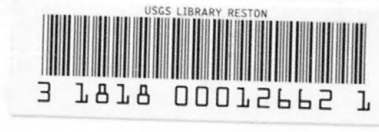

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

GSLITH Version 2.0: A prototype program to draw cross sections and plot plan views from drill hole data with latitude, longitude coordinates, using an IBM PC (or compatible) microcomputer, digitizer, and plotter.

by

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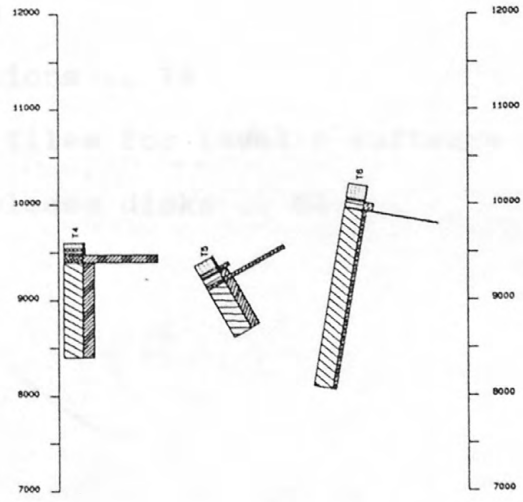

Open File Report
89-114A
Program disks
89-114B

Disclaimer

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INTRODUCTION

GSLITH is a microcomputer program for IBM PC or compatible microcomputers and requires a digitizer and a plotter. The program is designed to process and plot data that define the "vertical" sequence of rock units at locations specified by latitude, longitude coordinates. The program's name comes from **G**eological **S**urvey **Lith**ology. A counterpart program GSLXY that uses X,Y coordinates was released previously (Selner and Taylor, 1988b).

GSLITH can be used to digitize the locations of drill holes, measured sections, or other places where information has been obtained. It stores information about the vertical extent of units at each locality, and as many as five numeric variables that apply to each unit. It employs a user-defined "standard set" of unit identifiers. Input of data for units at each locality is checked against this standard set to guarantee consistency. Plotter patterns are specified by the user for each unit, and are used in drawing plan views and cross sections.

GSLITH Version 2.0 adds the following capabilities to GSLITH Version 1.0, Selner and Taylor 1987:

- As many as five numeric variables associated with each unit can be stored in the data base and plotted on sections.

- Vertical limits can be specified for sections, and data within these limits plotted. This allows use of a greater range of vertical scales without exceeding plotter limits.

- The following map projections are now supported for digitizing and plotting: Mercator, Universal Transverse Mercator, Transverse Mercator, Oblique Mercator, Polyconic, Lambert Conformal Conic, Albers Equal Area, and Equidistant Conic. Underlines indicate projections added in Version 2.0. Projection files are the same as those for GSMAP Version 5.0, Selner and Taylor 1988a.

- Version 2.0 can drive a plotter, or generate HPGL (Hewlett Packard Graphics Language) files for later use with plotters or printers with appropriate software, e.g the program called Queit used to drive a plotter using an HPGL file, Selner and Taylor, 1988c.

GSLITH Version 2.0 is one of a series of computer programs for geologists, for use in an office environment. It is designated as "level 5" software because it operates in a manner consistent with Version 5 of GSMAP and GSDRAW, uses the same configuration files to interface with digitizers and plotters, the same projection parameter files, and can produce output files written in HPGL.

HARDWARE REQUIREMENTS

The program requires: 1. an IBM PC (or compatible) microcomputer with 512K of RAM or more, math co-processor chip, an RS232C serial port; 2. a digitizer that interfaces with the computer through an RS232C serial port, transmits X,Y coordinate pairs in an ASCII string, and has a keypad with at least 14 keys that send different ASCII characters, and 3., a plotter that supports HPGL plot commands.

Information to assist interconnection and installation is given in Appendix 1. Additional information is contained in manuals supplied with equipment.

SOFTWARE REQUIREMENTS

The minimum software requirements for utilizing the program are PC/DOS (or MS/DOS) Version 2.1 or higher, release disk Number 1, and a word processing program capable of generating ASCII files.

INSTALLATION

Release disk #1 contains the executable program, **GSLITH.EXE** and two configuration files defining parameters for communicating between computer, digitizer and plotter, **CONFIG.DIG**, and **CONFIG.PLT**. CONFIG.PLT also contains definitions for a standard set of symbols.

The two configuration files and the executable program file can be stored on a floppy disk or in any sub-directory on a hard disk. The user should employ the standard DOS COPY command to copy the program and configuration files to working disks, or into the appropriate sub-directory of a hard disk. Sample projection parameter files, unit identifier files, plot control files, and a small data base have been included on release disk #1. We suggest that the entire contents of release disk #1 be copied, in addition to the three files required to start the program.

Files CONFIG.DIG and CONFIG.PLT may require modification to match the configuration of the system. Instructions for these modifications are provided in Appendix 1. If GSMAP Version 5.0 or another "level 5" program is already installed on your system, the configuration and projection files can be used.

The user must create projection parameter files, unit identifier files, and plot control files for each project. Instructions are provided in this documentation.

APPLICATIONS OF GSLITH

The GSLITH program was designed to assist analysis of lithologic and associated numeric data from drill holes. The words "hole" or "well" are used in this documentation to indicate a place where data on the vertical sequence of units are available. GSLITH data bases store information from wells that then can be used for graphic and numeric output. Lithologic units are shown using plotter defined patterns set by the user on cross section and plan view.

The program can draw a series of cross sections from drill hole data plotting the lithologic units in the drill hole, and numeric variables (such as chemical values) at true positions as projected to the vertical plane of section. This provides a quick and accurate way of determining the consistency of a data set, locating critical holes, identifying errors in the data, and starting the process of data analysis. These sections also furnish a basis for construction of standard cross sections, allowing the geologist to connect like features without the tedium of projection of well data to the plane of section.

Plots of drill holes on cross sections can be made at true elevations, or adjusted so that the base or top of a specified unit, or a particular contact is plotted at a specified elevation. Such alignment of a stratigraphic horizon may facilitate stratigraphic analysis. If a contact is specified, only those holes where this contact has been identified in the data will be plotted. A type of block diagram can be constructed on a single sheet by drawing a series of stacked cross sections, thus providing an overview of a data set in three dimensions. The program projects data from slant holes to the plane of cross section in proper geometric projection, including changes in apparent thickness of units and apparent plunge of slant holes to accommodate the bearing and plunge of the hole and horizontal and vertical scale selected for the section.

Plan views can be drawn to provide information on the stratigraphic and structural framework of an area. A plot of the elevation of the contact of two units provides data for construction of a structure contour map. A plot of the thickness of a unit provides data for construction of an isopach map. ASCII files generated by GSLITH can be used with computer-driven contouring programs. If the elevation data from a series of holes are adjusted to bring a particular contact to a specified vertical position by the program, a plot of the vertical offset required for this adjustment provides insight into the shape of this contact in three dimensions. Horizontal slices through well data sets provide data for a subsurface geologic map at the chosen elevation. Figure 1 is a plan view of a hypothetical set of drill holes. Examples of plots from GSLITH are provided in figures 2-7, p. 7-12

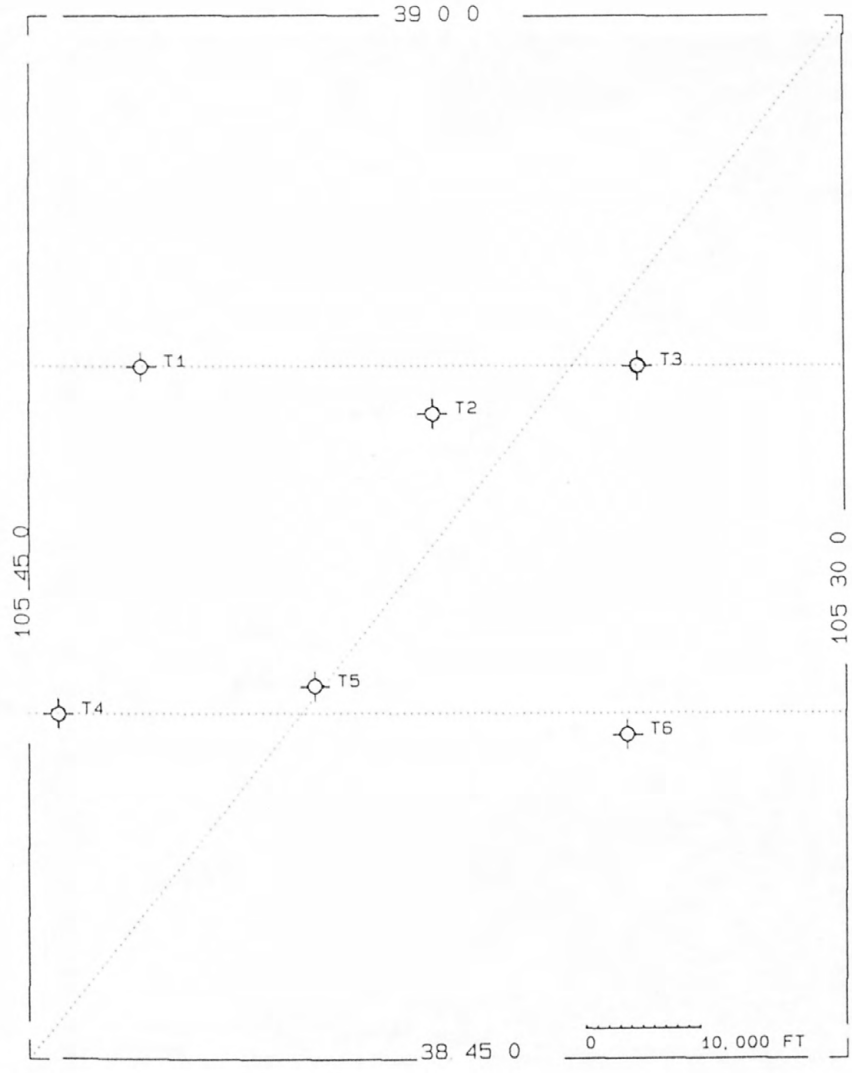

Figure 1. The plan view for the exercise suggested in the tutorial. Drill holes with identifiers and lines (dotted) of section have been drawn.

Figure 2._ Plan view from tutorial exercise. Well identifiers have been plotted. GSLITH plot file PLAN1.PLT.

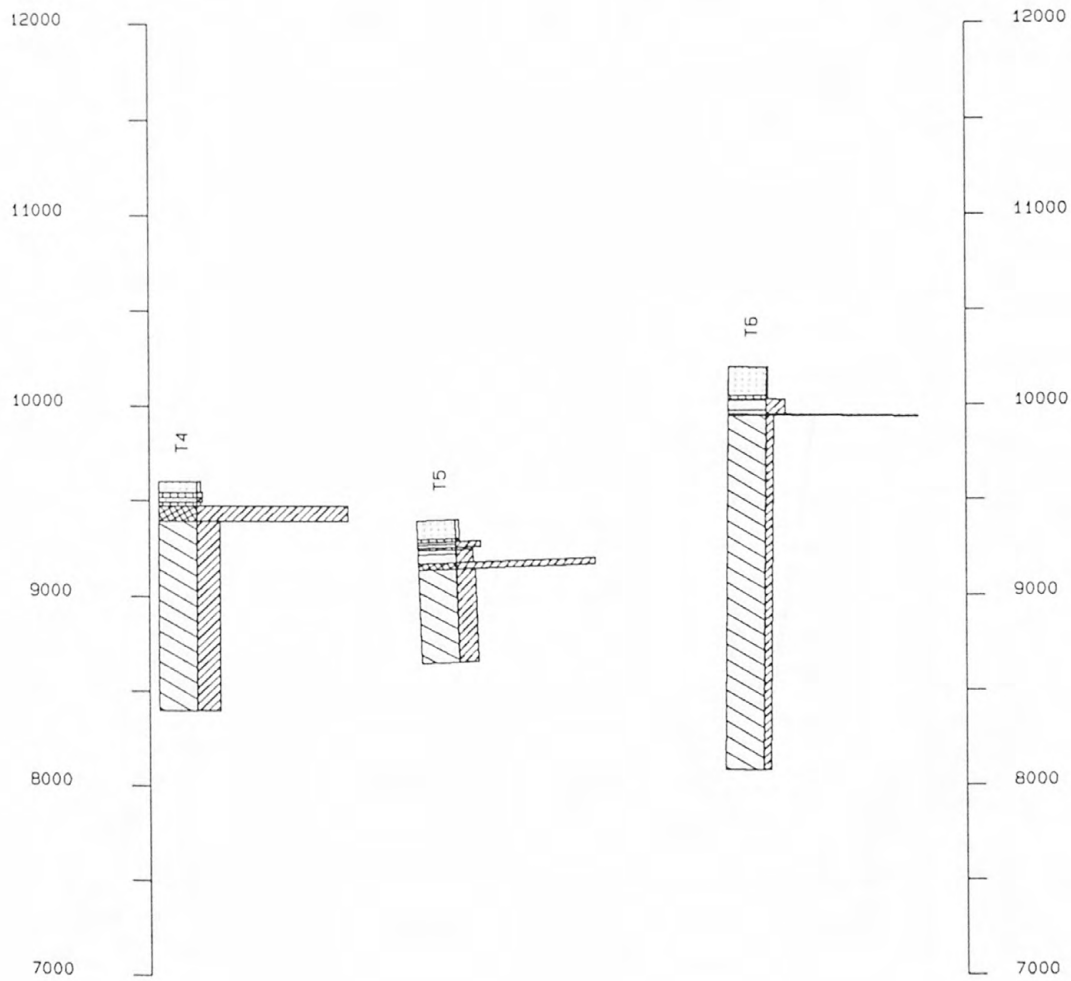

Figure 3._ Example of cross section with numeric variables plotted as a bar graph attached to the lithologic log. GSLITH plot file SECT1.PLT, numeric variable file HIST.VAR.

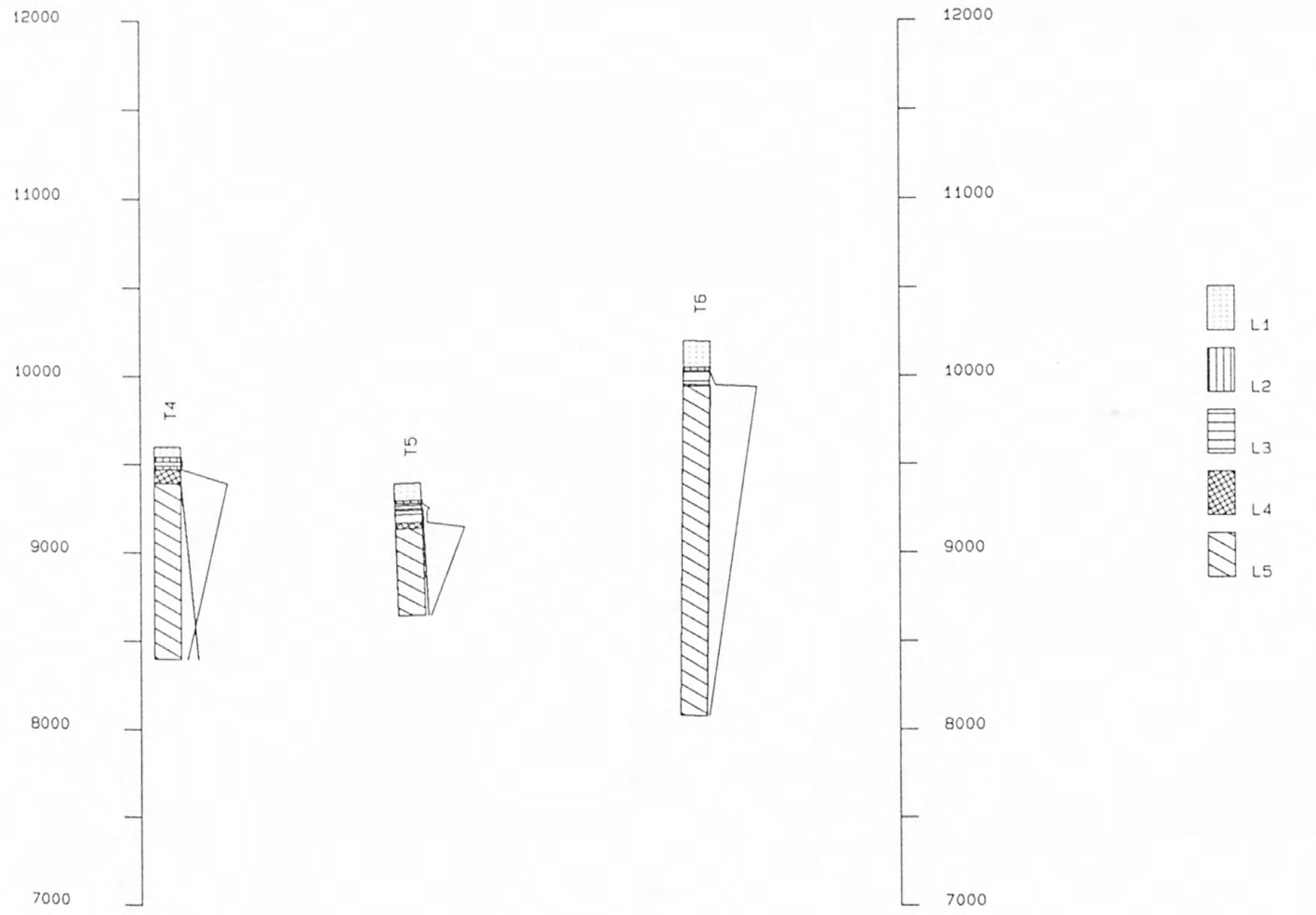

Figure 4._ Cross section with numeric variables plotted as a trace on the right side of the lithologic log. GSLITH plot file SECT2.Plt, numeric variable file TRACE.VAR, legend plotted.

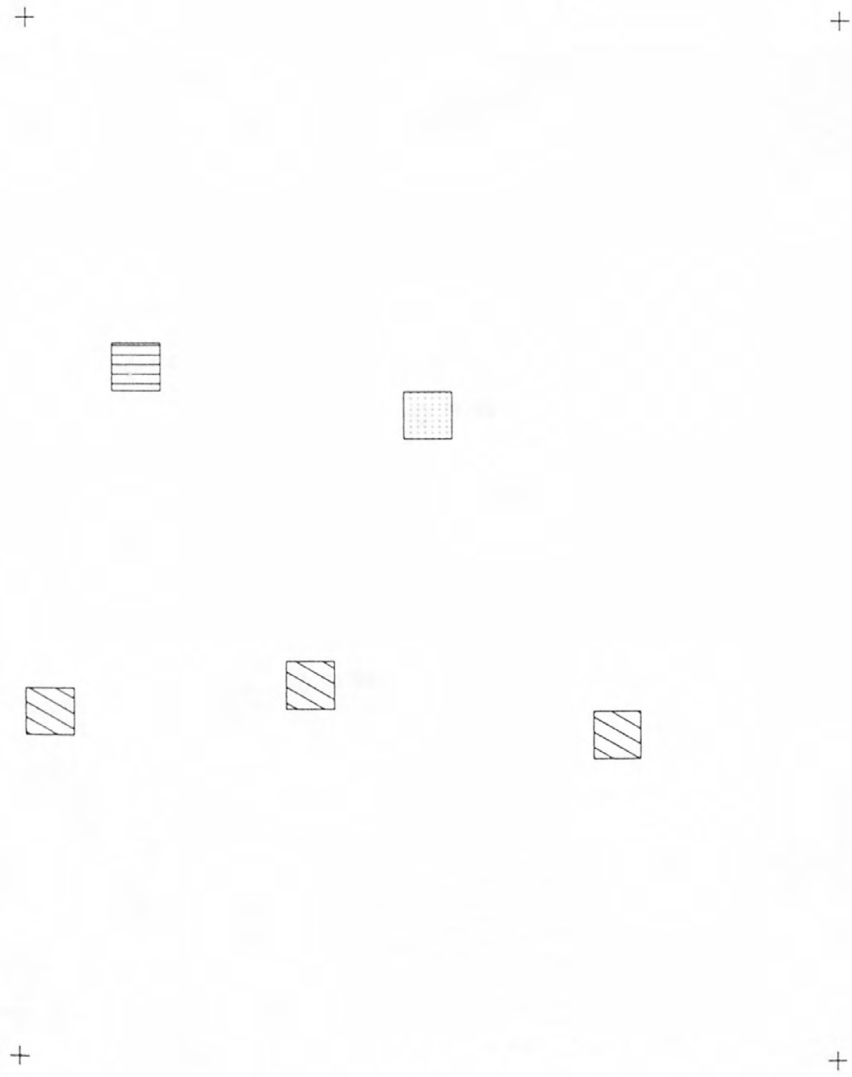

Figure 5._ Plan view, type 11. Units plotted at an elevation of 9000 feet. GSLITH plot file Plan2.PLT. Offset due to plunge of drill holes seems small because of disparity between horizontal and vertical scales.

Figure 6._ Plan view type 7. Locations of drill holes, with thickness(s) of unit L1 plotted. GSLITH plot File PLAN3.PLT.

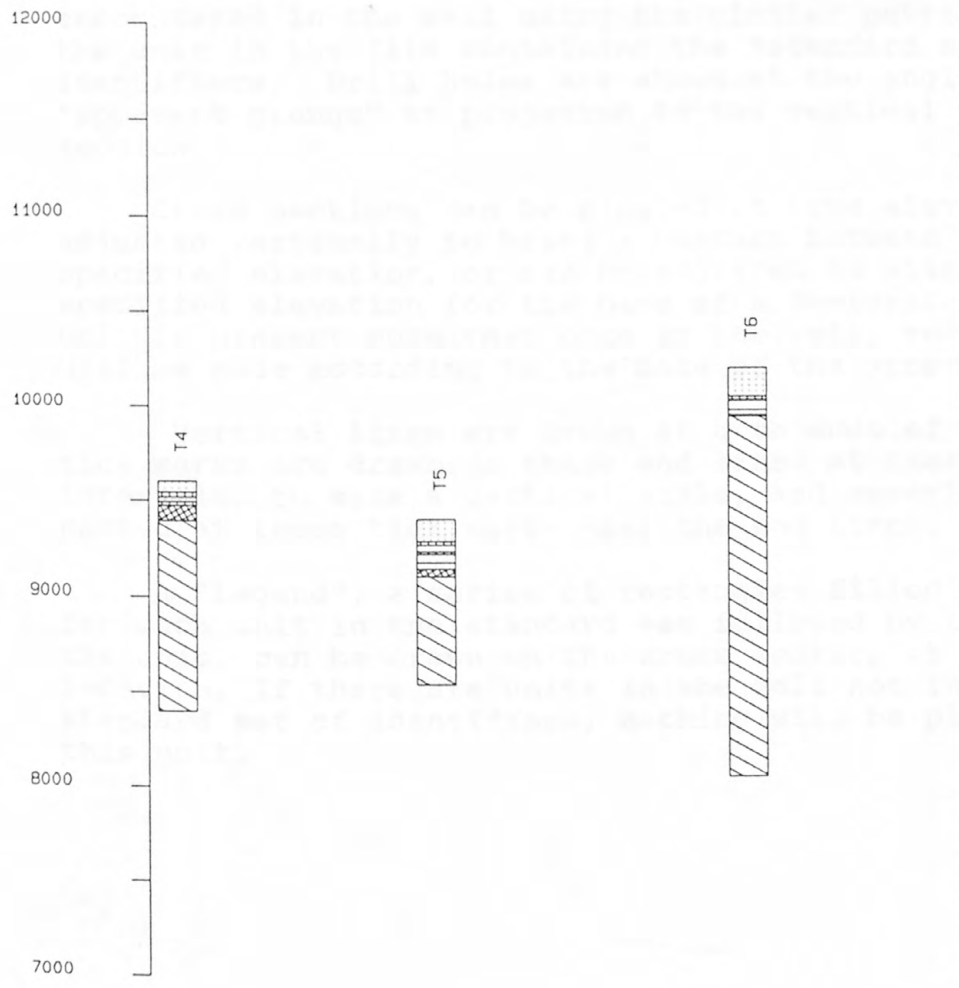

Figure 7. Section of type 3, compare with Fig. 2, especially the apparent change in length of hole T5 due to 60 plunge of hole. Distance and spacing specified in an ASCII file. GSLITH plot file SECT3.PLT, ASCII data file, SECT1.ASC

CROSS SECTIONS

The GSLITH program provides options to adjust the vertical positions of plots of drill hole data on cross sections. An understanding of some of the algorithms used by the program is important in following these procedures. In this description, the base or top of a unit refers to the bottom or top of a unit as recorded in the well log. They are not necessarily the stratigraphic base or top. The contact of two units refers to a position in a well where the elevation of the base of the upper unit is **identical** to the elevation of the top of the lower unit. Once again, this position is not necessarily a stratigraphic contact. The base and top depend on a single record in the log, a contact depends on two.

Cross sections drawn by the GSLITH program show the units encountered in the well using the plotter patterns specified by the user in the file containing the "standard set" of unit identifiers. Drill holes are shown at the angle of plunge "apparent plunge" as projected to the vertical plane of the cross section.

Cross sections can be plotted at true elevation, can be adjusted vertically to bring a contact between two units to a specified elevation, or can be adjusted to align the plots at a specified elevation for the base of a designated unit. If the unit is present more than once in the well, vertical adjustments will be made according to the base of the uppermost unit.

Vertical lines are drawn at both ends of the cross-section, tick marks are drawn on these end lines at user specified intervals, to make a vertical scale, and numerical elevations are posted at these tick marks near the end lines.

A "Legend", a series of rectangles filled with the patterns for each unit in the standard set followed by the identifier for the unit, can be drawn on the cross section at a specified location. If there are units in the well not included in the standard set of identifiers, nothing will be plotted to represent this unit.

Three different methods of creating cross sections are supported:

Type 1. The beginning and ending points of a line of cross section are specified by the Latitude and Longitude coordinates of the end points of the desired section on the plan view. Wells within a specified distance of this line are selected, by specifying this distance in feet. Wells within this distance (both sides of the line of section) are projected to the line of cross section (perpendicular to this line) and drawn in section. An ASCII file can be created during this procedure and used to generate a section of Type 3.

Type 2. The beginning and ending points of a line of cross-section are defined by their latitude, longitude coordinates; wells designated **by identifier** are projected to this line of section and drawn in cross section. An ASCII file can be created during this procedure and used to generate a section of Type 3.

Type 3. All parameters of the cross section are specified in an ASCII file: these include the beginning and ending points of the line of section (measured in inches to the top of the well along the section), and listings of well numbers, and their desired position along the line of section. All wells are plotted as if vertical.

The first two types of cross sections enable plotting and analysis of well data. The first plots all wells in a band specified by width along the line of section. The second allows selection of individual wells, and hence omission of unwanted or overlapping wells on the plot. The third facilitates the checking of data and data entry.

PLAN VIEWS

The area drawn on plan views is specified by providing the latitude and longitude coordinates for the corners. Eleven different types of plots can be drawn. For ten of these numerical data from the well log is posted immediately to the right of a symbol (of users choice) plotted at the well location. The posted data may be any of the following:

Well identifier
Elevation at the top of the well
Elevation at the bottom of the well
Depth of the well
Elevation at the top of a unit
Elevation at the bottom of a unit
Thickness of a unit
Elevation of a contact between two units
Thickness of a unit between two contacts
The computed vertical offset necessary for alignment of a horizon to a specified elevation.

If a unit is present more than once in a well, the specified values will be posted in sequence, that for the upper above that for the lower.

Another kind of plan view shows the unit present at a designated elevation, as if cut by a horizontal slice. The units are shown by patterns specified by the user in the standard set in a square box of size specified at the time of plotting. If a contact between two units has been adjusted to a specified elevation, the slice is cut and well intersections drawn as adjusted to the specified contact, not at a "true" elevation of intersection.

GENERAL INSTRUCTIONS

GSLITH operates from a Main Menu screen. An option is selected by entering the number of the option desired. Type the number, then hit the enter key. After selecting an option a series of prompts will be displayed. Each must be answered in sequence. Type the response, then hit the enter key.

A data base is specified by entering its name observing DOS conventions for naming files. The extensions for the several files generated by the program are not entered. Drives, or directories other than the default can be specified by following DOS conventions.

A file is specified by entering its full name with extension. Drives, or directories other than the default can be specified by following DOS conventions.

Latitude and longitude coordinates are entered in degree, minute, second, compass direction, format. Prompts will show this by DD,MM,SS,C,DDD,MM,SS,C. Provide commas in all of the places specified. An example of the response might be: **38,15,0,N,106,30,0,W**. Remember that latitudes are **N** and longitudes **W** in the conterminous 48 states.

For most entries upper or lower case letters are equivalent: either may be used. This is NOT the case for well identifiers and lithologic identifiers. For these, upper and lower case letters are different.

Unit identifier files and plot files must be prepared before using GSLITH. See section, page 45, on how to prepare these files.

TUTORIAL SECTION

We suggest starting with GSLITH by doing a small "hands on" exercise. The exercise includes digitizing, data entry, and plotting of sections and plan views. We assume the availability of hardware, properly configured. Perhaps a system configured for GSMAP.

First turn all of the hardware on: plotter, digitizer, printer, monitor and computer. If units are separately switched, boot up the computer last. Check to see that the files listed below are available on the default drive. They are included on Disk 1 of this release.

We assume now that all hardware is operative and properly connected. The first four files are necessary to the operation of GSLITH; the other files (labeled with an asterisk in the list below) are specific to the exercise described in this section.

CONFIG.SCR ... This file is used to specify the graphics configuration of the computer
CONFIG.DIG ... This file is used to specify the digitizer configuration
CONFIG.PLT ... This file is used to specify the plotter configuration and provides the symbol set.
GSLITH.EXE ... This file contains the executable code for GSLITH
*DRILL.BED ... This is the unit identifier file for this exercise.
*PLAN1.PLT .. Example of plan view plot control file type 1.
*PLAN2.PLT .. Example of plan view plot control file, type 11.
*PLAN3.PLT .. Example of plan view plot control file, type 7
*SECT1.PLT .. Example of cross section plot control file, type 1.
*SECT2.PLT .. Example of cross section plot control file, type 2.
*SECT3.PLT .. Example of cross section plot control file, type 3.
*SECT1.ASC .. Example of data file used with SECT3.PLT.
*TRACE.VAR .. Example of a "trace" file used for plotting numeric variables.
*HIST.VAR ... Example of a "hist" file used for plotting numeric variables.
*EXAMPLE.NDX Index file for data base EXAMPLE
*EXAMPLE.LSF Data file for data base EXAMPLE

In addition to these files from the release disk, A word processing program should be available.

THE UNIT IDENTIFIER FILE

The file which contains identifying names and graphic patterns for each unit that will be distinguished in the well records is called the UNIT IDENTIFIER FILE, or may be requested as the file containing VALID BED IDENTIFIERS.

The example of the unit identifier file printed below is DRILL.BED. Its six columns contain the data needed by the GSLITH program for data entry and for definition of the patterns used to represent rock units in the drawings produced by the program. Each record (line in the file) contains information for one unit. This file is used in the tutorial exercise.

```
FILE                  |CONTENTS
                      |
L1, 1, 1, 1, .03, 0   |Unit=L1,Pen#=1, Line type=1, Fill=1, Spacing=0.03", 0°
L2, 1, 0, 1, .04, 90  |Unit=L2,Pen#=1, Line type=1, Fill=1, Spacing=0.04", 90°
L3, 1, 0, 1, .05, 0   |Unit=L3,Pen#=1, Line type=0, Fill=1, Spacing=0.05", 0°
L4, 1, 0, 2, .03, 30  |Unit=L4,Pen#=1, Line type=0, Fill=2, Spacing=0.03", 30°
L5, 1, 0, 1, .07, -30 |Unit=L5,Pen#=1, Line type=0, Fill=1, Spacing=0.07", -30°
```

Each record (line) of the unit identifier file contains the following data for one lithologic unit.

Identifier,pen number,line type,fill type,spacing between lines in inches,angle from horizontal in degrees (+=counterclockwise.

A carriage return is required at the end of each line in the file.

All projects start by creating a unit identifier file using a word processing program. We assume that you know how to create an ASCII file, so to speed things along we suggest using the file DRILL.BED included on release disk number 1.

When you create such ASCII files, be sure that your word processing program doesn't leave non-printing embedded characters. We use non-document mode WORDSTAR or SIDEKICK.

The map needed for this project is included here as Fig. 1. Symbols on this map indicate the locations of six drill holes. A location identifier (eg. T2) Immediately to the right of each symbol provides the identifier (ID) of the well. The four corners of the map are shown by angled braces; the latitude and longitude of the map boundaries are provided: please read 105 45 0 on this figure as 105°,45',0", W, etc.

Start the tutorial exercise by entering **GSLITH** from the keyboard. The files listed on page 17 should be on the default drive or subdirectory.

After a brief display of the disclaimer the Main Menu will appear on the screen. Begin by entering **1** to start a new data base (type **1**, then hit the enter key). Screen prompts will direct you to make a series of entries:

ENTER DATA BASE NAME:

We used "EXAMPLE", please use a different name. The name **EXERCISE** might be used: This name is used for data base files generated by GSLITH and must follow the DOS convention for the name of a file.

ENTER MAP TITLE (36 CHARACTERS):

The title **"Tutorial"** might be used. A message will be displayed next:

TYPES OF MAPS

1 - 7 1/2 MINUTE
2 - 15 MINUTE
3 - 30 MIN LAT x 1 DEG LONG
4 - 1 DEG LAT x 2 DEG LONG
5 - OTHER

ENTER TYPE:

Enter **2**

The next prompt asks for entry of the coordinates of the northwest corner of the map.

ENTER LATITUDE,LONGITUDE OF NW CORNER
DD,MM,SS,C,DDD,MM,SS,C

Enter the coordinates in the format requested. Enter **39,0,0,N,105,45,0,W**

The next prompts will ask for the number of numeric variables: Enter **2.**

The next prompt will ask for the file name for valid bed identifiers:

Enter filename for Valid Bed Identifiers: ?

Enter **DRILL.BED**

This entry will return the screen to the Main Menu.

Digitizing locations of drill holes

Option 3 of the Main Menu is used to digitize locations. When a location is digitized a record is started for that well.

Tape Figure 1 securely to the digitizer table within the active area of the digitizer. The map must not move during digitizing.

Select option 3 DIGITIZE NEW WELL LOCATIONS by entering **3** from the Main Menu screen.

A screen prompt will ask:

ENTER FILENAME OF PROJECTION PARAMETERS: ?
Enter **UTM105.PRJ**. We will use the the UTM projection for this exercise. The next prompt will be:

ARE THE DATA BASE CORNERS THE CORNERS OF THIS MAP?(Y/N): ?
Enter **Y**

The next prompts establish a "mask" to enable use of alpha characters at the start and end of the well identifier. The prompts are as below.

FOLLOWING QUESTIONS APPLY TO WELL ID MASK(MAX OF 12 CHARS (TOTAL)

ENTER PREFIX: ?
Enter **T**

MAXIMUM NO OF DIGITS: ?
Enter **1**

ENTER SUFFIX
Press **Enter** indicating no suffix.

The next prompt will start a sequence of entries from the keypad of the digitizer.

ENTER 0 (ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

For this entry from the digitizer the position of the cursor (within the active area of the digitizer) is not important. Press the zero key on the keypad of the digitizer. The next part of the digitizing procedure indexes the map to the digitizer table using the the map corners. Follow the directions provided by the screen prompts as they appear:

ENTER NORTHWEST CORNER ON DIGITIZER
ENTER SOUTHWEST CORNER ON DIGITIZER
ENTER SOUTHEAST CORNER ON DIGITIZER
ENTER NORTHEAST CORNER ON DIGITIZER

These entries are made by pressing the zero key on the cursor keypad with the cross hair of the cursor precisely

positioned on the map at the position called for. These entries complete the indexing of the map to the digitizer table.

A prompt will appear:

X SCALE= 200,322. Y SCALE= 201,244 (or similar numbers)
CONTINUE (Y/N) ?

If there is a problem in indexing the corners, you may get a message: SCALE DIFFERS BY MORE THAN 2%, CONTINUE (Y/N?). This message always indicates a problem: If digitizing real data points digitizing should not continue (answer **N**). If you are working with a copy of this documentation copied too many times you may get this message. For purposes of this exercise can proceed.

If all is well enter **Y** from the keyboard so that digitizing can continue. A prompt will appear:

ENTER WELL ID:

Choose a well to digitize. Using the keypad of the cursor, enter the number of the well, e.g. **1**. After entry the computer will sound an audible tone and the identifier will be shown on the screen followed by a prompt:

ENTER LOCATION ON DIGITIZER:

Accurately position the cross hair of the cursor at the location of the well being digitized , and depress the **1** key to record this location. After this has been done, the system is ready to accept the number for another another well from the keypad. the prompt ENTER WELL IDENT: will again be displayed. Continue the procedure as described to enter the next well number, then digitize the location of this well. Continue until all wells have been entered and their locations have been digitized.

To end the digitizing session press the **C** key on the keypad instead of entering a well number.

Three prompts requesting entry of prefix, then the number of digits, and last the suffix will be provided on the lowest line of the screen. Press the **Enter** key on the keyboard of the computer as the response to each of these prompts. These entries will return operations to the Main Menu screen.

Additional wells can be digitized at a later time if desired and thus added to the data base if you choose to enlarge the data base.

The next step in this exercise is to enter data on the units encountered in the drill holes, and the numeric values that apply to those units.

Entering data

Select option 6 by entering **6** from the Main Menu to begin the process of entering data for the wells for this project.

The screen will display the following prompt:

```
ENTER WELL IDENT (cr to EXIT): ?
```

Enter **T1** to select well T1 for data entry. Unlike DOS operations T1 and t1 are not equivalent. The distinction between upper case and lower case letters is honored for well identifiers and for lithologic units.

At this point the screen should show:

```
ENTER WELL IDENT(cr TO EXIT): T1
THERE ARE 0 BED RECORDS CURRENTLY
ENTER TOP ELEVATION
```

The next two pages provide data for the drill holes of this exercise. In this listing "Well#" is used for the well identifier, and "Unit" for bed identifier. The depths to the top and bottom of each unit are provided in separate columns.

During data entry follow directions provided by the screen prompts. When all data for a well has been entered hit the enter key instead of entering a bed identifier, and the next prompt will request entry of another Well IDENT; enter another WELL IDENT and proceed until all data is entered. The example below shows the appearance of the screen early in the process of data entry:

```
ENTER WELL IDENT(cr TO EXIT): ? T1
THERE ARE 0 BED RECORDS CURRENTLY
ENTER TOP ELEVATION: ? 9200
ENTER TOTAL DEPTH: ? 901
ENTER BEARING: ? 0
ENTER PLUNGE: ? 90
ENTER BED IDENTIFIER: ? L1
ENTER DEPTH TO TOP: (0) ?
ENTER DEPTH TO BOTTOM (100) ?
ENTER NUMERIC VARIABLES (N,N): 1,1
ENTER BED IDENTIFIER: ? ?
```

Enter data for lithologic units starting with the uppermost unit and ending with the lowest unit. After entering data for the uppermost lithologic unit if the depth to the top of the next unit (down) is the same as the depth to the bottom of the overlying unit, hit the ENTER key and this value will be entered as the default value. As shown above, numeric variables are entered by typing the number, then a comma, then the next numeric variable for the unit, then pressing the enter key to record the values.

At some point, you may want to try to enter an incorrect unit name (other than the L1, L2, L3, L4, and L5 defined in the unit identifier file DRILL.BED. The program will check, then call for a correct bed identifier without allowing entry of the incorrect record. The prompt INVALID BED IDENTIFIER - RE-ENTER will be shown.

When all lithologic data has been entered for a well hit the **ENTER** key instead of specifying a lithologic identifier at the prompt:

ENTER BED IDENTIFIER: ?

This will bring the prompt:

ENTER WELL IDENT (cr to EXIT): ?

Follow the prompts. Continue entering data in this way until data for all wells has been entered.

When you have entered data for all wells, or are tired of the exercise, hit the **ENTER** key at the prompt:
ENTER WELL IDENT (cr to EXIT): ?

This returns operations to the Main Menu.

Data for tutorial exercise

Well#	Elev.	Depth	Bearing	Plunge
T1	9200	901	0	90

			Numeric Variables	
Unit	Top	Bottom	#1	#2
L1	0	100	1	1
L2	100	193	3	0
L3	193	305	2	1
L4	305	411	80	1
L5	411	901	22	18

Well#	Elev.	Depth	Bearing	Plunge
T2	9000	752	78	85

			Numeric Variables	
Unit	Top	Bottom	#1	#2
L1	0	20	1	0
L2	20	135	3	0
L3	135	156	7	1
L4	156	200	62	3
L5	200	752	14	6

Well#	Elev.	Depth	Bearing	Plunge
T3	8800	540	270	60

			Numeric Variables	
Unit	Top	Bottom	#1	#2
L1	0	55	4	0
L4	55	75	80	1
L5	75	540	12	40

Well#	Elev.	Depth	Bearing	Plunge
T4	9600	1020	0	90
			Numeric Variables	
Unit	Top	Bottom	#1	#2
L1	0	55	2	0
L2	55	80	3	0
L1	80	105	3	2
L2	105	125	2	0
L4	125	207	78	1
L5	207	1020	12	20

Well#	Elev.	Depth	Bearing	Plunge
T5	9400	860	75	60
			Numeric Variables	
Unit	Top	Bottom	#1	#2
L1	0	112	2	1
L2	112	132	2	0
L3	132	167	13	1
L2	167	179	1	1
L3	179	258	9	2
L4	258	298	72	2
L5	298	860	10	4

Well#	Elev.	Depth	Bearing	Plunge
T6	10200	2150	270	80
			Numeric Variables	
Unit	Top	Bottom	#1	#2
L1	0	151	1	1
L2	151	172	1	0
L3	172	252	10	0
L4	252	260	80	1
L5	260	2150	4	0

GSLITH requires user-created files to control the drawing of cross sections and plan views. Cross sections are drawn using Option 9 from the Main Menu; plan views are drawn using Option 10.

Plan view with drill hole IDs posted, Fig. 2. This plan is drawn using the plot control file PLAN1.PLT printed below.

```
File  PLAN1.PLT          |Comments (not a part of the file)

1                        | Plan view type 1 (locations, with identifiers)
39,00,00,N,105,45,0,W    | Lat, Long of NW corner of plot area
38,45,0,N,105,45,0,W     | Lat, Long of SW corner of plot area
38,45,0,N,105,30,00,W    | Lat, Long of SE corner of plot area
39,00,00,N,105,30,00,W   | Lat, Long of NE corner of plot area
200000,200000            | Xscale=200000, Yscale=200000
1,2                      | XOFFSET=1", YOFFSET=2"
Y                        | Yes rotate on plotter
12,2                     | Speed=12 cm/sec, Force=2
0.1,0.15                 | Width=0.1", Height=0.15" of label characters
"NOSTRAT",,0             | Record required for labeling
1,9,80                   | Pen=1, Symbol=9, Size=80/1000"
```

Now, plot figure 2 using this plot control file. Load the plotter with paper and check to see that pens are ready. You might use a fine black pen in position #1, fine red in #2, fine blue in #3. Option 10 from the Main Menu by entering **10**.

The program will supply a series of prompts: answer each in turn as shown below in bold type.

```
DO YOU WANT TO USE THE ONLINE PLOTTER(Y/N):
Enter Y
```

After this entry a prompt will be displayed:

```
PLOTTER SHOULD BE TURNED ON AND PAPER LOADED
HIT ANY KEY WHEN READY
```

Hit any key, and the next prompt will be displayed:

```
ENTER FILENAME OF PROJECTION PARAMETERS:
Enter UTM105.PRJ

ENTER PLOT CONTROL FILENAME:
Enter PLAN1.PLT
```

After this entry a message will provide the size of the map in inches.

```
MAP SIZE(X,Y) 5.306437  7.4903
```

The next prompt will be:

```
DO YOU WANT TO CREATE AN ASCII FILE X,Y,Z?(Y/N)
```
Enter **N** or hit the **ENTER** key (the default answer in N).

The plotter will then draw figure 2. After plotting, two prompts will request entries:

```
DO YOU WANT TO DRAW CORNER BRACES?(Y/N): ?
```
ENTER **Y**

```
DO YOU WANT INTERNAL TICK MARKS?(Y/N ?
```
ENTER **N**

After this entry the system will return to the Main Menu. The plot should be ready for your inspection.

Cross section view, Fig. 3. This section is drawn along the east-west line 38°,50′,0" latitude, see Fig. 1 for trace. SECT1.PLT is the plot control file used to draw this cross section.

File SECT1.PLT	Comments (not a part of the file)
1	|Section type=1
7000,12000,1000,500,.20	|Base elev.=7000′,top elev.=12000′,vert scale=1000′/inch, tick interval 500′ width 0.2"
200000	|Horizontal scale 1:200000
1,2	|XOFFSET=1", YOFFSET=2"
Y	|Yes rotate on plotter
12,2	|Speed=12 cm/sec, Force=2
0.1,0.15	| Width=0.1", Height=0.15 of label characters
"NOSTRAT",,0	| Plot at true elevation
N,0,0	| No don't plot legend
38,50,0,N,105,45,0,W	| Lat, Long coordinates of left end of section
38,50,0,N,105,30,0,W	| Lat, Long coordinates of right end of section
10000	| 10000′ (plot wells within this distance of section)

Select option 9 from the Main Menu.

Enter **9**

Prompts will request entries; answer each prompt in turn.

```
DO YOU WANT TO USE THE ONLINE PLOTTER?(Y/N): ?
```
Enter **Y**

```
PLOTTER SHOULD BE TURNED ON AND PAPER LOADED
HIT ANY KEY WHEN READY
```
Hit any key:

```
ENTER FILE NAME OF PROJECTION PARAMETERS:
```
Enter **UTM105.PRJ**

```
DO YOU WANT TO PLOT THE NUMERIC VARIABLES:? (Y  N): ?
```
Enter **Y**

```
ENTER PLOT CONTROL FILE FOR NUMERIC TRACE: ?
```

Enter **HIST.VAR**
ENTER PLOT CONTROL FILENAME: ?
Enter **SECT1.PLT**

CREATE AN ASCII FILE CONTAINING WELL #, DISTANCE DOWN SECTION?(Y/N): ?
Enter **N**

After this entry the plotter will draw Fig. 3. When the plot is complete the system will return to the Main Menu.

Review of tutorial

The file that identifies standard units and specifies graphical plot patterns for these units must be prepared before starting GSLITH. This unit identifier file or bed file is utilized by the program to check the well data as they are entered to verify consistency of the unit identifiers during entry. This insures that a standard terminology is used, that all identifiers have been specified, and that graphical patterns are defined for all lithologic units. Similar files are used to control plots of the numeric variables. These must be available when using Option 9 if you wish to plot the variables.

When starting a new project Option 1 from the Main Menu is used to to create a database. The latitude and longitude coordinates of the corners specified for the database should match the corners of the map that will be used for digitizing well locations.

Next, one uses Option 3 from the main GSLITH Menu to enter the well identifiers and to digitize the well locations from the map.

Then, using option 6 from the Main Menu, data for the lithologic units in each well log is entered into the data base.

At this point data can be edited, wells deleted and recovered, and drawing of plan views and cross sections can begin. The tutorial exercise suggests plotting of one plan view and one cross section. The plot files used to create Figures 2-8 are included on the release disk. Using your word processing program you can create plot control files for other views of this data.

Plan views drawn at the same scale as the base, with well numbers posted enable easy checking of data entered from the digitizer. Data dumps made using Option 8 can be compared with the input data to check keyboard entry. Changes can be made from the keyboard of the computer using Option 7.

Values for coordinates of a well can be changed either from the keyboard or by redigitizing the location. The program allows the user to change unit lithology, depth to top and depth to bottom for individual units, and provides for the deletion or

addition of unit records.

We have found that the drawing of cross sections at an early stage is useful for checking data entry and the consistency of well data.

A data base is tied to specific map corners for digitizing but maps with different corner coordinates can be digitized by specifying these coordinates during the digitizing procedure.

The data base "EXAMPLE" is included, so that you can try plotting without taking the time to enter well data, if you choose. Use of this data base and associated files can also serve to check the configuration of the system.

The GSLITH program is menu driven. The user operates the program by making choices from the menus and responding to messages and prompts (requests for entries) that are displayed on the screen. A unit identifier file must be prepared before creating or opening a data base. Before using options for digitizing and plotting projection parameter files must be prepared. Plot control files must be prepared before plotting, including the control files that are used for plots of numeric variables on sections.

Start operation of the program by entering **GSLITH** at the DOS prompt. A disclaimer screen will be displayed briefly followed by the Main Menu screen:

THE MAIN MENU

G S L I T H

CURRENT DATA BASE:

1 - START A NEW DATA BASE
2 - OPEN AN EXISTING DATA BASE
3 - DIGITIZE NEW WELL LOCATIONS
4 - DELETE A WELL
5 - RECOVER A WELL
6 - ENTER UNIT RECORDS FOR A WELL
7 - EDIT UNIT RECORDS FOR A WELL
8 - LIST CONTENTS OF DATA BASE
9 - PLOT SECTION VIEW ON THE PLOTTER
10 - PLOT PLAN VIEW ON THE PLOTTER(POSTING)
11 - MERGE ANOTHER DATA BASE INTO THE CURRENT DATA BASE
12 - EXIT

ENTER CHOICE BY NUMBER: ?

The Main Menu is provided above. The user chooses one of the options by entering the appropriate number.

After starting the program, a new data base must be started using Option 1 or an existing data base must be opened using Option 2. Choice of another option before selecting a "CURRENT DATA BASE" will bring the reminder:

You must start or open a DATA BASE before using options 3-11
Press any key to continue.

OPTION 1. START A NEW DATA BASE

The program will clear the screen and prompts will request entry of the **NAME** for the new data base. This name will be used to form the filenames for the two parts of the data base: the index file and the data file. The data base name can consist of up to eight alphanumeric characters containing no blanks, periods or commas. The extension NDX will be added for the index file; LSF will be added for the data file. DOS conventions (an eight character limit) for naming files must be followed when specifying data base names.

A prompt will then request entry of a **Title**. A name with up to 36 characters can be used. This title will be shown on data listings.

A prompt will provide information to help open the data base:

TYPES OF MAPS

1 - 7 1/2 MINUTE
2 - 15 MINUTE
3 - 30 MIN LAT x 1 DEG LONG
4 - 1 DEG LAT x 2 DEG LONG
5 - OTHER

Enter the type desired: e.g. **2**

If types 1-4 are chosen, the next prompt will request entry of the latitude and longitude coordinates for the northwest corner of the map area. If type 5 is chosen, coordinates for all four corners must be entered. These coordinates for the map corners can be used as default corners when digitizing. These coordinates must be entered in the format shown on screen (degrees, minutes, seconds, compass direction, separated by commas. This is shown by prompts with the format DD,MM,S,C,DDD,MM,S,C. Remember that latitudes are **N** and longitudes **W** in the conterminous 48 states.

Another prompt will ask for the number of numeric variables. Enter the number desired. 0 to 5 can be specified.

After these entries, prompts will call for entry of the name of the file (including extension) containing the valid bed identifiers. After this is supplied, operation will return to the main menu.

Starting a new data base using option 1 establishes it as the current data base for the session in GSLITH unless it is changed later (Options 1 or 2). It also establishes the specified unit identifier file as the operative identifier file. The number of numeric variables is fixed for a given data base. If more numeric variables (limited to 5 total) are needed, a new data base should be created and the old data added to the new data base using the merge option, number 11.

OPTION 2. OPEN AN EXISTING DATA BASE

Generally, the user will be working with a data base started in a previous session, for which the database files already exist. Selection of Option 2 will clear the screen and bring a prompt requesting the name of the data base.

ENTER MAP DATA BASE NAME: ?

The name of the desired data base should be entered. The program will add the extensions NDX and LSF to the data base name and will check to see that both of the required files exist and will open the data base if they do. If the files cannot be found in the default area a prompt will again call for entry of the name of a map data base. Pressing the Return key at this prompt will return operations to the Main Menu.

After entry of the name of a valid data base a prompt will request entry of the name of the file (including extension) containing the valid bed identifiers.

Enter filename for Valid Bed Identifiers: ?

After this entry operation of the program will return to the Main Menu screen. The name of the current data base will be shown at the upper right of the screen.

OPTION 3. DIGITIZE NEW WELL LOCATIONS

Make sure that the map to be digitized is securely fixed to the digitizer table within the active area of the digitizer. The map must not move during digitizing.

Selection of Option 3 from the Main Menu screen will clear the screen and bring a prompt for entry of the projection file to be use

ENTER FILENAME OF PROJECTION PARAMETERS: ?

Enter the name of the projection file. The next prompt will be:

ARE THE DATA BASE CORNERS THE CORNERS OF THIS MAP?(Y/N):
Enter **Y** if the corners are the same. If the corners to be used for registering the map to the digitizer table are not the same as the data base corners respond **N** to this prompt. The default (hit enter key is **N**). If you enter **N** prompts similar to those used to start a data base will be shown:

TYPES OF MAPS

1 - 7 1/2 MINUTE
2 - 15 MINUTE
3 - 30 MIN LAT x 1 DEG LONG
4 - 1 DEG LAT x 2 DEG LONG
5 - OTHER

Enter the type desired as in Option 1:

The next prompts establish a "mask" to enable use of alpha characters at the start and end of the well identifier. The prompts are as below.

FOLLOWING QUESTIONS APPLY TO WELL ID MASK(MAX OF 12 CHARS (TOTAL)

ENTER PREFIX: ?

MAXIMUM NUMBER OF DIGITS: ?

ENTER SUFFIX: ?

After responding to these prompts, digitizing will require entries from the keypad of the digitizer.

ENTER 0 (ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

For this entry from the digitizer the position of the cursor within the active area of the digitizer is not important: press the zero key on the keypad of the digitizer.

The next part of the digitizing procedure indexes the map to the digitizer table using the the map corners. Follow the directions provided by the screen prompts as they appear:

ENTER NORTHWEST CORNER ON DIGITIZER
ENTER SOUTHWEST CORNER ON DIGITIZER
ENTER SOUTHEAST CORNER ON DIGITIZER
ENTER NORTHEAST CORNER ON DIGITIZER

These entries are made by pressing the zero key on the cursor keypad with the cross hair of the cursor precisely positioned on the map at the position called for. These entries complete the indexing of the map to the digitizer table. A prompt will appear:

X SCALE= YSCALE=
CONTINUE (Y/N) ?

If there is a problem in indexing the corners, you may get a message: SCALE DIFFERS BY MORE THAN 2%, CONTINUE (Y/N?). This message always indicates a problem: digitizing should not continue (answer **N**).

If all is well enter **Y** from the keyboard so that digitizing can continue. A prompt will then appear:

ENTER WELL IDENT:

Choose a well to start digitizing. Then using the keypad of the cursor, enter the number of the well (the number between the prefix and suffix specified). After entry the complete identifier will be shown on the screen followed by a prompt:

ENTER LOCATION ON DIGITIZER:

Accurately position the cross hair of the cursor at the location of the well being digitized , and depress the "1" key to record this location. After this has been done, the system is ready to accept the number for another another well from the keypad. The prompt ENTER WELL IDENT: will again be shown.

Continue the procedure to enter the next well number, then digitize the location of the new well. Continue until all desired wells have been entered and their locations digitized.

To change any part or all of the identifier mask (prefix, number of digits, or suffix) press the **C** key on the keypad of the digitizer at the point where a new well number is to be entered. This will return to the prompt sequence requesting entry of prefix, number of digits, and suffix, and thence lead back to digitizing.

If an incorrect well identifier is entered, pressing the **E** key before digitizing the location of the well will return the system to the ENTER WELL IDENT: prompt so that an incorrect entry can be avoided.

Notes on digitizing:

- If you attempt to enter a well identifier that has already been entered, the program will ask if you wish to redigitize the location for this well before allowing its position to be re-digitized. A "Y" from the keyboard of the computer will allow you to re-digitize this position. A "N" from the keyboard will return the digitizing procedure to permit entry of a new well identifier. The newly digitized location will replace the old in the data base.

- For well identifiers either upper case letters or lower case letters may be used; they are NOT equivalent: Eg. T21 and and t21 are not the same. Alphanumeric prefixes and suffixes are specified when defining the mask.

- Prefix, maximum number of numeric digits , and suffix can be changed during the digitizing session by hitting the **C** key instead of entering a number for a well. This will bring prompts allowing resetting of prefix, maximum number of variables, and suffix.

-To end the digitizing session press the **C** key on the keypad instead of entering a well number. The prompts requesting entry of prefix, number of digits, and suffix will be provided. Press the **Enter** key on the keyboard of the computer instead of supplying a prefix, number of digits, and suffix at each of these prompts. This returns operations to the Main Menu screen.

OPTION 4. DELETE A WELL

Selection of Option 4 from the Main Menu will clear the screen. A prompt will request entry of the WELL IDENT (the identifier) for the well to be deleted. After entering the identification of the well(s) to be deleted, each (one at a time) in response to repetitions of this prompt.

To return to the Main Menu, hit the ENTER key in response to this prompt.

Notes:

- Wells without bed records cannot be deleted.

OPTION 5. RECOVER A WELL

This option allows you to recover a deleted well. After entry of **5** from the Main Menu, the screen will clear, and a prompt will request entry of the identifier (WELL IDENT) for the well to be "undeleted". "Undelete" wells as required. Use the carriage return at the (WELL IDENT) prompt to return to the main menu.

OPTION 6. ENTER UNIT RECORDS FOR A WELL

Selection of Option 6 from the Main Menu will clear the screen and provide a series of prompts. This option is used to enter information about the units in each well after the location of the well has been digitized.

Prompts will request the well identifier (IDENT) for a well, then the elevation of the top of the well, the total depth of the well, its bearing, and plunge.

Prompts will ask the user to supply information about the units cut by the well. Each unit identifier, depth to top, and depth to bottom, should be entered. The program will check each unit identifier to verify that it is a standard unit identifier defined in the unit identifier file.

A prompts will call for entry of the numeric variables for each unit The numbers are separated by commas during entry.
When unit information for all lithologic units has been entered, hitting the Enter key, instead of providing a valid lithologic identifier will return the system to the enter a Well identifier prompt.

Enter data for lithologic units starting with the uppermost unit and ending with the lowest unit. After entering data for the uppermost lithologic unit, if the depth to the top of the next unit (down) is the same as the depth to the bottom of the overlying unit, hit the ENTER key and this value will be entered as the default value. As shown above, numeric variables are entered by typing the number, then a comma, then the next numeric variable for the unit, then pressing the enter key to record the values. Follow the format for data entry shown by prompts on the screen.

If a unit identifier not present in the unit identifier file is specified during data entry the program will check, then call for a correct bed identifier without allowing entry of the incorrect record. The prompt INVALID BED IDENTIFIER - RE-ENTER will be shown.

For <u>well identifiers</u> and <u>lithologic identifiers</u> upper and lower case letters are different.

When data entry for all wells has been completed, hit the Enter key instead of entering a new well identifier to return the system to the Main Menu.

OPTION 7. EDIT UNIT RECORDS FOR A WELL

Once a well location has been digitized and the unit record detail entered, changes to the values should be made using Option 7. After entry of **7** from the Main Menu the screen will clear and the user will be requested to enter the identifier of the well to be edited. The well identifier, latitude,longitude, top elevation, depth, bearing, and plunge, will then appear across the top of the screen and will be followed by up to ten unit records. The prompt below will be shown:

Enter Option: ?

The lowest line of the screen will display a series of options.

The choices are as follows:

1 - CHANGE
Change the well number, top elevation, latitude, longitude, total depth, bearing, plunge, or any unit record.

2 - DELETE
Delete any unit record

3 - PRINT NEXT SECTION
Prints the next ten unit records

4 - INSERT AFTER
Insert a new unit record after an existing unit record

5 - QUIT
Returns to the well identification to edit question

Choice of Options 1-4 will bring prompts for entries as to the unit record to edit, and values to be entered.

When all editing has been completed, hit the ENTER key instead of providing a well identifier at the prompt, and the system will return to the main menu.

Notes:

- For ease in operation use 3-PRINT NEXT SECTION to print the record you wish to change on the screen, so that you are aware of the values being changed or inserts being made without reference to a printout.

For <u>well identifiers</u> and <u>lithologic identifiers</u> upper and lower case letters are different.

OPTION 8. LIST CONTENTS OF DATA BASE

Selection of Option 8 from the Main Menu will clear the screen. A prompt will then ask the user to indicate whether the data should be printed to the screen or to the printer. Enter **S** (SCREEN) or **P** (PRINTER). The default (hit the Enter key) is to the screen. The user is then prompted to indicate whether he wants records for a specific well or all wells. A response of **ALL** will create a listing of the data for all wells. Entry of a specific well identifier (WELL IDENT) will cause the program to list the data for that well, then return to the ENTER WELL IDENT prompt. After the desired wells have been listed, hitting the carriage return key instead of entering a well identifier at the ENTER WELL IDENT prompt will return operations to the Main Menu.

If the screen display is selected, data will be displayed 20 lines at a time. Prompts will be displayed at the bottom of the screen:

HIT ANY KEY TO CONTINUE LISTING (Q TO EXIT)
FUNCTION KEY 9 TO PAUSE, THEN Q TO QUIT, RETURN TO CONTINUE
If you hit **Q** the prompt: ENTER WELL IDENT(ALL FOR ALL, cr TO QUIT will be displayed. Follow directions.

Note:

- Lower case and upper case letters are NOT equivalent when used in well identifiers.

OPTION 9. PLOT SECTION VIEW ON THE PLOTTER

After entering **9** from the Main Menu the screen will clear. The first prompt will request:

DO YOU WANT TO USE THE ONLINE PLOTTER(Y/N):

Enter **Y** to plot on the plotter. The default answer to this prompt is **N**. If you answer **Y** a prompt will remind you that the plotter must be ready. Follow directions.

PLOTTER SHOULD BE TURNED ON AND PAPER LOADED
HIT ANY KEY WHEN READY

A response of **Y** will skip prompts related to creating an HPGL plot file, and proceed to the prompt requesting entry of the name of the projection parameter file to be used.

Enter **N** to generate an HPGL file to be used to drive an external program. If you enter **N**, a prompt will ask for the name of the file to be used to store the data. A file name must be entered.

The prompt will ask:
ENTER DISK FILENAME: ?

Enter the name of the file to be created. There is no default answer to this prompt.

After entry of this file name with extension, an arcane prompt will request entry of the scaling points:

P1X,P1Y,P2X,P2Y:

These are the scaling points (see Appendix 1 and plotter documentation). They are entered in the form, **80,320,10080,7520** There is no default for these values. The values depend on the kind of plotter, the size of the plot media, and in certain cases the orientation of the media in the plotter.

After entry of these numeric values for the scaling points, a prompt will request:

ENTER FILE NAME OF PROJECTION PARAMETERS:

Enter the full name, with extension, of the file containing the projection parameters, e.g. **UTM105.PRJ**. There is no default answer to this prompt.

The next prompt asks about plotting the numeric variables.

DO YOU WANT TO PLOT THE NUMERIC VARIABLES?(Y/N).
If you answer **N** numeric variables will not be plotted and the prompt listed next will be skipped. The default answer is **Y**. If you enter **Y**, the next prompt will request:

ENTER PLOT CONTROL FILE FOR NUMERIC TRACE: ?

Enter the filename with extension for the file that controls plotting of the numeric variables, e.g. **hist.var.** The next prompt asks for entry of the plot control file for the section:

ENTER PLOT CONTROL FILENAME: ?

Enter the name of this file, with extension, e.g. **SECT1.PLT).**

After this entry, if a section is being drawn of type 1 or 2, the next prompt will request entry of **Y** or **N.**

CREATE AN ASCII FILE CONTAINING WELL #, DISTANCE DOWN SECTION? (Y/N):

If you wish to create an ASCII file containing the WELL IDs and the distance along the section, enter **Y.** The default answer is **N.** If you answer **N** the program will skip prompts related to this file and begin to operate. If you answer **Y,** a prompt will request entry of the complete name for the file, including extension:

ENTER FILENAME:

After this entry or a **N** answer to the previous prompt the program will operate and plot the section specified.

During plotting the bottom line of the screen will display the message:

FUNCTION KEY 9 TO PAUSE, THEN Q TO QUIT, RETURN TO CONTINUE

If you wish to stop plotting before the plot is complete, press the F9 key, then either the Return key to continue or the Q key to return operations to the main menu.

The ASCII file containing WELL IDs and distances has the format shown below:

```
T4          ,     0.151
T5          ,     1.490
T6          ,     3.124
"          ",     4.272
```

This file is included on the release disk as SECT1.ASC, and was used to plot Fig. 7.

Notes:

- Vertical clip limits for the section are set by the lower and upper elevations entered for the scales at the end of the section. This permits selecting and plotting a vertically delimited part of well data.

- The vertical clip limits apply when wells are plotted at true elevations, and also to the adjusted elevations when plots are adjusted to a selected datum.

- The unit identifier file that provides the plot patterns for each unit is specified just after the data base is opened, (Option 1 or 2). A different file can be specified by using option 2 to re-open the data base.

- Units in the data base that are not in the identifier file in use at the time of making the plot will not be plotted. This permits making cross sections that emphasize selected units.

OPTION 10. PLOT PLAN VIEW ON THE PLOTTER (POSTING)

This option is used for all plan views, including horizontal slices.

After entry of **10** from the Main Menu, the screen will clear and the user must respond to prompts. The first asks:

ENTER FILENAME OF PROJECTION PARAMETERS:

Enter the name with extension of the projection parameter file, e.g. **UTM105.PRJ**

DO YOU WANT TO USE THE ONLINE PLOTTER(Y/N): ?

If you enter **Y** (yes) output will go to the plotter, and a prompt will remind you:

PLOTTER SHOULD BE TURNED ON AND PAPER LOADED
HIT ANY KEY WHEN READY

If the response is **N**, (NO) prompts will request the name of a disk file where the HPGL commands (ASCII) are to be written, and then for values of the scaling points on the plotter.

P1X,P1Y,P2X,P2Y:

These are the scaling points (see Appendix 1 and plotter documentation). They are entered in the form, **80,320,10080,7520** There is no default for these values. The values depend on the kind of plotter, the size of the plot media, and in certain cases the orientation of the media in the plotter. The values here are for the HP 7550A plotter with 8 1/2" X 11" plot media.

After entry of numeric values for the scaling points, a prompt will request:

ENTER PLOT CONTROL FILENAME:

The name of the plot control file must be entered, e.g. **SECT1.PLT**. After this entry a prompt will ask:

DO YOU WANT TO CREATE AN ASCII FILE X,Y,Z?(Y/N) ?

If **Y** a prompt will ask for be for the name of the file. This allow the user to export the data to programs such as gridding and contouring. The format of this file is shown in Appendix 1. After the entry of the file name the program will operate to make the plot.

If **N** the program will operate and make the plot. When the plot of data has been finished complete prompts will ask:

DO YOU WANT TO DRAW CORNER BRACES? (Y/N): ?

Enter **Y** to mark the corners of the plot with braces. The default value is **N**. Enter **Y** or **N**. The corners that are plotted will be the corners specified in the plot control file (not the data base corners).

DO YOU WANT INTERNAL GEODETIC TICK MARKS? (Y/N)?

Enter **Y** or **N**. The default value is **N**. If **Y**, a prompt will ask for the desired spacing:

ENTER DELTA(DD,MM,SS):

Enter the spacing in degrees, minutes, seconds as desired, e.g. **0,2,30**. Plus (+) signs will be plotted at the spacing specified. After plotting the tick marks, operations will return to the Main Menu.

Notes:

- During plotting the bottom line of the screen will display the message:
FUNCTION KEY 9 TO PAUSE, THEN Q TO QUIT, RETURN TO CONTINUE

If you wish to stop a plot, press the F9 key, then either the Return key to continue or the Q key, to return operations to the main menu.

- Units in the data base that are not in the identifier file in use at the time of plotting a horizontal slice will not be recognized or plotted.

OPTION 11. MERGE ANOTHER DATA BASE INTO THE CURRENT DATA BASE

After entry of **11** from the Main Menu, the screen will clear and the user will be prompted to enter the name of the data base from which data is to be added to the current data base.

The information contained in the specified data base will be added at the end of the current data base. If the current data base has more numeric variables than the added data base, zeros will be supplied for the missing numeric variables; if it has less, the extra values will not be copied.

When merging is complete, the screen will return to the Main Menu.

OPTION 12. EXIT

Entry of **12** from the Main Menu will return operation of the system to the DOS prompt.

UNIT IDENTIFIER FILES

The unit identifier file (or bed file) is created with the aid of an ASCII word processing program (like SIDEKICK or non-document mode WORDSTAR). Each record (line) in the Unit Identifier File contains the identifier assigned to a particular lithologic (or stratigraphic) unit followed by parameters that define the pen and the pattern to be plotted as graphic output. A maximum of 99 different units can be specified. Each record contains the following entries separated by commas:

Unit Identifier	Up to eight alphanumeric characters no blanks or commas
Pen number	1-8 (1-6 on some plotters)
Line type	0-12 See p. 64 and fig. 10
Fill type (pattern)	0-2 See p. 64 and fig. 11

Spacing between lines of fill pattern in inches.

Angle of lines is Measured in degrees (+ angles counterclockwise, - angles counterclockwise).

Example of a unit identifier file

FILE	Explanation of contents (not a part of the file)
	|
L1, 1, 1, 1, .03, 0	|Unit=L1,Pen#=1, Line type=1, Fill=1, Spacing=0.03", 0°
L2, 1, 0, 1, .04, 90	|Unit=L2,Pen#=1, Line type=1, Fill=1, Spacing=0.04", 90°
L3, 1, 0, 1, .05, 0	|Unit=L3,Pen#=1, Line type=0, Fill=1, Spacing=0.05", 0°
L4, 1, 0, 2, .03, 30	|Unit=L4,Pen#=1, Line type=0, Fill=2, Spacing=0.03", 30°
L5, 1, 0, 1, .07, -30	|Unit=L5,Pen#=1, Line type=0, Fill=1, Spacing=0.07", -30°

Units should be listed from top to bottom in this file in order of increasing age, The youngest in the first record, the oldest in the last. This gives the vertical sequence (arranged from top to bottom by increasing age) plotted in the legend, see fig 4.

Please follow the format above **exactly.** Omission of a comma from this file will probably bring an error message when operating the program, following entry of the name of the file, and return the system to the DOS prompt.

The first (left hand) column of the unit identifier file contains the identifier to be used for each lithologic unit present in well data set (in this example: L1, L2, L3,L4, and L5.

The second column of the table contains the number of the pen that will be used to draw the unit, The carousel of the plotter has numbered positions. The pen called by the GSLITH program will be the pen you load into the position with that number in the carousel.

The third column designates the line type to be used in the graphical representation of the unit. The line type is specified by providing a number from 0 to 12. These line types are shown in figure 10, p. 74.

The fourth column contains the entry that specifies the fill type to be used in representation of the unit. The fill type is designated by a number, 0, 1, or 2, see examples Fig 11, p. 75.

Fill type 0 draws only the outline of the area.
Fill type 1 is a fill drawn by parallel lines.
Fill type 2 consists of two sets of mutually perpendicular parallel lines that form a rectangular grid.

The fifth column of the table contains a number that specifies the separation in inches between parallel lines drawn as polygon fills types 1, 2. Use **0** as the entry for fill type 0.

The sixth column of the table specifies the angle of the first set of parallel lines from the horizontal measured in degrees (+ angles are counterclockwise, - angles clockwise). Note that the angle zero (0) specifies horizontal lines, 90 specifies vertical lines. In the bed file, the entry in each column is ended by a comma, as shown shown in the example, DRILL.BED on the preceding page. Comparison of the entries in this table with the plots on figures 3, 4, and may help you visualize the graphical results of these plotter instructions. See also Figures 10 and 11, p. 74,75.

The last line of this file must be ended with a carriage return. There should be no blank lines at the beginning or end of this file.

CONTROL FILE FOR NUMERIC VARIABLES

Numeric data are plotted on the right side of the plot of the well on the cross section. If numeric variables are to be plotted, a control file is needed. The first record (line) in the control file for numeric variables file is used to select the method for plotting the numeric data. Two kinds of plots can be produced. The first HIST produces a graphical record in the form of a bar graph. The outlines of the bars can be plotted alone, or the bars can be patterned. The second, TRACE, graphs the numeric variables using a line connecting values at the base of each lithologic unit. The values for the numeric variables are in the data base. Scales are specified in the control file for each of the numeric variables. Any or all of the numeric variables can be plotted on a single plot. Scales are separately set for each of the variables.

Record 1. The first record is either **HIST** or **TRACE**

HIST produces a bar graph.
TRACE graphs a line connecting values at the base of each lithologic unit.

After Record 1, one additional record is needed for each variable in the data base. The first (record 2) sets parameters for Variable 1, the second (record 3) for Variable 2, and so on. Up to 5 numeric variables are allowed. The number of records specifying plot parameters for numeric variables must match the number of numeric variables in the data base to be plotted. The examples below provide specifications for the contents of each record.

Each record for a numeric variable control file using the TRACE method consists of the following, separated by commas:

Pen number (position in carousel)
Line type (number)
Base value for numeric variable (value plotted along the right side of the well
Units per inch for graph of numeric variable

Each record for a numeric variable control file using the HIST method consists of the following, separated by commas:

Pen number (position in carousel)
Line type (number)
Base value for numeric variable (value plotted along the right side of the well
Units per inch for graph of numeric variable
Fill type (number, 0-2)
Spacing between lines in inches
Angle of rotation in degrees

Examples of plot control files for numeric variables

TRACE

```
FILE        | EXPLANATION
            |
TRACE       |TRACE selects the numeric trace option
1,0,0,100   |1 (Pen=1), Line type=0,Base value=0,Units/inch=100  "Variable 1
2,1,0,100   |2 (Pen=2), Line type=1,Base value=0,Units/inch=100  "Variable 2
1,0,0,80    |3 (Pen=1), Line type=0,Base value=0,Units/inch=80   "Variable 3
2,3,0,100   |4 (Pen=2), Line type=3,Base value=0,Units/inch=100  "Variable 4
```

HIST

```
File                | EXPLANATION

HIST                |HIST selects the bar graph option
0,100,2,1,1,.03,45  |Base value=0,Units/inch=100,Pen=2,Line type=1,Fill=#1,Spacing=.03",angle=45 Var#1
0,  0,1,1,1,.01,0   |Base value=0,Units/inch=0,Pen=1,Line type=1,Fill=#1,Spacing=0.01",angle=0 Var#2
0, 50,1,1,1,.01,0   |Base value=0,Units/inch=50,Pen=1,Line type=1,Fill=#1,Spacing=0.01", angle=0 Var#3
0, 80,1,1,2,.01,0   |Base value=0,Units/inch=80,Pen=1,Line type=1,Fill=#2,Spacing=0.01",angle=0 Var#4
```

Notes:

-If you do NOT want to plot a particular numeric variable, set the scale for that variable to 0 (Zero), see variable #2 in file HIST above.

-Examples of line types are shown on Fig. 10

-Examples of fill patterns are shown on Fig. 11.

PLOT CONTROL FILES FOR CROSS SECTIONS

Plot control files are required for making plots using GSLITH. For plots of sections these files specify the plot parameters. These files must be written by the user. The plot control file consists of a series of ASCII records in a file with a name specified by the user. Each record is a single line of data items separated by commas and ended by a carriage return. Examples of plot control files are included on disk #1 of this release.

Types of cross sections

1 = Beginning and ending points to be specified by latitude, longitude coordinates and well data to be projected (perpendicularly) to this cross-section line if the wells are located within a specified distance (in feet) of this line of section. Wells are plotted with correct plunge (apparent plunge along plane of section compensated for vertical and horizontal scale).

2 = Beginning (left) and ending points (right) of the section specified by latitude, longitude coordinates and wells specified by well identifier (ID) projected (perpendicularly) to this line of cross section. Wells are plotted with correct plunge (apparent plunge along plane of section compensated for vertical and horizontal scale).

3 = An ASCII text file specifies the beginning and ending points of the cross-section (inches along the cross section), the wells to be plotted by well identification, and the positions of their plots along the cross section. Wells are plotted as if vertical.

Record 1 specifies the type of the cross section to be drawn. types of cross sections are specified by a number, 1, 2, or 3. Example **1**

Record 2 specifies the base elevation, top elevation, vertical scale, tick mark interval on the scale, and the width of the well column in inches. The program will construct a vertical scale on the left and right sides of the cross-section. The scale will be labeled on even multiples of the vertical scale. Example: **3600,4600,200,100,0.25**

Record 3 specifies the horizontal scale. The scale is expressed as the denominator of the scale fraction, If the base map is plotted at 1:24000 a same-scale section would be drawn by specifying a scale of 24000.0: Example **240000**

Record 4 specifies the offset, in inches, of the lower left corner of the cross section from the default position of the plotter on the paper: Example **1,1**

Record 5 contains an entry of Y or N specifying whether or not

the plot is to be rotated by the plotter. Example **Y**

Record 6 specifies the speed and force at which the plotter is to draw the map or cross-section. Normally the speed is 12 centimeters per second (cps) for final drawings and up to 55 cps for drafts. Minimal force is generally used to minimize wear on the pen points (value of 1 or 2). Example **25,2**

Record 7 specifies the width and height, in inches, for letters and numbers that are posted: Example **0.1,0.15**

Record 8 specifies parameters that determine (1) whether the plots of well data are drawn to their correct elevation (based on the elevation entered for the top of the hole); (2) are to be aligned at a specified elevation for the bottom of a chosen unit if it was encountered in the hole; or (3) are to be aligned at a specified elevation on the contact of two specified units.

- To draw plots that show wells at their actual elevation, enter **"NOSTRAT",,0** for Record 8.

- To draw plots of wells in which the bottom of the uppermost occurrence of a unit is drawn at a specified elevation, enter the unit identifier and the elevation desired: Example **Or,,1000** for Record 8.

- To draw plots that show wells in which a contact is fixed at a specified elevation, enter the two unit identifiers and the elevation desired: Example **Or,Oc,1000**. A plot of the well will be drawn only if both units are present in the well and the depth of the base of the first unit (here Or) matches the depth of the top of the second unit (here Oc).

Record 9 specifies whether or not a legend is to be plotted. To plot a legend, enter **Y** and the position of the top left corner location (in inches) where the legend is to be plotted; to not plot a legend, enter **N,0,0**

Examples:
- To plot a legend with top at position X=6",Y=9" on the sheet, enter **Y,6,9**

- To make a plot without a legend, enter **N,0,0**

Legends are always drawn the same height. Changing the scale of a plot does not change the height of the boxes. The width of the boxes is determined by the width specified for the wells.

Beyond record 9 the contents of the Plot Control File differ according to the type of section specified in record 1.

<u>For a section of Type 1</u>

Record 10 specifies the starting point of the cross section (left end) using latitude, longitude coordinates. Example:
38,0,0,N,105,0,0,W

Record 11 specifies the ending point of the cross section (right end) using latitude, longitude coordinates. Example:
38,30,10,N,110,15,10,W

Record 12
This record specifies the distance (in feet) on both sides of the line of section to be used to select wells to be drawn on the cross-section. Example: **1000**

For a section of Type 2

Record 10
This record determines the starting point of the cross-section (left end) using latitude, longitude coordinates
Example: **36,15,0,N,109,15,0,W**

Record 11
This record determines the ending point (right end) of the cross-section as using latitude, longitude coordinates
Example: **46,0,0,N,109,7,30,W**

For a section of Type 2

Records number 12 and higher.

These records specify the well identifiers (ID) for wells to be projected to the section line.

- A single well identifier makes up each line of the file. - There must be a carriage return at the end of the final line of the file. An Examples of records 12-17 are printed below.

T12
T22
T32
T43
T53
T63

For a section of Type 3

Record 10
This record specifies the name of a file that contains a list of well identification and distance in inches from the left end of the section with the last line containing a blank well number (" ") and the total length of the section in inches.
Example: **INPUT.ASC**

Example of ASCII file listing wells for sections of type 3:

```
T12          ,      0.250
T22          ,      0.751
T32          ,      1.249
T42          ,      1.751
T62          ,      2.749
"          ",       3.750
```

This file can be generated while making sections of Type 1 or 2; alternatively it can be written using a word processing program. The file above is in the format written by GSLITH. The file below has a format more convenient for a word processing program. Both work.

```
T12,0.25
T22,0.751
T32,1.249
T42,1.751
T62,2.749
" ",3.750
```

Example of a plot control files for a section of type 1.

```
1                       | Section type 1
-6000,5000,500,100,0.25 | Top=-6000',Base=5000',Vertical scale=500'/in.,tick mark interval=100', width of well=0.25"
24000                   | Horizontal scale=1:24000
1,1                     | XOFF=1",YOFF=1"
N                       | No, don't rotate on plotter
12,2                    | Speed=12, Force=2
0.1,0.15                | Width=0.1". Height=0.15" for label characters
"CACHE",,2800           | Adjust base of unit Cache to 2800'
Y,30,14                 | Yes,plot legend, top at X=30" Y=14"
44,25,0,N,105,37,30,W   | Coordinates left end of section
44,25,0,N,105,30,00,W   | Coordinates right end of section
3000                    | Plot wells within 3000' of line of cross section on plan view
```

Notes:

- If adjustment of elevation of wells based on a particular unit or contact is specified that unit or contact must be present in a well or it will not be plotted.

- Deleted wells will not be plotted.

PLOT CONTROL FILES FOR PLAN VIEWS

Plot control files for plan views (maps) consist of a series of ASCII records that specify the kind of plot desired.

Record 1

This record specifies the type of plan view, and the kind of value to be posted. Example **2**

Types of plan views

1 = Well Identification (symbol plotted at the position of the well, posting just to the right of the top of the well).

2 = Elevation at the top of the well (symbol plotted at the position of the well, posting just to the right of the top of the well).

3 = Elevation at the bottom of the well (symbol plotted at the position of the well, posting just to the right of the top of the well).

4 = Depth of the well, (symbol plotted at the position of the well, posting just to the right of the top of the well).

5 = Elevation at the top of a unit, (symbol plotted at the position of the well, posting just to the right of the top of the well).

6 = Elevation at the bottom of a unit (symbol plotted at the position of the well, posting just to the right of the top of the well).

7 = Thickness of a unit (symbol plotted at the position of the well, posting just to the right of the top of the well).

8 = Elevation of a contact between two units (symbol plotted at the position of the well, posting just to the right of the top of the well).

9 = Thickness of a unit between two contacts (symbol plotted at the position of the well, posting just to the right of the top of the well).

10 = The computed vertical offset necessary for stratigraphic alignment (symbol plotted at the position of the well, posting just to the right of the top of the well).
(See Note Below)

11 = Plot horizontal slice at a specified elevation (no posting), square filled with pattern designated for unit plotted at true position for specified elevation.

Note: If elevations are adjusted to the base of a rock unit, contact, or other horizon, the posted values are relative to the fixed elevation for the selected horizon.

Record 2

This record specifies the latitude, longitude coordinates of the NW corner of the area. Example: **38,0,0,N,106,0,0,W**

Record 3

This record specifies the latitude, longitude coordinates of the SW corner of the area. Example: **37,0,0,N,106,0,0,W**

Record 4

This record specifies the latitude longitude coordinates of the SE corner of the area. Example: **38,0,0,N,105,0,0,W**

Record 5

This record specifies the latitude, longitude coordinates of the NE corner of the area. Example: **39,0,0,N,106,0,0,W**

Record 6

This record specifies the map scale for the X and Y directions. Example: **24000,24000.** The scale is given as the denominator of the scale fraction.

Record 7

This record specifies the offset (in inches) from the corner of the paper where the SW corner of the map is to be drawn. Example: **1,2**

Record 8

This record indicates whether the plot is to be rotated on the plotter paper, Y=Rotate, N=Don't rotate. Example: **Y** Rotate plot.

Record 9

This record specifies the speed and force at which the plotter is to draw the map or section. Normally the speed is 15 centimeters per second (cps) or less for drawings using technical pens and ink, and up to 55 cps for drafts using fibertip pens. Minimal force is generally used to minimize wear on the pen points, value of 1 or 2. Example: **25,2**

Record 10

This record specifies the size (width and height) in inches of the characters that are posted. Example: **0.1,0.15**

Record 11

This record contains the specifications that control the vertical parameters of data. Vertical positioning can be based on the elevation of the top of the well (true elevation), on a selected (and fixed) elevation for the bottom of a unit, or on a fixed elevation for the contact between two units.

- If plots are to be based on the elevations of the well tops (true elevations without adjustment), the entry is: **"NOSTRAT",,0**
- If plots are to be based on the elevation of the bottom of the uppermost occurrence of a unit (adjustments based on that position), the entry is the unit identifier, a second comma, and the elevation specified for alignment. Example: **Or,,10000**
- If plots are to be aligned at a stratigraphic contact, the entry consists of the identifier of the upper unit, followed by the identifier of the lower unit, followed by the elevation chosen for that contact on the diagram. Example: **"Ocs","Or",1000**

Record 12

For plan view types 1-10 as defined in record 1 of the

plot file, this record (# 12) specifies the pen number to be used, the symbol number and the size of the symbol in units of 1/1000 inch. Example **1,5,35** (specifies pen number 1, symbol type 5 at a size of 35/1000 inch. Symbols and procedures for coding of additional symbols are described in Appendix 1.

For plan view type 11 this record (#12) specifies the elevation of the horizontal slice and the size of the square to be plotted in inches. Example: **9600,0.2**

Record 13

For plan view types 5-9, as defined in record 1 of the plot file: This record (#13) specifies the unit or contact (upper contact for type 9) contact. For a single unit plan types 5, 6, 7, the unit ID followed by a comma: Example **"Or",** for a contact (plan types 8, 9, the two unit IDs separated by a comma, example: **"Ocs","Or".**

Record 14

For plan view type 9, this record specifies the 2nd (lower) contact. Example: **"Or","Oj"**

Example of a plot control file for a plan view of type 1

```
File                    | Explanation of contents (not a part of the file)
1                       | Plan type 1
44,30,00,N,105,37,30,W  | Coordinates NW corner of plot
44,22,30,N,105,37,30,W  | Coordinates SW corner of plot
44,22,30,N,105,30,0,W   | Coordinates SE corner of plot
44,30,0,N,105,30,0,W    | Coordinates NE corner of plot
100000,100000           | XSCALE=1:100000, YSCALE=1:100000
0,0                     | XOFF=0, YOFF=)
Y                       | Yes, rotate on plotter
25,2                    | Speed=25, Force=2
0.1,0.15                | Width=0.1",Height=0.15" for label characters
"NOSTRAT",,0            | Do not adjust elevations
1,77,50                 | Pen=1, Symbol#=77, Size=50/1000"
```

REFERENCES

Selner, G. I. and Taylor Richard B., 1987, GSLITH Version 1.0: a program to draw cross sections and plot plan views from regional-scale drill hole data using an IBM PC (or compatible) microcomputer, digitizer, and plotter: U.S. Geological Survey Open-File Report 87-126A, documentation and tutorial, 46 p., 87-126B executable program disk.

Selner, G. I., and Taylor, R. B., 1988a, GSDRAW and GSMAP Version 5.0: prototype programs, Level 5, for the IBM PC and compatible microcomputers to assist compilation and publication of geologic maps and illustrations: U.S. Geological Survey Open-File Report 88-295 A, documentation and tutorial, 130 p., 88-295 B executable program disks (2).

Selner, G., I., and Taylor, R. B., 1988b, GSLXY, A prototype program to draw cross sections and plot plan views from drill hole data on an X, Y coordinate system, using an IBM PC (or compatible microcomputer), digitizer, and plotter: U.S. Geological Survey Open-File Report 387-A, documentation, 71p., 88-387-B executable program disk.

Selner, G. I., and Taylor, R. B., 1988c, Utility programs for GSDRAW and GSMAP Version 5.0 using an IBM PC (or compatible microcomputer, digitizer and plotter: U.S. Geological Survey Open-File Report 88-537 A, documentation 32 p., 88-537 B executable program disks.

Snyder, J. P., 1982, Map Projections used by the U.S. Geological Survey: U.S. Geological Survey Bulletin 1532, 313 p.

Snyder, J. P., 1987, Map projections, a working manual: U.S. Geological Survey Professional Paper 1395, 393 p.

APPENDIX 1

DATA BASE STRUCTURE

Each data base contains records for wells within a study area. The data base consists of two data files: an index file and a data file. Both files use direct access methodology with the data stored in binary format. The index file contains one record for each well; the data file contains one record for each unit within a well.

INDEX FILE

First Record

Number of Wells in this data base	4 bytes
First Record in Data file	4 bytes
Last Record in Data File	4 bytes
4 bytes Number of numeric variables	
Unused	40 bytes

All subsequent records

Well Identification	12 bytes
Well collar elevation	4 bytes
Total depth of well	4 bytes
Starting record in Data File for well	4 bytes
Ending record in Data File for well	4 bytes
Latitude for well	8 bytes
Longitude for well	8 bytes
Bearing from North	4 bytes
Plunge (angle from horizontal)	4 bytes

DATA FILE

First Record

Title of data base	36 bytes

Second Record

Latitude of NW corner of data base	8 bytes
Longitude of NW corner of data base	8 bytes
Unused	20 bytes

Third Record

Latitude of SW corner of data base	8 bytes
Longitude of SW corner of data base	8 bytes
Unused	20 bytes

Fourth Record

Latitude of SE corner of data base	8 bytes
Longitude of SE corner of data base	8 bytes
Unused	20 bytes

Fifth Record

Latitude of NE corner of data base	8 bytes
Longitude of NE corner of data base	8 bytes
Unused	20 bytes

All Subsequent Records

Bed Identification	8 bytes
Elevation of top of bed	4 bytes
Elevation of bottom of bed	4 bytes
Value of first numeric variable	4 bytes
Value of second numeric variable	4 bytes
Value of third numeric variable	4 bytes
Value of fourth numeric variable	4 bytes
Value of fifth numeric variable	4 bytes

Version 2.0 of GSLITH was written and tested using the MicroSoft QuickBASIC Compiler, Version 4.0. The program cannot be tested or executed under BASICA, but must be compiled. A DOS command file **CLLITH.BAT** is included with this release. This command file should be used to compile and link GSLITH. The source code is provided in ASCII format as well as the executable program generated by the QuickBASIC compiler.

The program has been tested using 512K of RAM memory and should run on DOS Versions 2.1 and higher.

HARDWARE INSTALLATION AND CONFIGURATION FILES

This section deals with the physical installation of the digitizer and plotter, the connection of these devices to the computer, and verification of correct installation. A work sheet is supplied to assist recording of settings. The makeup of configuration files and modifications required to tune the files to specific hardware configurations is also described.

The plotter and the digitizer must be connected to serial ports; there must be a match between the port connections, the communications parameters of these devices, and the settings of the programs. The printer must be connected to parallel port #1 (LPT1:).

If 1. the digitizer is connected to COM2 and set to 1200 baud and is a GTCO Digi-Pad 5, or emulates the GTCO, 2. the plotter is connected to COM1, and set to 2400 baud, and 3. both are set as recommended in the hardware installation section, the configuration files supplied on Disk #1 can be used without modification. The functions of the files are as shown below:

CONFIG.DIG	Digitizer configuration.
CONFIG.PLT	Plotter configuration and symbol definition.

The contents of the configuration files, and changes that may be made to accommodate different systems are described on subsequent pages, with printouts of sample files annotated to explain their contents. The form below provides a convenient format for recording needed data to customize connfiguration files.

INSTALLATION WORKSHEET

DIGITIZER

Port _____	Key Char position _____
Speed _____	X Coordinate Starting _____
Parity _____	Width of X Coordinate _____
Bits/Char ____	Y Coordinate Starting _____
Stop bits ____	Width of Y Coordinate _____

Non Numeric Keys:

A Labeled _____	Transmits as _____	ASCII code _____
B Labeled _____	Transmits as _____	ASCII code _____
D Labeled _____	Transmits as _____	ASCII code _____
E Labeled _____	Transmits as _____	ASCII code _____

ASCII codes are listed in the back of the BASIC Manual

PLOTTER

Port _____
Speed _____
Parity _____
Bits/Char _____
Stop bits _____

DIGITIZER

The digitizer must have the following characteristics:

- Transmit data to the computer using RS232C communications protocol
- Send information in the form of ASCII characters followed by a carriage return. When a key is depressed on the keypad of the digitizer, the digitizer must send three pieces of information as a part of the string: a character representing the key depressed, the X coordinate, and the Y coordinate.
- It must have a multi-button cursor keypad with the 10 numeric keys and a minimum of four other non-numeric keys that can be assigned to program functions.
- It should have a resolution of 0.001 inches.

Digitizer installation

1. Connect the cable from the digitizer to one of the serial ports. Note whether the port is COM1 or COM2 on the work sheet.

2. Set the digitizer switches for the communications speed you want to operate; we have found 1200 baud to be satisfactory. Record the baud rate on the work sheet.

3. Set digitizer switches for parity; generally you will have a choice of the following:

S - SPACE: Parity bit always transmitted and received as a space (0 bit)
N -NONE: No parity transmitted or checked on receive.
O - ODD: Odd transmit parity, odd receive parity checking
E -EVEN: Even transmit parity, even receive parity checking
M -Mark: Parity bit always transmitted and received as a mark (1 bit)

We normally use N. Record the setting on the work sheet

4. Set the number of databits per character on the digitizer switches. The choice is generally 7 or 8. We use 8. Record the value on the work sheet

5. Set the number of stopbits on the digitizer switches. The choice is 1 or 2; we use 1. Record the setting on the work sheet.

6. Set the digitizer switches to transmit a carriage return only; set switches to NOT transmit a line feed.

The following BASIC (BASICA) program can be used to check transmission between the digitizer and computer. It may require modification to reflect the values set in previous steps. It is set up using the values we normally use. Modifications normally are on line 10; refer to the BASIC manual supplied with your computer for a description of the OPEN COMn: command.

```
10 OPEN "COM2:1200,N,8,1" FOR INPUT AS #1
20 PRINT "HIT KEYS ON DIGITIZER KEYPAD ONE AT A TIME"
30 LINE INPUT #1, DSTRING$
40 PRINT DSTRING$
50 GOTO 30
60 END
```

If the above program does not run, check switch settings and/or cable connections, and retry the program. If it still does not work, check the digitizer manual, and seek assistance.

For the GTCO Digi-Pad series of digitizers used for development connect a null-modem cable from the computer serial port (COM2:) to port J5 on the digitizer. The cable diagram is shown in the User's Manual, appendix on RS232 interfacing, DTE-to-DTE cabling. The following switch settings are used.

	1	2	3	4	5	6	7	8
S1	1	1	1	0	0	0	0	1
S2	1	1	1	0	1	0	0	0
S3	0	1	1	0	1	0	0	0

1 = ON
0 = OFF

PLOTTER

Hewlett-Packard plotters were used to develop this program. It may work with other plotters that use the Hewlett-Packard Graphics Language.

Plotter Installation
1. Connect the cable from the plotter to the remaining asynchronous communications port; note on the work sheet whether it is connected to COM1 or COM2. If you have only one serial port you will have to use an external switch between the computer and the digitizer and plotter.

2. Set the plotter switches (hardware or software) for the communication speed at which you want to operate; we have found 2400 baud to work well. Record the baud rate on the work sheet.

3. Set the plotter switches for parity. Generally you will have a choice of the following:

S - SPACE: Parity bit always transmitted and received as a space (0 bit)
N -NONE; No parity transmitted or checked on receive
O -ODD: Odd transmit parity, odd receive parity checking
E -EVEN: Even transmit parity, even receive parity checking
M -Mark: Parity bit always transmitted and received as a mark (1 bit)

We use N. Record the setting on the work sheet

4. Set the number of stop bits on the plotter switches. You will have a choice of 1 or 2; we use 1. Record the setting on the work sheet.

5. Check other settings on the plotter. We use the following:

Remote
Standalone
Handshake: hardwire Direct
Duplex: Full

The following BASIC program (BASICA) can be used to check transmission between the plotter and computer. It may require modification to reflect values set in previous steps. It is set up for the values we normally use. Modifications normally are to line 10. This program came from the Hewlett-Packard operation and Interconnection Manual for the HP 7550A Graphics Plotter; refer to the BASIC manual supplied with your computer for a description of the OPEN COMn: command.

```
10 OPEN "COM1:2400,N,8,1,RS,CS65535,DS,CD" AS #1
20 PRINT #1 "IN;OI;"
30 INPUT #1,ID$
40 PRINT #1,"LB";ID$;" COMMUNICATION OK";CHR$(3)
60 PRINT #1, "PA 0,0;SP0;"
70 END
```

The program will read the model of the plotter and plot the following message on the plotter using the pen in carousel position one.

```
7550A COMMUNICATIONS OK
(YOUR MODEL #, if not a 7550A)
```

If the above program does not run, check switch settings and/or cable connections, and then retry the program. If it still does not work, check the plotter manual, and seek assistance.

For the HP 7585B plotter the following switch settings apply: the cable must be connected to the COMPUTER/MODEM port.

```
RS232C              NORMAL
                    NORMAL
     STANDALONE
                    NORMAL

Parity              OFF
                    ODD
Duplex              ODD
     HARDWIRE
                    NORMAL
```

For the HP 7475 plotter, the following switch settings apply:

```
     0    S2
     0    S1
     0    Y
       1  US
     0    B/A3-.A/A4
       1  B4
     0    B3
       1  B2
     0    B1
```

CONFIG.DIG

Parameters apply to GTCO digitizer. Annotations are not a part of the file

```
"COM2: 1200,N, 8, 1"  |          Port, baud rate, see OPEN COM, instruction
 1,1                  | Position, # characters sent when a key is depressed
2, 5, .001            |           Start position, field length X coordinate
8, 5, .001            |Start position, field length Y coordinate,resolution
15                    |Number of records below (keys to be used)
0,0                   | The final lines contain the character sent by the
1,1                   | digitizer, a comma, and the label on the key of the
2,2                   | digitizer keypad (15 lines in this example)
3,3                   |
4,4                   |
5,5                   |
6,6                   |
7,7                   |
8,8                   |
9,9                   |
:,A                   |
;,B                   |
<,C                   |
=,D                   |
>,E                   |
```

No blank lines are allowed at the beginning or end of the file

Without comments the file is as below.

```
"COM2: 1200,N, 8, 1"
 1,1
2, 5, .001
8, 5, .001
15
0,0
1,1
2,2
3,3
4,4
5,5
6,6
7,7
8,8
9,9
:,A
;,B
<,C
=,D
>,E
```

CONFIG.PLT

The first line of the CONFIG.PLT file sets communication parameters between the computer and the plotter. The rest of the file contains the description for symbols (see p. 67. These parameters are described in the BASIC manual, see OPEN COM statement.
the

Part of CONFIG.PLT [code after symbol 2 not printed]

```
"COM1: 2400,N, 8, 1,RS,CS65535,DS,CD"
50,4
"PU",1.0,0.0
"PD",-1.0,0.0
"PD",0.0,-1.0
"PU",0.0,1.0
1,2
"PU",0.0,0.0
"CI",1.0,0.0
2,4
"PM",0,0
"PU",0.0,0.0
"CI",1.0,0.0
"PM",2,0
```

SYMBOLS

The type and size of the symbols for wells on plan views can be specified during plotting. The instructions to the plotter that define symbols are contained in the file named CONFIG.PLT. Additions to this file are easily made, see p. 68. The following numbered symbols are in the standard file supplied with GSLITH. Version 2.0:

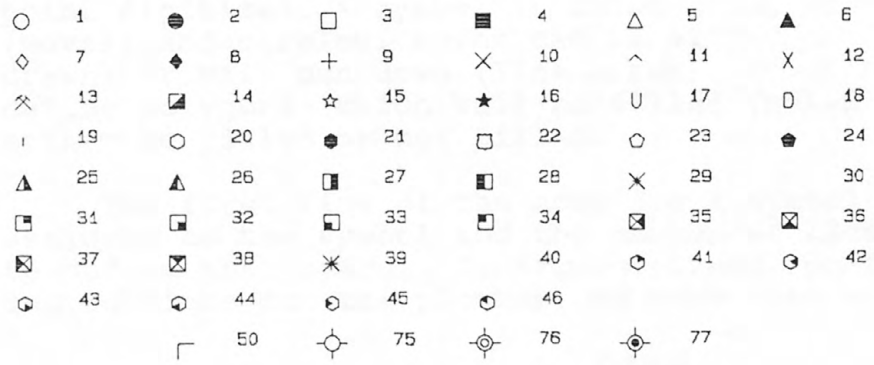

Figure 8._ Standard symbols plotted at a size of 100 (100/1000 inch).

CODING OF NEW SYMBOLS

New symbols can be encoded by the user and included in the CONFIG.PLT file. Coding is easier than might be anticipated. Symbols are drawn with straight lines and/or with circles. Closed polygons defined by lines or circles may be filled.

Starting

To be consistent with other symbols, sketch a square with sides of unit length and a point at the center. Figure 9 provides examples. Assume that the pen is at the center point of the square. Each line of the code describing the symbol provides one instruction to the computer. The center of the square locates the point digitized. A symbol is drawn using straight line segments (moves) and circles. Moves can be either with pen up (no line drawn) or with pen down (line drawn). Moves can be combined to define polygons which will be filled (solid fill). Circles may either be filled or not filled.

The first line of the code for a symbol specifies the number assigned to the symbol and the number of lines (records) required to define that symbol. Subsequent lines consist of a series of instructions for the plotter. No more than 25 lines may be used.

Moves

A line starting with a "PU" tells the the plotter to move to a new position with the PEN UP (no line drawn), a line starting with "PD" specifies that the move is made with PEN DOWN (drawing a line). All moves are relative to the last point. After the "PU" or "PD" at the start of a line a comma must be used; the number after this comma specifies the X distance to the next point, then a comma must be used; the number after the second comma specifies the Y distance to the next point.

Polygons

A line starting with a "PM" is an instruction to the plotter about a polygon.

"PM",0,0 defines the start of a polygon.
"PM",2,0 ends a polygon and ends polygon mode for the symbol.

The polygon defined between "PM",0,0 and "PM",2,0 instructions will be filled with a solid pattern.

Moves between "PM"0,0 and "PM,2,0 instructions should define a closed polygon); if the polygon is not closed, the "PM"2 instruction forces a closing of the exterior polygon to the point occupied by the pen when the "PM",0 instruction was issued.

Exterior and interior polygons

"PM",1,0 ends a polygon but leaves the computer in polygon

mode. This instruction is used, for example, between moves that define an external polygon and moves that define an internal polygon to be left unfilled.

The "PM",1,0 instruction forces a closing of the polygon back to the position just to the right of the the pen at the time the " instruction was issued.

Circles

A line of code starting with a "CI", instruction calls for the drawing of a circle. The "CI" must be followed by a comma. The number following the comma specifies the diameter of the circle to be drawn. This number is followed by a comma, then by a 0 (zero). The diameter is specified in units relative to the unit square as discussed at the start of this section.

The center of the circle is the point occupied by the pen at the time the "CI" instruction is given. A "CI" instruction defines a complete polygon; it is equivalent to a set of moves between "PM"1,0 instructions, but counts as a single line.

Additional information on coding is given in the Interfacing and Programming Manual supplied with HP plotters. Please note that all of the HPGL commands **ARE NOT SUPPORTED** by GSLITH or other level 5 programs. Use only the commands provided above.

Examples of the coding of symbols are diagrammed on Fig. 9.

Symbol 209; Uses PU and PD moves

```
209,6                - symbol number, number of lines of code
"PU",0.2,-0.5
"PD",0.0,1.0
"PD",0.1,-0.2
"PU",-0.5,0.2
"PD",0.0,-1.0
"PD",-0.1,0.2
```

Symbol 14; Uses PU and PD moves, and one filled polygon

```
14,8                -symbol number, number of lines of code
"PU",0.5,0.5        - move to the upper right corner of symbol; PU
"PD",-1.0,0.0       - move to upper left corner; PD
"PD",0.0,-1.0       - move to lower left corner; PD
"PM",0,0            - starts polygon to be filled
"PD",1.0,0.0        - move draws lower line of filled triangle
"PD",0.0,1.0        - move draws right edge of filled triangle
 "PD",-1.0,-1.0      - move draws hypotenuse of filled triangle
"PM",2,0             Ends definition of filled polygon
```

- Filling of triangular polygon
  Note: the "PM",0,0 instruction starts definition of a polygon to be filled; the PM",2,0 ends the polygon's definition

Symbol 77, uses PU and PD moves, and two circles defined as exterior and interior polygon.

```
77,14
"PU",0,1.0
"PD",0,-0.5
"PU",0,-0.5
"PM",0,0            -starts filled polygon=circle
"CI",.5,0           -specifies circle, diameter 0.5
"PM",2,0            -ends filled polygon=circle
"PU",0,-0.5
"PD",0,-0.5
"PU",-1.0,1.0
"PD",0.5,0.0
"PU",1.0,0.0
"PD",0.5,0
"PU",-1.0,0.0
"CI",1,0             open circle; polygon not specified; circle
                     will not be filled
```

- The "units" for the diameter of the circles are specified in the same "units" as the "moves" for the pen, based on the unit square
- Lines for symbol 77 go outside the unit square; this is permissible. The only reason for the unit square is to assist in keeping symbols similar in size.
- Symbol 209 with coding as drawn here was found to be too small;

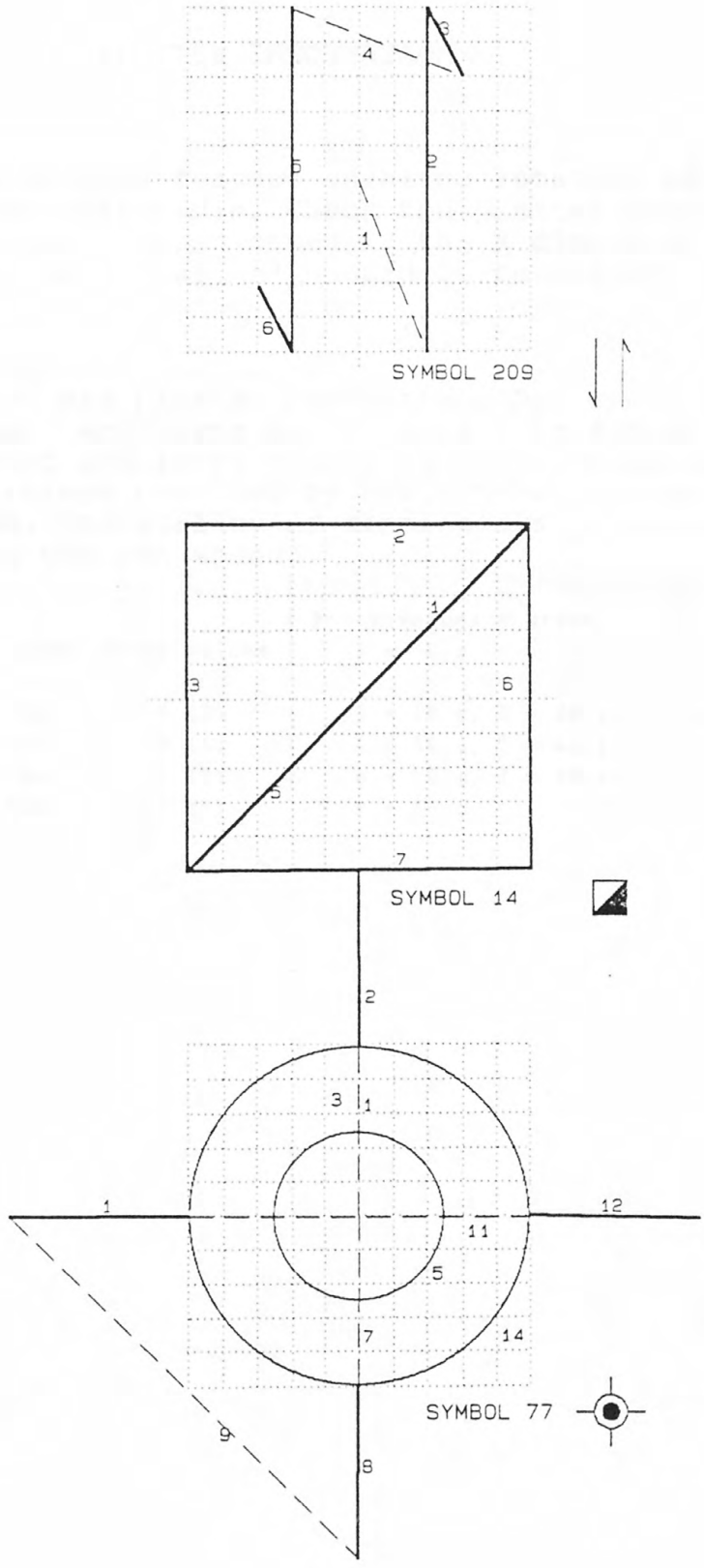

Figure 9._ Examples of coding of symbols. Unit square shown by dotted lines, pen up moves by dashed lines, pen down moves by solid lines.

PLOTTER INFORMATION

ROTATION

Rotation is a plotter feature enabling rotation of a plot by 90 degrees on the plotter media. Check the plotter manual for rotation instructions. In most cases if the X dimension of the plot exceeds the Y, no "rotation" should be specified.

SPEED AND FORCE

Speed and force are plotter parameters. Pen speed is specified in (cm/sec) and force by integers 1 to 8 that set the force. Optimum speed and force depend on pen type and plot media. Default settings provided by Hewlett-Packard are given here in parentheses. The quality of final plots is generally improved by slowing the pen speed.

PEN TYPE	SPEED cm/sec	FORCE values	Force values = grams 1 = 10 g
Fiber	25 (50)	1 (2)	2 = 18 g, 3 = 26 g
Roller	30 (60)	3 (6)	4 = 34 g, 5 = 42 g
Refillable ink pens	12 (30)	2 (2)	6 = 50 g, 7 = 58 g
Disposable ink pens	15 (15)	1 (1)	8 = 60 g

SCALING POINTS P1 and P2

If a plot is sent to a plotter, values for scaling points are provided to the computer by the plotter. Entry of scaling Points is required if plots are sent to a file rather than to a plotter. Scaling points P1 and P2 are discussed in the documentation for each plotter. The values of scaling points depend on the kind of plotter and on the size of the plot paper. Values for two plotters are provided below. Paper dimensions are in inches. Scaling points are the coordinates of the lower left and upper right corner of the sheet in plotter units (1/1024").

For the HP 7550A

	P1x,P1y	P2x,P2y
A size paper 8 1/2 x 11	80,320	10080,7520
B size paper 11 x 17	620,80	15820,10080

For the HP 7585/7586

	P1x,P1y	P2x,P2y
A size paper (8 1/2 x 11	-2790,-4500	2790,4500
B size paper 11 x 17	-7100,-4500	7100,4500
C size paper 17 x 22	-7090,-10075	7090,10075
D size paper 22 x 34	-15710,-15060	15710,15060
E size paper 34 x 44	-20840,-16180	20840,16180

LINE TYPES AND FILL TYPES

A line type is a plotter defined pattern. e. g. solid, dotted, dashed. Line types are specified by a number, 0-12. Examples of these line types are shown in Fig. 10, below.

A fill type is a pattern of lines specified by a number 0-2.

0 -- A line outlines the polygon **but there is no fill.**
1 -- A set of parallel lines fill the polygon
2 -- Two sets of mutually perpendicular parallel lines (a rectangular grid) fill the polygon

Line types and fill types can be combined to create different graphic effects. Examples are provided in Fig. 11.

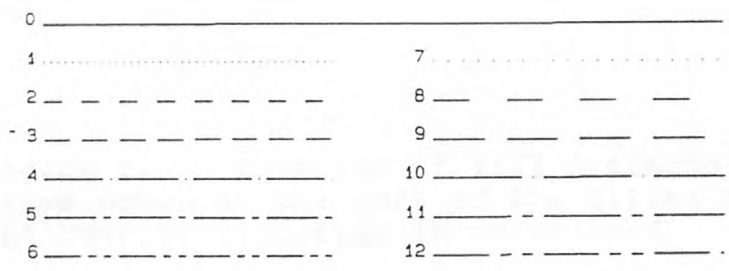

Figure 10._ Line types

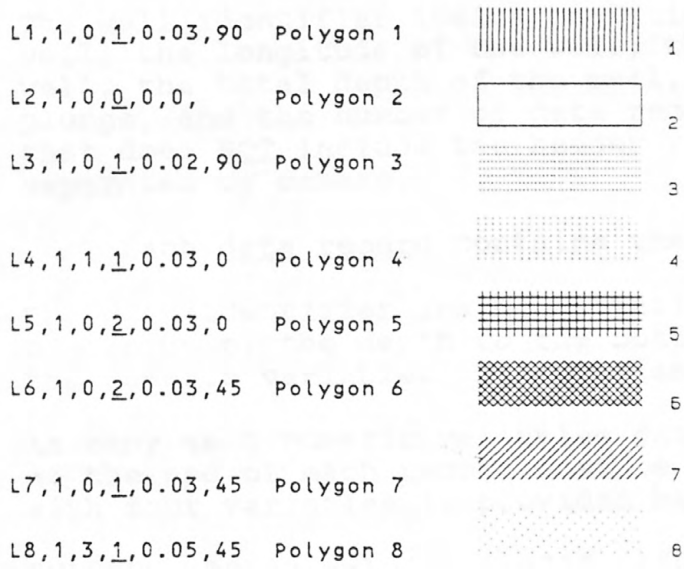

Figure 11._ Examples of fill patterns, with unit identifier files shown at the left of the filled areas. The number designating fill type is underlined.

The utility program ASCLITH is supplied as a part of this release so that a formatted ASCII file can be used to to open a GSLITH data base and load data. Latitude and Longitude coordinates must be in signed decimal degrees (north latitudes are positive, west longitudes are negative.

The file must have the format below:

The first record for each well is a header record.

The header record contains the following:

The well identifier inside quotation marks, the Latitude of the well, the longitude of the well, the elevation of the top of the well, the total depth of the well, the bearing of the well, the plunge, and the number of data records for the well (a number that does NOT include the header record. These entries should be separated by commas.

Each data record contains the following:

The unit identifier inside quotation marks, the depth to the top of the unit, the depth to the bottom of the unit, and the values of the numeric variables. All entries must be separated by commas

As many as 5 numeric variables can be entered. Separate columns at the end of each record must be used for each one. An example with four variables is provided below.

```
"T100",  38.52, -106.11, 9720, 450, 45, 72, 5
"L1  ",    0,100,    00, .50,       .01
"L2  ",  100,200,  0.50,   1.00,    .02
"L3  ",  200,300,  1.00,   1.50,    .03
"L4  ",  300,400,  1.50,   2.00,    .04
"L5  ",  400,450,  2.00,   2.50,   2.65
```

The ASCII file consists of a series of well header records and data records as above. No overall header record is permitted. No blank lines, are permitted in the file.

)PERATING ASCLITH

With the program ASCLITH.EXE in the default area, start)perations by entering **ASCLITH** . The program operates .nteractively from prompts on the screen. The entries required in :esponse to the prompts follow the practice of GSLITH and will ıot be described here in detail.

ENTER DATA BASE NAME:

ENTER MAP TITLE(36 CHARACTERS):

ENTER LAT LON OF NW CORNER
ENTER LAT LON OF SW CORNER
ENTER LAT LON OF SE CORNER
ENTER LAT LON OF NE CORNER

ENTER THE NUMBER OF NUMERIC VARIABLES

ENTER FILENAME OF ASCII DATA

After entry of the file name for the ASCII data, the program will operate. When it finishes, operation of the system will return to the DOS prompt.

If you select a data base name that is already in use, a prompt will call this to your attention. You can choose to continue and overwrite the old data base or choose to use a different name.

Notes:

- Enter coordinates of corners of the data base in the DD,MM,SS,C,DDD,MM,SS,C format used by GSLITH.

- Enter the name (not extension) to be used for the data base.

- Enter the complete name with extension for the ASCII file containing the data.

- Enter a constant number of numeric variables in the data file and specify for this number of variables when running ASCLITH.

APPENDIX 2

MAP PROJECTIONS

Map projections and USGS practice are described by Snyder, 1982, in USGS Bulletin 1532. Information on the map projection is given in marginal notes on USGS maps, but the data on the parallels and meridian used to prepare the map is not provided. The summary below should help, but please read the original by Snyder, 1982. This bulletin answers questions you should have. Unless otherwise stated on the margin or Snyder, use the Clarke 1866 Ellipsoid.

Small Scale Maps

Maps labeled Albers Equal-Area projection

When used for maps of the 48 conterminous states, the standard parallels are 29,30,0,N degrees and and 45,30,0,N . The central meridian is 96,0,0,W.

For maps of Alaska, the standard parallels are 55,0,0,N degrees and 65,0,0,N degrees. The central meridian is 154,0,0,W.

For maps of Hawaii, the standard parallels are 8,0,0,N and 18,0,0,N. The central meridian is 157,0,0,W.

Maps labeled Lambert Conformal Conic

The Lambert conformal conic is used by the USGS for a map of the US showing all 50 states in true relative position. This map has been issued at scales of 1:6,000,000 and at 1:10,000,000. For this map the standard parallels are 37,0,0,N and 65,0,0 N. The central meridian is the line of longitude at the center of the sheet.

Maps labeled Transverse Mercator

In 1979 a spherical form of the Transverse Mercator was chosen for a base map of North America at a scale of 1:5,000,000 for tectonic and other geologic maps. The scale factor along the central meridian of 100,0,0,W longitude is reduced to 0.926. (See Example 8 below)

State Scale Maps (1:500,000)

For the 500,000 scale base maps of the 48 contiguous states, the Lambert projection was used with standard parallels of 33,0,0,N and 45,0,0,N. The central meridian is the line of longitude central to the map.

1 x 2 Degree Maps (1:250,000)

Maps labeled Transverse Mercator

Army Map Service (AMS) 1 degree by 2 degree sheets use the Transverse Mercator projection. The central meridian is the line of longitude central to the map.

Maps labeled Universal Transverse Mercator (UTM)

The UTM projection will be used by the USGS for 1 x 2 degree sheets as it updates the AMS series. The proper central meridian can be determined either by using tables listing the central meridian for the UTM Zone or by locating the nearest line of longitude of whole number of degrees that is divisible by 3 but not by 2.

30′ x 60′ Maps (1:100,000)

For all new 30 minute by 60 minute quadrangles, the UTM projection is used. The proper central meridian can be determined either by using tables listing the central meridian for the UTM Zone or by locating the nearest line of longitude of whole number of degrees that is divisible by 3 but not by 2.

15′ Quadrangles (1:62,500)

Maps labeled Polyconic

Many 7 1/2 minute quadrangle maps have been drawn using the Polyconic projection. The central meridian is the line of longitude central to the map.

7 1/2' Quadrangles (1:24,000)

Maps labeled Polyconic

Many 7 1/2 minute quadrangle maps have been drawn using the Polyconic projection. The central meridian is the line of longitude central to the map.

Maps labeled Lambert and Transverse Mercator

Beginning in the late 1950's the USGS began using projections that were based on the parameters that serve as the basis of the State Plane Coordinates System. Depending on the state the projection will be either a Lambert Conformal Conic, Transverse Mercator or Oblique Mercator (panhandle of Alaska only). USGS Bulletin 1532 (Snyder, 1982) presents an excellent description of the basis of the SPCS and the projection that is used for each State. This Bulletin also describes in Table 8 the projection parameters that are used for each zone of each State. Table 8 lists a scale reduction for Transverse Mercator such as 1:2500. The projection file require a scale factor. The formula to compute scale factor from scale reduction is scale factor = 1.0 - (1/scale reduction) i.e. a 1:2500 scale reduction results in a scale factor of 0.9996 or scale factor=1.0 -(1.0/2500)=0.9996.

A useful approximation for digitizing and plotting is to use the Polyconic Projection. The maximum difference in the 700-800 mm diagonals of 7 1/2 or 15 minute between Transverse Mercator, Lambert, and Polyconic projections is about 0.05 mm. This is a much smaller figure than that expected due to size changes due to changes in humidity for a paper copy. It is only twice the accuracy attributed to a good digitizer.

PROJECTION FILES FOR LEVEL 5 SOFTWARE

Examples of Projection Files

Latitude,Longitude values are entered in Degrees, Minutes, Seconds and followed by the Appropriate letter: for example, W longitude, N latitude in the conterminous U.S. Equatorial and polar radii are specified in kilometers.

Universal Transverse Mercator

File	Description of Contents
1	"1" designates Universal Transverse Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, Principal Meridian of UTM Zone
0.9996	Scale factor

Albers Equal Area

File	Description of contents
2	"2" designates Albers Equal Area
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
45,30,0,N	Latitude, first standard parallel
29,30,0,N	Latitude, second standard parallel
100,0,0,W	Longitude, meridian central to map

Lambert Conformal Conic

File	Description of contents
3	"3" designates Lambert Conformal Conic
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
33,0,0,N	Latitude, first standard parallel
45,0,0,N	Latitude, second standard parallel
105,0,0,W	Longitude, meridian central to map

Mercator

File	Description of contents
4	"4" designates Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, Meridian Central to map

Polyconic

File	Description of contents
5	"5" designates Polyconic
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, meridian central to map

Transverse Mercator

File	Description of contents
6	"6" designates Transverse Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, meridian central to map
0.9996	Scale factor

"Parameters of special DNAG map for spherical Earth"

File	Description of contents
6	"6" designates Transverse Mercator
6371.204	Radius of Earth in km
6371.204	Radius of Earth in Km
100,0,0,W	Longitude, meridian central to map
0.926	Scale factor unique to this map

Oblique Mercator Projection

The sample oblique mercator projection file provides parameters used in generating the Appalachian Map

File	Contents
7	"7" designates Oblique Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
1.0	Scale factor along central axis
42,0,0,N	Latitude, center point of projection
73,0,0,W	Longitude, center point of projection
51,30,0,N	Latitude, S end of line defining axis
56,0,0,W	Longitude, S end of line defining axis
33,30,0,N	Latitude, N end of line defining axis
84,30,0,W	Longitude, N end of line defining axis

Equidistant Conic

File	Description of contents
8	"8" designates Equidistant Conic
6378.38584	Radius of Earth in km
6356.910	Radius of Earth in Km
9,0,0,N	Latitude, first standard parallel
4,0,0,N	Latitude, second standard parallel
66,0,0,W	Longitude, meridian central to map

Values in this example are for Venezuela maps labeled "Proyeccion Conico Secante Compensada". This projection is also used for certain maps in Alaska labeled "Modified Mercator", see Snyder, 1982.

```
  Files on release disk number 1


SECT1     PLT
HIST      VAR
TRACE     VAR
SECT2     PLT
PLAN2     PLT
PLAN3     PLT
SECT3     PLT
SECT1     ASC
CONFIG    DIG
CONFIG    PLT
EXAMPLE   NDX
EXAMPLE   LSF
UTM105    PRJ
ALB100    PRJ
DNAG      PRJ
PLAN1     PLT
OM        PRJ
LCC105    PRJ
MERC      PRJ
POL105    PRJ
VENEZ     PRJ
TM105     PRJ
PLAN      PLT
GSLITH    EXE
DRILL     BED

Files on release disk number 2

ASCLITH   EXE
GSLITH    BAS
LITH1          BAS
ASCLITH   BAS
LITH2          BAS
LITH3          BAS
LITH4          BAS
PROJLIB   BAS
LITH5          BAS
LITH6          BAS
LITH7          BAS
LITH8          BAS
LITH9          BAS
LITH10         BAS
LITH11         BAS
LCOMMON    BAS
LIOLIB     BAS
PLOTLIB   BAS
CLLITH    BAT
CLASCLIT  BAT
```