

Chapter 5 - GAEP Reference

This chapter describes the usage of the GAEP program in detail. Throughout this chapter, commands entered by the user are in the COURIER face.

Starting GAEP

The user begins a GAEP session by entering the command:

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C:\> GAEP <CR>
```

at the DOS prompt. After the sign-on copyright screen is displayed, the main GAEP menu (Figure 5.1) is displayed. The GAEP program is entirely menu-driven, and uses a simple "point-and-shoot" interface.

Menus

The GAEP main menu is shown in Figure 5.1. The menu shows the current settings of GAEP options and a list of available commands are arrayed across the top of the screen. GAEP commands are accessed by either pressing the "hot" key for the command (shown on the menu in upper case - and in red on color monitors) or by placing the mouse cursor on the desired command and pressing the left mouse button. For example, the <F> (file), <A> (aquifer), <D> (digitize), <E> (element), <U> (utilities), <O> (options) and <Q> (quit) "hot" keys are available either by pressing the key or by using the mouse.

Special Keys

In addition to the "hot" keys available from the GAEP menu system, some additional special keys are used:

- <F1> key - Help!

Whenever you are at a GAEP menu, press the <F1> key to display a help screen which describes the commands available from that menu. This feature is available from menus only, not while entering data or while at any graphical display.

- <ESC> key - Go Back

At all times while using GAEP, the <ESC> key (upper left on most keyboards) aborts the current command and returns to the previous menu. This key is active at all times while using GAEP to abort the current command (even when performing graphical selections). The <ESC> key is commonly known as the "escape" key. At menus, the <ESC> function duplicates the <Q> command.

- <F3> key - I'm Done

While performing certain functions, the <F3> key is used to tell GAEP that an operation is complete (examples are completing entry of a stream with the

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File Aquifer Digitize Element Options Utility Quit

GAEP for GFLOW1 Release 1.0
Main Menu                                Current Directory:
                                         C:\
                                         Current Map File:

                                         Current Element File:

                                         Memory available:  436224

                                         Option Settings:

                                         Unit Conversion:      M->FT
                                         Digitizer Mode:       DIGITIZER
                                         Video graphics mode:   COLOR

                                         <f1> help  <esc> return to previous menu
```

Figure 5.1 - GAEP Main Menu

digitizer or creating linesink elements). This key is used consistently as the "Successful Completion" command while performing graphical data entry.

- <PAGE UP> / <PAGE DOWN> / <HOME> / <END> - Graphics Zoom Functions

Whenever graphics screen is active, the <PAGE UP> and <PAGE DOWN> keys zoom in or out on the area around the center of the screen. To zoom in, press <PAGE DOWN>. To zoom out, press <PAGE UP>. The <HOME> key zooms out to a window which shows the entire extent of the digital map data presently loaded. The <END> key allows the user to enter the limits of the view window in world coordinates (such as State Plane or UTM). When a later graphics-mode command is selected, GAEP remembers where you have set the view window.

- Arrow Keys - Scrolling

Whenever the graphics screen is active, the left, right, up and down arrow keys scroll the graphics image in the indicated direction. When a later graphics-mode command is selected, GAEP remembers where you have set the view window.

Data Entry Considerations - Free-Form Input

Whenever more than one value on a single line is requested by GAEP, the user may use either spaces or commas. All punctuation marks are ignored. For example, if the latitude of a point is requested in degrees, minutes and seconds, the user may enter

37 30 15 or 37,30,15

for the entry 37 degrees, 30 minutes, 15 seconds.

Coordinate Systems and Data Units

GFLOW works in any consistent system of units selected by the user. Before beginning a project, you should determine which unit of length to use. Some common selections are feet and meters for length and days or seconds for time. Once a set of units has been decided upon, the modeler must maintain it throughout the project. Although any units system may be used, the *preferred units* are meters and days or feet and days.

World Coordinates

GAEP requires that data be entered in a set of world coordinates selected by the user. If you are working from a USGS topographic map, a convenient system is the UTM coordinate system. If you are working from a plat for a site or from a simple map layout, the units might be shown on your figures. GAEP allows you to work in either system. If you are digitizing in georeferenced coordinates (UTM or State Plane, for example), you can set up your digitizer with the appropriate world coordinates and GAEP can translate the world coordinates into a local coordinate system, shifting the origin and converting units when analytic element data files are written.

Conversion of Latitude-Longitude to UTM Coordinates

Groundwater models require that the units used to define locations be Cartesian (that is, the x - and y - dimensions must have the same length). Often, the user will have maps which have world coordinates marked as latitude and longitude. A problem with the direct use of latitude-longitude coordinates is that they are not Cartesian (a degree of latitude is usually not the same length as a degree of longitude). One standard way to achieve a Cartesian system is to use the UTM (Universal Transverse Mercator) coordinate system.

The UTM system breaks the globe into "zones", each of which has a central meridian. Within each zone, a set of coordinates is assigned to each point, measured (in meters) relative to the central meridian (UTM X value at the meridian is 500000) and to the equator (UTM Y value at the equator is 0). Over a relatively small geographic area, the coordinates can be considered to be Cartesian, with only a small amount of error. This provides a simple X-Y coordinate system in data units for modeling work.

For users' convenience, a facility is included in GAEP for converting between UTM coordinates and latitude-longitude coordinates, given the number of the UTM zone. This feature simplifies the process of locating digitizer origin points (see below). Users who are unfamiliar with the UTM coordinate system may wish to investigate this topic further.

Coordinate Origins

The GAEP user is required to set two different types of coordinate origins when creating a groundwater model with GAEP. The first, the "Model Origin" is consistent throughout all modeling operations and should be set at the beginning of the project. The second, the "Digitizer Origin" is set whenever a map is mounted on the digitizing tablet. It is important that the modeler not confuse the meanings of these two terms.

Model Origin

As discussed above, GFLOW works in a dimensionless coordinate space. GAEP allows the user to set any world coordinates he chooses. A conversion may be performed by GAEP to change the X-Y coordinates from meters-to-feet or feet-to-meters, if the modeler desires.

The numeric values of UTM coordinates are so large (particularly in the Y direction) that numerical errors can occur in GFLOW if the geographic coordinates are simply used directly from GAEP. To prevent this, GAEP allows the user to enter a "Model Origin" in UTM coordinates that will be the "zero point" for GFLOW's computations. The model origin should be maintained throughout a particular modeling project. To select a Model Origin, simply choose a point near the model study region and record its UTM coordinates. It is particularly convenient to mark and label this point on your maps as well. GAEP allows you to enter a model origin by use of a keystroke command (see below). If a model origin is specified, GAEP will report coordinates in the output data file relative to the specified model origin. If a coordinate conversion is specified, GAEP will perform this computation relative to the local origin.

Digitizer Origin

Whenever a map is mounted on the digitizer, the GAEP user must tell GAEP how to convert digitizer coordinates (typically measured in inches or millimeters internally) to "real-world" coordinates. This task is performed by the use of origin points, which are points marked on the map for which the world coordinates are known. GAEP requires that the user locate these points with the digitizer and then enter the world coordinates from the keyboard.

A pair of digitizer origin points are required each time a map is mounted on the digitizer and must fit on the digitizer surface (of course). This means that for a small digitizer, several sets of origin points may be required on each topographic map. A convenient way to enter these is by the use of the UTM conversion utility (see above), converting the latitude-longitude points on the edges of the map, and writing the corresponding UTM coordinates in the map margin.

Data Preparation for Digitizing with GAEP

Prior to beginning a digitizing session, it is useful to examine your map and mark certain features with a pencil. Carefully annotating features on your map helps to speed the process of digitizing and also reduces errors. Some examples:

1. Mark the digitizer origin points and write the world coordinates nearby. One easy way to do this use GAEP's latitude-longitude to UTM conversion facility to get UTM coordinates for the corners of a USGS quadrangle map.
2. Note all features (streams, lakes, roads, etc.) which are to be digitized.
3. Locate the points where streams are crossed by contour lines on the map. These are usually used to enter water levels on streams in GAEP.
4. Mark points of interest (houses, contamination sources, wells, etc.) on the map.

5. Mark points of observed water levels and write the water level and a label nearby.
These may be used to create "piezometer" files for aid in model calibration.

Procedure for Using GAEP

The user should apply the following procedure when using GAEP on a modeling project:

- Create the digital map (Digitize menu)
This step involves the entry of hydrologic features using the digitizer, including the points of known head, and the maintenance of the digital map using GAEP's editing features.
- Save the digital map (File menu)
The digital map is saved to a Digital Map File (see above). It is **STRONGLY** recommended that the user perform save operations regularly during map creation and editing to prevent loss of data. Always back up your digital map files to floppy disks for safekeeping!
- Create analytic elements (Element menu)
Once a digital map is complete, the modeler uses GAEP to create analytic elements (linesinks and wells).
- Set the various aquifer properties. Use the "Aquifer" menu to set aquifer properties and add an areal "rainfall" infiltration element.
- Save the Analytic Element Data file (File menu)
After element creation is finished, the user saves the analytic element file for use in GFLOW1. GAEP also allows the modeler to re-load the analytic element file into GAEP for editing and modifications.

Command Descriptions

The next section of this manual shows each of the GAEP menus and briefly describes the commands available. Detailed GAEP command descriptions follow the menu descriptions.

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Main Menu

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File Aquifer Digitize Element Options Utility Quit

GAEP for GFLOW Release 1.0
Main Menu                                Current Directory:
                                           C:\
                                           Current Map File:

                                           Current Element File:

                                           Memory available: 293184

                                           Option Settings:

                                           Unit Conversion:      M->FT
                                           Digitizer Mode:       DIGITIZER
                                           Video graphics mode:  COLOR

                                           <f1> help  <esc> return to previous menu  05/Jul/94
12.05 PM

```

Figure 5.2 - GAEP Main Menu

When GAEP is first invoked, the user is placed at the main menu (Figure 5.2). Commands from the main menu allow entry into the various GAEP modules. To return from any module to the main menu, either select the Q command or press <ESC>.

- File <F> Enters the "File" module, for performing file operations.
- Aquifer <A> Enters the "Aquifer" module, for setting aquifer properties.
- Digitize <D> Enters the "Digitize" module, for digital map preparation and editing.
- Element <E> Enters the "Element" module, for analytic element creation and editing.
- Options <O> Enters the "Options" module, for setting of GAEP operational features.
- Utility <U> Enters the "Utilities" module, for access to utility functions (such as the DOS shell or UTM-to-latitude/longitude coordinate conversion).
- Quit <Q> Exits GAEP. If changes to the digital map file or analytic element data file have been made but not saved to disk, GAEP will ask if the user really wishes to leave the program. Answer YES to exit GAEP without saving to disk.

Note

If the ESC key is used to exit GAEP, GAEP prompts:

Are you sure you want to exit (y/n)?

(as opposed to simply exiting the program). This is intended to prevent the user from inadvertently leaving GAEP and returning to DOS.

Aquifer Menu

```

Base Thick Permeability p0rosity reFerence Rain Quit

Aquifer Parameter Settings:      Current Directory:
Base Elevation:                  C:\
Thickness:                       Current Map File:
Permeability:                    Current Element File:
Porosity:                        Memory available: 293184
Reference point: X               Option Settings:
                             Y               Unit Conversion:
                             Head            Digitizer Mode:
Rain element is not defined      Video graphics mode:
                                   M->FT
                                   DIGITIZER
                                   COLOR

                                   <f1> help <esc> return to previous menu 05/Jul/94
12.04 PM

```

Figure 5.3 - Aquifer Module Menu

This menu allows the specification of aquifer properties.

Commands

- Base Set the aquifer base
- Thick <T> Set the aquifer thickness
- Permeability <P> Set the aquifer permeability
- Porosity <O> Set the aquifer porosity
- Reference <F> Set the reference point (optional; see the reference command)
- Rain <R> Define an areal "rainfall" recharge circle
- Quit <Q> Return to the main menu

Aquifer Module

Base

Command Description

Sets the elevation of the base of the aquifer. GAEP will request the elevation, in units consistent with the desired project units. Enter the value and press <CR>. Press <ESC> to abort.

GFLOW1 computes discharge potentials at element control points based upon the difference between the head at the control point and the base elevation. Only a single base elevation for the entire model aquifer may be used.

Example

- To set the aquifer base elevation to 500 feet, select the "Aquifer/Base" command from the main menu:

A B

ENTER BASE ELEVATION: 500 <CR>

Aquifer Module

Permeability

Command Description

Sets the permeability (hydraulic conductivity) of the aquifer. GAEP will request the permeability, in units consistent with the desired project units (feet per day or meters per day are commonly used). Enter the value and press <CR>. Press <ESC> to abort.

Note

The permeability entered in the Aquifer module of GAEP (and GFLOW1) is the "regional" permeability for the aquifer domain. GFLOW1 allows the user to create internal domains of varying permeability, porosity and recharge (INHOMOGENEITY module). GAEP does not support the creation and editing of inhomogeneities as it is more conveniently done with GFLOW1.

Example

- To set the aquifer permeability to 100 feet/day, select the "Aquifer/Permeability" command from the main menu:

A P

ENTER PERMEABILITY: 100 <CR>

Aquifer Module

Porosity

Command Description

Sets the porosity of the aquifer. GAEP will request the porosity, as a fraction between 0.0 and 1.0. Enter the value and press <CR>. Press <ESC> to abort.

Aquifer porosity does not have any effect on modeled heads in GFLOW1. It does, however affect modeled flow velocities.

Note

The porosity entered in the Aquifer module of GAEP (and GFLOW1) is the "regional" porosity for the aquifer domain. GFLOW1 allows the user to create internal domains of varying permeability, porosity and recharge (INHOMOGENEITY module). GAEP does not support the creation and editing of inhomogeneities as it is more conveniently done in GFLOW1.

Example

- To set the aquifer porosity to 25%, select the "Aquifer/Porosity" command from the main menu (note that porosity is entered as a fraction, not as percent):

A 0

ENTER POROSITY: 0.25 <CR>

Aquifer Module**Rain****Command Description**

Allows the user to define the rain (areal recharge) element. GAEP will display the digital map and request the center of the rain circle. Select the center for the rain circle and press the left mouse button. GAEP then requests that a point on the perimeter of the circle be selected. Select the point and press the left mouse button. GAEP then requests that a recharge rate be entered. Enter the value and press <CR>. Press <ESC> at any time to abort.

Note

- Since the units throughout the modeling effort must be consistent, the rainfall recharge rate should have the same units as the aquifer permeability. If your recharge rate is in inches/year and permeability is in feet/day, you will need to convert the units before entering the value.
- The sign convention for GFLOW1 is that a positive strength parameter removes water from the aquifer (extraction). Hence, the rainfall recharge rate entered by this command should have a negative value (infiltration).

Example

- To create a rain circle with a recharge rate of 4 inches/year (9.13×10^{-4} ft/day), select the "Aquifer/Rain" command from the main menu:

A R

{Graphics screen appears}

SELECT CENTER OF THE RAIN CIRCLE

{User selects center with mouse and presses the left mouse button}

SELECT EDGE OF RAIN CIRCLE

{User selects the edge of the rain circle and presses the left mouse button}

ENTER EXFILTRATION RATE: -9.13E-4 <CR>

Aquifer Module

Reference

Command Description

Allows the user to define a reference point for the model. For a discussion of the purpose and proper choice of the reference point, see the modeling discussion in the main GFLOW1 manual. The use of this command is optional. If the user does not specify a reference point, GAEP will generate a default reference point location and head. The default reference point is appropriate for models with properly defined near field and far field features. For conceptual models with few features (for example, a well in uniform flow), the user will need to manually select a reference point location and head.

GAEP will request the location of the reference point in world coordinates. Enter the location and press <CR>. GAEP will then request the reference head. Enter the value and press <CR>. Press <ESC> to abort at any point.

Note

Though it might seem that a logical way to select the location of the reference point would be to graphically select it with the mouse, in practice the reference point should be much farther from the model region of interest than would normally appear on the screen. The most practical approach is to directly enter the coordinates of the reference point.

Example

- The user has a model in which the region of interest is centered at the world coordinates (450000,4280000 UTM). To place a reference point of 405 feet, 200000 meters north of the study region, select the "Aquifer/Reference" command from the main menu:

A F

ENTER REF POINT LOCATION: 450000 4480000 <CR>

ENTER HEAD: 405 <CR>

Aquifer Module

Thickness

Command Description

Sets the thickness of the aquifer. GAEP will request the thickness, in units consistent with the desired project units. Enter the value and press <CR>. Press <ESC> to abort.

GFLOW1 uses the aquifer base elevation and thickness to determine whether flow conditions are confined or unconfined at any point in the aquifer. Only a single thickness for the entire model aquifer may be used.

Note

If unconfined flow is to be modeled throughout the aquifer, the aquifer thickness should be set to some arbitrarily large value (for example: 1000).

Example

- To set the aquifer thickness to 50 feet, select the "Aquifer/Thickness" command from the main menu:

A T

ENTER THICKNESS: 50 <CR>

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Digitize Menu

```

Origin Stream Lake Heads Curve Points pieZometers View Edit Quit

GAEP for GFLOW Release 1.0
Digitizer Menu

Current Directory:
C:\
Current Map File:

Current Element File:

Memory available: 293184

Option Settings:
Unit Conversion: M->FT
Digitizer Mode: DIGITIZER
Video graphics mode: COLOR

12.07 PM <f1> help <esc> return to previous menu 05/Jul/94

```

Figure 5.4 - Digitize Module Menu

This menu provides access to the digital map feature creation and editing facilities.

Commands

- Origin <O> Set the digitizer origin
- Stream <S> Digitize a stream
- Heads <H> Digitize heads on a stream
- Curve <C> Digitize a background map curve
- Points <P> Digitize a background map point set
- Piezometers <Z> Digitize a set of piezometers (points of known head)
- View <V> View the digital map
- Edit <E> Edit the background map. Selects the Digitize/Edit submodule menu (Figure 5.4a).
- Quit <Q> Return to the main menu

Digitize Module

Curve

Command Description

Allows the user to digitize the location of a digital map curve. A curve is a digital map feature which denotes a road, property boundary, political boundary, etc. These curves become "background map" features in GFLOW1 and are used to orient the viewer when interpreting GFLOW1 output.

GAEP will prompt for the name of the feature; enter the name and press <CR>. GAEP will now design an abbreviation for the name and allow you to change it by entering a new abbreviation (up to 9 characters), or just press <CR> to use the one GAEP suggests. Once the name and abbreviation are set, GAEP will request that a color for the curve be selected (green, cyan, brown or magenta). Enter at least one letter of the desired color and press <CR>.

Now, the graphics screen will show the extent of the digitizer. Select points on the curve from the map and press the first digitizer button to enter points on the curve; use as many as required to describe the shape. As points are entered, they appear on the graphics screen as "plus" signs in the desired color. When complete, press <F3>, or press <ESC> to abort digitizing the feature.

Note

The digitizer origin must be set and the "Digitizer:" option set to DIGITIZER prior to use of this command with a digitizer. If you wish to use "Mouse Markup" mode to enter curves, the "Digitizer" option should be set to MOUSE MARKUP.

Example

- To digitize Highway 41 as a curve with the abbreviation "HWY41", select the "Digitize/Curve" command from the main menu (it is assumed that the origin has been set already):

D C

ENTER CURVE NAME: HIGHWAY 41 <CR>

ENTER ABBREVIATION [H4_____]: HWY41 <CR>

The graphics screen appears. Digitize points on the curve and press...

<F3>

to accept the points entered, or...

<ESC>

to abort.

Digitize Module

Edit

Command Description

Enters the Digitize/Edit submodule, for editing of the digital map. See the discussion of the Digitize/Edit submodule commands for details.

Example

- To enter the Digitize/Edit submodule from the Digitize module, press

E

To return to the Digitize module menu, press Q or <ESC>

Digitizer Module

Heads

Command Description

Allows the user to digitize the locations of known elevations on a stream. GAEP will show the entire digital map onscreen. When the mouse is moved, the nearest feature to the mouse will be highlighted, and its name appears in the upper left corner of the screen. Highlight the feature to have heads added and press the left mouse button.

Now, the graphics screen will show the extent of the digitizer. Select points where elevation contours cross the stream from the map and press the first digitizer button. GAEP will request the elevation. Enter the elevation in units consistent with the desired model units (feet or meters). Repeat the process for all possible elevations. When complete, press <F3> to save heads or <ESC> to abort digitizing the heads. If an elevation is entered incorrectly, you should press <ESC> and start again.

Note

- If a stream feature which already has heads associated is selected, GAEP asks whether new heads are to be added to those already present or the current heads are to be removed and replaced. Type ADD <CR> to add new heads or REPLACE <CR> to remove the current heads and replace them.
- The digitizer origin must be set and the "Digitizer:" option set to DIGITIZER prior to use of this command with a digitizer. If you wish to use "Mouse Markup" mode to enter heads, the "Digitizer" option should be set to MOUSE MARKUP.

Dealing with stream confluences

When a network of streams is entered, the slopes of tributary streams are often much steeper than those of major rivers. This can cause inaccuracies when elements are created with GAEP. It is best to estimate the head at the confluence of a tributary stream with the large stream and digitize it as well. This ensures that linesinks which represent tributary streams connect properly with linesinks for the trunk stream (particularly important when using groundwater-surface water interactions in GFLOW1).

Example

- To add heads to the stream Raccoon Creek, select the "Digitize/Heads" command from the main menu:

D H

The digital map appears. Select Raccoon Creek with the mouse and press the left mouse button. The digitizer extent appears and GAEP prompts for a point

to be entered. Select a point of known head on the stream and press the first puck button (in this case, a point at 410 feet is selected)...

ENTER HEAD: 410 <CR>

Continue the process for all known heads on the stream and press...

<F3>

to accept the heads entered or...

<ESC>

to abort.

Digitize Module

Origin

Command Description

Sets up the conversion between digitizer coordinates and world coordinates on your map. This is accomplished by defining the world coordinates for two different points ("origin points") on the map which is placed on the digitizer. GAEP will request that the user input one of the origin points marked on the map (see above). Place the digitizer puck on the first point and press the first button on the puck. GAEP will prompt for the world coordinates of the first point. Next, GAEP will repeat the process for the second origin point. Once the digitizer origin is set, it is possible to digitize hydrologic and background map features. During selection of origin points with the digitizer puck, the coordinates of the puck on the digitizer surface (in inches) are displayed in the upper right corner of the screen.

Note

- If the digitizer option is set to "mouse markup" mode, you may digitize onscreen at any time after a digital map is loaded. The origin cannot be set using this command, but matches the current display window. See the "Options/Digitizer" command discussion of the "Digitizer" setting. To use the "Digitize/Origin" command, the "Digitizer Mode:" option must be set to DIGITIZER.
- To obtain maximum accuracy, the origin points should be chosen far apart on the map, preferably near opposite corners.

Example

- The user has two origin points marked on his map at (450000,4280000 UTM) and (460000,4280000 UTM). The mapping of digitizer - to - world coordinates is established by selecting the "Digitize/Origin" command from the main menu (it is assumed that the "Digitizer Mode:" option is set to DIGITIZER):

D O

SELECT FIRST ORIGIN POINT WITH PUCK

{The user places the puck at the first origin point and presses the first puck button}

ENTER UTM COORDINATES: 450000 4280000

SELECT SECOND ORIGIN POINT WITH PUCK

{The user places the puck at the second origin point and presses the first puck button}

ENTER UTM COORDINATES: 460000 4280000

Digitize Module

Piezometers

Command Description

Allows the user to digitize the location of a digital map piezometer set. A piezometer set is a digital map feature which denotes a group of points of known head for use in model calibration. These piezometer sets can be used to create piezometer files for use in GFLOW1 (see the "File/Piezometer" command).

GAEP will prompt for the name of the piezometer set; enter the name and press <CR>. GAEP will now design an abbreviation for the name and allow you to change it by entering a new abbreviation (up to 9 characters), or just press <CR> to use the one GAEP designs.

Now, the graphics screen will show the extent of the digitizer. Select points of known head from the map and press the first digitizer button to enter them. As piezometers are entered, they appear on the graphics screen as cyan "plus" signs. GAEP will prompt for the head and a label for each piezometer. When complete, press <F3>, or press <ESC> to abort digitizing the feature.

Note

- The digitizer origin must be set and the "Digitizer:" option set to DIGITIZER prior to use of this command with a digitizer. If you wish to use "Mouse Markup" mode to enter piezometer sets, the "Digitizer" option should be set to "Mouse". If the digitizer mode is set to "Direct", the user enters coordinates directly from the keyboard; this is useful if the user has a list of known water levels and locations given in world coordinates.
- Piezometers are entered in sets. The wise use of this feature is to digitize piezometers which are to be used together into related groups (such as a group of "shallow" and a group of "deep" wells). When piezometer files are created for GFLOW1, each group of piezometers can be used to make its own file. This provides for a variety of scenarios to be considered based on different data sources when calibrating your model.

Example

- To digitize a group of shallow piezometers with the abbreviation "SHAL", select the "Digitize/Piezo" command from the main menu (it is assumed that the origin has been set already):

D Z

ENTER PIEZOMETER SET NAME: SHALLOW WELLS <CR>

ENTER ABBREVIATION [SW]: SHAL <CR>

The graphics screen appears. Digitize a piezometer location and press the first puck button...

ENTER HEAD: 417 <CR>

ENTER LABEL: SH#1 <CR>

Repeat the process for each piezometer in the piezometer set and press...

<F3>

to accept the points entered, or...

<ESC>

to abort entry.

*Digitize Module***Points****Command Description**

Allows the user to digitize the location of a digital map point set. A point set is a digital map feature which denotes a group of point features such as houses, monitoring wells, pumping wells or contaminated sites. These point sets become "background map" features in GFLOW1 and are used to orient the viewer when interpreting GFLOW1 output. They are also used in GAEP as base features for the creation of WELL analytic elements.

GAEP will prompt for the name of the point set; enter the name and press <CR>. GAEP will now design an abbreviation for the name and allow you to change it by entering a new abbreviation (up to 9 characters), or just press <CR> to use the one GAEP designs.

Now, the graphics screen will show the extent of the digitizer. Select points from the map and press the first digitizer button to enter them. As points are entered, they appear on the graphics screen as green "plus" signs. When complete, press <F3>, or press <ESC> to abort digitizing the feature.

Note

- The digitizer origin must be set and the "Digitizer:" option set to DIGITIZER prior to use of this command with a digitizer. If you wish to use "Mouse Markup" mode to enter point sets, the "Digitizer" option should be set to MOUSE MARKUP.
- If you have points of known head for model calibration, GAEP supports the creation of PIEZOMETERS for use in GFLOW1. Piezometers allow for the creation of plots which graphically illustrate the magnitude of head errors when modeling. To use this feature, choose the Piezometer command, rather than the Points command.
- All points created will be part of the background map. They may be used as visual guides when creating well analytic elements (see the Well command, Element Menu), but will not automatically become wells when elements are created.

Example

- To digitize the city well field as a set of points with the abbreviation "WELLS" (in preparation for creating WELL elements), select the "Digitize/Points" command from the main menu (it is assumed that the origin has been set already):

D P

ENTER POINT SET NAME: CITY WELL FIELD <CR>

ENTER ABBREVIATION [CWF]: WELLS <CR>

The graphics screen appears. Digitize well location points and press...

<F3>

to accept the points entered, or...

<ESC>

to abort.

Stream

Command Description

Allows the user to digitize the location of a surface water feature, either a stream, the edge of a lake or one side of a large river. GAEP will prompt for the name of the feature; enter the name and press <CR>. GAEP will now design a unique abbreviation for the name and allow you to change it by entering a new abbreviation (up to 9 characters), or just press <CR> to use the one GAEP designs. When elements are created for the feature, this abbreviation will be used to create element labels.

Now, the graphics screen will show the extent of the digitizing area. Select points on the stream from the map and press the first digitizer button to enter the stream's location. When complete, press <F3>, or press <ESC> to abort digitizing the feature.

While digitizing, GAEP will show the world coordinates of the digitizer puck (or mouse if in "Mouse Markup" mode). When points are entered, GAEP displays them as dark blue "plus" signs. The points are connected into a stream feature after the user presses the <F3> key. Once entered, the stream will be displayed as a continuous curve when the "Digitize/View" command is selected.

Note

- The digitizer origin must be set and the "Digitizer:" option set to DIGITIZER prior to use of this command with a digitizer. If you wish to use "Mouse Markup" mode to enter streams, the "Digitizer" option should be set to MOUSE MARKUP.
- It is up to the user to determine the number of points which define the stream. The best rule-of-thumb is to use the fewest points necessary to describe the shape of the channel. When elements are created, the heads on a stream are distributed according to the length of the channel curve which was digitized.

Dealing with reservoirs and lakes

- Often, the question arises as to what to do about digitizing reservoirs and lakes. The best way to handle these features is to digitize both sides of the lake as streams, dividing the two streams at the dam and the inflow point of the "major inlet". Heads will need to be entered for both edges - the best places are at the dam and inlet - make sure that they are "slightly" different (a 0.1 foot drop in the downstream direction is enough). The gradient in the reservoir boundary is needed to allow GFLOW1 to properly incorporate them in a stream network for conjunctive surface water and groundwater solutions. When elements are then created, you can create linesinks for both sides of the dam, even using the groundwater/surface water interaction facility of GFLOW1 to simulate the

interaction of the lake with the regional aquifer. Make sure that you use discrete stream segments to define each edge of the lake.

Dealing with waterfalls

- The best way to think of a waterfall is as two distinct streams, one ending at the top of the falls and the next beginning at the bottom. When adding heads to these features, include the head at the top of the waterfall on the upstream segment and add the head at the bottom of the waterfall to the downstream segment. Do not attempt to digitize a continuous stream reach across the falls - when element creation is performed, you will get poor estimation for the heads of linesinks near the falls.

Example

- To digitize Raccoon Creek as a stream with the abbreviation "RACCOON", select the "Digitize/Stream" command from the main menu (it is assumed that the origin has been set already):

D S

ENTER STREAM NAME: RACCOON CREEK <CR>

ENTER ABBREVIATION [RC_____]: RACCOON <CR>

The graphics screen appears. Digitize points on the stream and press...

<F3>

to accept the points entered, or...

<ESC>

to abort.

Digitize Menu

View

Command Description

Shows the current digital map on the screen. Streams which have heads associated with them will appear in bright blue (or white on monochrome systems). Streams without heads are dark blue (or dashed on monochrome systems). Background map curves and points are dark purple (or dotted on monochrome systems).

The mouse is enabled during a digital map view for interpretation. The feature nearest the mouse location is highlighted on screen and its name appears in the upper left corner. Move the mouse to inspect the map.

This command does not require that the digitizer origin be set prior to use.

Example

- A map has just been read (using the "File/ReadDM" command). The map can be viewed by selecting the "Digitize/View" command from the main menu:

D V

All currently loaded map features appear on screen. Press

<CR>

or

<ESC>

or the left mouse button to return to the menu.

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Digitize/Edit Submenu

```
Join Delete Rename View Quit

GAEP for GFLOW Release 1.0
Digitize/Edit Menu

Current Directory:
C:\
Current Map File:

Current Element File:

Memory available: 293184

Option Settings:
Unit Conversion:      M->FT
Digitizer Mode:      DIGITIZER
Video graphics mode:  COLOR

<f1> help <esc> return to previous menu 05/Jul/94
12.09 PM
```

Figure 5.4a - Digitize/Edit Submodule Menu

This menu provides facilities for editing existing digital map features.

Commands

- Join <J> Join two map features into a single feature
- Rename <R> Rename a feature
- Delete <D> Delete a feature
- View <V> View the digital map
- Quit <Q> Return to the Digitize menu

Digitize/Edit Submodule

Delete

Command Description

Allows a digital map feature to be deleted. GAEP requests that the feature be selected from the graphics screen. Select the feature with the mouse and press the left mouse button. GAEP asks the user to confirm the deletion (Y <CR> or N <CR>) and then requests that another feature be selected for deletion. When all deletions are complete, press <ESC> to return to the menu.

Example

- The stream "Mistake" has been digitized by mistake. To delete it, use the following commands from the main menu:

D E D

GAEP will ask that the feature be selected; select it and press the first mouse button. GAEP asks,

ARE YOU SURE?

Y

The feature has been deleted. If you wish to delete another feature, select it or press

<ESC>

to return to the Digitize/Edit submenu.

Join

Command Description

Allows two segments of a curve or stream to be digitized separately and joined together. GAEP requests that the first segment be selected from the graphics screen. Select the feature with the mouse and press the left mouse button. GAEP then requests the second feature; select with the mouse and press the left button. GAEP will ask ARE YOU SURE?. Press Y <CR> to join the features. GAEP will continue to prompt for additional "second features" to join to the selected feature. When joins for this feature are complete, press <ESC>. GAEP will then prompt for a new "first feature" for joining. Press <ESC> when all join operations are complete.

One use for this feature is that it can be convenient to digitize large map features in segments to prevent errors. Simply mark the segments on the map, digitize them separately, and then join them using GAEP.

Example

- The stream "Blue River" has been digitized as two stream segments. To join them, use the following commands from the main menu:

D E J

GAEP will ask that the first segment be selected; select it and press the first mouse button. Now, GAEP asks that the second segment be selected; select it and press the first mouse button. GAEP asks,

ARE YOU SURE?

Y

The streams have been joined, including any heads which may have been digitized. Press

<ESC>

to finish the joining for Blue River and to select another feature. When all joins are complete, press

<ESC>

to return to the Digitize/Edit submenu.

Note

If the joined features have different names, the combined feature will take the name of the first feature selected.

Digitize/Edit Submodule

Rename

Command Description

Allows a feature's name and abbreviation to be changed. GAEP requests that the feature be selected from the graphics screen. Select the feature with the mouse and press the left mouse button. GAEP then requests a new name; enter the new name or simply hit <CR> to keep the old name. GAEP then requests a new abbreviation; enter the new abbreviation or simply hit <CR> to keep the old abbreviation. GAEP will now request another feature to be renamed; select it with the mouse or press <ESC> to return to the menu.

Example

- The stream "Blue River" was accidentally named "Blew River" by the person who digitized it. Select the rename command from the main menu:

D E R

GAEP will ask that the feature be selected; select it and press the first mouse button.

NEW NAME FOR BLEW RIVER

BLUE RIVER <CR>

NEW ABBREVIATION [BR_____]:

<CR>

The name has been changed, and the abbreviation left as it was. If another feature is to be renamed, select it with the mouse. When all rename operations are complete, press

<ESC>

to return to the Digitize/Edit submenu.

View

Command Description

Shows the current digital map on the screen. Streams which have heads associated will be in bright blue (or white on monochrome systems). Streams without heads are dark blue (or dashed). Background map curves and points are dark purple (or dotted on monochrome systems).

The mouse is enabled during a digital map view for interpretation. The feature nearest the mouse location is highlighted on screen and its name appears in the upper left corner. Move the mouse to inspect the map.

This command does not require that the digitizer origin be set prior to use.

Example

- A map has just been read (using the "File/ReadDM" command). The map can be viewed by selecting the "Digitize/Edit/View" command from the main menu:

D E V

All currently loaded map features appear on screen. Press

<CR>

or

<ESC>

or the left mouse button to return to the menu.

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Element Menu

```

Linesink Sinkdisc Well Delete Properties View Quit

GAEP for GFLOW Release 1.0
Element Menu                                Current Directory:
                                           C:\
                                           Current Map File:

                                           Current Element File:
                                           Memory available: 293184

                                           Option Settings:
                                           Unit Conversion:      M->FT
                                           Digitizer Mode:      DIGITIZER
                                           Video graphics mode: COLOR

                                           <f1> help  <esc> return to previous menu  05/Jul/94
12.10 PM

```

Figure 5.5 - Element Module Menu

This menu allows for creation of analytic elements.

- Linesink <L> Create line sink elements
- Sinkdisc <K> Create sink disc elements
- Well <W> Create well elements
- Delete <D> Delete elements associated with a digital map feature
- Properties <P> Change properties of analytic elements in the model
- View <V> View the digital and element map
- Quit <Q> Return to the main menu

Element Module

Delete

Command Description

Allows analytic elements associated with a digital map feature to be deleted. Since elements are created in groups and a single feature may have several element groups associated with it, GAEP prompts for deletion for each group of elements in turn.

GAEP requests that the feature be selected from the graphics screen. Select the feature with the mouse and press the left mouse button. GAEP will then prompt for deletion for each group of elements associated with the digital map feature; the group of elements to be deleted will be shown in red.

Example

- To delete all elements associated with the digital map feature "Blue River", select the Element/Delete command from the main menu,

E D

GAEP will then prompt for selection of the map feature for element deletion. Select the feature Blue River and press the first mouse button. For each group of elements (in this case, line sinks), GAEP will highlight the elements and ask,

DELETE ELEMENTS (Y/N)?

Press

Y <CR>

to delete or

N <CR>

to keep the highlighted elements. Press

<ESC>

to return to the Element menu.

Linesink

Command Description

Allows the user to create line sink elements for a stream digital map feature. GAEP requests that the user select a stream for line sink creation and then displays the stream in the highlighted color (or line type, on monochrome systems). The user then creates line sink elements by selecting the end points of the line sinks with the mouse and pressing the first mouse button. GAEP uses the head and point data digitized for the stream feature to determine the average head for each line sink and displays the line sink and its associated head.

Line sinks are created in sets, all associated with the selected stream map feature. When additional line sinks are created for the same map feature, the additional line sinks are placed in their own sets. The Stream and Delete commands allow the user to make sets of linesinks into GFLOW1 STream features for surface-groundwater interaction modeling or to delete sets of line sinks.

It does not matter to GFLOW1 whether linesinks are entered "heading upstream" or "heading downstream", but the user might wish to work in a consistent manner, creating linesinks in the same direction for all features.

GAEP will also prompt for the line sink's width, resistance and resistance layer depth parameters. See the GFLOW1 documentation (Chapter 4) for details on the meaning of these parameters.

Note

When creating "far field" line sinks, the width parameter should be set to zero (0). By setting this value to zero, GFLOW1 will ignore the infiltration limits placed on percolating features and allow the line sink to infiltrate sufficient water to "nail down" the head in the far field. GAEP will display such line sinks as dotted lines; all far field linesinks should appear as dotted lines in GAEP.

Example

- To create line sink elements for the digital map stream feature "Blue River", the user selects the Element/Linesink command from the main menu:

E L

Now, GAEP prompts for the user to select a stream. Select the stream with the mouse and press the first mouse button. GAEP then prompts for the width, resistance and resistance layer depth.

ENTER WIDTH: 50 <CR>

ENTER RESISTANCE: 5 <CR>

ENTER RESISTANCE LAYER DEPTH: 5 <CR>

GAEP prompts for the user to select the end points of line sinks and press the mouse button for each. When complete, press

<F3>

to save the line sinks or

<ESC>

to abort.

Properties

Command Description

Allows the properties of elements to be changed. Since elements are created in groups (strings of line sinks associated with a single stream or several wells at a wellfield, for example), GAEP prompts for each group of elements associated with the selected map feature, in turn. The properties which may be changed are:

- For wells, radius and pumping rate may be changed for each well.
- For line sinks, GFLOW1 stream networks may be created. If a string of line sinks is to be made a GFLOW stream, GAEP will request values for the end inflow and overland flow parameters (see GFLOW1 documentation). In addition, GAEP allows the width, resistance and resistance layer depth to be changed as well.
- For ponds, the resistance and resistance layer depth may be changed.

Note

Normally, all analytic elements are displayed in yellow in GAEP. Line sinks which are defined as part of a stream network are displayed in white.

Examples

- To make the line sinks associated with the digital map stream feature "Blue River" into a GFLOW1 stream, select the Element/Properties command from the main menu,

E P

GAEP prompts for the stream to be selected; select Blue River and press the first mouse button. For each set of line sinks associated with Blue River,

LINESINK OR STREAM (L/S)? S <CR>

IS THIS AN END STREAM [N]? N <CR>

(or Y <CR> if the line sinks do comprise an end stream)

ENTER END INFLOW [0]: 0 <CR>

ENTER OVERLAND FLOW [0]: 0 <CR>

GAEP will then prompt for width, resistance and resistance layer depth.

- To change the GFLOW1 streams associated with the digital map stream feature "Blue River" back to "normal" line sinks, select the Properties command from the main menu,

E P

GAEP prompts for the stream to be changed; select Blue River and press the first mouse button. For each set of line sinks,

LINESINK OR STREAM (L/S)? L <CR>

(or S <CR> to leave the set of line sinks a GFLOW1 stream). GAEP will then prompt for width, resistance and resistance layer depth.

- Adjustment of parameters for other elements proceed similarly, with GAEP prompting for the new values for all parameters. The default or current value for each parameter is shown in square brackets [] on the prompt line. To select the default value, just press <CR>.

Note

GAEP will change the properties for an entire group of elements (for example, a string of line sinks). If properties need to be changed for individual line sinks in a string, you may use the CURSOR option in the LInesink module of GFLOW1.

Sinkdisc

Command Description

Allows the user to create sink disc elements for a lake digital map feature. GAEP requests that the user select a lake for sink disc creation and then displays the lake in the highlighted color (or line type, on monochrome systems). The user then creates the sink disc elements by selecting the center and edges of the sink discs with the mouse and pressing the first mouse button. GAEP uses the head for the lake feature to determine the head for each sink disc and displays the sink disc.

Sink discs are created in sets, all associated with the selected lake map feature. When additional sink discs are created for the same map feature, the additional sink discs are placed in their own sets. The Delete command allows the user to delete individual sets of sink discs.

Example

- To create sink disc elements for the digital map stream feature "Big Lake", the user selects the Element/Sinkdisc command from the main menu:

E S

Now, GAEP prompts for the user to select a lake. Select the lake with the mouse and press the first mouse button. GAEP then prompts for the resistance and resistance layer depth.

ENTER RESISTANCE: 5 <CR>

ENTER RESISTANCE LAYER DEPTH: 5 <CR>

For each sink disc created, GAEP prompts for the user to select the center and the edge of the sink disc. Press the first mouse button for each center and each edge. GAEP displays the sink disc's size as it is created. When complete, press

<F3>

to save the sink discs or

<ESC>

to abort.

Element Module

View

Command Description

Shows the current digital map and analytic element layout on the screen, with all elements. Streams which have heads associated will be in bright blue (or white on monochrome systems). Streams without heads are dark blue (or dashed). Background map curves and points are dark purple (or dot-dashed). Line sink or sink disc or well elements which have been created by the user will appear in yellow, those which have been made into GFLOW1 streams (for the surface/groundwater interaction facility) in white. If it has been defined, the rain circle will be shown in yellow.

Note

- In certain circumstances, the parameter selection for line sinks may affect the ability of a model solution to converge. If GAEP detects one of the following situations:
 - Linesinks with very small widths
 - Linesinks which are part of a stream network, but have no resistance, or linesinks with resistance, but a zero resistance layer depthGAEP will display the line sinks as dotted lines, either in yellow (if not part of a stream network) or in white (if part of a stream network).
- An exception: When defining far field line sinks, the width should be set to zero. Correctly defined far field line sinks should appear as yellow dotted lines in GAEP.

Example

- To view an element layout, choose the Element/View command from the main menu,
E V

Well

Command Description

Allows the user to create well elements for a point set digital map feature. GAEP requests that the user select a point set for well creation and then displays the point set in the highlighted color (or line type, on monochrome systems). The user then creates the well elements by selecting the center of the well with the mouse and pressing the first mouse button. GAEP prompts for the discharge rate and radius for each well created.

Wells are created in sets, all associated with the selected point set. When additional wells are created for the same map feature, the additional wells are placed in their own sets. The Delete command allows the user to delete individual sets of wells.

Example

- To create well elements for the digital map point set feature "City Wells", the user selects the Element/Well command from the main menu:

E W

Now, GAEP prompts for the user to select a point set. Select the point set with the mouse and press the first mouse button. For each well created, GAEP prompts for the user to select the center. Press the first mouse button for each center. GAEP requests that the user enter the discharge rate and radius for each well as it is created (in units compatible with the modeler's units for length and time, commonly ft³/day and feet, respectively):

ENTER WELL DISCHARGE: 100000 <CR>

ENTER RADIUS: 0.5 <CR>

When complete, press

<F3>

to save the wells or

<ESC>

to abort.

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File Module

```

New ReadDM WriteDM LoadElem SaveElem Map pieZometer ChangeDir Quit

GAEP for GFLOW Release 1.0
File Menu                                Current Directory:
                                         C:\
                                         Current Map File:

                                         Current Element File:
                                         Memory available: 293184

                                         Option Settings:
                                         Unit Conversion:      M->FT
                                         Digitizer Mode:      DIGITIZER
                                         Video graphics mode:  COLOR

                                         <f1> help  <esc> return to previous menu  05/Jul/94
12.12 DM

```

*Figure 5.6 - File Module Menu***Commands**

This menu provides access to the various file management facilities in GAEP.

- New <N> Clears GAEP memory, resets the program.
- ReadDM <R> Reads a digital map file from disk, for editing or for element creation.
- WriteDM <W> Writes the current digital map to a disk file.
- LoadElem <L> Reads an existing analytic element file.
- SaveElem <S> Writes analytic elements to a GFLOW1- compatible data file
- Map <M> Create a GFLOW1-compatible background map data file
- Piezometer <Z> Create a GFLOW1-compatible data file of piezometers
- ChangeDir <C> Change the working directory
- Quit <Q> Return to the main menu

File Module

ChangeDir

Command Description

Changes the working directory for GAEP. GAEP will prompt for the new working directory. The default working directory is the directory that was current when GAEP was started.

Note

Users who are familiar with the WhAEM version of GAEP will find that this command works differently with GFLOW1. GAEP for WhAEM saves the working directory for future sessions; GAEP for GFLOW1 does not.

Example

- If the user is in the directory \PROJECT and wishes to save analytic elements to the directory \PROJECT\MODELS, he can change directories in GAEP by selecting the "File/ChangeDir" commands from the main menu:

F C

ENTER NEW WORKING DIRECTORY: \PROJECT\MODELS <CR>

LoadElem

Command Description

Reads a GFLOW1-compatible analytic element data file from the current directory. GAEP will prompt for the name of the file to be read from disk. Type the name of the file, followed by the <CR> key, or press <ESC> to abort the command. The standard for analytic element data files is that the extension .DAT is used; GAEP will provide the extension .DAT if any other extension is used.

Note

- GAEP can read analytic element data files which were written by GAEP or by GFLOW1. The only limitation is that the labels for the elements associated with a digital map feature in GFLOW1 must agree with the abbreviation of the feature's name in GAEP. If this is not the case, GAEP will be unable to manipulate the elements. As a practical matter, this means that GAEP will generally be able to read only files which it had created or files rewritten by GFLOW1 which were originally created by GAEP. To work effectively with GAEP, do not create elements by using an editor directly on the data file or change element labels in GFLOW1.
- If elements already exist in GAEP when this command is issued, GAEP prompts:

ADD FILE TO EXISTING ELEMENTS (Y/N)?

Enter Y <CR> to add the file to the elements already loaded or N <CR> to abort this command.
- If the user desires to view or edit the analytic elements loaded from a data file, a corresponding digital map file must be loaded - see the ReadDM command. If elements exist in the element file which are associated with digital map features which are not presently loaded, GAEP will display them, but will not allow these elements to be modified. The user may use several detailed digital map files to manage a single very large set of analytic elements in a super-regional model, by successively combining the analytic element data with different digital map files (see the File/New command).

Example

- Assuming a file of analytic elements called MODEL.DAT exists in the current working directory, the file can be loaded by selecting the "File/Load Element" command from the main menu:

F L

Chapter 5 - GAEP Reference

ENTER NAME OF ELEMENT FILE: MODEL.DAT <CR>

File Module

Map

Command Description

Writes any currently defined "background map features" (that is, curves and point sets) to a data file in the current directory. The file created will be a GFLOW1-compatible data file (.DAT) which, when switched into GFLOW1, creates a GFLOW1-compatible map file (.MAP). GAEP will prompt you for the Model Origin for the project, so that map features will align with elements. GAEP will then prompt for the name of the file to be written. The standard for GFLOW1 data file names is to use the extension .DAT; GAEP will change the extension to .DAT if another entry is made..

Once the data file is created, you must later run GFLOW1 and SWITCH in the data file to prepare the map file. Once the map file is created, you can enable plotting by use of the PLOT command in the MAP module (see GFLOW1 documentation).

Example

- If the user has several roads digitized in GAEP as "curve" digital map features, he can create a GFLOW1-compatible data file ROADS.DAT, which creates the GFLOW1 map file ROADS.MAP by selecting the "File/Map" command from the main GAEP menu:

F R

ENTER MODEL ORIGIN: 450000 4280000 <CR>

ENTER NAME OF DATA FILE: ROADS.DAT <CR>

ENTER NAME OF GFLOW1 MAP FILE: ROADS <CR>

GAEP will write the background map features to ROADS.DAT. Before the background map can be used in GFLOW1, the user must enter the following commands in GFLOW1:

SWITCH ROADS.DAT <CR>

{GFLOW1 will process the file}

QUIT <CR>

ROADS.MAP has been created. To select the file ROADS.MAP for plotting in GFLOW1, enter the GFLOW1 commands:

MAP <CR>

PLOT ROADS.MAP <CR>

New

Command Description

Clears GAEP's memory. GAEP allows either the digital map information or the analytic elements (or both) to be removed from memory.

Example

- If a digital map and a set of analytic elements have been loaded, they may be removed by entering the "File/New" commands from the main menu:

```
F N
```

```
CLEAR DIGITAL MAP? Y <CR>
```

```
CLEAR ELEMENTS? Y <CR>
```

Note

The File/New command may be used to facilitate the use of several digital maps with a single large analytic element data file in a super-regional modeling project. To do this, use the File/LoadElem command to load the large element file, then read in the digital map file for the area where editing of elements is required. To change elements in another portion of the project domain, use the File/New command to clear only the digital map, then use the File/ReadDM command to load the new digital map file.

File Module

Piezometer

Command Description

Writes any set of piezometers to a data file in the current directory. The file created will be a GFLOW1-compatible data file (.DAT) which, when switched into GFLOW1, defines a set of known heads for use in model calibration (see the GFLOW1 CHeck module). GAEP will first request that the piezometer set to be written be selected from the background map view. Only one set of piezometers may be written to each file. Select the set of piezometers and press the left mouse button. GAEP then prompts for the Model Origin for the project, so that piezometers will align with elements. GAEP will then prompt for the name of the file to be written. The standard for GFLOW1 data file names is to use the extension .DAT; GAEP will change the extension to .DAT if another entry is made..

Note

- GAEP allows you to create only one GFLOW1-compatible piezometer file for each piezometer set in a digital map file. This allows the user to create multiple sets of piezometers in a digital map file and to use them separately in GFLOW1. This may be useful for cases when several different sets of known heads (such as shallow and deep wells in a single aquifer or head data inside and outside an inhomogeneity) are available for a single project.
- GAEP places a `FILTER -10 10` command in the piezometer file, to ensure consistent scaling of symbols. The scaling range may be altered in GFLOW1.

Example

- If the user has several sets of piezometers digitized in GAEP, he can create a GFLOW1-compatible data file `PIEZOS.DAT` (from one of the sets) by selecting the "File/Piezometer" command from the main GAEP menu:

F Z

User selects a piezometer set from the graphics screen and presses the first mouse button.

ENTER MODEL ORIGIN: 450000 4280000 <CR>

ENTER NAME OF DATA FILE: PIEZOS.DAT <CR>

GAEP will write the piezometers to `PIEZOS.DAT`.

ReadDM

Command Description

Reads a digital map file from the current directory. GAEP will prompt for the name of the file to be read from disk. Type the name of the file, followed by the <CR> key, or press <ESC> to abort the command. The standard for digital map files is that the extension .DM is used; GAEP will provide the extension .DM if any other extension is used.

If a digital map is already loaded, this command will add the newly read map to the already loaded map. To remove the previously loaded map, either re-start GAEP or use the New command (see discussion of the File/New command).

Note

A digital map file **MUST** be loaded before element creation functions can be performed. It is impossible to create or to view analytic elements unless a digital map is loaded.

Example

- Assuming that the user has a digital map called MODEL.DM in the current directory, the digital map features can be loaded into GAEP from the main menu by selecting the "File/ReadDM" command:

F R

ENTER NAME OF DIGITAL MAP FILE: MODEL.DM <CR>

To abort the command, press <ESC> before pressing <CR>

File Module

SaveElem

Command Description

Writes the currently defined analytic elements and aquifer properties to an analytic element data file in the current directory. GAEP will prompt you for the Model Origin for the project. GAEP will then prompt for the name of the file to be written. The standard for analytic element data file names is to use the extension .DAT; GAEP will change the extension to .DAT if another entry is made. Type the name of the file, followed by the <CR> key, or press <ESC> to abort the command.

Note

If you have defined any GAEP digital map features for "background" maps in GFLOW1 (that is, curves or point sets), these background map features will not be added to the output file. To place background map features (such as roads) in a GFLOW1-compatible file, you must use the Map (M) command.

Example

- Assuming a set of analytic elements have been created, from the main menu select the "File/Save Element" command:

F S

ENTER NAME OF ELEMENT FILE: MODEL.DAT <CR>

GAEP will place all analytic elements in the GFLOW1-compatible file MODEL.DAT.

WriteDM

Command Description

Writes the current digital map to a digital map file in the current directory. GAEP will prompt for the name of the file to be written. The current version of GAEP does not enforce file extensions, so any filename and extension are allowed, but it is useful to choose a consistent naming convention. The standard for digital map file names is to use the extension .DM; GAEP will change the extension to .DM if another entry is made. Type the name of the file, followed by the <CR> key, or press <ESC> to abort the command.

Example

- If the user has digitized a number of digital map features, he can write them to a file called MODEL.DM in the current directory by selecting the "File/WriteDM" command:

F W

ENTER NAME OF DIGITAL MAP FILE: MODEL.DM <CR>

To abort the command, press <ESC> before pressing <CR>

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```
UnitConv Digitizer VideoMode Quit

GAEP for GFLOW Release 1.0
Options Menu                               Current Directory:
                                           C:\
                                           Current Map File:

                                           Current Element File:
                                           Memory available: 293184

                                           Option Settings:
                                           Unit Conversion:      M->FT
                                           Digitizer Mode:       DIGITIZER
                                           Video graphics mode:  COLOR

                                           <f1> help  <esc> return to previous menu  05/Jul/94
12.18 PM
```

Figure 5.7 - Options Module Menu

Options Menu

All of the commands listed here set program option settings and perform no direct action on the digital maps or analytic elements in use. Once a setting is modified, it is saved to the disk and remains set until changed, regardless of whether GAEP is re-started.

- UnitConv <U> Set the unit conversion mode
- Digitizer <D> Select the digitizer mode
- VideoMode <V> Switch video modes
- Quit <Q> Return to the main menu

Options Module

Digitizer

Command Description

Selects the digitizer mode. The digitizer mode can have any of three states: "Digitizer", "Mouse Markup", or "Direct". In digitizer mode, all coordinate input is performed using the presently configured digitizer. In "Mouse Markup" mode, the mouse may be used to enter points directly on a displayed digital map. The "mouse markup" mode is intended for making small corrections to existing digital maps. It is NOT RECOMMENDED for general-purpose data entry. "Direct" mode allows the user to enter the coordinate locations (in world coordinates) from the keyboard; may be commonly useful for definition of piezometers and wells.

Note

For "keyboard digitizing" in the absence of a digitizer, refer to the GAEP Installation Guide (Chapter 1).

Example

- To toggle between digitizer usage and mouse markup mode, choose the Options/Digitizer command from the main menu,
 - D

GAEP cycles through the various options and displays the current settings at all times in the lower left corner of all menus.

Unit Conversions

Command Description

Allows the user to change the way unit conversions on (x,y) locations are handled when reading or writing analytic element files. Three modes are supported; "feet-to-meters", "none" and "meters-to-feet". If your digital map was digitized in UTM, you would use the "meters-to-feet" setting to make analytic element files in feet or the "none" setting for analytic element files in meters.

When this command is selected, GAEP cycles through the unit conversion options. Continue until the desired mode is shown on the screen.

Note

- The unit conversion setting is used both during the reading and writing of GFLOW1 element files. GAEP saves the setting as part of the data file; when the data file is reread by GAEP, the setting used when the file was created is restored.
- GAEP does not support unit conversions for head values associated with analytic elements; only for the (x,y) locations.

Example

- To change the unit conversion settings, choose the Options/Unit Conversions command from the main menu,

○ U

GAEP cycles through the three options and displays the current settings at all times in the lower left corner of all menus.

Options Menu

```

File Aquifer Digitize Element Options Utility Quit

GAEP for GFLOW Release 1.0
Main Menu                                Current Directory:
                                           C:\
                                           Current Map File:

                                           Current Element File:
                                           Memory available: 293184

                                           Option Settings:
                                           Unit Conversion:      M->FT
                                           Digitizer Mode:       DIGITIZER
                                           Video graphics mode:  COLOR

                                           <f1> help  <esc> return to previous menu  05/Jul/94
12.32 PM

```

Figure 5.8 - Utility Module Menu

Video Mode

Command Description

Toggles the video mode from color to monochrome or from monochrome to color. GAEP will create all menus and graphics displays using line types or capital/lower case letters rather than color in the monochrome mode.

Example

- To toggle between video modes, choose the Options/Video Mode command from the main menu,
 - V

GAEP cycles through the various options and displays the current settings at all times in the lower left corner of all menus.

Utility Menu

This menu provides several useful utility functions.

- UTM/LatLon <U> Enter the UTM/Latitude-Longitude conversion utility
- Dos <D> Run MS-DOS
- DXF Import <X> Import a drawing interchange format (DXF) file.
- Quit <Q> Return to the main menu

Utility Module

DOS

Command Description

Temporarily transfers control to the DOS shell specified in the COMSPEC environmental variable (usually C:\COMMAND.COM). Regular DOS commands may be executed while in the DOS shell, but only within the limits of available memory (GAEP and a large digital map file can consume a large amount of memory). Use the DOS EXIT command to return control to GAEP.

Example

- To escape to the DOS shell, choose the Utility/DOS command from the main menu,

```
U D
```

```
C:\>
```

Control has been transferred to the DOS shell. To return to GAEP, use the DOS EXIT command,

```
C:\> EXIT <CR>
```

DXF Import

Command Description

Imports a DXF format file, as written by a CAD program or a GIS system. The entire DXF file will be loaded, either as hydrography (streams) or as base map features (curves and point sets). If curves are to be created, the user may specify a color for the map features.

Example

- To read the DXF format file BASEMAP.DXF, as green base map features use the Utility/DXFImport command from the Main Menu,

```
U X
DXF FILE TO READ? BASEMAP <CR>
IMPORT AS HYDROGRAPHY OR BASEMAP? BASEMAP <CR>
COLOR FOR CURVE FEATURES? GREEN <CR>
```

Note

- The implementation of DXF file importation in GAEP is an incomplete implementation of the DXF standard. Only LINES, POINTS and POLYLINES are supported, and no dotted/dashed lines or line widths are supported.
- See Appendix B, "Use of GFLOW With Other Software" for a further discussion of the DXF facilities.

Utility Module

```

Zone Latitude Longitude Utm Quit

GAEP for GFLOW Release 1.0

Geographic Location:          Current Directory:
UTM Zone:                     C:\
                               Current Map File:
Latitude:    00 d 00 m 00 s
Longitude:   00 d 00 m 00 s
UTM coordinates: X      0.0
                  Y      0.0
                               Current Element File:
                               Memory available: 293184

                               Option Settings:
                               Unit Conversion:    M->FT
                               Digitizer Mode:    DIGITIZER
                               Video graphics mode: COLOR

                               <f1> help <esc> return to previous menu 05/Jul/94
12.31 PM

```

Figure 5.8a - UTM/Latitude-Longitude Conversion Utility Menu

UTM/Lat-Long

Command Description

Enters the UTM/Latitude-Longitude conversion utility. This utility is provided to simplify the use of topographic maps which do not have preprinted grids for UTM coordinates. The utility allows the user to compute the UTM coordinates of corners (or other points of known latitude and longitude) or vice versa.

Note

This facility was adapted from the U.S. Geological Survey document "Computer Programs for Common Map Projections", by G. D. Newton. U.S. Geological Survey Bulletin 1642, 1985.

Example

- To enter the UTM/Latitude-Longitude conversion utility, choose the Utility/UTM command from the main menu,

U U

You will proceed to the UTM/Latitude-Longitude conversion utility screen (Figure 5.8a).

UTM / Latitude-Longitude Utility

This menu allows the user to convert UTM coordinates to latitude-longitude coordinates or latitude-longitude coordinates to UTM coordinates, given a known UTM zone.

- Zone <Z> Enter the UTM zone
- Latitude <T> Enter the latitude, convert to UTM
- Longitude <O> Enter the longitude, convert to UTM
- UTM <U> Enter UTM coordinates, convert to latitude-longitude
- Quit <Q> Return to the utility menu

UTM / Latitude-Longitude Utility

Latitude

Command Description

Allows the user to enter the latitude of a point for conversion to UTM coordinates. The conversion utility performs the conversion and prints the results immediately on the menu.

Note

UTM zones are defined such that they overlap. It is possible that the user's model region can span the edge of two UTM zones. If this is the case, select one of the two zones and use it throughout your digitizing work.

Example

- To enter the latitude 34 degrees, 45 minutes, 15 seconds, select the Latitude command from the UTM/Latitude-Longitude Utility menu:

T

ENTER LATITUDE:

Enter the desired latitude.

34 45 15 <CR>

All coordinate conversions will be done based on the current UTM zone and the resulting coordinates will appear on the menu.

Longitude

Command Description

Allows the user to enter the longitude of a point for conversion to UTM coordinates. The conversion utility performs the conversion and prints the results immediately on the menu.

Note

UTM zones are defined such that they overlap. It is possible that the user's model region can span the edge of two UTM zones. If this is the case, select one of the two zones and use it throughout your digitizing work.

Example

- To enter the longitude 103 degrees, 30 minutes, select the Longitude command from the UTM/Latitude-Longitude Utility menu:

G

ENTER LONGITUDE:

Enter the desired latitude.

103 30 00 <CR>

All coordinate conversions will be done based on the current UTM zone and the resulting coordinates will appear on the menu.

UTM / Latitude-Longitude Utility

UTM

Command Description

Allows the user to enter the UTM coordinates of a point for conversion to Latitude-Longitude. The conversion utility performs the conversion and prints the results immediately on the menu.

Note

UTM zones are defined such that they overlap. It is possible that the user's model region can span the edge of two UTM zones. If this is the case, select one of the two zones and use it throughout your digitizing work.

Example

- To find the latitude and longitude for the UTM coordinates 502000 4239850 in the presently-selected UTM zone, select the UTM command from the UTM/Latitude-Longitude Utility menu:

U

ENTER UTM COORDINATES:

Enter the desired coordinates.

502000 4239850 <CR>

All coordinate conversions will be done based on the current UTM zone and the resulting coordinates will appear on the menu.

Zone

Command Description

Allows the user to define the UTM zone for conversions. GAEP will request that the zone number be entered. The UTM zone number is printed in the lower left corner of a USGS 1:24,000 scale topographic map. A UTM zone **MUST** be specified prior to performing unit conversions.

Note

UTM zones are defined such that they overlap. It is possible that the user's model region can span the edge of two UTM zones. If this is the case, select one of the two zones and use it throughout your digitizing work.

Example

- To select UTM zone 16, select the Zone command from the UTM/Latitude-Longitude Utility menu:

Z

ENTER UTM ZONE :

Enter the desired zone number.

16 <CR>

All coordinate conversions will be done based on UTM zone 16.

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