CHAPTER 21   ABSTRACTION

21.1. Background Information and Modifications to Version 1.10

This module distinguishes version 1.20 from version 1.10 of the Ground Water for Windows software. The word "Abstraction" is used in this text to specify the pumping, extraction, development or production from wells. The Abstraction module was added in November 1995 to the Ground Water for Windows software package, eight months after the main program and its user manual were written (in March 1995). Its development was financed by the Government of Bahrain, Water Resources Directorate, Manama, Bahrain. It is compatible with the previous version (1.10) in the sense that data bases that have been created with version 1.10 will work as long as some additionally required files are copied to the directory in which the GWW program files reside. These additional files are the following:

ABS.STR Data structure for abstraction application.
ABSRF.FRM Reporting form for abstraction application.
ABS.EXE Executable file.
ABSSE.FRM Standard entry form for abstraction application.
ABSMEAS.FRM Reporting form for measurements.
ABSTAB.FRM Reporting form for abstraction table.

Here below all form and structure (.frm and .str) files are reproduced, just in case you can't find them in the GWW program directory. These are the simplified versions with the minimum content.

ABS.STR may look as follows

```
Well Ident        10   Well
Agriculture(A)    10   Num(Dim) Fixed 2  m3
Agriculture(PR)   10   Num(Dim) Fixed 2 m3/day
Home(A)           10   Num(Dim) Fixed 2  m3
Home(PR)          10   Num(Dim) Fixed 2  m3/day
```

ABSRF.FRM may look as follows:

```
DATA 'Well Ident' (100,110,330,100) 2,15,10,10 P(0,0,0)
B(255,255,255)
'Well Ident' LT,5,5
```

'Arial' 10,0,0,0 C(0,0,0)
CB,10,-10
'Arial' 14,1,0,0 C(0,0,0)
DRAW 'Diagram' (190,390,1590,2070) 2,15,0,0 P(0,0,0) B(255,255,255)

CT,0,-20
'Arial' 16,1,0,0 C(0,0,0)

ABSSE.FRM may look as follows:

TEXT 'Abstraction General Data' (30,50,1340,420) 2,15,10,10 P(0,0,0)
B(255,223,191)
'Abstraction General Data' CT,0,20
'Arial' 16,1,0,0 C(0,0,0)
DATA 'Well Ident' (70,140,320,100) 2,15,0,0 P(0,0,0) B(255,255,255)
'Well Ident' LT,5,5
'Arial' 10,0,0,0 C(0,0,0)
CB,10,-10
'Courier' 10,0,0,0 C(0,0,0)

ABSMEAS.FRM may look as follows:

DATA 'Well Ident' (100,20,1700,100) 2,15,10,10 P(0,0,0)
B(255,255,255)
'Abstraction' CC,0,0
'Arial' 18,1,0,0 C(0,0,0)
CB,10,-10
'Courier' 10,0,0,0 C(0,0,0)
DATA 'X' (100,370,280,100) 2,15,0,0 P(0,0,0) B(255,255,255)
'X' LT,5,5
'Arial' 10,0,0,0 C(0,0,0)
CB,10,-10
'Courier' 10,0,0,0 C(0,0,0)
DATA 'Y' (380,370,280,100) 2,15,0,0 P(0,0,0) B(255,255,255)
'Y' LT,5,5
'Arial' 10,0,0,0 C(0,0,0)   CB,10,-10
'Courier' 10,0,0,0 C(0,0,0)
DATA 'Z' (660,370,280,100) 2,15,0,0 P(0,0,0) B(255,255,255)
'Z' LT,5,5
'Arial' 10,0,0,0 C(0,0,0)
CB,10,-10
'Courier' 10,0,0,0 C(0,0,0)
DRAW 'Diagram' (200,530,1510,1710) 4,15,10,10 P(0,0,0)
B(255,255,255)
CT,0,-20
'Arial' 16,1,0,0 C(0,0,0)

ABSTAB.FRM may look as follows:

TEXT 'Abstraction General Data' (110,20,1780,80) 2,15,10,10 P(0,0,0)
B(255,255,255)
'Abstraction General Data' CC,0,0
'Arial' 16,1,0,0 C(0,0,0)
DATC 'Well Ident ' (110,140,270,2370) 2,15,0,0 P(0,0,0) B(255,255,255)
'Well Ident' CC,0,0
'Arial' 12,1,0,0 C(0,0,0)
CB,0,0
'Courier' 10,0,0,0 C(0,0,0) 80   60   38
DATC 'X' (830,140,290,2370) 2,15,0,0 P(0,0,0) B(255,255,255)
'X' CC,0,0
'Arial' 12,1,0,0 C(0,0,0)
CB,0,0
'Courier' 10,0,0,0 C(0,0,0) 80   60   38
DATC 'Y' (1120,140,270,2370) 2,15,0,0 P(0,0,0) B(255,255,255)
'Y' CC,0,0
'Arial' 12,1,0,0 C(0,0,0)
CB,0,0
'Courier' 10,0,0,0 C(0,0,0) 80   60   38
DATC 'Z' (1390,140,230,2370) 2,15,0,0 P(0,0,0) B(255,255,255)
'Z' CC,0,0
'Arial' 12,1,0,0 C(0,0,0)
CB,0,0
'Courier' 10,0,0,0 C(0,0,0) 80   60   38

The new GWW.000 template (a blank data base) contains all internal structures required for the abstraction module. The version 1.20 will work with old "EXE" files, provided you have the new executable files GWWA.EXE (replaces GWW.EXE), FORMED.EXE and ABS.EXE, plus the new template GWW.000 as a minimum. It is recommended that all "EXE" files from the older version are replaced by their equivalents. Also, the main executable file is no longer GWW.EXE but its equivalent GWWA.EXE. Otherwise, every application which was compiled under the 1.10 version, will terminate the GWW program upon exiting the application. In other words, exiting an application will kick you out of GWW instead of returning the control to the main menu. This in itself will not prevent you from continuing the work; it will only present a minor inconvenience.

When you select for the first time an existing data base, the program will notice that your data base has been created with the version 1.10 and that the abstraction data structure, entry and reporting forms are missing from internal data structure and entry/reporting editors. The program will use the existing

files as described above to create missing data structure and forms. From that point on the existing data base will behave in the same way as a new data base to be created using the version 1.20.

21.2. Overview

The Abstraction module is a dedicated pumping-from-wells data processing application. It is intended to store data on pumping from wells ("abstraction" in further text) either as pumping rates, individual pumping volumes, or cumulative volumes in a user-specified time interval. Basically it is structured around a "water meter" concept, in a similar fashion to the way water utility companies measure, calculate and report "water consumptions." The application is listed in version 1.20 under the main menu command Applications (Figure 21.1).

GWW [c:\jordan\28oct.gww]

Data   Applications   Tools   Customization   Help

Master Data
Chemistry   ▶
Pumping Tests
Hydrographs
Mapping
Well Log
Cross Section
Fence Diagrams
Step Drawdown Test
Grain Size Curve
Abstraction

Miscellaneous
User Data
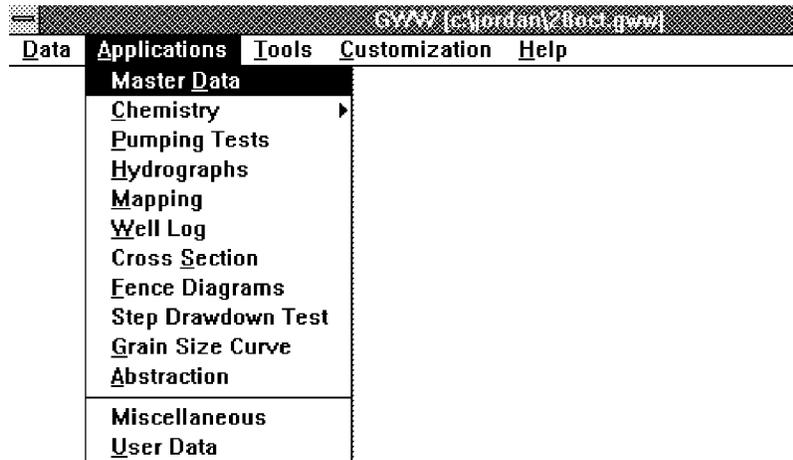
Figure 21-1

Each abstraction well may have more than one "water use," that is more than one "water meter." The idea is to provide a mechanism for storing abstraction data separately for each water use. For example, a well may have a branching pipeline immediately after the wellhead; each line is equipped with a meter. One line is used for agriculture, and the other for domestic (home or water supply) purpose. When presenting and interpreting data, it may be important to distinguish between the two uses. The input data may come in a form of actual readings from a "water meter," or as calculated volumes abstracted in a certain time interval. GWW's abstraction module

permits both ways of data entry. Abstraction data may be displayed and printed as tables, graphs or both. The program may calculate average rates or cumulative rates for one or all uses. The data can be exported in a selective way as ASCII files (comma delimited) ready to be input into a spreadsheet software package.

All other routines normally found in other applications of the GWW software are also available to the abstraction application (selection of wells from a map or using a selection criterion, making internal random files, selecting units for abstraction rates and volumes, writing to or reading from ASCII files, etc.).

21.3. Water Use

"Water Use" is the basic concept in the abstraction module. The following water uses are prepared by default in the GWW.000 template: Home and Agriculture.

In a project in Jordan, the following uses are added, as an example: Home private, Home government, Agriculture private and Agriculture government (see Figure 21.2). The number of water use entries is not limited by the program. Practical considerations, that is the speed of data processing, will limit this number to a realistic number for adequate data storage. The entry "water use" appears in three places: (1) Tools/Data Structure Design/Files/Abstraction (Figure 21.3); (2) Abstraction application under Data/Define a New Water Use (Figure 21.4), and (3) Abstraction application under Display/Design Display (Figure 21.5).

21.4. Creating New Water Use

If none of the existing water uses adequately describes the use of a well, the following steps should be taken:

1. Start the abstraction application by clicking on Applications/Abstraction.

2. Click on Data. The pop-down submenu is opened as shown in Figure 21.4.

3. Select Define a New Water Use. The dialogue box is displayed as shown in Figure 21.6.
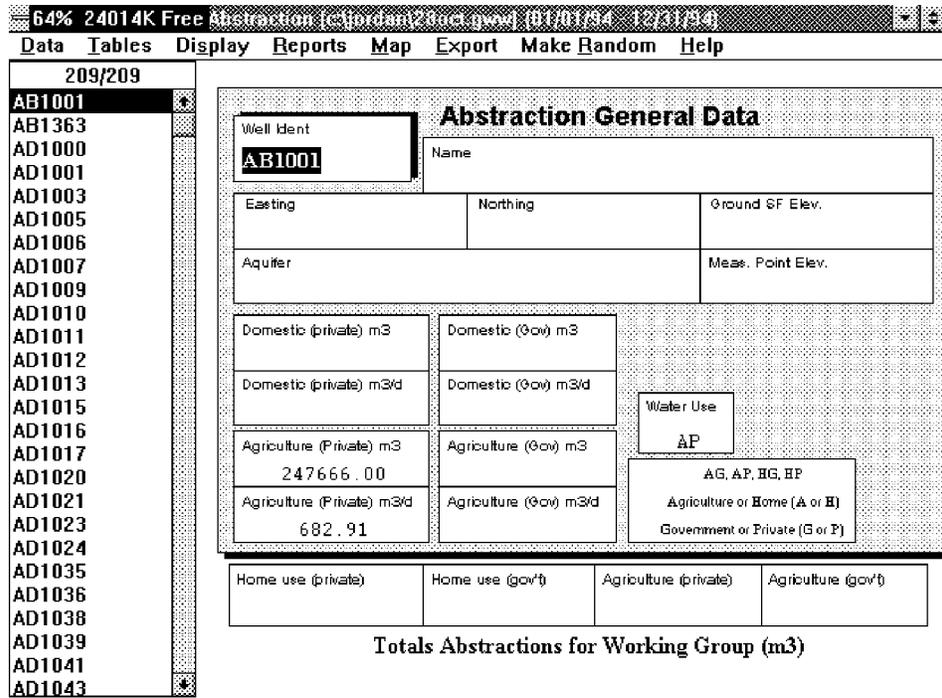
Figure 21-2
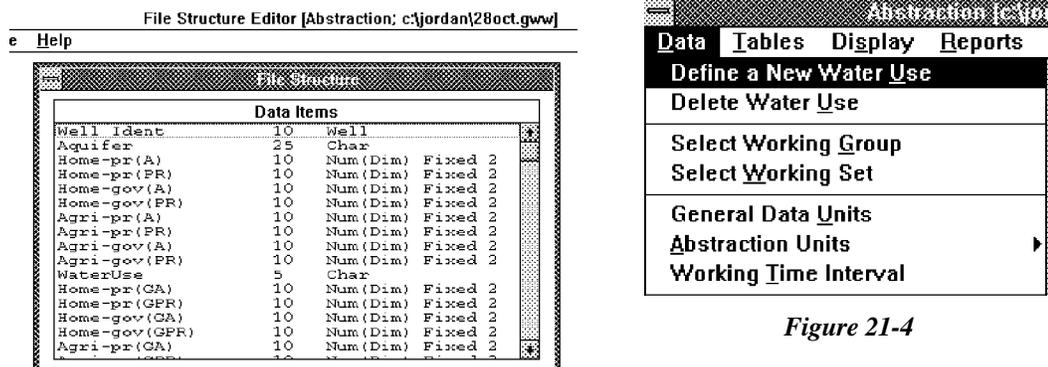
Figure 21-3

Figure 21-4

4. Type the name for the new water use, e.g. Fisheries. The list of legitimate water uses will be internally expanded for this new water use. It will automatically figure out in the Display/Design Graph command, and in Tables/Edit table command. However, whenever you make a change to a current list of water uses, the program will warn you to redesign the graph for display/printing. The warning is shown in Figure 21-7.

Figure 21-5

Figure 21-6

Figure 21-7

NOTE. *A new water use must be created in the application Abstraction. This is done by selecting Data/Define a New Water Use. However, since some data are shown also in an Entry Form as well as reported in a Report Form, the same*

water use must be added to the data structure under Tools/Data Structure Design/File/Old/Abstraction. The sequence of these operations is not important.

The design of a display graph dialogue with a list of all available water uses may look as shown in Figure 21-8.
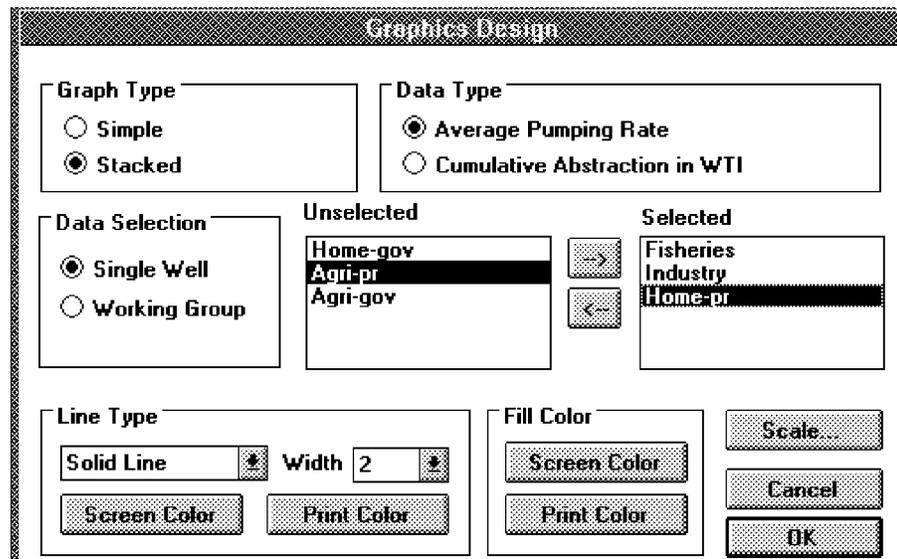

Figure 21-8

The dialogue box that will be displayed after the command **Tables/Edit** table is activated may look as shown in Figure 21-9.

It is important to add to the data structure a new water use with an adequate suffix (that is ending characters). A new abstraction data structure may contain for each water use one or more of the following entries:

**WaterUse(A)** .... Interpreted as a water use in volumetric units for an individual well.
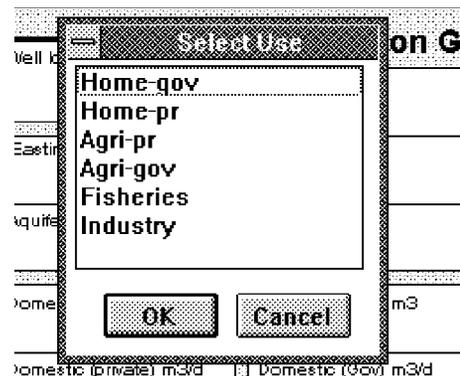
Figure 21-9

WaterUse(PR) .... Interpreted as a water use in pumping rate units for an individual well.

WaterUse(GA) .... Interpreted as a water use in volumetric units for a group of wells.

WaterUse(GPR) .... Interpreted as a water use in pumping rate units for a group of wells.

Total(A) .... Interpreted as total of all water uses in volumetric units for an individual well.

Total(PR) .... Interpreted as total of all water uses in pumping rate units for an individual well.

Total(GA) .... Interpreted as total of all water uses in volumetric units for a group of wells.

Total(GPR) .... Interpreted as total of all water uses in pumping rate units for a group of wells.

When these field entries are placed on an entry form, they are

Figure 21-10

of a "read-only" type. That is, the program calculates values and fills the fields. A user cannot edit these values. With all these fields a data structure for two water uses, namely home and agriculture use, may look as shown in Figure 21-10.

21.5. Data Entry Form

The selection of the data entry form will depend on which water uses one may have in the data structure. The default form may come with two uses only: home and agriculture. However,

Figure 21-11

as shown in Figure 21-2, there can be more than two water uses. Just the same as in any other application of the GWW software, the program offers a default entry form whenever there is a change in data structure. One of such forms may look as shown in Figure 21-11. The zeros in the fields labeled as "Total" are filled in by the program. These fields are "protected," or of a read-only type.

A user-defined entry form may look as shown in Figure 21-2. This form is created using the following commands: **Tools/Data Entry Forms Editor/Abstraction/Form/New**. The list of available fields to place on an entry form is displayed in the left side window and shown in Figure 21-12. The construction of the form may start with the entry Well Ident, and follows with one or more abstraction fields. It is suggested that group reporting fields, such as **Total(GA)** and **Total(GPR)** are kept separate from the fields for an individual well [e.g. **Home(A)** and **Home(PR)**]. Save this new form under a name, say NewForm. Close the Data Entry Forms Editor (click on **Form/Exit**), and from the Main menu start the application Abstraction (**Applications/Abstraction**). To select your new form click on **Data/Select Entry Form**. The dialogue box as shown in Figure 21-13 opens. Double click on NewForm or click once followed by clicking on OK. The forms change and the new one may look as shown in Figure 21-14.

Figure 21-12

21.6. Deleting a Water Use

One or more water uses can be deleted from the data structure. Click on **Data/Delete Water Use** as shown in Figure 21-15. The dialogue box identified as Delete Use will open as shown in Figure 21-16. Click on Fisheries and click on OK. After you select the use "Fisheries"
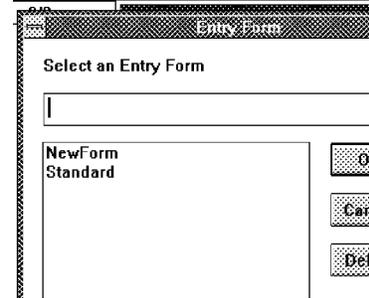
Figure 21-13

Abstraction General Data

Well Ident

Name

Easting

Northing

Ground SF Elev.

Aquifer

Meas. Point Elev.

Domestic (private) m3

Domestic (Gov) m3

Domestic (private) m3/d

Domestic (Gov) m3/d

Agriculture (Private) m3

Agriculture (Gov) m3

Agriculture (Private) m3/d

Agriculture (Gov) m3/d

Water Use

AG, AP, HG, HP
Agriculture or Home (A or H)
Government or Private (G or P)

Home use (private)	Home use (gov't)	Agriculture (private)	Agriculture (gov't)

Totals Abstractions for Working Group (m3)

Figure 21-14

72% 25936K Free

Data   **Tables**   **Display**

Define a New Water Use

Delete Water Use

Select Working Group

Select Working Set

Figure 21-15

Delete Use

Home
Agriculture
Fisheries

OK   Cancel

*Figure 21-16*

**Delete Water Use**

You have to redesign graph

OK
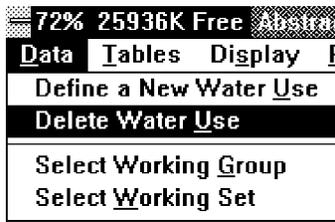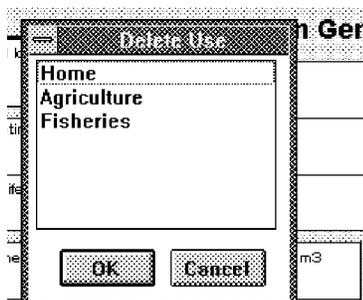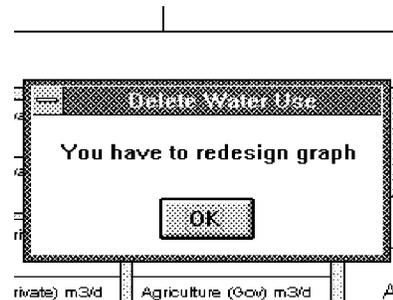
Figure 21-17

and click on OK button, the program will once again warn you

with a warning as shown in Figure 21-17. In other words, whenever you change the list of water uses, either by adding or deleting a use, you are expected to redesign the display graph/report.

21.7. Data Units

For abstraction volumes and pumping rates the units are selected and specified by the user in **Tools**/**Data Structure Design**/**File**/**Abstraction**. The units can be changed under **Data**/**General Units**, but by doing this in this place, all already entered data will be automatically recalculated and converted into new units. For a new water use, units can be selected from **Data**/**Abstraction units** followed by either **Volume** or **Time**.

21.8. Pumping Rate or Abstraction Volume

Data entry is always in volumetric units (m^3, liters, gallons, etc.). Program displays both volumes and rates. To distinguish between the two, each water use is defined in **Tools**/**Data Structure Design** with a suffix (A) or (PR). These 3 or 4 characters are added to the "Water Use" name. For example, if a new water use should be defined as Food processing, the entries into the Data Stucture table should be Food processing(A) and Food processing(PR). Although Food processing, typed exactly as two words with one blank between words and without any suffix, will be displayed under **Tables**/**Edit table** and in **Display**/**Design Graph** in the Abstraction application, the two field names Food processing(A) and Food processing(PR) are treated in the same way as any other field in GWW. That is, these fields can be added to an entry form or used in various reporting forms.

21.9. Data Entry

Data can be entered in two ways: (1) directly into GWW built-in spreadsheet table, and (2) from an imported ASCII file.

21.9.1. Entry into GWW Table

The command is **Data**/**Tables**/**Edit table**. The program opens a dialogue box with a list of all available water uses. Select a proper one, or return to **Data** menu and create a new water use (**Data**/**Define a New Water Use**).

This entry is only in the form of abstraction volumes which are normally reported by reading water meters. Thus the input must be in ascending order, that is cumulative. The program will not accept entries such as: 94/1/31 10000 followed by 94/2/28 6500.

If in January 1994 2,200 m^3 were abstracted, and in February 1994 additional 1,150 m^3, then the input must be:

94/1/1   0
94/1/31 2200
94/2/28 3350

Type 11 as well identification for a new well. If you do not press Page-Down or click En-ter key as many times as there are fields in the entry form, the program will display an error mes-sage as shown in Fig-ure 21-18. If the well is already listed on the left side, that is if the well is in the data base, you may select **Tables/Edit table**. The program will display a dialogue box with all currently available water uses. Select one from the list and type the data as shown in Figure 21.19. When finished hold the Ctrl key and press S. Alternatively click on **Ta-bles/Save data**.
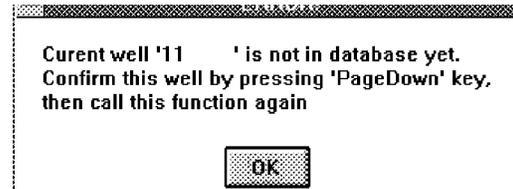
Figure 21-18

Figure 21-19

If the first line is ommitted, the program will interpret the input as follows. On 1 February 1994 the water meter reads 2,200 m^3. This is taken as an initial reading. In the month of February the abstraction was 1,150 m^3, but the total input abstraction on 1 March is not 3,350 m^3 but only 1,150 m^3. With a zero typed on 1 January, the interpretation is different. Between 1 and 31 January a total of 2,200 m^3 was abstracted, with an additional 1,150 m^3 abstracted in February. Thus the total for the two months is 3,350 m^3. Depending on the way the data are input, the display will reflect either 1,150 m^3 or 3,350 m^3.

21.9.2. ASCII File Input

Input from ASCII files can be prepared in two ways:

1. Date typed as year, month and day (in whichever order, separated by dots or slashes), followed by volumes. E.g.,

```
1994/01/01      0
1994/02/28 16500
1994/03/31 21350
1994/04/30 26450 etc.
```

2. Date typed as year and month but without day. In this case you are expected to enter actual volumes abstracted in that particular month. The legitimate input is:

```
1994/02 16500
1994/03 4850
1994/04 5100
```

GWW will convert the second input into a cumulative table, that is make it equivalent to the input under 1. This second input can be done only from an ASCII file. The GWW built-in table does not have a provision for not entering a day! In either case there must be a header line preceding the input followed by the identification of the well (Well Ident): yyyy/mm/dd <Home> Well1

Thus the correct input may look as:

```
yyyy/mm/dd <Home>
Well1
1994/02 16500
1994/03 4850
1994/04 5100
```

An ASCII input file may contain more than one well, more than one water use, and more than one data input format. The following is an example of the input from an ASCII file:

```
mm/dd/yy <Home> <Agriculture>
Well1
01/01/94   23300      11400
02/01/94   23500      11800
03/01/94   24000      12000
.....
06/01/95   27500      15000
07/01/95   27700      15200
08/01/95   28000      15350
```

```
09/01/95  28100      15500
10/01/95  28500      15700
11/01/95  28750      15900
12/01/95  29000      16000
/*
Well2
06/01/94  44900      72750
07/01/94  45100      72950
08/01/94  *          73100   (There is no measurement for "Home use"
water meter in this month.)
09/01/94  45550      73250
10/01/94  45700      73400
11/01/94  46000      73550
12/01/94  46250      73750
01/01/95  46350      74000
02/01/95  46600      74150
03/01/95  46750      74350
04/01/95  47100      74600
05/01/95  47200      74850
06/01/95  47500      75000
06/01/95    0          0   (Both water meters were changed on this date.)
07/01/95   250        150
08/01/95   500        350
09/01/95   650        500
10/01/95   900        750
11/01/95  1250        900
12/01/95  1500       1000
/*
```

`<mm/yy> <Home>` (Data are input as monthly abstractions.)
```
Well3
02/94  400
03/94  100
04/94  500
05/94  700
```

Input data for one well will terminate with a line with the characters /*. This convention is more or less followed throughout the GWW software. An asterisk placed instead of a measured value for abstraction is interpreted by GWW as "measurement does not exist." A 0 placed in a sequence of growing abstraction numbers is interpreted by GWW as "new water meter is replacing an old one." This will happen when one water meter is replaced by another for repair, recalibration or another reason. In this case, the date (day, month and year) must be repeated, so two measurements are entered for the day when

there is a change in water meter. (It is not necessary to enter zero. Any initial number will be accepted and abstraction volumes will be subtracted from that initial reading.)

Figure 21-20

21.10. Working Time Interval

Time interval is selected in the same way as in other time-series applications: hydrographs and chemistry-time. Click on **Data/Working Time Interval** and fill in the data for the beginning (Figure 21-20) and the end of the time interval (Figure 21-21). Since the abstraction application calculates sums for all wells in the working group, whenever there is a change in the working time interval the program recalculates these sums.

Figure 21-21

NOTE. *You may enter abstraction data only within a current or working time interval. If an ASCII input data file contains data falling outside the working interval, these data will not be transferred into the GWW data base. There is no warning to that effect.*

21.11. Display

21.11.1. Display Options

Display can be designed by a user with the following options:

1. Display for a single well: average pumping rates or cumulative abstraction volumes for one water use or for several water uses (as a simple or stacked diagram).

2. Display for a working group: average pumping rates, cumulative abstraction, one or more water uses.

Definitions:

Simple implies a line graph, one for one water use. Each line can be assigned line attributes, such as pattern (solid, dashed, dot, etc.), thickness (2 through 8, in 1/10th of a millimeter increments), screen and print color.

Stacked implies one water use on top of the other. In this case one can assign different patterns, thickness and color of a line, and also the fill underneath the line.

Average pumping rate is used to display average pumping rates for a time period (not necessarily a month) as a step-wise (bar) diagram. If in addition the stacked graph type is selected, a water use will be identified with line attributes and filling color. If the simple graph type is selected, there will be no filling under individual water use step-wise lines.

Cumulative abstraction in WTI (working time interval) is a line graph, with or without filling (depending on whether the graph type is simple or stacked). Remember that the program always takes the first reading in a time interval as the initial reading from which the abstraction started. Doing this it subtracts the second reading from the first one and interprets the difference as the first abstraction volume in that time interval.

One water use is selected if all other water uses are unselected, so that only the one that needs to be displayed remains on the right side of the selection/unselection dialogue box. Of course, the selection of graph types, single well or working group, one or more water uses and associated enhancements to the display are done using the command **Display/Design Graph**.

An example of one water use is shown in Figure 21-22. The selection is done in **Display/Design Graph**. Using an arrow between "Unselected" and "Selected" water uses, you may unselect or select one or more uses to display/print. In the example above, only abstractions assigned to "Home" water use will be displayed and printed.

**21.11.2. Saving and Loading Display Graphs**
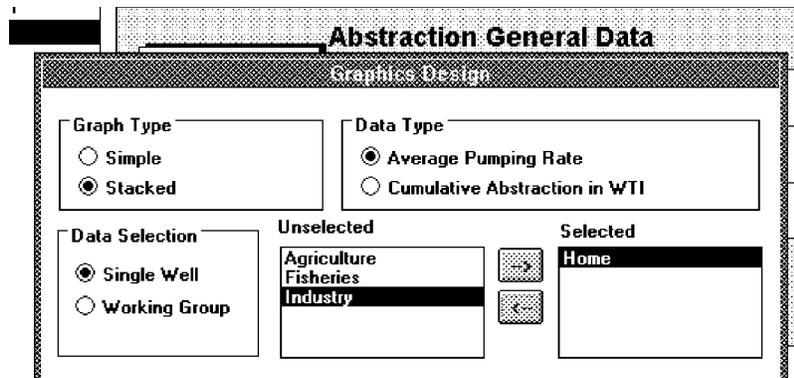
Figure 21-22

Once created, a display graph can be saved under a name using the command **Display/Save Design**. It also can be loaded by selecting the command **Display/Load Design**.
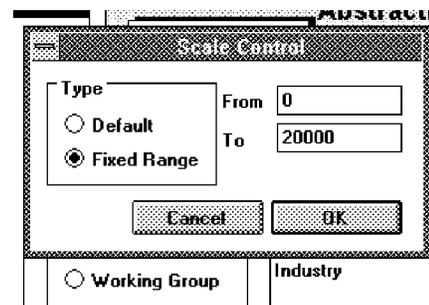

Figure 21-23

21.11.3. Scale for Display and Printout

Program offers a default scale and a custom-selected fixed range scale. The default is good for most cases. If a fixed-range scale is selected then one should type the range from ... to as shown in Figure 21-23. Scale is controlled using the command **Display/Design Graph** and clicking on button **Scale**. This scale will apply only to the currently highlighted Water Use.

21.11.4. Single Well Abstraction Sums

If an entry form is prepared in such a way that it contains fields showing a water use with suffix A and PR, e.g. Home(A) and Home(PR), the form will always display the cumulative abstraction for a currently selected well over current working time interval [in the field WaterUse(A)] and the average pumping rate for that water use for the same time interval [WaterUse(PR)]. One example is shown in Figure 21-24.

21.11.5. Display / Printing Enhancements

You may select for each line on a graph the following (Figure 21-25):
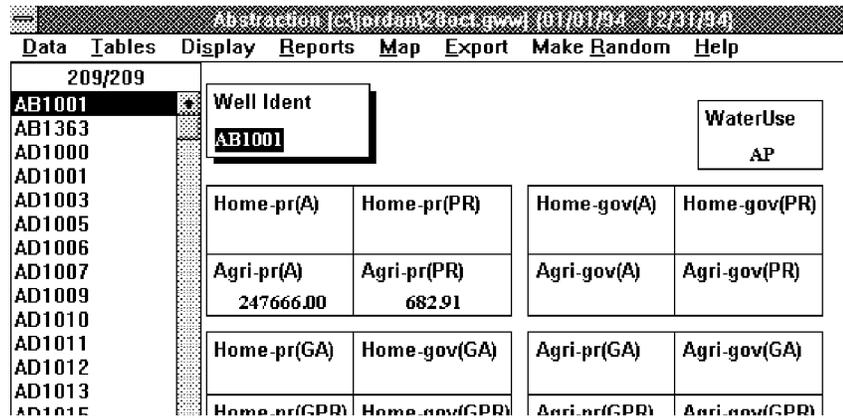
Figure 21-24
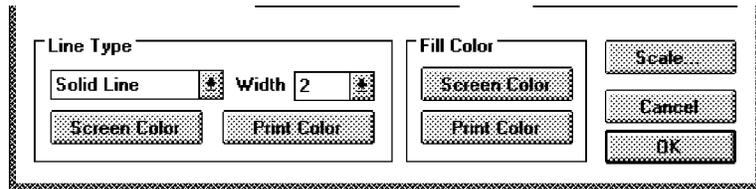
Figure 21-25

Line Type (solid, dash, dot, dash dot, dash dot dot,dash dash dot); Line Width (from 2 to 8, in 0.1 mm increments); Line Screen Color; Line Print Color; and Fill Color separately for a screen display or for a printout.

Figure 21-26

21.12. Reports   The command **Reports** on the Main menu offers the options as shown in Figure 21-26.
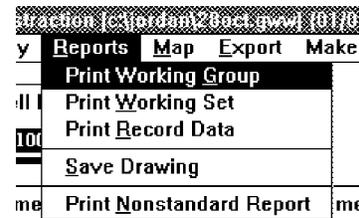
Under the command **Reports** you may select to print all wells currently making Working Set (all wells listed in the left side window), all wells currently making Working Group (click on **Data/Select Working Group** to see which wells make the

group), or a single well (a well that is currently highlighted and shown in the Entry Form).

Whichever set, group or a single well is selected, a user is prompted to select a reporting form.

You may also decide to save a drawing and print it using a "nonstandard reporting form."

21.12.1. Working Group or Working Set Reports

Reports for a group of wells are prepared using the **Report Form Editor** on the **Tools** menu as shown in Figure 21-27. You should select **General Data Table** option. Normally reports for a set or group (that is for more than one well) are
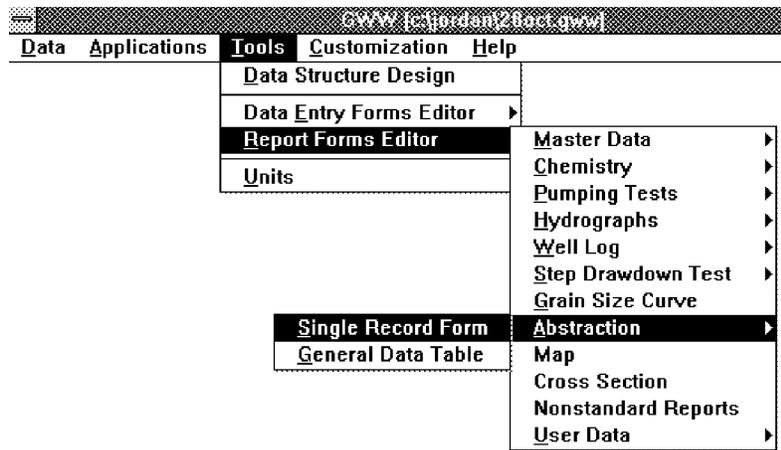

Figure 21-27

so-called column reports. A column is made of monthly rows with individual monthly abstractions, calculated average monthly rates, cumulative abstraction volumes from the beginning of a time interval, and totals for the same time interval.

The options listed on the left side window as shown in Figure 21-28 are columns that can be placed on a reporting form. These forms can be created after the following sequence of commands: **Tools/Report Forms Editor/Abstraction/General Data Table**. Notice that suffix (A) denotes cumulative abstraction and (PR) average pumping rate for one well in the working time interval; suffixes (GA) and (GPR) denote cumulative abstraction and average pumping rate for a group of wells for a selected water use in the same working time inter-

val. WaterUse(GA) and WaterUse(GPR) are not "column data." Their use is intended for one single value that is the total
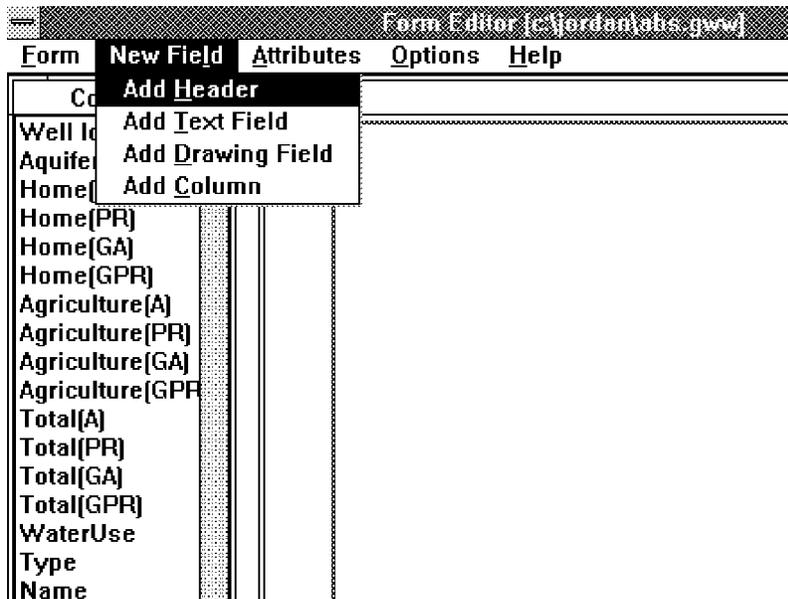

Figure 21-28

abstraction for all wells in a working group over a working time interval (GA) or average pumping rate for all wells in a working group over a working time interval (GPR).

These columns can be used to prepare a "Working Group" report as shown in Figures 21-29 (left side) and 21-30 (right side).

Another kind of reporting columns can be prepared using the command **New Field/Add Column** from the **Report Form Editor** menu. The suffixes for a water use are no longer enclosed within brackets, such as (A) or (PR), but separated from the water use name with one underline character. Thus a correct field name can be Home_A as shown in Figure 21-31, or Agriculture_PR, etc.

Columns of data with field names terminating with _A, _PR are interpreted as monthly volumes and monthly average rates, respectively, for a group of wells. To report such values in a table, a column with the field name **Date** should be added. A portion of a block of columns that will report monthly abstrac-

tions and average monthly rates for a group of wells may look as shown in Figure 21-32.

Figure 21-29

Figure 21-30

NOTE. *The upper part of this form displays field names used to create the table. These field names are not listed in the left*

side window. The lower part, which is prepared only for convenience of readers of this manual, displays field labels using the same fields as the upper part. In other words, to prepare such a report with monthly values typed in corre-
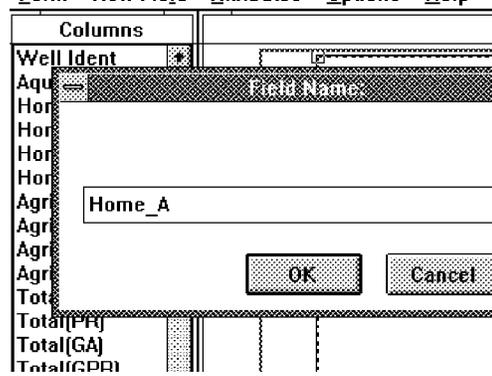
Figure 21-31
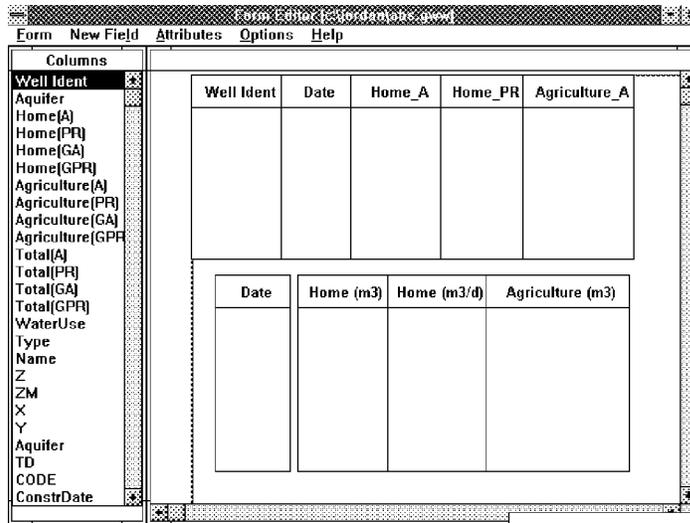
Figure 21-32

sponding columns, one should use field names as shown above, but for field labels for the same columns one should type a more meaningful text than the one offered by field names.

You may also use the following for field names :

Total_A and **Total_PR**. These would be total abstractions and average rates for each month of a currently selected working time interval, summing up all water uses from all wells making a current working group.

As in other applications of the GWW software, a composite report can be prepared with a dedicated graph as displayed on the screen (stacked, pumping rates, cumulative abstractions, etc.), followed by columnar table with either rates, volumes or both for each month within the time interval, and terminated with a location map. The map is prepared in the Map application and the reporting form itself is designed in **Tools/Report Form Editor/Abstraction/General Data Table.**

21.12.2. Single Well Record

The reporting fields that can be placed on a single well reporting form are Home(A), Home(PR), etc., in addition to all master data fields. However, in this case these fields will be filled with only one number, that is cumulative abstraction for that well in the working time interval, and average pumping rate for the whole working time interval, respectively. There will be no monthly reporting abstractions or rates as is the case of a working group/set report.

If a monthly report is required for a single well, this well should be made as the only well within a working group or a working set and one of General Data Table reporting forms should be used instead. The program will prepare the same kind of report for one well as if it were a whole group of wells. One possible single well reporting form is shown in Figure 21-33. The form contains general data for a well (coordinates, elevation, total drilled depth, and aquifer which is being pumped). The lower part displays a "diagram" of the type "drawing." This field is created by clicking on Diagram on the left side window showing available list of drawings. The drawing will be the one that is currently "designed" using the command **Display/Design Graph**. The "information" rectangle shown within the field prepared for the drawing displays the following information: name of drawing, which is by default Diagram, type, "coordinates" of the upper left and lower right corner of the frame allocated for the drawing, and the size of the frame. (The size is 100 mm width by 90 mm height.)

Another example of a single well reporting form can be prepared as shown in Figure 21-34. This form will report abstraction rates for a selected well and average pumping rates for the same well, both for a currently selected working time interval.
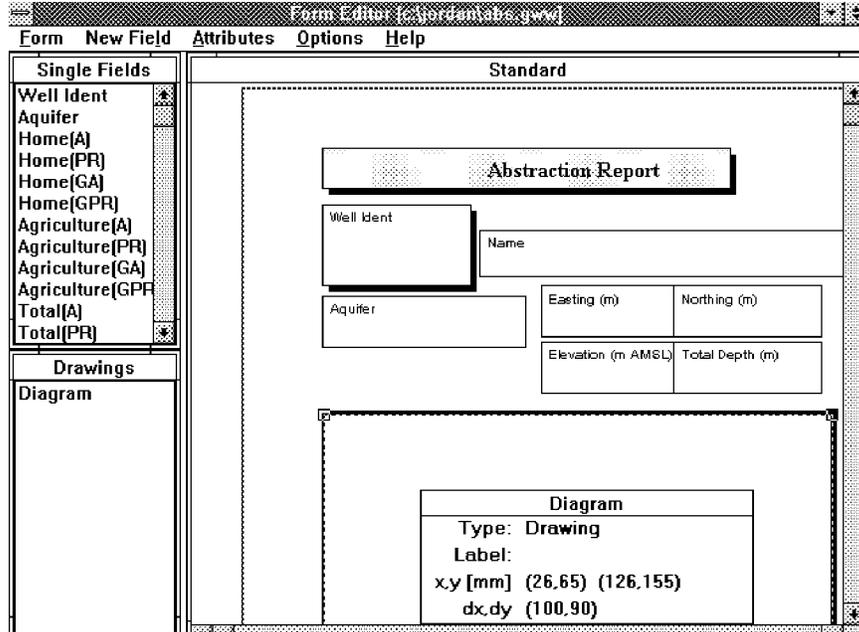
Figure 21-33
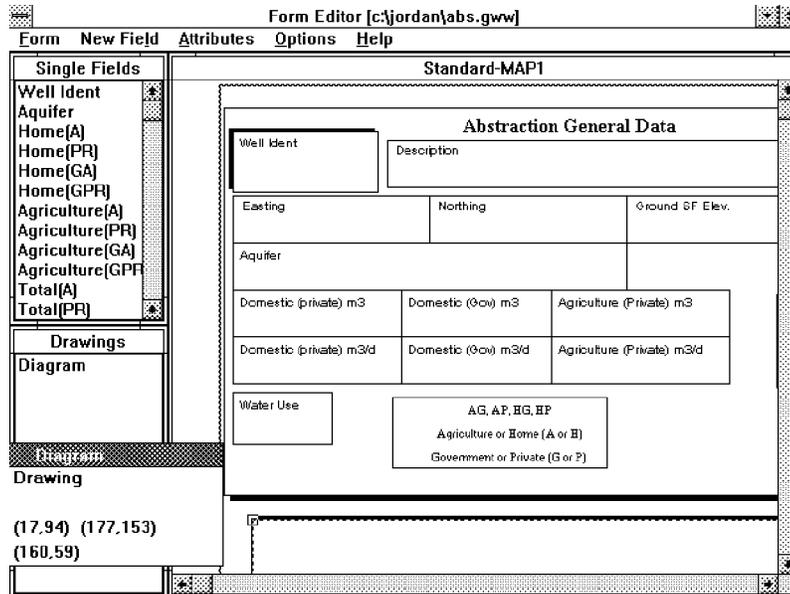
Figure 21-34

The form may also contain information on water use, some comments identifying abbreviations used for "water use" and eventually the time interval selected to report.

Still another form may combine data as shown in Figure 21-34 with a diagram (showing either cumulative abstractions for a

well for a time interval, or average monthly pumping rates) with a location map. The map can be added to the form using the command **New Field/Add Drawing Field** as shown in Figure 21-35, and by answering the prompt for drawing name by typing a name of a map that was, or will be, created using the Mapping application.
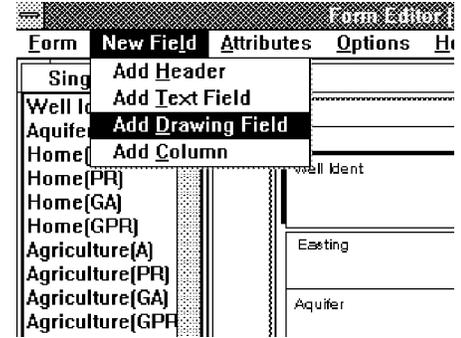

Figure 21-35

NOTE. *As in other parts of the software, take care that the size of the frame allocated for such a location map matches the size of the map drawing that is created in the Mapping application.*

**21.13. Saving Data as ASCII Files and Reading Data from ASCII Files**
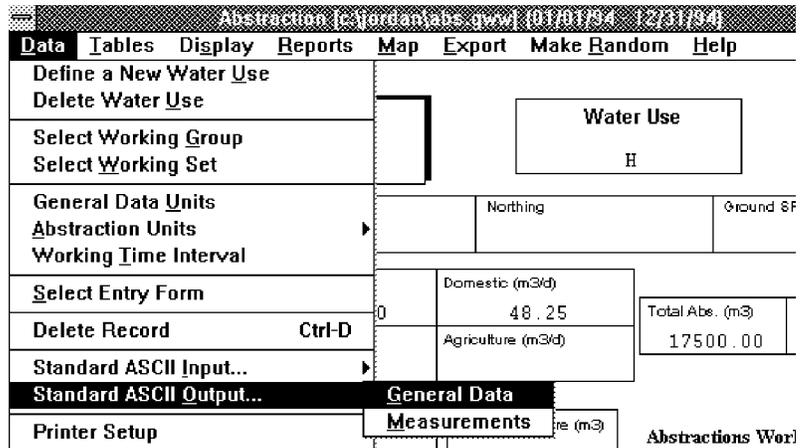
Figure 21-36

Both general data identifying wells and abstraction data can be saved in an ASCII file. Likewise, data can be prepared as ASCII files and input into the GWW data base from such files. The command is listed under the **Data** submenu (Figure 21-36). You are expected to first save General Data followed by saving Measurements (abstractions). The program suggests default extension for general data **.abg** and for measurements **.abm**
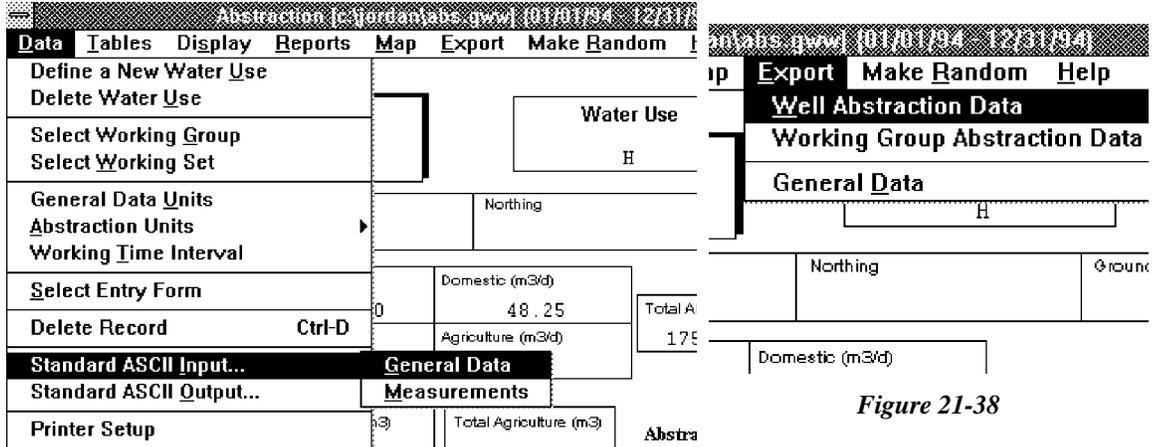
Figure 21-37

Figure 21-38

You may also import general data and measurements (abstractions) by using the command **Data/Standard ASCII Input** as shown in Figure 21-37.
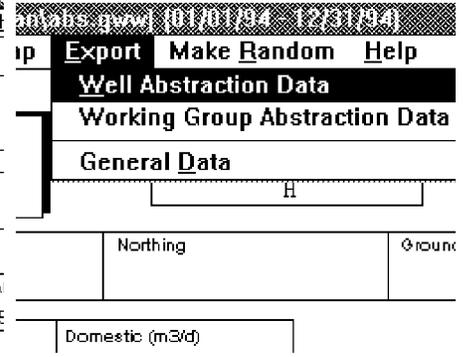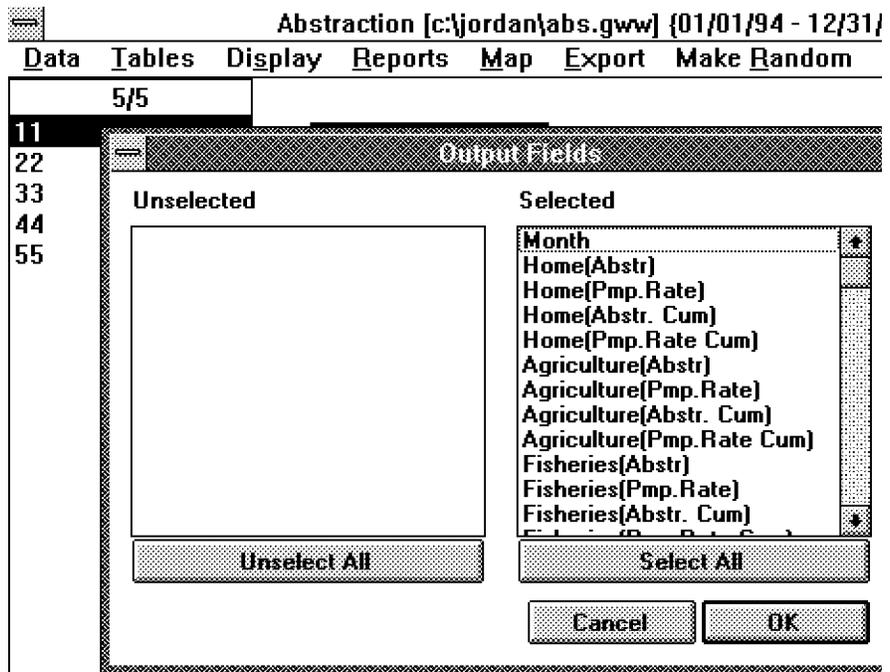

Figure 21-39

21.14. Exporting Data to Spreadsheet and Other Formats

Using the command **Export** from the application's main menu bar you may copy various categories of data as shown in Figure 21-38. When **Well Abstraction Data** option is selected you will be offered a list of items to select from as shown in

Figure 21-39. An ASCII file will be created with the following content:

```
"01.1994",2200,70.9677,2200,70.9677,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,2200,70.
9677,2200,70.9677
"02.1994",1150,41.0714,3350,56.7797,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,1150,41.0714,3350,56.7797
"03.1994",2170,70.0000,5520,61.3333,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,2170,70.0000,5520,61.3333
"04.1994",1980,66.0000,7500,62.5000,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,1980,66.0000,7500,62.5000
"05.1994",700,22.5806,8200,54.3046,0,0.00000,0,0.00000,0,0.00000,0,0
.00000,0,0.00000,0,0.00000,700,22.5806,8200,54.3046
"06.1994",1700,56.6667,9900,54.6961,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,1700,56.6667,9900,54.6961
"07.1994",600,19.3548,10500,49.5283,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,600,19.3548,10500,49.5283
"08.1994",700,22.5806,11200,46.0905,0,0.00000,0,0.00000,0,0.00000,0
,0.00000,0,0.00000,0,0.00000,700,22.5806,11200,46.0905
"09.1994",2300,76.6667,13500,49.4505,0,0.00000,0,0.00000,0,0.00000,
0,0.00000,0,0.00000,0,0.00000,2300,76.6667,13500,49.4505
"10.1994",1700,54.8387,15200,50.0000,0,0.00000,0,0.00000,0,0.00000,
0,0.00000,0,0.00000,0,0.00000,1700,54.8387,15200,50.0000
"11.1994",2029.412,67.6471,17229.412,51.5851,0,0.00000,0,0.00000,0,
0.00000,0,0.00000,0,0.00000,0,0.00000,2029.412,67.6471,17229.412,51
.5851
"12.1994",270.588,8.72865,17500,47.9452,0,0.00000,0,0.00000,0,0.000
00,0,0.00000,0,0.00000,0,0.00000,270.588,8.72865,17500,47.9452
```

The file contains all entries from the Well Abstraction Data list, in the same order as shown in the list, one line for each month of the working time interval. The date entry, that is the month and year, is shown under quotation signs, and each entry is separated by a comma.

When **Working Group Abstraction Data** option is selected, the screen displays the same list of entries, as shown in Figure

Figure 21-40

21-40 (only the lower part is displayed). This time the data would refer to the current working group of wells.

The final option, **General Data**, exports all data, both abstraction and master data to a comma-delimited ASCII file. The file content is as shown below.

```
"WellIdent","Aquifer","Home(A)","Home(PR)","Home(GA
)","Home(GPR)","Agriculture(A)","Agriculture(PR)","Agri
culture(GA)","Agriculture(GPR)","Total(A)","Total(PR)","
Total(GA)","Total(GPR)","WaterUse","Type","Name","Z",
"ZM","X","Y","Aquifer","TD","CODE","ConstrDate","Bas
in","RecPeriod","ValMaster","ObsPeriod","Info"
"11","",17500.00,48.25,3550.00,9.79,,,
,12800.00,35.29,17500.00,48.25,16350.00,11.27,"H","","","",,,
"","","","","","","22","","",,,
,3550.00,9.79,4000.00,11.03,12800.00,35.29,4000.00,11.03,
,16350.00,11.27,"A","","","33","","",
,3550.00,9.79,7000.00,19.30,12800.00,35.29,7000.00,19.30,
,16350.00,11.27,"A","","","44",
,2200.00,6.07,3550.00,9.79,1800.00,4.96,12800.00,35.29,4
000.00,11.03,16350.00,11.27,"H,A",,,,,,,,,,,,"55",
,1350.00,3.72,3550.00,9.79,
,12800.00,35.29,1350.00,3.72,16350.00,11.27,"H",,,,,,,,,,
,,,,,,
```

21.15. Printouts

Figures 21-41 through 21-46 are selected printouts from the Abstraction application. These are mostly composite drawings and tabular data for a single well and for a group of wells.