEMBER OF COTTER FORMATION OR DOLOMITE..... 368SCRK

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CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

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BONNETERRE FORMATION..... 371BNTR
CAMBRIAN, UPPER..... 371CMBRU
DERBY-DOERON DOLOMITES..... 371DRBD
DAVIS FORMATION..... 371DVIS
ELVINS GROUP..... 371ELVS
EMINENCE-POTOSI DOLOMITES..... 371EMCP
EMINENCE DOLOMITE..... 371EMNC
LAMOTTE SANDSTONE..... 371LMTT
POTOSI DOLOMITE..... 371POTS
TRANSITION ARKOSE..... 371TRAK

PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB

CENOZOIC

CENOZOIC ERATHEM	100CNZC

QUATERNARY

ALLUVIAL FAN DEPOSITS	110ALVF
QUATERNARY ALLUVIUM	110ALVM
PEDIMENT DEPOSITS	110PDMN
TERRACE DEPOSITS	110TRRC

HOLOCENE

ALLUVIAL FAN DEPOSITS	111ALVF
HOLOCENE ALLUVIUM	111ALVM
DREDGE PILINGS	111DDGP
MINE TAILINGS	111MTLG
PEDIMENT DEPOSITS	111PDMN
SPOIL BANKS	111SPBK
TERRACE DEPOSITS	111TRRC

PLEISTOCENE

ALTAMONT MORAINE-WISCONSIN STAGE	112ALMN
ALLUVIUM	112ALVM
DRIFT	112DRFT
GLACIAL OUTWASH	112GCLO
GREAT FALLS LAKE SANDS	112GFLK
GLACIOLACUSTRINE DEPOSITS	112GLCC
LAKE MISSOULA BEDS	112LKML
OUTWASH	112OTSH
TILL	112TILL
TERRACE DEPOSITS	112TRRC
WIOTA GRAVELS	112WIOT

TERTIARY

BELMONT PORPHYRY	120BLMN
BOZEMAN GROUP	120BZMN
CARPENTER CREEK GRANITE PORPHYRY	120CPCK
DRUMLUMMON PORPHYRY	120DMLM
LINLEY CONGLOMERATE	120LNLY
LIVINGSTON FORMATION	120LVGS
PLUTONIC ROCKS	120PLNC
PINTO DIORITE	120PNTO
SEDIMENTS	120SDMS
STANFORD CONGLOMERATE	120SFRD
TERTIARY SYSTEM	120TRTR
VOLCANICS	120VLCC

PLIOCENE

CASTLE GRANITE	121CSTL
FLAXVILLE FORMATION	121FLXV

FORT ELLIS BEDS..... 121FREL
LACUSTRINE DEPOSITS..... 121LCSR
SEDIMENTS..... 121SDMS
VOLCANICS..... 121VLCC

MIOCENE

AKIKAREE FORMATION..... 122ARKR
DEEP RIVER BEDS (MIDDLE MIOCENE)..... 122DPRVM
FORT LOGAN BEDS (LOWER MIOCENE)..... 122FRLGL
LACUSTRINE DEPOSITS..... 122LCSR
SEDIMENTS..... 122SDMS
VOLCANICS..... 122VLCC
WOOD MOUNTAIN GRAVELS..... 122WDMN

OLIGOCENE

CLIMBING ARROW FORMATION OF BOZEMAN GROUP (OLIGOCENE-EOCENE)..... 123CBGA
CHALLIS VOLCANICS..... 123CHLS
COOK RANCH FORMATION..... 123CKRC
CYPRESS HILLS BEDS..... 123CPHL
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LACUSTRINE DEPOSITS..... 123LCSR
SEDIMENTS..... 123SDMS
VOLCANICS..... 123VLCC
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EOCENE

BEAVERHEAD FORMATION (EOCENE-PALEOCENE)..... 124BVRD
CRANDALL CONGLOMERATE..... 124CRDL
GOLDEN VALLEY FORMATION..... 124GLDV
KINGSBURG CONGLOMERATE MEMBER OF WASATCH FORMATION..... 124KGBG
REESE FORMATION..... 124REES
SEDIMENTS..... 124SDMS
SAGE CREEK FORMATION..... 124SGCK
SPHINX CONGLOMERATE..... 124SPNX
VOLCANICS..... 124VLCC
WASATCH FORMATION..... 124WSTC

PALEOCENE

BEAR FORMATION..... 125BEAR
FORT UNION FORMATION..... 125FRUN
LUDLOW MEMBER OF FORT UNION FORMATION..... 125LDLW
LEBO SHALE MEMBER OF FORT UNION FORMATION..... 125LEBO
SENTINEL BUTTE MEMBER OF FORT UNION FORMATION..... 125SNLB
TONGUE RIVER MEMBER OF FORT UNION FORMATION..... 125TGRV
TULLOCK MEMBER OF FORT UNION FORMATION..... 125TLCK
WILLOW CREEK FORMATION (PALEOCENE-LATE CRETACEOUS)..... 125WLCK

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

ASH CREEK SANDSTONE MEMBER OF STEEL SHALE..... 211ACRK
ADEL MOUNTAIN VOLCANICS..... 211ADLM
ASPEN SHALE..... 211ASPN
BIG ELK SANDSTONE MEMBER OF COLORADO SHALE..... 211BGEK
BULL CREEK SANDY LIMESTONE MEMBER OF GREENHORN FORMATION..... 211BLCK
BELLE FOURCHE SHALE MEMBER OF GRANEROS SHALE..... 211BLFC
BENTON SHALE OF COLORADO GROUP..... 211BNTN
BEARPAW SHALE..... 211BRPW
BASIN SHALE..... 211BSIN
BEAVER CREEK CHALKY MEMBER OF NIOBRARA FORMATION..... 211BVCK
CLAGGETT SHALE OF THE MONTANA GROUP..... 211CLGG
COLGATE SANDSTONE MEMBER OF FOX HILLS FORMATION..... 211CLGT
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CODY SHALE..... 211CODY
CONE CALCAREOUS MEMBER OF MARIAS RIVER FORMATION..... 211CONE
CARLILE SHALE..... 211CRLL
DAKOTA SANDSTONE OR FORMATION..... 211DKOT
EAGLE SANDSTONE..... 211EGLE
ELK BASIN SANDSTONE MEMBER OF TELEGRAPH CREEK FORMATION..... 211ELKB
ELKHORN MOUNTAINS VOLCANICS..... 211ELKM
FOX HILLS-HELL CREEK AQUIFER..... 211FHHC
FLOWEREE MEMBER OF MARIAS RIVER FORMATION..... 211FLWR
FERDIG SHALE MEMBER OF MARIAS RIVER FORMATION..... 211FRDG
FORT HAYS LIMESTONE MEMBER OF NIOBRARA FORMATION..... 211FRHS
FRONTIER FORMATION..... 211FRNR
FOX HILLS FORMATION..... 211FXHL
GAMMON FERRUGINOUS MEMBER OF PIERRE SHALE..... 211GMMN
GREENHORN LIMESTONE OF COLORADO GROUP..... 211GRNR
GRUAT SANDSTONE BED OF PIERRE SHALE..... 211GROT
GRANEROS SHALE OF COLORADO GROUP..... 211GRRS
HELL CREEK FORMATION..... 211HLCK
HORSETHIEF SANDSTONE OF MONTANA GROUP..... 211HRSF
JUDITH RIVER FORMATION OF MONTANA GROUP..... 211JDRV
KEVIN SHALE MEMBER OF MARIAS RIVER FORMATION..... 211KVIN
LANCE FORMATION..... 211LNCE
LENNEP SANDSTONE OF MONTANA GROUP..... 211LNNP
MONUMENT HILL BENTONITIC MEMBER OF PIERRE SHALE..... 211MMHL
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MARIAS RIVER FORMATION OF COLORADO GROUP..... 211MRRV
MOSBY SANDSTONE MEMBER OF WARM CREEK SHALE..... 211MSBY
MITTEN BLACK SHALE MEMBER OF PIERRE SHALE..... 211MTTN
MEETEETSE FORMATION..... 211MTTS
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PEDRO BENTONITE BED OF PIERRE SHALE..... 211PDRO
PEAY SANDSTONE MEMBER OF FRONTIER FORMATION..... 211PEAY
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PARKMAN SANDSTONE OF MONTANA GROUP..... 211PRKM
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SAGE HEN LIMESTONE OF COLORADO SHALE..... 211SGHN
SMOKY HILL CHALK MEMBER OF NIOBRARA SHALE..... 211SMKH
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SLIM SAM FORMATION..... 211SMSM
SHANNON SANDSTONE MEMBER OF CODY SHALE..... 211SNNN
SOAP CREEK BENTONITE BED MEMBER OF FRONTIER FORMATION..... 211SPCK
SUSSEX SANDSTONE MEMBER OF CODY SHALE..... 211SSSX
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TWO MEDICINE FORMATION OF MONTANA GROUP..... 211TMDC
TELEGRAPH CREEK FORMATION OF MONTANA GROUP..... 211TPCK
TEAPOT SANDSTONE MEMBER OF MESAVERDE FORMATION..... 211TPOT
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VIRGELLE SANDSTONE MEMBER OF EAGLE SANDSTONE..... 211VRGL
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BOW ISLAND SANDSTONE..... 217BILD
BOOTLEGGER MEMBER OF BLACKLEAF FORMATION..... 217BLGR
BIRDHEAD SANDSTONE MEMBER..... 217BRDD
CUT BANK SANDSTONE..... 217CBNK
CHILSON MEMBER OF LAKOTA FORMATION..... 217CLSN
CLAY SPUR BENTONITE BED OF MOWRY SHALE..... 217CLSP
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DARLING SANDSTONE..... 217DRLG
FIRST CAT CREEK SANDSTONE OF COLORADO GROUP..... 217FCCK
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FALL RIVER FORMATION OF INYAN KARA GROUP..... 217FLRV
FUSON MEMBER OF LAKOTA FORMATION..... 217FUSN
GREYBULL SANDSTONE MEMBER OF CLOVERLY FORMATION..... 217GRBL
HINES MEMBER OF CLOVERLY FORMATION..... 217HINS
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LITTLE SHEEP MEMBER OF CLOVERLY FORMATION..... 217LLSP
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MOULTON SANDSTONE..... 217MLTN
MOSSER SANDSTONE..... 217MSSR
MOWRY SHALE..... 217MWRY
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PRYOR CONGLOMERATE MEMBER OF CLOVERLY FORMATION..... 217PRYR
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THERMOPOLIS SHALE..... 217TMPL
VAUGHN MEMBER OF BLACKLEAF FORMATION..... 217VGHN

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HULETT SANDSTONE MEMBER OF SUNDANCE FORMATION..... 221HLTT
LAK MEMBER OF SUNDANCE FORMATION..... 221LAK
MORRISON FORMATION..... 221MRSN
REDWATER SHALE MEMBER OF SUNDANCE FORMATION..... 221RDTR
RIERDON FORMATION OF ELLIS GROUP..... 221RRDN
STOCKADE BEAVER SHALE MEMBER OF SUNDANCE FORMATION..... 221SKBV
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FIREMOON LIMESTONE MEMBER OF PIPER FORMATION..... 224FRMN
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NESSON FORMATION..... 224NSSN
PICARD MEMBER OF NESSON FORMATION..... 224PCRD
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GRANDEUR MEMBER OF PARK CITY FORMATION..... 310GRDR
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MINNELUSA FORMATION (PERMIAN AND PENNSYLVANIAN)..... 310MNLS
PARK CITY FORMATION OR GROUP..... 310PRKC
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RETORT PHOSPHATIC SHALE MEMBER OR TONGUE OF PHOSPHORIA FORMATION..... 310RTRT
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AMSDEN FORMATION..... 320AMSD
DARWIN SANDSTONE OF AMSDEN GROUP..... 320DRWN
DEVILS POCKET FORMATION OF AMSDEN GROUP..... 320DVPK
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QUADRANT QUARTZITE OR FORMATION..... 320QDRN
TYLER FORMATION OF AMSDEN GROUP..... 320TYLR

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HANNAH LIMESTONE..... 330HNNH
MIDDLE CANYON FORMATION OF WHITE KNOB GROUP..... 330MDLC
MILLIGEN FORMATION..... 330MLGN
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SOUTH CREEK FORMATION OF WHITE KNOB GROUP..... 330SCRK
SURRETT CANYON FORMATION OF WHITE KNOB GROUP..... 330SRCN
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KIBBEY SANDSTONE OF BIG SNOWY GROUP..... 331KBBY
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MISSION CANYON LIMESTONE..... 331MSNC
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D ZONE OF MISSION CANYON FORMATION..... 337D
DEAN LAKE CHERT MEMBER OF MADISON LIMESTONE..... 337DNLK
LITTLE CHIEF CANYON MEMBER OF LODGEPOLE LIMESTONE..... 337LCFC
LODGEPOLE LIMESTONE OF MADISON GROUP..... 337LDGP
MONITOR MOUNTAIN LIMESTONE MEMBER OF MADISON LIMESTONE..... 337MNRM
PAHASAPA LIMESTONE..... 337PHSP
PAINE SHALE MEMBER OF LODGEPOLE FORMATION..... 337PINE
ROONEY CHERT MEMBER OF MADISON LIMESTONE..... 337RONY
SILVERTIP CONGLOMERATE MEMBER OF MADISON LIMESTONE..... 337SLVP
SAPPINGTON SANDSTONE MEMBER OF THREE FORKS SHALE..... 337SPNG
SAYPO LIMESTONE MEMBER OF MADISON LIMESTONE..... 337SYPO
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EXSHAW SHALE..... 341EXSH
GLEN CREEK SHALE MEMBER OF JEFFERSON LIMESTONE..... 341GLCK
GRAND VIEW DOLOMITE..... 341GRDV
JEFFERSON LIMESTONE DOLOMITE FORMATION OR GROUP..... 341JFRS
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POTLATCH FORMATION OR ANHYDRITE..... 341PTLC
SPOTTED BEAR LIMESTONE MEMBER OF JEFFERSON LIMESTONE..... 341SPDB
SOURIS RIVER FORMATION..... 341SRRV
THREE FORKS SHALE..... 341TRFK
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MAYWOOD FORMATION..... 344MYWD
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WINNEPEGOSIS FORMATION OF ELK POINT GROUP..... 344WPGS

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GUNTON MEMBER OF STONY MOUNTAIN FORMATION..... 361GNTN
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LEIGH DOLOMITE MEMBER OF BIGHORN DOLOMITE..... 361LIGH
LANDER SANDSTONE OF BIGHORN DOLOMITE..... 361LNDR
RED RIVER FORMATION OF BIGHORN GROUP..... 361RDRV
STONY MOUNTAIN FORMATION OF BIGHORN GROUP..... 361SNMN
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ICE BOX SHALE MEMBER OF WINNIPEG FORMATION..... 364ICBX
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DU NOIR LIMESTONE MEMBER OF GALLATIN LIMESTONE..... 371DUNR
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GROVE CREEK MEMBER OF SNOWY RANGE FORMATION..... 371GVCK
HASMARK FORMATION OR DOLOMITE..... 371HMRK
OPEN DOOR LIMESTONE..... 371OPDR
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DAMNATION LIMESTONE..... 374DMNN
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GORDON SHALE..... 374GRDN
GROS VENTRE FORMATION..... 374GRVR
MEAGHER LIMESTONE..... 374MGHR
PARK SHALE OR ARGILLITE..... 374PARK
PAGODA LIMESTONE..... 374PGOD
PENTAGON SHALE..... 374PNGN
SILVER HILL FORMATION..... 374SLVL
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GORDON SHALE..... 377GRDN
PAGODA LIMESTONE..... 377PGOD
PENTAGON SHALE..... 377PNGN
SWITCHBACK SHALE..... 377SCBK
SILVER HILL FORMATION..... 377SLVH
STEAMBOAT LIMESTONE..... 377STMB

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ALTYN LIMESTONE..... 400ALTN
APPEKUNNY FORMATION..... 400APKN
BOUCHARD FORMATION OF MISSOULA GROUP..... 400BCRD
BELT SUPERGROUP..... 400BELT
BONNER QUARTZITE OF MISSOULA GROUP..... 400BNNR
BURKE FORMATION OF RAVALLI GROUP..... 400BURK
CHAMBERLAIN SHALE..... 400CMBL
COOK GRANITE..... 400COOK
CHERRY CREEK GROUP (PRE-BELT)..... 400CRCK
CAYUSE LIMESTONE..... 400CYUS
EMPIRE FORMATION..... 400EMPR
GOOSE CREEK GRANITE..... 400GCRK
GRINNELL FORMATION OF RAVALLI GROUP..... 400GRNL
GARNET RANGE QUARTZITE OR FORMATION OF MISSOULA GROUP..... 400GRRG
GREENHORN MOUNTAIN QUARTZITE..... 400GRRM
GREYSON SHALE..... 400GRSN
GATEWAY FORMATION..... 400GTWY
HOADLEY FORMATION..... 400HDLY
HELENA DOLOMITE..... 400HELN
HELLGATE QUARTZITE MEMBER OF MILLER PEAK ARGILLITE..... 400HLGT
KINTLA ARGILLITE OF MISSOULA GROUP..... 400KNTL
LIBBY FORMATION OF MISSOULA GROUP..... 400LBBY
LAHOOD FORMATION..... 400LHOD
LEMHI QUARTZITE..... 400LMHI
LUPINE QUARTZITE OF MISSOULA GROUP..... 400LUPN
MCNAMARA ARGILLITE OR FORMATION OF MISSOULA GROUP..... 400MCMR
MILLER PEAK ARGILLITE OR FORMATION OF MISSOULA GROUP..... 400MLPK
MARSH FORMATION OF MISSOULA GROUP..... 400MRSH

MISSOULA GROUP..... 400MSSL
NEIHART QUARTZITE..... 400NHRT
NEWLAND FORMATION OR LIMESTONE..... 400NLND
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PILCHER QUARTZITE OF MISSOULA GROUP..... 400PLCR
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REVETT FORMATION OF RAVALLI GROUP..... 400RVTT
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STRIPED PEAK FORMATION OF MISSOULA GROUP..... 400SPPK
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SHEPARD FORMATION OF MISSOULA GROUP..... 400SPRD
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NEBRASKA

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CENOZOIC ERATHEM..... 100CNZC

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WINDBLOWN SAND DEPOSITS,UNDIFFERENTIATED..... 110WDBS

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PLEISTOCENE

LOESS..... 112LOSS
PLEISTOCENE SERIES..... 112PLSC
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TILL..... 112TILL

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OGALLALA FORMATION..... 1210GLL
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GERING FORMATION..... 122GRNG
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HARRISON SANDSTONE..... 122HRSN
MIOCENE SERIES..... 122MOCN
MONROE CREEK SANDSTONE..... 122MRCK
MARSLAND FORMATION..... 122MRLD
SHEEP CREEK FORMATION..... 122SPCK

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CHADRON FORMATION..... 123CDRN
CHADRON FORMATION,BASAL SAND AND GRAVEL..... 123CDRNB
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CODELL SANDSTONE MEMBER OF CARLILE SHALE..... 211CDLL
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UPPER CRETACEOUS SERIES..... 211CRCSU
CARLILE SHALE..... 211CRLL
DAKOTA SANDSTONE OR FORMATION..... 211DKOT
FAIRPORT CHALKY SHALE MEMBER OF CARLILE SHALE..... 211FRPR
FORT HAYS LIMESTONE MEMBER OF NIOBRARA FORMATION..... 211FTHS
FOX HILLS FORMATION..... 211FXHL
GREENHORN LIMESTONE..... 211GRNR
GRANEROUS SHALE..... 211GRRS
LANCE FORMATION..... 211LNCE
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J SAND..... 217J
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MATFIELD SHALE..... 310MFLD
NOLANS LIMESTONE..... 310NLNS
NINNESCAH SHALE..... 310NNSC
ONAGA SHALE..... 310ONAG
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FORELLE LIMESTONE..... 311FRLL
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BARNESTON LIMESTONE..... 319BRNS
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DOYLE SHALE..... 319DOYL
ESKRIDGE SHALE..... 319EKDG
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FORAKER LIMESTONE..... 319FRCK
GRENOLA LIMESTONE..... 319GRNL
JOHNSON SHALE..... 319JNSN
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DEER CREEK LIMESTONE..... 322DRCK
EMPORIA LIMESTONE..... 322EMPR
HOWARD LIMESTONE..... 322HWRD
KANWAKA SHALE..... 322KNWK
LECOMPTON LIMESTONE..... 322LCMP
LAWRENCE SHALE..... 322LRNC
OREAD LIMESTONE..... 322ORED
PILLSBURY SHALE..... 322PLBR
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ROOT SHALE..... 322ROOT
SCRANTON SHALE..... 322SCRN
SHAWNEE GROUP..... 322SHWN
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TECUMSEH SHALE..... 322TCMS
TOPEKA LIMESTONE..... 322TOPK
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WABAUNSEE GROUP..... 322WBNS
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WILLARD SHALE..... 322WLRD
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CHANUTE SHALE..... 323CHNT
DENNIS LIMESTONE..... 323DNNS
DRUM LIMESTONE..... 323DRUM
FONTANA SHALE..... 323FNTN
GALESBURG SHALE..... 323GLBG
HERTHA LIMESTONE..... 323HRTH
IATAN LIMESTONE..... 323IATN
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DES MOINESIAN SERIES..... 325DSMS
FORT SCOTT LIMESTONE..... 325FRSC
LABETTE SHALE..... 325LBTT
MARMATON GROUP..... 325MRMN
NOWATA SHALE..... 325NOWT
PAWNEE LIMESTONE..... 325PWNE

MISSISSIPPIAN

CHATTANOOGA SHALE..... 330CTNG
MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

MISSISSIPPIAN, UPPER..... 331MSSPU

MERAMECIAN

MERAMECIAN SERIES..... 333MRMC
ST GENEVIEVE LIMESTONE..... 333SGVV
SALEM LIMESTONE..... 333SLEM
SPERGEN LIMESTONE..... 333SPRG
ST LOUIS LIMESTONE..... 333STLS
WARSAW FORMATION..... 333WRSW

LOWER MISSISSIPPIAN

MISSISSIPPIAN, LOWER..... 337MSSPL

OSAGEAN

KEOKUK-BURLINGTON LIMESTONES UNDIFFERENTIATED..... 338KKKB
OSAGEAN SERIES..... 338OSGE

KINDERHOOKIAN

BOICE SHALE..... 339BOIC

GILMORE CITY LIMESTONE..... 339GLMC
HAMPTON FORMATION..... 339HMPN
KINDERHOOKIAN SERIES..... 339KDRK

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

DEVONIAN, UPPER..... 341DVNNU
LIME CREEK FORMATION..... 341LMCK

MIDDLE DEVONIAN

CEDAR VALLEY LIMESTONE..... 344CDVL
DEVONIAN, MIDDLE..... 344DVNNM
WAPSIPINICON LIMESTONE..... 344WPPC

SILURIAN

SILURIAN SYSTEM..... 350SLRN

MIDDLE SILURIAN

SILURIAN, MIDDLE..... 354SLRNM

NIAGARAN

GOWER FORMATION..... 355GOWR
HOPKINTON FORMATION..... 355HPKN
NIAGARAN SERIES..... 355NGRN

LOWER SILURIAN

KANKAKEE FORMATION..... 357KNKK

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

MAQUOKETA SHALE..... 361MQKT
ORDOVICIAN, UPPER..... 361ODVCU

CINCINNATIAN

CINCINNATIAN SERIES..... 362CNCN

MIDDLE ORDOVICIAN

DECORAH FORMATION..... 364DCRH
GALENA DOLOMITE..... 364GLEN
ORDOVICIAN, MIDDLE..... 364ODVCM
PLATTEVILLE FORMATION..... 364PLVL

ST PETER SANDSTONE..... 364STPR

CHAMPLAINIAN

CHAMPLAINIAN SERIES..... 365CMPL

LOWER ORDOVICIAN

ORDOVICIAN, LOWER..... 367ODVCL
PRAIRIE DU CHIEN GROUP..... 367PRDC

CANADIAN

CANADIAN SERIES..... 368CNDN

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

CAMBRIAN, UPPER..... 371CMBRU
DRESBACH GROUP..... 371DRBC
FRANCONIA SANDSTONE..... 371FRNC
TREMPEALEAU FORMATION..... 371TMPL

PRECAMBRIAN

PRECAMBRIAN IGNEOUS ROCKS..... 400IGNS
PRECAMBRIAN METAMORPHIC ROCKS..... 400MMPC
METAMORPHIC ROCKS UNDIFFERENTIATED..... 400MMRP
PRECAMBRIAN ERATHEM..... 400PCMB
SIOUX QUARTZITE..... 400SOUX

CENOZOIC

CONSOLIDATED ROCKS..... 100CLDD
VALLEY-FILL RESERVOIR..... 100VFRV
VALLEY-FILL DEPOSITS..... 100VLFL

QUATERNARY

CONSOLIDATED DEPOSITS..... 110CLDD
LAS VEGAS FORMATION..... 110LSVG
QUATERNARY SYSTEM..... 110QRNR
UNCONSOLIDATED DEPOSITS..... 110UCDD
VOLCANIC ROCKS..... 110VLCC
VALLEY FILL..... 110VLFL

HOLOCENE

ALLUVIAL-FAN DEPOSITS..... 111ALVF
ALLUVIAL-FAN DEPOSITS,YOUNGER..... 111ALVFY
HOLOCENE ALLUVIUM..... 111ALVM
ALLUVIUM,YOUNGER..... 111ALVMY
COLLUVIUM..... 111CLVM
CHANNEL DEPOSITS..... 111CNNL
DUNE SAND..... 111DUNE
FLOOD-PLAIN DEPOSITS..... 111FLDP
GRAVEL-BAR DEPOSITS..... 111GVLB
HOLOCENE SERIES..... 111HLCN
LANDSLIDE DEPOSITS..... 111LDLD
LAKEBEDS AND PLAYA DEPOSITS..... 111LKBP
PLAYA DEPOSITS..... 111PLAY
SINTER DEPOSITS..... 111SNTR
TUFFA DEPOSITS..... 111TUFF

PLEISTOCENE

ALLUVIAL-FAN DEPOSITS,OLDER..... 112ALVFO
ALLUVIUM,OLDER..... 112ALVM
BASALT OF BASALT RIDGE..... 112BBRG
BROUGHER DACITE..... 112BRGR
DUNE..... 112DUNE
FANGLOMERATE..... 112FGLM
GLACIAL DEPOSITS..... 112GLCL
HORSE CAMP FORMATION..... 112HCMP
LAKEBED DEPOSITS..... 112LKBD
LAKEBEDS AND PLAYA DEPOSITS..... 112LKBP
ODDIE RHYOLITE..... 112ODDI
PLEISTOCENE SERIES..... 112PLSC
RABBIT SPRING FORMATION..... 112RBSP
SINTER DEPOSITS..... 112SNTR
TUFFA DEPOSITS..... 112TUFF
VOLCANIC ROCKS..... 112VLCC

TERTIARY

CHARCOAL OVEN TUFF..... 120CCOV
CONSOLIDATED DEPOSITS..... 120CLDD
CURRANT TUFF..... 120CRNT
GALE HILLS FORMATION (POSSIBLY CRETACEOUS)..... 120GLHL
GRANITIC ROCKS..... 120GRNC
HORSE SPRING FORMATION..... 120HSPG
IDA VADA VOLCANICS..... 1201DVO
JASPEROID BRECCIA..... 120JPRD
KINSEY CANYON FORMATION..... 120KNSC
OVERTON FORMATION (POSSIBLY CRETACEOUS)..... 120OVRN
PANACA BEDS..... 120PANC
PANCAKE SUMMIT TUFF..... 120PKSM
PANSY LEE CONGLOMERATE..... 120PNSL
SEDIMENTARY ROCKS..... 120SDMR
SHINGLE PASS TUFF..... 120SGLP
STONE CABIN TUFF..... 120SNCB
TERTIARY SYSTEM..... 120TRTR
VOLCANIC ROCKS..... 120VLCC
WINDOUS BUTTE FORMATION..... 120WDSB

PLIOCENE

ALLUVIAL-FAN DEPOSITS,OLDER..... 121ALVFO
ALLUVIUM,OLDER..... 121ALVMO
AMMONIA TANKS MEMBER..... 121AMTK
COTTONWOOD CANYON FORMATION..... 121CNDC
ESMERALDA FORMATION..... 121EMLD
GOLD FLAT MEMBER..... 121GLDF
HIDDEN CLIFF TRACHYTE..... 121HDCF
HIGH ROCK SEQUENCE..... 121HGRK
HUMBOLDT FORMATION..... 121HMBD
KATE PEAK FORMATION..... 121KTPK
LABYRINTH CANYON MEMBER..... 121LBRC
MUDDY CREEK FORMATION..... 121MDCK
PANACA FORMATION..... 121PANC
PLIOCENE SERIES..... 121PLCN
PILLAR SPRING RHYOLITE..... 121PSPG
RIBBON CLIFF RHYOLITE..... 121RBCF
RAINIER MESA MEMBER..... 121RRMS
SIEBERT TUFF..... 121SBRT
SALT LAKE FORMATION..... 121SLLK
STONEWALL MOUNTAIN BASALT..... 121SNLM
TIMBER MOUNTAIN RHYOLITE..... 121TMBM
TRUCKEE FORMATION..... 121TRCK
THIRSTY CANYON TUFF..... 121TRSC
TRAIL RIDGE, SPEARHEAD AND ROCKET WASH MEMBERS OF THIRSTY CANYON TUFF. 121TRSR
YELLOW CLEFT TRACHYTE..... 121YLCF

MIOCENE

ALTA FORMATION..... 122ALTA
ANTELOPE SPRINGS TUFFS..... 122APSP
BUCKWHEAT RIM TUFF..... 122BCKR
BELTED RANGE TUFF..... 122BDRG

BLACK BEAUTY MESA TUFF..... 122BKBM
BATES MOUNTAIN TUFF..... 122BSMN
BIG SAND SPRINGS VALLEY RHYOLITE..... 122BSSV
CACTUS PEAK RHYOLITE..... 122CCPK
CHISPA ANDESITE..... 122CHSP
CANON RHYOLITE..... 122CNON
EDWARDS CREEK TUFF..... 122EDCK
ESMERALDA FORMATION..... 122EMLD
FISH CREEK MOUNTAINS TUFF..... 122FCKM
FRACTION TUFF..... 122FRCN
GOLD FLAT TUFF AND RHYOLITE..... 122GLDF
GROUSE CANYON MEMBER..... 122GRSC
HARTFORD HILL RHYOLITE TUFF..... 122HFDH
INDIAN TRAIL FORMATION..... 122IDTL
KAWICH VALLEY RHYOLITE..... 122KCVL
KENDALL TUFF..... 122KNDL
LUNAR CUESTA TUFF..... 122LRCS
MIRA BASALT..... 122MIRA
MILLTOWN ANDESITE..... 122MLTN
MIOCENE SERIES..... 122MOCN
MORENA RHYOLITE..... 122MORN
NEW PASS TUFF..... 122NPSS
O BRIENS KNOB RHYOLITE..... 122OBKB
OCHER RIDGE AND BELTED PEAK RHYOLITE..... 122ORBP
PAINTBRUSH TUFF..... 122PBRS
PAH CANYON MEMBER..... 122PCNN
PRE-ESMERALDA VOLCANIC ROCKS..... 122PEMD
PYRAMID SEQUENCE..... 122PRMD
QUARTET DOME RHYOLITE..... 122QRDM
QUARTZ MOUNTAIN RHYOLITE..... 122QRZM
STOCKADE WASH MEMBER..... 122SCKW
SAUCER MESA TRACHYTE..... 122SCRM
SANDSTORM RHYOLITE..... 122SDRM
STONEWALL FLAT ANDESITE..... 122SLFL
SALYER FORMATION..... 122SLYR
TUB SPRINGS MEMBER..... 122TBSP
TOLICHA PEAK TUFF..... 122TCPK
TOPOPAH SPRING MEMBER..... 122TPPS
TIVA CANYON MEMBER..... 122TVCN
VINDICATOR RHYOLITE..... 122VDCR
WHITE BLOTCH SPRING TUFF..... 122WBSP
WILSONS CAMP TUFF..... 122WCMP
WAHMONIE FORMATION..... 122WHMN
WHITE RIDGE RHYOLITE..... 122WRDG

OLIGOCENE

BIG ROUND VALLEY TUFF..... 123BGRV
BLACK ROCK SUMMITT TUFF..... 123BKRS
CALLOWAY WELL FORMATION..... 123CLWL
CAETANO TUFF..... 123CTNO
GILMORE GULCH FORMATION..... 123GMGC
HOT CREEK CANYON TUFF..... 123HCKC
HARTFORD HILL RHYOLITE..... 123HFDH
HALLIGAN MESA TUFF..... 123HLGM
MONOTONY TUFF..... 123MNTN

MOORES STATION BUTTE TUFF..... 123MRSB
MIZPAH TRACHYTE..... 123MZPH
THE NEEDLES TUFF..... 123NDLS
NEEDLES RANGE FORMATION..... 123NDRG
ORANGE LICHEN CREEK TUFF..... 123OLCK
OLIGOCENE SERIES..... 123OLGC
PRICHARDS STATION..... 123PCDS
POTT HOLE VALLEY TUFF..... 123PHLV
PAH RAH FORMATION..... 123PHRH
PALISADE MESA TUFF..... 123PLDM
RED ROCK CANYON TUFF..... 123RRKC
SOUTH WILLOW FORMATION..... 123STWL
TONOPAH FORMATION..... 123TNPH
TWIN PEAKS TUFF..... 123TPKS
TITUS CANYON FORMATION..... 123TSCN
WILLIAMS RIDGE AND MOREY PEAK TUFF..... 123WRMP

EOCENE

SHEEP PASS FORMATION..... 124SPPS

MESOZOIC

GRANITIC ROCKS..... 200GRNC
METAMORPHIC ROCKS..... 200MMPC
SEDIMENTARY ROCKS..... 200SDMR

CRETACEOUS

CHOKECHERRY CANYON FORMATION..... 210CKCC
GARDEN VALLEY FORMATION..... 210GDVL
GRANITIC ROCKS..... 210GRNC
INTRUSIVE ROCKS..... 210IRSV
KING LEAR FORMATION..... 210KGLR
NEWARK CANYON FORMATION..... 210NRKC
THUMB FORMATION..... 210THMB
WILLOW TANK FORMATION..... 210WLTK
WEAVER CANYON BRECCIA..... 210WVRC

JURASSIC

AZTEC SANDSTONE..... 220AZTC
GRANITIC ROCKS..... 220GRNC
NIGHTINGALE SEQUENCE..... 220NGGL
PEAVINE SEQUENCE..... 220PVIN

LOWER JURASSIC

DUNLAP FORMATION..... 227DNLP

TRIASSIC

AUGUSTA SEQUENCE..... 230AGST
CANE SPRING FORMATION..... 230CSPG
DUN GLEN FORMATION..... 230DNGL
DIXIE VALLEY FORMATION..... 230DXVL

EXCELSIOR FORMATION..... 230EXCL
MOENKOPI FORMATION..... 230MNKP
NATCHEZ PASS FORMATION..... 230NCZP
PRIDE FORMATION..... 230PRID
RASPBERRY FORMATION..... 230RSPB
STAR PEAK GROUP..... 230SRPK
TOBIN FORMATION..... 230TOBN
WINNEMUCCA FORMATION..... 230WNMC

UPPER TRIASSIC

CHINLE FORMATION..... 231CHNL
CRANE SPRING FORMATION..... 231CSPG
GABBS FORMATION..... 231GBBS
GRASS VALLEY FORMATION..... 231GRVL
LUNING FORMATION..... 231LNNG
OSOBB FORMATION..... 231OSBB
SUNRISE FORMATION..... 231SNRS

MIDDLE TRIASSIC

AUGUSTA MOUNTAIN FORMATION..... 234AGSM
CHINA MOUNTAIN FORMATION..... 234CNMN
FAVRET FORMATION..... 234FVRT
GRANTSVILLE FORMATION..... 234GRVL
PANTHER CANYON FORMATION..... 234PNRC

LOWER TRIASSIC

CANDELARIA FORMATION..... 237CDLR
QUINN RIVER FORMATION..... 237QRVR

PALEOZOIC

CLASTIC SEDIMENTARY ROCKS..... 300CCSM
CARBONATE ROCKS..... 300CRBN
METAMORPHIC ROCKS..... 300MMPC
REGIONAL GROUND-WATER SYSTEM..... 300RGWS

PERMIAN

ANTLER PEAK LIMESTONE..... 310ALPK
ANTLER SEQUENCE..... 310ANLR
ARCTURUS FORMATION..... 310ARCR
BATTLE FORMATION..... 310BTTL
CARBON RIDGE FORMATION..... 310CBRG
COCONINO FORMATION..... 310CCNN
DIABLO FORMATION..... 310DBLO
EDNA MOUNTAIN FORMATION..... 310EDNM
GRANDEUR FORMATION..... 310GRDR
GERSTER FORMATION..... 310GRSR
HIGHWAY LIMESTONE..... 310HGHY
HAPPY CREEK VOLCANIC SERIES..... 310HPCK
HAVALLAH SEQUENCE..... 310HVLL
KAIBAB LIMESTONE..... 310KIBB
KOIPATA GROUP..... 310KOPT

LORAY FORMATION..... 310LORY
MEADE PEAK FORMATION..... 310MDPK
PABLO FORMATION..... 310PBLO
PLYMPTON FORMATION..... 310PLMP
PEQUOP FORMATION..... 310PQUP
PARK CITY GROUP..... 310PRKC
PHOSPHORA FORMATION..... 310PSPR
RIB HILL FORMATION..... 310RBHL
RIEPE SPRING FORMATION..... 310RPSP
TIPPIPAH LIMESTONE..... 310TPPP
TOROWEAP FORMATION..... 310TRWP

GUADALUPIAN

GUADALUPIAN ROCKS..... 313GDLP

LOWER PERMIAN

BIRD SPRING FORMATION..... 317BSPG
CALLVILLE LIMESTONE..... 317CLVL

PENNSYLVANIAN

BROCK CANYON FORMATION..... 320BCKC
ELY LIMESTONE..... 320ELY
HAVALLAH FORMATION..... 320HVLL
INSKIP FORMATION..... 320ISKP
KOIPATO FORMATION..... 320KOPT
PUMPERNICKEL FORMATION..... 320PMPK
WILDCAT PEAK FORMATION..... 320WCPK

MIDDLE PENNSYLVANIAN

ELY LIMESTONE..... 324ELY

LOWER PENNSYLVANIAN

ELEANA FORMATION..... 327ELEN

MISSISSIPPIAN

JOANA LIMESTONE..... 330JOAN
LEACH FORMATION..... 330LECH
ROGERS SPRING LIMESTONE..... 330RGSP

UPPER MISSISSIPPIAN

CHAINMAN SHALE..... 331CNMN
DIAMOND PEAK FORMATION..... 331DMPK
MONTE CRISTO LIMESTONE..... 331MCRS
MEIKLEJOHN FORMATION..... 331MKLJ

LOWER MISSISSIPPIAN

PILOT SHALE..... 337PLOT

DEVONIAN

MISSISSIPPIAN-DEVONIAN SYSTEMS..... 340DVMP
DEVONIAN SYSTEM..... 340DVNN
SLAVEN CHERT..... 340SLVN

UPPER DEVONIAN

GUILMETTE FORMATION..... 341GLMT
SULTAN LIMESTONE..... 341SLTNM

MIDDLE DEVONIAN

FLUORSPAR CANYON FORMATION..... 344FLPC
MUDDY PEAK LIMESTONE..... 344MDPK
NEVADA FORMATION..... 344NEVD
SEVY DOLOMITE..... 344SEVY
SIMONSON DOLOMITE..... 344SMNS

SILURIAN

ELDER SANDSTONE..... 350ELDR
ELY SPRINGS DOLOMITE..... 350ESPG
HANSON CREEK DOLOMITE..... 350HCRK
LAKETOWN DOLOMITE..... 350LKTN
LONE MOUNTAIN DOLOMITE..... 350LNMN
MC MONNIGAL LIMESTONE..... 350MCMG
SILURIAN SYSTEM..... 350SLRN
TOR LIMESTONE..... 350TOR

MIDDLE SILURIAN

ROBERTS MOUNTAIN FORMATION..... 354RBRM

ORDOVICIAN

ANTELOPE VALLEY LIMESTONE..... 360ALPV
BROAD CANYON FORMATION..... 360BRDC
CLIPPER CANYON SEQUENCE..... 360CLPC
COMUS FORMATION..... 360CMUS
GATECLIFF FORMATION..... 360GCLF
MASKET SHALE..... 360MSKT
NINEMILE FORMATION..... 360NNML
ORDOVICIAN SYSTEM..... 360ODVC
PALMETTO FORMATION..... 360PLMT
PINECONE SEQUENCE..... 360PNCN
SONOMA RANGE FORMATION..... 360SMRG
VININI FORMATION..... 360VINN
VALMY FORMATION..... 360VLMY
WILLOW CANYON SEQUENCE..... 360WLCN

UPPER ORDOVICIAN

EUREKA QUARTZITE..... 361EURK
FISH HAVEN DOLOMITE..... 361FSHV

MIDDLE ORDOVICIAN

ANTELOPE VALLEY LIMESTONE..... 364ALPV
ELY SPRINGS DOLOMITE..... 364ESPG
POGONIP GROUP..... 364PGNP

LOWER ORDOVICIAN

GOODWIN LIMESTONE..... 367GDWN
NINE MILE FORMATION..... 367NNML

CAMBRIAN

CAMBRIAN SYSTEM-PRECAMBRIAN ERATHEM..... 370CBPB
CAMBRIAN SYSTEM..... 370CMBR
GOODSPRINGS DOLOMITE..... 370GDPG
GOLD HILL FORMATION..... 370GLDH
HARMONY FORMATION..... 370HRMN
LINCOLN PEAK FORMATION..... 370LCPK
CAMBRIAN LIMESTONE..... 370LMSN
OSGOOD MOUNTAIN QUARTZITE..... 370OGDM
POST-DUNDERBURG SHALE..... 370PDBG
POLE CANYON LIMESTONE..... 370PLCN
PREBLE FORMATION..... 370PRBL
SWARBRICK FORMATION..... 370SBCK
STELLA LAKE QUARTZITE..... 370SLLK
TYBO SHALE..... 370TYBO
WOOD CANYON FORMATION..... 370WDCN
WINDFALL LIMESTONE..... 370WDFL

UPPER CAMBRIAN

BONANZA KING FORMATION..... 371BZKG
CRANE CANYON FORMATION..... 371CRNCM
CORSET SPRING SHALE..... 371CSPG
DUNDERBURG SHALE..... 371DDBG
EMIGRANT FORMATION..... 371EMGRM
HALES LIMESTONE..... 371HLES
HALFPINT MEMBER OF NOPAH FORMATION..... 371HLFP
HAMBURG DOLOMITE..... 371HMBG
NOTCH PEAK LIMESTONE..... 371NCPK
NOPAH FORMATION..... 371NOPH
SHWIN FORMATION..... 371SHWN
SMOKY MEMBER OF NOPAH FORMATION..... 371SMKM

MIDDLE CAMBRIAN

CARRARA FORMATION..... 374CRRR
CHISHOLM SHALE..... 374CSLM
ELDORADO DOLOMITE..... 374ELDDL
HIGHLAND PEAK LIMESTONE..... 374HGPK
LYNDON LIMESTONE..... 374LNDN
PIOCHE SHALE..... 374POCH
TAPEATS SANDSTONE..... 374TPTSL

LOWER CAMBRIAN

CARRARA FORMATION..... 377CRRR
HARKLESS FORMATION..... 377HRKL
MILLER MOUNTAIN FORMATION..... 377MLRM
MULE SPRING FORMATION..... 377MSPG
POLETA FORMATION..... 377POLT
PROSPECT MOUNTAIN QUARTZITE..... 377PPCM
SCOTT CANYON FORMATION..... 377SCCN
ZABRISKIE QUARTZITE..... 377ZBRK

PRECAMBRIAN

CAMPITO FORMATION..... 400CMPT
DEEP SPRING FORMATION..... 400DPSP
JOHNNIE FORMATION..... 400JHNN
MC COY CREEK GROUP..... 400MCCK
PRECAMBRIAN ERATHEM..... 400PCMB
REED DOLOMITE..... 400REED
STIRLING QUARTZITE..... 400SRLG
WYMAN FORMATION..... 400WYMN

NEW HAMPSHIRE

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
BEACH DEPOSITS,MARINE AND NON-MARINE	111BECH
COLLUVIUM	111CLVM
EOLIAN DEPOSITS	111EOLN
FILL	111FILL
MARINE DEPOSITS	111MRIN
SEDIMENTS, UNDIFFERENTIATED	111SDMN
SWAMP DEPOSITS	111SWMP

PLEISTOCENE

DELTA DEPOSITS	112DELT
ICE-CONTACT DEPOSITS, INCLUDING ESKERS AND KAMES	112ICCC
LACUSTRINE DEPOSITS	112LCSR
MORAINE DEPOSITS,EXCEPT GROUND MORAINE AND DRUMLINS	112MORN
MARINE DEPOSITS	112MRIN
OUTWASH	112OTSH
STRATIFIED DEPOSITS, UNDIFFERENTIATED	112SRFD
TILL	112TILL

TERTIARY

SEDIMENTS,UNDIFFERENTIATED	120SDMS

MESOZOIC

CRYSTALLINE ROCKS	200CRSL

CRETACEOUS

SEDIMENTS,UNDIFFERENTIATED	210SDMS

TRIASSIC

IGNEOUS ROCKS,EXTRUSIVE	230IGNSE
IGNEOUS ROCKS,INTRUSIVE	230IGNSI
SEDIMENTARY ROCKS	230SDMR

UPPER TRIASSIC

EAST BERLIN FORMATION	231EBRL
HOLYOKE BASALT	231HLYK
HAMPDEN BASALT	231HMPD
NEW HAVEN FORMATION	231NHVN
PORTLAND FORMATION	231PRLD

PALEOZOIC

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 300CRSL
CRYSTALLINE ROCKS,CARBONATE..... 300CRSLN

PENNSYLVANIAN

CRYSTALLINE ROCKS..... 320CRSL
SEDIMENTARY ROCKS..... 320SDMR

MISSISSIPPIAN

CRYSTALLINE ROCKS..... 330CRSL
SEDIMENTARY ROCKS..... 330SDMR

DEVONIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 340CRSL
CRYSTALLINE ROCKS,NONCARBONATE..... 340CRSLN

SILURIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 350CRSL
CRYSTALLINE ROCKS,CARBONATE..... 350CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 350CRSLN

ORDOVICIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 360CRSL
CRYSTALLINE ROCKS,CARBONATE..... 360CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 360CRSLN

CAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 370CRSL
CRYSTALLINE ROCKS,CARBONATE..... 370CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 370CRSLN

PRECAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 400CRSL
CRYSTALLINE ROCKS,CARBONATE..... 400CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 400CRSLN

NEW JERSEY

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

BRIDGETON FORMATION..... 112BRDG
CAPE MAY FORMATION..... 112CPMY
DELTAIC SAND FACIES..... 112DLTC
ESTUARINE CLAY FACIES..... 112ESRNC
ESTUARINE SAND FACIES..... 112ESRNS
GLACIAL LAKE DEPOSITS..... 112GCLK
KAME AND KAME TERRACE DEPOSITS..... 112GKMK
GLACIAL DELTA DEPOSITS..... 112GLCD
GLACIAL LAKE DEPOSITS..... 112GOLK
HOLLY BEACH WATER-BEARING ZONE..... 112HLBC
ICE-CONTACT DEPOSITS..... 112ICCN
MORAINE..... 112MORN
MARINE SAND FACIES..... 112MRIN
OUTWASH..... 112OTSH
PENSAUKEN-BRIDGETON FORMATIONS..... 112PKBG
PLEISTOCENE SERIES-COHANSEY SAND..... 112PLCC
PLEISTOCENE SERIES..... 112PLSC
PENSAUKEN FORMATION..... 112PNSK
TILL..... 112TILL

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

BEACON HILL GRAVEL..... 121BCHL
COHANSEY SAND-KIRKWOOD FORMATION..... 121CKKD
COHANSEY SAND..... 121CNSY
PLIOCENE-MIOCENE SERIES..... 121PCMC
PLIOCENE SERIES..... 121PLCN

MIOCENE

KIRKWOOD FORMATION..... 122KRKD
KIRKWOOD FORMATION,LOWER SAND..... 122KRKDL
KIRKWOOD FORMATION,UPPER SAND..... 122KRKDU
MIOCENE SERIES..... 122MOCN

OLIGOCENE

OLIGOCENE SERIES..... 123OLGC

EOCENE

EOCENE SERIES..... 124EOCN
MANASQUAN FORMATION..... 124MNSQ
MANASQUAN-VINCENTOWN FORMATIONS..... 124MQVC
PINEY POINT FORMATION..... 124PNPN
SHARK RIVER MARL..... 124SKRV

PALEOCENE

HORNERSTOWN SAND..... 125HRRS
PALEOCENE SERIES..... 125PLCN
VINCETOWN FORMATION-HORNERSTOWN SAND..... 125VCHR
VINCENTOWN FORMATION..... 125VNCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

ENGLISHTOWN FORMATION..... 211EGLS
FARRINGTON SAND MEMBER OF RARITAN FORMATION..... 211FRNG
MERCHANTVILLE FORMATION..... 211MCVL
MAGOTHY-RARITAN FORMATIONS..... 211MGRR
MAGOTHY FORMATION..... 211MGTY
MOUNT LAUREL SAND..... 211MLRL
MOUNT LAUREL SAND-WENONAH FORMATION..... 211MLRW
MAGOTHY-RARITAN-POTOMAC AQUIFER SYSTEM..... 211MRPA
MARSHALLTOWN FORMATION..... 211MRSL
NAVESINK FORMATION..... 211NVSK
OLD BRIDGE SAND MEMBER OF MAGOTHY FORMATION..... 211ODBG
RED BANK SAND..... 211RDBK
RARITAN FORMATION..... 211RRTN
SAYREVILLE SAND MEMBER OF RARITAN FORMATION..... 211SRVL
TINTON SAND..... 211TNTN
WOODBURY CLAY-MERCHANTVILLE FORMATION..... 211WBMV
WOODBURY CLAY..... 211WDBR
WENONAH FORMATION..... 211WNNH

LOWER CRETACEOUS

POTOMAC GROUP..... 217PTMC

TRIASSIC

TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

BRUNSWICK SHALE OR FORMATION..... 231BRCK
BASALT..... 231BSLT
LOCKATONG FORMATION..... 231LCKG
STOCKTON FORMATION..... 231SCKN
1ST WATCHUNG FLOW..... 23101WG
2ND WATCHUNG FLOW..... 23102WG
3RD WATCHUNG FLOW..... 23103WG

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC
WISSAHICKON GNEISS..... 300WSCK

PENNSYLVANIAN

MIDDLE PENNSYLVANIAN

LOWER KITTATINY LIMESTONE..... 324KTTNL
MIDDLE KITTATINY LIMESTONE..... 324KTTNM

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

SKUNNEMUNK CONGLOMERATE..... 341SKMK

MIDDLE DEVONIAN

BELLVALE SANDSTONE..... 344BLVL
CORNWALL SHALE..... 344CRNL
ESOPUS FORMATION..... 344ESPS
KANOUSE SANDSTONE..... 344KNUS
MARCELLUS SHALE..... 344MRCL
ONONDAGA LIMESTONE..... 344ONDG

LOWER DEVONIAN

COEYMANS FORMATION..... 347CMNS
DEPUE LIMESTONE MEMBER OF COEYMANS FORMATION..... 347DEPU
DUTTONVILLE MEMBER OF RONDOUT FORMATION..... 347DNVL
FLATBROOKVILLE MEMBER OF NEW SCOTLAND FORMATION..... 347FBKV
KALKBERG LIMESTONE..... 347KKBG
MINISINK LIMESTONE..... 347MNSK
MASHIPACONG MEMBER OF RONDOUT FORMATION..... 347MPCG
MASKENOZHA MEMBER..... 347MSKZ
NEW SCOTLAND FORMATION..... 347NSCD
ORISKANY FORMATION..... 347ORSK
PORT EWEN SHALE..... 347PREN
PETERS VALLEY MEMBER OF COEYMANS FORMATION..... 347PRVL
RONDOUT FORMATION..... 347RNDT
RAVENA MEMBER OF COEYMANS LIMESTONE..... 347RVEN
SHAWNEE ISLAND MEMBER OF COEYMANS FORMATION..... 347SILD

STORMVILLE MEMBER OF COEYMANS FORMATION..... 347SMVL
THACKER MEMBER OF MANLIUS LIMESTONE..... 347TCKR
WHITEPORT DOLOMITE MEMBER OF RANDOUT FORMATION..... 347WTPR

SILURIAN

GREEN POND CONGLOMERATE..... 350GRPD
HIGH FALLS FORMATION..... 350HGFL
SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

BOSSARDVILLE LIMESTONE..... 351BDVL
CLOVE BROOK MEMBER OF DECKER FORMATION..... 351CVBK
DECKER FORMATION..... 351DCKR
LONGWOOD SHALE..... 351LNGD
POXONO ISLAND FORMATION..... 351PXID
WALLPACK CENTER MEMBER OF DECKER FORMATION..... 351WPKC

MIDDLE SILURIAN

SHAWANGUNK FORMATION..... 354SNGK

ORDOVICIAN

KITTATINNY LIMESTONE..... 360KTTN
ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

BUSHKILL MEMBER OF MARTINSBURG SHALE..... 361BSKL
MARTINSBURG SHALE..... 361MRBG
PEN ARGYL MEMBER OF MARTINSBURG SHALE..... 361PAGL
RAMSEYBURG MEMBER OF MARTINSBURG SHALE..... 361RMBG

MIDDLE ORDOVICIAN

JACKSONBURG LIMESTONE..... 364JKBG

LOWER ORDOVICIAN

EPLER FORMATION..... 367EPLR
UPPER KITTATINY LIMESTONE..... 367KTTNU
RICKENBACH DOLOMITE..... 367RCKB

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

ALLENTOWN DOLOMITE..... 371ALNN

MIDDLE CAMBRIAN

LEITHSVILLE FORMATION..... 374LSVL

LOWER CAMBRIAN

HARDYSTON QUARTZITE..... 377HRDS

PRECAMBRIAN

BALTIMORE GNEISS..... 400BLMR
FRANKLIN LIMESTONE..... 400FRKL
PRECAMBRIAN ERATHEM..... 400PCMB

UNKNOWN

EXTRUSIVE ROCKS	000EXRV
INCARNACION GRANITE	000ICRC
INTRUSIVE ROCKS	000IRSV

CENOZOIC

LAS FEVERAS FORMATION	100LFVR

QUATERNARY

ALLUVIUM,BOLSON DEPOSITS AND OTHER SURFACE DEPOSITS	110AVMB
BOLSON FILL	110BLSN
CHICO PHONOLITES	110CHCO
CLAYTON BASALTS	110CLTN
CANJILON TILL	110CNJL
CANONES ANDESITE	110CNNS
GATUNA FORMATION	110GTUN
JORNADAN SERIES	110JRND
LOBATO BASALTIC LAVAS	110LOBT
PEDIMENT,TERRACE,AND OTHER DEPOSITS OF GRAVEL,SAND,AND CALICHE	110OPTOD
PALOMASAN SERIES	110PLMS
PEDIMENT,TERRACE,AND OTHER DEPOSITS OF GRAVEL,SAND AND CALICHE	110PTOD
RED MOUNTAIN DACITES	110RDMN
SANTA CLARA PUMICE BED	110SCLR
SLAGLE TRACHYTE	110SLGL
TURKEY MOUNTAIN ANDESITE	110TRKM
TUERTO GRAVEL OF SANTA FE GROUP	110TURT
UNIVERSITY BEDS	110UVRS
VALLECITO BASALT	110VLCT

HOLOCENE

CAPULIN BASALTS	111CPLN
CARRIZOZO LAVA FLOW	111CRZZ
GAMERCO FORMATION	111GMRC
LITTLE BLACK PEAK BASALT FLOW	111LBKP
MC CARTYS BASALT FLOW	111MCCR
MESCALERO SANDS	111MCLR
NAKAIBITO FORMATION	111NKBT
ZUNI CANYON BASALT FLOW	111ZNCN

PLEISTOCENE

ANCHA FORMATION,UPPER PART OF SANTA FE GROUP	112ANCH
BANDELIER RHYOLITE TUFF OF TEWA GROUP	112BDLR
BROKEN BACK BASALT FLOW	112BKBK
BATTLESHIP ROCK FLOW	112BLSP
BLUE WATER BASALT FLOW	112BLTR
BANCO BONITO FLOWS	112BNCB
CLOVIS BEDS	112CLVS
CERRO RUBIO QUARTZ LATITE OF TEWA GROUP	112CRRB
CERRO TOLEDO RHYOLITE OF TEWA GROUP	112CTLD

CUERBIO BASALT..... 112CURB
EL CAJETE FLOW..... 112ELCJ
GUAJE MEMBER OF BANDELIER TUFF OF TEWA GROUP..... 112GUJE
LAGUNA BASALT FLOW..... 112LGUN
OTOWI MEMBER OF BANDELIER TUFF OF TEWO GROUP..... 112OTOW
PALOMAS GRAVEL..... 112PLMS
SAND CANYON FORMATION..... 112SNDC
SAN JON FORMATION..... 112SNJN
SANTA FE GROUP..... 112SNTF
SANTA FE GROUP,UPPER PART..... 112SNTFU
SUWANEE BASALT FLOW..... 112SUWN
TEWA GROUP..... 112TEWA
TSHIREGE MEMBER OF BANDELIER TUFF OF TEWA GROUP..... 112TSRG
VALLES RHYOLITE OF TEWA GROUP..... 112VLLS
WHEATLAND FORMATION..... 112WLND

TERTIARY

ALBUQUERQUE MARL..... 120ABQQ
AMALIA FORMATION..... 120AMLI
ARRIBAN SERIES..... 120ARBN
CABALLO BLANCO RHYOLITE TUFF..... 120CBBC
CIENEGUILLA LIMBURGITE..... 120CGLB
CONGLOMERATE OF TERTIARY AGE..... 120CGLM
CONEJOS QUARTZ LATITE (POTOSI VOLCANIC SERIES)..... 120CNJS
COONEY QUARTZ LATITE..... 120CONY
CRANKTOWN SANDSTONE..... 120CRNK
CARSON CONGLOMERATE..... 120CRSN
CARSON CONGLOMERATE,UPPER PART..... 120CRSNU
DEADWOOD GULCH RHYOLITE TUFF..... 120DDGC
DEZA FORMATION..... 120DEZA
DOG GULCH FORMATION..... 120DGGC
DATIL FORMATION..... 120DTIL
DATIL FORMATION(LATITE BRECCIAS,FLOW-BANDED LATITE,ANDESITE,RHYOLITE). 120DTILB
DATIL FORMATION(CLASTIC ROCKS OF VOLCANIC FRAGMENTS)..... 120DTILC
DATIL FORMATION(BOULDER BEDS AND COARSE CLASTIC ROCKS,MOSTLY VOLCANIC) 120DTILD
DATIL FORMATION(PUMICEOUS TUFF AND BRECCIA)..... 120DTILP
DATIL FORMATION(WELDED AND CRYSTAL RHYOLITE TUFFS,FLOWS AND BRECCIAS). 120DTILW
EL RITO FORMATION..... 120ELRT
ESPINOSA VOLCANICS..... 120ESPS
FANNEY RHYOLITE..... 120FNNY
HOUSTON ANDESITE..... 120HSTN
LUFKIN RHYOLITE..... 120LFKN
LOBO FORMATION..... 120LOBO
LATIR PEAK LATITE..... 120LRPK
LAST CHANCE ANDESITE..... 120LSCC
LOVE RANCH FORMATION OF KOTTLOWSKI AND OTHERS..... 120LVRC
MAYA CONGLOMERATE..... 120MAYA
MIMBRES PEAK FORMATION..... 120MBPK
MACHO PYROXENE ANDESITES..... 120MCHO
MC RAE FORMATION..... 120MCRE
MOGOLLON ANDESITE..... 120MGLN
MINERAL CREEK ANDESITE..... 120MLCK
MANGAS QUARTZITE..... 120MNGS
MONUMENT ANDESITE..... 120MNMN
PACIFIC QUARTZ LATITE..... 120PCFC

POLLACK QUARTZ LATITE..... 120PLCK
POTOSI VOLCANIC SERIES..... 120POTS
PUYE CONGLOMERATE,UPPER PART OF SANTA FE GROUP..... 120PUYE
RIO GRANDE GRAVELS..... 120RGRD
RAZORBACK FORMATION..... 120RZBK
SIERRA BLANCA VOLCANICS..... 120SBLC
SUGARLUMP TUFFS..... 120SGMP
SELDEN BASALT TONGUE..... 120SLDN
WIMSATTVILLE FORMATION..... 120WMVL
WHITEWATER CREEK RHYOLITE..... 120WRCK

PLIOCENE

BRIDGE TIMBER GRAVEL..... 121BGTB
CHUSKA SANDSTONE..... 121CHSK
CORDITO MEMBER OF LOS PINOS FORMATION..... 121CRDT
CISNEROS BASALT..... 121CSRS
DORADO BASALT..... 121DORD
EAGLE NEST FORMATION..... 121EGLN
GILA CONGLOMERATE (GROUP)..... 121GILA
JARITA BASALT OF LAS PINAS FORMATION..... 121JRIT
LOS PINOS GRAVEL MEMBER OF HINSDALE FORMATION..... 121LSPS
MIMBRES CONGLOMERATE..... 121MMBR
OGALLALA FORMATION..... 121OGLL
PLACITA MARL..... 121PLCT
PUYE CONGLOMERATE,FANGLOMERATE MEMBER..... 121PUYEF
SIERRA NEGRA BASALT..... 121SRNG
TSCHICOMA FORMATION..... 121TCCM
TOTAVI LENTIL OF PUYE CONGLOMERATE..... 121TOTV
TESUQUE FORMATION,UNDIFFERENTIATED UNIT..... 121TSUQ

MIOCENE

ABIQUIU TUFF,LOWER PART OF SANTA FE GROUP..... 122ABQU
BELL TOP FORMATION..... 122BLTP
BISHOPS LODGE MEMBER OF TESUQUE FORMATION..... 122BPLG
CHAMA CLAYS..... 122CHAM
CHAMISA MESA MEMBER OF SANTA FE FORMATION..... 122CMSM
HELLS MESA MEMBER OF DATIL FORMATION..... 122HLSM
KNEELING NUN RHYOLITE TUFF..... 122KLGN
LUCKY BILL FORMATION..... 122LCKB
LA JARA PEAK MEMBER OF DATIL FORMATION..... 122LJPK
PICURIS TUFF..... 122PCRS
POPOTOSA FORMATION..... 122PPTS
RITITO CONGLOMERATE..... 122RTTO
RUBIO PEAK FORMATION..... 122RUBO
SANTA FE GROUP,LOWER PART..... 122SNTFL
SPEARS MEMBER OF DATIL FORMATION..... 122SPRS
THURMAN FORMATION..... 122TRMN
UVAS BASALT..... 122UVAS

OLIGOCENE

BLANCO BASIN FORMATION..... 123BLCB
GALISTEO FORMATION..... 123GLST
PALM PARK FORMATION..... 123PMPK

SOLEDAD RHYOLITE..... 123SLDD

EOCENE

ALMAGRE BEDS..... 124ALMG
ANIMAS FORMATION..... 124ANMS
BACA FORMATION..... 124BACA
CUB MOUNTAIN FORMATION..... 124CBMN
CHACO MARL..... 124CHCO
CANYON LARGO SANDSTONE..... 124CLRG
CUEVA RHYOLITE..... 124CUEV
HOUTEN SANDSTONE..... 124HUTN
LLAVES MEMBER OF SAN JOSE FORMATION..... 124LLVS
LARGO FACIES..... 124LRGO
OREJON ANDESITE..... 124ORJN
PINYON MESA GROUP..... 124PNMS
POISON CANYON FORMATION..... 124PSNC
REGINA MEMBER OF SAN JOSE FORMATION..... 124RGIN
SAN JOSE FORMATION..... 124SNJS
TAPICITOS MEMBER OF SAN JOSE FORMATION..... 124TPCS
TORREJON FORMATION..... 124TRJN
WASATCH FORMATION..... 124WSTC
YEGUA CANYON FACIES..... 124YGCN
ZIA MARL..... 124ZIA

PALEOCENE

NACIMIENTO FORMATION..... 125NCMN
NACIMIENTO FORMATION, SANDY SHALE FACIES..... 125NCMNS
PUERCO FORMATION..... 125PURC
RATON FORMATION..... 125RTON

MESOZOIC

REVUELTO SHALE..... 200RVLT

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS
GALLINAS SHALE..... 210GLNS
MANCOS SHALE,LOWER PART,AND DAKOTA SANDSTONE,UNDIVIDED..... 210MCDK
MANCOS SHALE..... 210MNCS
MORA SANDSTONE..... 210MORA
PYRAMID SHALE..... 210PRMD
SANASTEE SANDSTONE MEMBER OF MANCOS SHALE..... 210SNST
TACITO SANDSTONE LENTIL OF MANCOS SHALE..... 210TCTO
TRES HERMANOS SANDSTONE MEMBER OF MANCOS SHALE..... 210TRHM

UPPER CRETACEOUS

ALLISON MEMBER OF MENEFEE FORMATION OF MESAVERDE GROUP..... 211ALSN
ARCHULETA SHALE..... 211ARCL
ATARQUE MEMBER OF MESAVERDE FORMATION..... 211ATRQ
BEECHATUDA TONGUE OF CLIFF HOUSE SANDSTONE..... 211BCTD
BELL MOUNTAIN SANDSTONE MEMBER OF MIGUEL FORMATION..... 211BLMN
BARTLETT BARREN MEMBER OF CREVASSE CANYON FORMATION..... 211BRLB

CANO MEMBER OF MESAVERDE FORMATION..... 211CANO
CHACRA SANDSTONE MEMBER OF MESAVERDE FORMATION..... 211CHCR
CHOLLA CANYON TONGUE OF CLIFF HOUSE SANDSTONE..... 211CLCN
CLIFF HOUSE SANDSTONE(INCLUDES LA VENTANA TONGUES IN NW SANDOVAL CO).. 211CLFH
COLORADO SHALE..... 211CLRDH
COLORADO FORMATION,SHALE MEMBER..... 211CLRDN
COLORADO FORMATION,SANDSTONE MEMBER..... 211CLRDS
CLEARY COAL MEMBER..... 211CLRYC
CARLILE SHALE..... 211CRLL
D-CROSS TONGUE OF MANCOS SHALE OF MESAVERDE GROUP..... 211DCRS
DAKOTA SANDSTONE OR FORMATION..... 211DKOT
DILCO COAL MEMBER OF CREVASSE CANYON FORMATION OF MESAVERDE GROUP..... 211DLCOC
DALTON SANDSTONE MEMBER OF CRAVASSE CANYON FORMATION OF MESAVERDE GP.. 211DLTN
FORT HAYS LIMESTONE MEMBER OF NIOBRARA FORMATION..... 211FRHS
FRUITLAND FORMATION..... 211FRLD
FARMINGTON SANDSTONE MEMBER OF KIRTLAND SHALE..... 211FRMG
FORT STANTON SHALE..... 211FRSN
GIBSON COAL MEMBER OF CREVASSE CANYON FORMATION OF MESAVERDE GROUP.... 211GBSNC
GALLEGO SANDSTONE MEMBER OF GALLUP SANDSTONE..... 211GLLG
GALLUP SANDSTONE..... 211GLLP
GREENHORN AND GRANEROS FORMATIONS..... 211GRRG
GRANEROS SHALE..... 211GRRS
HANOVER GRANODIORITE PORPHYRY..... 211HNVR
HOSTA TONGUE OF POINT LOOKOUT SANDSTONE OF MESAVERDE GROUP..... 211HOST
HORSEHEAD TONGUE OF PIKE,MANCOS SHALE..... 211HRSD
JUAN LOPEZ SANDSTONE MEMBER OF CARLILE SHALE..... 211JLPZ
KIRTLAND SHALE..... 211KRLD
KIRTLAND SHALE,LOWER SHALE MEMBER..... 211KRLDL
KIRTLAND SHALE,UPPER SHALE MEMBER..... 211KRLDU
LA JARA SHALE..... 211LAJR
LA CRUZ PEAK FORMATION..... 211LCZP
LA VENTANA TONGUE OF CLIFF HOUSE SANDSTONE..... 211LVNN
LEWIS SHALE..... 211LWIS
MC DERMOTT MEMBER OF ANIMAS FORMATION..... 211MCDM
MENEFEE FORMATION..... 211MENF
MIGUEL FORMATION..... 211MGUL
MULATTO TONGUE..... 211MLTT
MADRID FORMATION..... 211MORD
MESAVERDE GROUP..... 211MVRD
NIOBRARA FORMATION..... 211NBRR
NORTH HOGBACK TONGUE OF POINT LOOKOUT SANDSTONE..... 211NHBK
OJO ALAMO SANDSTONE..... 211OJAM
CREVASSE CANYON FORMATION..... 211ORVC
PICTURED CLIFFS SANDSTONE..... 211PCCF
PIERRE SHALE..... 211PIRR
PLACER MOUNTAIN GROUP..... 211PLCM
POINT LOOKOUT SANDSTONE..... 211PNLK
PUNTA DE LA MESA SANDSTONE MEMBER OF MESAVERDE FORMATION..... 211PNMS
PINA VITITOS SANDSTONE..... 211PNVS
PRIETA SANDSTONE..... 211PRIT
PYRAMID CONGLOMERATE..... 211PRMD
PESCADO TONGUE OF MANCOS SHALE..... 211PSCD
RAIL CANYON SANDSTONE MEMBER OF VERMEJO FORMATION..... 211RLCN
SATAN TONGUE OF MANCOS SHALE..... 211SATN
SMOKY HILL MARL MEMBER..... 211SMKH
SANTA RITA GRANODIORITE PORPHYRY..... 211SNTR

SARTEN SANDSTONE..... 211SRTN
TOHACHI FORMATION..... 211THTC
TWOWELLS SANDSTONE LENTIL OF PIKE OF DAKOTA SANDSTONE..... 211TLLS
UTE CANYON TONGUE OF CLIFF HOUSE SANDSTONE..... 211UTCN
VIRDEN FORMATION..... 211VRDN
VERMEJO FORMATION AND TRINIDAD SANDSTONE,UNDIVIDED..... 211VRMJ
WHIM HILL BRECCIA..... 211WMHL

LOWER CRETACEOUS

BROKEN JUG LIMESTONE OF BISBEE GROUP..... 217BKJG
CORBETT SANDSTONE OF BISBEE GROUP..... 217CRBT
LOWER CRETACEOUS ROCKS,UNDIVIDED..... 217CRCSL
HIDALGO VOLCANICS OF BISBEE GROUP..... 217HDLG
HIDALGO VOLCANICS,SEDIMENTARY MEMBER,OF BISBEE GROUP..... 217HDLGS
HELL TO FINISH FORMATION..... 217HLFS
HOWELLS RIDGE FORMATION OF BISBEE GROUP..... 217HRDG
HOWELLS RIDGE FORMATION,TOP LIMESTONE MEMBER..... 217HRDGL
HOWELLS RIDGE FORMATION,VOLCANIC MEMBER..... 217HRDGV
MOJADO FORMATION OF ZELLER..... 217MOJD
PAJARITO SHALE MEMBER OF DAKOTA SANDSTONE..... 217PJRT
PLAYAS PEAK FORMATION..... 217PLPK
PURGATOIRE FORMATION..... 217PRGR
PUERTOCITO FORMATION..... 217PRTC
RINGBONE SHALE OF BISBEE GROUP..... 217RNGB
RINGBONE SHALE,VOLCANIC MEMBERS,OF BISBEE GROUP..... 217RNGBV
SKUNK RANCH CONGLOMERATE OF BISBEE GROUP..... 217SKKR
SKUNK RANCH CONGLOMERATE,VOLCANIC MEMBER..... 217SKKRV
SUPRAREEF LIMESTONE MEMBER OF U-BAR FORMATION..... 217SPRF
U-BAR FORMATION..... 217UBAR

COMANCHEAN

BISBEE GROUP..... 218BISB
BEARTOOTH QUARTZITE..... 218BRTT
DUCK CREEK FORMATION..... 218DKCK
KIAWA MOUNTAIN FORMATION..... 218KIAW
KIAMICHI FORMATION..... 218KMCH
MESA RICA SANDSTONE..... 218MSRC
TUCUMCARI SHALE..... 218TCMC

COAHUILAN

GARRETT CONGLOMERATE..... 219GRRT

JURASSIC

AMARILLO SANDSTONE..... 220AMRL
GLEN CANYON GROUP..... 220GLNC
JURASSIC..... 220JRSC
NAVAJO SANDSTONE..... 220NVJO

UPPER JURASSIC

AGUA ZARCA SANDSTONE MEMBER OF SIERRA NACIEMIENTO..... 221AGZC
BLUFF SANDSTONE OF MORRISON FORMATION..... 221BLFF

BELL RANCH FORMATION OF SAN RAFAEL GROUP..... 221BLRC
BRUSHY BASIN SHALE MEMBER OF MORRISON FORMATION..... 221BRSB
CHAQUAQUA SHALE..... 221CHQQ
CHAVEZ MEMBER OF MORRISON FORMATION..... 221CHVZ
CARMEL FORMATION OF SAN RAFAEL GROUP..... 221CRML
COW SPRINGS SANDSTONE OF MORRISON FORMATION..... 221CSPG
ENTRADA SANDSTONE,UPPER SANDY MEMBER,OF SAN RAFAEL GROUP..... 221ENRD
MORRISON FORMATION..... 221MRSN
PREWITT SANDSTONE MEMBER OF MORRISON FORMATION..... 221PRTT
RECAPTURE SHALE MEMBER OF MORRISON FORMATION..... 221RCPR
SALT WASH SANDSTONE MEMBER OF MORRISON FORMATION..... 221SLWS
SUMMERVILLE FORMATION OF SAN RAFAEL GROUP..... 221SMVL
SAN RAFAEL GROUP..... 221SRFL
SAN RAFAEL GROUP,LOWER PART..... 221SRFLL
TODILTO LIMESTONE OF MORRISON FORMATION OF SAN RAFAEL GROUP..... 221TDLT
THOREAU FORMATION..... 221THRU
WHITE SANDSTONE MEMBER OF MORRISON FORMATION..... 221WHIT
WANAKAH FORMATION..... 221WNKH
WESTWATER CANYON SANDSTONE MEMBER OF MORRISON FORMATION..... 221WSRC
ZUNI SHALE..... 221ZUNI
ZUNI SANDSTONE..... 221ZUNIS

MIDDLE JURASSIC

OCATE SANDSTONE..... 224OCTE
TRAVESTER SHALE..... 224TRVR

TRIASSIC

BALDY HILL FORMATION..... 230BLDH
CAMP SPRINGS CONGLOMERATE OF DOCKUM GROUP..... 230CPSP
ENDEE SHALE..... 230ENDE
HOSKINNINI MEMBER OF MOENKOPI FORMATION..... 230HSKN
MOENKOPI FORMATION..... 230MNKP
NARANJO FORMATION..... 230NRNJ

UPPER TRIASSIC

CHINLE FORMATION..... 231CHNL
CORRED SANDSTONE MEMBER OF CHINLE FORMATION..... 231CORR
DOCKUM GROUP..... 231DCKM
KAYENTA FORMATION..... 231KYNT
LUKACHUKAI MEMBER OF WINGATE SANDSTONE..... 231LKCK
OWL ROCK MEMBER OF CHINLE FORMATION..... 231ORCK
PETRIFIED FOREST MEMBER,UPPER PART,OF CHINLE FORMATION..... 231PFDF
POLEO SANDSTONE LENTIL OF CHINLE FORMATION..... 231POLO
ROCK POINT MEMBER OF WINGATE SANDSTONE..... 231RCKP
REDONDA FORMATION..... 231RDND
SLOAN CANYON FORMATION OF DOCKUM GROUP..... 231SLNC
SALITRAL SHALE TONGUE OF CHINLE FORMATION..... 231SLRL
SANTA ROSA SANDSTONE..... 231SNRS
SENORITO SANDSTONE LENTIL OF CHINLE FORMATION..... 231SNRT
SONSELA SANDSTONE BED OF PETRIFIED FOREST MEMBER OF CHINLE FORMATION.. 231SNSL
SHEEP PEN SANDSTONE..... 231SPPN
SHINARUMP MEMBER OF CHINLE FORMATION..... 231SRMP
TECOVAS FORMATION OF DOCKUM GROUP..... 231TCVS

WINGATE SANDSTONE..... 231WNGT

PALEOZOIC

PERMIAN

AQUA TORRES FORMATION..... 310AQTR
BLUEWATER FORMATION..... 310BLTR
BERNALILLO SHALE..... 310BRLL
CEDAR MESA SANDSTONE MEMBER OF CUTLER FORMATION..... 310CDRM
CHIRICAHUA LIMESTONE,UPPER PART..... 310CHRC
CHAVES SHALE..... 310CHVS
CEJA GLORIETA SANDSTONE..... 310CJGL
CUTLER FORMATION..... 310CTLR
DE CHELLY SANDSTONE MEMBER OF CUTLER FORMATION..... 310DCLL
EARP FORMATION..... 310EARP
EDDY SANDSTONE..... 310EDDY
FORTY-NINER MEMBER OF RUSTLER FORMATION..... 310FRNR
FIERRO LIMESTONE..... 310FRRO
GLORIETA SANDSTONE MEMBER OF SAN ANDRES FORMATION OF MANZANO GROUP.... 310GLRT
GYM LIMESTONE..... 310GYM
HONAKER TRAIL FORMATION OF HERMOSA GROUP..... 310HKTL
HALGAITO MEMBER OF CUTLER FORMATION..... 310HLGT
HONDO SANDSTONE MEMBER OF SAN ANDRES LIMESTONE..... 310HOND
HERMIT SHALE..... 310HRMT
JICARILLA MONZONITE..... 310JCRL
KAIBAB LIMESTONE..... 310KIBB
LOS VALLOS MEMBER OF YESO FORMATION..... 310LSVL
MESETA BLANCA SANDSTONE MEMBER OF YESO FORMATION..... 310MBLC
MAGENTA MEMBER OF RUSTLER FORMATION..... 310MGNT
MANZANO GROUP..... 310MNZN
NOGAL FORMATION..... 310NOGL
ORGAN ROCK MEMBER OF CUTLER FORMATION..... 310OGRK
PECOS FORMATION..... 310PCOS
PECOS CANYON SANDSTONE..... 310PCSC
RICO FORMATION..... 310RICO
RAINVALLEY FORMATION OF NACO GROUP..... 310RNVL
SANGRE DE CRISTO FORMATION..... 310SGRC
SUPAI FORMATION,EVAPORITE MEMBER..... 310SUPIE
SUPAI FORMATION,LOWER MEMBER..... 310SUPIL
SAN YSIDRO MEMBER OF YESO FORMATION..... 310SYDR
TORRANCE SHALE..... 310TRNC
TORRES MEMBER OF YESO FORMATION..... 310TRRS
WHITE RIM SANDSTONE MEMBER OF CUTLER FORMATION..... 310WTRM
YESO FORMATION,MANZONO GROUP..... 310YESO

OCHOAN

CULEBRA DOLOMITE MEMBER OF RUSTLER FORMATION..... 312CLBR
CASTILE FORMATION..... 312CSTL
DEWEY LAKE REDBEDS..... 312DYLK
OCHOAN SERIES..... 312OCHO
RUSTLER FORMATION..... 312RSLR
RUSTLER FORMATION,UNNAMED LOWER MEMBER..... 312RSLRL
SALADO FORMATION..... 312SLDO
TAMARISK MEMBER OF RUSTLER FORMATION..... 312TMRK

GUADALUPIAN

ARTESIA GROUP..... 313ARTS
AZOTEA TONGUE OF SEVEN RIVERS FORMATION..... 313AZOT
BELL CANYON FORMATION..... 313BLCN
BERNAL FORMATION OF ARTESIA GROUP..... 313BRNL
BRUSHY CANYON FORMATION OF DELAWARE MOUNTAIN GROUP..... 313BRSC
BROWN LIMESTONE MEMBER OF U-BAR FORMATION..... 313BRWN
CHALK BLUFF FORMATION..... 313CKBF
CARLSBAD GROUP..... 313CLBD
CARLSBAD LIMESTONE..... 313CLBDI
CONCHA LIMESTONE OF NACO GROUP..... 313CNCH
CAPITAN LIMESTONE..... 313CPTN
CHERRY CANYON FORMATION..... 313CRCN
CUTOFF SHALY MEMBER OF BONE SPRING LIMESTONE..... 313CTFF
DOG CANYON LIMESTONE..... 313DGCN
DELAWARE MOUNTAIN GROUP..... 313DLRM
GUADALUPIAN SERIES..... 313GDLP
GRAYBURG FORMATION OF ARTESIA GROUP..... 313GRBG
GOAT SEEP DOLOMITE..... 313GTSP
LIMESTONE AQUIFER..... 313LMSN
LOVINGTON SANDSTONE MEMBER OF SAN ANDRES FORMATION..... 313LVNG
OCOTILLO SILT MEMBER..... 313OCTL
QUEEN FORMATION..... 313QUEN
SAN ANDRES LIMESTONE AND GLORIETA SANDSTONE..... 313SADG
SAN ANDRES LIMESTONE OF MANZANO GROUP..... 313SADR
SAN ANDRES LIMESTONE,LOWER CHERTY MEMBER..... 313SADRL
SAN ANDRES LIMESTONE,UPPER CLASTIC MEMBER..... 313SADRU
SAN ANDRES LIMESTONE AND YESO FORMATION,UNDIVIDED..... 313SADY
SHATTUCK MEMBER OF QUEEN FORMATION..... 313STCK
SEVEN RIVERS FORMATION..... 313SVRV
TANSILL FORMATION..... 313TNSL
THREE TWINS MEMBER OF CHALK BLUFF FORMATION..... 313TRTS
YATES FORMATION,GUADALUPE GROUP..... 313YTES

LOWER PERMIAN

OTERO FORMATION..... 317OTRO

LEONARDIAN

ABO SANDSTONE (LOWER TONGUE)..... 318ABO L
ABO SANDSTONE (UPPER TONGUE)..... 318ABO U
BONE SPRING LIMESTONE..... 318BSPG
CANAS GYPSUM MEMBER OF YESO FORMATION..... 318CANS
COCINING SANDSTONE..... 318CCNN
CIMARRON FORMATION..... 318CMRN
CHUPADERA FORMATION..... 318CPDR
EPITAPH DOLOMITE OF NACO GROUP..... 318EPTP
JOYITA SANDSTONE MEMBER OF YESO FORMATION..... 318JOYT
KAIBAB FORMATION..... 318KIBB
SCHERRER FORMATION..... 318SCRR
VICTORIO PEAK LIMESTONE..... 318VCPK

WOLFCAMPIAN

BURSUM FORMATION AND EQUIVALENT ROCKS..... 319BRSM
COLINA LIMESTONE..... 319COLN
LOWER CUTLER GROUP..... 319CTLRL
ELEPHANT CANYON FORMATION..... 319ELPC
HUECO LIMESTONE..... 319HUCO
PENDEJO TONGUE OF HUECO FORMATION..... 319PNDJ
PUEBLO QUARTZITE..... 319PUBL
SANTA ANA MEMBER OF SANTA FE FORMATION..... 319SNAN

PENNSYLVANIAN

ALAMITO SHALE..... 320ALMT
ANTONITO LIMESTONE..... 320ANTN
ATRASADO MEMBER OF MADERA FORMATION..... 320ARSD
BAR B FORMATION..... 320BARB
BULLINGTON MEMBER OF MAGDALENA FORMATION..... 320BLNG
CORTADO FORMATION..... 320CRTD
DON LIMESTONE..... 320DON
GRAY MESA MEMBEK OF MADERA FORMATION..... 320GRMS
HUMBOLDT FORMATION..... 320HMBD
HORQUILLA LIMESTONE,LOWER PART..... 320HRQLL
HORQUILLA LIMESTONE,UPPER PART..... 320HRQLU
HOT SPRINGS FORMATION..... 320HSPG
INCARNACION FIRE CLAY..... 320ICRC
MOUNTAIN HOME SHALE..... 320MNHM
MONTOSA LIMESTONE..... 320MNTS
MOLAS FORMATION..... 320MOLS
MOSCA LIMESTONE..... 320MOSC
NACO GROUP..... 320NACO
NAKAYE FORMATION..... 320NAKY
OSCURO LIMESTONE..... 320OSCR
OSWALDO FORMATION..... 320OSLD
RED HOUSE FORMATION..... 320RDHS
RED TANKS MEMBEK OF MADERA FORMATION..... 320RDTK
SANDIA FORMATION..... 320SNDI
SYRENA FORMATION..... 320SYRN
TELLERA LIMESTONE..... 320TLLR
WARMINGTON LIMESTONE MEMBER OF ELEPHANT BUTTE FORMATION..... 320WRMG

VIRGILIAN

BRUTON FORMATION..... 322BRTN
DEL CUERTO FORMATION..... 322DLCR
FRESNAL GROUP..... 322FRSL
HOLDER FORMATION OF MAGDALENA GROUP..... 322HLDR
MOYA FORMATION..... 322MOYA
PANTHER SEEP FORMATION..... 322PRSP

MISSOURIAN

ADOBE FORMATION..... 323ADOB
BEEMAN FORMATION OF MAGDALENA GROUP..... 323BEMN
BURREGO FORMATION..... 323BRRG
COANE FORMATION..... 323CONE

COUNCIL SPRING LIMESTONE..... 323CSPG
HANSONBURG GROUP..... 323HBRG
STORY FORMATION..... 323STRY
VEREDAS GROUP..... 323VRDS

MIDDLE PENNSYLVANIAN

HERMOSA FORMATION..... 324HRMS

DES MOINESIAN

ARMENDARIS GROUP..... 325ARMD
BUG SCUFFLE LIMESTONE MEMBER OF GOBBLER FORMATION..... 325BGSF
BOLANDER GROUP..... 325BLDR
CIENEGUILLA FORMATION..... 325CNGL
COYOTE SANDSTONE MEMBER OF MADERA LIMESTONE..... 325COYT
GOBBLER FORMATION OF MAGDALENA GROUP..... 325GBLR
GARCIA FORMATION..... 325GRCI
MADERA LIMESTONE..... 325MDER
MADERA LIMESTONE,LOWER GRAY LIMESTONE MEMBER..... 325MDERL
MADERA LIMESTONE,UPPER ARKOSIC LIMESTONE MEMBER..... 325MDERU
WHISKEY CANYON LIMESTONE..... 325WSKC

ATOKAN

APODACA FORMATION..... 326APDC
ARREY FORMATION..... 326ARRY
CUCHILLO NEGRO FORMATION..... 326CCNG
FRA CRISTOBAL FORMATION..... 326FCBL
GREEN CANYON GROUP..... 326GRNC
MAGDALENA GROUP..... 326MGDL
MUD SPRINGS GROUP..... 326MSPG

LOWER PENNSYLVANIAN

LOG SPRINGS FORMATION..... 327LGSP

MISSISSIPPIAN

CALOSO FORMATION..... 330CLOS
CHLORIDE FORMATION..... 330CLRD
HELMS FORMATION..... 330HLMS
PERCHA SHALE..... 330PRCH
SIERRA LIMESTONE..... 330SIRR
TERERRO FORMATION..... 330TRRR

UPPER MISSISSIPPIAN

LEADVILLE LIMESTONE..... 331LDVL

CHESTERIAN

PARADISE FORMATION..... 332PRDS

MERAMECIAN

ARROYO PENASCO FORMATION..... 333ARPC
LAS CRUCES FORMATION..... 333LCRC
RANCHERIA FORMATION..... 333RNCR

LOWER MISSISSIPPIAN

BELLA SHALE..... 337BELL
COWLES MEMBER OF TERRERO FORMATION..... 337CWLS
HANOVER LIMESTONE..... 337HNVR
MACHO MEMBER OF TERRORO FORMATION..... 337MCHO
MANUELITAS MEMBER OF TERRORO FORMATION..... 337MNLS
READY PAY MEMBER OF PERCHA SHALE..... 337RDYP
SILVER SHALE..... 337SLVR

USAGEAN

ANDRECITO MEMBER OF LAKE VALLEY LIMESTONE..... 338ADRC
ALAMGORDO MEMBER OF LAKE VALLEY LIMESTONE..... 338AMGD
ARCENTE MEMBER OF LAKE VALLEY LIMESTONE..... 338ARCN
DONA ANA MEMBER OF LAKE VALLEY LIMESTONE..... 338DNAN
GRANDE LIMESTONE..... 338GRND
KELLEY LIMESTONE..... 338KLLY
LAKE VALLEY LIMESTONE..... 338LKVL
NUNN MEMBER OF LAKE VALLEY LIMESTONE..... 338NUNN
TIERRA BLANCA MEMBER OF LAKE VALLEY FORMATION..... 338TBLC

KINDERHOOKIAN

CABALLERO FORMATION..... 339CBLR
ESCABRASO LIMESTONE..... 339ECBR

DEVONIAN

ESPIRITU SANTO FORMATION..... 340EPRS

UPPER DEVONIAN

BOX MEMBER OF PERCHA SHALE FORMATION..... 341BOX
BERENDA LIMESTONE..... 341BRND
CONTADERO FORMATION..... 341CNDR
ELBERT FORMATION..... 341ELBR
SLY GAP FORMATION..... 341SLGP

MIDDLE DEVONIAN

BEAR SPRINGS BASALT..... 344BSPG
ONATE FORMATION..... 344ONTE
SANTA RITA LIMESTONE..... 344SNTR

SILURIAN

CIBOLA LIMESTONE..... 350CBOL
NAIAD LIMESTONE..... 350NAID

MIDDLE SILURIAN

FUSSELMAN DOLOMITE..... 354FSLM

ORDOVICIAN

ARMENDARIS LIMESTONE..... 360ARMD
CRISTOBAL LIMESTONE..... 360CRBL
FRONDOSA LIMESTONE..... 360FRDS

UPPER ORDOVICIAN

ALEMAN FORMATION..... 361ALMN
CABLE CANYON SANDSTONE..... 361CBLC
CUTTER FORMATION OF MONTOYA DOLOMITE..... 361CTTR
JORNADA LIMESTONE..... 361JRND
MONTOYA DOLOMITE GROUP..... 361MNTY
CUTTER FORMATION OF MONTOYA DOLOMITE..... 361OTTR
PAR VALUE MEMBER OF MONTOYA DOLOMITE..... 361PRVL
RAVEN MEMBER OF MONTOYA DOLOMITE..... 361RVEN
SECOND VALUE MEMBER OF MONTOYA DOLOMITE..... 361SCDV
UPHAM DOLOMITE..... 361UPHM
VALMONT DOLOMITE..... 361VLMN

LOWER ORDOVICIAN

BAT CAVE LIMESTONE..... 367BTCV
EL PASO LIMESTONE OR GROUP..... 367ELPS
SIERRITE LIMESTONE..... 367SRRT

CAMBRIAN

BURRO QUARTZITE..... 370BURR
DRAGOONAN SERIES..... 370DRGN
HAWKINS LIMESTONE..... 370HKNS

UPPER CAMBRIAN

BLISS SANDSTONE..... 371BLSS
CARRASCO LIMESTONE..... 371CRSC
SHANDON QUARTZITE..... 371SNDN

ST. CROIXIAN

IGNACIO QUARTZITE..... 372IGNC

PRECAMBRIAN

AGUA CALIENTE GABBRO..... 400AGCL
ANTONIO SLATE..... 400ANTN
BADITO QUARTZITE MEMBER OF HOPEWELL SERIES..... 400BDTO
BIG ROCK CONGLOMERATE OF KIAWA MOUNTAIN FORMATION..... 400BGRK
BURNED MOUNTAIN METARHYOLITE..... 400BRDM
BLUE SPRINGS MUSCOVITE SCHIST..... 400BSPG
CABRESTO METAQUARTZITE..... 400CBRS
CABRESTO QUARTZITE..... 400CBRSQ

COSTILLA GRANITE..... 400CSTL
CLEVELAND GULCH QUARTZITE MEMBER OF HOPEWELL SERIES..... 400CVGC
DIXON GRANITE..... 400DXON
EMBUDO GRANITE..... 400EMBD
GARNUAN SERIES..... 400GRNN
GRAPHIC LAVAS..... 400GRPC
HONDO SLATE..... 400HOND
HOPEWELL SERIES..... 400HPLL
INCARNACION GRANITE..... 400ICRC
JAWBONE CONGLOMERATE OF KIAWA MOUNTAIN FORMATION..... 400JWBN
LACOROCAH META-ANDESITE TUFF MEMBER OF GREENSTONE COMPLEX..... 400LCRC
MOPPIN METAVOLCANIC SERIES..... 400MPPN
MAQUINITA GRANODIORITE..... 400MQNT
NINOS SCHIST..... 400NNOS
ORTEGA QUARTZITE..... 400ORTG
PRECAMBRIAN ERATHEM..... 400PCMB
PICURIS BASALT..... 400PCRS
PETACA SCHIST..... 400PETC
PILAR PHYLLITE MEMBER OF ORTEGA FORMATION..... 400PILR
PENASCO QUARTZITE..... 400PNSC
PRIEST GRANITE..... 400PRST
ROCIADA LIMESTONE..... 400ROCD
SAIS QUARTZITE..... 400SAIS
SANDOVAL GRANITE..... 400SDVL
SERNA SCHIST..... 400SERN
SOLITARIO SLATE..... 400SLTR
SAPELLO QUARTZITE..... 400SPLL
SEVILLETA FORMATION..... 400SVLT
TIJERAS QUARTZITE..... 400TJRS
TRUCHAS SLATE..... 400TRCS
TUSAS GRANITE..... 400TUSS
VADITO FORMATION..... 400VDTO
VALLECITOS RHYOLITE..... 400VLCS
WHITE RIDGE QUARTZITE..... 400WRDG
YSIDRO SHALE..... 400YSDR

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
BAY-BOTTOM DEPOSITS..... 111BBTM
BEACH (SHORE)DEPOSITS..... 111BECH
DUNE (AEOLIAN) DEPOSITS..... 111DUNE
FILL..... 111FILL
HOLOCENE SERIES..... 111HLCN
LAKE DEPOSITS..... 111LAKE
SALT-MARSH DEPOSITS..... 111SLMR
TERRACE DEPOSITS..... 111TRRC

PLEISTOCENE

GLACIAL DELTA DEPOSITS..... 112GLCD
GLACIAL AQUIFER,UPPER..... 112GLCLU
GARDINERS CLAY..... 112GRDR
HARBOR HILL DRIFT..... 112HBHD
HARBOR HILL OUTWASH..... 112HBHO
HARBOR HILL TILL..... 112HBHT
HARBOR HILL GROUND MORAINE..... 112HHGM
HARBOR HILL TERMINAL MORAINE..... 112HHTM
ICE-CONTACT DEPOSITS..... 1121CNC
JAMECO AQUIFER..... 112JMCO
KAME TERRACE DEPOSITS..... 112KMTC
LAKE DEPOSITS..... 112LAKE
OUTWASH..... 1120TSH
RONKONKOMA GROUND MORAINE..... 112RKGM
RONKONKOMA DRIFT..... 112RKKD
RONKONKOMA OUTWASH..... 112RKKO
RONKONKOMA TILL..... 112RKKT
RONKONKOMA TERMINAL MORAINE..... 112RKTM
SAND..... 112SAND
SAND AND GRAVEL..... 112SDGV
SMITHTOWN CLAY..... 112SMTN
TILL..... 112TILL
20-FOOT CLAY..... 11220CL

TERTIARY

PLIOCENE

MANNETTO GRAVEL..... 121MNNT

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU
LLOYD AQUIFER..... 211LLYD
MAGOTHY AQUIFER..... 211MGTY
MONMOUTH GREENSAND..... 211MMGD
MATAWAN GROUP-MAGOTHY FORMATION..... 211MNMG
MONMOUTH GROUP..... 211MNMT
MATAWAN FORMATION..... 211MTWN
RARITAN FORMATION..... 211RRTN

TRIASSIC

TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

BRUNSWICK FORMATION..... 231BRCK
NEWARK GROUP..... 231NWRK
PALISADE DIABASE..... 231PLSD
STOCKTON FORMATION..... 231STCN
UPPER TRIASSIC SERIES..... 231TRSCU

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

MIDDLE PENNSYLVANIAN

POTTSVILLE FORMATION..... 324PSVL

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

LOWER MISSISSIPPIAN

POCONO GROUP..... 337POCN

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

CANADAWAY GROUP..... 341CNDY
CONEWANGO GROUP..... 341CNNG
CONNEAUT GROUP..... 341CNNT
DEVONIAN, UPPER..... 341DVNNU
GENESEE FORMATION..... 341GENS
JAVA-WEST FALLS FORMATION..... 341JVWF
SONYEA FORMATION..... 341SONY

MIDDLE DEVONIAN

DEVONIAN, MIDDLE..... 344DVNNM
ESOPUS SHALE..... 344ESPS
HAMILTON GROUP..... 344HMLN
ONONDAGA LIMESTONE..... 344ONDG
TULLY LIMESTONE..... 344TLLY

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL
HELDERBERG GROUP..... 347HDBG
ORISKANY SANDSTONE..... 347ORSK

SILURIAN

GREEN POND CONGLOMERATE..... 350GRPD
SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

AKRON-COBLESVILLE-BERTIE FORMATIONS,UNDIFFERENTIATED..... 351ACBB
AKRON DOLOMITE..... 351AKRN
BINNEWATER SANDSTONE..... 351BNTR
BERTIE LIMESTONE..... 351BRTI
COBLESKILL LIMESTONE..... 351CBLK
CAMILLUS SHALE..... 351CMLS
LONGWOOD SHALE..... 351LNGD
SALINA GROUP..... 351SLIN
SILURIAN, UPPER..... 351SLRNU
SYRACUSE SALT..... 351SRCS
VERNON SHALE..... 351VRNN

MIDDLE SILURIAN

CLINTON GROUP..... 354CLNN
SILURIAN, MIDDLE..... 354SLRNM
SHAWANGUNK CONGLOMERATE..... 354SNGK

NIAGARAN

LOCKPORT DOLOMITE..... 355LCKP

LOWER SILURIAN

ALBION GROUP..... 357ALBN

SILURIAN, LOWER..... 357SLRNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

LORRAINE SHALE..... 361LRRN
ORDOVICIAN, UPPER..... 361ODVCU
OSWEGO SANDSTONE..... 361OSWG
QUEENSTON SHALE..... 361QNSN
UTICA SHALE..... 361UTIC

MIDDLE ORDOVICIAN

BERKSHIRE SCHIST..... 364BRKR
CHAZY GROUP..... 364CHZY
CANAJOHARIE SHALE..... 364CNJR
NORMANSKILL FORMATION..... 364NMKL
ORDOVICIAN, MIDDLE..... 364ODVCM
SNAKE HILL FORMATION..... 364SKHL
TRENTON-BLACK RIVER GROUP..... 364TBRV
TRENTON GROUP..... 364TRNN
WALLOOMSAC SLATE..... 364WLMC

LOWER ORDOVICIAN

BEEKMANTOWN GROUP..... 367BKMN
ORDOVICIAN, LOWER..... 367ODVCL
POULTNEY SLATE..... 367PLTN
TRIBES HILL LIMESTONE..... 367TBHL

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

MIDDLE CAMBRIAN SERIES..... 371CMBRM
CAMBRIAN, UPPER..... 371CMBRU
LITTLE FALLS DOLOMITE..... 371LLFL
POTSDAM SANDSTONE..... 371PSDM
TACONIC SEQUENCE..... 371TCSQ
THERESA DOLOMITE..... 371THRS

MIDDLE CAMBRIAN

CAMBRIAN, MIDDLE..... 374CMBRM
STOCKBRIDGE GROUP..... 374SKBG

LOWER CAMBRIAN

BULL SLATE..... 377BULL
LOWER CAMBRIAN SERIES..... 377CMBRL
DALTON FORMATION..... 377DLTN

ELIZAVILLE AND BERKSHIRE FORMATIONS..... 377EZVB
NASSAU FORMATION..... 377NSSU
POUGHQUAY QUARTZITE..... 377PGQY
SCHODACK FORMATION..... 377SCCK
STISSING DOLOMITE..... 377SSNG

PRECAMBRIAN

BASEMENT COMPLEX..... 400BCPX
PRECAMBRIAN ERATHEM..... 400PCMB

UNKNOWN

SAPROLITE(UNKNOWN AGE)..... 000SPRL

CENOZOIC

CENOZOIC-MESOZOIC ERATHEMS..... 100CZMZ

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
POST MIOCENE (QUATERNARY + PLIOCENE) ROCKS..... 110QPLC
QUATERNARY SYSTEM..... 110QRNR
SAPROLITE..... 110SPRL

HOLOCENE

FLUVIAL DEPOSITS..... 111FVDP
MARINE DEPOSITS..... 111MRIN
STRATIFIED DEPOSITS,UNDIFFERENTIATED..... 111SRFD

PLEISTOCENE

FLUVIAL DEPOSITS..... 112FVDP
MARINE DEPOSITS..... 112MRIN
STRATIFIED DEPOSITS,UNDIFFERENTIATED..... 112SRFD

TERTIARY

TERTIARY SYSTEM..... 120TRTR

MIOCENE

MIOCENE-EOCENE SERIES..... 122MCEC
MIOCENE-EOCENE-PALEOCENE SERIES..... 122MCEP
MIOCENE SERIES..... 122MOCN
PUNGO RIVER FORMATION..... 122PGRV
YORKTOWN FORMATION..... 122YRKN
YORKTOWN AQUIFER..... 122YRKNQ
YORKTOWN AQUITARD..... 122YRKNT

OLIGOCENE

OLIGOCENE SERIES..... 123OLGC

EOCENE

CASTLE HAYNE FORMATION..... 124CSLH
LOWER CASTLE HAYNE AQUIFER..... 124CSLHL
UPPER CASTLE HAYNE AQUIFER..... 124CSLHU
EOCENE-PALEOCENE SERIES..... 124ECPC
EOCENE SERIES..... 124EOCN

PALEOCENE

BEAUFORT FORMATION	125BFRT
BEAUFORT AQUIFER	125BFRTQ
BEAUFORT AQUITARD	125BFRTT
PALEOCENE SERIES	125PLCN

MESOZOIC

MESOZOIC ERATHEM	200MSZC

CRETACEOUS

UPPER CRETACEOUS

UPPER CRETACEOUS AQUIFER SYSTEM	211CRAQU
UPPER CRETACEOUS SERIES	211CRCSU
PEEDEE FORMATION	211PEED
TUSCALOOSA FORMATION	211TSCL

LOWER CRETACEOUS

LOWER CRETACEOUS SEDIMENTS UNDIFFERENTIATED	217SDMS

TRIASSIC

ARKOSE	230ARKS
CONGLOMERATE	230CGLM
COAL	230COAL
DOLERITE (DIABASE)	230DLRT
SHALE	230SHLE
SILTSTONE	230SLSN
SANDSTONE	230SNDS

PALEOZOIC

AUGEN GNIESS	300AGGS
ARGILLITE	300AGLL
ALASKITE	300ALSK
AMPHIBOLITE	300AMPB
ANDESITE	300ANDS
BRECCIA	300BRCC
BASALT	300BSLT
CONGLOMERATE	300CGLM
DACITE	300DCIT
DIABASE	300DIBS
PALEOZOIC DOLOMITE	300DLMT
DOLERITE (DIABASE)	300DLRT
DIORITE	300DORT
DUNITE	300DUNT
GABBRO	300GBBR
GNEISS	300GNSS
GRANODIORITE	300GRDR
GRANITE GNEISS	300GRGS
GRANITE	300GRNT
GRAYWACKE	300GWCK

HORNBLENDE GNEISS..... 300HBDG
MICA GNEISS..... 300MCGS
MICA SCHIST..... 300MCSC
METASEDIMENTARY ROCKS..... 300MDMR
METAIGNEOUS ROCKS..... 300MGNS
METAMORPHIC ROCKS..... 300MMPC
MONZONITE..... 300MNZN
MARBLE..... 300MRBL
METAVOLCANIC ROCKS..... 300MVCC
PEGMATITE..... 300PGMT
PHYLLITE..... 300PLLT
PALEOZOIC-PRECAMBRIAN ERATHEMS..... 300PZPB
QUARTZITE..... 300QRTZ
RHYOLITE..... 300RYLT
SCHIST..... 300SCST
PALEOZOIC SHALE..... 300SHLE
SILTSTONE..... 300SLSN
SLATE..... 300SLTE
PALEOZOIC SANDSTONE..... 300SNDS
SYENITE..... 300SYNT
TRACHYTE..... 300TRCT
TUFF..... 300TUFF

PRECAMBRIAN

AUGEN GNEISS..... 400AGGS
ARGILLITE..... 400AGLL
ALASKITE..... 400ALSK
AMPHIBOLITE..... 400AMPB
ANDESITE..... 400ANDS
BRECCIA..... 400BRCC
BASALT..... 400BSLT
CONGLOMERATE..... 400CGLM
DACITE..... 400DCIT
DOLOMITE..... 400DLMT
DOLERITE (DIABASE)..... 400DLRT
DIORITE..... 400DORT
DUNITE..... 400DUNT
GABBRO..... 400GBBR
GNEISS..... 400GNSS
GRANODIORITE..... 400GRDR
GRANITE GNEISS..... 400GRGS
PRECAMBRIAN GRANITE..... 400GRNT
GRAYWACKE..... 400GWCK
HORNBLENDE GNEISS..... 400HBDG
MICA GNEISS..... 400MCGS
MICA SCHIST..... 400MCSC
METASEDIMENTARY ROCKS..... 400MDMR
METAIGNEOUS ROCKS..... 400MGNS
PRECAMBRIAN METAMORPHIC ROCKS..... 400MMPC
MONZONITE..... 400MNZN
MARBLE..... 400MRBL
METAVOLCANIC ROCKS..... 400MVCC
PEGMATITE..... 400PGMT
PHYLLITE..... 400PLLT
QUARTZITE..... 400QRTZ

RHYOLITE..... 400RYLT
SCHIST..... 400SCST
SHALE..... 400SHLE
SILTSTONE..... 400SLSN
SLATE..... 400SLTE
SANDSTONE..... 400SNDS
SYENITE..... 400SYNT
TRACHYTE..... 400TRCT
TUFF..... 400TUFF

UNKNOWN

UNKNOWN MATERIAL..... 000UMTL

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

ANTELOPE CREEK AQUIFER..... 112APCK
APPLE CREEK AQUIFER,LOWER..... 112APCKL
APPLE CREEK AQUIFER,UPPER..... 112APCKU
BALD HILL CREEK AQUIFER..... 112BCK
BRADDOCK AQUIFER..... 112BDCK
BURIED VALLEY DEPOSITS..... 112BDVL
BEACH DEPOSITS..... 112BECH
BUFFALO CREEK AQUIFER..... 112BFCK
BURIED GLACIOFLUVIAL DEPOSITS..... 112BGFV
BELMONT AQUIFER..... 112BLMN
BISMARCK AQUIFER..... 112BMCK
BANTEL AQUIFER..... 112BNTL
BURNT CREEK AQUIFER..... 112BRCK
BURIED OUTWASH DEPOSITS..... 112BRDO
BRIGHTWOOD AQUIFER..... 112BRGD
BURLINGTON AQUIFER..... 112BRLG
BUTTE AQUIFER..... 112BUTT
CUTBANK CREEK AQUIFER..... 112CBKC
CENTRAL EDDY AQUIFER..... 112CLED
COLFAX AQUIFER..... 112CLFX
COLUMBUS AQUIFER..... 112CLMB
CHERRY LAKE AQUIFER..... 112CRLK
CARRINGTON AQUIFER..... 112CRNG
COURTNAY AQUIFER..... 112CRTN
CREVASSE DEPOSITS..... 112CRUS
CAT TAIL AQUIFER..... 112CTTL
DELTA DEPOSITS..... 112DELT
DOUGLAS AQUIFER..... 112DGLS
DENBIGH AQUIFER..... 112DNBH
DEER LAKE AQUIFER..... 112DRLK
DUNE DEPOSITS..... 112DUNE
ERIC LAKE AQUIFER..... 112ECLK
EDINBURG AQUIFER..... 112EDBG
EDGELEY AQUIFER..... 112EDGL
ENGLEVALE AQUIFER..... 112EGLV

ELLENDALE AQUIFER..... 112ELDL
ELK VALLEY AQUIFER..... 112ELKV
ELM CREEK AQUIFER..... 112EMCK
EMERADO AQUIFER..... 112EMRD
ESKER DEPOSITS..... 112ESKR
ESMOND AQUIFER..... 112ESMD
EASTMAN AQUIFER..... 112ESMN
FORDVILLE AQUIFER..... 112FDVL
FARGO AQUIFER..... 112FRGO
FORT MANDAN AQUIFER..... 112FRMD
FAIRMOUNT AQUIFER..... 112FRMN
FOREST RIVER AQUIFER..... 112FRRV
GRAND FORKS AQUIFER..... 112GDFK
GALESBURG AQUIFER..... 112GLBG
GLENCO CHANNEL AQUIFER..... 112GLCC
GLENVIEW AQUIFER..... 112GLNV
GOLDWIN AQUIFER..... 112GLON
GUELPH AQUIFER..... 112GLPH
GOODMAN CREEK AQUIFER..... 112GMCK
GRENORA AQUIFER..... 112GRNR
GARRISON AQUIFER..... 112GRSN
HAMAR AQUIFER..... 112HAMR
HIDDENWOOD LAKE AQUIFER..... 112HDLK
HOFFLUND AQUIFER..... 112HFLD
HILLSBORO AQUIFER..... 112HLBR
HAMILTON AQUIFER..... 112HMLN
HANKINSON AQUIFER..... 112HNKS
HOMER AQUIFER..... 112HOMR
HORSESHOE VALLEY AQUIFER..... 112HRVL
HORSE NOSE BUTTE AQUIFER..... 112HSNB
HEART RIVER AQUIFER..... 112HTRV
ICE CONTACT DEPOSITS..... 112ICCC
ICELANDIC AQUIFER..... 112ICDC
INKSTER AQUIFER..... 112IKSR
JAMES RIVER AQUIFER..... 112JMRV
JAMESTOWN AQUIFER..... 112JMSN
JUANITA LAKE AQUIFER..... 112JNLK
JOHNSON LAKE AQUIFER..... 112JSLK
KAME DEPOSITS..... 112KAME
KNIFE RIVER AQUIFER..... 112KFRV
KILLDEER AQUIFER..... 112KLDR
KILGORE AQUIFER..... 112KLGR
KARLSRUHE AQUIFER..... 112KLRH
KAME TERRACE DEPOSITS..... 112KMTC
KENMARE AQUIFER..... 112KNMR
LACUSTRINE DEPOSITS..... 112LCSR
LEEDS AQUIFER..... 112LEDS
LONG LAKE AQUIFER..... 112LGLK
LIGNITE CITY AQUIFER..... 112LGNC
LAKE NETTIE AQUIFER SYSTEM..... 112LKNT
LAKE NETTIE AQUIFER SYSTEM, LOWER..... 112LKNTL
LAKE NETTIE AQUIFER SYSTEM, UPPER..... 112LKNTU
LAKE SOURIS AQUIFER..... 112LKSO
LITTLE MUDDY AQUIFER..... 112LLMD
LAMOURE AQUIFER..... 112LMUR
LOWER SOURIS AQUIFER..... 112LRSR

LOST LAKE AQUIFER..... 112LSLK
LITTLE HEART AQUIFER..... 112LTHR
MC KENZIE AQUIFER..... 112MCKZ
MC VILLE AQUIFER..... 112MCVL
MADDOCK AQUIFER..... 112MDCK
MEDFORD AQUIFER..... 112MDFD
MEDINA AQUIFER..... 112MDIN
MIDWAY AQUIFER..... 112MDWY
MANFRED AQUIFER..... 112MFRD
MILNOR CHANNEL AQUIFER..... 112MLCL
MARSTONMOOR PLAIN AQUIFER..... 112MMPL
MUNICH AQUIFER..... 112MNCH
MINNEWAUKAN AQUIFER..... 112MNKN
MOUNT MORIAH AQUIFER..... 112MNMR
MINOT AQUIFER..... 112MNOT
MERCER AQUIFER..... 112MRCR
MARTIN AQUIFER SYSTEM..... 112MRTN
NORTHWEST BURIED CHANNEL AQUIFER..... 112NBDC
NORTH BURLEIGH AQUIFER..... 112NBLG
NAPOLEON AQUIFER..... 112NPLN
NORTHWEST EDDY AQUIFER..... 112NRED
NORTH HILL AQUIFER..... 112NRHL
NEW ROCKFORD AQUIFER..... 112NRKF
NORTONVILLE AQUIFER..... 112NRVL
NEW TOWN AQUIFER..... 112NWTN
OBERON AQUIFER..... 112OBRN
OAKES AQUIFER..... 112OKES
OTTERTAIL AQUIFER..... 112OTRL
OUTWASH DEPOSITS..... 112OTSH
PAGE AQUIFER..... 112PAGE
PLEASANT LAKE AQUIFER..... 112PLLK
PLEISTOCENE SERIES..... 112PLSC
PEMBINA DELTA AQUIFER..... 112PMBD
PEMBINA RIVER AQUIFER..... 112PMBR
PIPESTEM CREEK AQUIFER..... 112PPCK
POPLAR AQUIFER..... 112PPLR
PAINTED WOODS LAKE AQUIFER..... 112PWLK
RAY AQUIFER..... 112RAY
ROCKY RUN AQUIFER..... 112RCKR
ROSEFIELD AQUIFER..... 112RFLD
RUSSEL LAKE AQUIFER..... 112RLLK
RANDOM CREEK AQUIFER..... 112RMCK
RUSLAND AQUIFER..... 112RSLD
RIVERDALE AQUIFER..... 112RVDL
RYDER AQUIFER..... 112RYDR
SIBLEY CHANNEL AQUIFER..... 112SBLC
STRAWBERRY LAKE AQUIFER..... 112SBLK
STRASBURG AQUIFER..... 112SBRG
SOO CHANNEL AQUIFER..... 112SCNL
SUNDRE BURIED CHANNEL AQUIFER..... 112SDBC
SAND PRAIRIE AQUIFER..... 112SDPR
SOUTH FESSENDEN AQUIFER..... 112SFSD
SIMS AQUIFER..... 112SIMS
ST. JAMES AQUIFER..... 112SJMS
SNAKE CREEK AQUIFER..... 112SKCK
SKJERMO LAKE AQUIFER..... 112SKJL

SHELL CREEK AQUIFER SYSTEM..... 112SLCK
SHIELDS AQUIFER..... 112SLDS
SHEYENNE CHANNEL AQUIFER..... 112SNCL
SHEYENNE DELTA AQUIFER..... 112SNDL
SOURIS VALLEY AQUIFER..... 112SORV
SPIRITWOOD AQUIFER..... 112SPRD
SQUARE BUTTE CREEK AQUIFER..... 112SQBC
STONEY SLOUGH AQUIFER..... 112SSLG
SOUTH HILL AQUIFER..... 112STHL
STREETER AQUIFER..... 112STRR
SHEYENNE VILLAGE AQUIFER..... 112SVLG
SEVEN MILE COULEE AQUIFER..... 112SVMC
SYDNEY AQUIFER..... 112SYDN
TILL DEPOSITS..... 112TILL
TOLGEN AQUIFER..... 112TLGN
TURTLE LAKE AQUIFER SYSTEM..... 112TLLK
THOMPSON AQUIFER..... 112TMPS
TOKIO AQUIFER..... 112TOKO
TOWER CITY AQUIFER..... 112TRCT
TRENTON AQUIFER..... 112TRNN
TERRACE DEPOSITS..... 112TRRC
UPPER BUFFALO CREEK AQUIFER..... 112UBCK
VANG AQUIFER..... 112VANG
VALLEY CITY AQUIFER..... 112VLCT
WINDSOR AQUIFER..... 112WDSR
WOLF CREEK AQUIFER..... 112WFCK
WEST FARGO AQUIFER..... 112WFRG
WING CHANNEL AQUIFER..... 112WGCL
WAGONSPORT AQUIFER..... 112WGPR
WILDROSE AQUIFER..... 112WLDR
WELLER SLOUGH AQUIFER..... 112WLSG
WIMBLEDON AQUIFER..... 112WMBD
WAHPETON AQUIFER..... 112WPTN
WARWICK AQUIFER..... 112WRCK
WHITE SHIELD AQUIFER..... 112WSLD
WEST WILDROSE AQUIFER..... 112WWLD
YANKTONAI CREEK AQUIFER..... 112YKCK

TERTIARY

TERTIARY SYSTEM..... 120TRTR

MIOCENE

MIOCENE SERIES..... 122MOCN

OLIGOCENE

WHITE RIVER FORMATION..... 123WRVR

EOCENE

GOLDEN VALLEY FORMATION..... 124GLDV

PALEOCENE

CANNONBALL-LUDLOW MEMBERS OF FORT UNION FORMATION..... 125CBLD
COAL LAKE COULEE INTERVAL..... 125CLCI
COAL LAKE COULEE BED..... 125CLKC
CANNONBALL MEMBER OF FORT UNION FORMATION..... 125CNBL
FORT UNION FORMATION..... 125FRUN
HAGEL BED..... 125HGEL
HAGEL INTERVAL..... 125HGIV
HENSLER BED..... 125HSLR
KINNEMAN CREEK INTERVAL..... 125KCIV
LUDLOW MEMBER OF FORT UNION FORMATION..... 125LDLW
LUDLOW MEMBER OF FORT UNION FORMATION-HELL CREEK FORMATION..... 125LHCK
SENTINEL BUTTE-TONGUE RIVER MEMBERS OF FORT UNION FORMATION..... 125SBTR
SENTINEL BUTTE MEMBER OF FORT UNION FORMATION..... 125SNLB
TONGUE RIVER MEMBER OF FORT UNION FORMATION..... 125TGRV
TONGUE RIVER-LUDLOW MEMBERS OF FORT UNION FORMATION..... 125TRVL
TRAVIS CREEK INTERVAL..... 125TVCI
TRAVIS CREEK BED..... 125TVCK
UNDERWOOD B BED..... 125UDDB
UNDERWOOD C BED..... 125UDDC
UNDERWOOD SHEET SAND..... 125UDDS
UNDERWOOD SAND..... 125UDRD
WELLER SLOUGH BED..... 125WLSG
WELLER SLOUGH INTERVAL..... 125WSIV

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

BELLE FOURCHE FORMATION..... 211BLFC
COLORADO GROUP..... 211CLRD
UPPER CRETACEOUS SERIES..... 211CRCSU
CARLILE SHALE..... 211CRLL
EAGLE FORMATION..... 211EGLE
FOX HILLS FORMATION..... 211FXHL
GREENHORN FORMATION..... 211GRNR
GRANEROS SHALE..... 211GRRS
HELL CREEK FORMATION-FOX HILLS SANDSTONE..... 211HCFH
HELL CREEK FORMATION-FOX HILLS SANDSTONE, LOWER..... 211HCFHL
HELL CREEK FORMATION-FOX HILLS SANDSTONE, UPPER..... 211HCFHU
HELL CREEK FORMATION..... 211HLCK
JUDITH RIVER FORMATION..... 211JDRV
MONTANA GROUP..... 211MNTN
NIOBRARA FORMATION..... 211NBRR
PIERRE SHALE..... 211PIRR

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL

DAKOTA GROUP OR FORMATION OR AQUIFER..... 217DKOT
FALL RIVER FORMATION..... 217FLRV
LAKOTA FORMATION..... 217LKOT
MOWRY SHALE..... 217MWRY
NEWCASTLE SANDSTONE..... 217NCSL
SKULL CREEK FORMATION..... 217SKCK

JURASSIC

JURASSIC SYSTEM..... 220JRSC
JURASSIC RED BEDS..... 220RDBD

UPPER JURASSIC

UPPER JURASSIC SERIES..... 221JRSCU
MORRISON FORMATION..... 221MRSN
RIERDON FORMATION..... 221RRDN
SUNDANCE FORMATION..... 221SNDC
SWIFT FORMATION..... 221SWFT

MIDDLE JURASSIC

MIDDLE JURASSIC SERIES..... 224JRSCM
PIPER FORMATION..... 224PIPR

TRIASSIC

SPEARFISH FORMATION (TRIASSIC-PERMIAN)..... 230SPRF
TRIASSIC SYSTEM..... 230TRSC

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

MINNEKAHTA FORMATION..... 310MNKT
MINNELUSA FORMATION (PERMIAN AND PENNSYLVANIAN)..... 310MNLS
PERMIAN SYSTEM..... 310PRMN

LOWER PERMIAN

OPECHE SHALE..... 317OPCH

PENNSYLVANIAN

AMSDEN FORMATION..... 320AMSD
PENNSYLVANIAN SYSTEM..... 320PSLV
TYLER FORMATION..... 320TYLR

MISSISSIPPIAN

BAKKEN FORMATION (MISSISSIPPIAN AND DEVONIAN)..... 330BKKN
MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

BIG SNOWY GROUP	331BGSN
CHARLES FORMATION	331CRLS
HEATH FORMATION	331HETH
KIBBEY SANDSTONE	331KBBY
MADISON GROUP (UPPER AND LOWER MISSISSIPPIAN	331MDSN
MISSION CANYON LIMESTONE	331MSNC
MISSISSIPPIAN, UPPER	331MSSPU
OTTER FORMATION	331OTTR

LOWER MISSISSIPPIAN

LODGEPOLE LIMESTONE	337LDGP
MISSISSIPPIAN, LOWER	337MSSPL

DEVONIAN

DEVONIAN SYSTEM	340DVNN

UPPER DEVONIAN

BIRD BEAR FORMATION	341BRDB
DUPEROW FORMATION	341DUPR
DEVONIAN, UPPER	341DVNNU
JEFFERSON GROUP	341JFRS
SOURIS RIVER FORMATION	341SRRV
THREE FORKS SHALE	341TRFK

MIDDLE DEVONIAN

DAWSON BAY FORMATION	344DDNB
DEVONIAN, MIDDLE	344DVNNM
ELK POINT GROUP	344ELKP
PRAIRIE FORMATION	344PRIR
WINNIPEGOSIS FORMATION	344WPGS

LOWER DEVONIAN

BEARTOOTH BUTTE FORMATION	347BRTB
DEVONIAN, LOWER	347DVNNL

SILURIAN

INTERLAKE FORMATION	350IRLK

MIDDLE SILURIAN

SILURIAN, MIDDLE	354SLRNM

LOWER SILURIAN

SILURIAN, LOWER	357SLRNL

ORDOVICIAN

DEADWOOD FORMATION..... 360DDWD
ORDOVICIAN SYSTEM..... 360ODUC

UPPER ORDOVICIAN

ORDOVICIAN, UPPER..... 3610DVCU
RED RIVER FORMATION..... 361RDRV
STONY MOUNTAIN FORMATION..... 361SNMN
STONEWALL FORMATION..... 361STNL

MIDDLE ORDOVICIAN

ORDOVICIAN, MIDDLE..... 3640DVCM
WINNIPEG FORMATION..... 364WNPG

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

CAMBRIAN, UPPER..... 371CMBRU

PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB
PRECAMBRIAN GRANITE..... 400PCMBG

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
COLLUVIUM..... 111CLVM
TERRACE DEPOSITS..... 111TRRC

PLEISTOCENE

LAKE DEPOSITS..... 112LAKE
OUTWASH..... 112OTSH
TILL..... 112TILL

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

PERMIAN SYSTEM..... 310PRMN

LOWER PERMIAN

GREENE FORMATION..... 317GREN
WASHINGTON FORMATION..... 317WSNG

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

UPPER PENNSYLVANIAN

CONEMAUGH FORMATION..... 321CNMG
MONONGAHELA FORMATION..... 321MNGL

MIDDLE PENNSYLVANIAN

ALLEGHENY FORMATION..... 324ALGN
POTTSVILLE FORMATION..... 324PSVL

MISSISSIPPIAN

BEDFORD SHALE..... 330BDFD
BEREA SANDSTONE..... 330BERE
CUYAHOGA FORMATION..... 330CYHG
MISSISSIPPIAN SYSTEM..... 330MSSP
MISSISSIPPIAN-DEVONIAN SYSTEMS..... 330MSSPD

SUNBURY SHALE..... 330SNBR

UPPER MISSISSIPPIAN

LOGAN FORMATION..... 331LOGN
MAXVILLE LIMESTONE..... 331MXVL

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

OHIO SHALE..... 341OHIO
OLENTANGY SHALE..... 341OLNG

MIDDLE DEVONIAN

AMHERSTBURG FORMATION..... 344AMBG
COLUMBUS LIMESTONE..... 344CLMB
DELAWARE LIMESTONE..... 344DLWR
DETROIT RIVER GROUP..... 344DRVR
LUCAS LIMESTONE..... 344LUCS
MARCELLUS SHALE..... 344MRCL

LOWER DEVONIAN

ORISKANY SANDSTONE..... 347ORSK

SILURIAN

SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

BASS ISLANDS DOLOMITE..... 351BILD
GREENFIELD DOLOMITE..... 351GFLD
PUT-IN-BAY DOLOMITE..... 351PINB
RAISIN RIVER DOLOMITE..... 351RRVR
TYMOCHTEE FORMATION..... 351TMCT

MIDDLE SILURIAN

CEDARVILLE DOLOMITE..... 354CDVL
DAYTON LIMESTONE..... 354DYTN
EUPHEMIA DOLOMITE..... 354EPHM
OSGOOD FORMATION..... 354OSGD
SPRINGFIELD LIMESTONE..... 354SPGF

NIAGARAN

LOCKPORT DOLOMITE..... 355LCKP
NIAGARA DOLOMITE..... 355NIGR

LOWER SILURIAN

BRASSFIELD LIMESTONE..... 357BFLD

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

ARNHEIM SHALE..... 361ARNM
EDEN GROUP..... 361EDEN
ELKHORN FORMATION..... 361ELKR
FULTON SHALE..... 361FLTN
FAIRVIEW FORMATION..... 361FRVW
LIBERTY FORMATION..... 361LBRT
LATONIA SHALE..... 361LTON
MC MILLAN FORMATION..... 361MCML
MAYSVILLE GROUP..... 361MSVL
RICHMOND GROUP..... 361RCMD
UTICA SHALE..... 361UTIC
WAYNESVILLE SHALE..... 361WSVL
WHITEWATER FORMATION..... 361WTTR

MIDDLE ORDOVICIAN

GLENWOOD SHALE MEMBER OF PLATTEVILLE FORMATION..... 364GLND
POINT PLEASANT FORMATION..... 364PPLS
SAINT PETER SANDSTONE..... 364SNPR
TRENTON LIMESTONE..... 364TRNN

CHAMPLAINIAN

BLACK RIVER FORMATION..... 365BKRV

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
LACUSTRINE DEPOSITS..... 110LCSR
QUATERNARY SYSTEM..... 110QRNR
TERRACE,LOW,DEPOSITS..... 110TRRCL

PLEISTOCENE

DUNE SAND..... 112DUNE
ODEE FORMATION..... 112ODEE
PLEISTOCENE SERIES..... 112PLSC
TERRACE,HIGH,DEPOSITS..... 112TRRCH

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

LAVERNE FORMATION..... 121LVRN
OGALLALA FORMATION..... 121OGLL
PLIOCENE SERIES..... 121PLCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

DAKOTA FORMATION-CHEYENNE SANDSTONE..... 211DKCN
DAKOTA SANDSTONE OR FORMATION..... 211DKOT
EAGLE FORD FORMATION..... 211EGFD
GREENHORN FORMATION..... 211GRNR
GRANEROS SHALE..... 211GRRS

GULFIAN

BROWNSTOWN MARL..... 212BRNS
COLORADO FORMATION..... 212CLRD
GULFIAN SERIES..... 212GLFN
OZAN FORMATION..... 212OZAN
TOKIO FORMATION..... 212TOKO
WOODBINE FORMATION..... 212WDBN

LOWER CRETACEOUS

CHEYENNE SANDSTONE..... 217CYNN
KIOWA SHALE..... 217KIOW
PURGATOIRE FORMATION..... 217PRGR

COMANCHEAN

ANTLERS SAND..... 218ALRS
BOKCHITO FORMATION..... 218BKCT
BENNINGTON LIMESTONE..... 218BNNG
CADDO LIMESTONE..... 218CDDO
COMANCHEAN SERIES..... 218CMNC
DUCK CREEK FORMATION..... 218DKCK
DENTON CLAY..... 218DNTN
DE QUEEN LIMESTONE..... 218DQUN
FREDERICKSBURG GROUP..... 218FKBG
FORT WORTH LIMESTONE..... 218FRWR
GOODLAND LIMESTONE..... 218GDLD
GRAYSON FORMATION..... 218GRSN
HOLLY CREEK FORMATION..... 218HLCK
KIAMICHI FORMATION..... 218KMCH
PAWPAW FORMATION..... 218PWPW
TRINITY GROUP..... 218TRNT
WENO LIMESTONE..... 218WENO
WALNUT CLAY..... 218WLNT
WASHITA GROUP..... 218WSHT

JURASSIC

JURASSIC SYSTEM..... 220JRSC

UPPER JURASSIC

EXETER SANDSTONE..... 221EXTR
UPPER JURASSIC SERIES..... 221JRSCU
MORRISON-DOCKUM FORMATIONS..... 221MDKM
MORRISON FORMATION..... 221MRSN

TRIASSIC

TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

DOCKUM GROUP..... 231DCKM
UPPER TRIASSIC SERIES..... 231TRSCU

HOLLY CREEK FORMATION..... 281HLCK

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

GLORIETA SANDSTONE..... 310GLRT
PERMIAN SYSTEM..... 310PRMN
QUARTERMASTER FORMATION..... 310QRRM
WELLINGTON FORMATION..... 310WLNG
WHITEHORSE SANDSTONE OR GROUP..... 310WTRS

OCHOAN

CLOUD CHIEF FORMATION..... 312CDCF
DOXEY MEMBER OF QUARTERMASTER FORMATION..... 312DOXY
ELK CITY MEMBER OF QUARTERMASTER FORMATION..... 312ELKC
OCHOAN SERIES..... 312OCHO
WEATHERFORD MEMBER OF CLOUD CHIEF FORMATION..... 312WRFD

GUADALUPIAN

BLAINE GYPSUM..... 313BLIN
DOG CREEK SHALE..... 313DGCK
EL RENO GROUP..... 313ELRN
FLOWERPOT SHALE..... 313FLRP
GUADALUPIAN SERIES..... 313GDLP
MARLOW FORMATION..... 313MRLW
RUSH SPRINGS FORMATION..... 313RSPG

LOWER PERMIAN

ADMIRE GROUP..... 317ADMR

LEONARDIAN

BISON BANDED MEMBER OF HENNESSEY SHALE..... 318BSON
CEDAR HILLS SANDSTONE MEMBER OF HENNESSEY SHALE..... 318CDHL
FAIRMONT SHALE MEMBER OF HENNESSEY SHALE..... 318FRMN
GARBER SANDSTONE..... 318GRBR
HENNESSEY SHALE..... 318HNSS
KINGMAN SANDSTONE MEMBER OF HARPER SILTSTONE..... 318KNGM
LEONARD FORMATION..... 318LNRD
OSCAR SANDSTONE..... 318OSCR
PURCELL SANDSTONE LENS IN HENNESSEY SHALE..... 318PRCL
POST OAK CONGLOMERATE MEMBER OF WICHITA FORMATION..... 318PSOK
SALT PLAIN FORMATION..... 318SLPL
WICHITA GROUP..... 318WCHT

WOLFCAMPIAN

ADMIRE GROUP..... 319ADMR
COUNCIL GROVE GROUP..... 319CCGV
CHASE GROUP..... 319CHSE
PONTOTOC GROUP..... 319PNTC
WOLFCAMP FORMATION..... 319WFMP

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

VIRGILIAN

ADA FORMATION..... 322ADA
COLLINGS RANCH CONGLOMERATE..... 322CGRC
ELGIN SANDSTONE MEMBER OF VAMOOSA FORMATION..... 322ELGN
VAMOOSA FORMATION..... 322VMOS
VANOSS FORMATION..... 322VNSS
VIRGILIAN SERIES..... 322VRGL

MISSOURIAN

BARNSDALL FORMATION..... 323BRDL
CHECKERBOARD LIMESTONE..... 323CCKB
COFFEYVILLE FORMATION..... 323CFVL
CHANUTE FORMATION..... 323CHNT
DEWEY LIMESTONE..... 323DEWY
FRANCIS FORMATION..... 323FRCS
HOGSHOOTER LIMESTONE..... 323HGSR
HOXBAR FORMATION..... 323HXBR
IOLA LIMESTONE..... 3231OLA
MISSOURIAN SERIES..... 323MSSR
NELLIE BLY FORMATION..... 323NLBL
NOXIE SANDSTONE MEMBER OF CHANUTE FORMATION..... 323NOXI
SEMINOLE FORMATION..... 323SMNL
TALLANT FORMATION..... 323TLNT
TORPEDO SANDSTONE MEMBER OF WANN FORMATION..... 323TRPD
WANN FORMATION..... 323WANN

MIDDLE PENNSYLVANIAN

BELLE CITY LIMESTONE..... 324BLCT
FRANKS CONGLOMERATE..... 324FRKS
HILLTOP FORMATION..... 324HLTP
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM

DES MOINESIAN

ALTAMONT LIMESTONE..... 325ALMN
BOGGY SHALE..... 325BGGY
BLUEJACKET SANDSTONE MEMBER OF BOGGY SHALE..... 325BJCK
BANDERA SHALE..... 325BNDR
CHELSEA SANDSTONE MEMBER OF SENORA FORMATION..... 325CHLS
CALVIN SANDSTONE..... 325CLVN
DEESE FORMATION..... 325DEES
DES MOINESIAN SERIES..... 325DSMS
FORT SCOTT LIMESTONE..... 325FRSC
HOLDENVILLE SHALE..... 325HLDV
HARTSHORNE SANDSTONE..... 325HRSR
LABETTE SHALE..... 325LBTT
LENAPAH LIMESTONE..... 325LNPH
MC ALESTER SHALE..... 325MCAL
NOWATA SHALE..... 325NOWT
OOLOGAH LIMESTONE..... 325OLGH
PAWNEE LIMESTONE..... 325PWNE
SENORA FORMATION..... 325SNOR
STUART SHALE..... 325STRT

SAVANNA SANDSTONE..... 325SVNN
THURMAN SANDSTONE..... 325TRMN
WETUMKA SHALE..... 325WTMK
WEWOKA FORMATION..... 325WWOK

ATOKAN

ATOKA FORMATION..... 326ATCK

LOWER PENNSYLVANIAN

LOWER PENNSYLVANIAN SERIES..... 327PSLVL
UNION VALLEY FORMATION..... 327UNVL

MORROWAN

BLOYD SHALE..... 328BLYD
CHICKACHOC CHERT..... 328CCKC
DORNICK HILLS FORMATION..... 328DCKH
HALE FORMATION..... 328HALE
JACKFORK SANDSTONE..... 328JKFK
JOHNS VALLEY SHALE..... 328JSVL
MORROWAN SERIES..... 328MRRW
WAPANUCKA LIMESTONE..... 328WPCK

MISSISSIPPIAN

CHATTANOOGA SHALE..... 330CTNG
MISSISSIPPIAN SYSTEM..... 330MSSP
STANLEY SHALE..... 330STNL

UPPER MISSISSIPPIAN

BOONE FORMATION..... 331BOON
HINDSVILLE LIMESTONE..... 331HDVL
MOOREFIELD FORMATION..... 331MFLD
PITKIN LIMESTONE..... 331PTKN

CHESTERIAN

BATESVILLE SANDSTONE..... 332BSVL
CHICKASAW CREEK FORMATION..... 332CKCK
CHESTERIAN SERIES..... 332CSTR
FAYETTEVILLE SHALE..... 332FTVL
GODDARD SHALE MEMBER OF SPRINGER FORMATION..... 332GDRD
MOYERS FORMATION..... 332MYRS
TENMILE CREEK FORMATION..... 332TMCK

MERAMECIAN

DELAWARE CREEK MEMBER OF CANEY SHALE..... 333DLCK
MERAMECIAN SERIES..... 333MRMC

LOWER MISSISSIPPIAN

ST JOE LIMESTONE MEMBER OF BOONE FORMATION..... 337STJO

OSAGEAN

KEOKUK LIMESTONE..... 338KKUK
OSAGEAN-KINDERHOOKIAN SERIES..... 338OGKK
REEDS SPRING LIMESTONE..... 338RSPG
SYCAMORE LIMESTONE..... 338SCMR

KINDERHOOKIAN

KINDERHOOKIAN-CHAUTAUQUAN SERIES..... 339KKCQ

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN
HUNTON GROUP..... 340HNTN

UPPER DEVONIAN

ARKANSAS NOVACULITE..... 341ARKS
DEVONIAN, UPPER..... 341DVNNU
WOODFORD CHERT..... 341WDFD

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL

SILURIAN

BLAYLOCK SANDSTONE..... 350BLCK
MISSOURI MOUNTAIN SLATE..... 350MSRM
ST CLAIR LIMESTONE..... 350SCLR
SILURIAN SYSTEM..... 350SLRN

CAYUGAN

CAYUGAN SERIES..... 352CYGN

LOWER SILURIAN

SILURIAN, LOWER..... 357SLRNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

FERNVALE LIMESTONE..... 361FRVL
ORDOVICIAN, UPPER..... 361ODVCU
POLK CREEK SHALE..... 361PKCK
SYLVAN SHALE..... 361SLVN
VIOLA LIMESTONE..... 361VIOL
WOMBLE FORMATION..... 361WMBL

MIDDLE ORDOVICIAN

BIGFORK CHERT..... 364BGFK
BURGEN SANDSTONE..... 364BRGN
BROMIDE FORMATION..... 364BRMD
JOINS FORMATION..... 364JONS
MC LISH FORMATION..... 364MCLS
ORDOVICIAN, MIDDLE..... 364ODVCM
OIL CREEK FORMATION..... 364OLCK
SIMONSON GROUP..... 364SMPS
TULIP CREEK FORMATION..... 364TPCK
TYNER FORMATION..... 364TYNR

LOWER ORDOVICIAN

ARBUCKLE LIMESTONE,UPPER..... 367ABCKU
BLAKELY SANDSTONE..... 367BLKL
COOL CREEK FORMATION..... 367CLCK
CRYSTAL MOUNTAIN SANDSTONE..... 367CRLM
CUTTER DOLOMITE..... 367CTTR
GASCONADE DOLOMITE..... 367GSCD
KINDBLADE FORMATION..... 367KDBD
MCKENZIE HILL FORMATION..... 367MKZH
MAZARN SHALE..... 367MZRN
ORDOVICIAN, LOWER..... 367ODVCL
ROUBIDOUX FORMATION..... 367RBDX
WEST SPRING CREEK FORMATION..... 367WSCK

CANADIAN

CANADIAN SERIES..... 368CNDN
JEFFERSON CITY DOLOMITE..... 368JFRC

CAMBRIAN

COLLIER SHALE..... 370CLLR
CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

ARBUCKLE FORMATION,LOWER..... 371ABCKL
BONNETERRE DOLOMITE..... 371BNTR
BUTTERLY DOLOMITE..... 371BTRL
CAMBRIAN, UPPER..... 371CMBRU
EMINENCE DOLOMITE..... 371EMNC
FORT SILL LIMESTONE..... 371FRSL
LOKFATA SANDSTONE..... 371LKFT
LAMOTTE SANDSTONE..... 371LMTT
POTOSI DOLOMITE..... 371POTS
ROYER DOLOMITE..... 371ROYR
SIGNAL MOUNTAIN FORMATION..... 371SGLM
TIMBERED HILLS GROUP..... 371TMBH

CENOZOIC

CENOZOIC ERATHEM	100CNZC

QUATERNARY

ALLUVIAL FAN DEPOSITS	110ALVF
QUATERNARY ALLUVIUM	110ALVM
ALLUVIUM,OLDER	110ALVMO
ALLUVIUM,YOUNGER	110ALVMY
BASALT	110BSLT
COLLUVIUM	110CLVM
DUNE SAND	110DUNE
QUATERNARY SYSTEM	110QRNR
VOLCANIC ROCKS	110VLCCT
VALLEY-FILL DEPOSITS	110VLFL

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
ALLUVIUM,YOUNGER	111ALVMY
DUNE SAND	111DUNE
HOLOCENE SERIES	111HLCN
MAZAMA PUMICE	111MAZM
MARINE SAND	111MRSD

PLEISTOCENE

ANDESITIC LAVA	112ADSCP
ALLUVIUM	112ALVM
ALLUVIUM,OLDER	112ALVMO
BORING LAVA	112BRNGP
CONGLOMERATE	112CGLM
FLUVIOLACUSTRINE DEPOSITS	112FLVC
LACUSTRINE DEPOSITS	112LCSR
MARINE DEPOSITS	112MRIN
PLEISTOCENE-PLIOCENE SERIES	112PCPC
PIEDMONT DEPOSITS	112PDMN
PLEISTOCENE SERIES	112PLSC
PAULINA BASALT	112PULNP
SPRINGWATER FORMATION	112SPRG
TERRACE DEPOSITS	112TRRC
WILLAMETTE SILT	112WLMT

TERTIARY

FLUVIOLACUSTRINE DEPOSITS	120FLVC

PLIOCENE

BASALT	121BSLT
COLUMBIA RIVER GROUP OR BASALT	121CBRVM
DALLES FORMATION	121DLLS
DANFORTH FORMATION	121DNFT

FANGLOMERATE DEPOSITS..... 121FGLM
FORT ROCK FORMATION..... 121FRCK
HAYNES BUTTE BASALT..... 121HSBT
PICTURE ROCK BASALT..... 121PCRK
SANDY RIVER MUDSTONE..... 121SDRV
TUFF AND BRECCIA..... 121TFBC
TROUTDALE FORMATION..... 121TRDL
VOLCANIC PYROCLASTIC AND SEDIMENTARY ROCKS..... 121VPSM
YONNA FORMATION..... 121YONN

MIOCENE

ASTORIA FORMATION..... 122ASTR
BASALT ANDESITE AND RHYODACITE..... 122BARC
JOHN DAY FORMATION..... 122JNDY
LITTLE BUTTE VOLCANIC SERIES..... 122LTLBO
MIOCENE SERIES..... 122MOCN
MARINE SEDIMENTS..... 122MRINE
SARDINE FORMATION..... 122SRDN

OLIGOCENE

EOCENE SERIES..... 123EOCN
EUGEN FORMATION..... 123EUGNE
FISHER FORMATION..... 123FSHRE
KEASEY FORMATION..... 123KESY
MARINE ROCKS,OLDER..... 123MRINO
OLIGOCENE-EOCENE SERIES..... 1230GCE
OLIGOCENE SERIES..... 1230LGC
ROXY FORMATION..... 123ROXY
YAQUINA FORMATION..... 123YQUN

EOCENE

CLARNO FORMATION..... 124CLRN
COLESTIN FORMATION..... 124CLSN
COALEDO FORMATION..... 124COLD
EOCENE SERIES..... 124EOCN
NONMARINE SEDIMENTARY ROCKS..... 124NMSM
NESTUCCA FORMATION..... 124NSTC
SPENCER FORMATION..... 124SPCR
SILETZ RIVER VOLCANIC SERIES..... 124SZRV
TILLAMOOK VOLCANIC SERIES..... 124TMKV
TYEE FORMATION..... 124TYEE
UMPQUA FORMATION..... 124UMPQ
VOLCANIC ROCKS..... 124VLCC
YAMHILL FORMATION..... 124YMHL

MESOZOIC

SEDIMENTARY ROCKS..... 200SDMR
SERPENTINE..... 200SRPN
VOLCANIC ROCKS..... 200VLCC

CRETACEOUS

UPPER CRETACEOUS

HORNBROOK FORMATION..... 211HRBK

LOWER CRETACEOUS

GRANITIC INTRUSIVE ROCKS..... 217GCIVJ
GRANODIORITE..... 217GRDR
QUARTZ DIORITE..... 217QRZD

JURASSIC

DOTHAN FORMATION..... 220DTHN

UPPER JURASSIC

GALICE FORMATION..... 221GLIC
ULTRAMAFIC INTRUSIVE ROCKS..... 221UFIV

TRIASSIC

UPPER TRIASSIC

APPLEGATE GROUP..... 231APLG

PENNSYLVANIA

UNKNOWN

AMPHIBOLITE	000AMPB
ANORTHOSITE	000ANRS
GABBRO AND GABBROIC GNEISS	000GBBR
GRANODIORITE	000GRDR
GRANITE GNEISS	000GRGS
GREENSTONE SCHIST	000GRNS
GRANITE	000GRNT
GRAPHITIC GNEISS	000GRPC
HORNBLENDE GNEISS	000HBLD
METABASALT	000MBSL
METADIABASE	000MDBS
METARHYOLITE	000MTRL
PEGMATITE	000PGMT
QUARTZ MONZONITE	000QZMZ
SERPENTINITE	000SRPN

CENOZOIC

CENOZOIC ERATHEM	100CNZC

QUATERNARY

QUATERNARY SYSTEM	110QRNR

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
COLLUVIUM	111CLVM
FILL	111FILL
HOLOCENE SERIES	111HLCN
SWAMP DEPOSITS	111SWMP
TERRACE DEPOSITS	111TRRC

PLEISTOCENE

ALLUVIUM	112ALVM
CARMICHAELS FORMATION	112CMCL
CAPE MAY-RARITAN FORMATIONS	112CPMR
CAPE MAY-RARITAN FORMATIONS-LOWER SAND MEMBER	112CPMRL
CAPE MAY-RARITAN FORMATIONS-MIDDLE SAND MEMBER	112CPMRM
CAPE MAY-RARITAN FORMATIONS-UPPER SAND MEMBER	112CPMRU
CAPE MAY FORMATION	112CPMY
DRIFT	112DRFT
DRUMLINS	112DRML
ESKERS	112ESKR
FLUVIAL DEPOSITS	112FLVL
ICE CONTACT DEPOSITS	1121CCC
KAME DEPOSITS	112KAME
KAME TERRACE DEPOSITS	112KMTC
LAKE DEPOSITS	112LAKE
LOESS	112LOSS
MORAINE DEPOSITS	112MORN

OUTWASH..... 112OTSH
PLEISTOCENE SERIES..... 112PLSC
PENSAUKEN FORMATION..... 112PNSK
STRATIFIED DRIFT..... 112SFDF
TILL..... 112TILL
TERMINAL MORAINE DEPOSITS..... 112TMLM
TERRACE DEPOSITS..... 112TRRC

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

BRYN MAWR FORMATION..... 121BRMR
PLIOCENE SERIES..... 121PLCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU
MAGOTHY FORMATION..... 211MGTY
RARITAN FORMATION..... 211RRTN
RARITAN FORMATION, LOWER SAND MEMBER (FARRINGTON?)..... 211RRTNF
RARITAN FORMATION, LOWER CLAY MEMBER..... 211RRTNL
RARITAN FORMATION, MIDDLE CLAY MEMBER..... 211RRTNM
RARITAN FORMATION, UPPER SAND MEMBER (OLD BRIDGE?)..... 211RRTNO
RARITAN FORMATION MIDDLE SAND MEMBER (SAYREVILLE?)..... 211RRTNS
RARITAN FORMATION, UPPER CLAY MEMBER..... 211RRTNU

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL
PATAPSCO FORMATION..... 217PPSC

TRIASSIC

TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

BRUNSWICK FORMATION..... 231BRCK
BRUNSWICK,LIMESTONE FANGLOMERATE..... 231BRCKF
BRUNSWICK,QUARTZ FANGLOMERATE..... 231BRCKQ
BASALT..... 231BSLT
DIABASE DIKES AND SILLS..... 231DIBS
GETTYSBURG SHALE..... 231GBRG
GETTYSBURG SHALE,LOWER MEMBER..... 231GBRGL
GETTYSBURG SHALE,UPPER MEMBER..... 231GBRGU

HEIDLERSBURG MEMBER..... 231HDBG
HAMMER CREEK FORMATION..... 231HMCK
LOCKATONG FORMATION..... 231LCKG
NEW OXFORD FORMATION..... 231NOXF
STOCKTON FORMATION..... 231SCKN
STOCKTON FORMATION,LOWER MEMBER..... 231SCKNL
STOCKTON FORMATION,MIDDLE MEMBER..... 231SCKNM
STOCKTON FORMATION,UPPER MEMBER..... 231SCKNU
UPPER TRIASSIC SERIES..... 231TRSCU

PALEOZOIC

BOULDER GNEISS OF WISSAHICKON FORMATION..... 300BLDR
COCKEYSVILLE MARBLE..... 300CCKV
GLENARM SERIES..... 300GLRM
METACONGLOMERATE OF WISSAHICKON FORMATION..... 300MCGM
METAGRAYWACKE OF WISSAHICKON FORMATION..... 300MGCK
MARBURG SCHIST..... 300MRBG
OCTARARO PHYLLITE..... 300OCRR
PELITIC SCHIST,LOWER,OF WISSAHICKON FORMATION..... 300PLTCL
PELITIC SCHIST,UPPER,OF WISSAHICKON FORMATION..... 300PLTCU
PALEOZOIC ERATHEM..... 300PLZC
PALEOZOIC ERATHEM,LOWER..... 300PLZCL
PETERS CREEK SCHIST..... 300PRCK
SETTERS FORMATION..... 300STRS
WAKEFIELD MARBLE..... 300WKFD
WISSAHICKON FORMATION..... 300WSCK
WISSAHICKON FORMATION,ALBITE CHLORITE SCHIST..... 300WSCKA
WISSAHICKON FORMATION,OLIGOCLASE MICA SCHIST..... 300WSCKO
WISSAHICKON FORMATION,METAVOLCANICS..... 300WSCKV
WISSAHICKON FORMATION,INFORMAL SUBUNIT WAS-1..... 300WSCK1
WISSAHICKON FORMATION,INFORMAL SUBUNIT WAS-2..... 300WSCK2
WISSAHICKON FORMATION,INFORMAL SUBUNIT WAS-3..... 300WSCK3
WISSAHICKON FORMATION,INFORMAL SUBUNIT WAS-4..... 300WSCK4
WISSAHICKON FORMATION,INFORMAL SUBUNIT WAS-5..... 300WSCK5

PERMIAN

PERMIAN SYSTEM..... 310PRMN

LOWER PERMIAN

CASSVILLE SHALE MEMBER..... 317CSVL
DUNKARD GROUP..... 317DKRD
GREENE FORMATION..... 317GREN
JOLLYTOWN COAL..... 317JLTN
LITTLE WASHINGTON COAL..... 317LLWG
NINEVEH LIMESTONE MEMBER..... 317NNVHN
NINEVEH SANDSTONE MEMBER..... 317NNVHS
LOWER PERMIAN SERIES..... 317PRMNL
TEN MILE COAL..... 317TNML
WAYNESBURG FORMATION..... 317WBRG
WAYNESBURG A COAL..... 317WBRGA
WAYNESBURG B COAL..... 317WBRGB
WAYNESBURG COAL..... 317WBRGC
WAYNESBURG FORMATION,LOWER MEMBER..... 317WBRGL

WAYNESBURG FORMATION,MIDDLE MEMBER..... 317WBRGM
WAYNESBURG FORMATION, UPPER MEMBER..... 317WBRGU
WASHINGTON FORMATION..... 317WSNG
WASHINGTON COAL..... 317WSNGC
WASHINGTON FORMATION,LOWER MEMBER..... 317WSNGL
WASHINGTON FORMATION,MIDDLE MEMBER..... 317WSNGM
WASHINGTON FORMATION,UPPER MEMBER..... 317WSNGU

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

UPPER PENNSYLVANIAN

ARNOLDSBURG SANDSTONE..... 321ADBG
ALBRIGHT LIMESTONE..... 321ALBG
AMES COAL..... 321AMES
AMES LIMESTONE..... 321AMESN
BUFFALO SANDSTONE MEMBER OF CONEMAUGH FORMATION..... 321BFFL
BAKERSTOWN COAL,LOWER..... 321BKRSL
BIRMINGHAM REDBED..... 321BMGM
BENWOOD LIMESTONE..... 321BNWD
BRUSH CREEK LIMESTONE..... 321BRCK
BRUSH CREEK COAL..... 321BRCKC
BARTON LIMESTONE..... 321BRTN
BARTON COAL..... 321BRTNC
CLARKSBURG LIMESTONE..... 321CKBG
CONNELLSVILLE SANDSTONE MEMBER OF CONEMAUGH FORMATION..... 321CLVL
CLARYSVILLE COAL..... 321CLVLC
CAMBRIDGE LIMESTONE..... 321CMBG
CONEMAUGH FORMATION..... 321CNMG
CORINTH SANDSTONE..... 321CRNT
CASSELMAN FORMATION..... 321CSLM
DUQUESNE COAL..... 321DQSN
EWING LIMESTONE..... 321EWNG
FEDERAL HILL COAL..... 321FDLH
FRIENDSVILLE SHALE..... 321FDVL
FRANKLIN COAL..... 321FRKL
FISHPOT MEMBER OF PITTSBURGH FORMATION..... 321FSPT
FISHPOT COAL..... 321FSPTC
FISHPOT LIMESTONE..... 321FSPTN
GILBOY SANDSTONE..... 321GLBY
GLENSHAW FORMATION..... 321GLNS
GRAFTON SANDSTONE..... 321GRFN
HOFFMAN COAL GROUP..... 321HFMN
HUMBERT COAL..... 321HMBR
IRONDALE LIMESTONE..... 321IRDL
LLEWELLYN FORMATION..... 321LLLN
LONACONING COAL..... 321LNCG
LITTLE PITTSBURGH COAL..... 321LPBG
LAVANSVILLE LIMESTONE..... 321LVVL
LITTLE WAYNESBURG COAL..... 321LWBG
MONONGAHELA GROUP..... 321MNGL
MAHONING SANDSTONE MEMBER OF CONEMAUGH FORMATION..... 321MNNG
MAHONING COAL..... 321MNNGC
MAHONING SANDSTONE,LOWER MEMBER..... 321MNNGL

MAHONING REDBED..... 321MNNGR
MAHONING SANDSTONE,UPPER MEMBER..... 321MNNGU
MEYERSDALE REDBED..... 321MRDL
MORGANTOWN SANDSTONE MEMBER OF CONEMAUGH FORMATION..... 321MRGN
MORGANTOWN COAL..... 321MRGNC
NIVERTON SHALE..... 321NVRN
PITTSBURGH FORMATION..... 321PBRG
PITTSBURGH COAL..... 321PBRGC
PITTSBURGH FORMATION,LOWER MEMBER..... 321PBRGL
PITTSBURG LIMESTONE, LOWER..... 321PBRGN
PITTSBURGH REDBED..... 321PBRGR
PITTSBURGH SANDSTONE..... 321PBRGS
PITTSBURGH FORMATION, UPPER MEMBER..... 321PBRGU
PINE CREEK LIMESTONE..... 321PCRK
UPPER PENNSYLVANIAN SERIES..... 321PSLVU
REDSTONE MEMBER OF PITTSBURGH FORMATION..... 321RDSN
REDSTONE COAL..... 321RDSNC
REDSTONE LIMESTONE..... 321RDSNN
SEWICKLEY MEMBER..... 321SCKL
SEWICKLEY COAL..... 321SCKLC
SEWICKLEY SANDSTONE..... 321SCKLS
SALTSBURG SANDSTONE..... 321SLBG
SUMMERHILL SANDSTONE MEMBER OF CONEMAUGH FORMATION..... 321SMRL
THOMAS CLAY..... 321THMS
THORNTON CLAY..... 321TRNN
UFFINGTON SHALE..... 321UFNG
UNIONTOWN FORMATION..... 321UNNN
UNIONTOWN COAL..... 321UNNNC
UNIONTOWN FORMATION,LOWER MEMBER..... 321UNNNL
UNIONTOWN LIMESTONE..... 321UNNNN
UNIONTOWN SANDSTONE..... 321UNNNS
UNIONTOWN FORMATION,UPPER MEMBER..... 321UNNNU
UPPER BAKERSTOWN COAL..... 321UPBK
WOODS RUN LIMESTONE..... 321WDSR
WELLERSBURG LIMESTONE..... 321WLBG
WELLERSBURG COAL..... 321WLBGC
WILMORE SANDSTONE MEMBER OF CONEMAUGH FORMATION..... 321WLMR

MIDDLE PENNSYLVANIAN

ALLEGHENY GROUP..... 324ALGN
BROOKVILLE COAL..... 324BKVL
BOLIVAR CLAY..... 324BLVR
BUTLER SANDSTONE..... 324BTLR
CLEARFIELD CREEK FORMATION..... 324CFCK
COLUMBIANA SHALE..... 324CLMB
CLARION FORMATION..... 324CLRN
CLARION COAL,LOWER..... 324CLRNL
CLARION SANDSTONE MEMBER..... 324CLRNS
CLARION COAL,UPPER..... 324CLRNU
CORWENSVILLE FORMATION..... 324CRVL
FREEPORT FORMATION..... 324FRPR
FREEPORT SANDSTONE..... 324FRPRS
GLEN RICHEY FORMATION..... 324GLRC
HOMEWOOD FORMATION..... 324HMWD
HOMEWOOD SANDSTONE MEMBER..... 324HMWDS

JOHNSTOWN LIMESTONE..... 324JNSN
KITTANNING FORMATION..... 324KNNG
KITTANNING COAL GROUP,UPPER..... 324KNNGA
KITTANNING COAL GROUP,MIDDLE..... 324KNNGB
KITTANNING COAL GROUP,LOWER..... 324KNNGC
KITTANNING FORMATION OR MEMBER,LOWER..... 324KNNGL
KITTANNING FORMATION OR MEMBER,MIDDLE..... 324KNNGM
KITTANNING LIMESTONE..... 324KNNGN
KITTANNING SANDSTONE MEMBER OF ALLEGHENY FORMATION..... 324KNNGS
KITTANNING FORMATION OR MEMBER,UPPER..... 324KNNGU
LAUREL RUN FORMATION..... 324LRLR
MILLSTONE RUN FORMATION..... 324MLSR
MERCER FORMATION..... 324MRCR
MERCER COAL GROUP..... 324MRCRC
MINERAL SPRINGS FORMATION..... 324MSPG
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM
POTTSVILLE FORMATION..... 324PSVL
SCRUBGRASS COAL..... 324SCBG
SHARP MOUNTAIN..... 324SRPM
VANPORT LIMESTONE MEMBER OF ALLEGHENY FORMATION..... 324VNPR
WASHINGTONVILLE SHALE..... 324WGVL
WORTHINGTON SANDSTONE MEMBER,LOWER..... 324WRNGL
WORTHINGTON SANDSTONE MEMBER,UPPER..... 324WRNGU
WESTERNPORT SANDSTONE..... 324WRPR

LOWER PENNSYLVANIAN

CONNOQUENESSING FORMATION..... 327CQSG
CONNOQUENESSING FORMATION,LOWER MEMBER..... 327CQSGL
CONNOQUENESSING FORMATION,MIDDLE MEMBER..... 327CQSGM
CONNOQUENESSING FORMATION,UPPER MEMBER..... 327CQSGU
ELLIOT PARK FORMATION..... 327ELPK
MAUCH CHUNK FORMATION..... 327MCCK
MAUCH CHUNK FORMATION,UPPER MEMBER..... 327MCCKU
NEW RIVER FORMATION..... 327NRVR
OLEAN SANDSTONE MEMBER OF POTTSVILLE FORMATION..... 327OLEN
PINEVILLE SANDSTONE MEMBER OF NEW RIVER FORMATION..... 327PNVL
LOWER PENNSYLVANIAN SERIES..... 327PSLVL
QUAKERTOWN MEMBER OF CONNOQUENESSING FORMATION..... 327QKRN
QUAKERTOWN COAL..... 327QKRNC
SCHUYLKILL MEMBER OF POTTSVILLE FORMATION..... 327SCLK
SHARON FORMATION..... 327SHRN
SHARON CONGLOMERATE..... 327SHRNC
TUMBLING RUN MEMBER OF POTTSVILLE FORMATION..... 327TBGR

MISSISSIPPIAN

MISSISSPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

DEER VALLEY LIMESTONE..... 331DRVL
GREENBRIER LIMESTONE..... 331GRBR
MAUCH CHUNK FORMATION,LOWER MEMBER..... 331MCCKL
MAUCH CHUNK FORMATION,MIDDLE MEMBER..... 331MCCKM
MISSISSIPPIAN, UPPER..... 331MSSPU

TROUGH CREEK LIMESTONE..... 331TGCK
WYMPS GAP LIMESTONE..... 331WPGP

LOWER MISSISSIPPIAN

BECKVILLE MEMBER..... 337BCKV
BEDFORD FORMATION..... 337BDFD
BEREA SANDSTONE..... 337BERE
BIG INJUN SAND..... 337BGIJ
BURGOON MEMBER OF POCONO FORMATION..... 337BRGN
CORRY FORMATION..... 337CRRY
CUSSEWAGO FORMATION..... 337CSSG
CUYAHOGA GROUP..... 337CYHG
HEMPFIELD SHALE..... 337HMPF
HUNTLEY MOUNTAIN FORMATION..... 337HNLM
KNAPP FORMATION..... 337KNPP
LOYALHANNA LIMESTONE..... 337LLNN
MOUNT CARBON MEMBER OF POCONO FORMATION..... 337MCRB
MEADVILLE FORMATION..... 337MDVL
MURRYSVILLE FORMATION..... 337MRVL
MISSISSIPPIAN, LOWER..... 337MSSPL
MYERS SHALE..... 337MYRS
ORANGEVILLE SHALE OR FORMATION..... 337OGVL
PINKERTON SANDSTONE..... 337PNKR
POCONO FORMATION..... 337POCN
PATTON SHALE..... 337PTTN
ROCKWELL FORMATION..... 337RCKL
RIDDLESBURG SHALE MEMBER OF POCONO FORMATION..... 337RDBG
SHELLHAMMER HOLLOW FORMATION..... 337SLMH
SHENANGO FORMATION..... 337SNNG
SHENANGO FORMATION,LOWER MEMBER..... 337SNNGL
SHENANGO FORMATION,UPPER MEMBER..... 337SNNGU
SPECHTY KOPF FORMATION..... 337SPKP
SHARPSVILLE FORMATION..... 337SPVL
SQUAW SAND..... 337SQUW

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

ALLEGRIPPIS SANDSTONE MEMBER OF CHEMUNG FORMATION..... 341ALGP
AMITY SHALE..... 341AMTY
BUDDYS RUN MEMBER OF CATSKILL FORMATION..... 341BDSR
BURKETT MEMBER OF RUSH FORMATION..... 341BRKT
BRAILLER FORMATION..... 341BRLR
BERRY RUN MEMBER OF CATSKILL FORMATION..... 341BRRN
BEAVERDAM RUN MEMBER OF CATSKILL FORMATION..... 341BVMR
CHADAKOIN FORMATION..... 341CDKN
CLARKS FERRY..... 341CLKF
CHEMUNG FORMATION..... 341CMNG
CHEMUNG FORMATION,MARINE BEDS..... 341CMNGB
MARINE BEDS OF CHEMUNG FORMATION..... 341CMNGR
CANADAWAY FORMATION..... 341CNDY
CONEWANGO GROUP..... 341CNNG

CONNEAUT FORMATION..... 341CNNT
CHERRY RIDGE FORMATION OR MEMBER..... 341CRDG
CATTARAUGUS FORMATION..... 341CRGS
CATSKILL FORMATION..... 341CSKL
CATSKILL FORMATION,LOWER REDBEDS MEMBER..... 341CSKLL
CATSKILL FORMATION,UPPER SANDSTONE MEMBER..... 341CSKLS
CATSKILL FORMATION,UPPER REDBEDS MEMBER..... 341CSKLU
DUNKIRK FORMATION..... 341DKRK
DELAWARE RIVER FORMATION..... 341DLRV
DUNCANNON MEMBER OF CATSKILL FORMATION..... 341DNCN
DEVONIAN, UPPER..... 341DVNNU
FRANKLINDALE LIMESTONE MEMBER OF CHEMUNG FORMATION..... 341FKLD
FALL CREEK CONGLOMERATE MEMBER OF CHEMUNG FORMATION..... 341FLCK
FOREKNOBS FORMATION..... 341FRKB
GARDEAU FORMATION..... 341GRDU
GIRARD FORMATION..... 341GRRD
HAMPSHIRE FORMATION..... 341HMPR
HARRELL SHALE..... 341HRRL
HONESDALE FORMATION OR MEMBER OF CATSKILL FORMATION..... 341HSDL
IRISH VALLEY MEMBER OF CATSKILL FORMATION..... 341IRVL
JENNINGS FORMATION..... 341JNGS
KINGS MILL MEMBER OF CATSKILL FORMATION..... 341KGML
LACKAWAXEN FORMATION..... 341LCKX
LOCK HAVEN FORMATION..... 341LKHV
LONG RUN MEMBER OF CATSKILL FORMATION..... 341LNGR
MIDDLESEX FORMATION..... 341MDLX
MILLRIFT FORMATION..... 341MLRF
MOUNT PLEASANT FORMATION..... 341MPLS
NEW MILFORD FORMATION..... 341NMFD
NORTHEAST SHALE..... 341NRTS
NUNDA FORMATION..... 341NUND
OSWAYO FORMATION..... 341OSWY
PACKERTON MEMBER OF CATSKILL FORMATION..... 341PCKR
POPLAR GAP MEMBER OF CATSKILL FORMATION..... 341PLGP
PIPE CREEK FORMATION..... 341PPCK
PINEY RIDGE SANDSTONE MEMEBER OF CHEMUNG FORMATION..... 341PRDG
RICEVILLE FORMATION..... 341RCVL
RHINESTREET FORMATION..... 341RNSR
RUSH FORMATION..... 341RUSH
SCHERR FORMATION..... 341SCRR
SHOHOLA FORMATION..... 341SHHL
SLOAT BROOK FORMATION..... 341SLBK
SALAMANCA FORMATION..... 341SLMC
SHERMAN CREEK MEMBER OF CATSKILL FORMATION..... 341SMCK
SAWMILL RUN MEMBER OF CATSKILL FORMATION..... 341SMLR
SUNFISH FORMATION..... 341SNFS
SONYEA FORMATION..... 341SONY
SUSQUEHANNA GROUP..... 341SSQN
SAXTON CONGLOMERATE MEMBER OF CHEMUNG FORMATION..... 341SXTN
TRIMMERS ROCK FORMATION..... 341TMRK
TOWAMENSING MEMBER OF CATSKILL FORMATION..... 341TMSG
TRIMMERS ROCK AND HARRELL FORMATIONS,UNDIFFERENTIATED..... 341TRKH
TOWANDA FORMATION..... 341TWND
VENANGO FORMATION..... 341VNNG
WALCKSVILLE MEMBER OF CATSKILL FORMATION..... 341WCKV
WOODMONT FORMATION..... 341WDMN

WALTON GROUP..... 341WLTN
WISCOY FORMATION..... 341WSCY

MIDDLE DEVONIAN

BUTTERMILK FALLS FORMATION..... 344BMKF
BEAVER DAM BLACK SHALE MEMBER OF NEEDMORE SHALE..... 344BVDM
CENTERFIELD ZONE..... 344CFLD
DALMATIA MEMBER..... 344DLMT
DEVONIAN, MIDDLE..... 344DVNNM
ESOPUS FORMATION..... 344ESPS
FISCHER RIDGE MEMBER..... 344FCRG
HAMILTON GROUP..... 344HMLN
KUNKELTOWN ZONE..... 344KNKL
LITTLE GAP ZONE..... 344LLGP
MONTEBELLO SANDSTONE MEMBER OF MAHANTANGO FORMATION..... 344MNBL
MAHANTANGO FORMATION..... 344MNNG
MARCELLUS SHALE..... 344MRCL
NEEDMORE SHALE..... 344NDMR
NIS HOLLOW MEMBER..... 344NSHL
ONONDAGA LIMESTONE..... 344ONDG
ROMNEY SHALE..... 344RMNY
SCHOHARIE AND ESOPUS FORMATIONS,UNDIFFERENTIATED..... 344SCEP
SELINSGROVE MEMBER OR LIMESTONE OF ONONDAGA LIMESTONE..... 344SLGV
SHERMAN RIDGE FORMATION OR MEMBER OF MAHANTANGO FORMATION..... 344SMRG
SPARROW BUSH FORMATION..... 344SPRB
TURKEY RIDGE MEMBER OF MARCELLUS SHALE..... 344TKRG
TULLY LIMESTONE..... 344TLLY

LOWER DEVONIAN

ANDREAS RED BEDS..... 347ADRS
BECRAFT LIMESTONE..... 347BCRF
COEYMANS LIMESTONE (FORMATION)..... 347CMNS
DEPUE LIMESTONE MEMBER OF COEYSMANS FORMATION..... 347DEPU
DUTTONVILLE MEMBER OF RONDOUT FORMATION..... 347DNVL
DEVONIAN, LOWER..... 347DVNNL
FLATBROOKVILLE MEMBER OF NEW SCOTLAND FORMATION..... 347FBKV
HELDERBERG GROUP..... 347HDBG
KALKBERG LIMESTONE..... 347KKBG
KEYSER LIMESTONE..... 347KYSR
MANDATA MEMBER OF HELDERBERG FORMATION..... 347MNDT
MANLIUS FORMATION..... 347MNLS
MINISINK LIMESTONE..... 347MNSK
MASHIPACONG MEMBER OF RONDOUT FORMATION..... 347MPCG
MASKENOZHA MEMBER OF NEW SCOTLAND FORMATION..... 347MSKZ
NEW SCOTLAND LIMESTONE..... 347NSCD
OLD PORT FORMATION..... 347OLDP
ORISKANY GROUP..... 347ORSK
PALMERTON FORMATION..... 347PLMR
PORT EWEN SHALE..... 347PREN
PETERS VALLEY MEMBER OF COEYSMANS FORMATION..... 347PRVL
RIDGELEY SANDSTONE..... 347RDGL
RONDOUT FORMATION..... 347RNDT
SCHOHARIE FORMATION..... 347SCHR
SHAWNEE ISLAND MEMBER OF COEYMANS FORMATION..... 347SILD

STORMVILLE MEMBER OF COEYMANS FORMATION..... 347SMVL
SHRIVER CHERT..... 347SRVR
WHITEPORT DOLOMITE MEMBER OF RONDOUT FORMATION..... 347WTPR

SILURIAN

SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

BRIDGEPORT MEMBER OF BLOOMSBURG FORMATION..... 351BDGP
BOSSARDVILLE FORMATION..... 351BDVL
BLOOMSBURG FORMATION..... 351BMBG
CAYUGA GROUP..... 351CYUG
DECKER FORMATION..... 351DCKR
POXONO ISLAND FORMATION..... 351PXID
SILURIAN, UPPER..... 351SLRNU
TONOLOWAY LIMESTONE..... 351TNLY
WILLS CREEK FORMATION..... 351WLCK
WILLS CREEK FORMATION,LOWER MEMBER..... 351WLCKL
WILLS CREEK FORMATION,UPPER MEMBER..... 351WLCKU
WALLPACK CENTER MEMBER OF DECKER FORMATION..... 351WPKC

MIDDLE SILURIAN

CABIN HILL MEMBER OF ROSE HILL FORMATION..... 354CBHL
CLINTON FORMATION OR GROUP..... 354CLNN
CENTER MEMBER OF ROSE HILL FORMATION..... 354CNTR
KEEFER SANDSTONE MEMBER OF CLINTON FORMATION..... 354KEFR
MC KENZIE FORMATION..... 354MCKZ
MIFFLINTOWN FORMATION..... 354MFLN
ROCHESTER MEMBER OF MUFFLINTOWN FORMATION..... 354RCSR
ROSE HILL FORMATION..... 354RSHL
ROSE HILL FORMATION,LOWER MEMBER..... 354RSHLL
ROSE HILL FORMATION,MIDDLE MEMBER..... 354RSHLM
ROSE HILL FORMATION,UPPER MEMBER..... 354RSHLU
SILURIAN, MIDDLE..... 354SLRNM
SHAWANGUNK FORMATION..... 354SNGK
SHAWANGUNK FORMATION,MIDDLE MEMBER..... 354SNGKM
SHAWANGUNK FORMATION,UPPER MEMBER..... 354SNGKU

LOWER SILURIAN

CASTANEA MEMBER OF TUSCARORA FORMATION..... 357CSTN
SILURIAN, LOWER..... 357SLRNL
SHAWANGUNK FORMATION,LOWER MEMBER..... 357SNGKL
TUSCARORA SANDSTONE..... 357TCRR

ORDOVICIAN

CARDIFF METACONGLOMERATE..... 360CRDF
PEACH BOTTOM SLATE..... 360PCBM

UPPER ORDOVICIAN

BALD EAGLE FORMATION..... 361BDEG

BUSHKILL MEMBER OF MARTINSBURG FORMATION..... 361BSKL
COCALICO FORMATION..... 361CCLC
COCALICO PHYLLITE..... 361CCLCP
JUNIATA AND BALD EAGLE FORMATIONS..... 361JBEG
JUNIATA FORMATION..... 361JUNT
LOST RUN MEMBER OF BALD EAGLE FORMATION..... 361LSRN
MILL HILL SLATE FORMATION..... 361MLHL
MARTINSBURG SHALE..... 361MRBG
MARTINSBURG SHALE, A UNIT..... 361MRBGA
MARTINSBURG SHALE, B UNIT..... 361MRBGB
MARTINSBURG SHALE, C UNIT..... 361MRBGC
MARTINSBURG SHALE, D UNIT..... 361MRBGD
MARTINSBURG SHALE, E UNIT..... 361MRBGE
MARTINSBURG SHALE, F UNIT..... 361MRBGF
MARTINSBURG SHALE, G UNIT..... 361MRBGG
MARTINSBURG SHALE, H UNIT..... 361MRBGH
MARTINSBURG SHALE,LOWER MEMBER..... 361MRBGL
MARTINSBURG SHALE,MIDDLE MEMBER..... 361MRBGM
MARTINSBURG FORMATION, BASAL LIMESTONE..... 361MRBGN
MARTINSBURG SHALE,UPPER MEMBER..... 361MRBGU
ORDOVICIAN, UPPER..... 361ODVCU
PENN ARGYL MEMBER OF MARTINSBURG SHALE..... 361PAGL
REEDSVILLE FORMATION..... 361RDVL
RAMSEYBURG MEMBER OF MARTINSBURG SHALE..... 361RMBG
SHOCHARY SANDSTONE..... 361SCRY
SHALE..... 361SHLE

MIDDLE ORDOVICIAN

ANTES FORMATION..... 364ANTS
ANNVILLE FORMATION..... 364ANVL
BEEKMANTOWN GROUP..... 364BKMN
BENNER FORMATION..... 364BNNR
CHAMBERSBURG FORMATION..... 364CBBG
COBURN FORMATION..... 364CBRN
CENTER HALL MEMBER OF NEALMONT FORMATION..... 364CRHL
CURTIN FORMATION..... 364CRTN
EYER MEMBER OF HATTER FORMATION..... 364EYER
GRAZIER MEMBER OF HATTER FORMATION..... 364GRZR
HAMBURG SEQUENCE..... 364HMBG
HAMBURG SEQUENCE, SUBUNIT 2A..... 364HMBGA
HAMBURG SEQUENCE, SUBUNIT 2B..... 364HMBGB
HAMBURG SEQUENCE, SUBUNIT 1..... 364HMBG1
HAMBURG SEQUENCE, SUBUNIT 2..... 364HMBG2
HAMBURG SEQUENCE, SUBUNIT 3..... 364HMBG3
HAMBURG SEQUENCE, SUBUNIT 4..... 364HMBG4
HAMBURG SEQUENCE, SUBUNIT 5..... 364HMBG5
HAMBURG SEQUENCE, SUBUNIT 6..... 364HMBG6
HAMBURG SEQUENCE, SUBUNIT 7..... 364HMBG7
HAMBURG SEQUENCE, SUBUNIT 8..... 364HMBG8
HAMBURG SEQUENCE, SUBUNIT 9..... 364HMBG9
HUNTER FORMATION..... 364HNTR
HERSHEY FORMATION..... 364HRSY
HUSTLER MEMBER OF HATTER FORMATION..... 364HSLR
HATTER FORMATION..... 364HTTR
JACKSONBURG FORMATION..... 364JKBG

JACKSONBURG FORMATION,CEMENT LIMESTONE..... 364JKBGC
JACKSONBURG FORMATION,CEMENT ROCK..... 364JKBGR
LINDEN HALL FORMATION..... 364LDHL
LOWVILLE FORMATION..... 364LVLL
MYERSTOWN FORMATION..... 364MRSN
NEALMONT FORMATION..... 364NLMN
ORDOVICIAN, MIDDLE..... 364ODVCM
OAK HALL MEMBER OF NEALMONT FORMATION..... 364OKHL
ONTELAUNEE FORMATION..... 364ONLN
RODMAN LIMESTONE OR MEMBER OF NEALMONT FORMATION..... 364RDMN
SALONA FORMATION..... 364SLON
SNYDER MEMBER OF BENNER FORMATION..... 364SNDR
ST PAUL GROUP..... 364STPL
STOVER MEMBER OF BENNER FORMATION..... 364STVR
TRENTON LIMESTONE..... 364TRNN
VALLEY VIEW MEMBER OF CURTIN FORMATION..... 364VLLV
VALENTINE MEMBER OF CURTIN FORMATION..... 364VLNN

CHAMPLAINIAN

BLACK RIVER FORMATION..... 365BKRV

LOWER ORDOVICIAN

AXEMANN FORMATION..... 367AXMN
BELLEFONTE FORMATION..... 367BLFN
CLOVER MEMBER OF LOYSBURG FORMATION..... 367CLVR
CONESTOGA FORMATION..... 367CNSG
CARLIM FORMATION..... 367CRLM
EPLER FORMATION..... 367EPLR
LOYSBURG FORMATION..... 367LBRG
LARKE FORMATION..... 367LRKE
MILROY MEMBER OF LOYSBURG FORMATION..... 367MLRY
NITTANY FORMATION..... 367NTTN
ORDOVICIAN, LOWER..... 367ODVCL
PINESBURG STATION DOLOMITE..... 367PBGS
RICKENBACH FORMATION..... 367RCKB
ROCKDALE RUN FORMATION..... 367RCKR
STOUFFERSTOWN FORMATION..... 367SFRS
STONEHENGE FORMATION..... 367SNNG
TIGER-STRIPED MEMBER..... 367TGSP

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

ALLENTOWN FORMATION..... 371ALNN
CONOCOCHEAGUE GROUP..... 371CCCG
CAMBRIAN, UPPER..... 371CMBRU
ELBROOK FORMATION..... 371ELBK
GATESBURG FORMATION..... 371GBRG
GATESBURG FORMATION,LOWER SANDY MEMBER..... 371GBRGL
GATESBURG FORMATION,UPPER SANDY MEMBER..... 371GBRGU
MAIDEN CREEK MEMBER OF ALLENTOWN FORMATION..... 371MDCK

MINES FORMATION OR MEMBER OF GATESBURG FORMATION..... 371MINS
MILBACH FORMATION..... 371MLBC
MUHLENBERG MEMBER OF ALLENTOWN FORMATION..... 371MLBG
ORE HILL MEMBER OF GATESBURG FORMATION..... 371ORHL
POTTSDAM SANDSTONE..... 371PSDM
RICHLAND FORMATION..... 371RCLD
SCHAEFFERSTOWN FORMATION..... 371SCFR
SHADYGROVE FORMATION..... 371SDGV
STACY MEMBER OF GATESBURG FORMATION..... 371STCY
SNITZ CREEK FORMATION..... 371SZCK
TUCKERTON MEMBER OF ALLENTOWN FORMATION..... 371TCKR
WARRIOR FORMATION..... 371WRRR
ZULLINGER FORMATION..... 371ZLGR

MIDDLE CAMBRIAN

BUFFALO SPRINGS FORMATION..... 374BSPG
CAMBRIAN, MIDDLE..... 374CMBRM
LEITHSVILLE FORMATION..... 374LSVL
PLEASANT HILL FORMATION..... 374PLHL
ZOOKS CORNER FORMATION..... 374ZKCR

LOWER CAMBRIAN

ANTIETAM FORMATION..... 377ANTM
CHICKIES FORMATION..... 377CCKS
CHILHOWEE GROUP..... 377CHLH
LOWER CAMBRIAN SERIES..... 377CMBRL
HELLAM MEMBER OF CHICKIES FORMATION..... 377HLLM
HARDYSTON QUARTZITE..... 377HRDS
HARPERS FORMATION..... 377HRPR
KINZERS FORMATION..... 377KZRS
LEDGER FORMATION..... 377LDGR
LOUDOUN FORMATION..... 377LUDN
MONTALTO MEMBER OF HARPERS FORMATION..... 377MNTL
TOMSTOWN FORMATION..... 377TMSN
VINTAGE FORMATION..... 377VNTG
WAYNESBORO FORMATION..... 377WSBR
WEVERTON FORMATION..... 377WVRN

PRECAMBRIAN

AMPHIBOLITE..... 400AMPB
BALTIMORE GNEISS..... 400BLMR
BYRAM GNEISS..... 400BYRM
FELSIC GNEISS..... 400FLGC
FRANKLIN LIMESTONE..... 400FRKL
GRANULITE GNEISS, MAFIC..... 400GRLGB
GRANULITE GNEISS, FELSIC..... 400GRLGF
LOSEE DIORITE GNEISS..... 400LOSE
MORAVIAN HEIGHTS FORMATION..... 400MRVN
POCHUCK GNEISS..... 400PCCK
PICKERING GNEISS..... 400PCKG
PRECAMBRIAN ERATHEM..... 400PCMB
SPRINGFIELD GRANODIORITE..... 400SPGF

RHODE ISLAND

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
BEACH DEPOSITS,MARINE AND NON-MARINE	111BECH
COLLUVIUM	111CLVM
EOLIAN DEPOSITS	111EOLN
FILL	111FILL
MARINE DEPOSITS	111MRIN
SEDIMENTS, UNDIFFERENTIATED	111SDMN
SWAMP DEPOSITS	111SWMP

PLEISTOCENE

DELTA DEPOSITS	112DELT
ICE-CONTACT DEPOSITS, INCLUDING ESKERS AND KAMES	112ICCC
LACUSTRINE DEPOSITS	112LCSR
MORAINE DEPOSITS,EXCEPT GROUND MORAINE AND DRUMLINS	112MORN
MARINE DEPOSITS	112MRIN
OUTWASH	112OTSH
STRATIFIED DEPOSITS, UNDIFFERENTIATED	112SRFD
TILL	112TILL

TERTIARY

SEDIMENTS,UNDIFFERENTIATED	120SDMS

MESOZOIC

CRYSTALLINE ROCKS	200CRSL

CRETACEOUS

SEDIMENTS,UNDIFFERENTIATED	210SDMS

TRIASSIC

IGNEOUS ROCKS,EXTRUSIVE	230IGNSE
IGNEOUS ROCKS,INTRUSIVE	230IGNSI
SEDIMENTARY ROCKS	230SDMR

UPPER TRIASSIC

EAST BERLIN FORMATION	231EBRL
HOLYOKE BASALT	231HLYK
HAMPDEN BASALT	231HMPD
NEW HAVEN FORMATION	231NHVN
PORTLAND FORMATION	231PRLD

PALEOZOIC

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 300CRSL
CRYSTALLINE ROCKS,NONCARBONATE..... 300CRSLN

PENNSYLVANIAN

CRYSTALLINE ROCKS..... 320CRSL
SEDIMENTARY ROCKS..... 320SDMR

MISSISSIPPIAN

CRYSTALLINE ROCKS..... 330CRSL
SEDIMENTARY ROCKS..... 330SDMR

DEVONIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 340CRSL
CRYSTALLINE ROCKS,NONCARBONATE..... 340CRSLN

SILURIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 350CRSL
CRYSTALLINE ROCKS,CARBONATE..... 350CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 350CRSLN

ORDOVICIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 360CRSL
CRYSTALLINE ROCKS,CARBONATE..... 360CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 360CRSLN

CAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 370CRSL
CRYSTALLINE ROCKS,CARBONATE..... 370CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 370CRSLN

PRECAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 400CRSL
CRYSTALLINE ROCKS,CARBONATE..... 400CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 400CRSLN

SOUTH CAROLINA

CENOZOIC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
SAND DEPOSITS..... 111SAND

PLEISTOCENE

SAND DEPOSITS..... 112SAND

TERTIARY

PLIOCENE

WACCAMAW FORMATION..... 121WCCM

MIOCENE

DUPLIN FORMATION..... 122DPLN
HAWTHORN FORMATION..... 122HTRN
TAMPA LIMESTONE..... 122TAMP

OLIGOCENE

COOPER MARL..... 123COPR
FLINT RIVER FORMATION..... 123FLRV

EOCENE

BLACK MINGO FORMATION..... 124BKMG
BARNWELL FORMATION..... 124BRNL
CONGAREE FORMATION..... 124CNGR
CASTLE HAYNE LIMESTONE..... 124CSLH
MC BEAN FORMATION..... 124MCBN
OCALA LIMESTONE..... 124OCAL
SANTEE LIMESTONE..... 124SNTE
WARLEY HILL MARL..... 124WLHL

PALEOCENE

PALEOCENE SERIES..... 125PLCN

MESOZOIC

CRETACEOUS

UPPER CRETACEOUS

BLACK CREEK FORMATION..... 211BKCK

EUTAW FORMATION..... 211EUTW
PEEDEE FORMATION..... 211PEED
SNOW HILL MARL MEMBER OF BLACK CREEK FORMATION..... 211SNHL
TUSCALOOSA FORMATION..... 211TSCL

LOWER CRETACEOUS

LOWER CRETACEOUS AQUIFER SYSTEM, UNDIFFERENTIATED..... 217CRAQL

TRIASSIC

UPPER TRIASSIC

NEWARK GROUP..... 231NWRK

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

PERMIAN SYSTEM..... 310PRMV
YORKVILLE QUARTZ MONZONITE..... 310YKVL

SOUTH DAKOTA

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
ALLUVIUM, TERRACE, NON-GLACIAL..... 110AVTN
QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM

PLEISTOCENE

ALTAMONT AQUIFER..... 112ALMN
ALTAMONT AQUIFER 3..... 112ALMNL
ALTAMONT AQUIFER 2..... 112ALMNM
ALTAMONT AQUIFER 1..... 112ALMNU
AURORA AQUIFER..... 112AURR
BAD-CHEYENNE RIVER AQUIFER..... 112BDCN
BIG SOUIX AQUIFER..... 112BGSX
BOWDLE AQUIFER..... 112BWDL
CHOTEAU AQUIFER..... 112CHTU
COTEAU-LAKES AQUIFER..... 112CLKS
COBB AQUIFER..... 112COBB
COTEAU AQUIFER..... 112COTU
CROW CREEK AQUIFER..... 112CRCK
CROW LAKE AQUIFER..... 112CRLK
CORSICA AQUIFER..... 112CRSC
DELMONT AQUIFER..... 112DELM
DRY CHOTEAU AQUIFER..... 112DRCT
EDEN AQUIFER..... 112EDEN
ELM AQUIFER..... 112ELM
ELM CREEK AQUIFER..... 112EMCK
FIRESTEEL CREEK AQUIFER..... 112FLCK
FLOYD AQUIFER..... 112FLYD
GARY AQUIFER..... 112GARY
GEDDES AQUIFER..... 112GEDS
GREENWOOD AQUIFER..... 112GENO
GRAND AQUIFER..... 112GRND
HUBONMIX AQUIFER..... 112HBMX
HIDEWOOD AQUIFEK..... 112HDWD
HIGHMORE AQUIFER..... 112HGMR
JAVA AQUIFEK..... 112JAVA
JAMES AQUIFER..... 112JMES
JAMES AQUIFER,DEEP..... 112JMESD
JAMES AQUIFER,MIDDLE..... 112JMESM
LONG LAKE AQUIFER..... 112LGLK
LAKE DAKOTA AQUIFER..... 112LKDK
MOREAU GRAVELS..... 112MORU
MARDAY AQUIFER..... 112MRDY
NORTH ANDES AQUIFER..... 112NORD

ORTON GRAVELS..... 112ORTN
OUTWASH DEPOSITS..... 112OTSH
PEASE AQUIFER..... 112PESE
PLEISTOCENE SERIES..... 112PLSC
PLATTE AQUIFER..... 112PLTT
PRAIRIE COTEAU AQUIFER..... 112PRRC
PRAIRIE COTEAU AQUIFER 3..... 112PRRCL
PRAIRIE COTEAU AQUIFER 2..... 112PRRCM
PRAIRIE COTEAU AQUIFER 1..... 112PRRCU
ROSLYN AQUIFER..... 112RSLN
SELBY AQUIFER..... 112SLBY
SLAUGHTER AQUIFER..... 112SLGR
SPRING CREEK AQUIFER..... 112SPCK
SPRING AQUIFER..... 112SPRG
TYNDALL-SCOTLAND AQUIFER..... 112TDLC
TWIN LAKES AQUIFER..... 112TNLS
TOWER AQUIFER..... 112TOWR
TULARE AQUIFER..... 112TULR
VEBLEN AQUIFER..... 112VBLN
VOLTAIRE AQUIFER..... 112VLTRA
LOWER VERMILLION-MISSOURI AQUIFER..... 112VRML
WAKONDA AQUIFER..... 112WKND
WILMARTH LAKE AQUIFER..... 112WMLK
WARREN AQUIFER..... 112WRRN
WESSINGTON SPRINGS AQUIFER..... 112WSPG

TERTIARY

IGNEOUS ROCKS OF BLACK HILLS..... 120IBKH
TERTIARY SYSTEM..... 120TRTR

PLIOCENE

ASH HOLLOW FORMATION..... 121ASHL
BIJOU FORMATION..... 121BJOU
OGALLALA FORMATION..... 121OGLL
PLIOCENE SERIES..... 121PLCN
VALENTINE FORMATION..... 121VLNN

MIOCENE

ARIKAREE FORMATION..... 122ARKR
HARRISON SANDSTONE..... 122HRSN
MELLETTE FORMATION..... 122MLLT
MIOCENE SERIES..... 122MOCN
MONROE CREEK FORMATION..... 122MRCK
ROCKYFORD ASH MEMBER OF SHARPS FORMATION..... 122RCKF
ROSEBUD FORMATION..... 122RSBD
SHARPS FORMATION..... 122SRPS

OLIGOCENE

AHEARN MEMBER OF CHADRON FORMATION..... 123AHRN
BRULE FORMATION..... 123BRUL
CHADRON FORMATION..... 123CRDN
CRAZY JOHNSON MEMBER OF CHADRON FORMATION..... 123CRZJ

OLIGOCENE SERIES..... 123OLGC
POLESLIDE MEMBER OF BRULE FORMATION..... 123PLSD
PEANUT PEAK MEMBER OF CHADRON FORMATION..... 123PNPK
REE BEDS..... 123REE
SCENIC MEMBER OF BRULE FORMATION..... 123SCNC
SLIM BUTTES FORMATION..... 123SLMB
WHITE RIVER GROUP OR FORMATION..... 123WRVR

PALEOCENE

CANNONBALL MEMBER OF FORT UNION FORMATION..... 125CNBL
FORT UNION FORMATION..... 125FRUN
LUDLOW MEMBER OF FORT UNION FORMATION..... 125LDLW
PALEOCENE SERIES..... 125PLCN
SCUTCH CAP SANDSTONE..... 125SCCP
TONGUE RIVER MEMBER OF FORT UNION FORMATION..... 125TGRV

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

ARDMORE BENTONITE BED OF PIERRE SHALE..... 211ARDM
BELLE FOURCHE SHALE..... 211BLFC
BULLHEAD LITHOFACIES OF IRON LIGHTNING MEMBER OF FOX HILLS FORMATION.. 211BLLD
BREIEN MEMBER OF HELL CREEK FORMATION..... 211BRJN
CODELL SANDSTONE MEMBER OF CARLILE SHALE..... 211CDLL
COLGATE LITHOFACIES OF IRON LIGHTNING MEMBER OF FOX HILLS FORMATION... 211CLGT
COLORADO GROUP..... 211CLRD
CROW CREEK MEMBER OF PIERRE SHALE..... 211CRCK
UPPER CRETACEOUS..... 211CRCSU
CARLILE SHALE..... 211CRLL
DEGREY MEMBER OF PIERRE SHALE..... 211DGRY
DAKOTA SANDSTONE OR FORMATION..... 211DKOT
ELK BUTTE MEMBER OF PIERRE SHALE..... 211ELKB
FOX HILLS FORMATION..... 211FXHL
GAMMON FERRUGINOUS MEMBER OF PIERRE SHALE..... 211GMMN
GREGORY MEMBER OF PIERRE SHALE..... 211GRGR
GREENHORN LIMESTONE OR FORMATION..... 211GRNR
GROAT SANDSTONE BED OF GAMMON FERRUGINOUS MEMBER OF PIERRE SHALE..... 211GROT
GRANEROS SHALE..... 211GRRS
HELL CREEK FORMATION..... 211HLCK
ISABEL-FIRESTEEL COAL MEMBER OF HELL CREEK FORMATION..... 211IBLF
IRON LIGHTNING MEMBER OF THE FOX HILLS FORMATION..... 211IRLG
MOBRIDGE MEMBER OF PIERRE SHALE..... 211MBDG
MONUMENT HILL BENTONITIC MEMBER OF PIERRE SHALE..... 211MMHL
MONTANA GROUP..... 211MNTN
MITTEN BLACK SHALE MEMBER OF PIERRE SHALE..... 211MTTN
AQUIFER IN NIOBRARA FORMATION & CODELL SANDSTONE MEMBER CARLILE SHALE. 211NBCD
NIOBRARA FORMATION..... 211NBRR
ORMAN LAKE LIMESTONE MEMBER OF GREENHORN FORMATION..... 211OMLK

PIERRE SHALE..... 211PIRR
POOL CREEK SHALE MEMBER OF CARLILE SHALE..... 211PLCK
RED BIRD SILTY MEMBER OF PIERRE SHALE..... 211RDBD
SAGE BREAKS SHALE MEMBER OF CARLILE SHALE..... 211SGBK
STONEVILLE MEMBER OF FOX HILLS SANDSTONE..... 211SNVL
SHARON SPRINGS MEMBER OF PIERRE SHALE..... 211SSPG
TIMBER LAKE MEMBER OF THE FOX HILLS FORMATION..... 211TBLK
TRAIL CITY MEMBER OF THE FOX HILLS FORMATION..... 211TRLC
TURNER SANDY MEMBER OF CARLILE SHALE..... 211TRNR
VIRGIN CREEK MEMBER OF PIERRE SHALE..... 211VGCK
VERENDRYE MEMBER OF PIERRE SHALE..... 211VRDR

LOWER CRETACEOUS

CHILSON MEMBER OF LAKOTA FORMATION..... 217CLSN
CLAY SPUR BENTONITE BED OF MOWRY SHALE..... 217CLSP
LOWER CRETACEOUS SERIES..... 217CRCSL
D SAND..... 217D
DYNNESON SANDSTONE MEMBER OF MOWRY SHALE..... 217DNSN
FALL RIVER FORMATION..... 217FLRV
FUSON MEMBER OF LAKOTA FORMATION..... 217FUSN
INYAN KARA GROUP..... 217INKR
J SAND..... 217J
KEYHOLE SANDSTONE MEMBER OF FALL RIVER FORMATION..... 217KYHL
LAKOTA FORMATION..... 217LKOT
MINNEWASTE LIMESTONE MEMBER OF LAKOTA FORMATION..... 217MNST
MOWRY SHALE..... 217MWRY
NEWCASTLE SANDSTONE..... 217NCSL
SKULL CREEK SHALE..... 217SKCK

JURASSIC

JURASSIC SYSTEM..... 220JRSC

UPPER JURASSIC

CANYON SPRINGS SANDSTONE MEMBER OF SUNDANCE FORMATION..... 221CSPGS
HULETT SANDSTONE MEMBER OF SUNDANCE FORMATION..... 221HLTT
LAK MEMBER OF SUNDANCE FORMATION..... 221ILAK
UPPER JURASSIC SERIES..... 221JRSCU
LAK MEMBER OF SUNDANCE FORMATION..... 221LAK
MORRISON FORMATION..... 221MRSN
REDWATER SHALE MEMBER OF SUNDANCE FORMATION..... 221RDTR
STOCKADE BEAVER SHALE MEMBER OF SUNDANCE FORMATION..... 221SKBV
SUNDANCE FORMATION..... 221SNDC
UNKPAPA SANDSTONE MEMBER OF MORRISON FORMATION..... 221UKPP

MIDDLE JURASSIC

GYPSUM SPRING FORMATION..... 224GPSP
MIDDLE JURASSIC SERIES..... 224JRSCM
PIPER FORMATION..... 224PIPR

TRIASSIC

PINE SALT MEMBER OF SPEARFISH FORMATION (TRIASSIC-PERMIAN)..... 230PNSL

SPEARFISH FORMATION (TRIASSIC-PERMIAN)..... 230SPRF

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

BROOM CREEK MEMBER OF MINNELUSA FORMATION..... 310BMCK
CASSA MEMBER OF MINNELUSA..... 310CASS
MINNEKAHTA LIMESTONE..... 310MNKT
MINNELUSA FORMATION (PERMIAN AND PENNSYLVANIAN)..... 310MNLS
OWL CANYON FORMATION..... 310OLCN
PERMIAN SYSTEM..... 310PRMN

LOWER PERMIAN

OPECHE SHALE..... 317OPCH

PENNSYLVANIAN

VIRGILIAN

WENDOVER-MEEK MEMBER OF MINNELUSA FORMATION..... 322WVMK

DES MOINESIAN

HAYDEN MEMBER OF MINNELUSA FORMATION..... 325HYDN

ATOKAN

RECLAMATION MEMBER OF MINNELUSA FORMATION..... 326RCLM
ROUNDTOP MEMBER OF MINNELUSA FORMATION..... 326RNDP

MORROWAN

FAIRBANK MEMBER OF MINNELUSA FORMATION..... 328FRBK

MISSISSIPPIAN

BAKKEN FORMATION (MISSISSIPPIAN AND DEVONIAN)..... 330BKKN
ENGLEWOOD FORMATION (MISSISSIPPIAN AND DEVONIAN)..... 330EGLD
MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

BIG SNOWY GROUP..... 331BGSN
CHARLES FORMATION..... 331CRLS
KIBBEY SANDSTONE..... 331KBBY
MADISON GROUP..... 331MDSM
MADISON GROUP (UPPER AND LOWER MISSISSIPPIAN..... 331MDSN
MISSION CANYON LIMESTONE..... 331MSNC
MISSISSIPPIAN, UPPER..... 331MSSPU

LOWER MISSISSIPPIAN

LODGEPOLE LIMESTONE..... 337LDGP
MISSISSIPPIAN, LOWER..... 337MSSPL
PAHASAPA LIMESTONE..... 337PHSP

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

BIRDBEAR FORMATION..... 341BRDB
DUPEROW FORMATION..... 341DPRW
DEVONIAN, UPPER..... 341DVNNU
JEFFERSON GROUP..... 341JFRS
SOURIS RIVER FORMATION..... 341SRRV
THREE FORKS SHALE..... 341TRFK

MIDDLE DEVONIAN

ASHERN FORMATION..... 344ASRN
DEVONIAN, MIDDLE..... 344DVNNM

SILURIAN

INTERLAKE FORMATION..... 350IRLK

ORDOVICIAN

DEADWOOD FORMATION..... 360DDWD
ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

BIGHORN GROUP..... 361BGRN
GUNTON MEMBER OF STONY MOUNTAIN FORMATION..... 361GNTN
ORDOVICIAN, UPPER..... 361ODVCU
PENITENTIARY MEMBER OF STONY MOUNTAIN FORMAT..... 361PNNR
RED RIVER FORMATION..... 361RDRV
STONY MOUNTAIN FORMATION..... 361SNMN
STOUGHTON MEMBER OF STONY MOUNTAIN FORMATION..... 361STGN
STONEWALL FORMATION..... 361STNL
WHITEWOOD DOLOMITE..... 361WHTD

MIDDLE ORDOVICIAN

ALADDIN SANDSTONE MEMBER OF WINNIPEG FORMATION..... 364ALDN
ICE BOX SHALE MEMBER OF WINNIPEG FORMATION..... 364ICBX
ORDOVICIAN, MIDDLE..... 364ODVCM
ROUGHLOCK SILTSTONE MEMBER OF WINNIPEG FORMATION..... 364RGCK
"WINNIPEG SHALE" OF WINNIPEG FORMATION..... 364WGSL
"WINNIPEG SANDSTONE" OF WINNIPEG FORMATION..... 364WGSS
WINNIPEG FORMATION..... 364WNPG
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CROW FORMATION..... 400CROW
MAYO FORMATION..... 400MAYO
MILBANK GRANITE..... 400MLBK
PRECAMBRIAN ERATHEM..... 400PCMB
SIOUX QUARTZITE..... 400SOUX

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PLEISTOCENE SERIES..... 112PLSC
TERRACE DEPOSITS..... 112TRRC

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TERTIARY SYSTEM..... 120TRTR

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COOK MOUNTAIN FORMATION..... 124CKMN
CLAIRBORNE GROUP..... 124CLBR
EOCENE SERIES..... 124EOCN
EOCENE SERIES,UPPER..... 124EOCNU
FLOUR ISLAND FORMATION..... 124FLID
FORT PILLOW SAND..... 124FRPL
JACKSON GROUP..... 124JCKS
MEMPHIS SAND..... 124MMPS
OLD BREASTWORKS FORMATION..... 124ODBK
SPARTA SAND..... 124SPRT
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1400-FOOT SAND OF MEMPHIS AREA..... 12414MP

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PALEOCENE SERIES..... 125PLCN
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COFFEE SAND..... 211COFF
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DEMOPOLIS FORMATION..... 211DMPL
EUTAW FORMATION..... 211EUTW
MC NAIRY FORMATION..... 211MCNR
OWL CREEK FORMATION..... 211OLCK
RIPLEY FORMATION..... 211RPLY
SARDIS FORMATION..... 211SRDS
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MIDDLE JURASSIC

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GRAVES GAP GROUP..... 324GVGP
INDIAN BLUFF GROUP..... 324IDBF
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DORTON SHALE..... 327DRTN
FENTRESS FORMATION..... 327FNRS
GLENMARY SHALE..... 327GLMR
GIZZARD FORMATION..... 327GZRD
NEWTON SANDSTONE..... 327NWTN
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RACCOON MOUNTAIN MEMBER OF GIZZARD FORMATION..... 327RCNM
SEWANEE CONGLOMERATE..... 327SEWN
SIGNAL POINT SHALE..... 327SGLP
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WARTBURG SANDSTONE..... 327WRBG

WARREN POINT SANDSTONE MEMBER OF LEE FORMATION..... 327WRNP
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STE GENEVIEVE LIMESTONE..... 333SGVV
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CLINCH SANDSTONE..... 354CLNC
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SILURIAN, MIDDLE..... 354SLRNM
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RICHMOND GROUP..... 361RCMD
SEQUATCHIE FORMATION..... 361SQTC

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ATHENS SHALE..... 364ATNS
BAYS FORMATION..... 364BAYS
BIGBY AND CANNON LIMESTONES..... 364BGBC
CARTERS LIMESTONE..... 364CRRS
HOLSTON FORMATION..... 364HLSN
HERMITAGE FORMATION..... 364HRMG
LEBANON LIMESTONE..... 364LBNN
LENOIR LIMESTONE..... 364LNOR
MURFREESBORO LIMESTONE..... 364MRFB
NASHVILLE GROUP..... 364NSVL
ORDOVICIAN, MIDDLE..... 364ODVCM
OTTOSEE SHALE..... 364OTTS
PIERCE LIMESTONE..... 364PIRC
RIDLEY LIMESTONE..... 364RDLY
STONES RIVER GROUP..... 364SRVR
SEVIER SHALE..... 364SVIR

LOWER ORDOVICIAN

CHEPULTEPEC DOLOMITE..... 367CPPC
JONESBORO LIMESTONE..... 367JSBR
KINGSPORT FORMATION..... 367KGPR
KNOX DOLOMITE..... 367KNOX
LONGVIEW DOLOMITE..... 367LNGV
MASCOT DOLOMITE..... 367MSCT
NEWALA FORMATION..... 367NEWL
ORDOVICIAN, LOWER..... 367ODVCL
WELLS CREEK FORMATION..... 367WLCK

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

CONOCOCHEAGUE LIMESTONE..... 371CCCG
CAMBRIAN, UPPER..... 371CMBRU
CONASAUGA GROUP..... 371CNSG
COPPER RIDGE DOLOMITE..... 371CPRG
MAYNARDSVILLE LIMESTONE..... 371MDVL
NOLICHUCKY SHALE..... 371NCCK

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CAMBRIAN, MIDDLE..... 374CMBRM
HONAKER DOLOMITE..... 374HNKR
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ERWIN FORMATION..... 377ERWN
HESSE SANDSTONE..... 377HESS
HAMPTON SHALE OR FORMATION..... 377HMPN
MURRAY SHALE..... 377MRRY
NICHOLS SHALE..... 377NCLS
NEBO SANDSTONE..... 377NEBO
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PRECAMBRIAN

BEECH GRANITE..... 400BECH
BAKERSVILLE GABBRO..... 400BKVL
CADES SANDSTONE..... 400CDES
CRANBERRY GRANITE..... 400CRBR
GREAT SMOKY GROUP..... 400GSMK
INTRUSIVE ROCKS..... 400IVIG
MOUNT ROGERS VOLCANIC GROUP..... 400MRGR
OCOEE SERIES..... 400OCOE
PRECAMBRIAN ERATHEM..... 400PCMB
RICH BUTT SANDSTONE..... 400RCBT
ROAN GNEISS..... 400ROAN
SNOWBIRD GROUP..... 400SBRD
SANDSUCK FORMATION..... 400SDCK
WALDEN CREEK GROUP..... 400WDCK

CENOZOIC

ALLUVIUM	100ALVM
ALLUVIUM AND SANTA ROSA SANDSTONE	100AVSR
CENOZOIC ERATHEM	100CNZC
PECOSIAN SERIES	100PCOS

QUATERNARY

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ALLUVIAL,CHANNEL AND PLAIN DEPOSITS,OGALLALA FORMATION AND DOCKUM GRP.	110ACOD
ALLUVIAL CHANNEL AND PLAIN DEPOSITS,AND ARTESIA GROUP	110ACPA
ALLUVIAL CHANNEL AND PLAIN DEPOSITS,AND DOCKUM GROUP	110ACPD
ALLUVIAL CHANNEL AND PLAIN DEPOSITS,AND OCHOA SERIES	110ACPO
ALLUVIUM,CRETACEOUS ROCKS AND SANTA ROSA SANDSTONE	110ACSR
ALLUVIAL TERRACE AND CHANNEL DEPOSITS,DOG CREEK SHALE,BLAINE GYPSUM	110ADCB
ALLUVIUM,FLUVIAL TERRACE DEPOSITS,AND ARTESIA GROUP	110AFTA
ALLUVIUM,FLUVIAL TERRACE DEPOSITS,AND PEASE RIVER GROUP	110AFTP
ALLUVIUM AND HIGH TERRACE PLAIN DEPOSITS	110AHTP
ALLUVIUM,HIGH TERRACE DEPOSITS,AND WHITEHORSE GROUP	110AHTW
ALLUROSA AQUIFER	110ALRS
ALLUVIUM,LOW TERRACE AND CHANNEL FILL DEPOSITS	110ALTC
ALLUVIUM,LOW TERRACE AND CHANNEL FILL DEPOSITS,AND DUNE SAND	110ALTD
ALLUVIUM,LOW TERRACE AND CHANNEL FILL DEPOSITS,AND OGALLALA FORMATION.	110ALTO
ALLUVIUM,LOW TERRACE AND CHANNEL FILL DEPOSITS,AND WHITEHORSE GROUP	110ALTW
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ALLUVIAL PLAIN DEPOSITS	110ALVP
ALLUVIUM,LEONA FORMATION,AND WILCOX GROUP	110ALWX
ALLUVIUM,TERRACE DEPOSITS AND SEYMOUR FORMATION,AND CLEAR CREEK GROUP.	110ASCF
ALLUVIUM,CRETACEOUS ROCKS,AND SANTA ROSA SANDSTONE	110ASCR
ALLUVIUM,CRETACEOUS ROCKS,SANTA ROSA SANDSTONE,AND RUSTLER FORMATION	110ASRR
ALLUVIUM,TERRACE DEPOSITS AND SEYMOUR FORMATION, AND SAN ANGELO SS	110ASSA
ALLUVIAL TERRACE AND CHANNEL DEPOSITS,AND FLOWERPOT SHALE	110ATCF
ALLUVIAL TERRACE AND CHANNEL DEPOSITS,AND OGALLALA FORMATION	110ATCO
ALLUVIAL TERRACE AND CHANNEL DEPOSITS,AND WHITEHORSE GROUP	110ATCW
ALLUVIUM,TERRACE DEPOSITS AND SEYMOUR FORMATION,AND BLAINE FORMATION	110ATSB
ALLUVIUM,TERRACE DEPOSITS AND SEYMOUR FORMATION,AND FLOWERPOT SHALE	110ATSF
ALLUVIUM,BEACH SAND AND TERRACE DEPOSITS	110AVBT
ALLUVIUM AND CRETACEOUS ROCKS	110AVCC
ALLUVIUM AND CLEAR FORK GROUP	110AVCF
ALLUVIUM AND COOK MOUNTAIN FORMATION	110AVCM
ALLUVIAL CHANNEL AND PLAIN DEPOSITS	110AVCP
ALLUVIAL,EOLIAN,AND LITTORAL DEPOSITS	110AVEL
ALLUVIUM AND EVANGELINE AQUIFER	110AVEV
ALLUVIUM,FLOOD PLAIN	110AVFP
ALLUVIUM AND FLUVIATILE TERRACE DEPOSITS	110AVFV
ALLUVIUM AND JACKSON GROUP	110AVJK
ALLUVIUM,LEONA FORMATION,AND AUSTIN CHALK	110AVLA
ALLUVIUM AND ARTESIA GROUP	110AVMA
ALLUVIUM AND CHINLE FORMATION EQUIVALENT	110AVMC
ALLUVIUM AND EDWARDS AND ASSOCIATED LIMESTONES	110AVME
ALLUVIUM AND LEONA FORMATION	110AVML
ALLUVIUM AND TRIASSIC SYSTEM	110AVMT
ALLUVIUM AND WICHITA GROUP	110AVMW

ALLUVIUM AND OGALLALA FORMATION..... 110AVOG
ALLUVIUM AND OAKVILLE SANDSTONE..... 110AVOV
ALLUVIUM AND PEASE RIVER GROUP..... 110AVPR
ALLUVIAL PLAIN DEPOSITS AND WHITEHORSE GROUP..... 110AVPW
ALLUVIUM AND PALUXY SAND..... 110AVPX
ALLUVIUM AND SANTA ROSA SANDSTONE..... 110AVSR
ALLUVIAL TERRACE AND CHANNEL DEPOSITS..... 110AVTC
ALLUVIUM AND TRINITY SAND..... 110AVTR
ALLUVIUM,TERRACE DEPOSITS,AND SEYMOUR FORMATION..... 110AVTS
ALLUVIUM AND YEGUA FORMATION..... 110AVYG
BARRIER ISLAND AND BEACH DEPOSITS..... 110BIBC
BARRIER ISLAND DEPOSITS..... 110BILD
DUNE SAND AND OGALLALA FORMATION..... 110DOGL
DUNE SAND..... 110DUNE
GRAVEL..... 110GRVL
KOKERNOT FORMATION..... 110KKRN
MONAHANS FORMATION..... 110MNNS
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TERRA BLANCA FORMATION..... 110TBLC
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ALLUVIUM,BEACH AND DUNE SAND..... 111AVBD
ALLUVIUM,COLORADO RIVER..... 111AVCR
ALLUVIUM,FLOOD PLAIN..... 111AVFP
ALLUVIUM AND TERRACE DEPOSITS..... 111AVMT
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HOLOCENE,PLEISTOCENE, AND PLIOCENE? ALLUVIAL DEPOSITS..... 111HPPA
INGLESIDE FORMATION..... 111IGLD
NUECES RIVER ALLUVIUM..... 111NCRV
PECOS RIVER ALLUVIUM..... 111PCRV
RED RIVER ALLUVIUM..... 111RDRV
RIO GRANDE ALLUVIUM..... 111RGRD
STREAM AND TERRACE GRAVEL..... 111STGV
TRINITY RIVER ALLUVIUM..... 111TRRV

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BEAUMONT CLAY,LISSIE FORMATION AND GOLIAD SAND..... 112BMLG
BEAUMONT CLAY AND LISSIE FORMATION..... 112BMLS
BEAUMONT CLAY..... 112BMNT
BENTLEY FORMATION..... 112BNTL
CHICOT AND EVANGELINE AQUIFERS..... 112CEVG
CHICOT AQUIFER..... 112CHCT
CHICOT AQUIFER,LOWER..... 112CHCTL
CHICOT AQUIFER,MIDDLE..... 112CHCTM
CHICOT AQUIFER,UPPER..... 112CHCTU

T AQUIFER,UPPER..... 112CHICO
CHICOT AQUIFER AND LOWER UNIT OF EVANGELINE AQUIFER..... 112CLEV
DEWEYVILLE FORMATION..... 112DVLL
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GULF COAST AQUIFER..... 112GLFC
GOLIAD AND YOUNGER ROCKS,UNDIFFERENTIATED..... 112GOLD
HUECO BOLSON DEPOSITS..... 112HCBL
LEONA FORMATION AND ANACACHO LIMESTONE..... 112LACC
LEONA FORMATION AND BULLWAGON DOLOMITE..... 112LBLG
LEONA FORMATION AND EDWARDS AND ASSOCIATED LIMESTONES..... 112LEDD
LEONA FORMATION AND EAGLE FORD SHALE..... 112LEGF
LEONA FORMATION..... 112LEON
LINN-FAYSVILLE AQUIFER..... 112LFSV
LISSIE FORMATION AND GOLIAD SAND..... 112LGLD
LEONA FORMATION AND GLEN ROSE LIMESTONE..... 112LGLR
LISSIE FORMATION..... 112LISS
LA MESA BOLSON DEPOSITS..... 112LMBL
LEONA FORMATION AND AUSTIN CHALK..... 112LNAS
LEONA FORMATION AND BUDA LIMESTONE..... 112LNBD
LEONA FORMATION AND BLAINE GYPSUM..... 112LNBL
LEONA FORMATION AND CHOZA FORMATION..... 112LNCZ
LEONA FORMATION AND INDIO FORMATION..... 112LNID
LEONA FORMATION AND TRINITY GROUP..... 112LNTR
LOWER RIO GRANDE AQUIFER..... 112LRGD
LEONA FORMATION AND SERPENTINE..... 112LSRP
LEONA FORMATION AND WILCOX FORMATION..... 112LWCX
LISSIE FORMATION, WILLIS SAND AND GOLIAD SAND..... 112LWGD
MERCEDES-SEBASTIAN AQUIFER..... 112MCSB
MONTGOMERY FORMATION..... 112MGMR
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PLEISTOCENE SERIES..... 112PLSC
PRAIRIE FORMATION..... 112PRIR
SAN ANGELO SANDSTONE AND CHOZA FORMATION..... 112SACZ
SEYMOUR FORMATION AND CLEAR FORK GROUP..... 112SCFK
SANTA FE FORMATION..... 112SNTF
SEYMOUR FORMATION..... 112SYMR
TAHOKA CLAY..... 112THOK
TERRACE GRAVEL,INCLUDING LEONA FORMATION..... 112TRCL
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TULE FORMATION..... 112TULE
WILLIANA FORMATION..... 112WLLN
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BASALT..... 120BSLT
COTTONWOOD SPRING BASALT..... 120CSPG
DUFF FORMATION..... 120DUFF
GOODNIGHT FORMATION..... 120GDNG
IGNEOUS ROCKS..... 120IGNS
INTRUSIVE ROCKS..... 120IVIG
MCCUTCHEON VOLCANIC SERIES..... 120MCCC
MITCHELL MESA RHYOLITE..... 120MCLM
PRUETT FORMATION..... 120PRTT
POTATO HILL ANDESITE..... 120PTHL

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SHEEP CANYON BASALT..... 120SPCN
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PLIOCENE

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BLOUNTS CREEK MEMBER OF FLEMING FORMATION..... 121BLCK
BLANCO FORMATION..... 121BLNC
CLARENDON BEDS..... 121CLRD
CUETAS FORMATION..... 121COTS
EVANGELINE AQUIFER AND BURKEVILLE AQUICLUDE..... 121EVBV
EVANGELINE AQUIFER..... 121EVGL
EVANGELINE AND JASPER AQUIFERS..... 121EVJP
EVANGELINE AQUIFER AND UPPER UNIT OF JASPER AQUIFER..... 121EVJPU
FOLEY FORMATION..... 121FOLY
GOLIAD SAND AND LAGARTO CLAY..... 121GDLG
GOLIAD AND YOUNGER ROCKS,UNDIFFERENTIATED..... 121GDYG
GOLIAD SAND..... 121GOLD
HEAVILY-PUMPED LAYER..... 121HVPP
LAPARA SAND MEMBER OF THE GOLIAD SAND..... 121LAPR
LABAHIA MEMBER OF THE GOLIAD SAND..... 121LBHI
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OGALLALA FORMATION..... 121OGLL
OGALLALA FORMATION AND WHITEHORSE GROUP..... 121OGLW
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MIOCENE

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CASTOR CREEK MEMBER OF FLEMING FORMATION..... 122CRCK
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JASPER AQUIFER AND CATAHOULA SANDSTONE..... 122JPCL
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OAKVILLE SANDSTONE..... 122OKVL
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BIGFORD FORMATION CLAIBORNE GROUP..... 124BGFD
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CADELL FORMATION..... 124CDLL
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CARRIZO SAND..... 124CRRZ
CROSSON TRACHYTE..... 124CRSN
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CARRIZO SAND AND REKLAW FORMATION..... 124CZRK
CARRIZO SAND AND SIMSBORO SAND MEMBER OF ROCKDALE FORMATION..... 124CZSB
CARRIZO SAND AND SPARTA SAND..... 124CZSP
CARRIZO SAND AND WILCOX GROUP,UNDIFFERENTIATED..... 124CZWX
CARRIZO-WILCOX AQUIFER..... 124CZWXA
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DILLWORTH SAND..... 124DLRT
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EL PICO CLAY..... 124ELPC
EOCENE SERIES..... 124EOCN
FASHING CLAY..... 124FSNG
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INDIO FORMATION..... 124INDO
JACKSON GROUP..... 124JCKS
JACKSON GROUP AND YEGUA FORMATION..... 124JKYG
LAREDO FORMATION..... 124LRDO
MC ELROY FORMATION..... 124MCEL
MANNING FORMATION OF JACKSON GROUP..... 124MNNG
MARQUEZ SHALE MEMBER OF REKLAW FORMATION..... 124MRQZ
NEWBY GLAUCONITIC SAND MEMBER OF REKLAW FORMATION..... 124NWBY
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OMEN MEMBER OF MOUNT SELMAN FORMATION..... 124OMEN
POST-BIGFORD BEDS OF MOUNT SELMAN FORMATION..... 124PBGF
QUEEN CITY SAND,CARRIZO SAND AND WILCOX GROUP..... 124QCCW
QUEEN CITY SAND AND CARRIZO SAND..... 124QCCZ
QUEEN CITY SAND AND SPARTA SAND..... 124QCSP

QUEEN CITY SAND OF CLAIBORNE GROUP..... 124QNCT
ROCKDALE FORMATION..... 124RCKD
REKLAW FORMATION AND CARRIZO SAND..... 124RKCZ
REKLAW FORMATION OF CLAIBORNE GROUP..... 124RKLW
SABINETOWN FORMATION..... 124SBNN
SEGUIN FORMATION..... 124SGUN
SIMSBORO SAND MEMBER OF ROCKDALE FORMATION..... 124SMBR
STONE SWITCH SAND..... 124SNSC
SPILLER SAND MEMBER OF COOK MOUNTAIN FORMATION..... 124SPLR
SPARTA SAND AND QUEEN CITY SAND..... 124SPQC
SPARTA SAND..... 124SPRT
SPARTA SAND AND SPILLER SAND MEMBER OF COOK MOUNTAIN FORMATION..... 124SPSP
THERRILL CLAY MEMBER OF WECHES FORMATION..... 124TRLL
TYLER GREENSAND MEMBER OF SPARTA SAND..... 124TYLR
WECHES FORMATION OF CLAIBORNE GROUP..... 124WCHS
WELLBORN SANDSTONE..... 124WLBR
WILCOX GROUP..... 124WLCX
WHITSETT FORMATION..... 124WTST
WILCOX GROUP AND SIMSBORO SAND MEMBER OF ROCKDALE FORMATION..... 124WXSB
YEGUA FORMATION,COOK MOUNTAIN FORMATION AND SPARTA SAND..... 124YCMS
YEGUA FORMATION..... 124YEGU
YEGUA FORMATION AND JACKSON GROUP..... 124YGJK
YEGUA FORMATION AND SPARTA SAND..... 124YGSP

PALEOCENE

KINCAID FORMATION..... 125KNCD
KERENS MEMBER OF WILLS POINT FORMATION..... 125KRNS
LITTIG GLAUCONITIC MEMBER OF KINCAID FORMATION..... 125LTTG
MIDWAY GROUP..... 125MDWY
MEXIA MEMBER OF WILLS POINT FORMATION..... 125MEXI
PALEOCENE SERIES..... 125PLCN
PISGAH MEMBER OF KINCAID FORMATION..... 125PSGH
TEHUACANA MEMBER OF KINCAID FORMATION..... 125THCN
WILLS POINT FORMATION..... 125WLSP

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS ROCKS AND SANTA ROSA SANDSTONE..... 210CCSR
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FARRER FORMATION..... 211FRRR
GARLEY CANYON SANDSTONE MEMBER OF MANCOS SHALE..... 211GRLC
HILLIARD SHALE OR FORMATION..... 211HLRD
HENEFER FORMATION..... 211HNFR
IRON SPRINGS FORMATION..... 211ISPG
KAIPAROWITS FORMATION..... 211KPRS
MASUK MEMBER OF MANCOS SHALE..... 211MSUK
MESAVERDE GROUP..... 211MVRD
NESLEN FORMATION OF MESAVERDE GROUP..... 211NSLN
PRICE RIVER FORMATION OF MESAVERDE GROUP..... 211PCRV
ROCK SPRINGS FORMATION OF MESAVERDE GROUP..... 211RKSP
SEGO SANDSTONE OF MESAVERDE GROUP..... 211SEGO
SANPETE FORMATION OF INDIANOLA GROUP..... 211SNPT
STAR POINT SANDSTONE OF MESAVERDE GROUP..... 211SRPN
SIXMILE CANYON FORMATION OF INDIANOLA GROUP..... 211SXMC
TUNUNK SHALE MEMBER OF MANCOS SHALE..... 211TNNK
TROPIC SHALE OR FORMATION..... 211TRPC
TUSCHER FORMATION OF MESAVERDE GROUP..... 211TSCR
WAHWEAP SANDSTONE..... 211WHWP
WANSHIP FORMATION..... 211WNSP

LOWER CRETACEOUS

ASPEN SHALE MEMBER OF MANCOS SHALE..... 217ASPN
BUCKHORN CONGLOMERATE MEMBER OF CEDAR MOUNTAIN FORMATION..... 217BCKR
BURRO CANYON FORMATION..... 217BRCN
BEAR RIVER FORMATION..... 217BRRV
CEDAR MOUNTAIN FORMATION..... 217CDRM
CLOVERLY FORMATION..... 217CLVL
KELVIN FORMATION..... 217KLVN
MOWRY SHALE..... 217MWRY

JURASSIC

GLEN CANYON FORMATION OR GROUP(JURASSIC-TRIASSIC)..... 220GLNC
JURASSIC SYSTEM..... 220JRSC
NAVAJO SANDSTONE OF GLEN CANYON GROUP(JURASSIC-TRIASSIC)..... 220NVJO

UPPER JURASSIC

ARAPIEN SHALE..... 221ARPN
BLUFF SANDSTONE OF SAN RAFAEL GROUP..... 221BLFF
BRUSHY BASIN MEMBER OF MORRISON FORMATION..... 221BRSB

CARMEL FORMATION OF SAN RAFAEL GROUP..... 221CRML
CURTIS FORMATION OF SAN RAFAEL GROUP..... 221CRTS
COW SPRINGS SANDSTONE..... 221CSPG
DEWEY BRIDGE MEMBER OF ENTRADA SANDSTONE..... 221DBDG
ENTRADA SANDSTONE OF SAN RAFAEL GROUP..... 221ENRD
JUNCTION CREEK SANDSTONE OF SAN RAFAEL GROUP..... 221JCCK
MORRISON FORMATION..... 221MRSN
PREUSS SANDSTONE OR RED BEDS..... 221PRSS
RECAPTURE MEMBER OF MORRISON FORMATION..... 221RCPR
SALT WASH MEMBER OF MORRISON FORMATION..... 221SLWS
SUMMERVILLE FORMATION OF SAN RAFAEL GROUP..... 221SMVL
SAN RAFAEL GROUP..... 221SRFL
STUMP SANDSTONE..... 221STMP
TWIN CREEK LIMESTONE OR FORMATION..... 221TCRK
TWIST GULCH MEMBER OF ARAPIEN SHALE..... 221TGLC
TWELVEMILE CANYON MEMBER OF ARAPIEN SHALE..... 221TVMC
WINSOR FORMATION OF SAN RAFAEL GROUP..... 221WNSR
WESTWATER CANYON MEMBER OF MORRISON FORMATION..... 221WSRC

LOWER JURASSIC

NUGGET SANDSTONE..... 227NGGT

TRIASSIC

HOSKINNINI MEMBER OF MOENKOPI FORMATION..... 230HSKN
MOENKOPI FORMATION..... 230MNKP
TENDERFOOT MEMBER OF MOENKOPI FORMATION..... 230TDRF
TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

ANKAREH SHALE FORMATION OR RED BEDS..... 231ANKR
CHURCH ROCK MEMBER OF CHINLE FORMATION..... 231CCRK
CEDAR CITY TONGUE OF KAYENTA FORMATION..... 231CDRC
CHINLE FORMATION..... 231CHNL
DINOSAUR CANYON MEMBER OF MOENAVE FORMATION..... 231DSCR
DINOSAUR CANYON SANDSTONE MEMBER OF MOENAVE FORMATION..... 231DSRC
GARTRA MEMBER OF CHINLE FORMATION..... 231GRTR
KAYENTA FORMATION OF GLEN CANYON GROUP..... 231KYNT
MOSS BACK MEMBER OF CHINLE FORMATION..... 231MBCK
MONITOR BUTTE MEMBER OF CHINLE FORMATION..... 231MNRB
MOENAVE FORMATION OF GLEN CANYON GROUP..... 231MONV
PETRIFIED FOREST MEMBER OF CHINLE FORMATION..... 231PFDF
SHNABKAIB MEMBER OF MOENKOPI FORMATION..... 231SBKB
SPRINGDALE SANDSTONE MEMBER OF MOENAVE FORMATION..... 231SPGD
SHINARUMP MEMBER OF CHINLE FORMATION..... 231SRMP
SUICIDE GRIT OF ANKAREH FORMATION..... 231SUCD
TEMPLE MOUNTAIN MEMBER OF CHINLE FORMATION..... 231TMPM
WHITMORE POINT MEMBER OF MOENAVE FORMATION..... 231WMRP
WINGATE SANDSTONE OF GLEN CANYON GROUP..... 231WNGT

MIDDLE TRIASSIC

PARIOTT MEMBER OF MOENKOPI FORMATION..... 234PRTT
SEWEMUP MEMBER OF MOENKOPI FORMATION..... 234SWMP

LOWER TRIASSIC

AGATHLA SANDSTONE..... 237AGTL
ALI BABA MEMBER OF MOENKOPI FORMATION..... 237ALBB
DINWOODY FORMATION..... 237DNDY
HARRINGTON FORMATION..... 237HRNG
MAHOGANY FORMATION..... 237MGNY
SINBAD LIMESTONE MEMBER OF MOENKOPI FORMATION..... 237SNBD
TIMPOWEAP MEMBER OF MOENKOPI FORMATION..... 237TMPP
THAYNES LIMESTONE,FORMATION OR GROUP..... 237TYNS
VIRGIN LIMESTONE MEMBER OF MOENKOPI FORMATION..... 237VRGN
WOODSIDE FORMATION SILTSTONE OR RED BEDS..... 237WDSD

PALEOZOIC

DOVE CREEK FORMATION OR GROUP..... 300DVCK
PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

AUBREY GROUP(PERMIAN-PENNSYLVANIAN)..... 310ABRY
ARCTURUS LIMESTONE OR FORMATION..... 310ARCR
BIRD SPRING FORMATION(PERMIAN-PENNSYLVANIAN-MISSISSIPPIAN)..... 310BSPG
COCONINO SANDSTONE OF AUBREY GROUP..... 310CCNN
CEDAR MESA SANDSTONE MEMBER OF CUTLER FORMATION..... 310CDRM
CALLVILLE LIMESTONE(PERMIAN-PENNSYLVANIAN-MISSISSIPPIAN)..... 310CLVL
CUTLER FORMATION..... 310CTLR
DE CHELLY SANDSTONE MEMBER OF CUTLER FORMATION..... 310DCLL
DIAMOND CREEK SANDSTONE..... 310DMCK
GERSTER FORMATION OR LIMESTONE OF PARK CITY GROUP..... 310GRSR
HALGAITO TONGUE OR MEMBER OF CUTLER FORMATION..... 310HLGT
HERMIT SHALE OF AUBREY GROUP..... 310HRMT
INDIAN CANYON FORMATION OF PARK CITY GROUP..... 310INDC
KAIBAB LIMESTONE..... 310K16B
KIRKMAN LIMESTONE..... 310KRKM
LORAY FORMATION..... 310LORY
ORGAN ROCK TONGUE OR MEMBER OF CUTLER FORMATION..... 310OGRK
OQUIRRH GROUP (PERMIAN-PENNSYLVANIAN-MISSISSIPPIAN)..... 310OQRR
PAKOON LIMESTONE..... 310PKON
PLYMPTON FORMATION OF PARK CITY GROUP..... 310PLMP
PARK CITY FORMATION OR GROUP..... 310PRKC
PERMIAN SYSTEM..... 310PRMN
PHOSPHORIA FORMATION..... 310PSPR
RICO FORMATION(PERMIAN-UPPER PENNSYLVANIAN)..... 310RICO
RIEPE SPRING LIMESTONE..... 310RPSP
RIEPETOWN SANDSTONE..... 310RPTN
SUPAI FORMATION OF AUBREY GROUP(PERMIAN-PENNSYLVANIAN)..... 310SUPI
TOROWEAP FORMATION OF AUBREY GROUP..... 310TRWP
WEBER QUARTZITE OR SANDSTONE(PERMIAN-PENNSYLVANIAN)..... 310WEBR
WELLS FORMATION(PERMIAN-PENNSYLVANIAN)..... 310WLLS
WHITE RIM SANDSTONE MEMBER OF CUTLER FORMATION..... 310WTRM

LOWER PERMIAN

QUEANTOWEAP SANDSTONE..... 317QNTP

WOLFCAMPIAN

ELEPHANT CANYON FORMATION..... 319ELPC

PENNSYLVANIAN

ELEPHANT LIMESTONE..... 320ELPN
ELY LIMESTONE..... 320ELY
MANNING CANYON SHALE(PENNSYLVANIAN-MISSISSIPPIAN)..... 320MNGC
MOLAS FORMATION(PENNSYLVANIAN-MISSISSIPPIAN)..... 320MOLS
PENNSYLVANIAN SYSTEM..... 320PSLV
TILDEN LIMESTONE LENTIL..... 320TLDN
TALISMAN QUARTZITE..... 320TLSM

UPPER PENNSYLVANIAN

BINGHAM MINE FORMATION OF OQUIRRH GROUP..... 321BGMM
HONAKER TRAIL MEMBER OF HERMOSA FORMATION..... 321HKTL
KESSLER CANYON FORMATION OF OQUIRRH GROUP..... 321KLRC

MIDDLE PENNSYLVANIAN

ERDA FORMATION OF OQUIRRH GROUP..... 324ERDA
HOGAN FORMATION..... 324HOGN
HERMOSA FORMATION..... 324HRMS
MORGAN FORMATION..... 324MRGN
PARADOX MEMBER OF HERMOSA FORMATION..... 324PRDX

LOWER PENNSYLVANIAN

LAKE POINT LIMESTONE OF OQUIRRH GROUP..... 327LKPN
PINKERTON TRAIL LIMESTONE MEMBER OF HERMOSA FORMATION..... 327PKRT
WEST CANYON LIMESTONE OF OQUIRRH GROUP..... 327WSCN

MISSISSIPPIAN

BRAZER LIMESTONE OR DOLOMITE..... 330BRZR
DESERET LIMESTONE..... 330DSRT
LEADVILLE LIMESTONE..... 330LDVL
MADISON GROUP..... 330MDSN
MISSISSIPPIAN SYSTEM..... 330MSSP
REDWALL LIMESTONE..... 330RDLL
STANSBURY FORMATION(MISSISSIPPIAN-DEVONIAN)..... 330SSBR
TOPACHE LIMESTONE(MISSISSIPPIAN-DEVONIAN)..... 330TPCH

UPPER MISSISSIPPIAN

CHESTERFIELD RANGE GROUP..... 331CFDR
CHAINMAN SHALE..... 331CNMN
DOUGHNUT FORMATION..... 331DGNT
DIAMOND PEAK FORMATION..... 331DMPK
GREAT BLUE LIMESTONE OR FORMATION..... 331GRBL
GREEN RAVINE FORMATION..... 331GRRV
HUMBUG FORMATION..... 331HMBG
OCHRE MOUNTAIN LIMESTONE..... 331OCRM
WOODMAN FORMATION..... 331WDMN

LOWER MISSISSIPPIAN

FITCHVILLE FORMATION..... 337FCVL
GARDISON LIMESTONE..... 337GRDS
JOANA LIMESTONE..... 337JOAN
LODGEPOLE LIMESTONE OF MADISON GROUP..... 337LDGP
LEATHAM FORMATION..... 337LTHM
NARROW CANYON LIMESTONE(LOWER MISSISSIPPIAN-UPPER DEVONIAN)..... 337NRCN
PILOT SHALE(LOWER MISSISSIPPIAN-UPPER DEVONIAN)..... 337PLOT
PINYON PEAK LIMESTONE(LOWER MISSISSIPPIAN-UPPER DEVONIAN)..... 337PNPK

DEVONIAN

BLUEBELL DOLOMITE(DEVONIAN-SILURIAN-ORDOVICIAN)..... 340BLBL
DEVONIAN SYSTEM..... 340DVNN
KINGS CANYON DOLOMITE..... 340KGSC
RED WARRIOR LIMESTONE(DEVONIAN-SILURIAN-ORDOVICIAN)..... 340RDWR

UPPER DEVONIAN

ANETH FORMATION..... 341ANTH
BEIRDNEAU FORMATION..... 341BRDN
COVE FORT QUARTZITE..... 341CVFR
ENGELMANN FORMATION(UPPER-MIDDLE DEVONIAN)..... 341EGLM
ELBERT FORMATION..... 341ELBR
GUILMETTE FORMATION..... 341GLMT
GILSON DOLOMITE..... 341GLSN
GOSHOOT FORMATION..... 341GSHT
HANAUER FORMATION..... 341HNUR
HYRM DOLOMITE(UPPER-MIDDLE DEVONIAN)..... 341HYRM
JEFFERSON LIMESTONE,DOLOMITE OR FORMATION..... 341JFRS
MOWITZA SHALE..... 341MWTZ
OURAY LIMESTONE..... 341OURY
VICTORIA FORMATION..... 341VCTR

MIDDLE DEVONIAN

MUDDY PEAK LIMESTONE..... 344MDPK
SEVY DOLOMITE(LOWER DEVONIAN-UPPER SILURIAN)..... 344SEVY
SIMONSON DOLOMITE..... 344SMNS

SILURIAN

BEAVER LAKE DOLOMITE(SILURIAN-UPPER ORDOVICIAN)..... 350BVLK
DECATHON DOLOMITE..... 350DCTN
FLORIDE DOLOMITE..... 350FLRD
JACK VALLEY FORMATION..... 350JCKV
LIME MOUNTAIN DOLOMITE..... 350LMMN
LONE MOUNTAIN DOLOMITE..... 350LNMN
SILURIAN SYSTEM..... 350SLRN

MIDDLE SILURIAN

BELL HILL DOLOMITE..... 354BLHL
HARRISITE DOLOMITE..... 354HRST
LOST SHEEP DOLOMITE..... 354LSSP

ROBERTS MOUNTAIN FORMATION OR LIMESTONE..... 354RBRM
THURSDAY DOLOMITE..... 354TRSD

ORDOVICIAN

CHOKECHERRY DOLOMITE(ORDOVICIAN-UPPER CAMBRIAN)..... 360CKCR
GRAMPIAN LIMESTONE(ORDOVICIAN-CAMBRIAN)..... 360GRMP
HOUSE LIMESTONE OF POGONIP GROUP(ORDOVICIAN-CAMBRIAN)..... 360HOUS
ORDOVICIAN SYSTEM..... 360ODVC
POGONIP GROUP(ORDOVICIAN-CAMBRIAN)..... 360PGNP

UPPER ORDOVICIAN

EUREKA QUARTZITE..... 361EURK
FISH HAVEN DOLOMITE..... 361FSHV

MIDDLE ORDOVICIAN

GARDEN CITY FORMATION OR LIMESTONE(MIDDLE-LOWER ORDOVICIAN)..... 364GRDC
KANOSH SHALE OF POGONIP GROUP..... 364KNSH
LEHMAN FORMATION OF POGONIP GROUP..... 364LHMN
SWAN PEAK FORMATION..... 364SNPK

LOWER ORDOVICIAN

FILLMORE LIMESTONE OF POGONIP GROUP..... 367FLMR
JUAB LIMESTONE OF POGONIP GROUP..... 367JUAB
OPOHONGA LIMESTONE..... 367OPNG
WAHWAH LIMESTONE OF POGONIP GROUP..... 367WHWH

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR
MOREHOUSE QUARTZITE..... 370MRHS
PINE VALLEY QUARTZITE..... 370PNVL

UPPER CAMBRIAN

AJAX DOLOMITE..... 371AJAX
CORSET SPRING SHALE..... 371CSPG
DUNDERBURG SHALE..... 371DDBG
DUGWAY RIDGE DOLOMITE..... 371DGRG
FERA LIMESTONE..... 371FERA
HICKS FORMATION..... 371HCKS
LAMB DOLOMITE(UPPER-MIDDLE CAMBRIAN)..... 371LAMB
LODORE FORMATION OR SHALE..... 371LODR
LYNCH DOLOMITE(UPPER-MIDDLE CAMBRIAN)..... 371LYNC
NOTCH PEAK LIMESTONE..... 371NCPK
NOUNAN LIMESTONE(UPPER-MIDDLE CAMBRIAN)..... 371NUNN
OPEX FORMATION..... 371OPEX
ORR FORMATION..... 371ORR
ST CHARLES LIMESTONE..... 371SCRL
STRAIGHT CANYON FORMATION..... 371SRGC

MIDDLE CAMBRIAN

ABERCROMBIE FORMATION..... 374ABMB
BLACKSMITH DOLOMITE OR LIMESTONE..... 374BCKM
BLUEBIRD DOLOMITE..... 374BLBD
BLOOMINGTON FORMATION..... 374BLMG
BRIGHAM QUARTZITE(MIDDLE CAMBRIAN-UPPER PRECAMBRIAN)..... 374BRGM
BOWMAN LIMESTONE..... 374BWMN
COLE CANYON DOLOMITE..... 374CLCN
CHISHOLM SHALE..... 374CSLM
DAGMAR DOLOMITE..... 374DGMR
DOME LIMESTONE..... 374DOME
FANDANGLE LIMESTONE..... 374FDGL
HERKIMER LIMESTONE..... 374HRKM
HARTMANN LIMESTONE..... 374HRMN
HOWELL FORMATION..... 374HWLL
LYNDON LIMESTONE..... 374LNDN
LANGSTON LIMESTONE..... 374LNGS
MARJUM LIMESTONE..... 374MRJM
MAXFIELD LIMESTONE..... 374MXFD
OPHIR FORMATION OR SHALE..... 374OPHR
PIOCHE SHALE(MIDDLE-LOWER CAMBRIAN)..... 374POCH
SHADSCALE FORMATION..... 374SDCL
SWASEY FORMATION..... 374SWSY
TINTIC QUARTZITE(MIDDLE-LOWER CAMBRIAN)..... 374TNTC
TRAILER LIMESTONE..... 374TRLR
TRIPPE LIMESTONE..... 374TRPP
TEUTONIC LIMESTONE..... 374TTNC
UTE LIMESTONE..... 374UTE
WEEKS LIMESTONE(UPPER-MIDDLE CAMBRIAN)..... 374WEKS
WHEELER FORMATION..... 374WHLR
WHIRLWIND FORMATION..... 374WRLD
YOUNG PEAK DOLOMITE..... 374YGPK

LOWER CAMBRIAN

BUSBY QUARTZITE..... 377BSBY
CABIN SHALE..... 377CBIN
PROSPECT MOUNTAIN QUARTZITE(LOWER CAMBRIAN-UPPER PRECAMBRIAN)..... 377PPCM

PRECAMBRIAN

ALBION RANGE GROUP..... 400ABRG
AUTS CANYON FORMATION OF SHEEPROCK GROUP..... 400ASCN
BIG COTTONWOOD FORMATION..... 400BGCD
BALD MOUNTAIN FORMATION..... 400BLDM
GREEN CREEK COMPLEX..... 400CRCK
EKKER FORMATION OF SHEEPROCK GROUP..... 400EKKR
FARMINGTON CANYON COMPLEX..... 400FMGC
HORSE CANYON FORMATION..... 400HRSC
LITTLE WILLOW SERIES..... 400LLWL
MC COY CREEK GROUP..... 400MCCK
MINERAL FORK TILLITE..... 400MLFK
MUTUAL FORMATION..... 400MUTL
PRECAMBRIAN ERATHEM..... 400PCMB
RED CREEK QUARTZITE..... 400RDCK

RED PINE SHALE OF UINTA MOUNTAIN GROUP..... 400RDPN
SHEEPROCK GROUP OR SERIES..... 400SPCK
UINTA MOUNTAIN GROUP..... 400UNMN
WILDHORSE CANYON SERIES..... 400WLDC

VERMONT

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
BEACH DEPOSITS,MARINE AND NON-MARINE	111BECH
COLLUVIUM	111CLVM
EOLIAN DEPOSITS	111EOLN
FILL	111FILL
MARINE DEPOSITS	111MRIN
SEDIMENTS, UNDIFFERENTIATED	111SDMN
SWAMP DEPOSITS	111SWMP

PLEISTOCENE

DELTA DEPOSITS	112DELT
ICE-CONTACT DEPOSITS, INCLUDING ESKERS AND KAMES	112ICCC
LACUSTRINE DEPOSITS	112LCSR
MORAINE DEPOSITS,EXCEPT GROUND MORAINE AND DRUMLINS	112MORN
MARINE DEPOSITS	112MRIN
OUTWASH	112OTSH
STRATIFIED DEPOSITS, UNDIFFERENTIATED	112SRFD
TILL	112TILL

TERTIARY

SEDIMENTS,UNDIFFERENTIATED	120SDMS

MESOZOIC

CRYSTALLINE ROCKS	200CRSL

CRETACEOUS

SEDIMENTS,UNDIFFERENTIATED	210SDMS

TRIASSIC

IGNEOUS ROCKS,EXTRUSIVE	230IGNSE
IGNEOUS ROCKS,INTRUSIVE	230IGNSI
SEDIMENTARY ROCKS	230SDMR

UPPER TRIASSIC

EAST BERLIN FORMATION	231EBRL
HOLYOKE BASALT	231HLYK
HAMPDEN BASALT	231HMPD
NEW HAVEN FORMATION	231NHVN
PORTLAND FORMATION	231PRLD

PALEOZOIC

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 300CRSL
CRYSTALLINE ROCKS,NONCARBONATE..... 300CRSLN

PENNSYLVANIAN

CRYSTALLINE ROCKS..... 320CRSL
SEDIMENTARY ROCKS..... 320SDMR

MISSISSIPPIAN

CRYSTALLINE ROCKS..... 330CRSL
SEDIMENTARY ROCKS..... 330SDMR

DEVONIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 340CRSL
CRYSTALLINE ROCKS,CARBONATE..... 340CRSLN

SILURIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 350CRSL
CRYSTALLINE ROCKS,CARBONATE..... 350CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 350CRSLN

ORDOVICIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 360CRSL
CRYSTALLINE ROCKS,CARBONATE..... 360CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 360CRSLN

CAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 370CRSL
CRYSTALLINE ROCKS,CARBONATE..... 370CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 370CRSLN

PRECAMBRIAN

CRYSTALLINE ROCKS,UNDIFFERENTIATED..... 400CRSL
CRYSTALLINE ROCKS,CARBONATE..... 400CRSLC
CRYSTALLINE ROCKS,NONCARBONATE..... 400CRSLN

VIRGINIA

UNKNOWN

AMPHIBOLITE AND AMPHIBOLITE RICH FOLIATS..... 000AARF
COLUMBIA GRANITE..... 000CLMB
EVERONA LIMESTONE..... 000EVRN
GRANITE AND HORNBLEND GNEISS..... 000GHBG
GRANITE GNEISS..... 000GRGS
GRANITE..... 000GRNT
GREENSTONE VOLCANICS..... 000GVCC
HORNBLEND GABBRO AND GNEISS TALC..... 000HGGT
INTRUSIVE ROCKS..... 000IRSV
LIMESTONE AND MARBLE..... 000LMMB
METAMORPHOSED SEDIMENTARY ROCKS..... 000MMPS
METAMORPHOSED VOLCANIC AND SEDIMENTARY ROCKS..... 000MPVS
QUARTZ DIORITE..... 000QRZD

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

DISMAL SWAMP PEAT..... 111DMMP
HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

BACONS CASTLE FORMATION..... 112BCCL
COLUMBIA GROUP..... 112CLMB
GREAT BRIDGE FORMATION..... 112GBDG
KEMPSVILLE FORMATION..... 112KPVL
LONDONBRIDGE FORMATION..... 112LDBG
MOORINGS UNIT..... 112MORG
NORFOLK FORMATION..... 112NFLK
PLEISTOCENE SERIES..... 112PLSC
SANDBRIDGE FORMATION..... 112SDBG
SEDLEY FORMATION..... 112SDLY
WINDSOR FORMATION..... 112WDSR

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

PLIOCENE-MIOCENE SERIES..... 121PCMC
PLIOCENE SERIES..... 121PLCN

MIOCENE

CALVERT FORMATION..... 122CLVR
CHOPTANK FORMATION..... 122CPNK
CHESAPEAKE GROUP..... 122CSPK
MIOCENE SERIES..... 122MOCN
ST MARYS FORMATION..... 122SMRS
YORKTOWN FORMATION..... 122YRKN

OLIGOCENE

OLIGOCENE SERIES..... 123OLGC

EOCENE

CHICKAHOMINY FORMATION..... 124CCKM
EOCENE-PALEOCENE SERIES..... 124ECPC
EOCENE SERIES..... 124EOCN
MARLBORO CLAY..... 124MRLB
NANJEMOY FORMATION..... 124NNJM
PAMUNKEY GROUP..... 124PMNK

PALEOCENE

AQUIA FORMATION..... 125AQUI
MATTAPONI FORMATION..... 125MTPN
PALEOCENE SERIES..... 125PLCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL
PATAPSCO FORMATION..... 217PPSC
POTOMAC GROUP..... 217PTMC
PATUXENT FORMATION..... 217PTXN

JURASSIC

JURASSIC SYSTEM..... 220JRSC

TRIASSIC

CEDAR FOREST FORMATION..... 230CDRF
DRY FORK FORMATION..... 230DRFK
IGNEOUS ROCKS..... 230IGNS

LEAKSVILLE FORMATION..... 230LKVL
TRIASSIC SYSTEM..... 230TRSC

UPPER TRIASSIC

BALLS BLUFF FORMATION..... 231BLBF
BULL RUN FORMATION..... 231BLRN
MANASSAS FORMATION..... 231MNSS
NEWARK GROUP..... 231NWRK
OTTERDALE SANDSTONE..... 231ORDL
UPPER TRIASSIC SERIES..... 231TRSCU
VINTA FORMATION..... 231VINT

PALEOZOIC

ARCH MARBLE..... 300ARCH
BIG VALLEY FORMATION..... 300BGVL
COCKEYSVILLE MARBLE..... 300CCKV
CANDLER FORMATION..... 300CDLR
CHOPAWAMSIC FORMATION..... 300CPMC
EVINGTON GROUP..... 300EVNG
JOSHUA SCHIST..... 300JSHU
MOUNT ATHOS FORMATION..... 300MNAS
PELIER SCHIST..... 300PLIR
PALEOZOIC ERATHEM..... 300PLZC
PETERSBURG GRANITE..... 300PRBG
PALEOZOIC-PRECAMBRIAN ERATHEMS..... 300PZPB
STONEY GAP SANDSTONE MEMBER OF HINTON FORMATION..... 300SNGP
SLIPPERY CREEK GREENSTONE..... 300SPCK
WISSAHICKON SCHIST..... 300WSCK

PERMIAN

PERMIAN SYSTEM..... 310PRMN

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

MIDDLE PENNSYLVANIAN

GLADEVILLE SANDSTONE AND NORTON FORMATION..... 324GDVN
GLADEVILLE SANDSTONE..... 324GLDV
HARLAN GROUP..... 324HRLN
NORTON FORMATION..... 324NRTN
PETERSBURG FORMATION..... 324PRBG
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM
WISE FORMATION..... 324WISE

LOWER PENNSYLVANIAN

LEE FORMATION..... 327LEE
LOWER PENNSYLVANIAN SERIES..... 327PSLVL

MISSISSIPPIAN

COVE CREEK LIMESTONE..... 330CVCK
GRAINGER FORMATION..... 330GRGR
MACCRADY SHALE..... 330MCCD
MAC CRADY AND PRICE FORMATION..... 330MCCP
MISSISSIPPIAN SYSTEM..... 330MSSP
NEWMAN LIMESTONE..... 330NWMN
PRICE FORMATION..... 330PRIC

UPPER MISSISSIPPIAN

BLUEFIELD FORMATION AND GREENBRIER LIMESTONE..... 331BFGB
BLUEFIELD FORMATION..... 331BLFD
BLUESTONE AND PRINSTON FORMATIONS..... 331BLPR
BLUESTONE FORMATION..... 331BLSN
FIDO SANDSTONE..... 331FIDO
GREENBRIER LIMESTONE..... 331GRBR
HINTON FORMATION..... 331HNTN
LITTLE VALLEY LIMESTONE..... 331LLVL
MISSISSIPPIAN, UPPER..... 331MSSPU
PENNINGTON GROUP..... 331PNNG
PRINSTON FORMATION..... 331PRNS

LOWER MISSISSIPPIAN

MISSISSIPPIAN-DEVONIAN SYSTEM..... 337MPDV
MISSISSIPPIAN, LOWER..... 337MSSPL
POCONO FORMATION..... 337POCN

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN
HUNTERVILLE CHERT..... 340HRVL

UPPER DEVONIAN

BRALLIER FORMATION..... 341BRLR
CHEMUNG FORMATION..... 341CMNG
DEVONIAN, UPPER..... 341DVNNU
GENESEE FORMATION..... 341GENS
HAMPSHIRE FORMATION..... 341HMPR
MILLBORO SHALE..... 341MLBR

MIDDLE DEVONIAN

MIDDLE-LOWER DEVONIAN SERIES..... 344DVNML
DEVONIAN, MIDDLE..... 344DVNNM
HAMILTON FORMATION..... 344HMLN
MARCELLUS SHALE..... 344MRCL
NEEDMORE SHALE..... 344NDMR
ONONDAGA LIMESTONE..... 344ONDG

LOWER DEVONIAN

BECRAFT LIMESTONE..... 347BCRF

COEYMANS LIMESTONE..... 347CMNS
DEVONIAN, LOWER..... 347DVNNL
DEVONIAN-SILURIAN SYSTEMS..... 347DVSL
HELDERBERG GROUP..... 347HDBG
KEYSER LIMESTONE..... 347KYSR
LICKING CREEK LIMESTONE..... 347LKCK
NEW SCOTLAND LIMESTONE..... 347NSCD
RIDGLEY SANDSTONE..... 347RDGL

SILURIAN

SILURIAN SYSTEM..... 350SLRN
SILURIAN-ORDOVICIAN SYSTEMS..... 350SOVC

UPPER SILURIAN

SILURIAN, UPPER..... 351SLRNU
TONOLOWAY LIMESTONE..... 351TNLY
WILLS CREEK FORMATION..... 351WLCK

CAYUGAN

BLOOMSBURG FORMATION..... 352BMBG
CAYUGA GROUP..... 352CYUG
HANCOCK DOLOMITE..... 352HCCK

MIDDLE SILURIAN

CLINCH SANDSTONE..... 354CLNC
CLINTON FORMATION..... 354CLNN
CLINTON AND TUSCARORA FORMATIONS..... 354CLTC
MC KENZIE FORMATION..... 354MCKZ
MASSANUTTEN SANDSTONE..... 354MSNN
SILURIAN, MIDDLE..... 354SLRNM

LOWER SILURIAN

SILURIAN, LOWER..... 357SLRNL
TUSCARORA SANDSTONE..... 357TCRR

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

ARVONIA FORMATION..... 361ARVN
JUNIATA FORMATION..... 361JUNT
MARTINSBURG SHALE..... 361MRBG
ORDOVICIAN, UPPER..... 361ODVCU
UPPER-MIDDLE ORDOVICIAN SERIES..... 361ODVUM
OSWEGO SANDSTONE..... 361OSWG
QUANTICO SLATE..... 361QNTC
SEQUATCHIE FORMATION..... 361SQTC

MIDDLE ORDOVICIAN

BLACKFORD FORMATION..... 364BCKF
BENBOLT LIMESTONE..... 364BNBL
BEN HUR LIMESTONE..... 364BNHR
BOWEN LIMESTONE..... 364BOWN
COLLIERSTOWN LIMESTONE..... 364CLRS
DOT LIMESTONE..... 364DOT
EDINBURG FORMATION..... 364EDBG
EFFNA LIMESTONE..... 364EFFN
EGGLESTON FORMATION..... 364EGLS
ELWAY LIMESTONE..... 364ELWY
FIVE OAK LIMESTONE..... 364FVOK
GRATTON LIMESTONE..... 364GRTN
HURRICANE BRIDGE LIMESTONE..... 364HCBG
HARDY CREEK LIMESTONE..... 364HDCK
LINCOLNSHIRE FORMATION..... 364LCLR
LURICH FORMATION..... 364LRCH
MC GLONE FORMATION..... 364MCGL
MOCCASIN FORMATION..... 364MCSN
MARTIN CREEK LIMESTONE..... 364MRCK
NEW MARKET LIMESTONE..... 364NMRK
ORDOVICIAN, MIDDLE..... 364ODVCM
ORANDA FORMATION..... 364ORND
POTEET FORMATION..... 364POTT
ROB CAMP LIMESTONE..... 364RBCP
ROCKDELL LIMESTONE..... 364RCKD
RYE COVE FORMATION..... 364RYCV
TRENTON LIMESTONE..... 364TRNN
WOODWAY LIMESTONE..... 364WDWY
WHISTLECREEK LIMESTONE..... 364WLCK
WARDELL LIMESTONE..... 364WRDL
WITTEN LIMESTONE..... 364WTTN

LOWER ORDOVICIAN

BEEKMANTOWN AND CHEPULTEPEC FORMATIONS..... 367BKCP
BEEKMANTOWN GROUP..... 367BKMN
BELLEFONTE FORMATION..... 367BLFN
CHEPULTEPEC DOLOMITE..... 367CPPC
KNOX DOLOMITE..... 367KNOX
MASCOT,KINGSPORT AND LONGVIEW FORMATIONS..... 367MKLV
NITTANY FORMATION..... 367NTTN
ORDOVICIAN, LOWER..... 367ODVCL
ORDOVICIAN-CAMBRIAN SYSTEMS..... 367OVCB

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR
COANSAUGA GROUP..... 370CNSG

UPPER CAMBRIAN

UPPER CAMBRIAN SERIES..... 371CBBRU
CONOCOCHEAGUE FORMATION..... 371CCCG
CONOCOCHEAGUE GROUP..... 371CCCGC

CAMBRIAN, UPPER..... 371CMBRU
CONASAUGA GROUP..... 371CNSG
COPPER RIDGE DOLOMITE..... 371CPRG
ELBROOK FORMATION..... 371ELBK
MAYNARDVILLE FORMATION..... 371MDVL
NOLICHUCKY SHALE..... 371NCCK

MIDDLE CAMBRIAN

CAMBRIAN, MIDDLE..... 374CMBRM
HONAKER DOLOMITE..... 374HNKR
MARYVILLE LIMESTONE..... 374MRVL
PUMPKIN VALLEY SHALE..... 374PPKV
ROGERSVILLE SHALE..... 374RGVL
RUTLEDGE LIMESTONE..... 374RLDG

LOWER CAMBRIAN

CHILHOWEE GROUP..... 377CHLH
LOWER CAMBRIAN SERIES..... 377CMBRL
ERWIN FORMATION..... 377ERWN
FREDERICK LIMESTONE..... 377FDCK
HAMPTON SHALE OR FORMATION..... 377HMPN
LOUDOUN FORMATION..... 377LUDN
ROME FORMATION..... 377ROME
SHADY FORMATION..... 377SHDY
UNICOI FORMATION..... 377UNCO
WEVERTON FORMATION..... 377WVRN

PRECAMBRIAN

ALUM PHILLITE..... 400ALUM
BEAVERDAM CREEK AUGEN GNEISS..... 400BVCK
CHARLOTTESVILLE FORMATION..... 400CLVL
COMERS GRANITE GNEISS..... 400CMRS
CARSONVILLE GRANITE..... 400CRVL
CATOCTIN FORMATION..... 400CTCN
CATTRON GNEISS..... 400CTRN
GRANITE GNEISS..... 400GRGS
GRAYSON GRANODIORITE GNEISS..... 400GRSN
LYNCHBURG FORMATION..... 400LCBG
LEATHERWOOD GRANITE..... 400LTRD
LOVINGSTON FORMATION..... 400LVGS
MELROSE GRANITE..... 400MLRS
MECHUMS RIVER FORMATION..... 400MMRV
MONETA GNEISS..... 400MONT
MOUNT ROGERS VOLCANIC GROUP..... 400MRGR
MARSHALL FORMATION..... 400MRHL
OLD RAG FORMATION..... 400ODRG
PRECAMBRIAN ERATHEM..... 400PCMB
PEDLAR FORMATION..... 400PDLR
ROBERTSON RIVER FORMATION..... 400RBRV
ROCKFISH CONGLOMERATE..... 400RCKF
REDOAK GRANITE..... 400RDOK
ROSELAND ANORTHOSITE..... 400RSLD
SADDLE GNEISS..... 400SDDL

SWIFT RUN FORMATION..... 400SFRN
SHOAL GNEISS..... 400SHOL
SHELTON GRANITE GNEISS..... 400SLTN
STRIPED ROCK GRANITE..... 400SPRK
VIRGINIA BLUERIDGE COMPLEX..... 400VGBG
VIRGILINA GROUP..... 400VRGL
WILLIS PHYLLITE..... 400WLLS

UNKNOWN

HAWKINS FORMATION..... 000HKNS
LEECHER METAMORPHICS..... 000LCHR
MOUNT STUART GRANODIORITE..... 000MNSR
METHOW GNEISS..... 000MTHW
NEWAUKUM SERIES..... 000NWKM
ORCAS GROUP..... 000ORCS
PESHASTIN FORMATION..... 000PSSN
SHEEP CREEK CONGLOMERATE..... 000SPCK
TURTLEBACK COMPLEX..... 000TLBK

CENOZOIC

GRAVEL OF WALLA WALLA,OLDER..... 100GVWWO

QUATERNARY

QUATERNARY ALLUVIUM..... 110ALVM
BASALT..... 110BSLT
COLLUVIUM..... 110CLVM
DOGS HEAD ANDESITES..... 110DGHD
DRUMHELLER SILTS..... 110DRML
DUNE SAND..... 110DUNE
GLACIER PEAK VOLCANICS..... 110GCPK
GOAT ROCK PYROCLASTIC DEPOSITS..... 110GRCK
MOUNT BAKER LAVA..... 110MBKR
MOUNT RAINIER LAVAS..... 110MNRR
MOUNT ST HELENS LAVAS..... 110MSHS

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
COLWOOD FORMATION..... 111CLWD
DUNE SAND..... 111DUNE
ELECTRON MUDFLOW..... 111ELCR
OSCEOLA MUDFLOW..... 111OSCL

PLEISTOCENE

ADMIRALTY DRIFT OR CLAY..... 112ADML
ALLUVIUM..... 112ALVM
ARLINGTON GRAVEL MEMBER OF VASHON DRIFT..... 112ARLG
BORING LAVA..... 112BRNG
COLVOS SAND..... 112CLVS
CARSON LAVA..... 112CRSN
COWICHE GRAVEL..... 112CWCH
ESPERANCE SAND MEMBER OF VASHON DRIFT..... 112EPRC
EVANS CREEK DRIFT OF FRASER GLACIATION..... 112EVCK
EVERSON INTERSTADE OF FRASER GLACIATION..... 112EVRS
FLUVIOLACUSTRINE DEPOSITS..... 112FLVC
GALE SAND..... 112GALE
GLACIO-FLUVIATILE..... 112GLCV
KITSAP FORMATION..... 112KTSP

LACUSTRINE DEPOSITS..... 112LCSR
LOGAN HILL FORMATION..... 112LGHL
LILY CREEK FORMATION..... 112LLCK
LAWTON CLAY MEMBER OF VASHON DRIFT..... 112LWTN
MIDLAND SAND..... 112MDLD
MOUNT RAINIER VOLCANICS..... 112MNRR
MARINE DEPOSITS..... 112MRIN
MARYSVILLE SAND MEMBER OF VASHON DRIFT..... 112MRVL
NESPELEM SILT..... 112NPLM
OKANOGAN TILL..... 112OKNG
ORTING DRIFT OR GLACIATION..... 112ORNG
PILCHUCK CLAY MEMBER OF VASHON DRIFT..... 112PCCK
PUYALLUP FORMATION OR INTERGLACIATION..... 112PLLP
PALOUSE FORMATION..... 112PLUS
QUEETS BEDS..... 112QUTS
RINGOLD FORMATION..... 112RGLD
SCABLAND FLOOD DEPOSITS..... 112SCBD
SKOKOMISH GRAVEL..... 112SKKM
STEILACOOM GRAVEL..... 112SLCM
STILLAGUAMISH SAND MEMBER OF VASHON DRIFT..... 112SLGM
SALMON SPRINGS DRIFT..... 112SSPG
STUCK DRIFT..... 112STCK
SATSOP FORMATION..... 112STSP
SUMAS DRIFT OF FRASER GLACIATION..... 112SUMS
TOUCHET BEDS..... 112TCHT
TIFLIS MEMBER OF WAHLUKE FORMATION..... 112TFLS
TAHOLAH FORMATION..... 112THLH
TILL..... 112TILL
TROUT HILL LAVA FLOWS..... 112TRHL
TERRACE DEPOSITS..... 112TRRC
TIETON ANDESITE..... 112TTON
VASHON DRIFT OF FRASER GLACIATION..... 112VSHN
WINGATE HILL DRIFT..... 112WGHL
WAHLUKE FORMATION..... 112WHLK
WILLAPA CLAYS..... 112WLLP

TERTIARY

CAMAS BASALT..... 120CAMS
CATHEDRAL GRANITE..... 120CDRL
CLOUDY PASS DIORITE..... 120CLDP
KRUGER ALKALINE SYENITES..... 120KRGR
PHALEN LAKE VOLCANICS..... 120PLLK
PALMER VOLCANICS..... 120PLMR
ROSSLAND GROUP..... 120RSLD
SOLEDUCK FORMATION..... 120SDCK
SHEPPARD GRANITE..... 120SPRD
TIGER FORMATION..... 120TIGR
TWIN SISTERS DUNITE..... 120TSSR
UNDERWOOD LAVA..... 120UDRD

PLIOCENE

BEVERLY MEMBER OF ELLENSBURG FORMATION..... 121BVRL
COLUMBIA RIVER GROUP OR BASALT..... 121CBRV
ELLENSBURG FORMATION..... 121ELBG

ELEPHANT MOUNTAIN FLOW..... 121ELPM
HARO FORMATION..... 121HARO
HOKO FORMATION..... 121HOKO
HOWSON ANDESITE..... 121HWSN
MONTESANO FORMATION..... 121MNSN
QUILLAYUTE FORMATION..... 121QLLT
QUINAULT FORMATION..... 121QNLT
RAFT RIVER FORMATION..... 121RFRV
SADDLE MOUNTAINS MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP..... 121SDLM
SELAH TUFF MEMBER OF ELLENSBURG FORMATION..... 121SELH
SUGARLOAF ANDESITE..... 121SGLF
SELAH BUTTE FLOW..... 121SLBT
SUMMIT CONGLOMERATE..... 121SMMT
SNIPES CONGLOMERATES..... 121SNPS
SNOQUALMIE GRANODIORITE..... 121SQLM
TROUTDALE FORMATION..... 121TRDL
UNDERWOOD MOUNTAIN LAVA..... 121UDDM
YAKIMA BASALT OF COLUMBIA GROUP..... 121YKIM

MIOCENE

BROWNS POINT FORMATION..... 122BRNP
CLALLAM FORMATION..... 122CLLM
DOUGLAS CANYON FORMATION..... 122DGLC
EAGLE CREEK FORMATION..... 122EGCK
ENUMCLAW VOLCANIC SERIES..... 122EMCL
FIFES PEAK FORMATION..... 122FFPK
FRENCHMAN SPRINGS MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP..... 122FSPG
HAMMER BLUFF FORMATION..... 122HMBF
HOH FORMATION..... 122HOH
HOWARD ARKOSE..... 122HWRD
LATAH FORMATION..... 122LATH
LINCOLN CREEK FORMATION..... 122LCCK
LAKE VANTAGE LAVAS..... 122LKVG
MASHEL FORMATION..... 122MSHL
ORCHARD POINT CONGLOMERATE OF BLAKELEY FORMATION..... 122OCDP
PICTURE GORGE BASALT OF COLUMBIA RIVER GROUP..... 122PCGG
PEND OREILLE VALLEY ANDESITE..... 122PDOV
PRIEST RAPIDS MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP..... 122PRPD
QUINCY DIATOMITE BED OF PRIEST RAPIDS MBR OF YAKIMA BASALT..... 122QNCY
ROZA MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP..... 122ROZA
RESTORATION POINT MEMBER OF BLAKELEY FORMATION..... 122RSRP
SKAMANIA VOLCANIC SERIES..... 122SKMN
SILVER STAR GRANODIORITE..... 122SLVS
SQUAW CREEK DIATOMITE BED OF FRENCHMAN SPRINGS MBR OF YAKIMA BASALT... 122SQCK
STEVES RIDGE FORMATION..... 122SVRG
TANEUM ANDESITE..... 122TNUM
VANTAGE SANDSTONE MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP..... 122VNTG
WEST INDEX ANDESITIC SERIES..... 122WIDX

OLIGOCENE

BLAKELEY FORMATION..... 123BLKL
GEROME VOLCANICS..... 123GROM
GRIES RANCH FORMATION..... 123GRRC
KLONDIKE MOUNTAIN FORMATION..... 123KDKM

LINCOLN FORMATION..... 123LNCL
MARROWSTONE SHALE..... 123MRSN
OHANAPECOSH FORMATION..... 123OPCS
PORTER SHALE..... 123PRTR
PUGET GROUP..... 123PUGT
QUIMPER SANDSTONE..... 123QMPR
RENTON FORMATION OF PUGET GROUP..... 123RNTN
RESTORATION POINT HORIZON..... 123RSRP
SKATE CREEK LAHARIC BRECCIA..... 123SKCK
SEATTLE FORMATION..... 123STTL
TUKWILA FORMATION OF PUGET GROUP..... 123TKWL
TOM THUMB TUFF MEMBER OF KLONDIKE MOUNTAIN FORMATION..... 123TMTB
TOWNSEND SHALE..... 123TNSD
TWIN RIVER FORMATION..... 123TRVR
TOUTLE FORMATION..... 123TUTL
WAHKIAKUM FORMATION..... 123WKKM

EOCENE

BELLINGHAM BEDS..... 124BLGM
BOUNDARY SHALE..... 124BNDR
BAYNE SERIES..... 124BYNE
CARBON RIVER COAL SERIES..... 124CBRV
CHUCKANUT FORMATION..... 124CCKN
CHEHALIS SANDSTONE..... 124CHLS
COWLITZ FORMATION..... 124CLTZ
CARBONADO FORMATION OF PUGET GROUP..... 124CRBD
CRESCENT FORMATION..... 124CRSC
EVANS CREEK COAL SERIES..... 124EVCK
FAIRFAX COAL BEARING ROCKS..... 124FRFX
FRANKLIN SANDSTONE..... 124FRKL
FRANKLIN SERIES..... 124FRKLS
GUYE FORMATION..... 124GUYE
KNOB HILL ANDESTIE..... 124KBHL
KACHESS RHYOLITE..... 124KCSS
KUMMER SERIES..... 124KMMR
KUMMER FORMATION..... 124KMMRF
LYRE FORMATION..... 124LYRE
MC INTOSH FORMATION..... 124MCIS
METCHOSIN VOLCANIC SERIES..... 124MCSN
MELMONT COAL BEARING ROCKS..... 124MLMN
MANASTASH FORMATION..... 124MNSS
NACHES FORMATION..... 124NCHS
NORTHCRAFT FORMATION OF PUGET GROUP..... 124NRCF
NATAPOC FORMATION..... 124NTPC
OBRIEN CREEK FORMATION..... 124OBCK
OLEQUA FORMATION..... 124OLQU
OLEQUA CREEK MEMBER OF COWLITZ FORMATION..... 124OQCK
PE ELL VOLCANICS MEMBER OF COWLITZ FORMATION..... 124PELL
PIPESTONE CANYON FORMATION..... 124PPNC
PUYER FORMATION..... 124PUYR
RAGING RIVER FORMATION..... 124RGRV
ROSLYN FORMATION..... 124RSLN
SCATTER CREEK RHYODACITE OR FORMATION..... 124SCCK
SKOOKUMCHUCK FORMATION..... 124SKKK
STILLWATER CREEK MEMBER OF COWLITZ FORMATION..... 124SLCK

SANPOIL VOLCANICS..... 124SNPL
SPIKETON FORMATION OF PUGET GROUP..... 124SPKN
SOUTH PRAIRIE FORMATION..... 124SPRR
SUMAS SHALE IN CHUCKANUT FORMATION..... 124SUMS
SWAUK FORMATION..... 124SWUK
TIGER MOUNTAIN FORMATION OF PUGET GROUP..... 124TGRM
TEANAWAY BASALT..... 124TNWY
WILKESON COAL SERIES..... 124WLKS

PALEOCENE

EAGLE GREENSCHIST..... 125EGLE
EASTON SCHIST..... 125ESTN

MESOZOIC

JUMBO VOLCANICS..... 200JUMB
KRUGER MOUNTAIN MALIGNITE..... 200KRGM
OSOYOOS GRANODIORITE..... 200OSYS
WHISKEY MOUNTAIN GRANODIORITE..... 200WSKM

CRETACEOUS

BOGACHIEL FORMATION..... 210BGCL
CLE ELUM FORMATION..... 210CLEM
LEECH RIVER GROUP..... 210LCRV
LOON LAKE GRANITE..... 210LNLK
VIRGINIAN RIDGE FORMATION..... 210VGRG

UPPER CRETACEOUS

MIDNIGHT PEAK FORMATION..... 211MGPK
WINTHROP SANDSTONE..... 211WNRP

LOWER CRETACEOUS

PASAYTEN FORMATION..... 217PSTN
SPIEDEN FORMATION..... 217SPDN

JURASSIC

EAGLE CLIFF PORPHYRITE..... 220EGCF
INDEX GRANODIORITE..... 2201NDX
NEWBY FORMATION..... 220NWBY
REMMEL GRANODIORITE..... 220RMML
TYE GRANITE..... 220TYE

UPPER JURASSIC

CHELAN GRANODIORITE..... 221CHLN
METEOR GRANODIORITE..... 221MTOR
SHUKSAN FORMATION..... 221SKSN

TRIASSIC

VENTURA FORMATION..... 230VNTR

COVADA GROUP..... 230COVD
FIDALGO FORMATION..... 230FDLG
VENTURA FORMATION..... 230VNTR

PALEOZOIC

CLUGSTON LIMESTONE..... 300CLGS
DEER LAKE ARGILLITE..... 300DRLK
EAGLE MOUNTAIN QUARTZITE..... 300EGLM
FISH CREEK ARGILLITE..... 300FCRK
LEAD POINT ARGILLITE..... 300LDPN
SAN JUAN SERIES..... 300SNJN

PERMIAN

GRANITE FALLS LIMESTONE..... 310GRFL

PENNSYLVANIAN

CHOPAKA BASIC INTRUSIVES..... 320CHPKB
CHOPAKA SCHIST..... 320CHPKS
GUNN PEAK FORMATION..... 320GNPK
HOZOMEEN SERIES..... 320HZMN
KRUGER SCHIST..... 320KRGR

MISSISSIPPIAN

COLVILLE QUARTZITE..... 330CLVL

UPPER MISSISSIPPIAN

CHEWELAH ARGILLITE..... 331CHLH

SILURIAN

STEVENS SERIES..... 350SVNS

ORDOVICIAN

LEDBETTER SLATE..... 360LDBR
MALONEY METAMORPHIC SERIES..... 360MLNY

CAMBRIAN

BUCKSKIN SCHIST..... 370BCKK
BOUNDARY ARGILLITE..... 370BNDR
CEDAR CREEK ARGILLITE..... 370CDCK
CHIWAUKUM SCHIST..... 370CHKM
DEEP LAKE ARGILLITE..... 370DPLK
FERNOW GNEISS..... 370FRNW
GYPSY QUARTZITE..... 370GYPS
REEVES LIMESTONE MEMBER OF MAITLEN PHYLLITE..... 370REVS
SWAKANE BIOTITE GNEISS..... 370SWKN
TONGA FORMATION..... 370TONG

MIDDLE CAMBRIAN

MISSION ARGILLITE..... 374MSSN
METALINE LIMESTONE OR FORMATION..... 374MTLN
NORTHPORT LIMESTONE..... 374NRPR
REPUBLICAN CREEK LIMESTONE..... 374RBCK
RED TOP LIMESTONE..... 374RDTP

LOWER CAMBRIAN

ADDY QUARTZITE..... 377ADDY
MAITLEN PHYLLITE..... 377MTLN
OLD DOMINION LIMESTONE..... 377ODDM

PRECAMBRIAN

BEAD LAKE FORMATION..... 400BDLK
BUFFALO HUMP FORMATION OF DEER TRAIL GROUP..... 400BFHP
DEER TRAIL GROUP..... 400DRTL
EDNA DOLOMITE OF DEER TRAIL GROUP..... 400EDNA
HUCKLEBERRY FORMATION..... 400HCKB
LEOLA VOLCANICS..... 400LEOL
MC HALE SLATE OF DEER TRAIL GROUP..... 400MCHL
MOON HILL QUARTZITE MEMBER OF SKOOKUM FORMATION..... 400MNHL
MARTIN RIDGE SCHIST..... 400MRDG
MARSHALL DIORITE..... 400MRSL
NO NAME ARGILLITE..... 400NONM
NEWPORT GROUP..... 400NPRT
ORIENT GNEISS..... 400ORNT
RIBBON GNEISS..... 400RBBN
SHEDROOF CONGLOMERATE..... 400SDRF
SKOOKUM FORMATION..... 400SKKM
STENSGAR DOLOMITE OF DEER TRAIL GROUP..... 400SSGR
TOGO FORMATION OF DEER TRAIL GROUP..... 400TOGO

WEST VIRGINIA

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

TRIASSIC

INTRUSIVE ROCKS..... 2301RSV
TRIASSIC SYSTEM..... 230TRSC

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

PERMIAN SYSTEM..... 310PRMN

LOWER PERMIAN

DUNKARD GROUP..... 317DKRD
LOWER PERMIAN SERIES..... 317PRMNL

PENNSYLVANIAN

PENNSYLVANIAN SYSTEM..... 320PSLV

UPPER PENNSYLVANIAN

CONEMAUGH FORMATION..... 321CNMG
MONONGAHELA FORMATION..... 321MNGL
UPPER PENNSYLVANIAN SERIES..... 321PSLVU

MIDDLE PENNSYLVANIAN

ALLEGHENY FORMATION..... 324ALGN
MIDDLE PENNSYLVANIAN SERIES..... 324PSLVM

LOWER PENNSYLVANIAN

KANAWHA FORMATION..... 327KNWH
NEW RIVER FORMATION..... 327NEWR

LOWER PENNSYLVANIAN SERIES..... 327PSLVL
POTTSVILLE FORMATION..... 327PSVL

MISSISSIPPIAN

MISSISSIPPIAN SYSTEM..... 330MSSP

UPPER MISSISSIPPIAN

MAUCH CHUNK FORMATION..... 331MCCK
MISSISSIPPIAN, UPPER..... 331MSSPU

GREENBRIER LIMESTONE..... 334GRBR

LOWER MISSISSIPPIAN

MACCRADY SHALE..... 337MCCD
MISSISSIPPIAN, LOWER..... 337MSSPL
POCONO FORMATION..... 337POCN

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

UPPER-MIDDLE DEVONIAN SERIES..... 341DVNUM
MARCELLUS SHALE..... 341MRCL

MIDDLE DEVONIAN

HUNTERSVILLE CHERT..... 344HUNT
MAHANTANGO AND MARCELLUS FORMATIONS..... 344MNMR
NEEDMORE AND HUNTERSVILLE AND ONONDAGA AND ONESQUETHAW FORMATIONS..... 344NHNN
ONONDAGA LIMESTONE..... 344ONDG
ONESQUETHAW FORMATION..... 344SQTW

LOWER DEVONIAN

DEVONIAN, LOWER..... 347DVNNL
HELDERBERG GROUP..... 347HDBG
NEW CREEK FORMATION..... 347NWCK
ORISKANY FORMATION..... 347ORSK

SILURIAN

SILURIAN SYSTEM..... 350SLRN

UPPER SILURIAN

SILURIAN, UPPER..... 351SLRNU
TONOLOWAY LIMESTONE..... 351TNLY
TONOLOWAY AND WILLS CREEK FORMATIONS..... 351TNWL
WILLS CREEK SHALE..... 351WLCK
WILLIAMSPORT SANDSTONE..... 351WLMP

MIDDLE SILURIAN

CLINTON FORMATION..... 354CLNN
MC KENZIE FORMATION..... 354MCKZ
ROCHESTER AND KEEFER AND ROSE HILL FORMATIONS..... 354RKRH
SILURIAN, MIDDLE..... 354SLRNM

LOWER SILURIAN

SILURIAN, LOWER..... 357SLRNL
TUSCARORA SANDSTONE..... 357TCRR

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

JUNIATA AND OSWEGO..... 361JOSG
MARTINSBURG SHALE..... 361MRBG
ORDOVICIAN, UPPER..... 361ODVCU

MIDDLE ORDOVICIAN

ORDOVICIAN, MIDDLE..... 364ODVCM
ST PAUL GROUP..... 364STPL
TRENTON GROUP..... 364TRNN

CHAMPLAINIAN

BLACK RIVER FORMATION..... 365BKRV

LOWER ORDOVICIAN

BEEKMANTOWN GROUP..... 367BKMN
KNOX DOLOMITE..... 367KNOX
ORDOVICIAN, LOWER..... 367ODVCL

CAMBRIAN

CAMBRIAN SYSTEM..... 370CMBR

UPPER CAMBRIAN

CONOCOCHEAGUE GROUP..... 371CCCG
CAMBRIAN, UPPER..... 371CMBRU

MIDDLE CAMBRIAN

CAMBRIAN, MIDDLE..... 374CMBRM
ELBROOK FORMATION..... 374ELBK

LOWER CAMBRIAN

CHILHOWEE GROUP..... 377CHLH
LOWER CAMBRIAN SERIES..... 377CMBRL

CATOCTIN AND SWIFT RUN FORMATIONS..... 377CTSW
HARPERS AND WEVERTON FORMATIONS..... 377HRWV
TOMSTOWN DOLOMITE..... 377TMSN
WAYNESBORO FORMATION..... 377WSBR

PRECAMBRIAN

CATOCTIN FORMATION..... 400CTCN
PRECAMBRIAN ERATHEM..... 400PCMB
SWIFT RUN FORMATION..... 400SWFT

WISCONSIN

CENOZOIC

CENOZOIC ERATHEM	100CNZC
SAND AND GRAVEL AQUIFER	100SDGV

QUATERNARY

CLAY(HOLOCENE AND/OR PLEISTOCENE)	110CLAY
GRAVEL(HOLOCENE AND/OR PLEISTOCENE)	110GRVL
GRAVEL AND CLAY (HOLOCENE AND/OR PLEISTOCENE)	110GVCL
HARDPAN (HOLOCENE AND/OR PLEISTOCENE)	110HRDP
MARL(HOLOCENE AND/OR PLEISTOCENE)	110MARL
PEAT(HOLOCENE AND/OR PLEISTOCENE)	110PEAT
QUATERNARY SYSTEM	110QRNR
SAND(HOLOCENE AND/OR PLEISTOCENE)	110SAND
SAND CLAY (HOLOCENE AND/OR PLEISTOCENE)	110SDCL
SAND AND GRAVEL(HOLOCENE AND/OR PLEISTOCENE)	110SDGV
SAND, GRAVEL, AND CLAY (HOLOCENE AND/OR PLEISTOCENE)	110SGVC
SILT(HOLOCENE AND/OR PLEISTOCENE)	110SILT

HOLOCENE

HOLOCENE ALLUVIUM	111ALVM
FILL	111FILL
HOLOCENE SERIES	111HLCN
SOIL	111SOIL

PLEISTOCENE

BURIED CHANNEL DEPOSITS	112BDCL
BURIED WATERLAID DEPOSITS	112BDWD
DRIFT,UNSORTED	112DFUD
ICE-CONTACT DEPOSITS	112ICCC
LACUSTRINE DEPOSITS	112LCSR
OUTWASH DEPOSITS	112OTSH
PLEISTOCENE SERIES	112PLSC
TILL	112TILL
VALLEY TRAIN DEPOSITS	112VLTR

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PALEOZOIC ERATHEM	300PLZC
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SANDSTONE AQUIFER	300SNDS
SILURIAN-ORDOVICIAN SYSTEMS	300SODV

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DEVONIAN, UPPER	341DVNNU

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MILWAUKEE FORMATION..... 344MLWK
THIENSVILLE FORMATION..... 344TSVL

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DEVONIAN-SILURIAN SYSTEMS..... 347DVSL

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SILURIAN SYSTEM..... 350SLRN

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CAYUGAN SERIES..... 352CYGN
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BYRON DOLOMITE..... 355BYRN
CORDELL DOLOMITE..... 355CRDL
HENDRICKS DOLOMITE..... 355HDCK
MANISTIQUE DOLOMITE..... 355MNSQ
NIAGARAN SERIES..... 355NGRN
RACINE DOLOMITE..... 355RCIN
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CINCINNATIAN SERIES..... 362CNCN
FORT ATKINSON LIMESTONE MEMBER OF MAQUOKETA SHALE..... 362FRAK
MAQUOKETA SHALE AQUIFER..... 362MQKS
MAQUOKETA SHALE..... 362MQKT
SCALES MEMBER OF MAQUOKETA SHALE..... 362SCLS

CHAMPLAINIAN

ANCELL GROUP..... 365ANCL
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DECORAH FORMATION..... 365DCRH
DUNLEITH MEMBER OF GALENA DOLOMITE..... 365DNLT
DUBUQUE MEMBER OF GALENA DOLOMITE..... 365DUBQ
GUTTENBERG LIMESTONE MEMBER OF DECORAH FORMATION..... 365GBRG
GALENA DOLOMITE..... 365GLEN
GLENWOOD FORMATION..... 365GLND
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MCGREGOR LIMESTONE MEMBER OF PLATTEVILLE FORMATION..... 365MCGG
PECATONICA DOLOMITE MEMBER OF PLATTEVILLE FORMATION..... 365PCNC
PLATTEVILLE FORMATION..... 365PLVL
QUIMBYS MILL MEMBER OF PLATTEVILLE FORMATION..... 365QMBM
READSTOWN MEMBER OF ST. PETER SANDSTONE..... 365RDSN
SINNIPEE GROUP..... 365SNNP
SPECHTS FERRY SHALE MEMBER OF DECORAH FORMATION..... 365SPCF
ST. PETER SANDSTONE..... 365STPR
TONTI MEMBER OF ST. PETER SANDSTONE..... 365TONT
WISE LAKE MEMBER OF GALENA DOLOMITE..... 365WSLK

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HICKORY RIDGE MEMBER OF ONEOTA DOLOMITE..... 368HKRG
MOUND RIDGE MEMBER OF ONEOTA DOLOMITE..... 368MDRG
NEW RICHMOND SANDSTONE..... 368NRCM
ONEOTA DOLOMITE..... 368ONOT
PRAIRIE DU CHIEN GROUP..... 368PRDC
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BIRKMOSE MEMBER OF LONE ROCK FORMATION..... 372BRKM
DRESBACH GROUP..... 372DRBC
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ELK MOUND GROUP..... 372EKMD
FRANCONIA SANDSTONE..... 372FRNC
GALESVILLE MEMBER OF WONEWOC FORMATION..... 372GLVL
IRONTON MEMBER OF WONEWOC FORMATION..... 372IRNN
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LODI MEMBER OF ST. LAWRENCE FORMATION..... 372LODI
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MT.SIMON SANDSTONE..... 372MNSN
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RENO MEMBER OF MAZOMANIE SANDSTONE..... 372RENO

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DIORITE..... 400DORT
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FELSIC ROCKS..... 400FLSC
GABBRO..... 400GBBR
GNEISS..... 400GNSS
GREENSTONE..... 400GRNS
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GREENSTONE SCHIST..... 400GRSC
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MAFIC ROCKS..... 400MFIC
METAMORPHIC OR INTRUSIVE IGNEOUS ROCK..... 400MIVI
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RHYOLITE..... 400RYLT
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COPPER HARBOR CONGLOMERATE..... 420CPHB
CHEQUAMEGON SANDSTONE..... 420CQMG
DEVILS ISLAND SANDSTONE..... 420DVID
FREDA SANDSTONE..... 420FRED
KEWEENAWAN SUPERGROUP..... 420KWNN
LAKE SUPERIOR SEDIMENTARY ROCK..... 420LASS
LAKE SUPERIOR SANDSTONE AQUIFER..... 420LKSS
LAVA FLOW AQUIFER..... 420LVFL
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ORIENTA SANDSTONE..... 420ORNT
ORONTO GROUP..... 420ORON

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EOLIAN DEPOSITS..... 111EOLN
HOLOCENE SERIES..... 111HLCN
HYDROTHERMAL DEPOSITS..... 111HTML
KAYCEE FORMATION..... 111KYCE
LACUSTRINE DEPOSITS..... 111LCTN
LANDSLIDE DEPOSITS..... 111LDLD
LIGHTING FORMATION..... 111LGNG
SAND DUNE DEPOSITS..... 111SNDD
TERRACE DEPOSITS..... 111TRRC
UCROSS FORMATION..... 111UCRS

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ARVADA FORMATION..... 112ARVD
BULL LAKE DRIFT..... 112BLLK
BASALT FLOWS..... 112BSLT
BIVOUAC FORMATION..... 112BVUC
CEDAR RIDGE TILL..... 112CDRG
DINWOODY LAKE TILL..... 112DDLK
EOLIAN DEPOSITS..... 112EOLN
FENTON PASS FORMATION..... 112FNPS
GLACIAL DEPOSITS..... 112GLCL
PLEISTOCENE SERIES..... 112PLSC
PINEDALE DRIFT..... 112PNDL
RHYOLITE FLOWS..... 112RYLT
SACAGEWEA RIDGE TILL..... 112SCGR
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YELLOWSTONE GROUP..... 112YLSN

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INTRUSIVE ROCK..... 120INTV
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BROWNS PARK FORMATION..... 121BRPK
CANYON BASALT..... 121CNYN
CAMP DAVIS FORMATION..... 121CPDV

FOWKES FORMATION..... 121FWKS
GOOSEBERRY MEMBER OF FOWKES FORMATION..... 121GSBR
MOONSTONE FORMATION..... 121MNSN
NORTH PARK FORMATION..... 121NRPK
OGALLALA FORMATION..... 121OGLL
PLIOCENE SERIES..... 121PLCN
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SPOON BUTTE BEDS..... 121SPNB
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BISHOP CONGLOMERATE..... 122BSHP
COLTER FORMATION..... 122CLTR
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SHERMAN DIORITE..... 122SRMN

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BRULE FORMATION..... 123BRUL
BEAVER DIVIDE CONGLOMERATE MEMBER OF WHITE RIVER FORMATION..... 123BVDV
CHADRON FORMATION..... 123CDRN
CALDWELL CANYON VOLCANICS..... 123CLDC
HAT CREEK BEDS..... 123HCRK
OLIGOCENE SERIES..... 123OLGC
SWEETWATER MEMBER OF WHITE RIVER FORMATION..... 123STTR
TATEMAN MOUNTAIN GRAVEL..... 123TMNM
WIGGINS FORMATION..... 123WGNS
WHITE RIVER FORMATION OR GROUP..... 123WRVR
YODER FORMATION..... 123YODR

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AYCROSS FORMATION..... 124ACRS
ALKALI CREEK STRATUM OF WIND RIVER FORMATION..... 124AKCK
ANGELO MEMBER OF GREEN RIVER FORMATION..... 124ANGL
BULLDOG HOLLOW MEMBER OF FOWKES FORMATION..... 124BDGH
BLACKS FORK MEMBER OF BRIDGER FORMATION..... 124BKFK
BLACK ROCK COAL GROUP..... 124BKRK
BULLPEN MEMBER OF WASATCH FORMATION..... 124BLPN
BRIDGER FORMATION..... 124BRDG
BURNT FORK WHITE LAYER..... 124BRFK
BATES HOLE FORMATION..... 124BSHL
BATTLE SPRING FORMATION..... 124BSPG
CATHEDRAL BLUFFS TONGUE OF WASATCH FORMATION..... 124CDBF
COTTONWOOD DRAW BANDED LAYERS OF WIND RIVER FORMATION..... 124CDDR
CHAPPO MEMBER OF WASATCH FORMATION..... 124CHPP
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CONTINENTAL PEAK FORMATION..... 124CLPK
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EOCENE SERIES..... 124EOCN
FONTENELLE MEMBER OF GREEN RIVER FORMATION..... 124FNNL
FOSSIL BUTTE MEMBER OF GREEN RIVER FORMATION..... 124FSLB

GREEN COVE BEDS..... 124GRCV
GREENIAN SERIES..... 124GRNN
GREEN RIVER FORMATION..... 124GRRV
HANNA FORMATION..... 124HANN
HOBACK FORMATION..... 124HBCK
HENRY RANCH MEMBER OF TEPEE TRAIL FORMATION..... 124HRRC
HIAWATHA MEMBER OF WASATCH FORMATION..... 124HWTH
KINGSBURY CONGLOMERATE MEMBER OF WASATCH FORMATION..... 124KGBR
LA BARGE MEMBER OF WASATCH FORMATION..... 124LBRG
LANEY SHALE MEMBER OF GREEN RIVER FORMATION..... 124LNEY
LOST CABIN MEMBER OF WIND RIVER FORMATION..... 124LSCB
LONE TREE GULCH ASH..... 124LTGC
LUMAN TONGUE OF GREEN RIVER FORMATION..... 124LUMN
LYSITE MEMBER OF WIND RIVER FORMATION..... 124LYST
MONCRIEF MEMBER OF WASATCH FORMATION..... 124MCRF
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NEW FORK TONGUE OF WASATCH FORMATION..... 124NFRK
NILAND TONGUE OF WASATCH FORMATION..... 124NLND
PITCHFORK FORMATION..... 124PCFK
PASS PEAK CONGLOMERATE..... 124PSPK
RED DESERT TONGUE OF WASATCH FORMATION..... 124RDDR
RAMSHORN VOLCANIC SERIES..... 124RMSR
SILLEM MEMBER OF FOWKES FORMATION..... 124SLLM
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TEPEE TRAIL FORMATION..... 124TPTL
TIPTON SHALE MEMBER OF GREEN RIVER FORMATION..... 124TPTN
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WILLWOOD FORMATION..... 124WLWD
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HAMS FORK CONGLOMERATE MEMBER OF EVANSTON FORMATION..... 125HMFK
LOBO SHALE MEMBER OF FORT UNION FORMATION..... 125LOBO
MANTUA LENTIL OF POLECAT BENCH FORMATION..... 125MNTU
POLECAT BENCH FORMATION..... 125PCBC
PALEOCENE SERIES..... 125PLCN
PINYON CONGLOMERATE..... 125PNYN
ROCK BENCH QUARRY BEDS OF POLECAT BENCH FORMATION..... 125RKBQ
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TONGUE RIVER MEMBER OF FORT UNION FORMATION..... 125TGRV
TULLOCK MEMBER OF FORT UNION FORMATION..... 125TULK
WALTMAN SHALE MEMBER OF FORT UNION FORMATION..... 125WLMN

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MESOZOIC ERATHEM..... 200MSZC

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BLACK BUTTES COAL GROUP..... 211BCKB
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BLIND BULL FORMATION..... 211BLDB
BELLE FOURCHE SHALE..... 211BLFC
BLAIR FORMATION..... 211BLIR
BOW FORMATION OR GROUP..... 211BOW
BASIN SHALE..... 211BSIN
BAXTER SHALE..... 211BXTR
CLAGGETT SHALE OF THE MONTANA GROUP..... 211CLGG
CHIMNEY ROCK TONGUE OF BLAIR FORMATION..... 211CMRK
CODY SHALE..... 211CODY
UPPER CRETACEOUS SERIES..... 211CRCSU
CARLILE SHALE..... 211CRLL
DAKOTA SANDSTONE OR FORMATION..... 211DKOT
EAGLE SANDSTONE..... 211EGLE
ELK BASIN SANDSTONE MEMBER OF TELEGRAPH CREEK FORMATION..... 211ELKB
ERICSON SANDSTONE OR FORMATION..... 211ERCS
EVERTS FORMATION..... 211EVRS
FRONTIER FORMATION..... 211FRNR
FITZHUGH SAND (SUBSURFACE)..... 211FTZG
FOX HILLS FORMATION..... 211FXHL
GAMMON FERRUGINOUS MEMBER OF PIERRE SHALE..... 211GMMN
GREENHORN LIMESTONE..... 211GRNR
GRANEROS SHALE..... 211GRRS
HAYSTACK MOUNTAINS FORMATION..... 211HCKM
HAILEY SHALE..... 211HILY
HILLIARD SHALE OR FORMATION..... 211HLRD
HAREBELL FORMATION..... 211HRBL
HYGIENE SANDSTONE..... 211HYGN
ILES FORMATION..... 211ILES
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KIMBALL SAND (SUBSURFACE)..... 211KMBL
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LARAMIE FORMATION..... 211LRMI
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LAZEART SANDSTONE MEMBER OF ADAVILLE FORMATION..... 211LZRT
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MONUMENT HILL BENTONTIC MEMBER OF PIERRE SHALE..... 211MMHL
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MITTEN BLACK SHALE MEMBER OF PIERRE SHALE..... 211MTTN
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NIOBRARA FORMATION..... 211NBRR
OCTH LOUIE SAND (SUBSURFACE)..... 211OCTL
OYSTER RIDGE SANDSTONE MEMBER OF FRONTIER FORMATION..... 211ORDG
PEDRO BENTONITE BED OF PIERRE SHALE..... 211PDRO
PEAY SANDSTONE MEMBER OF FRONTIER FORMATION..... 211PEAY
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PIERRE SHALE..... 211PIRR
POOL CREEK SHALE MEMBER OF CARLILE SHALE..... 211PLCK
PINE RIDGE SANDSTONE..... 211PRDG
PARKMAN SANDSTONE MEMBER OF MESAVERDE FORMATION..... 211PRKM
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RED BIRD SILTY MEMBER OF PIERRE SHALE..... 211RDBD
ROCK SPRINGS FORMATION..... 211RKSP
RAWLINS SANDSTONE..... 211RLNS
SHANNON SANDSTONE MEMBER OF CODY SHALE..... 211SNNN
SUSSEX SANDSTONE MEMBER OF CODY SHALE..... 211SSSX
STEELE SHALE..... 211STEL
TORCHLIGHT SANDSTONE MEMBER OF FRONTIER FORMATION..... 211TCLG
TELEGRAPH CREEK FORMATION..... 211TPCK
TEAPOT SANDSTONE MEMBER OF MESAVERDE FORMATION..... 211TPOT
TORRINGTON MEMBER OF LANCE FORMATION..... 211TRNG
TURNER SANDY MEMBER OF CARLILE SHALE..... 211TRNR
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COKEVILLE FORMATION..... 217CKVL
CHILSON MEMBER OF LAKOTA FORMATION..... 217CLSN
CLAY SPUR BENTONITE BED OF MOWRY SHALE..... 217CLSP
CLOVERLY FORMATION..... 217CLVL
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EPHRAIM CONGLOMERATE..... 217EPRM
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FUSON MEMBER OF LAKOTA FORMATION..... 217FUSN
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HAY CREEK FORMATION..... 217HCRK
INYAN KARA GROUP..... 217INKR
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MUDDY SANDSTONE MEMBER OF THERMOPOLIS SHALE..... 217MDDY
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NEWCASTLE SANDSTONE..... 217NCSL
PETERSON LIMESTONE..... 217PRSN
QUEALY FORMATION..... 217QULY
SUBLETTE FORMATION..... 217SBLT
SAGE JUNCTION FORMATION..... 217SGJC
SKULL CREEK SHALE..... 217SKCK

SMITHS FORMATION..... 217SMTS
THOMAS FORK FORMATION..... 217TMFK
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CURTIS FORMATION..... 221CRTS
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GYPSUM SPRING FORMATION..... 221GPSP
HULETT SANDSTONE MEMBER OF SUNDANCE FORMATION..... 221HLTT
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LAK MEMBER OF SUNDANCE FORMATION..... 221LAK
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PREUSS SANDSTONE OR REDBEDS..... 221PRSS
RIERDON FORMATION..... 221RRDN
STOCKADE BEAVER SHALE MEMBER OF SUNDANCE FORMATION..... 221SKBV
SUNDANCE FORMATION..... 221SNDC
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SAWTOOTH FORMATION..... 224STTH
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LOWER JURASSIC SERIES..... 227JRSCL
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CROW MOUNTAIN SANDSTONE MEMBER OF CHUGWATER FORMATION..... 231CRMN
JELM FORMATION..... 231JELM
POPO AGIE MEMBER OF CHUGWATER FORMATION..... 231PPAG
UPPER TRIASSIC SERIES..... 231TRSCU
WYOPO FORMATION..... 231WYOP

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ERVAY MEMBER OF GOOSE EGG FORMATION..... 237ERVY
FREEZEOUT SHALE MEMBER OF GOOSE EGG FORMATION..... 237FRZT

GOOSE EGG FORMATION..... 237GSEG
LITTLE MEDICINE MEMBER OF GOOSE EGG FORMATION..... 237LMDC
RED PEAK FORMATION..... 237RDPK
SPEARFISH FORMATION..... 237SPRF
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THAYNES LIMESTONE..... 237TYNS
WOODSIDE FORMATION..... 237WDSD

PALEOZOIC

PALEOZOIC ERATHEM..... 300PLZC

PERMIAN

PERMIAN SYSTEM..... 310PRMN

UPPER PERMIAN

DIFFICULTY SHALE MEMBER OF GOOSE EGG FORMATION..... 311DFCL
FRANSON MEMBER OR TONGUE OF PARK CITY FORMATION..... 311FRNS
FREEZEOUT TONGUE OF CHUGWATER FORMATION..... 311FRZT
GLENDO SHALE MEMBER OF GOOSE EGG FORMATION..... 311GLND
GRANDEUR MEMBER OF PARK CITY FORMATION..... 311GRDR
MEADE PEAK PHOSPHATIC SHALE MEMBER OF PHOSPHORIA FORMATION..... 311MDPK
PARK CITY FORMATION..... 311PRKC
UPPER PERMIAN SERIES..... 311PRMNU
PHOSPHORIA FORMATION..... 311PSPR
RETORT PHOSPHATIC SHALE MEMBER OF PHOSPHORIA FORMATION..... 311RTRT
REX CHERT MEMBER OF PHOSPHORIA FORMATION..... 311RXCR
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FORELLE LIMESTONE MEMBER OF GOOSE EGG FORMATION..... 317FRLL
HARTVILLE FORMATION..... 317HRVL
INGLESIDE FORMATION..... 317IGLD
MINNEKAHTA LIMESTONE..... 317MNKT
MINNELUSA FORMATION..... 317MNLS
MAROON FORMATION..... 317MRON
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POPE SPRINGS SANDSTONE..... 317PPSP
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MISSISSIPPIAN, UPPER..... 331MSSPU

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GUERNSEY FORMATION..... 337GRNS
LODGEPOLE LIMESTONE..... 337LDGP
MISSISSIPPIAN, LOWER..... 337MSSPL
PAHASAPA LIMESTONE..... 337PHSP

DEVONIAN

DEVONIAN SYSTEM..... 340DVNN

UPPER DEVONIAN

DEVONIAN, UPPER..... 341DVNNU
JEFFERSON FORMATION..... 341JFRS
THREE FORKS SHALE..... 341TRFK

LOWER DEVONIAN

BEARTOOTH BUTTE FORMATION..... 347BRTB
DEVONIAN, LOWER..... 347DVNNL

ORDOVICIAN

ORDOVICIAN SYSTEM..... 360ODVC

UPPER ORDOVICIAN

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LEIGH DOLOMITE MEMBER OF BIGHORN DOLOMITE..... 361LIGH

LANDER SANDSTONE MEMBER OF BIGHORN DOLOMITE..... 361LNDR
ORDOVICIAN, UPPER..... 361ODVCU

MIDDLE ORDOVICIAN

ALADDIN SANDSTONE MEMBER OF WINNIPEG FORMATION..... 364ALDN
ORDOVICIAN, MIDDLE..... 364ODVCM

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DEADWOOD FORMATION..... 367DDWD
ORDOVICIAN, LOWER..... 367ODVCL

CAMBRIAN

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BOYSEN FORMATION..... 371BYSN
CAMBRIAN, UPPER..... 371CMBRU
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GROS VENTRE FORMATION..... 371GRVR
OPEN DOOR LIMESTONE..... 371OPDR
PILGRIM LIMESTONE..... 371PLGM
SNOWY RANGE FORMATION..... 371SNRG

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CAMBRIAN, MIDDLE..... 374CMBRM
DEATH CANYON MEMBER OF GROS VENTRE FORMATION..... 374DCNN
DEPASS FORMATION..... 374DPSS
FLATHEAD QUARTZITE OR SANDSTONE..... 374FLTD
MEAGHER LIMESTONE..... 374MGHR
PARK SHALE..... 374PARK
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PRECAMBRIAN

PRECAMBRIAN ERATHEM..... 400PCMB

AMERICAN SAMOA

CENOZOIC

CORALLINE RUBBLE DEPOSITS..... 100CLRB
CENOZOIC ERATHEM..... 100CNZC
LIMESTONE..... 100LMSN

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
ALLUVIAL AND TALUS DEPOSITS..... 111ALVT
AUNUU TUFF..... 111AUNU
BEACH DEPOSITS..... 111BECH
CALCAREOUS SAND AND RUBBLE DEPOSITS..... 111CSRB
LEONE VOLCANICS,UNDIFFERENTIATED..... 111LEON
LEONE VOLCANICS,ASH DEPOSITS..... 111LNAS
LEONE VOLCANICS,CINDER CONES..... 111LNCC
LEONE VOLCANICS,LAVA FLOWS..... 111LNLF
LEONE VOLCANICS,TUFF DEPOSITS..... 111LNTF
OFU VOLCANIC ROCKS,TUFF DEPOSITS..... 1110FTF
SWAMP DEPOSITS..... 111SWMP
TUA VOLCANIC ROCKS,LAVA FLOWS..... 111TULF
TUA VOLCANIC ROCKS,TUFF DEPOSITS..... 111TUTF

PLEISTOCENE

AFONO TRACHYTE..... 112AFON
LEILA TRACHYTE..... 112LEIL
LEFULUFULUA TRACHYTE..... 112LFLF
MATAFAO TRACHYTE..... 112MTFO
OFU VOLCANIC ROCK,LAVA FLOWS..... 1120FLF
OLOSEGA VOLCANIC ROCK, LAVA FLOWS..... 1120GLF
PIOA TRACHYTE..... 112PIOA
PLEISTOCENE SERIES..... 112PLSC
PAPATELE TRACHYTE..... 112PPTL
TAU TRACHYTE..... 112TAU
VATIA TRACHYTE..... 112VATI

TERTIARY

TERTIARY SYSTEM..... 120TRTR

PLIOCENE

ALOFAU VOLCANICS,UNDIFFERENTIATED..... 121ALFU
MASEFAU DIKE COMPLEX..... 121MSFU
OLOMOANA VOLCANICS, UNDIFFERENTIATED..... 1210LMN
PAGO VOLCANIC SERIES,EXTRA-CALDERA VOLCANICS,UNDIFFERENTIATED..... 121PAGOE
PAGO VOLCANIC SERIES,INTRA-CALDERA VOLCANICS,UNDIFFERENTIATED..... 121PAGOI
PLIOCENE SERIES..... 121PLCN
TAPUTAPU VOLCANICS,UNDIFFERENTIATED,LAVA FLOWS,TUFF AND CINDER CONES.. 121TPTP

MIDWAY ISLANDS

CENOZOIC

CORALLINE RUBBLE..... 100CLRB
CENOZOIC ERATHEM..... 100CNZC
LIMESTONE..... 100LMSN

QUATERNARY

HOLOCENE

BEACH DEPOSITS..... 111BECH

PUERTO RICO

CENOZOIC

ALLUVIUM AND TALUS..... 100ALVT
CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

ALLUVIUM,COASTAL..... 111AVMC
ALLUVIUM,VALLEY..... 111AVMV
HOLOCENE SERIES..... 111HLCN
VALLEY ALLUVIUM..... 111VLAV

TERTIARY

TERTIARY SYSTEM..... 120TRTR

MIOCENE

AGUADA LIMESTONE..... 122AGUD
AYMAMON LIMESTONE..... 122AMMN
CIBAO FORMATION..... 122CIBO
CAMUY FORMATION..... 122CMUY
ISLA MONA DOLOMITE (MONO ISLAND)..... 122ISLM
JANA DIAZ FORMATION..... 122JNDZJ
LIRIO LIMESTONE (MONO ISLAND)..... 122LIRO
MIOCENE-OLIGOCENE SERIES..... 122MCOG
MIOCENE SERIES..... 122MOCN
PONCE LIMESTONE..... 122PONC

OLIGOCENE

LARES LIMESTONE..... 123LRES
OLIGOCENE SERIES..... 123OLGC
SAN SABASTIAN FORMATION..... 123SSBS

EOCENE

EOCENE SERIES..... 124EOCN
PLUTONIC ROCKS,INCLUDING DIORITIC ROCKS AND INTRUSIVES..... 124PLNC
VOLCANIC ROCKS,INCLUDING LIMESTONE AND DETRITAL MATERIAL..... 124VLCC

TERR. OF PACIFIC IS.

CENOZOIC

ALLUVIAL AND TALUS DEPOSITS	100ALVT
BEACH DEPOSITS	100BECH
CENOZOIC ERATHEM	100CNZC
LIMESTONE	100LMSN
PRE-CALDERA VOLCANIC ROCKS,LAVA FLOWS	100PRLF
PRE-CALDERA VOLCANIC ROCKS,PYROCLASTIC DEPOSITS	100PRPY
PRE-CALDERA VOLCANIC ROCKS,UNDIFFERENTIATED	100PRVC
POST-CALDERA VOLCANIC ROCKS,LAVA FLOWS	100PSLF
POST-CALDERA VOLCANIC ROCKS,PYROCLASTIC DEPOSITS	100PSPY
POST-CALDERA VOLCANIC ROCKS,UNDIFFERENTIATED	100PSVC
REEF-ISLAND LIMESTONE	100RFID
REGOLITH	100RGLT
RAISED REEF AND BEACH DEPOSITS	100RRFB
VOLCANIC ROCKS,LAVA FLOWS,UNDIFFERENTIATED	100VCLF
VOLCANIC ROCK,PYROCLASTIC DEPOSITS AND ASSOCIATED SEDIMENTARY DEPOSITS	100VCSM
VOLCANIC ROCKS	100VLCC

QUATERNARY

QUATERNARY	110QRNR

HOLOCENE

ARTIFICIAL FILL	111AFCF
HOLOCENE ALLUVIUM	111ALVM
BEACH DEPOSITS	111BECH
EMERGED LIMESANDS	111EMGL
HOLOCENE SERIES	111HLCN
MARSH DEPOSITS	111MRSH
MERIZO LIMESTONE	111MRZO
PELELIU LIMESTONE	111PLLU
SAND DEPOSITS (ELEVATED OR INLAND FROM PRESENT BEACHES)	111SAND
SWAMP DEPOSITS	111SWMP
SALT-WATER SWAMP DEPOSITS	111SWSP

PLEISTOCENE

AGANA ARGILLACEOUS MEMBER OF MARIANA LIMESTONE	112AGAN
ALLUVIUM,MASS-WASTING DEPOSITS AND YOUNGER TERRACE DEPOSITS	112ANYT
LATERITE	112LTRT
MARIANA LIMESTONE,UNDIFFERENTIATED	112MRIN
MARIANA LIMESTONE,MAIN BODY	112MRNM
PALAU LIMESTONE	112PALU
PLEISTOCENE SERIES	112PLSC
TANAPAG LIMESTONE	112TNPG

TERTIARY

TERTIARY SYSTEM	120TRTR
VOLCANIC ROCKS	120VLCC

PLIOCENE

AIRAI CLAY..... 121AIRI
ALIFAN LIMESTONE..... 121ALFN
ALIFAN LIMESTONE,UPPER UNNAMED MEMBER..... 121ALFNU
BARRIGADA LIMESTONE..... 121BRGD
JANUM FORMATION..... 121JNUM

MIOCENE

BOLANOS PYROCLASTIC MEMBER,UMATAC FORMATION..... 122BLNS
BONYA LIMESTONE..... 122BONY
DANDAN FLOW MEMBER,UMATAC FORMATION..... 122DNDN
DONNI SANDSTONE MEMBER OF TAGPOCHAU LIMESTONE..... 122DONN
FACPIC VOLCANIC MEMBER OF UMATAC FORMATION..... 122FCPC
MAP FORMATION..... 122MAP
MACHEGIT CONGLOMERATE MEMBER,TAGPOCHAU LIMESTONE..... 122MCGT
MAEMONG LIMESTONE MEMBER,UMATAC FORMATION..... 122MMNG
MIOCENE SERIES..... 122MOCN
TOMIL VOLCANICS..... 122TOML
TAGPOCHAU LIMESTONE,PURE TO IMPURE LIMESTONE FACIES..... 122TPPI
UMATAC FORMATION,UNDIFFERENTIATED..... 122UMTC
VOLCANIC ROCKS..... 122VLCC

OLIGOCENE

ALUTOM FORMATION,MAIN BODY..... 123ALMM
ALUTOM FORMATION..... 123ALTM
ARAKABESAN MEMBER OF NGEREMLENGUI FORMATION..... 123ARKB
FINA-SISU FORAMTION..... 123FNSS
MEDORM MEMBER,NGEREMLENGUI FORMATION..... 123MDRM
MAHLAC MEMBER,ALUTOM FORMATION..... 123MHLC
NGHEMESED MEMBER NGEREMLENGUI FORMATION..... 123NGMD
NGEREMLENGUI FORMATION,UNDIFFERENTIATED..... 123NGMG
OLIGOCENE-EOCENE SERIES..... 123OGCE
OLIGOCENE SERIES..... 123OLGC

EOCENE

AIMELIIK FORMATION..... 124AMLK
BABELTHUAP FORMATION..... 124BBLP
DENSINYAMA FORMATION..... 124DNSM
EOCENE SERIES..... 124EOCN
HAGMAN FORMATION..... 124HGMN
MATANSA LIMESTONE..... 124MTNS
NGARDOK MEMBER,AIMELIIK FORMATION..... 124NGDK
NGARSUL MEMBER,AIMELIIK FORMATION..... 124NGRL
SANKAKUYAMA FORMATION..... 124SKKM
TINIAN PYROCLASTIC ROCKS..... 124TINN

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC
PERIDOTITE..... 200PRDT
SERPENTINITE..... 200SRPN
YAP FORMATION..... 200YAP

MISC. PACIFIC IS.

CENOZOIC

QUATERNARY

HOLOCENE

HOLOCENE SERIES..... 111HLCN

PLEISTOCENE

AGANA ARGILLACEOUS MEMBER OF MARIANA LIMESTONE..... 112AGAN

VIRGIN ISLANDS

CENOZOIC

CENOZOIC ERATHEM..... 100CNZC

QUATERNARY

QUATERNARY SYSTEM..... 110QRNR

HOLOCENE

HOLOCENE ALLUVIUM..... 111ALVM
HOLOCENE SERIES..... 111HLCN

TERTIARY

INTRUSIVE ROCKS..... 120IRSV
INTRUSIVE VOLCANICS (INCLUDES DIORITE)..... 120IVVC
TERTIARY SYSTEM..... 120TRTR

MIOCENE

KINGSHILL MARL..... 122KGSL
MIOCENE SERIES..... 122MOCN

OLIGOCENE

JEALOUSY FORMATION..... 123JLSY
OLIGOCENE SERIES..... 123OLGC

MESOZOIC

MESOZOIC ERATHEM..... 200MSZC

CRETACEOUS

CRETACEOUS SYSTEM..... 210CRCS

UPPER CRETACEOUS

UPPER CRETACEOUS SERIES..... 211CRCSU
LUISENHOJ FORMATION..... 211LSNJ
MOUNT EAGLE GROUP..... 211MEGL
OUTER BRASS LIMESTONE..... 211ORBR
TUTU FORMATION..... 211TUTU

LOWER CRETACEOUS

LOWER CRETACEOUS SERIES..... 217CRCSL
WATER ISLAND FORMATION..... 217WILD

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