

# **DISCLAIMER**

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To reduce the file size of this document, listings of source code, which are available on some original open-file reports, are not included.

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Hamburg, April 1998.

# COMPUTER PROGRAM TO SIMULATE AQUIFER-SYSTEM COMPACTION

## APPENDIX C

### TIME-VARIANT SPECIFIED-HEAD PACKAGE

The Time-Variant Specified-Head Package was developed to allow constant-head cells to take on different values for each time step. It provides a means of simulating head variations with time that can be approximated with piecewise linear segments. The Time-Variant Specified-Head Package does not alter the way constant-head boundaries are formulated in the finite-difference equations of the model by McDonald and Harbaugh (1988). Because the package is not a complex modification of the flow model, documentation in this appendix is the minimum amount required to implement the package. Additional information regarding the Time-Variant Specified-Head Package is given in the section entitled "Ramp-Load Test Problem." Modifications to the main program to implement the package are given in Appendix D.

As the package is presented here, a specified number of cells are defined for each stress period. The package sets the element in the IBOUND array to a negative value for all cells where a time-variant specified-head boundary is selected. Because layer, row, and column locations for cells having a time-variant specified head are read for each stress period, the opportunity exists to specify different sets of cells for each stress period. If a cell is specified as a time-variant specified-head boundary for a stress period and omitted in the specification for a subsequent period, it remains a constant-head boundary with a head equal to the end head of the last stress period for which it was specified.

The Time-Variant Specified-Head Package includes three modules. The first module, CHDIAL, allocates space for an array that is needed for the package. The second module, CHDIRP, reads boundary-cell indices and head values at the start of each stress period and sets corresponding elements in the IBOUND array to negative values. The third module, CHDIFM, linearly interpolates boundary head for each time-variant specified-head boundary cell and sets the corresponding elements in the HNEW and HOLD arrays to the interpolated values. As defined by McDonald and Harbaugh (1988), the Formulate Procedure calculates conductances and coefficients required by the finite-difference flow equation. Module CHDIFM is considered to be part of the Formulate Procedure because its function is to calculate values for the known heads, which are components of the flow equation. The flowchart for the model (McDonald and Harbaugh, 1988, chap. 3, p. 2) shows that modules in the Formulate Procedure are called each iteration during the iterative solution process; however, module CHDIFM is called outside the iterative program loop. CHDIFM is called only once each time step because the specified heads are constant during a time step.

Input Instructions

Input for the Time-Variant Specified-Head Package is read from the unit in IUNIT(20) specified in the Basic Package input (see McDonald and Harbaugh, 1988, chap. 4, p. 9-1 1).

FOR EACH SIMULATION

**CHDI AL**

1. Data: MXCHD  
Format: 110

FOR EACH STRESS PERIOD

**CHDIRP**

2. Data: ITMP  
Format: 110

3. Data: Layer      Row      Column      Start Head      End Head  
Format: 110      110      110      F10.0      F10.0

(Input item 3 normally consists of one record for each constant-head boundary cell. If ITMP is zero, item 3 is not read)

Explanation of Fields Used In Input Instructions

**MXCHD** is the maximum number of specified-head cells to be specified each stress period.

**ITMP** is a flag.

If  $ITMP < 0$ , specified-head boundary data from the previous stress period will be reused and input item 3 will not be read. Reusing data from a previous stress period means that the head values at the start and end of the current stress period will be the same as they were at the start and end of the previous stress period.

If  $ITMP \geq 0$ , it is the number of records of specified-head boundary data that will be read for the current stress period.

**Layer** is the layer number of the cell affected by the specified-head boundary.

**Row** is the row number of the cell affected by the specified-head boundary.

**Column** is the column number of the cell affected by the specified-head boundary.

**Start head** is the head value at the cell at the start of the stress period. Because the package assigns head values on the basis of linear interpolation to the end of a time step, the assigned specified-head value will never equal Start head unless Start head and End head are equal.

**End** is the head value at the cell at the end of the stress period. It is the value that will be assigned to the cell for the last time step in the stress period.