FLOW FROM WELLS AND RECHARGE PITS

VERSION 3.0

USER'S MANUAL

Groundwater Program
Colorado State University
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Introduction

Program Colorado State University Pit And Well (CSUPAW) allows you to predict the response of a water table to discharge from wells or artificial recharge of water from rectangular basins in a homogeneous aquifer of infinite aerial extent, in a homogeneous stream aquifer system or in an aquifer having a vertical impermeable boundary. The model calculates discharge (recharge) to the stream in a stream aquifer system at times specified by the user. Utilization of graphics allow visual evaluation of results which can be saved to and recalled from disk storage. In this manner comparisons can be easily made between different flow situations. The program is interactive and is designed to be self-explanatory. This manual explains the various options available. Make a backup copy of the floppy disk using the DOS copy command. Please do not give this program to others to use.

System Requirements

You will need an IBM-PC, XT, AT, PS/2 or IBM compatible computer with a minimum of 128K of storage, one disk drive, and monitor (graphics monitor is necessary to obtain graphical output). Printout of numerical results is available in the program. There are two programs on the floppy disk. CSPAWE is for a system having an EGA or VGA Board. The program CSUPAWC is

for a system having a CGA board or for a COMPAQ. You must also have IBM-PC DOS 2.1 or higher.

Starting the Program

Place the disk containing the artificial recharge program in the default drive. For the first time use of this program run CONFIG to configure the program to your system. You will be able to run the program CSUPAWC with or without the graphics monitor. Follow the prompts in the program. If you make a mistake or wish to change the configuration, just run CONFIG again. Thereafter, type CSUPAWC and the program will begin execution. You can also create an AUTOEXEC.BAT file to do this. The program CSUPAWE does not use the CONFIG file but does require a VGA or EGA board.

Program Options Menu

The first menu provided, gives you the option of selection flow to a well or flow from a rectangular recharge area. The second menu provided, gives you a choice of program options. At this point you decide whether you want to simulate recharge in an aquifer of infinite aerial extent (the NO STREAM option), a stream-aquifer system (the STREAM IN VICINITY option), or an impermeable boundary option. If one of these options is selected, the present value of the input data will be displayed on the screen.

The READ FILES option allows you to read files that were previously stored on disk. This provides a means of loading previously used and calculated results into the computer. With this capability you can easily compare results of many analyses.

If you choose the READ FILES option you will be asked for the file name. The program allows you to view the catalog to help you recall the names of files. If you want to escape from this option, type STOP. After reading a file the program goes to the output options sections described later.

Data Input

Appropriate variables are shown on the screen with their current values. Default values are given if no values have been specified. Figure 1 provides a definition sketch.

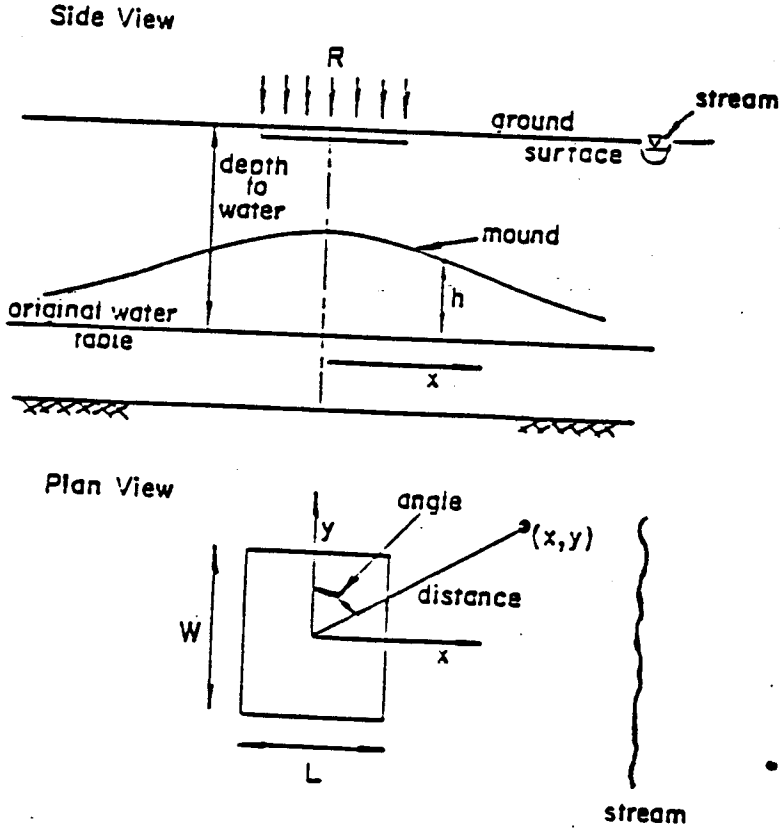

Figure 1. Definite Sketch

RECHARGE RATE (ft/day): The recharge rate is the volume of water recharged per surface area of the recharge basin per unit time. A constant recharge rate is used throughout the recharge period, mound heights, however, may be calculated beyond the recharge period.

DISCHARGE RATE (gpm): A constant discharge rate is used throughout the flow period. This option is available only for the analysis of a well.

AQUIFER PARAMETERS: TRANSMISSIVITY (square feet/day) and SPECIFIC YIELD (dimensionless) are constants for the homogeneous aquifer.

TIME PERIOD: Calculations are performed at discrete times. The BEGINNING TIME (days) must be greater than 0 and is the first time that the calculations are made. The TIME INCREMENT (days) gives the time interval between calculations. The FINAL TIME (days) gives the last time that calculations are to be made. For example, if the beginning time is 10 days, the time increment is 5 days and the final time is 20 days, calculations will be made at 10, 15, and 20 days. The final and initial times must be integer multiples of the time increment.

END OF RECHARGE PERIOD: The end of the recharge or discharge period (days) is the time when artificial recharge or well discharge is terminated. The program will continue to calculate mound profiles until the specified final times. Superposition in time is used to calculate the mound height after the end of the recharge period.

Distance: You must specify the points at which the recharge mount height is to be calculated. The BEGINNING DISTANCE (ft) is always set to 0 which is directly under the center of the basin or at the well. The DISTANCE INCREMENT (ft) gives the distance between points of mount height calculations.

FINAL DISTANCE (ft): This is the last point at which the mound height is to be calculated. For example, if the distance increment is 50 feet and the final distance is 300 feet, the mound height will be calculated at 0, 50, 100, 150, 200, 250, and 300 feet.

DEPTH TO WATER (ft): The depth to water is the distance from the ground surface to the water table in feet. A different depth to water may be selected to change the scale of mound heights. This variable does not affect the calculation. The time required for water to travel from ground surface to the water table is not taken into account.

SATURATED THICKNESS (ft): This is the distance from the bottom of the aquifer to the initial water table.

BASIN GEOMETRY: A rectangular basin is used, so enter the LENGTH and WIDTH in feet. Using a square basin to approximate a circular basin of equal area provides an excellent means of calculating the mound profile underneath a circular basin. Rectangular basins can often provide very good approximations of basins of irregular geometry. In a stream aquifer system the width is always along the axis of the stream.

ANGLE (degrees): This specifies the angle that a vertical plane makes with a line drawn from the center of the well or recharge basin perpendicular to the stream or impermeable boundary. The mound profile is calculated along this plane.

DISTANCE TO STREAM (ft) or DISTANCE TO IMPERMEABLE BOUNDARY (ft): The distance to the boundary is measured from the center of recharge basin (well) to the stream. The basin is always set up so that the width is parallel to the stream.

CALCULATE MOUND PROFILE and CALCULATE DISCHARGE TO STREAM: These options arise if you are modeling a stream aquifer system. You can either have the program calculate the mound profile or calculate the discharge to the stream or both.

The variables are changed by typing the number corresponding to the variable. For example, if you want to change the transmissivity, enter 2. The old value of the variable will appear on the screen and you will be asked to input the updated value. After the updating is completed you will be returned to the main data display. When you press just the <ENTER> key the program begins calculating with the current parameters.

Calculations:

As points on the mound are calculated they are plotted on the screen. When the calculations are finished, you will be asked to press <ENTER> to continue. All results are kept in memory and the output options menu appears.

Output Options:

This section of the program allows you to study results. You arrive at this section from either the read files section or after completing calculations. If you have read several files into memory, you will be asked to specify which file you wish to study.

DATA DISPLAY: The current input data are displayed on the screen.

RESULTS DISPLAY: The values for mound height and/or discharge to the stream are shown on the screen.

GRAPHICS DISPLAY: The graphics are recreated on the graphics screen if you have one. You will be asked if you wish to save the graphics screen. The saved screen can later be used to obtain a hard copy of the graph if you have the graphics dump software available.

RESULTS PRINTOUT: Input data and results are printed out. A graphics dump is not included in this program. The graphics can be saved to disk and should be accessible by screen dump programs. Graphics.com supplied with your system disk, can be used to print the graphics page to an IBM compatible printer such as an EPSON.

CREATE FILE: If you have just calculated mount profiles, you can store data and results on the disk with this option. Just provide a file name and the program will write all the information to the disk.

READ ANOTHER FILE: If you have just read a file, this option allows you to read more files. In this way you can quickly compare results from separate analyses. Up to a maximum of ten files may be read into memory.

MULTIPLE GRAPHICS DISPLAY: Choose this option if you wish to compare graphs of different files. After choosing this option another menu appears with four options. PRINT OUT RESULTS allows numerical results of different files to be compared on a hard copy. READ A FILE allows you to read in additional files into memory. EXIT TO PREVIOUS MENU selection takes you back to the preceding menu.

After selecting DISPLAY GRAPHICS a list of files which have been read into memory are displayed. You are asked how many files you wish to compare up to a maximum of three files. Next you are asked to type the number of the file you wish to compare. You are asked if you wish to save the graphics screen. The graphics screen is saved in a "Filename.PIC" file which can later be used to obtain a hard copy of the graph if you have a program to dump graphics to your particular printer. The graphics are then displayed on the graphics screen. You can display the results from a well analysis to that of a recharge put but the graph will be distorted because of the way the PC plots the data.

ANOTHER RUN: This allows you to move back to the original recharge options. The most recent data will be kept in memory and shown in the data display. This is one way to enter basic data without having to go back and change data on every run. However, computed data and results read in from files will be lost.

Exit: The program will terminate.

Note: Roundoff and mathematical approximation may produce unanticipated results. We cannot guarantee the accuracy of the program but if you feel that there is an error, please contact D. K. Sunada at (303)491-6095.

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