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GREAT ARTESIAN BASIN GROUNDWATER PROJECT - EXPLANATORY NOTE ON DIGITAL MODEL PACKAGE, GREAT ARTESIAN BASIN SIMULATION MODEL (GABSIM)

by

P. Ungemach *

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* B.R.G.M., France

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SUMMARY

A digital simulation model, GABSIM, has been designed to simulate the hydrodynamic behaviour of the Great Artesian Basin groundwater system. For this purpose it is assumed the basin is a multilayered system, and use is made of the HANTUSH approach for the simulation of leaky confined aquifers; basic equations and numerical solution methods are mentioned. Model organization and sub-routines are briefly described, and an imaginary case history is attached as an illustration.

INTRODUCTION

A hydrogeological study of the Great Artesian Basin (GAB) was started by the Bureau of Mineral Resources, Geology and Geophysics (BMR) in 1971*. It consisted mainly of the collation and interpretation of available data on about 10 000 bores from the files of State and Federal authorities. This is the basic information used to prepare a simulation model of the hydrodynamic system of the basin.

For satisfactory operation of a simulation model it is necessary to reconstruct the steady-state condition for the basin prior to 1900, and the changes in this condition since 1900 due to its development. The calibration stage of modelling consists of matching computed and observed pressure sequences. The model can then be used to forecast future groundwater behaviour in the basin.

There is sufficient known about the geology to correlate aquifers and establish the geometry of the basin. A permeability assessment of the main hydrogeologic units can also be made.

This note provides an elementary explanation of model simulation in the Great Artesian Basin groundwater project. Most of the input data for the model is to be computer-processed and generated. Discretized mathematical formulae will be derived by using finite differences approximations, and will be solved numerically on the computer. The early stages of simulation will be performed on a digital model; later, with increasing knowledge of the hydrodynamic features of the basin, an analog or hybrid simulation model may be feasible. A preference to work preliminary runs on a digital model is prompted by the availability of computing facilities within the BMR and the Division of Computing Research, CSIRO, Canberra.

The organization of the model package Great Artesian Basin Simulation Model (GABSIM) and the tasks devoted to specific routines are also described below and a test run, based on an imaginary history, is attached as an illustration of model capability.

The GABSIM package is programmed in FORTRAN IV language, compatible with Control Data Computers (CDC) 3600, 6600 and Cyber 76 Series. Input data are either punched onto computer cards or stored on disc permanent files, and the output results transferred to line printers. The design of the model allows use of overlay or segmentation procedures,

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* The draft of this Record was edited after the author returned overseas; it has not been returned to the author for checking.

but all array data are stored in the computer memory. In the operational stage of the model processing, it may be necessary, according to the quantity of data and memory available, to switch to magnetic tape (or disc) inputs and non-indexed data requiring temporary storage on peripheral storage units; modifications which meet the duties of the Project Systems Analyst. The computing technique to solve the set of linear equations is the Point Successive Overrelaxation Procudure (PSOR), with the optimized overrelaxation factor completed by the modified CARRE algorithm. When considering the 'real basin configuration', other computing procedures (such as Line Successive Overrelaxation (LSOR), Alternate Directions Implicit (ADIP), Direct Solving Technique or Invariant Inbedding) will be tested, with a view to defining the optimum computing scheme, according to the accuracy of results and time requirements. All data and results are to be read and printed in metric units.

The Model Package has been designed and programmed by P. Ungemach from Bureau de Recherches Géologiques et Minières (BRGM), France. GABSIM can handle any aquifer system in which one may apply the HANTUSH leaky artesian aquifer scheme.

The GABSIM package is held in the Bureau of Mineral Resources, Canberra, A.C.T.

1. SCOPE OF THE MODEL

1.1 Physical Setting

At the scale of a large sedimentary basin the groundwater system, considered as a stratification of alternating pervious and semi-pervious layers, can be studied by three different methods:

(1) A conventional description of the three-dimensional groundwater flow motion, governed by the following partial differential equation: *

$$\nabla \left[\bar{\bar{K}} (\nabla H) \right] = S_i \frac{\delta H}{\delta t} + q \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This scheme must faithfully reproduce the configuration of the actual pressure field, with respect to the regional groundwater flow theory (Freeze & Witherspoon, 1968; Toth, 1962). On the other hand it may require a considerable amount of computation time and storage.

(2) A quasi three-dimensional approach derived from the HANTUSH leaky artesian aquifer theory (Hantush & Jacob, 1955; Hantush, 1960) where the flow of water is assumed to be horizontal-planar within an aquifer, and vertical through the semi-pervious confining beds (Fig. 1). This hydrodynamic picture which historically allowed low-permeability beds to transmit water and thus extended the concept of impermeability, is relevant as long as the main aquifer units and confining beds can be clearly differentiated and as long as the hydraulic conductivity contrasts permit almost right-angle refraction of the flowlines at the interfaces (Fig. 1a).

Leakage through the semi-pervious confining beds is, according to Darcy's Law, proportional to its vertical hydraulic conductivity and to the hydraulic gradient between the two adjacent aquifers (release from storage within the confining stage being neglected). This simplification may be very constraining while dealing with non-steady-state motion, and can be regarded as a maximum upper boundary to the vertical flow exchanges.

Flow within an aquifer unit (labelled k)

$$\nabla \left[\bar{\bar{T}} (\nabla H) \right]_k = \left(S \frac{\delta H}{\delta t} \right)_k + (ql + q)_k \quad \ldots\ldots\ldots\ldots (2)$$

leakage rate =

$$(ql)_k = (ql \text{ up})_k + (ql \text{ down})_k$$

---

* For the meaning of symbols used in the text refer to the 'Notations' Item.

$$(ql\ up)_k = (K'_z)_k \frac{H_k - H_{k-1}}{b'_k} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

$$(ql\ down) = (K'_z)_{k+1} \frac{H_k - H_{k+1}}{b'_{k+1}}$$

(3) Multilayered schemes geometrically similar to the HANTUSH Scheme, taking into account the storage (or elastic) properties of the confining layers:

(a) The BOULTON delayed yield scheme (Boulton, 1954) which considers the hydraulic situation outlined in Fig. 2. The main aquifer is overlain by a clayey layer which delivers a delayed yield from storage equal (per unit area) to

$$q_d = \alpha \frac{S'}{T} \int_{\tau}^{t} \frac{\delta s}{\delta t} \exp\left[-\alpha(t - \tau)\right] d\tau \quad \ldots\ldots\ldots (4)$$

This scheme is applied in the completion of pumping tests, operating under so-called semi-unconfined aquifer conditions, for which analytical solutions and a set of type curves are available, but hydrogeologists are not likely to apply it to a reservoir scale where more convenient pictures can be foreseen. It shows anyhow, a marked tendency to underestimate the vertical flow of water from the upper confined bed, which is very similar to a recession with no recharge.

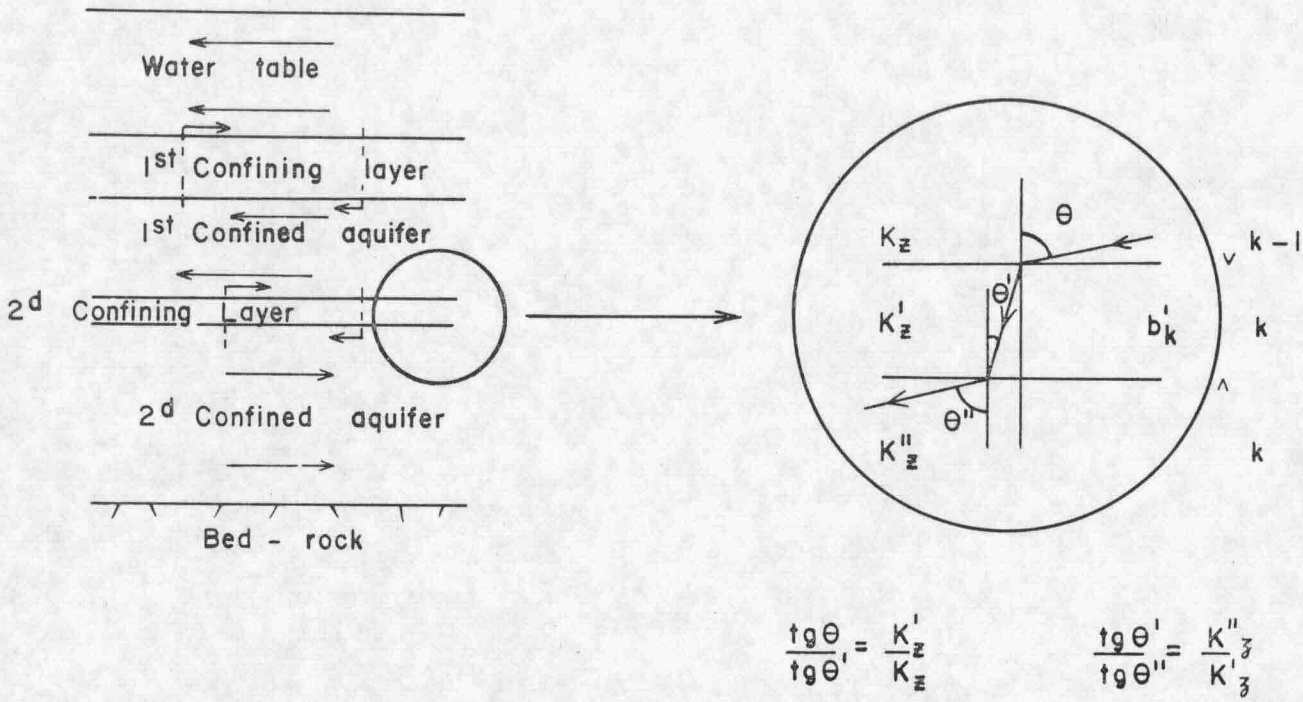
(b) The PINDER-BREDEHOEFT semi-analytical approach to storage within confining layers (Bredehoeft & Pinder, 1970) (Fig. 3):

Equation 5 (Fig. 3) is to be solved numerically (Section 1.3) while equation 6 is subjected to the following initial and boundary conditions:

$$\left.\begin{aligned} H'_k(z, o) &= o \qquad z > o \\ H'_k(o, t) &= o \\ H'_k(b', t) &= HO'_k \end{aligned}\right\} \quad t > o \qquad \ldots\ldots\ldots\ldots\ldots (8)$$

can be solved analytically due to its classical occurrence in mathematics of diffusion, thus:

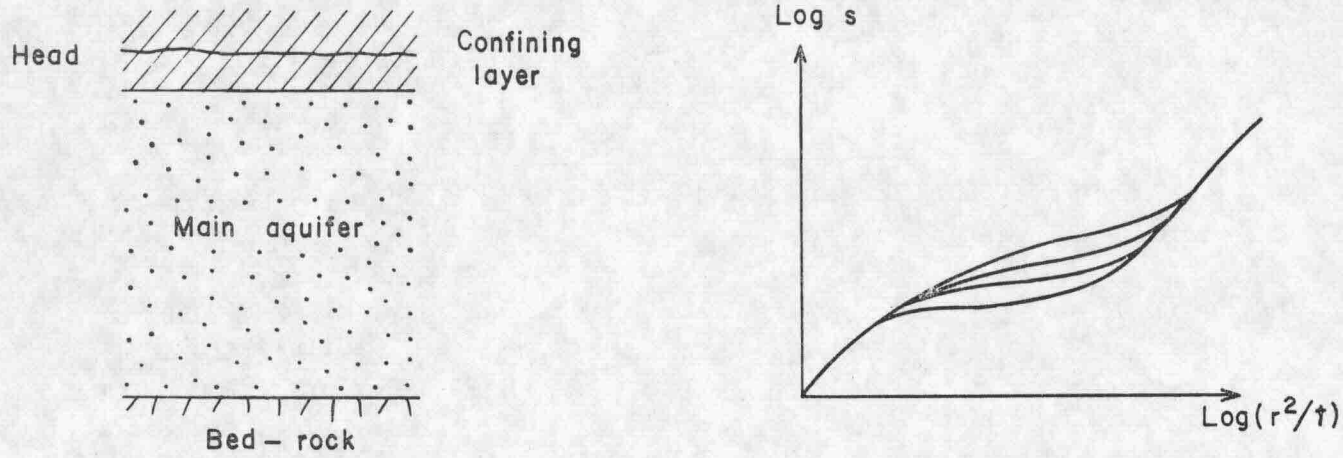
$$H'_k(z', t) = HO'_k \sum_{u=o}^{\infty} \left\{ \operatorname{erf}\left[\frac{(2u+1) + z/b'_k}{(4K'_{z_k}\, t/S'_{i_k}\, b'^{2}_k)^{\frac{1}{2}}}\right] - \operatorname{erf}\left[\frac{(2u+1) - z/b'_k}{(4K'_{z_k}\, t/S'_{i_k}\, b'^{2}_k)^{\frac{1}{2}}}\right] \right\} \quad \ldots\ldots\ldots (9)$$



a) The Multilayered System

b) Refraction of a Flow Line

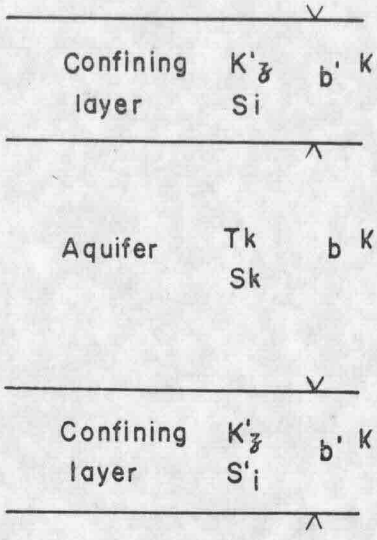
Fig. 1 The HANTUSH multilayerd system



a) The Aquifer

b) The Drawdown Evolutions

Fig.2 The BOULTON'S Two Layered Scheme



a) The aquifer system

Aquiferer (k) horizontal planar flow =

$$(5)\quad \nabla\left[\overline{\overline{T}}_k \nabla H_k\right] = S_k \frac{\partial H_k}{\partial t} + ql + q$$

$$ql = ql_k + ql_{k-1}$$

Semi – pervious confining layers (vertical flow)

$$(6)\quad \frac{\partial^2 H'_k}{\partial Z^2} = \frac{S'_{ik}}{K'_{zk}} \frac{\partial H'_k}{\partial t}$$

$$(7)\quad ql_k = -K'_{zk} \left(\frac{\partial H'}{\partial Z}\right)_{Z = b'_k}$$

b) Equations

Fig. 3 Unsteady aquitard transmission

and, deriving ql_k from (7) heads to:

$$ql_k = \frac{K'_{z_k} \; HO'_k}{b'_k \; (K'_{z_k} \; t/b'^2_k \; S'_{i_k})} \left\{ 1 + 2 \sum_{n=1}^{\infty} \exp\left[-n^2/(K'_{z_k} \; t/b'^2_k \; S'_{i_k}) \right] \right\} \quad \ldots\ldots\ldots\ldots (10)$$

This procedure is well adapted to numerical calculations requiring time discretization, the boundary condition HO'_k resulting from the numerical solution of Equation 5 at the previous time step. The leakage rates are computed from Equation 10, then incorporated in the second member of Equation 5 and the procedure repeated on the next time increment.

This scheme, although physically satisfying, requires an initial steady state (e.g. zero drawdown distribution) and the application of the principle of superposition for the computation of Equations 7 and 8, leading to somewhat time-consuming operations.

(c) Miscellaneous types of multilayered aquifer systems in which the groundwater motion is discretized by the following equations:

<u>α type C.1</u>

$$\text{Aquifers} = \nabla\left[T_k \; (\nabla H_k) \right] = S_k \frac{\delta H_k}{\delta t} + ql_k + ql_{k+1} + q_k$$

$$\text{Confining layers} = \frac{\delta H'_k}{\delta z} = \frac{S'_{i_k}}{K'_{z_k}} \frac{\delta H'_k}{\delta t} \quad \ldots\ldots\ldots\ldots (11)$$

$$\text{Leakage rates} = ql_k = 2K'_{z_k} \frac{H_k - H'_k}{b'_k + b_k} \quad \ldots\ldots\ldots\ldots (12)$$

<u>β type C.2</u>

We no more assume the flow to be vertical within the confining layer treated though as a standard aquifer unit. The interest of this description lies in the fact that relatively low contrasts in permeability can be handled as well as lateral movements within the confining layers occurring for large values of time. The vertical movements take place at the interfaces through composed vertical hydraulic conductivities as stated below (all units are labelled as aquifers):

Aquifer unit k =

a) $$\nabla\left[T_k \; (\nabla H_k) \right] = S_k \frac{\delta H_k}{\delta t} + ql_{k-1} + ql_k + q_k$$

b) $$ql_k = K'_{z_k} \frac{H_k - H_{k+1}}{\Delta z_{k+1}} \quad \ldots\ldots\ldots\ldots (13)$$

c) $$\frac{\Delta z_k}{K'_{z_k}} = \frac{1}{2}\left(\frac{b_k}{K_{z_{k'}}} + \frac{b_{k+1}}{K_{z_{k+1}}}\right)$$

$$2\,\Delta z_k = b_k + b_{k+1}$$

Figure 4 summarizes, in a qualitative illustration of the pressure distribution along a vertical line, the degrees of approximation expected from the various schemes.

Although a three-dimensional approach appears to be the ideal way of describing the real in-situ configuration of the basin, the lack of relevant data with respect to the accuracy of permeability, pressure and structure assessments, the considerable computer storage, and time required for processing the model make it unrealistic.

The Type-3 multilayered description, accounting for the elasticity of the confining layers, needs information on their storage coefficients which is not presently available.

The HANTUSH approach will thus be used in the early stage of the GAB project. A move to a more accurate configuration, including the storage coefficients of confining layers, may be designed at a later stage. The GABSIM model already offers, from the programming side, this opportunity.

1.2 Derivation of the mathematical model

As indicated previously (Section 1.1, Fig. 1) the groundwater movement within an aquifer unit k is described by a second-order partial differential equation of the diffusion type:

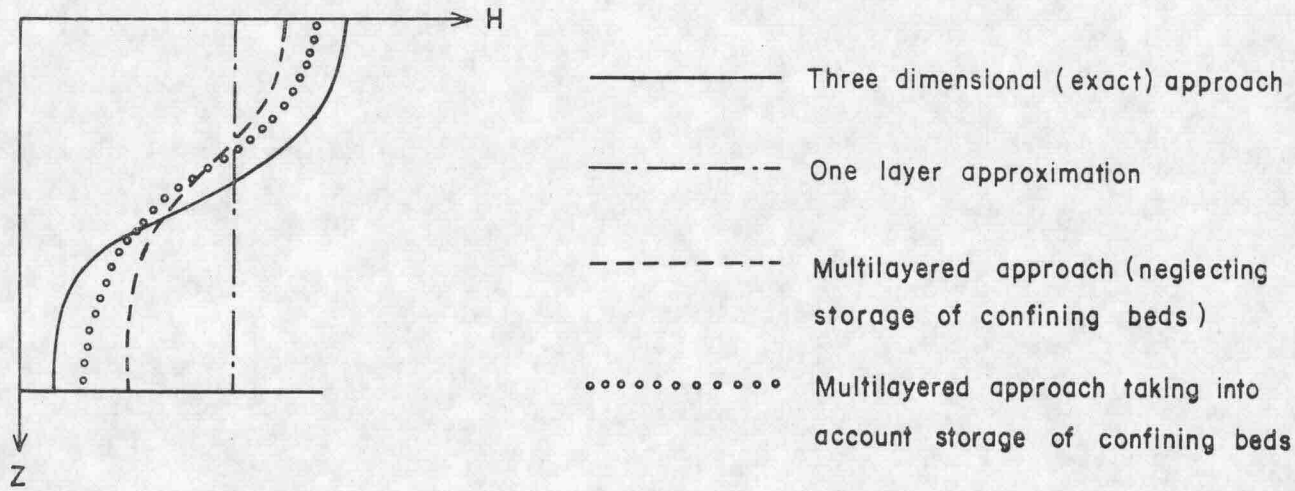
$$\nabla\left[\overline{\overline{T}}_k\,(\nabla H_k)\right] = S_k\frac{\delta H_k}{\delta t} + ql_k + q_k \qquad \ldots\ldots\ldots\ldots\ldots (14)$$

$$ql_k = K'_{z_k}\left(\frac{\delta H}{\delta z}\right)_{z=b'_k} + K'_{z_{k+1}}\left(\frac{\delta H}{\delta z}\right)_{z=b'_{k+1}} \qquad \ldots\ldots\ldots (15)$$

Vertical hydraulic gradients $\left(\frac{\delta H}{\delta z}\right)$ occurring in leakage through the confining layers, may be approximated by

$$\left(\frac{\delta H}{\delta z}\right)_{z=b'_k} = \frac{H_k - H_{k-1}}{b'_k}$$

$$\left(\frac{\delta H}{\delta z}\right)_{z=b'_{k+1}} = \frac{H_k - H_{k+1}}{b'_{k+1}} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (16)$$



Perturbation: Well Tapping the Upper Aquifers

Fig. 4 Degree of approximation expected from various schemes

A correct statement of the problem should include definitions of boundary and initial conditions. Boundary conditions can be of two types:

(a) DIRICHLET Condition; pressure (or head) is known at a given time and boundary location, e.g.

$$H(x_L, y_L, z_L, t) = h_L(t) \qquad t > 0$$

(b) NEUMANN Condition; the normal derivation of hydraulic potential is known at a given time and boundary location. This condition, written as follows

$$\left(\frac{\delta H}{\delta n}\right)_{\substack{x = x_L \\ y = y_L \\ z = z_L}} = q_L(t) \qquad t > 0,$$

expresses the knowledge of inflow or outflow rates through the boundary, an impervious boundary being considered as a zero-flow area.

(c) The FOURIER condition which represents a linear continuation of conditions (a) and (b), as follows

$$a\,H_L(t) + b\left(\frac{\delta H}{\delta n}(t)\right)_L,$$

referring to a radiation-type condition occurring in heat conduction, is almost never considered in groundwater hydraulics.

In initial conditions the hydraulic head is known at time zero in the overall field under study, to which Equation 13 applies, e.g.

$$H(x, y, z, o) = H_o(x, y, z)$$

Field singularities appearing in the second member of Equation 13 in given field locations must be added, such as well discharge, water consumption, evapo-transpiration and infiltration rates, river-aquifer exchanges, river head connected with aquifers etc.

Due to reservoir heterogeneity, complex field geometrics and occurrence of various field singularities, an analytical solution of Equation 14 subjected to its boundary and initial conditions cannot be expected. The aim is to achieve numerical calculations, requiring that Equation 14 and boundary and initial conditions should be arranged in a computer-accessible form, leading to finite difference approximations.

1.3 Finite difference equations

Considering the arbitrary situation (referring to one single aquifer) outlined in Figure 5, a uniform rectangular grid of elementary spacing Δx, Δy can be applied which fits the approximate boundary shape in the form of a staircase.* The field under study can then be shown by a finite number of points (meshes), the so-called 'discrete representation', by means of grid meshes (or nodes) located by the array indices K(OZ), I(OY) and J(OX) which number the aquifers, and, within the aquifer, the rows and columns (Fig. 5). The discrete representation is operated herein by finite differences techniques, although we could have used a finite element procedure based on a variational principle (Young, 1961). It is a substitute for the continuous field representation presupposed in analytical solving methods, and allows an approximate resolution by numerical calculations. It must be pointed out here that the time-period involved in non-steady-state simulation is discretized as well in successions of time increments in which steady states are assumed (Fig. 6). In Figure 6, one may notice that the lengths of time increments are governed by the potential gradient versus time. This rule applies to space discretization according to the distribution of hydraulic gradients. Samples of various discretization grids are indicated in Figure 7.

Writing the water balance (conservation of fluxes) for a time-increment Δt on the mesh node centred on i, j, k, yields the expression:

$$Q_{up} + Q_{north} + Q_{west} + Q_{east} + Q_{south} + Q_{down} = S_c \frac{\Delta H_c}{\Delta t} + Q_p + q \qquad \ldots\ldots\ldots\ldots\ldots\ldots \quad (17)$$

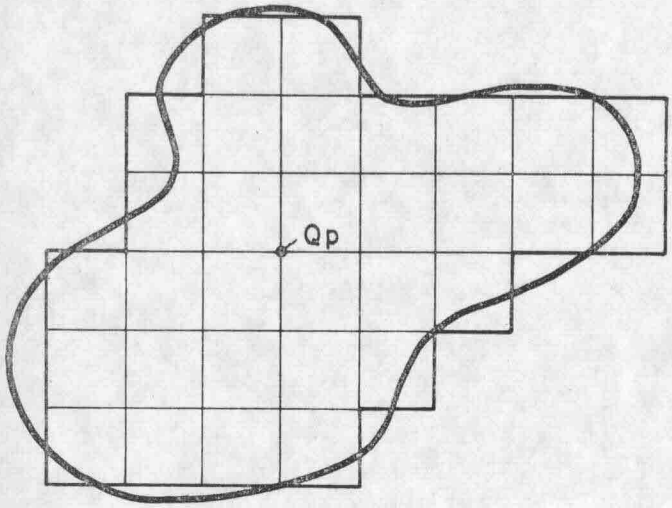
Lateral and vertical leakage flow Q/S are expressed by Darcy's Law:

$$Q_{up} = KZ_{c_{up}} \frac{H_c - H_{c_{up}}}{M_{c_{up}}} \Delta x \Delta y \quad \text{(upwards leakage)} \ldots\ldots\ldots\ldots \quad (18)$$

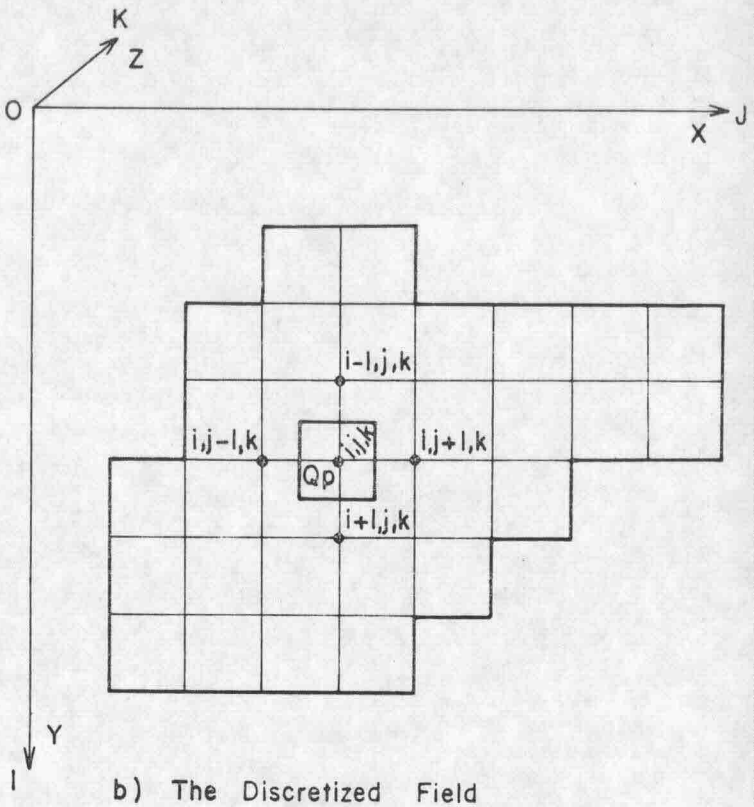
$$Q_{down} = KZ_{c_{down}} \frac{H_c - H_{c_{down}}}{M_{c_{down}}} \Delta x \Delta y \quad \text{(downwards leakage)}$$

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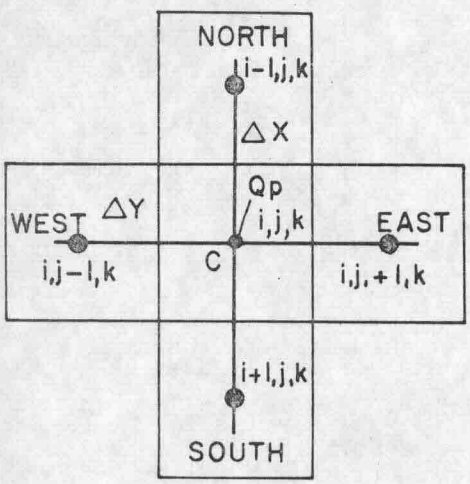
* A convenient 'staircase' approximation implies equalities of the areas (shifted or added) on both sides of the actual boundary. Otherwise space increments are to be weighted on the boundary meshes.



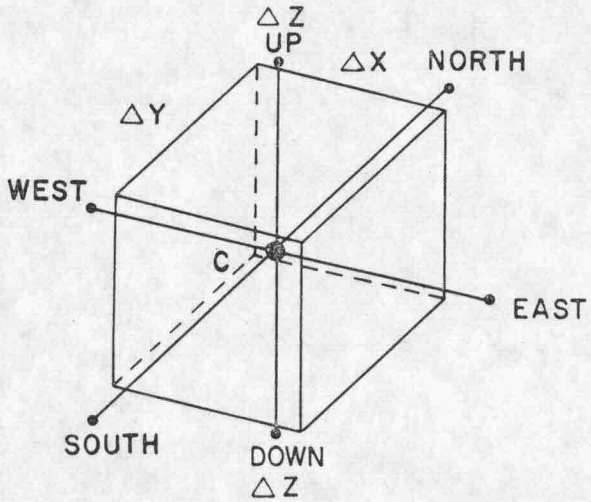
a) The Prototype



b) The Discretized Field



c) The Five Point Discretization Scheme



d) The Seven Point Discretization Scheme

Fig. 5 Discretization of Space

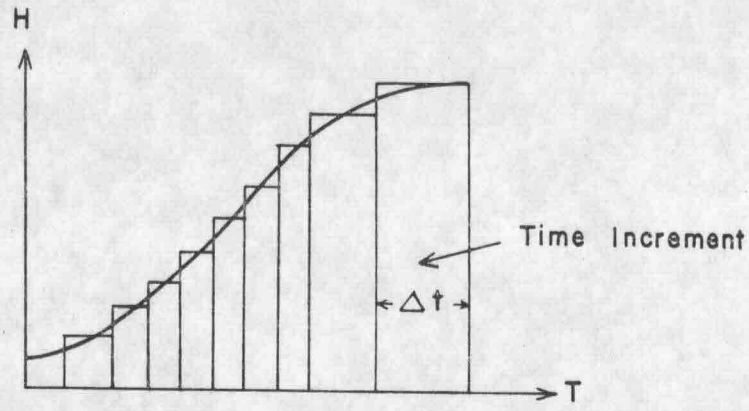
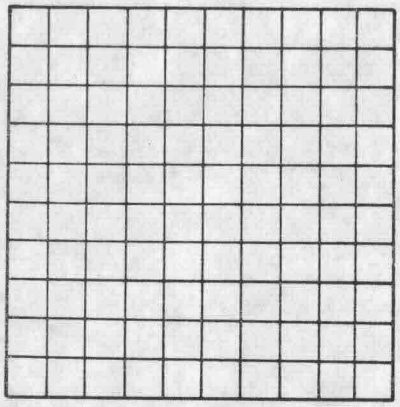
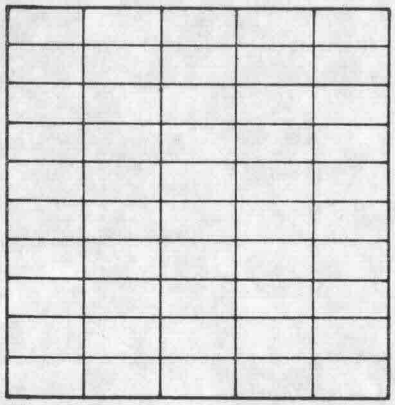


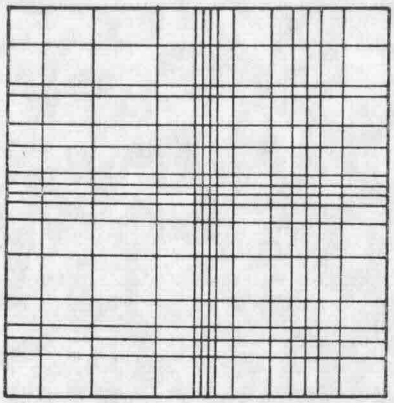
Fig.6 Time Discretisations



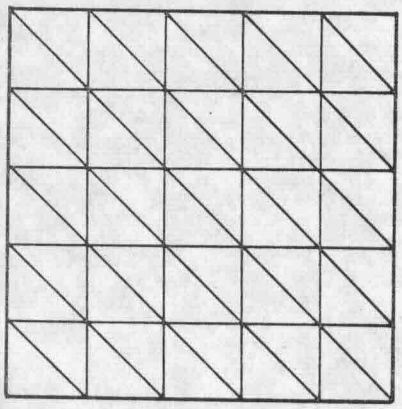
a) Square Uniform



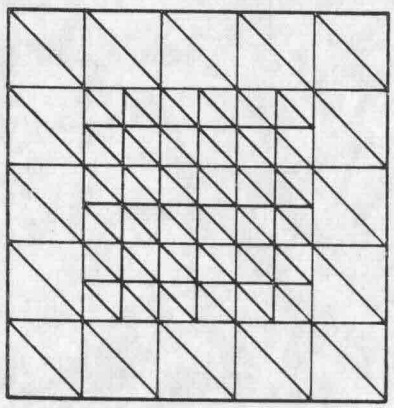
b) Rectangular Uniform



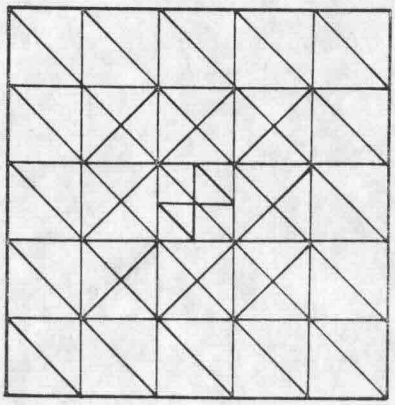
c) Rectangular Variable (without interraptions)

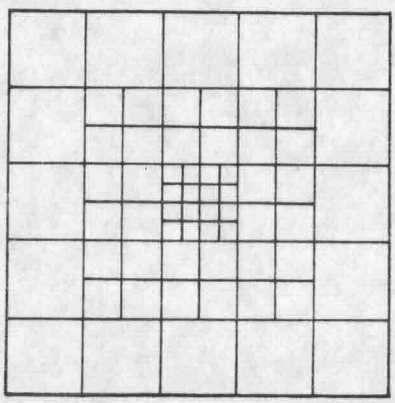


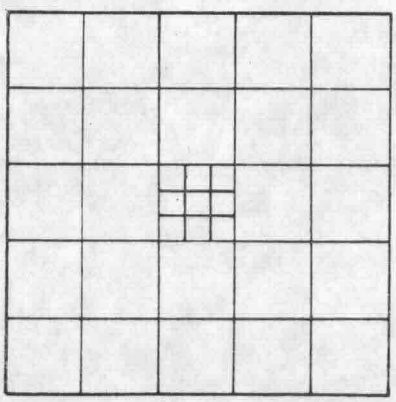
d) Uniform Triangles



e) Variable Triangles (Finite elements)







f) Variable squares (with interraptions), (finite differences or elements)

Fig 7 Space discretizations grids: selected samples

GABSIM deals with a and b grids

M(W) 21

$$Q_{north} = T_{north} \frac{H_c - H_{north}}{\Delta y} \Delta x$$

$$Q_{south} = T_{south} \frac{H_c - H_{south}}{\Delta y} \Delta x$$

$$Q_{east} = T_{east} \frac{H_c - H_{east}}{\Delta x} \Delta y$$

$$Q_{west} = T_{west} \frac{H_c - H_{west}}{\Delta x} \Delta y$$

Q_p = well flow discharge

q = miscellaneous field flow singularities

Subscripts c, up, down, north, south, east and west can be expressed through array indices as follows:

c (mesh centre)	= i, j, k	..... (19)
up	= i, j, k-1	
down	= i, j, k+1	
north	= i-1, j, k	
south	= i+1, j, k	
east	= i, j+1, k	
west	= i, j-1, k	

Directional transmissivities can be averaged, provided the meshes are uniformly spaced (Table 1)

OPTION / Directional Transmissivity	Arithmetic Mean	Harmonic Mean
T_{south}	$(T_{i,j,k} + T_{i+1,j,k})/2$	$2 \frac{T_{i,j,k} \times T_{i+1,j,k}}{T_{i,j,k} + T_{i+1,j,k}}$
T_{east}	$(T_{i,j,k} + T_{i,j+1,k})/2$	$2 \frac{T_{i,j,k} \times T_{i,j+1,k}}{T_{i,j,k} + T_{i,j+1,k}}$
T_{north}	$T_{south\ i-1,j,k}$	
T_{west}	$T_{east\ i,j-1,k}$	

TABLE 1

Release from storage is expressed as:

$$S_c \frac{\Delta H_c}{\Delta t} T = S_{i,j,k} \frac{H_{i,j,k} - Ho_{i,j,k}}{\Delta t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (20)$$

$Ho_{i,j,k}$ being the known value of head at initial time t_o.

Equation 17, including the indexed items given in Equations 18 to 20 and in Table 1, is the Finite Difference Equation (F.D.E.) of Equation 14.

A second derivation of the F.D.E. can be performed in a more abstract way by a series expansion of Equation 14 bounded by second-order space derivatives and first forward derivatives with respect to time. It yields, as the physical derivation which expresses more directly the conservation of masses (incorporating DARCY'S dynamic equation), the following set of linear equations:

$$AS_{i-1,j,k} H_{i-1,j,k} + AE_{i,j-1,k} H_{i,j-1,k} + AB_{i,j,k-1} H_{i,j,k-1} +$$

$$AC_{i,j,k} H_{i,j,k} + AB_{i,j,k} H_{i,j,k+1} + AE_{i,j,k} H_{i,j+1,k} + AS_{i,j,k} H_{i+1,j,k}$$

$$= B_{i,j,k} \quad \ldots\ldots\ldots\ldots\ldots\ldots (21)$$

with (for uniform grid spacing)

$$AS_{i,j,k} = -TS_{i,j,k} \quad \Delta x / \Delta y$$

$$AE_{i,j,k} = -TE_{i,j,k} \quad \Delta y / \Delta x$$

$$AB_{i,j,k} = -K'_{z\,k+1} \quad \Delta x \, \Delta y / b'_{k+1}$$

$$AC_{i,j,k} = S_{i,j,k} \quad \Delta x \, \Delta y / \Delta t - \sum$$

$$\sum = \sum_{l=0}^{1} AS_{i-l,j,k} + AE_{i,j-l,k} + AB_{i,j,k-l} \quad \ldots\ldots\ldots\ldots (22)$$

$$B_{i,j,k} = S_{i,j,k} Ho_{i,j,k} \quad \Delta x \, \Delta y / \Delta t - Q P_{i,j,k} - q_{i,j,k}$$

Equation 21 may be written in matrix form,

$$[A]\,[H] = [B] \qquad \ldots\ldots\ldots\ldots\ldots\ldots (23)$$

With -

$[A]$ a heptadiagonal square symmetric, diagonally dominant matrix including coefficients (provided there is at least one imposed head, $[A]$ is irreducible),

$[H]$ a column matrix including the H solution vector components,

$[B]$ a column matrix including the known values of the second member of Equation 21.

Solution of Equation 21 (or System 23) may be performed by various numerical techniques such as:

- Point-iterative processes
- Block semi-iterative processes
- Direct methods
- Invariant imbedding, etc.

In the framework of the GAB project we will focus on point-iterative (successive over-relaxation) processes, accelerated by optimizing the over-relaxation factor and by use of predictors, which appear often the most reliable for processing of field case histories.

Considering the linear system (Equation 23) we may seek a solution performed by successive iterations linked to one another through the recurrence formula.

$$H^{(p)} = G\,H^{(p-1)} + C \qquad \ldots\ldots\ldots\ldots\ldots\ldots (24)$$

with C = a constant vector

p = the iteration number

G = the interation matrix

$H^{(p)}$ converges to the solution of A H = B , e.g.

$$\lim_{p \to \infty} G^{(p)} = I + \sum_{i=1}^{p-i} G^{(i)} = C\left[I - G\right]$$

with I = unit matrix

if and only if, the spectral radius of the iteration matrix G (e.g. the greatest eigenvalue) verifies the inequality

$$p^{(G)} < 1 \qquad \ldots\ldots\ldots\ldots\ldots\ldots (25)$$

The patterns of the iteration matrices used in the main iterative methods are summarised in Table 2.

TABLE 2. Summary of the main point-iterative algorithms

TYPE OF ITERATION	SOLVING FORMULAE		ITERATION MATRIX	ALGORITHM
	Algebraic Form	Matrix Form		
Point JACOBI diagonal (simultaneous displacements)	$\sum_{\substack{j=1 \\ j\neq i}}^{n} a_{ij} X_j^{(p-1)} + a_{ii} X_i^{(p)} = b_i$	$X^{(p)} = -D^{-1}(L+U)\, X^{(p-1)} + D^{-1} b$	$-D^{-1}\,(L+U)$	$X_i^{(p)} = \frac{1}{a_{ii}} \left[b_i - \sum_{\substack{j=1 \\ j\neq i}}^{n} a_{ij} X_j^{(p-1)} \right]$ $i = 1, 2, \ldots, n$
Point GAUSS-SEIDEL (successive displacements)	$\sum_{j=1}^{i-1} a_{ij} X_j^{(p)} + a_{ii} X_i^{(p)} + \sum_{j=i+1}^{n} a_{ij} X_j^{(p-1)} = b_i$	$X^{(p)} = -(D+L)^{-1}\, U\, X^{(p-1)} + (D+L)^{-1} b$	$-(D+L)^{-1}\, U$	$X_i^{*} = X_i^{(p)} = \frac{1}{a_{ii}} \left[b_i - \sum_{j=1}^{i-1} a_{ij} X_j^{(p)} - \sum_{j=i+1}^{n} a_{ij} X_j^{(p-1)} \right]$ or $i=1, 2, \ldots, n$
Point successive Over-relaxation (or FRANKEL-YOUNG)	$\omega \sum_{j=1}^{i-1} a_{ij} X_j^{(p)} + a_{ii} X_i^{(p)} - (1-\omega)\, a_{ii} X_i^{(p-1)} + \omega \sum_{j=i+1}^{n} a_{ij} X_j^{(p-1)} = b_i$ $1 \leqslant \omega < 2$	$X^{(p)} = -(D+\omega L)^{-1} \left[(1-\omega)D + \omega U \right] X^{(p-1)} + (D+\omega L)^{-1} b$	$-(D+\omega L)^{-1} \left[(1-\omega)D + \omega U \right]$	$X_i^{(p)} = X_i^{(p-1)} + \omega \left[X_i^{*} - X_i^{(p-1)} \right]$

KEY

A X = b is the linear system to be solved

i, j = rows and columns subscripts

n = number of unknowns (rank of the matrix A)

= over-relaxation (OR) factor

L = the lower triangular matrix

U = the upper triangular matrix

D = the diagonal matrix

L, U and D verify =

$A = L + D + U$

$$L = \begin{cases} a_{ij} & j < i \\ o & j \geqslant i \end{cases}$$

$$U = \begin{cases} o & j \leqslant i \\ a_{ij} & j > i \end{cases}$$

$$D = \begin{cases} a_{ij} & j = i \\ o & j \neq i \end{cases}$$

GAUSS-SEIDEL iteration shows a convergence speed twice as fast as the JACOBI procedure. Successive over-relaxation (O.R.) increases the convergence speed provided the O.R. factor ω is close to its optimum value:

$$\omega_{opt} = \frac{2}{1 + \sqrt{1 - \mu^2}} = \frac{2}{1 + \sqrt{1 - \lambda}} \qquad \ldots\ldots\ldots\ldots\ldots (26)$$

μ = spectral radius of the S.O.R. matrix

λ = spectral radius of the GAUSS-SEIDEL matrix ($\lambda = \mu^2$)

One may notice that the GAUSS-SEIDEL iteration is a particular case of S.O.R., by setting ω to unity.

GABSIM solves the linear set of equations (21) by the P.S.O.R. procedure, the first iterations on each time step starting with the GAUSS-SEIDEL algorithm and the O.R. factor being calculated for each set of a given number of iterations by the modified CARRE algorithm (Carre, 1961; Franson & Ungemach, 1969; Ungemach, 1974).

The value of the unknown vector $H^*_{i,j,k}$ at time t_o iterated by GAUSS-SEIDEL at order p is equal according to Table 2 and the Finite Difference Equation (F.D.E.) (21) to

$$H^*_{i,j,k} = \frac{1}{AC_{i,j,k}} \left[B_{i,j,k} - \sum_{l=o}^{1} AS_{i-l,j,k}\, H_{i-2l+1,j,k} + AE_{i,j-l,k}\, H_{i,j-2l+1,k} - AB_{i,j,k-l}\, H_{i,j,k-2l+1} \right] \qquad \ldots\ldots\ldots\ldots\ldots (27)$$

Further comments

Space and time first derivatives (Fig. 8) may be performed in three different ways:

$$\frac{\delta H}{\delta x} = \frac{H_i - H_{i-1}}{\Delta x_i} \quad \text{backward differences}$$

$$\frac{\delta H}{\delta x} = \frac{H_{i+1} - H_i}{\Delta x_{i+1}} \quad \text{forward differences} \qquad \ldots\ldots\ldots\ldots\ldots (28)$$

$$\frac{\delta H}{\delta x} = \frac{H_{i+1} - H_{i-1}}{\Delta x_1 + \Delta x_{i+1}} \quad \text{central differences}$$

Time discretization: let us consider the one-dimensional flow equation (subscripts i and k referring to space (Δx) and time (Δt) increments), numbering

$$\frac{\delta}{\delta x}\left(T \frac{\delta H}{\delta x}\right) = S \frac{\delta H}{\delta t} \qquad \ldots\ldots\ldots\ldots\ldots (29)$$

and write the Finite Difference Equation (F.D.E.) in a more general way, assuming the medium is homogeneous (S and T constant):

$$\theta \left(\frac{H_{i-1,k+1} - 2H_{i,k+1} + H_{i+1,k+1}}{(\Delta x)^2}\right) + (1-\theta) \frac{H_{i-1,k} - 2H_{i,k} H_{i+1,k}}{(\Delta x)^2}$$

$$= a^2 \frac{H_{i,k+1} - H_{i,k}}{\Delta t} \qquad \ldots\ldots\ldots\ldots\ldots (30)$$

$$a^2 = \frac{S}{T}$$

If $\theta = 0$, F.D.E. is <u>explicit</u>, e.g. H at time k+1 is expressed directly in terms of head values at time k. This would have been performed if in Equation 30 we had put HO in the first member of the water balance instead of H.

If $\theta = 1$, F.D.E. is totally <u>implicit</u> and the unknown head H_{k+1} is expressed in terms of heads of neighbouring points through a linear system. This was illustrated in previous examples.

If $\theta = \frac{1}{2}$, F.D.E. is based on the CRANK-NICOLSON discretization scheme, e.g. the second member of Equation 29 is equal to half the sum of the terms included in the first member of Equation 29. $1 < \theta < 1$ F.D.E. is explicit-implicit, θ weighting both explicit and implicit terms.

These three modes of discretization are illustrated in a one-dimensional case in Figure 9. The CRANK-NICOLSON scheme yields more accuracy, but requires more computed items and is more time-consuming.

<u>Convergence and stability</u>

Solving Equation 14 by numerical means, one approaches the exact analytical solution with an accuracy of $\mathcal{E}$. <u>Convergence</u> consists of finding conditions in which the approximation error $\mathcal{E}$ tends uniformly to zero when increments Δx and Δt tend to zero. In practice, the iterative process will stop if a degree of accuracy n is reached, as stated by:

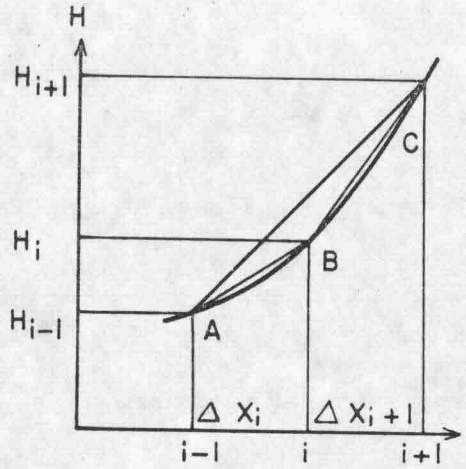


Fig. 8 Finite difference approximation of first derivates

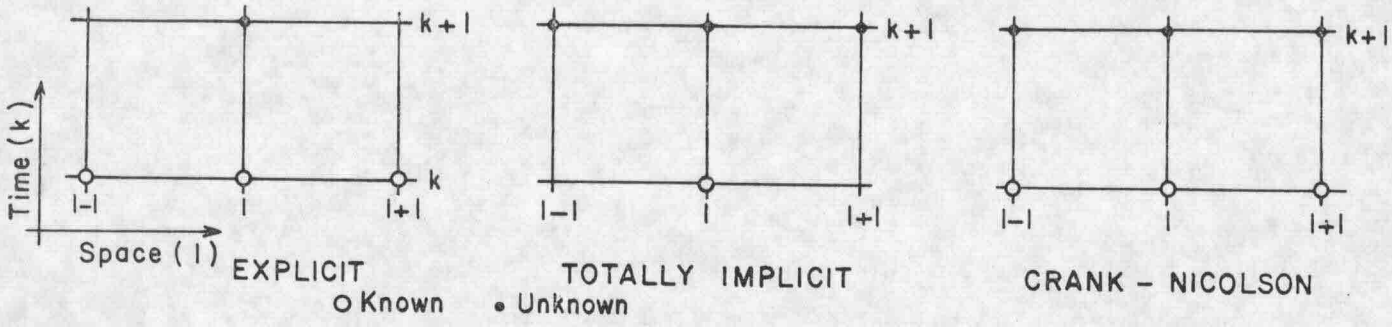


Fig. 9 Time – discretization modes – mnemonic representation

$$\left| \frac{H_{i,k+1}^{(p+1)} - H_{i,k+1}^{(p)}}{H_{i,k+1}^{(p)}} \right| < 10^{-n} \qquad \ldots\ldots\ldots\ldots\ldots (31)$$

p = iteration number

The water balance of the overall aquifer system can also be added as a final check.

Stability consists of finding the conditions linking discretization of time and space. If the approximation error ε tends uniformly to zero for all i values (at a given location in space), while time index k is increasing, the computing procedure is called stable. Stability in some respects is more powerful a notion than convergence, and in practice is often preferable.

Theory (Varga, 1962; Young, 1961) shows that the properties of the diffusion process matrices meet the stability and the convergence criteria.

Explicit schemes are stable under given conditions. Stability is called conditional. Thus for one-dimensional flow (Equation 30) the stability condition is stated by the inequality

$$\Delta t < a^2 \frac{(\Delta X)^2}{2} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (32)$$

and for the multilayered system (Equation 30) by -

$$AC_{i,j,k} > 0$$

$$\Delta t < \left. \frac{\min.\left[S_{i,j,k} \Delta X \Delta Y \right]}{\max.\left[\sum_{l=0}^{1} AS_{i-l,j,k} + AE_{i,j-l,k} + AB_{i,j,k-l} \right]} \right\} \ldots\ldots (33)$$

On the other hand, implicit schemes are unconditionally stable. However, time and space discretization is not arbitrary as it may influence the accuracy of the results with respect to truncation errors.

Derivation of a more general Finite Difference Equation

If one considers the discretization scheme outlined in Figure 10, the F.D.E. can be made suitable to any field situation or space and time discretization, as follows:

$$\theta\left[\sum_{l=o}^{1} AS_{i-1,j,k}\, H^{t+\Delta t}_{i-2l+1,j,k} + AE_{i,j-1,k}\, H^{t+\Delta t}_{i,j-2l+1,k} + AB_{i,j,k-1}\, H^{t+\Delta t}_{i,j,k-2l+1}\right]$$

$$+ AC_{i,j,k}\, H^{t+\Delta t}_{i,j,k} = B_{i,j,k} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (34)$$

$$AS_{i,j,k} = -TS_{i,j,k}\, \Delta X_j / (y_{i+1} - y_i)$$

$$AE_{i,j,k} = -TE_{i,j,k}\, \Delta Y_j / (x_{j+1} - x_j)$$

$$AB_{i,j,k} = -K'_{z_{i,j,k+1}}\, \Delta X_i\, \Delta Y_i / b'_{i,j,k+1} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (35)$$

$$AC_{i,j,k} = S_{i,j,k}\, \Delta X_j\, \Delta Y_i / \Delta t - \theta \sum$$

$$\sum = \sum_{l=o}^{1} AS_{i-1,j,k} + AE_{i,j-1,k} + AB_{i,j,k-1}$$

$$B_{i,j,k} = S_{i,j,k}\, \Delta X_j\, \Delta Y_i\, H^{t}_{i,j,k} / \Delta t - Q^{t+\Delta t/2}_{i,j,k} + (1 - \theta) \sum'$$

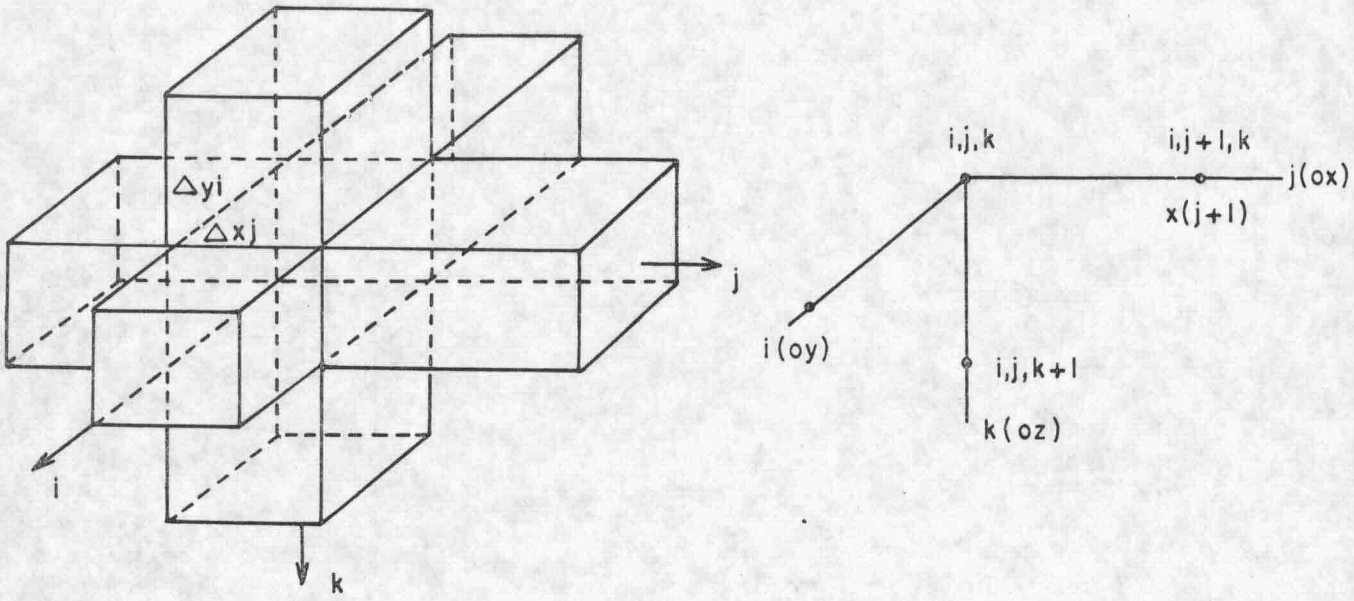
$$\sum' = \sum_{l=o}^{1} AS_{i-1,j,k}\, H^{t}_{i-2l+1,j,k} + AE_{i,j-1,k}\, H^{t}_{i,j-2l+1,k} +$$

$$AB_{i,j,k-1}\, H^{t}_{i,j,k-2l+1} - \sum xH^{t}_{i,j,k}$$

$$\theta = \begin{cases} 0 & \text{Explicit scheme} \\ 1 & \text{Totally Implicit scheme} \\ \frac{1}{2} & \text{Crank-Nicolson Implicit scheme} \\ o < \theta < 1 & \text{Implicit Explicit scheme} \end{cases} \qquad \ldots\ldots (36)$$

1.4 Summary of model design

Hydraulic scheme - HANTUSH multilayered leakage system including unique or a composite upper water table at fixed or computed head. GABSIM may handle, according to the upper aquifer features, the three situations outlined in Figure 11.



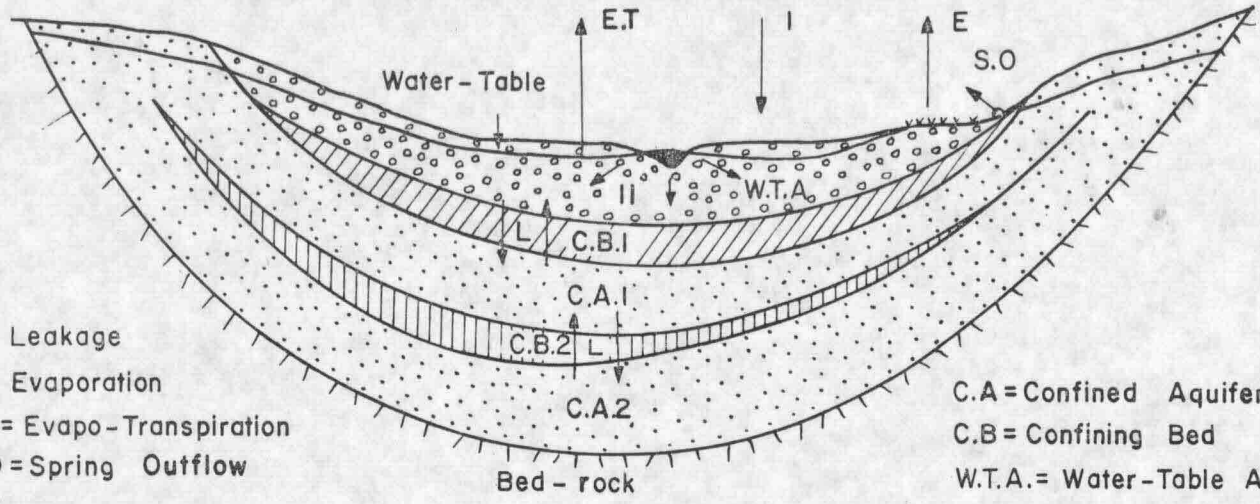
$$\Delta x_j = 2(x_j - x_{j-1}) - \Delta x_{j-i}$$

$$\Delta y_i = 2(y_i - y_{i-1}) - \Delta y_{i-i}$$

Fig. 10 Discretized aquifer block

I = Infiltration

II = Induced Infiltration



L = Leakage

E = Evaporation

E.T = Evapo-Transpiration

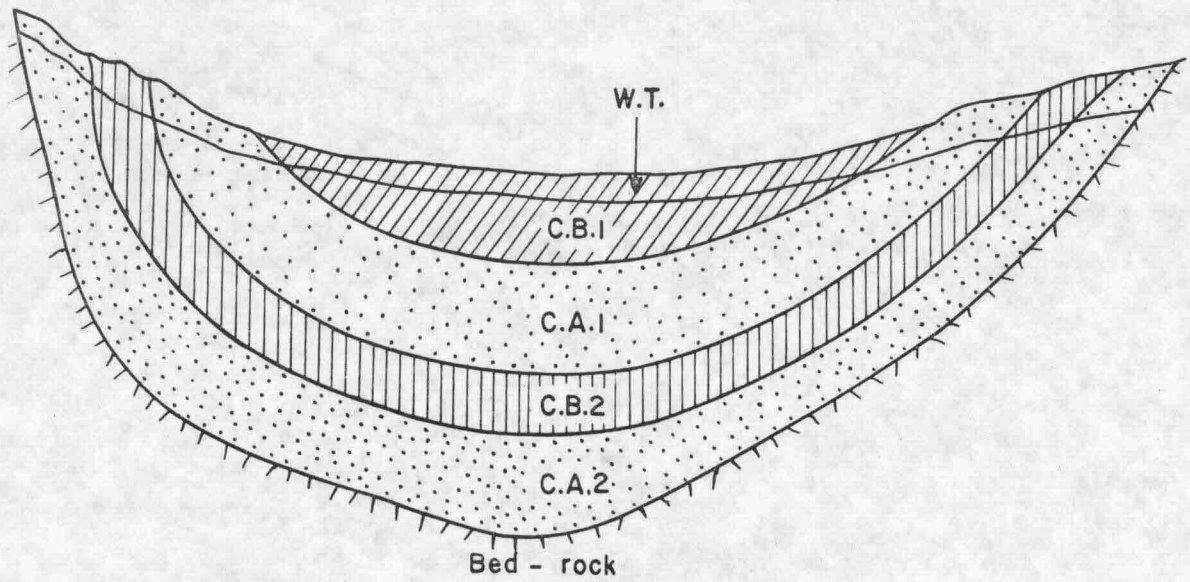
S.O = Spring Outflow

C.A = Confined Aquifer

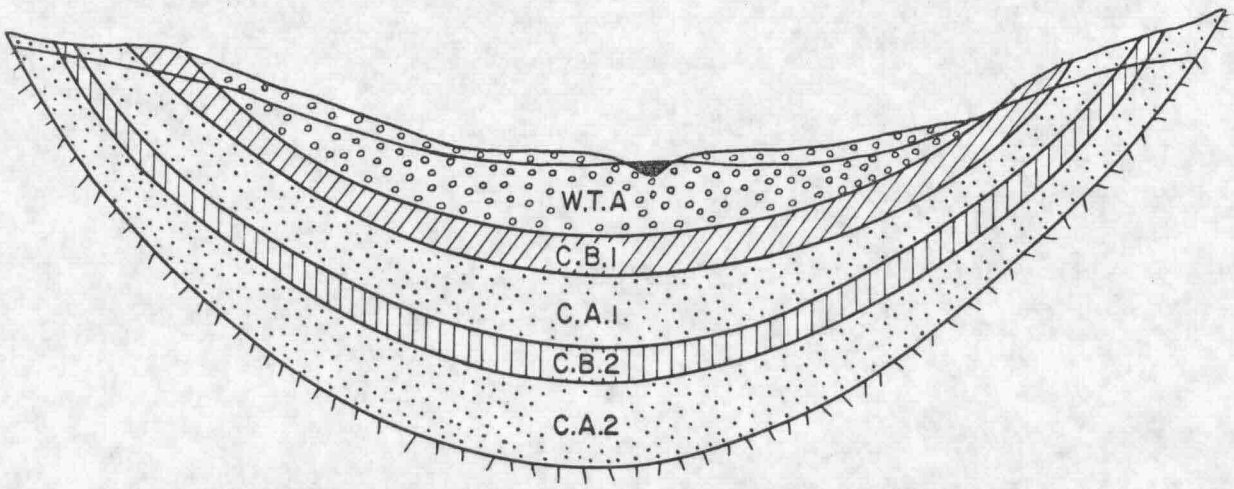
C.B = Confining Bed

W.T.A. = Water-Table Aquifer

Type I. Water Table Treated as a Single Aquifer Unit



Type 2. Water Table Lying in several Different Aquifer Units



Type 3. Combination of type I and type 2

Fig. II. Upper Conditions Handled by GABSIM : Water - Table

Type of model - Monophasic, bi-dimensional multilateral, steady and non-steady state case.

Discretization scheme - Finite differences, totally implicit, time forward differences.

Solving methods - Point Successive Over-Relaxation including the optimization of O.R. factor by the modified CARRE algorithm.

Discretization of space - Uniform rectangular meshes, the ratio between length and width not exceeding 2 (or 0.5).

Discretization of time - Exponential within a one-year period for the calibration phase.

Programming language - Fortran IV compatible with the CDC 3600, 6600 and Cyber 76 compilers.

Computers to be used - CDC 3600 for early preliminary runs, CDC 6600 remote batch terminal for operational runs, Cyber 76 after its installation at CSIRO Division of Computing Research in July-August 1973.

2. CALCULUS LOGIC ORGANIZATION

Model organization is summarized in Fig. 12. Four main items can be distinguished:

2.1 Input items

Input No. 1 refers to constant data, while Input No. 2 reads data variable with time. Constant data dealing with geometry figures, time and space discretization increments, field singularities locations, initial heads and flows, hydrodynamic parameters, and iteration processes coefficients are read through subroutines, representing a total degree of generality. Three subroutines read variable input data, such as heads and flows, the design of which is general and can be fitted to any type of multilayered aquifer system.

2.2 Preliminary transformation item

This item generates the complementary geometry indices (such as starting and ending row sweeping indices and upper and lower aquifer connections) and the values of directional transmissivities (eastwards and southwards). Corresponding values of directional transmissivities are set to zero on impervious lateral boundaries.

2.3 Computing item

Computing operations cover two distinct stages:

(a) Solving of the linear set of finite difference equations for the initial steady-state conditions and the further transient state which is performed by point successive overrelaxation through two sub-programmes.

(b) Check of the water balance by calculating the values of the main flow components (e.g. well discharge, lateral inflow (outflow), vertical leakage, releases from storage, aquifer/river exchanges) handled by six subroutines.

2.4 Output item

The results of the various calculations (as well as the input data) achieved by GABSIM are printed by line printer under various forms, including diagrammatic, arithmetic and symbolic maps.

3. DESCRIPTION OF SUBROUTINES

Brief comments and definitions of variables are set out in Appendix 4. A detailed description of subroutines called is attached in Appendix 2, reproducing the comment cards extracted from the FORTRAN deck. The comments added thereafter further explain the main steps in model processing. The general processing mode within the calibration stage of the study is operated according to the Appendix 5 flow chart.

3.1 Input procedure

The ordering of the input data deck is summarized in Table 3. One may notice that several data files are optional regarding the occurrence of field singularities such as rivers or of transient head conditions on lateral boundaries. Generation of the Input Data File is summarized in Appendix 4.

3.1.1 Space discretization and field location

The field under study is defined by the following indices (Fig. 13) and increments, allowing an automatic search location or characterization of any point of the field:

I = Row index ranging from 1 to N L (southwards)

J = Column index ranging from 1 to N C (eastwards)

K = Aquifer index ranging from 1 to N A Q (downwards)

GABSIM DIGITAL MODEL

Computing Logic Organisation

GABSIM MAIN PROGRAM		FUNCTION ITEM
SEQUENCE	SHORT DESCRIPTION OF SEQUENCE	
Read N1,N2 ..NN	Read integer dimensions of variable arrays, miscellaneous check indices and printing symbols	
Model Preliminary Data Arrangements (Read in, Transformations, Print-out)		
Call DATGAB Call SINGUL*) Call COORD 2 Call COORD 3 Call CLIM**) Call CONTR 3 Call MATCH 3 Call QPUMP	Read the constant input data necessary to model processing such as: - Field description indices - Hydrodynamic parameters and variables - Field singularities coordinates and heads - Successive over-relaxation parameters - Initial flow rates - Check point features	CONSTANT INPUT DATA
Call GEOMMC Call COORBC Call TDIRMC	Generates: - Rows sweeping extreme indices - Vertical aquifer connections - Lateral boundary indices - Directional transmissivities	PRELIMINARY CALCULATION
Call FRAMMC Call IMPRE Call IMPRE 2 Call MAPXY	Prints out - Field geometry and singularities - Maps (numeric and symbolic) of input and calculated array parameters	PRINT OUT
Call DEBLA 3 Call LEAKAG Call FLUXES Call DEBRN*)	Computes main components of the water balance as a preliminary check of the ability of input data	WATER FLOW COMPONENTS
Computing The Initial Steady-State Pressure-Flow Distribution		
Call PSORMC	Computes initial steady state pressure field by solving the linear set of Finite Differences Equations (F.D.E.)	COMPUTATION OF THE INITIAL STATIONARY PRESSURE FLOW TREND
Call DEBLA 3 Call LEAKAG Call FLUXES Call DEBRN*) Call BUDGET	Computes main components of the ground water flow system and checks accuracy of the overall water flow balance	
Call CHECK 3 Call IMPRE Call MAPXY	Prints out computed pressure maps and tables	PRINT OUT
Computing The Non Steady-State Pressure-Flow Distribution		
Do n of MEN INTSTEP		
Call QPUMP Call LIMVA**) Call VARSIN*)	Reads the input data varying with time: - Well discharge - Variations of head on lateral boundaries - Variations of head on rivers	VARIABLE INPUT DATA
Call PSORMC	Computes pressure field on a time step by solving the linear set of F.D.E.	COMPUTATION OF THE TRANSIENT PRESSURE FLOW TREND
Call DEBLA 3 Call LEAKAG Call FLUXES Call DEBRN*) Call BUDGET	Computes on each major time step the main flow components of the ground water system and checks the accuracy of overall water flow balance	
Call CHECK 3 Call IMPRE Call MAPXY	Prints out computed pressures in terms of numeric and symbolic (x,y) maps and of graphs (computed and observed vs time) on check points	PRINT OUT
*) Optional **) Time dependent		
END OF COMPUTATION		

DATGAB	Reads main physical input data (geometry, hydrodynamics, computing)
SINGUL	Reads coordinates and initial heads of field singularities
COORD 2	Reads two dimensional location indices
COORD 3	Reads three dimensional location indices
CLIM	Reads locations (start - end) of lateral boundary head variation laws
CONTR 3	Reads locations and initial steady state heads of check bores
MATCH 3	Reads locations and transient head sequences on check bores
GEOMMC	Computes row sweeping and vertical aquifer connection indices
COORBC	Computes lateral boundary meshes location indices
TDIRMC	Generates directional (Eastwards, Southwards) transmissivities
PSORMC	Solves linear set of F.D.E. (steady state) by P.S.O.R. — Call CARRE
DEBLA 3	Computes lateral boundaries in (out) flow rates
LEAKAG	Computes vertical leakage (upwards and downwards) flow rates
FLUXES	Computes total amount of field point flow rates
DEBRN	Computes river aquifer exchange flow rates
STORAG	Computes amount of water released from storage
BUDGET	Establishes overall ground water flow balance
QPUMP	Reads well flowing (discharge) rates
LIMVA	Reads variations of head on the lateral boundaries
VARSIN	Reads variations of head on field point singularities
PSORMC	Solves linear set of F.D.E. (non steady state) by P.S.O.R. — Call CARRE
CHECK 3	Prints out computed and observed steady state head on check points
FRAMMC	Prints out field geometry and singularity features
CURVE	Plots on same diagram two sets of variables (vs time or space)
IMPRE	Prints out a numerical XY map of one two dimensional array
IMPRE 2	Prints out a numerical XY map of two orthogonal bi-dimensional arrays
MAPXY	Prints out a symbolic contour map of bi-dimensional arrays
INTERP	Interpolates
ALPHA	Alphanumeric

CARRE
Computes optimum S.O.R. Factor

* Plots

** Time dependent (data processing stage) constant heads

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Fig 12

M(W) 26

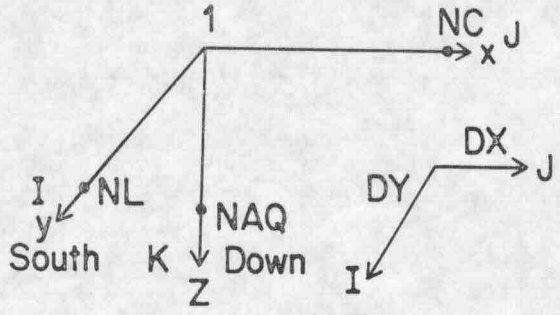


Fig. 13 Location indices

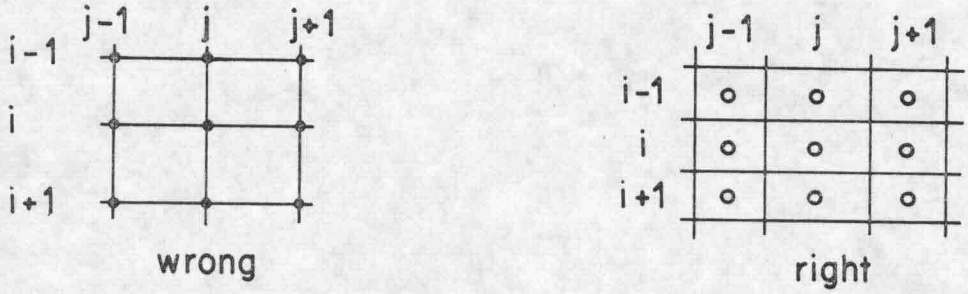


Fig. 14 Mesh convention

TABLE 3: Input data deck arrangement

SERIAL No.	INPUT DATA NAME(S)	SHORT DESCRIPTION	(SUB)ROUTINE	ARRAY INDEX (INDICES)	FORMAT	COMMENTS
1.	NL, NC, NAQ	Space discretisation dimensions	MAIN	NONE	12I5	
2.	NSTEP	Number of major time steps	"	"	"	
3.	NWELL	Number of wells	"	"	"	
4.	NRIV, KFRIV	Number of rivers and river field description value	"	"	"	optional
5.	NSCP, NNSCP	Number of check bores (steady and non steady state)	"	"	"	
6.	NØCCA1, NØCCB1	Number of outcropping member for CA_1 and CB_1 layers	"	"	"	specific to GAB
7.	KFCA1, KFCB1	Outcropping member field description values	"	"	"	"
8.	ISCHEM, IERR	Hydraulic scheme and error check indices	"	"	"	
9.	TETA	Time-space discretisation index	"	"	F5.3	
10.	BLANK, STAR, POINT, ZERO, WLETER, RLETER, ALETER, CHART	Alphanumeric printing symbols	"		7,2A1	
11.	DX, DY, DTO	Space and (initial) time increments	GABDATA	"	7 F10.0	
12.	FMT, FMS, FMPZ	T, S and PZ amplifying coefficients	"		7 F10.0	
13.	RØ, NITER, ERRØR, NMAX	S.O.R. parameters	"		2(F5.3, I5)	
14.	KFIELD (I,J,K,)	Field description index	"		36 I2	Items 14 to 19 are read for each aquifer and, within the aquifer per row labelled I, each ceiling value within a line referring to column index J.
15.	H (I,J,K,)	Mesh head	"	I: 1 →NL	10 F7.2	
16.	T (I,J,K,)	Mesh point tramsmissivity	"		"	
17.	S(I,J,K)	Mesh storage coefficient	"	J: 1 →NC	"	
18.	PZ (I,J,K,)	Mesh confining layer vertical permeats	"		"	
19.	EP(I,J,K,)	Mesh confining layer thickness	"	K: 1 → NAQ	"	

Table 3: Input data deck arrangement. (Cont.)

SERIAL NO	INPUT DATA NAME(S)	SHORT DESCRIPTION	(SUB)ROUTINE	ARRAY INDEX (INDICES)	FORMAT	COMMENTS
20.	HCB1 (I,J)	Head of upper confining layer C.B.	GABDATA	I:1 → NL, J:1 → NC	10 F7.2	
21	SINGNA(L,N,),NPSING(L)	Field singularity (F.S.) name and number of member per F.S.	SINGUL*	L:1 → NSING N: 1 → 4	4A6, 6X,I5	Items 21 to 24 are to be read per field singularity, (e.g. NSING times)
22	ISING (L,LL)	Row E.S. Location index	"	LL: 1 → NPSING(L)	36 I2	
23	JSING (L, LL)	Column F.S. location index	"		36 I2	
24	HSING (L,LL)	F.S. Initial mesh head	"		12 F6.2	optional
25	NLV(K)	Number of distinct lateral boundaries head variation laws	CLIM**	K:1 → NAQ	36 I2	
26	NLD (K,L)	Starting and ending locations	"	L:1 → NLV(K)	"	Not called in actual GAB representation
27	NLF (K,L)	of lateral boundaries assigned to NLV	"			
28.	K WELL (L)	Aquifer tapped by a well	CØØRD3	L:1 → NWELL	36 I2	
29.	I WELL (L)	Row, column (per aquifer) wells	"		"	
30	J WELL (L)	Location indices	"		"	
31	IØCCAI(L)	Row, column locations of CA1	CØØRD2	L:1 → NØCCA1	"	
32	JØCCA1(L)	Aquifer outcropping member	"		"	
33	IØCCB1	Row and column location of CB1	"	H:1 → NØCCB1	"	
34	JØCCB1(M)	Confining layer outcropping members	"		"	
35	CPNSS(L,LL),KCPSS,(L) ICPSS(L), JCPSS(L), HCPSS(L), HZRSS(L)	Steady state check bores name locations, heads values and heads origin	CØNTR3	L:1 → NSCP LL: 1 → 3	3A6,2X,3I5,5x,2FL0.2	
36	CPNSS(L,LL),KCPNSS(L), ICPNSS(L), JCPNSS(L)	Same as 35 for non steady state check bores. IYST(L) is the initial year of recording	MATCH3	L:1 → NNSCP LL: 1 → 3	3A6,2X,4I5,2F10.2	
37	HCPNSS (L,M)	Heads vs. time	"	M: 1 → NSTEP	10 F7.2	

Table 3 (Cont.)

SERIAL NO.	INPUT DATA NAME(S)	SHORT DESCRIPTION	(SUB)ROUTINE	ARRAY INDEX (INDICES)	FORMAT	COMMENTS
38.	QWELL (L)	Well flowing (discharging) rates	QPUMP	L:1 → NWELL	15 F5.0	Items 38 to 40 refer to data varying with time and are to be read on each main time step (e.g. NSTEP time)
39	HVSING (L), (LL)	Head of a F.S. mesh	VARSING*	L:1 → NSING LL: 1→ NPSING(L)	12 F6.2	
40	HLIM (K,L)	Head on a section of a lateral boundary	LIMVA **	K:1 → NAQ L:1 → NLV(K)		

UNITS: Heads and space increments are to be read in metres.

Time in Days

Transmissivity in M2/S (/FMT)
Storage coefficients in dimensionless units(/FMS)
Vertical permeability in M/S (FMPZ)
Flow rates are to be read in L/S

* optional

** not called for GAB processing at present stage.

DX, DY = uniform space increments

K F I E L D (I, J, K) = Field description index, referring to the mesh labelled I, J, K, set to:

- 2 if the mesh is out of the field,
- 1 if the mesh is on a lateral boundary on which a head condition is assigned,
- -1 if the mesh is on a zero flux (impervious) lateral boundary
- 0 if the mesh is in the active field an integer value ranging between -5 and -10 or +5 and +10 for any field singularity or special field identification modelled.

Blocks are related to the mesh centres and not to the XY grid intersection nodal points (Fig. 14).

In order to standardize the location searches within the computational process, two extra columns and rows are added to the maximum size NL : NC retangle in which are inscripted the N A Q aquifers. Thus each mesh, including the extreme lateral boundaries, can be positioned through its four cardinal neighbouring blocks (Fig. 15).

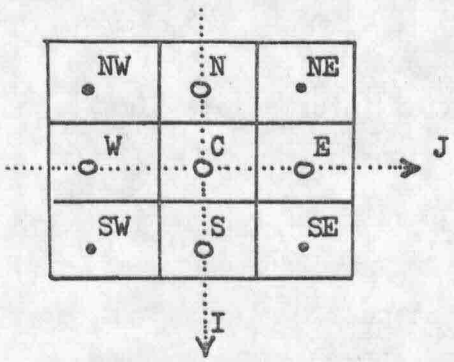


Fig. 15. Mesh location

Center mesh C = I,J,K.
Straight cardinal meshes
West = I,J-1,K
East = I,J+1,K
North = I+1,J,K
South = I+1,J,K
Mixed cardinal meshes
North West = I-1, J-1, K
North East = I-1, J+1, K
South West = I+1, J-1, K
South East = I+1, J+1, K

The upper and lower adjacent meshes relating to the vertical aquifer connections can also be defined by considering the 'facing' aquifer meshes identified by the K F I E L D (I,J,K) indices.

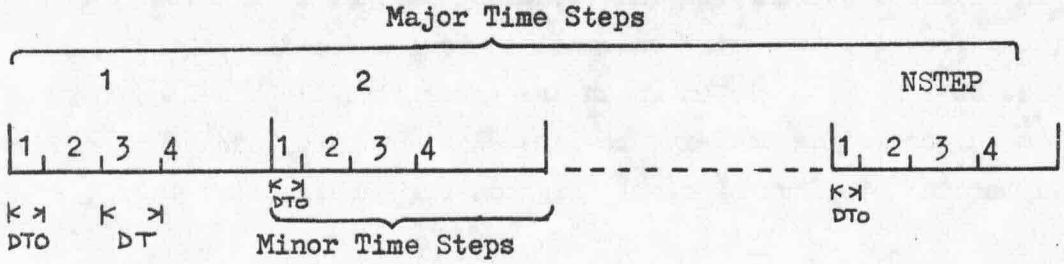
GABSIM deals only with uniform space discretization (e.g. with equal DX, DY space increments).

3.1.2 Time discretization

Two time steps are to be distinguished - see Figure 16 below.

- Major time steps are set to a uniform value (for example, day, week, month, or year in the case of GAB), numbered from 1 (initial time) to NSTEP (final time), on which changes in pumping (flowing) sequences, boundary conditions of field singularities heads are expected.

- Intermediate minor time steps are generated for computing purposes regarding stability improvements (required when dealing with CRANK-NICOLSON on Implicit, Explicit schemes). As outlined in Figure 16, the intermediate time increments are reset to their minimum value at each major time-step change. We suggest adopting an exponential variation law for such minor time increments in which the initial minimum value can be made equal to the critical time step (see Section 2 (Calculus Logic Organization), Explicit Schemes).



DTO = Minimum time increment (initial intermediate time)

DT = Time increment

DTM = Major time step = $\sum_{l=1}^{NINT} DT_l$

NINT = Number of intermediate time steps

TIMTØT = Total simulated time = NSTEP - DTM

NSTEP = Number of major time steps

$DT_{l>1} = DT_{l-1} * r \quad (r>1)$

Fig. 16. Time discretization

3.1.3 Hydrodynamic coefficients

The aquifer hydrodynamic coefficients; block transmissivities and storage coefficients S refer to each aquifer mesh (I,J,K), whereas the semi-confining layers' properties - vertical hydraulic conductivities P Z and thicknesses E P - deal with the upper layer mesh facing the aquifer mesh. When no upper aquifer (labelled K-1) is facing the Kth aquifer, the

corresponding P Z and E P values are set to zero on the input data deck. The GABDATA subroutine provides convenient checks on the reliability of hydrodynamic input data with vertical aquifer connections and the location of lateral boundaries (and field interruptions). Due to the occurrence of low values of hydrodynamic parameters, corresponding input data are multiplied by the amplification factors F T M (transmissivities), FSM (storage coefficients) F P Z M (vertical hydraulic conductivities).

In the case of the GAB prototype, one must add to the initial heads H, the constant heads of the upper confining bed CB_1.

All variables are to be set to metric units.

3.1.4 Local field items co-ordinates

These items do not refer to the so-called field singularities which are considered, to some extent, more continuously distributed (along segment lines for example). They include -

- the well locations, KWELL, IWELL, JWELL
- the outcropping areas of CA_1 and CB_2 aquifer and semi-pervious beds (the CB_1 outcrops are computer generated).

The corresponding location indices, read by subroutine CØØRD 3 and CØØRD 2, are one-dimensional in order to save C.P.U. core storage.

3.1.5 Field singularities items, aquifer 1 (water-table) only

These deal mainly with rivers (or lakes), although future more sophisticated versions of GABSIM could take into account other singularities (Ungemach, 1974) based on future knowledge.

The river input data, held by the subroutine SINGUL, consists of river names, locations, number of meshes per river, and initial heads.

The river meshes are ordered increasingly from north to south (Fig. 17). For a given river, mesh location (I, J,) indices and initial heads are one-dimensional.

3.1.6 Lateral boundaries

The lateral boundary meshes to which a time-variant law is assigned are processed by subroutine C L I M which reads for each aquifer labelled K:

- the number of distinct time-variant head laws NLV (K);
- the starting (NLD) and ending (NLF) meshes, ordered clockwise, between which the same head law applies (including the extreme mesh values).

An example is provided in Figure 18.

3.1.7 Check bores

In order to check the model results (in terms of computed aquifer heads) during the calibration stage, available information relating to steady-state head values and historical records (head time series) on given field locations (the so-called check bores) is scanned by subroutines CØNTR3 and MATCH3.

CØNTR3 refers to the steady-state check-bore figures (names, location indices (I,J,K), measured heads and zero elevations).

MATCH3 deals with the non-steady-state check-bore characteristics (names, location indices, head-time series and zero elevations). All the head-time records have the same length, equal to the total simulation period, whatever the length of the observed record; outside the available observation range, the head values are set to zero. The time sampling is completed on a yearly basis, leading to NSTEP single head values per bore. If the observation time sampling appears to be erratic or non-equidistant, appropriate interpolations should be made.

3.2 Computing item

3.2.1 Preliminary calculations

(a) Search of aquifer row sweeping and vertical aquifer connection indices (Subroutine GEØMMC)

For each aquifer (indexed K) subroutine GEØMMC searches:

- the extreme row indices IDEB(K) and IFIN(K) bounding the aquifer;
- for each row, in between IDEB(K) and IFIN(K), the 'active' starting and ending column indices JD (I,K,) and JF (I,K,);
- the upper (KAQSUP(I,J,K) and lower (KAQINF(I,J,K,)) aquifer connections.

These indices, deduced from the field description index KFIELD (I,J,K), are somewhat redundant, but save an appreciable amount of computing time in solving the linear set of F.D.E. by obviating numerous mesh-location checks.

(b) Generation of the lateral boundary location indices (subroutine CØØRBØ)

For each aquifer subroutine, CØØRBØ yields, by scanning the field description index (KFIELD (I,F,K,)) the locations of the lateral boundary meshes ILIM (K,L,) and JLIM (K,L,). The meshes are ordered clockwise, starting from the first mesh encountered in row sweeping (Fig. 18).

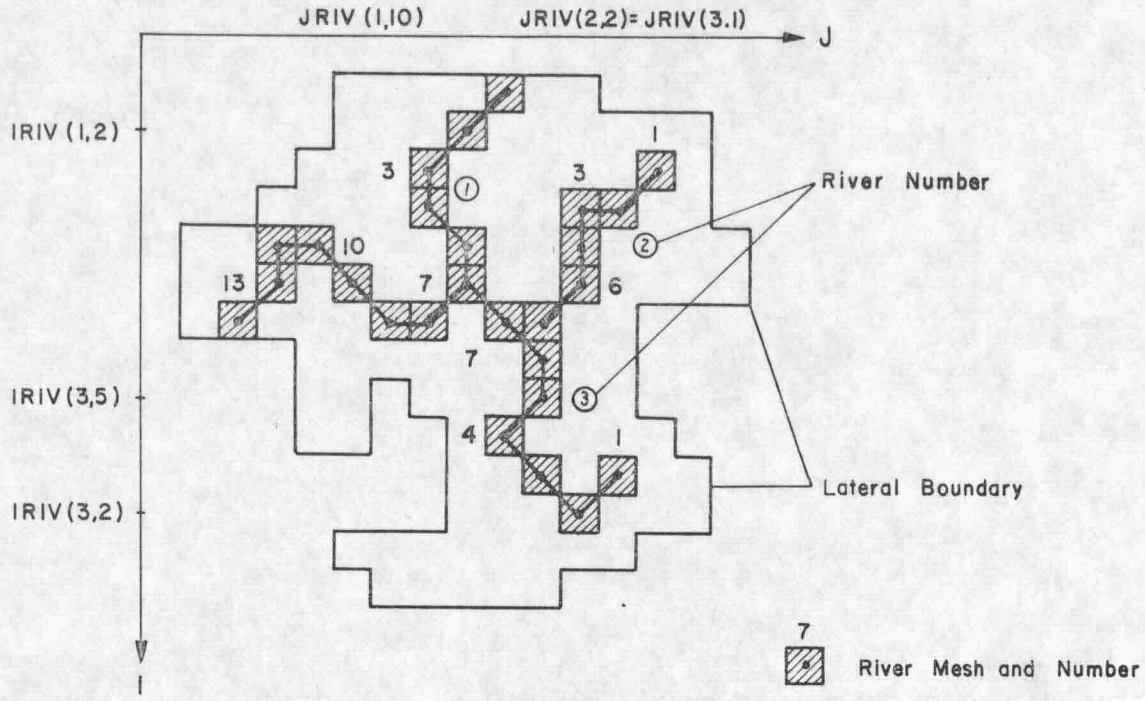


Fig. 17 River location indices

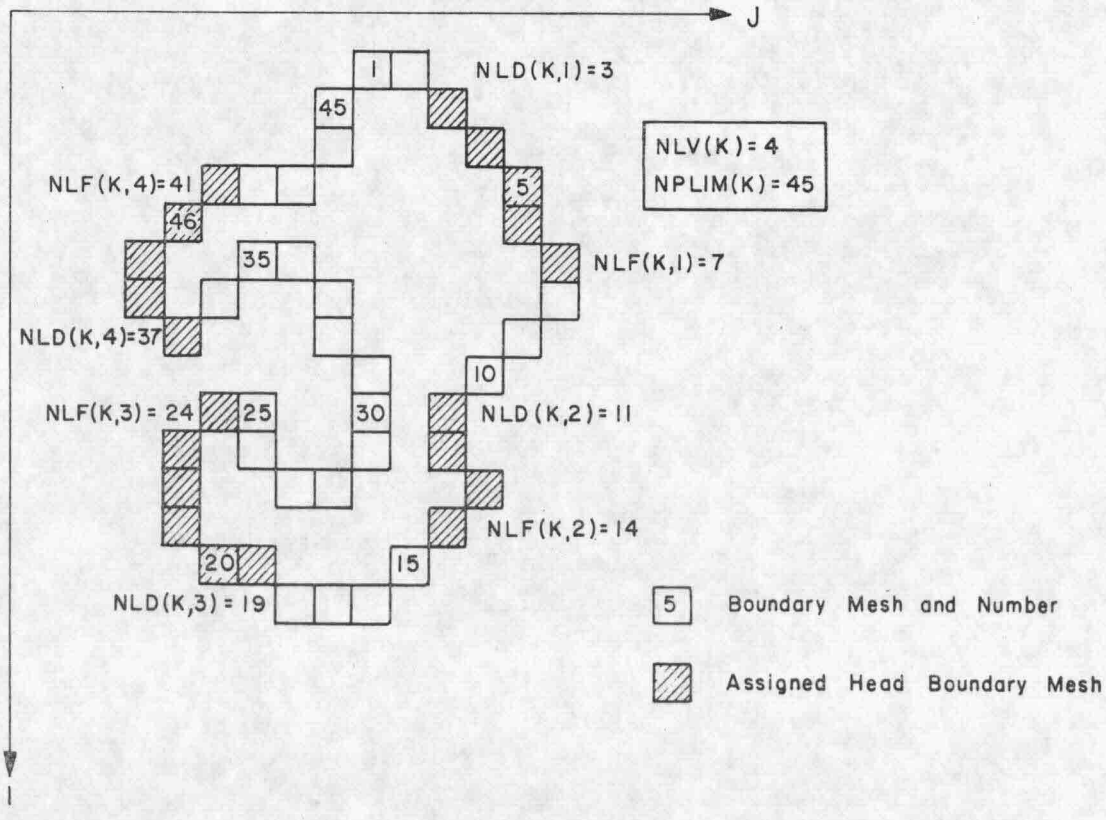


Fig. 18 Lateral boundry location indices

The knowledge of these location indices is indispensable for viewing lateral boundary inflow and outflow calculations (subroutine DEBLA), as well as heads allocations.

(c) Generation of directional transmissivities (subroutine TDIRMC)

Due to the reservoir heterogeneties one must deal with a transmissivity tensor reduced to its main components Txx and Tyy, assuming collinearity with the reference axes OX, OY - (basic assumption made while deriving Finite Difference approximations).

The main directional T values, may be deduced from individual T mesh values by two different means (given uniform grid spacing):

Arithmetic mean

$$Txx = TE\ (I,J,K) = \tfrac{1}{2}\left[T\ (I,J,K) + T\ (I,J+1,K)\right]$$
$$Tyy = TS\ (I,J,K) = \tfrac{1}{2}\left[T\ (I,J,K) + T\ (I+1,J,K)\right]$$

Harmonic mean

$$Txx = TE\ (I,J,K) = 2\,\frac{T\ (I,J,K) \times T\ (I,J+1,K)}{T\ (I,J,K) + T\ (I,J+1,K)}$$

$$Tyy = TS\ (I,J,K) = 2\,\frac{T\ (I,J,K) \times T\ (I+1,J,K)}{T\ (I,J,K) + T\ (I+1,J,K)}$$

The harmonic mean is recommended, because it is more sensitive to the contrasts in heterogeneities and automatically assigns a zero value to the directional transmissivity in the vicinity of an impervious mesh.

The option chosen is stated in the TDIRMC calling instruction through the correct index.

3.2.2 Solving the linear set of F.D.E

The F.D.E. written in its general form of Equations 34 to 36 (Section 1.3) over the N 'active meshes' of the discretized field (e.g. located within the boundaries and excluding field singularities and interruptions) leads:

- to a set of N explicit equations if the time-space discretization stated is explicit (TETA = 0)
- to a linear system of N simultaneous 7-point equations when the time-space discretization made is either implicit or half implicit ($0 < TETA \leq 1$)

all of which are solved by sub-program PSØRMC.

PSØRMC handles any type of boundary shape, vertical aquifer connections and field singularities assessed as head conditions.

Both steady and non-steady-state flows, identified through the integer formal parameter IREG, are processed by PSØRMC (steady-state calculations necessitate a totally implicit scheme).

Dealing with non-steady-state flow, the discretization mode, ranging from explicit to half-implicit type, is selected by setting the argument TETA (weighting coefficient of F.D.E.) to a value between 0 and 1 according to Equation 36.

Implicit, CRANK-NICOLSON, and Implicit-Explicit-derived F.D.E.s are solved by the Point-Successive Over-Relaxation Procedure (PSØR), the algorithm outlined in section 1.3 (see Table 2) and Young (1961). The first iterations are run with the GAUSS-SEIDEL algorithm (e.g. SOR factor equal to 1) allowing a faster convergence for asymptotic regimes not requiring more than one or two iterations. For all NMAX iterations (usually included between 5 and 10) the optimum SOR factor, RØ, is computed by the modified CARRE algorithm by Subroutine CARRE. In order to avoid excess computation the maximum number of iterations NITER (equal to 50 for non-steady state flow and to 100 for steady state) is transmitted as an input argument. The accuracy of the iterative process can be checked either by maximum or 'average' point error criteria specified by the index IERR. As soon as the error check satifies the required point accuracy, ERROR, the iterations are stopped.

PSØRMC can also process the three multilayered scheme regarding upper water table conditions, summarized in Fig. 11 (index ISCHEM).

Convenient print-outs, allowing control of the computing progress are assumed by PSØRMC and CARRE, for which flow charts are described in Figures 20, 21, 22, and 23.

Figure 20 provides the reader with the basic computation sequence used in iterative processes.

Figure 21 supplies a detailed illustrated and annotated flow chart of the entire process.

Figure 22 sketches the automatic search of an aquifer mesh and considers the following three cases regarding its upper connection:

- the aquifer is outcropping
- the aquifer is connected to an overlying outcropping aquitard
- the aquifer is connected to an overlying confined aquifer

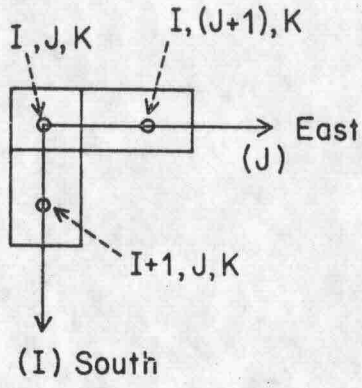


Fig. 19 Directional transmissivity convention

Numbered steps explained in text

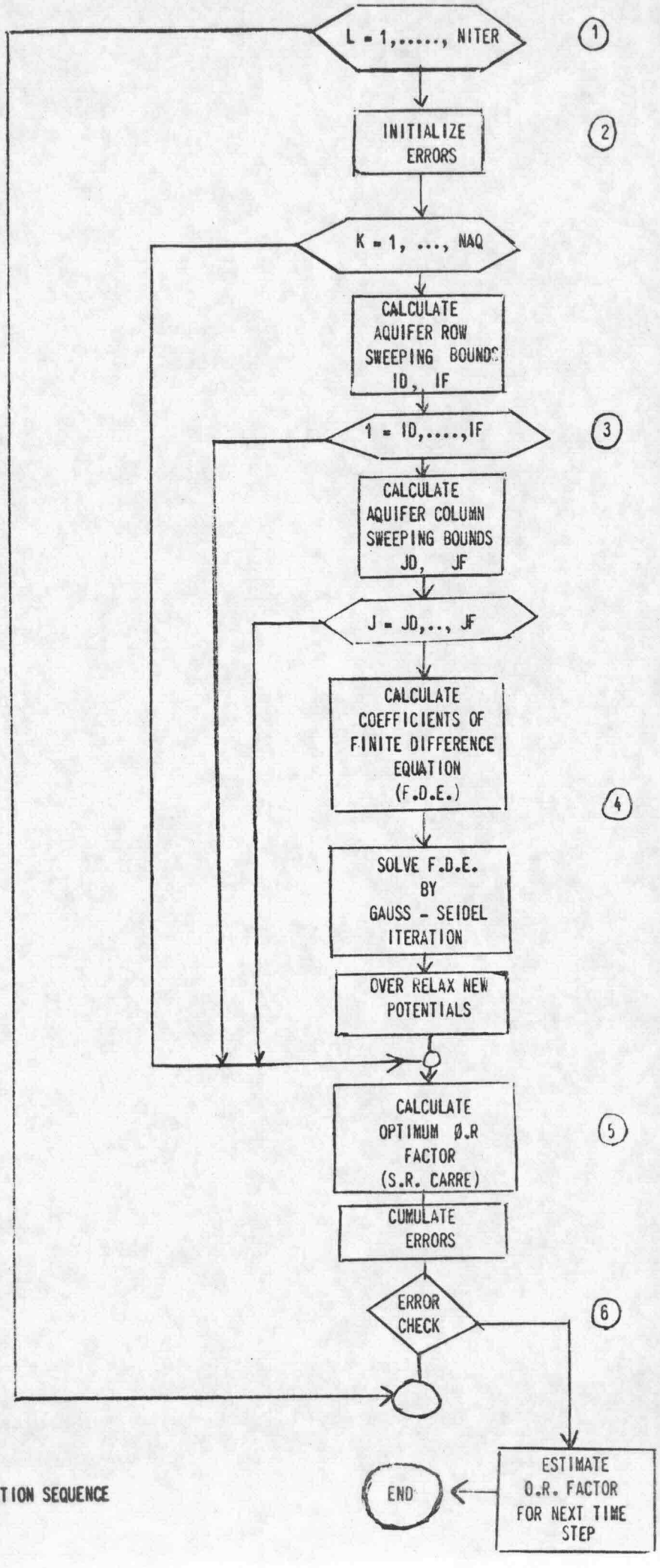


FIG. 20. SCHEMATIC OVER-RELAXATION SEQUENCE

MAIN PSØRMC SEQUENCE (Fig. 20)

1. Start (and increment) iterations

2. Initialize error routines

3. Sweep the field active meshes

4. Solve the Head Linear System by
   - calculating on each mesh the coefficients of F.D.E. (co-diagonal, diagonal, second member)
   - performing the Gauss-Seidel Iteration
   - over-relaxing new heads

5. Calculate the next estimate of Ø.R. factor (S/P CARRE)

6. Check the error in order to stop (eventually) the iteration process (before it reaches the maximum NITER iterations allocated in input)

Fig. 21.PSØRMC flow chart.

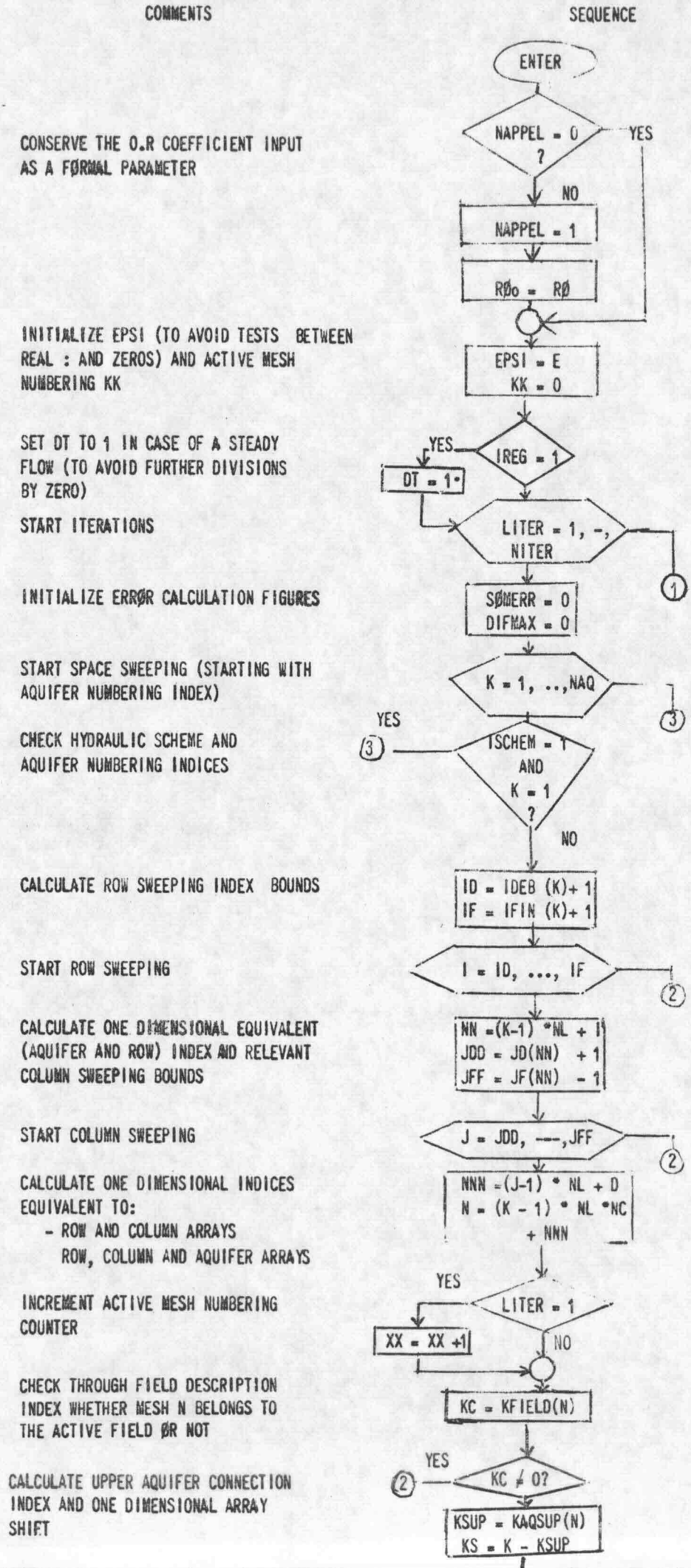


Fig.21. PSØRMC flow chart (contd.)

CHECK IF UPPER CONNECTION INDEX IS CORRECT. IF NOT SET ARRAY SHIFT INDEX KS TO ZERO.

CHECK IF MESH N IS UPPER CONNECTED. IF NOT SET AQUITARD THICKNESS TO 1. (TO AVOID DIVIDE CHECKS).

CALCULATE LOWER AQUIFER CONNECTION. IF MESH N BELONGS TO THE LAST AQUIFER SET RELEVANT INDEX TO ZERO.

CALCULATE THE ARRAY SHIFTING INDEX RELEVANT TO THE LOWER AQUIFER CONNECTION CHECK IF LOWER AQUIFER CONNECTION IS CONSISTANT. IF NOT SET SHIFTING INDEX TO ZERO.

CALCULATE UPPER AND LOWER AQUITARD THICKNESSES

CHECK IF CONFINING AQUITARD THICKNESSES ARE NON ZERO. IF NIL VALUES APPEAR MOVE TO NEXT MESH

CALCULATE THE DUMMY VARIABLES DEALING WITH THE OCCURRENCE OF EITHER AN OUT-CROPPING BED OR AN UPPER CONNECTION TO THE WATER TABLE AQUIFER (AQUITARD)

CHECK VALUE OF THE HYDRODYNAMIC SCHEME DESCRIPTION INDEX. IF DIFFERENT FROM 1 SET IPHY2 to 1.

CALCULATE

ASSIGN DUMMY HEAD VARIABLES (INITIAL AND FINAL) ON CALCULATED AND PLANAR ADJACENT MESHES.

ASSIGN INITIAL AND FINAL UPWARD DUMMY HEADS

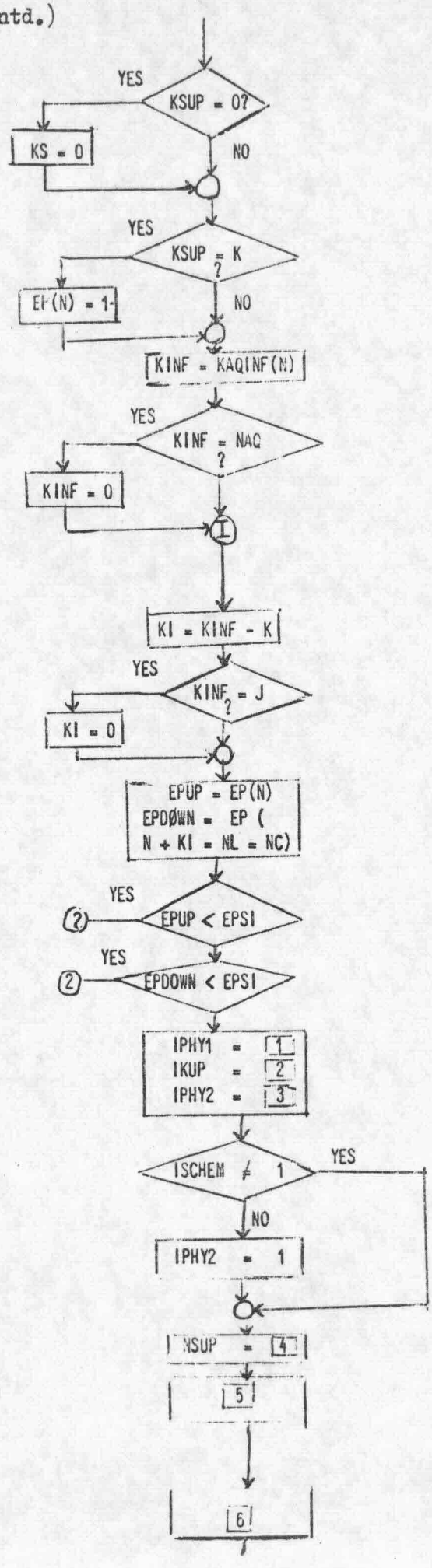


Fig.21. PSØRMC flow chart (contd.)

ASSIGN DUMMY HYDRAULIC PARAMETERS (DIRECTIONAL TRANSMISSIVITIES, STORAGE COEFFICIENT AND AQUITARD LEAKY ARTESIAN FACTORS).

CALCULATE COEFFICIENTS OF FINITE DIFFERENCE EQUATION (F.D.E.)

CHECK IF DIAGONAL TERM OF F.D.E. IS NON ZERO. IF NOT MOVE TO NEXT MESH

SOLVE F.D.E. BY USING GAUSS-SEIDEL ITERATION

CALCULATE DIFFERENCES IN HEADS BETWEEN TWO SUCCESSIVE ITERATIONS

CHECK THE DISCRETISATION MODE SELECTED (INPUT AS A FORMAL PARAMETER)

CALCULATE THE EXPLICIT SOLUTION

CALCULATE (ON ONE ITERATION) THE CUMULATED ERRØR

CALCULATE THE MAXIMUM ERRØR RELATING TO A SINGLE MESH

CALCULATE THE IMPLICIT (OR IMPLICIT -EXPLICIT) SOLUTION BY OVER RELAXING HEADS

END OF FIELD SWEEPING

CHECK NATURE OF DISCRETISATION NODE SELECTED IN INPUT
IF EXPLICIT RETURN TO MAIN
IF NOT EVALUATE THE OPTIMUM O.R. COEFFICIENT THROUGH SUBROUTINE CARRE

CALCULATE AVERAGE MESH ERROR

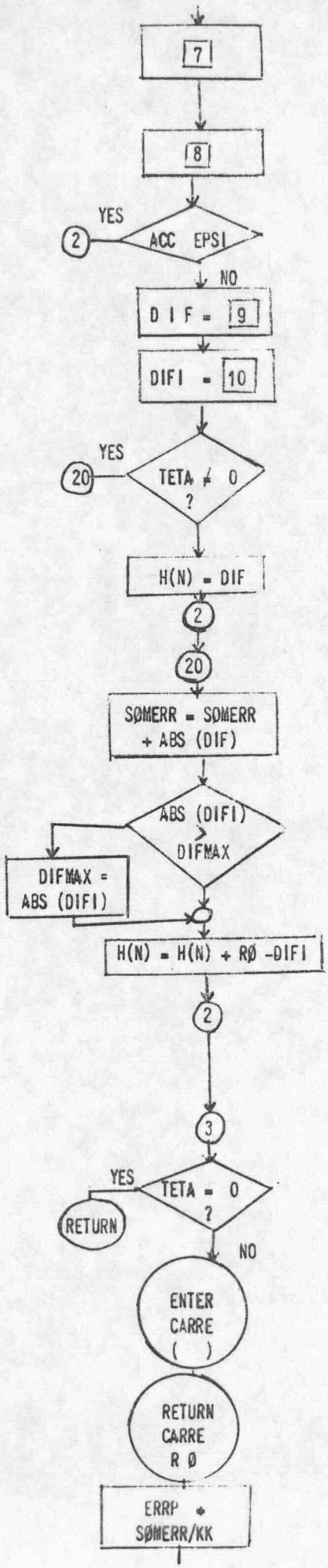


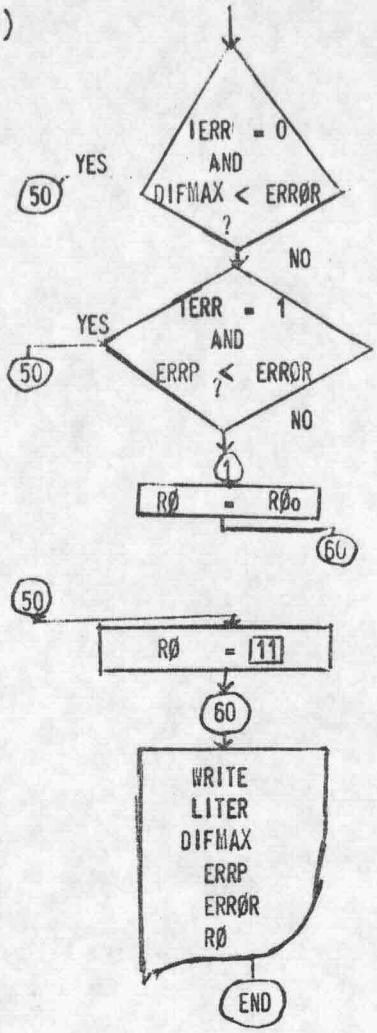
Fig.21. PSØRMC flow chart (contd.)

CHECK ERROR BOUNDS EITHER FOR A MAXIMUM POINT ERRØR OR AN AVERAGE POINT ERRØR CRITERION

END OF ITERATIONS
STORE LAST VALUE OF O.R. FACTOR

RE-ESTIMATE O.R. FACTOR FOR NEXT TIME STEP

PRINTOUT (ON LINE PRINTER) OVER RELAXATION FIGURES



```
1       IPHY1 = (KSUP - K + 1000) / (IABS (KSUP - K) + 1000)

2.      IKUP = KSUP - (10 + K)

3       IPHY2 = (IKUP + 1000) / (IABS (IKUP) + 1000)

4       NSUP = (1 - IPHY1) * KS * NL * NC

        HCENT = H (N)
        HØCENT = HO(N)
        HNØRTH = H (N-1)
        HSØUTH =(HN + 1)
        HWEST = H(N - NL)
5       HEAST = H(N + NL)
        HON   = HO (N - 1)
        HOS   = HO (N + 1)
        HOW   = HO (N - NL)
        HOE   = HO (N + NL)
        HINF  = H (N + KI * NL * NC)
        HOB   = HO (N + KI * NL * NC)

6       HSUP  = (1 - IPHY2) * H(N - NSUP) + IPHT2 * HCB (NNN)
        HINF  = (I - IPHY2) * HO(N-NSUP) + IPHY2 * HCB  (NNN)

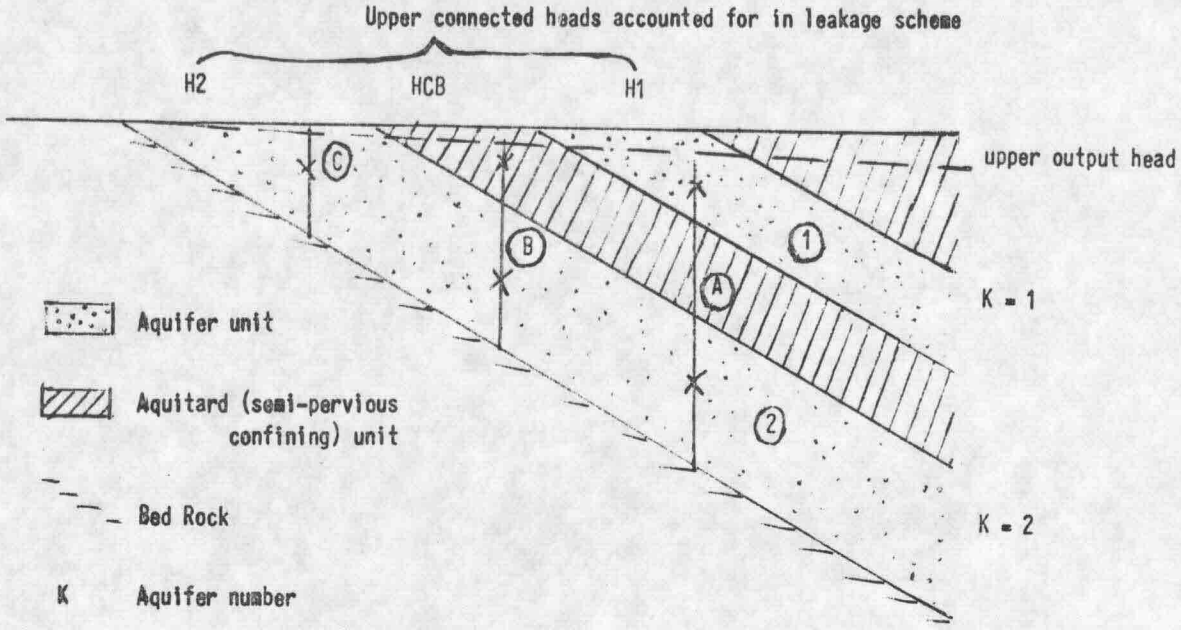
        TNØRTH = TS (N-1)
        TSØUTH = TS (N)
        TWEST  = TE (N-NL)
        TEAST  = TE (N)
7       SCENT  = S(N)
        QCENT  = Q(N)
        PZUP   = PZ(N)
        PZDØWN = PZ (N + KI * NL * NC)
        PZLSUP = PZUP/EPUP
        PZLINF = PZDØWN / EPDØWN

        AS = - TSØUTH * DX/DY
        AN = - TNØRTH * DX/DY
        AE = - TEAST * DY/DX
        AW = - TWEST * DY/DX
8       AB = - PZLINF * DX * DY
        AT = = PZLSUP * DX * DY
        SIGD = AS + AN + AE + AW + AB + AT
        AC = SCENT * (1 - IREG) * DX*DY/DT - TETA * SIGD
        SIG = AS * HØS + AN * HØN + AE * HØE + AW * HØW + AB* HOB +AT *HOT -
                  SIGD * HØCENT
        B = SCENT * ( 1 - IREG) * DX * DY*HØCENT/DT - QCENT + (1. - TETA)
                  * SIG

9       DIF = (B - TETA * (AN * HNØRTH + AS*HSØUTH + AW * HWEST + AE *
                    HEAST + AB * HINF + AT * HSUP1)/ AC

10      DIFI = DIF - HCENT

11      RØ = AMAX1 (1., RØ - 0.25 * ABS (2.-2 RØ ) )
```



Schematic cross-sectional view

$$IPHY1 = \frac{KSUP - K + 1000}{|KSUP - K1 + 1000|} = \begin{cases} 1 & KSUP \geq K \\ 0 & KSUP < K \end{cases}$$

$$IKUP = KSUP - 10 + K \qquad \begin{cases} > 0 & KSUP > 10 \\ < 0 & KSUP < 10 \end{cases}$$

$$IPHY2 = \frac{IKUP + 1000}{|IKUP| + 1000} = \begin{cases} 1 & IKUP > 0 \\ 0 & IKUP < 0 \end{cases}$$

$$NSUP = (1 - IPHY1) * KS * NL * NC = \begin{cases} 0 & IPHY1 = 1 \\ KS * NL * NC & IPHY1 = 0 \end{cases}$$

$$HSUP = (1 - IPHY2) * H(N-NSUP) + IPHY2 * HCB(NNN) = \begin{cases} HCB(NNN) & IPHY2 = 1 \\ H(N-NSUP) & IPHY2 = 0 \end{cases}$$

Case A = upper aquifer connection

Case B = upper (outcropping) aquitard connection

Case C = outcropping aquifer (no upward connection)

Note: Locations are input through upper aquifer field description index KSUP (for further details dealing with the generation of KSUP refer to Appendix 1).

Fig.22.Key to automatic handling of aquifer upper connection.

PSØRMC is available in two options: Option 1 deals with the exhaustive GABSIM package which does not account for any core-saving constraint (see listing attached in Appendix 2); Option 2 refers to the abbreviated version of GABSIM in which previous field description indices KFIELD, KAQSOP and KAQINF are concatenated in a single array KFIELD. Relevant aquifer upward and downward connections are thus to be decoded using the algorithm stated in Appendix 1, (see listing in Appendix 3). Directional transmissivities are also computed within the sub-program.

The handling of the outcrop situation is described in Appendix 1. The generation of the corresponding field description is operated in MAIN.

Figure 23 is a flow chart relevant to the calculation of the O.R. factor (S/P CARRE).

3.2.3 Water balance check

The water balance of the overall multilayered system can be written, one step at a time, the following way:

$$\sum_{K=1}^{NAQ} \sum_{i=1}^{N} (Q0 - Qf)_i = 0$$

with

NAQ = number of aquifers

N = number of flow components

Qo = initial flow

Qf = final flow

The main flow components include (non-restrictive list):

QB = lateral boundary in(out)flow

QL = vertical leakage flow

QF = field dis(re)charge

QAR = river-aquifer exchange flow

QS = release from storage

Adequate initial and final values of these items are computed by five routines (DEBLA (QB), LEAKAG (QL), FLUXES (QF), DEBRN (QAR), STØRAG (QS)), the total water balance loop being checked by subroutine BUDGET. It must be pointed out that these calculations provide the best check of the computational process with respect to the accuracy of the water balance and the physical reliability of the total and areal computed flow items. Consequently, intensive use and scanning of the results should be performed during the model calibration phase.

Additional comments:

a. Subroutine DEBLA

Four elementary cases, leading to the eight distinct boundary flows summarized in Figure 24, are to be considered regarding the location of a boundary mesh

1. KWEST = KFIELD (I,J-1,K) = 0 QB = QWEST
2. KEAST = KFIELD (I,J+1,K) = 0 QB = QEAST
3. KNORTH = KFIELD (I-1,J,K) = 0 QB = QNORTH
4. KSOUTH = KFIELD (I+1,J,K) = 0 QB = QSOUTH

b. Subroutine DEBRN

Figure 25 describes the cases to be distinguished in computing the exchange flow between aquifer and rivers. These cases realise a combination of the four basic direction flows described previously in DEBLA.

In calculating exchange flows we assume partial penetration of rivers, which occurrence is limited to the upper aquifer (k = 1).

In steady-stage flow, release from storage and distinction between initial and final flow vanishes.

3.3 Output item

The printout is performed exclusively on line printers.

The printout of model input data and computation results are, apart from miscellaneous writing instructions, undertaken by other routines, assumed by six specific sub-programs in terms of -

- Aquifer geometry figures (FRAMMC)
- Non-steady-state bore characteristics in a table and graph form (CHECK3)
- Graphs of one or two time-or-span-varying parameters (CURVE2)
- Numeric maps of one (IMPRE1) or two (IMPRE2) bi-dimensional arrays

(Note: IMPRE2 is to be used for directional arguments printing purposes, such as gradients, or directional transmissivities, or hydraulic conductivities)

- Symbolic maps of one bi-dimensional array (MAPXY)

IMPRE1, IMPRE2 and MAPXY printout, at adequate scale, uniformly square grid maps enabling superposition onto prototype field maps for matching purposes. The areas outside the simulated field are blank mapped, allowing easy identification of the boundary shape.

Sample output examples are attached in Appendix 6.

COMMENTS

CHECK ITERATION COUNTER

INITIALIZE ERRØRN

CHECK IF ERRØRN IS NON ZERO
IF NOT CARRE IS NOT REQUIRED (RESULTING GENERALLY FROM A FAILURE IN THE OVER RELAXATION PROCESS)

CALCULATE XNØRM WHICH MEASURES THE CONVERGENCE RATE

RESET ERRØRN

CHECK IF XNØRM IS NOW ZERO. IF NOT CAARE IS NOT REQUIRED

STORE 3 SUCCESSIVE VALUES OF THE ERRØR NORM

CHECK ITERATION COUNTER. IF THE NIT FREQUENCY IS REACHED EVALUATE O.R. FACTOR R Ø. IF NOT RETURN

CALCULATE XNØRM AS AN ARITHMETIC MEAN OF THE THREE LAST ESTIMATES

CHECK IF XNØR IS LOWER THAN UNITY IF NOT THE ITERATION PROCEDURE DOES NOT CONVERGE

CALCULATE DUMMY VARIABLE WK USED FOR R Ø ESTIMATE

CHECK SIGN OF WK. IF WK<0 MAKE A LOWER ESTIMATE OF PREVIOUSLY CALCULATED RØ. IF WK>0 APPLY STANDARD PROCEDURE

LOWER ESTIMATE OF R.Ø.

STANDARD PROCEDURE FOR RØ. ESTIMATE (SEE RELEVANT NOTE)

PRINT-OUT CARRE MAIN CALCULATION FIGURES

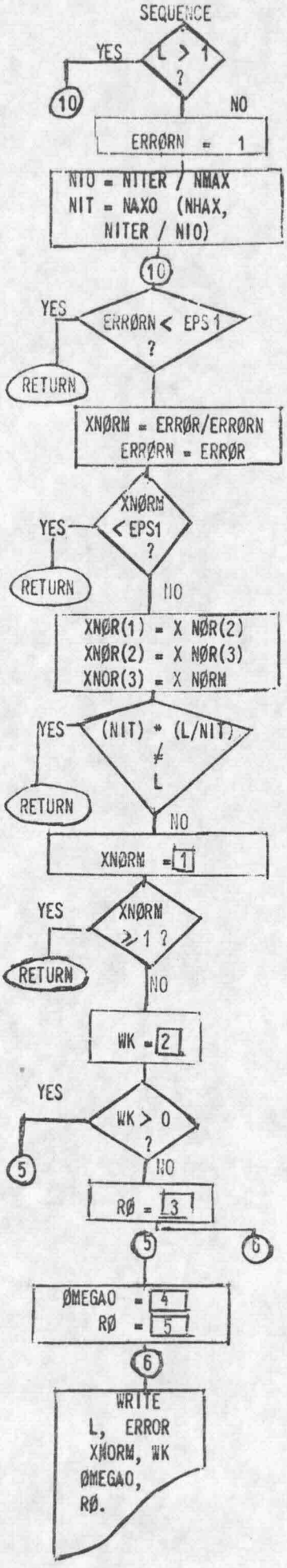
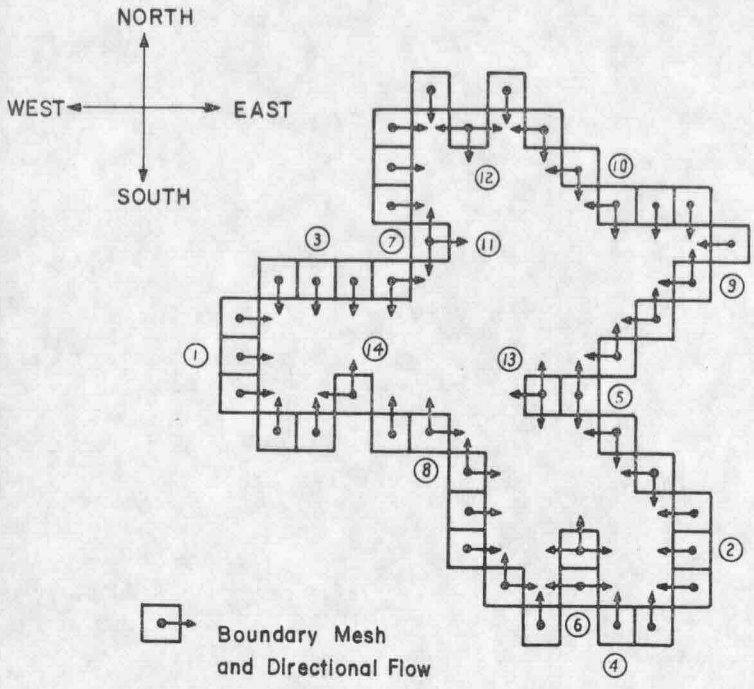


Fig.23. CARRE flow chart.

```
1       XNØRM = ( * NØR (1) + XNØR (2) + XNØR (3))/3.
2       WK = 1. - (XRØRM + RØ - 1.) ** 2 / (XRØRM * RØ ** 2)
3       RØ = RØ * 0.75
4       ØMEGA0 = 2. / (1 + SQRT (WK) )
5       RØ = ØMEGA0 - (2. - ØMEGA0) / 10
```



Edge Flows

① Q = QWEST
② Q = QEAST
③ Q = QNORTH
④ Q = QSOUTH

Corner Flows

⑦ Q = QSOUTH + QEAST
⑧ Q = QNORTH + QEAST
⑨ Q = QNORTH + QWEST
⑩ Q = QSOUTH + QWEST

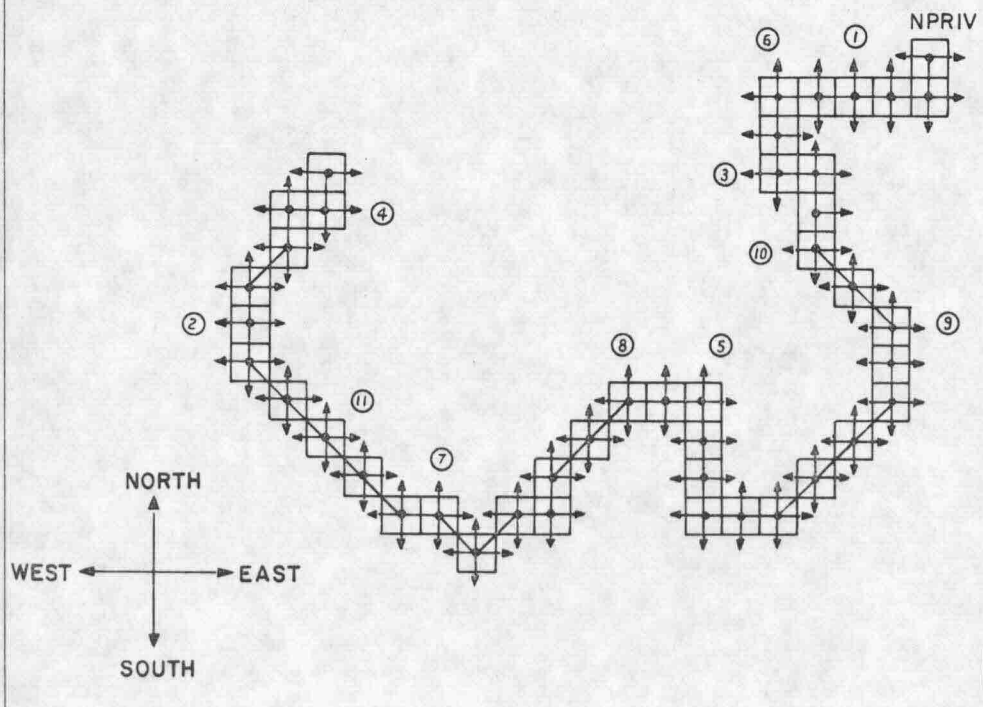
Intermediary Inlet Flows

⑤ Q = QNORTH + QSOUTH
⑥ Q = QWEST + QEAST

Terminal Inlet Flows

⑪ Q = QNORTH + QSOUTH + QEAST
⑫ Q = QWEST + QEAST + QSOUTH
⑬ Q = QNORTH + QSOUTH + QWEST
⑭ Q = QWEST + QEAST + QNORTH

Fig. 24 Lateral Boundary In(out) Flow



① Q = QNORTH − QSOUTH
② Q = QWEST + QEAST
③ Q = QWEST + QSOUTH
④ Q = QEAST + QSOUTH
⑤ Q = QEAST + QNORTH
⑥ Q = QWEST + QNORTH
⑦ Q = QNORTH + QSOUTH + QEAST
⑧ Q = QNORTH + QSOUTH + QWEST
⑨ Q = QNORTH + QWEST + QEAST
⑩ Q = QSOUTH + QWEST + QEAST
⑪ Q = QNORTH + QSOUTH + QEAST + QWEST

Fig. 25 River Aquifer Flow

BIBLIOGRAPHY

BOULTON, N.S., 1954 - Unsteady radial flow to a pumped well allowing delayed yield from storage. UN. Geoph. Geod. Int.,Inst. Ass. Sci. Hyd., Assembly Rome, 2, 472-477, Contrib. 37.

BREDEHOEFT, J.D. & PINDER, G.F., 1970 - Digital analysis of areal flow in multi-aquifer ground water system. A quasi three-dimensional model. Wat. Resources. Res., 6(3), 883-888.

CARRE, B.A., 1961 - The determination of the optimum accelerating factor for successive over-relaxation. Comp. J., 4, 73-78.

FRANÇON, J. & UNGEMACH, P., 1969 - Calcul du coefficient de surrelaxation optimal par l'algorithm de Carre Modifié. Applications a l'Hydrogeologie. Serv. Carte geol. Als. Lou. (Note interne).

FREEZE, R.A., & WITHERSPOON, P.A., 1968 - Theoretical analysis of regional ground water flow. Quantitative Interpretations. Wat. Resources Res., 4(3), 581-590.

HANTUSH, M.S. & JACOB, C.E., 1955 - Non-steady radial flow in an infinite leaky aquifer. Trans. Am. Geophys. Un, 36, 95-100.

HANTUSH, M.S., 1960 - Modification of the theory of leaky aquifers. J. Geophys. Res., 65,(11), 3713-25.

TÓTH, J., 1962 - A theory of groundwater motion in small drainage basins in Central Alberta, Canada. J. Geophys. Res., 67, 375-87.

UNGEMACH, P., 1974 - Simulation de Nappes d'Eau souterrains Outils, Methodes, Problemes - Applications aux Modeles de resources de Genie Civil et de Pollution. Thèse de Doctorat d'Etat, Universite Louis Pasteur, Strasbourg.

VARGA, R.S., 1962 - MATRIX ITERATIVE ANALYSIS. Englewoods Cliffs, N.J., Prentice Hall, 317.

YOUNG, D.M., 1961 - The numerical solution of elliptic and parabolic partial differential equations. In: MODERN MATHEMATICS FOR THE ENGINEER (2nd Series), New York, McGraw Hill.

ZIENKIEWICZ, O.C., 1967 - THE FINITE ELEMENT METHOD IN STRUCTURAL AND CONTINUUM MECHANICS. London, McGraw Hill, 372.

NOTATIONS

$AS_{i,j,k}$, $AE_{i,j,k}$, $AB_{i,j,k}$ ..... off-diagonal coefficients of the Finite Difference Equation (F.D.E.) of flow (L^2T^{-1})

$AC_{i,j,k}$ .....main diagonal coefficient of the F.D.E. (L^2T^{-1})

$B_{i,j,k}$ .....second member of the F.D.E. (L^3T^{-1})

$H_{(x,y,z,t)}$.....head of a main aquifer unit (L)

$H'_{(x,y,z,t)}$....head of a semi-previous confining layer (L)

$H_{o(x,y,z,o)}$....initial head

$\underline{\underline{K}}$ .....hydraulic conductivity tensor, of which the main components are* = K_{xx}, K_{yy}, K_{zz} (identified in the text as K_x, K_y, K_z)

$K(= K_x = K_y)$...horizontal hydraulic conductivity ($L\ T^{-1}$)

K_z .....vertical hydraulic conductivity of an aquifer ($L\ T^{-1}$)

K'_z .....vertical hydraulic conductivity of a confining layer ($L\ T^{-1}$)

Q_w .....well discharge flow rate ($L^3\ T^{-1}$)

S .....storage coefficient of an aquifer (dimensionless)

S_i .....specific storage coefficient of an aquifer $S_i = S/b$ (L^{-1})

S' .....storage coefficient of a confining layer

T .....transmissivity (L^2T^{-1})

T_E (T_{xx}) .....eastern directional transmissivity

T_S (T_{yy}) .....southern directional transmissivity

a^2 ($=S/T$) .....hydraulic diffusivity ($L^{-2}T$)

b .....aquifer thickness (L)

b' .....semi-pervious confining-layer thickness (L)

i(ox), j(oy), k(oz) .....discretization location indices

p .....iteration counter

q .....field point singularity flow ($L^3\ T^{-1}$)

ql .....leakage flow rate to (or out of) an aquifer ($L^3\ T^{-1}$)

$ql = ql_{up} + ql_{down}$

---

* While developing the flow equations the co-ordinate axes ox, oy, oz, are assumed to be colinear to the main components of the hydraulic conductivity (and transmissibility) tensor.

Notations (Continued)

ql .....ql_{up} , ql_{down}(upwards and downwards leakage rates)

q_d .....Boulton delayed yield ($L^3\ T^{-1}$)

$s\ (x, y, z, t) = H\ (x, y, z, t) - H\ (x,y,z,o)$.....drawdown (L)

t .....time (T)

x, y, z .....space co-ordinates

$\Delta x, \Delta y, \Delta z$ .....space discretization increments (L)

Δt .....time discretization increments (T)

α .....recession co-efficient (occurring in the BOULTON delayed yield formulae (T^{-1})

μ .....spectral radius of the Over-relaxation Iteration Matrix

λ .....spectral radius of the GAUSS-SEIDEL Iteration Matrix

∇ .....Nabla operator, whose components are: $\begin{cases} \delta/\delta x \\ \delta/\delta y \\ \delta/\delta z \end{cases}$

σ .....Elementary area (L^2)

τ .....Time integration variable (T)

Θ .....Time discretization weighting factor

APPENDIX 1. Modifications made to GABSIM as a result of operational runs

The unexpected shortage of core (less than 70K decimal 60 bytes words available for operative use) led to important changes in the initial design of GABSIM in terms of model organization, programming and use. Obviously these alterations reduce significantly most of GABSIM's original capabilities, regarding its versatility, speed and flexibility to users. In the process most of the advantages allowed by use of large computers have vanished. As a measure of this upset we consider that the calibration stage has been slowed down at least to twice its expected length, apart from the now familiar computer software and hardware breakdown.

In addition to summarizing the main modifications to GABSIM, Appendix 1 provides the user, with the necessary guide lines in order to operate the model.

It must be pointed out that, especially in the array-reducing process, we were trying to avoid direct access procedures in the computing stage.

Organization of the model

We deal only with the GABSIM option handling the particular GAB features, i.e. the redundant sub-progrograms, SINGUL, CLIM, DEBRN, LIMVA, VARSIN, and CHECK3 are excluded.

The first step consisted of suppressing dispensable routines such as CØØRD2, CØNTRØ3, MATCH3, MATCH3, CØØRBØ, TDIRMC (arrays TE, TS - see below - being eliminated) DEBLA3, LEAKAG, FLUXES, STØRAG, BUDGET (the water balance analysis is to be worked separately), FRAMMC, IMPRE2, MAPXY. The subroutine GEØMMC (to be run separately for the calculation of upper and lower aquifer connection indices. KAQSUP and KAQSNT to be concatenated finally to KFIELD) was replaced by GEØMC2 which computes solely the row-sweeping indices JD, JF, IDEB, IFIN).

The second step led to the splitting of the main items of the model into specific programs (steady-state, non-steady-state, water balance, etc..).

As a result, the five main steps, namely

- Preliminary calculations (necessarily, for the time being, performed by GEØMMC)
- Check (through the water balance spectral and global figures) the reliability of inputed and/or computed arrays
- Steady-state calculations
- Transient-state calculations
- Sophisticated printouts

are to be run separately by distinct programs instead of using a single deck enabling the selection of the desired processing sequence by setting the option index to the adequate value.

These steps and the resulting skeleton are summarised in the trees and strings of Figure A1.

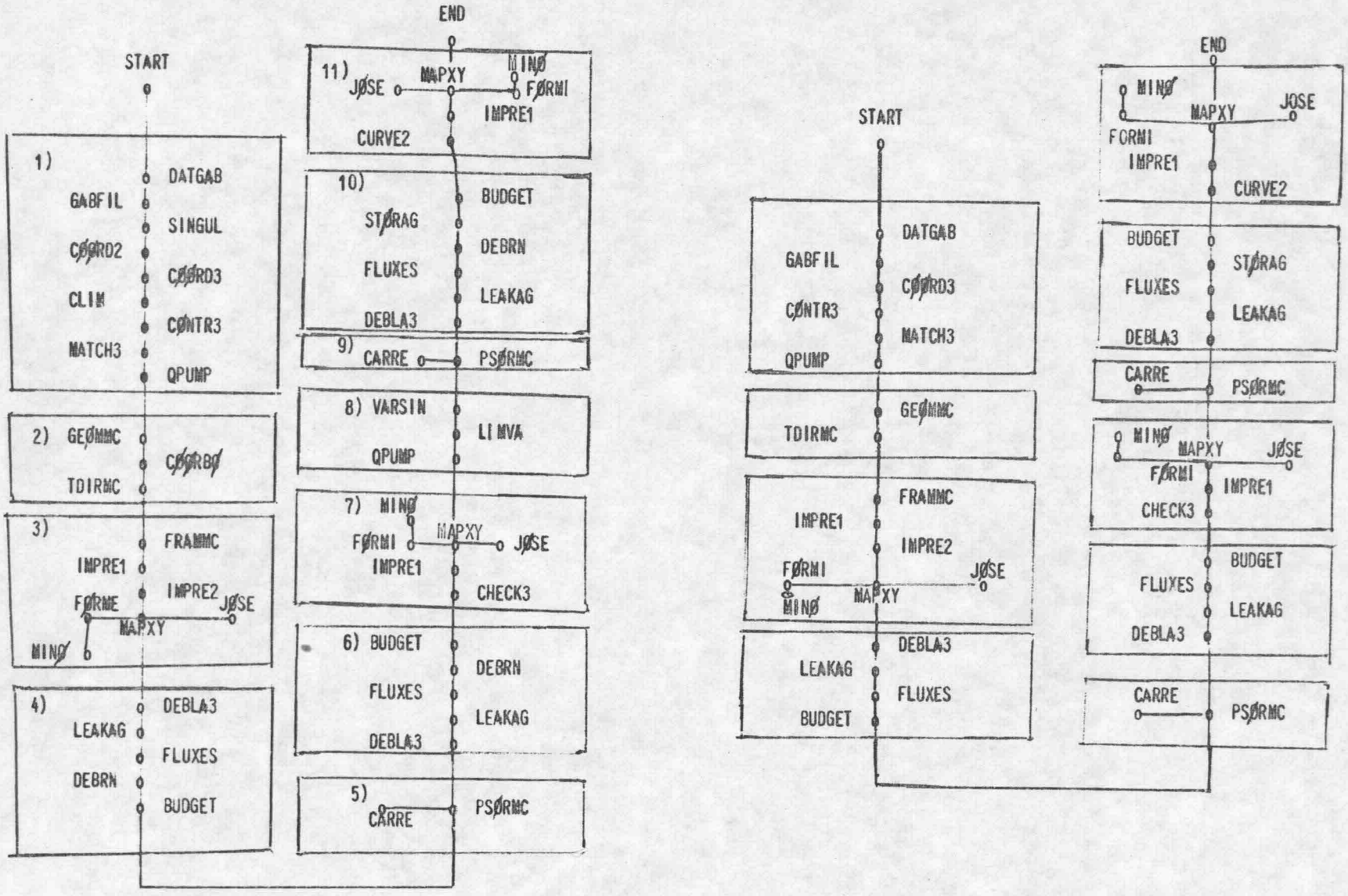
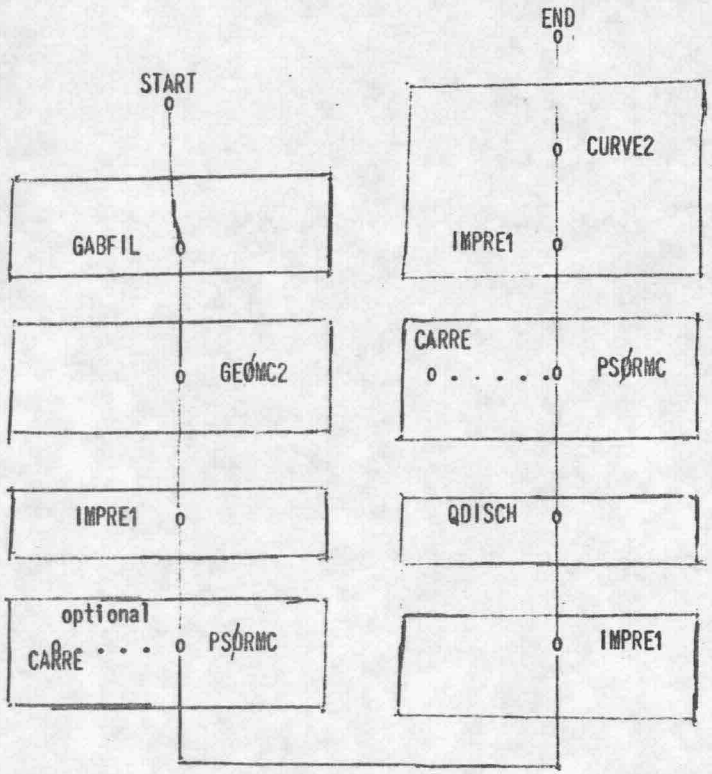


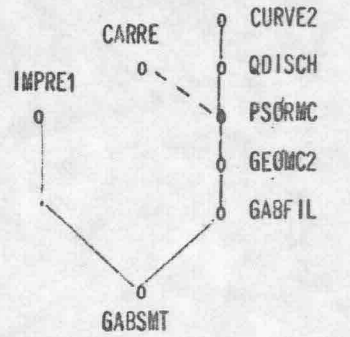
Fig. A1. GABSIM STRINGS.



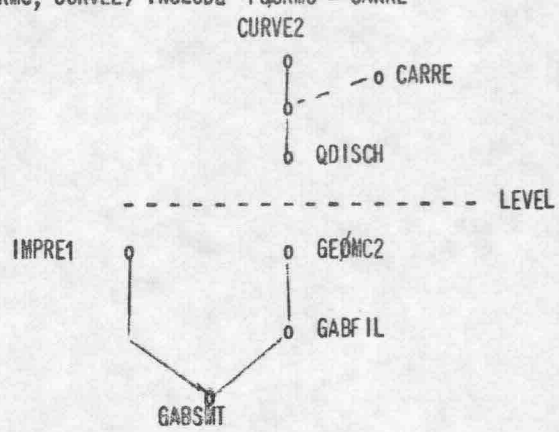
c— 2nd. modified version (unsteady state).

Fig. A 1. G A B S I M STRINGS (cont'd.)

MAIN TREE GABSMT- IMPRE1 - (GABFIL, GEØMC2 , PSØRMC, QDISCH, CURVE2)
INCLUDE PSØRMC CARRE (OPTIONAL)
END



MAIN TREE GABSMT, IMPRE1- (GABFIL, GEØMC2)
LEVEL
TWO TREE QDISCH - (PSØRMC, CURVE2) INCLUDE PSØRMC - CARRE
END



Two suggested segmentations for processing of (non) steady, GABSIM model (organization of trees (strings) and corresponding segmentation directives (TREE, INCLUDE, LEVEL. . . .) are subject to alterations regarding system or model organization modifcations).

d – Segmentation sequences relevant to option C.

Reduction of arrays (for explanation of array names see Appendix 4)

Once the (over) simplification of GABSIM organization was completed by the suppression of the subroutines (and the related arrays and formal parameters) mentioned previously, a significant amount of storage was saved by array reduction. This reduction was performed by suppression and concatenation.

Suppression

Arrays TE and TS (eastwards and southwards directional transmissivities) are suppressed by the elimination of routine TDIRMC, and recalculated from the node value T when necessary (for instance in PSØRMC) within the corresponding program or sub-program sequences.

The dummy printing array XMAP is suppressed and replaced by the water table potentiometry array HCB. This short cut naturally requires regeneration of HCB when implied in calculations following the print-out sequence, through READ (preceded by a pointer instruction referring to the location of HCB within the input file) and REWIND statements.

Concatenation (and/or merging)

The following input arrays were concatenated:

- KFIELD, KAQSUP, KAQINF.

  (KAQSUP, KAQINF are calculated apart from MAIN, in a preliminary program using GEØMMC)

- IJØCB1 : IØCCB1 - JØCCB1
- IJØCB2 : IØCCB2 - JØCCB2
- IJKWEL : IWELL - JWELL - KWELL
- IJKCP : ICP - JCP - KCP

The generation and decoding of resulting arrays is outlined in the FORTRAN instructions listed in Figure A2.

Further 'improvement' in array-reduction could be performed by concatenation (and/or merging) of such arrays as T - S, PZ - EP, but the advantages are off-set by increased computing time.

Generation of the upper aquifer connection index: when the aquifer is overlain by an outcropping aquitard, the relevant description index KAQSUP is generated as outlined in Figure A3.

Miscellaneous

GABSIM input data consist of one single permanent disc file resulting from the concatenation of parameter permanent disc subfiles,

Generation

```
      DØ a L = 1,N
      ISUM = 0
      DO  b LL = 1, NARRAY
      LLL = NARRAY - LL
b     ISUM = ISUM + IARIN (LL)* 100* LLL
      IAROUT(L) = ISUM
a     CØNTINUE
```

Play-back Decoding

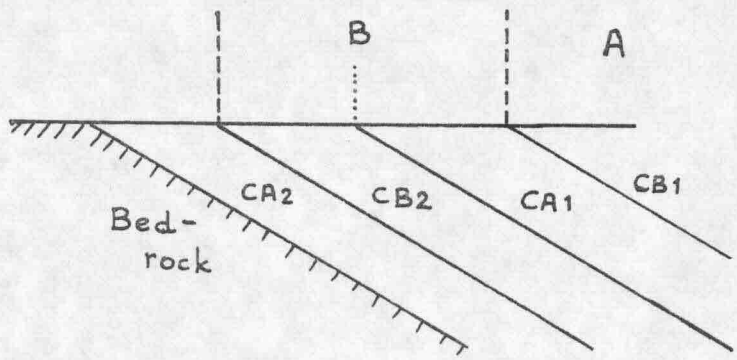
```
      DØ a L = 1,N
      ISUM = 0
      IARIN(1) = IARØUT (L)/(100 ** (NARRAY -1))
      DØ  b  LL = 2, NARRAY
      LLL = NARRAY - LL + 1
      ISUM = ISUM + IARIN(LL-1) * 100 ** LLL
b     IARIN(LL) = (IARØUT(L) - ISUM)/(100**(LLL-1))
      Further calculations using IARIN(LL)
      a  CØNTINUE
```

KEY

N	=	Dimension of arrays
NARRAY	=	number of arrays to be concatenated
IARIN	=	array to be concatenated
IARØUT	=	concatenated array

Note: - for simplification purposes, IARIN(LL) is assumed one dimensional, positive and formated I2.

Fig. A2. (De) concatenation Algorithm(s).



Case A: Aquifer CA_1
If CA_1 is overlain by CB_1, then KAQSUP (I_A, J_A, 1)= 1 0+ K = 11

Case B: Aquifer CA_2
If CA_2 is overlain by CB_2, then KAQSUP (I_B, J_B, 2)= 10 + K = 12

More generally -

KAQSUP (I,J,K,) = 10 + K

Provided the number of aquifers and working aquitards that may crop out remains less than 9.

Fig.A3. Key to outcrop location's through KAQSUP index.

separated from each other by the read-in format. The concatenated data file is designed as a card image file, the reading of which is performed by subroutine GABFIL. Though this procedure is constraining regarding the model calibration phase, it allows a significant reduction of core with respect to loader system routines. Further improvement could be expected by including the card reader loader in the data file, provided no data are to be read from punch cards.

Although the program organization is more relevant to a string than to a tree pattern, a reasonable amount of core (up to 2 or 3 K words) can be saved by implementing segmentation (rather than overlay) procedures for which several sketches are suggested in Fig.A1d.

APPENDIX 2.

PROGRAM AND SUB-PROGRAM LISTINGS

Appendix 2
PSØRMC
option 1

```
      SUBROUTINE PSORMC(H,H0,HC0,T,TS,S,PZ,EP,J,IDEB,IFIN,JD,JF,KFIELD,
     1KADSUP,KADINF,DX,DY,DT,RO,NITER,ERROR,NMAX,IREG,ISCHEM,IERR,TETA,N
     2L,NC,JAD)
      DIMENSION H(1),H0(1),HC0(1),T(1),TS(1),S(1),J(1),PZ(1),EP(1),KFIE
     1LD(1),KADSUP(1),KADINF(1),IDEB(1),IFIN(1),JD(1),JF(1)
      COMMON IN,IO
C
C          **PSORMC SOLVES THE SET OF LINEAR EQUATIONS DERIVED FR
C     OM THE DISCRETISATION (PERFORMED BY FINITE DIFFERENCES) OF THE FIN
C     E PARTIAL DIFFERENTIAL EQUATIONS IN A MULTILAYERED AQUIFER SYSTEM
C     UNDER HANTUSH LEAKY ARTESIAN AQUIFER ASSUMPTIONS,THE SOLVING TECHN
C     IC USED IS THE POINT SUCCESSIVE OVER-RELAXATION PROCEDURE THE OPTI
C     MUM O.R.FACTOR BEING COMPUTED THROUGH THE MODIFIED CARRE ALGORITHM
C               -RO IS THE O.R. FACTOR WHICH INITIAL VALUE IS SET TO RO0
C               -NITER IS THE MAXIMUM NUMBER OF ITERATIONS ALLOCATED
C               -ERROR IS THE ERROR TOLERATED FROM THE ITERATIVE PROCESS.
C                WHICH IS A MAXIMUM POINT ERROR IF  IERR=0 ,OR AN AVERAGE
C                POINT ERROR IF IERR=1
C               -NMAX IS THE NUMBER OF ITERATIONS AFTER WHICH WE COMPUTE
C                THE NEW VALUE OF THE O.R. FACTOR
C               -TETA IS A WEIGHTING FACTOR OF THE FINITE DIFFERENCE EQUAT
C                ION SET TO=
C                              0 (EXPLICIT SCHEME)
C                              1 (TOTALLY IMPLICIT SCHEME)
C                              0.5 (CRANK-NICOLSON IMPLICIT SCHEME)
C                              0<TETA<1 (IMPLICIT-EXPLICIT SCHEME)
C               -IREG DEFINES THE MOTION REGIME=
C                              1 MEANS A STEADY STATE MOTION
C                              0 MEANS A NON-STEADY STATE MOTION
C           -ISCHEM CHARACTERIZES THE HYDRODYNAMIC PICTURE CHOOSEN(FO
C            R FURTHER DETAILS REFER TO EXPLANATORY NOTE)
C
C          OTHER ARGUMENTS ARE DEFINED IN MAIN
C          SUBPROGRAMS CALLED=CARRE(CALCULATION OF OPTIMUM O.R. FACTOR)
C
C          **CONSERVATION OF THE EVALUATION OF THE O.R. FACTOR
C                    GIVEN IN INPUT**
C
      NAPPEL=0
      IF(NAPPEL.NE.0)GO TO 100
      NAPPEL=1
      RO0=RO
  100 CONTINUE
      IF(IREG.EQ.1)DT=1.
      XSUP=1000000000.*10000000.
      EPSI=1./XSUP
      KK=0
      DO 1 LITER=1,NITER
      SUMERR=0.
      DIFMAX=0.
      DO 3 K=1,NAD
      IF(ISCHEM.EQ.1.AND.K.EQ.1)GO TO 3
      IDEB=IDEB(K)+1
      IF=IFIN(K)-1
      DO 2 I=IDEB,IF
      NN=(K-1)*NL+I
      JDD=JD(NN)+1
      JFF=JF(NN)-1
      DO 2 J=JDD,JFF
      NNN=(J-1)*NL+I
      N=(K-1)*NL*NC+NNN
      KC=KFIELD(N)
      IF(KC.NE.0)GO TO 2
      IF(LITER.EQ.1)KK=KK+1
      KSUP=KADSUP(N)
      KS=K-KSUP
      IF(KSUP.EQ.0)KS=0
      IF(KSUP.EQ.K)EP(N)=1.
      IF(KSUP.EQ.K)PZ(N)=0.
      KINF=KADINF(N)
      IF(K.EQ.NAD)KINF=1
      KI=KINF-K
      IF(KINF.EQ.0)KI=0
      EPSUP=EP(N)
      EPSUM=S(NNN)*PZ(N)
      IF(EPSUP.LT.EPSI.OR.EPSUM.LT.EPSI)GO TO 2
      TPUX1=(KSUP+KI)*(J-1)*NL+I+(ABS(KSUP+K))*IDEB
      IKUP=KSUP-(10*K)
      TPUX2=(IKUP+IDEB)*(J-1)*NL+I+(ABS(IKUP))*IDEB
      IF(ISCHEM.EQ.1)TPUX1=-1
```

```
      IF(.ED.NAD)KT=KT-1
      KT=KTMP-K
      IF(KTMP.EQ.1)KT=0
      EPUP=EP(N)
      EPDWN=EP(N+KT*NL*NC)
      IF(EPUP.LT.EPST.OR.EPDWN.LT.EPSI)GO TO 2
      IPHY1=(KSUP-K+1000)/(1+ABS(KSUP-K))+1000)
      KUP=KSUP-(10+K)
      IPHY2=(IKUP+1000)/(1+ABS(1*KUP))+1000)
      IF(ISCHEM.EQ.1)IPHY2=1
      NSUP=(1-IPHY1)*KSX*NL*NC
      HCENT=H(N)
      HOCENT=HO(N)
      HNORTH=H(N-1)
      HSOUTH=H(N+1)
      HWEST=H(N-NL)
      HEAST=H(N+NL)
      HON=HO(N-1)
      HOS=HO(N+1)
      HOE=HO(N+NL)
      HOW=HO(N-NL)
      HOB=HO(N+KT*NL*NC)
      HOT=(1-IPHY2)*HO(N-NSUP)+IPHY2*HOB(NNN)
      HSUP=(1-IPHY2)*H(N-NSUP)+IPHY2*HOB(NNN)
      HTMP=HO(N+KT*NL*NC)
      TNORTH=TS(N-1)
      TSOUTH=TS(N)
      TWEST=TS(N-NL)
      TEAST=TS(N)
      SCENT=S(N)
      QCENT=Q(N)
      PZSUP=PZ(N)
      PZDWN=PZ(N+KT*NL*NC)
      PZLSUP=PZSUP/EPSUP
      IF(EPUP.LT.EPST)PZLSUP=0.
      PZLINF=PZDWN/EPDWN
      IF(K.EQ.NAD)PZLINF=0.
      IF(EPDWN.LT.EPSI)PZLINF=0.
      AS=-TSOUTH*DX/DY
      AN=-TNORTH*DX/DY
      AE=-TEAST*DY/DX
      AW=-TWEST*DY/DX
      AB=-PZLINF*DX*DY
      AT=-PZLSUP*DX*DY
      SIGD=AN+AS+AW+AE+AB+AT
      AC=SCENT*(1-IREG)*DX*DY/DT-TETA*SIGD
      SIG=AS*HOS+AN*HON+AC*HOC+AW*HOW+AB*HOB+AT*HOT-SIGD*HOCENT
      B=SCENT*(1-IREG)*DX*DY*HOCENT/DT-QCENT+(1.-TETA)*SIG
      IF(AC.LT.EPSI)GO TO 2
      DIF=(B-TETA*(AN*HNORTH+AS*HSOUTH+AW*HWEST+AE*HEAST+AB*HTMP+AT*HSUP
     1)/AC
      DIFI=DIF-HCENT
      IF(TETA.NE.0.)GO TO 20
      H(N)=DIF
      GO TO 2
   20 CONTINUE
      SOMERR=SOMERR+ABS(DIFI)
      IF(ABS(DIFI).GT.DIFMAX)DIFMAX=ABS(DIFI)
      H(N)=H(N)+RO*DIFI
    2 CONTINUE
    3 CONTINUE
      IF(TETA.NE.0.)CALL CARRE(RO,SOMERR,NITER,NMAX,ITER)
      IF(TETA.LT.EPSI)RETURN
      ERRR=SOMERR/KK
      IF(ERRR.EQ.0.AND.DIFMAX.LT.EPRTE)GO TO 50
      IF(IERR.EQ.1.AND.ERRR.LT.ERROR)GO TO 50
    1 CONTINUE
      RO=ROO
      GO TO 51
   50 CONTINUE
      RO=AMAX1(1.,RT-1.25*ABS(2.-RO))
   60 CONTINUE
      WRITE(IO,1000)ITER,DIFMAX,ERRR,ERROR,RO
 1000 FORMAT(1H0,20X,50HCONSTANT SUCCESSIVE OVER-RELAXATION CONVERGES WITHI
     1N ,I3,1H ITERATIONS/22X,36,50WITH A MAXIMUM POINT ERROR EQUAL TO ,F
     215.8/24X,36HAND AN AVERAGE POINT ERROR EQUAL TO ,E15.3/22X,28HTHE
     3ERROR CHECK IS EQUAL TO ,E5.3,7H METERS/22X,25HTHE O.R. FACTOR IS
     4WORTH ,E5.3/)
      RETURN
      END
      SUBROUTINE CARRE(RO,ERRR,ITER,NMAX,L)
```

LISTING OF P PSORMU

PSORMC option 2

```
      SUBROUTINE PSORMC(H,H0,HCB,T,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,DX,D
     1Y,DT,RO,NITER,ERROR,NMAX,IREG,ISCHEM,IERR,TETA,NL,NC,NAQ)
      DIMENSION H(1),H0(1),HCB(1),T(1),S(1),Q(1),PZ(1),EP(1),KFIELD(1),I
     1DEB(1),IFIN(1),JD(1),JF(1)
      COMMON IN,IO
      LEVEL 2,H,H0,T,S,PZ,EP,Q
C
C        **PSORTMC SOLVES THE SET OF LINEAR EQUATIONS DERIVED FR
C     OM THE DISCRETIZATION (PERFORMED BY FINITE DIFFERENCES) OF THE FLO
C     W PARTIAL DIFFERENTIAL EQUATIONS IN A MULTILAYERED AQUIFER SYSTEM
C     UNDER HANTUSH LEAKY ARTESIAN AQUIFER ASSUMPTIONS.THE SOLVING TECHN
C     IC USED IS THE POINT SUCCESSIVE OVER-RELAXATION PROCEDURE.THE OPTI
C     MUM O.R.FACTOR BEING COMPUTED THROUGH THE MODIFIED CARRE ALGORITHM
C
C              -RO IS THE O.R. FACTOR WHICH INITIAL VALUE IS SET TO RO0
C              -NITER IS THE MAXIMUM NUMBER OF ITERATIONS ALLOCATED
C              -ERROR IS THE ERROR TOLERATED FROM THE ITERATIVE PROCESS,
C               WHICH IS A MAXIMUM POINT ERROR IF  IERR=0 ,OR AN AVERAGE
C              _POINT ERROR IF IERR=1
C              -NMAX IS THE NUMBER OF ITERATIONS AFTER WHICH WE COMPUTE
C               THE NEW VALUE OF THE O.R. FACTOR
C              -TETA IS A WEIGHTING FACTOR OF THE FINITE DIFFERENCE EQUAT
C               ION SET TO:
C                        0 (EXPLICIT SCHEME)
C                        1 (TOTALLY IMPLICIT SCHEME)
C                        0.5 (CRANK-NICOLSON IMPLICIT SCHEME)
C                        0<TETA<1 (IMPLICIT-EXPLICIT SCHEME).
C            -IREG DEFINES THE MOTION REGIME:
C                        1 MEANS A STEADY STATE MOTION
C                        0 MEANS A NON-STEADY STITE MOTION
C              -ISCHEM CHARACTERIZES THE HYDRODYNAMIC PICTURE CHOOSEN(FO
C               R FURTHER DETAILS REFER TO EXPLANITORY NOTE"
C
C         OTHER ARGUMENTS ARE DEFINED IN MAIN
C
C         SUBPROGRAMS CALLED:CARRE(CALCULATION OF OPTIMUM A=9= 6  T69"
C
C
C           **CONSERVATION OF THE EVALUATION OF THE O.R. FACTOR
C                    GIVEN IN INPUT**
C
      NAPPEL=0
      IF(NAPPEL.NE.0)GO TO 100
      NAPPEL=1
      RO0=RO
  100 CONTINUE
      IF(IREG.EQ.1)DT=1.
      XSUP=100000000.*10000000.
      EPSI=1./XSUP
      KK=0
      DO 1 LITER=1,NITER
      SOMERR=0.
      DIFMAX=0.
      DO 3 K=1,NAQ
      ID=IDEB(K)+1
      IF=IFIN(K)-1
      DO 2 I=ID,IF
      NN=(K-1)*NL+I
      JDD=JD(NN)+1
      JFF=JF(NN)-1
      DO 2 J=JDD,JFF
      NNN=(J-1)*NL+I
      N=(K-1)*NL*NC+NNN
      KC=KFIELD(N)/10000
      IF(KC.NE.0)GO TO 2
      IF(LITER.EQ.1)KK=KK+1
      KFC=KFIELD(N)
      KSUP=KFC/100
      KS=K-KSUP
      IF(KSUP.EQ.0)KS=0
      IF(KSUP.EQ.K)EP(N)=1.
      IF(KSUP.EQ.K)PZ(N)=0.
      KINF=KFC-KSUP*100
      IF(K.EQ.NAQ)KINF=0
      KI=KINF-K
      IF(KINF.EQ.0)KI=0
      EPUP=EP(N)
      EPDOWN=EP(N+KI*NL*NC)
      IF(EPUP.LT.EPSI.OR.EPDOWN.LT.EPSI)GO TO 2
      IPHY1=(KSUP-K+1000)/((IABS(KSUP-K))+1000)
      IKUP=KSUP-(10*K)
      IPHY2=(IKUP+1000)/((IABS(IKUP))+1000)
      NSUP=(1-IPHY1)*KSUP*NL*NC
      HCENT=H(N)
      H0CENT=H0(N)
      HNORTH=H(N-1)
      HSOUTH=H(N+1)
      HWEST=H(N-NL)
      HEAST=H(N+NL)
      H0N=H0(N-1)
      H0S=H0(N+1)
      H0E=H0(N+NL)
      H0W=H0(N-NL)
      H09=H0(N+KI*NL*NC)
      H0T=(1-IPHY2)*H0(N-NSUP)+IPHY2*HCB(NNN)
      HSUP=(1-IPHY2)*H(N-NSUP)+IPHY2*HCB(NNN)
      HINF=H(N+KI*NL*NC)
      ONS=T(N)+T(N+1)
      IF(ONS.LT.EPSI)GO TO 2
      ONN=T(N)+T(N-1)
      IF(ONN.LT.EPSI)GO TO 2
```

```
      JFF=JF(NN)-1
      DO 2 J=JDD,JFF
      NNN=(J-1)*NL+I
      N=(K-1)*NL*NC+NNN
      KC=KFIELD(N)/10000
      IF(KC.NE.0)GO TO 2
      IF(LITER.EQ.1)KK=KK+1
      KFC=KFIELD(N)
      KSUP=KFC/100
      KS=K-KSUP
      IF(KSUP.EQ.0)KS=0
      IF(KSUP.EQ.K)EP(N)=1.
      IF(KSUP.EQ.K)PZ(N)=0.
      KINF=KFC-KSUP*100
      IF(K.EQ.NAQ)KINF=0
      KI=KINF-K
      IF(KINF.EQ.0)KI=0
      EPUP=EP(N)
      EPDOWN=EP(N+KI*NL*NC)
      IF(EPUP.LT.EPSI.OR.EPDOWN.LT.EPSI)GO TO 2
      IPHY1=(KSUP-K+1000)/((IABS(KSUP-K))+1000)
      IKUP=KSUP-(10*K)
      IPHY2=(IKUP+1000)/((IABS(IKUP))+1000)
      NSUP=(1-IPHY1)*KSUP*NL*NC
      HCENT=H(N)
      HØCENT=HØ(N)
      HNORTH=H(N-1)
      HSOUTH=H(N+1)
      HWEST=H(N-NL)
      HEAST=H(N+NL)
      HØN=HØ(N-1)
      HØS=HØ(N+1)
      HØE=HØ(N+NL)
      HØW=HØ(N-NL)
      HØB=HØ(N+KI*NL*NC)
      HØT=(1-IPHY2)*HØ(N-NSUP)+IPHY2*HCB(NNN)
      HSUP=(1-IPHY2)*H(N-NSUP)+IPHY2*HCB(NNN)
      HINF=H(N+KI*NL*NC)
      DNS=T(N)+T(N+1)
      IF(DNS.LT.EPSI)GO TO 2
      DNN=T(N)+T(N-1)
      IF(DNN.LT.EPSI)GO TO 2
      DNW=T(N)+T(N-NL)
      IF(DNW.LT.EPSI)GO TO 2
      DNE=T(N)+T(N+NL)
      IF(DNE.LT.EPSI)GO TO 2
      TSOUTH=2.*T(N)*T(N+1)/(T(N)+T(N+1))
      TNORTH=2.*T(N)*T(N-1)/(T(N)+T(N-1))
      TWEST=2.*T(N)*T(N-NL)/(T(N)+T(N-NL))
      TEAST=2.*T(N)*T(N+NL)/(T(N)+T(N+NL))
      SCENT=S(N)
      QCENT=Q(N)
      PZUP=PZ(N)
      PZDOWN=PZ(N+KI*NL*NC)
      PZLSUP=PZUP/EPUP
      IF(EPUP.LT.EPSI)PZLSUP=0.
      PZLINF=PZDOWN/EPDOWN
      IF(K.EQ.NAQ)PZLINF=0.
      IF(EPDOWN.LT.EPSI)PZLINF=0.
      AS=-TSOUTH*DX/DY
      AN=-TNORTH*DX/DY
      AE=-TEAST*DY/DX

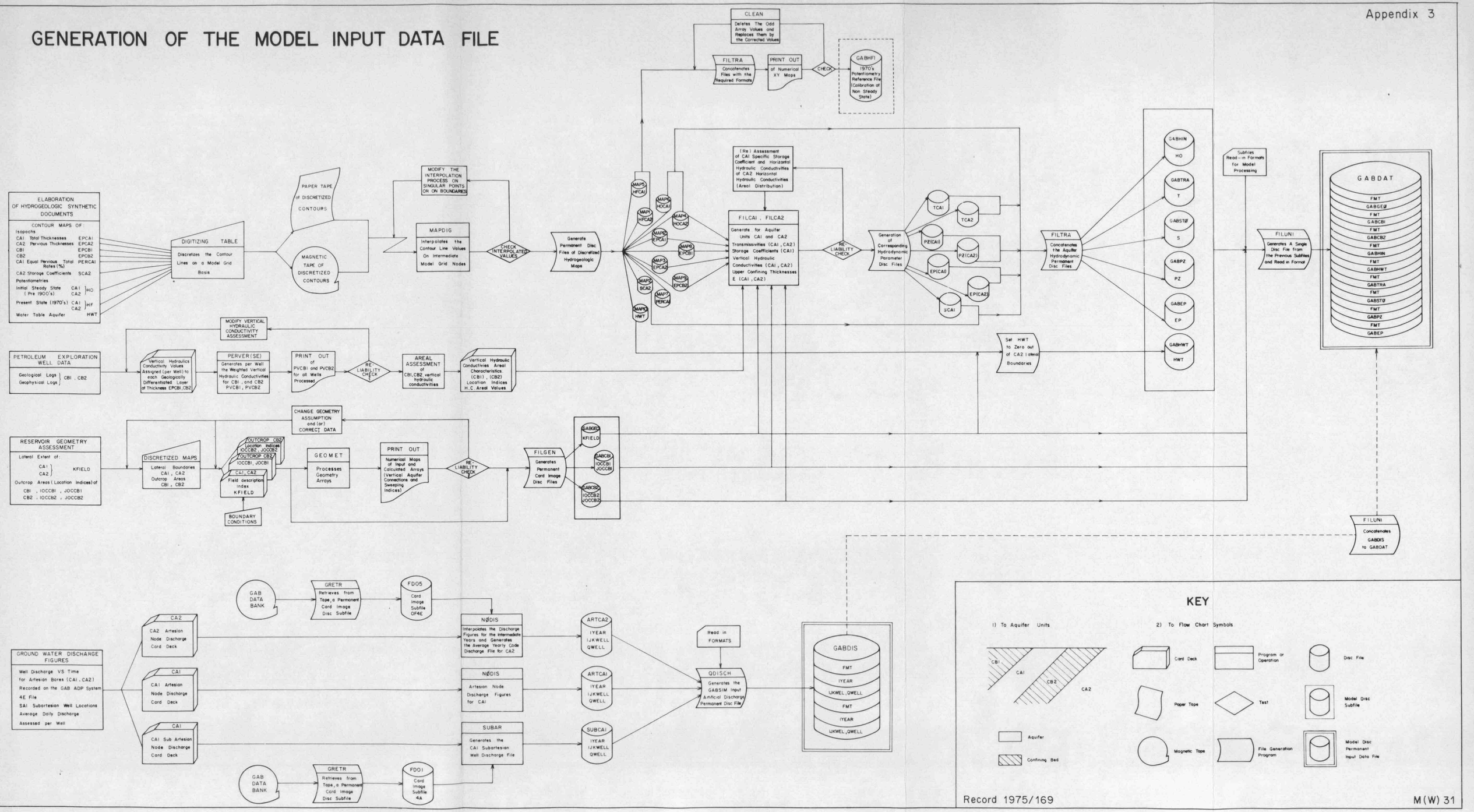


      AW=-TWEST*DY/DX
      AB=-PZLINF*DX*DY
      AT=-PZLSUP*DX*DY
      SIGD=AN+AS+AW+AE+AB+AT
      AC=SCENT*(1-IREG)*DX*DY/DT-TETA*SIGD
      SIG=AS*HØS+AN*HØN+AE*HØE+AW*HØW+AB*HØB+AT*HØT-SIGD*HØCENT
      B=SCENT*(1-IREG)*DX*DY*HØCENT/DT-QCENT*(1.-TETA)*SIG
      IF(AC.LT.EPSI)GO TO 2
      DIF=(B-TETA*(AN*HNORTH+AS*HSOUTH+AW*HWEST+AE*HEAST+AB*HINF+AT*HSUP
     1))/AC
      DIFI=DIF-HCENT
      IF(TETA.NE.0.)GO TO 20
      H(N)=DIF
      GO TO 2
   20 CONTINUE
      SOMERR=SOMERR+ABS(DIFI)
      IF(ABS(DIFI).GT.DIFMAX)DIFMAX=ABS(DIFI)
      H(N)=H(N)+RO*DIFI
      IF(K.GT.1)H(N)=HØ(N)
    2 CONTINUE
    3 CONTINUE
C
      IF(TETA.LT.EPSI)RETURN
      ERRP=SOMERR/KK
      IF(IERR.EQ.0.AND.DIFMAX.LT.ERROR)GO TO 50
      IF(IERR.EQ.1.AND.ERRP.LT.ERROR)GO TO 50
    1 CONTINUE
      RO=ROØ
      GO TO 60
   50 CONTINUE
C
   60 CONTINUE
      WRITE(IO,1000)LITER,DIFMAX,ERRP,ERROR,RO
 1000 FORMAT(1HØ,20X,50HPOINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHI
     1N ,I3,11H ITERATIONS/20X,36HWITH A MAXIMUM POINT ERROR EQUAL TO ,E
     215.8/20X,36HAND AN AVERAGE POINT ERROR EQUAL TO ,E15.8/22X,28HTHE
     3ERROR CHECK IS EQUAL TO ,F5.4,7H METERS/22X,25HTHE O.R. FACTOR IS
     4WORTH ,F5.3/)
      RETURN
      END
```

APPENDIX 3.

GENERATION OF GABSIM INPUT DATA FILE

GENERATION OF THE MODEL INPUT DATA FILE



APPENDIX 4.

GABSIM COMMENT SEQUENCE

Appendix II

PROGRAM GABSIM

DESCRIPTION

GABSIM SIMULATION MODEL CALCULATES THE GROUND WATER HEADS, WITHIN TIME AND SPACE, OF A MULTILAYERED AQUIFER SYSTEM GOVERNED BY HANTUSH HYDRODYNAMIC ASSUMPTIONS

FLOW IS LINEAR(E.G. DUPUIT-FORCHEIMER ASSUMPTIONS HOLD EVERYWHERE, NO FREE SURFACE CONDITIONS NOR TIME VARIANT TRANSMISSIVITIES IN THE UPPER WATER-TABLE AQUIFER), MONOPHASIC, STEADY AND NON STEADY STATE.

GABSIM CAN HANDLE ANY GEOMETRIC AND HYDRODYNAMIC CONFIGURATION AS LONG AS THE HANTUSH SCHEME IS A RELIABLE AQUIFER DESCRIPTION. TIME IS SWEPT FROM AN INITIAL STEADY STATE, EITHER COMPUTED OR INPUTED, PRECEEDING THE TRANSIENT HEAD CALCULATIONS. HEADS ARE PROCESSED EITHER IN TERMS OF DRAWDOWNS OR OF ABSOLUTE HEADS.

MODEL BRIEF CHARACTERISTICS.

- GRID=RECTANGULAR UNIFORM MESHES WITHOUT SWEEPING INTERRUPTIONS
- TRANSMISSIVITIES=DIRECTIONAL EASTWARDS AND SOUTHWARDS.
- DISCRETISATION SCHEME=FINITE DIFFERENCES(SEVEN POINTS APPROXIMATION), EXPLICIT, TOTALLY IMPLICIT, CHANK-NICOLSON IMPLICIT, IMPLICIT-EXPLICIT(OPTIONAL)
- COMPUTING TECHNICS=POINT SUCCESSIVE OVER-RELAXATION (SEE: VARGA R.S. MATRIX ITERATIVE ANALYSIS PRENTICE HALL 1963) INCLUDING THE COMPUTATION OF THE OPTIMUM S.O.R. FACTOR BY THE MODIFIED CARRE ALGORITHM. CONVERGENCE SPEED IS FASTENED BY USE OF A HEAD PREDICTOR.
- SPECIAL EFFECTS: RIVERS, OUTCROPPING AREAS, VARIOUS UPPER WATER TABLE AQUIFER FIGURES.
- INPUTS=PUNCHED CARDS, MAGNETIC DISCS OR DRUMS, NUMERICAL DATA ARE CODED IN FIXED FORMATS.
- OUTPUT=LINE PRINTER
- PROGRAMMING LANGUAGE: FORTRAN IV COMPATIBLE WITH CDC 3000, 6000 AND CYBER 76 COMPILERS
- COMPUTER(S) USED=CYBER 76 (C.S.I.R.O. CANBERRA ACT)
- PROGRAM AUTHOR=P. UNGEMACH B.R.G.M. FRANCE

SUB-PROGRAMS CALLED

HEAD-IN ITEM:

CONSTANT INPUT-DATA

1/DATGAB: AQUIFERS GEOMETRY AND HYDRODYNAMIC FIGURES, COMPUTING PARAMETERS(S, O.R)
2/SINGUL: FIELD SINGULARITIES FEATURES
3/COORD2: BI-DIMENSIONAL LOCATION INDICES
4/COORD3: THREE-DIMENSIONS LOCATION IND.
5/CONTR3: LOCATIONS AND STEADY STATE HEADS OF CHECK BORE HOLES
6/HATCH3: LOCATIONS AND NON STEADY STATE HEAD RECORDS ON CHECK BORE HOLES

TIME VARIANT INPUT DATA

1/QPUMP: WELL DISCHARGE RATES
2/LIMA: VARIATIONS IN HEADS ON LATERAL BOUNDARIES
3/VARSIN: VARIATIONS IN HEADS ON FIELD SINGULARITIES

COMPUTING ITEM:

PRELIMINARY CALCULATIONS:

1/GEOMMC: GENERATION OF FIELD SWEEPING AND VERTICAL AQUIFER CONNECTIONS INDICES
2/COORBO: GENERATION OF LATERAL BOUNDARIES LOCATION INDICES
3/TDIRMC: GENERATION OF DIRECTIONAL TRANSMISSIVITIES

WATER BALANCE

1/LEAKAG: VERTICAL LEAKAGE FLOW RATES
2/DEPLA3: LATERAL BOUNDARIES INFLOW
3/FLUXES: FIELD DISTRIBUTED CHARGE FLOWS
4/STORAG: WATER RELEASE FROM STORAGE
5/DEBRN: RIVER-AQUIFER EXCHANGE FLOW RATES
6/BUDGET: COMPUTING THE OVERALL WATER BALANCE

SOLVING THE LINEAR SET OF FINITE DIFF. EQUAT.

1/PSORMC: COMPUTING OF HEAD DISTRIBUTION VS TIME AND SPACE USING EITHER EXPLICIT, TOTALLY IMPLICIT, CRANK-NICOLSON IMPLICIT OR IMPLICIT-EXPLICIT SCHEMES BY SUCCESSIVE OVER-RELAXATION TECHNICS. PSORMC COMPUTES ALSO STEADY-STATE HEADS.
2/CARRE: COMPUTING OF THE OPTIMUM O.R. FACTOR USING THE MODIFIED CARRE ALGORITHM

PRINT-OUT ITEM:

TABLES

1/CHECK3: COMPUTED AND OBSERVED HEADS ON CHECK BORE HOLES

GRAPHS

1/CURVE2: PLOTS TWO SETS OF VARIABLES VS TIME OR SPACE

MAPS

1/FRAMMC: AQUIFER GEOMETRY AND FIELD SINGULARITIES
2/IMPRE1: TWO DIMENSIONAL ARRAY OF A NUMERIC FORM (ONE SINGLE PARAMETER)
3/IMPRE2: SAME AS IMPRE1 WITH TWO ORTHOGONAL PARAMETERS
4/MAPXY: TWO DIMENSIONAL ARRAY OF A SYMBOLIC FORM, CALLS JOSE AND FORMI

JOSE = INTERPOLATES
FORMI = CONVERTS REAL TO ALPHANUMERIC

NOTE = IMPRE1, IMPRE2, MAPXY USE A SQUARE GRID REPRESENTATION ALLOWING SUPERPOSITION OVER PROTOTYPE DOCUMENTS (IF MAPPED)

DEFINITION OF SYMBOLS

- -I: ROW INDEX(OY)
- -J: COLUMN INDEX(OX)
- -K: AQUIFER INDEX(OZ)
- -NL: NUMBER OF ROWS
- -NC: NUMBER OF COLUMNS
- -NAQ: NUMBER OF AQUIFERS
- -KFIELD(I,J,K): FIELD GEOMETRY INDEX
- -KAQSUP(I,J,K): UPPER AQUIFER CONNECTION
- -KAQINF(I,J,K): BOTTOM AQUIFER CONNECTION
- -IDEB(K): STARTING ROW
- -IFIN(K): ENDING ROW
- -JD(I,K): STARTING SWEEPING COLUMN INDEX/ROW
- -JF(I,K): ENDING SWEEPING COLUMN INDEX/ROW
- -DX, DY: SPACE DISCRETISATION INCREMENTS
- -DT: TIME DISCRETISATION INCREMENT
- -DTO: INITIAL TIME STEP
- -NTS: TOTAL NUMBER OF MAIN TIME STEPS
- -T(I,J,K): MESH AVERAGE TRANSMISSIVITY(M2/S)
- -TE(I,J,K): MESH DIRECTIONAL TRANSMISSIVITY(EAST)
- -TS(I,J,K): MESH DIRECTIONAL TRANSMISSIVITY(SOUTH)
- -S(I,J,K): STORAGE COEFFICIENT
- -Q(I,J,K): FLOW RATE(M3/S)
- -H(I,J,K): FINAL HEAD(M)
- -HO(I,J,K): INITIAL HEAD(M)
- -HCB1(I,J): HEAD OF THE SEMI-PERVIOUS CONF. LAY. (OUTCROP)
- -DT: TIME DISCRETISATION INCREMENT
- -DTO: INITIAL TIME STEP
- -NTS: TOTAL NUMBER OF MAIN TIME STEPS
- -XMAP(I,J): PRINT OUT DUMMY VARIABLE
- -IWELL(L), JWELL(L): WELL COORDINATES
- -QWELL(L): WELL DISCHARGE(M3/S)
- -NWELL: NUMBER OF WELLS
- -IRIV(L,LL), JRIV(L,LL): RIVER LOCATION COORDINATES
- -RIVNOM(L,L): RIVER NAME
- -HRIV(L,LL): RIVER HEAD(M)
- -HVRIV(L,LL): VARIATION IN HEAD ON A RIVER(M)
- -NPRIV(L): NUMBER OF DISCRETIZED MESHES PER RIVER
- -NRIV: NUMBER OF RIVERS
- -ILIM(K), JLIM(K): LATERAL BOUNDARIES COORDINATES
- -NPLIM(K): NUMBER OF LATERAL BOUNDARY MESHES
- -NLV(K): NUMBER OF BOUNDARY HEAD VARIATIONS LAWS
- -NLU(K,LL), NLF(K,LL): INDICES (START, END) OF HEAD VAR. LAWS
- -HLIM(K,LL): HEAD ON LATERAL BOUNDARY
- -IPCST(L), JPCST(L): LOCATION OF A CHECK BORE HOLE (STEADY)
- -KPCST(L): AQUIFER NO
- -CPNOM(L,J): CHECK BORE HOLE NAME
- -HCPST(L): STEADY HEAD ON A CHECK B.H.
- -IPCNS(L), JPCNS(L): LOCATION OF A CHECK BORE HOLE (NON-ST.)
- -KPCNS(L): AQUIFER NO
- -HPCNS(L): NON STEADY HEAD ON A CHECK B.H.
- -EP(I,J,K): THICKNESS OF A CONFINING LAYER(M)
- -PZ(I,J,K): VERTICAL HYDR. CONDUCT. OF A CONFINING LAYER
- -RO: SUCCESSIVE OVER RELAXATION COEFFICIENT
- -ROO: INITIAL S.O.R. COEFFICIENT
- -NITER: NUMBER OF ITERATIONS ALLOCATED TO O.R.
- -FAROR: PROD ALLOWED
- -NMAX: NUMBER OF ITERATIONS AFTER WHICH RO IS COMPUTED
- -IREG: REGIME (STEADY OR NON STEADY) INDEX
- -IERROR: ERROR CHECK INDEX
- -ISCHEM: HYDRAULIC SCHEME INDEX

```
      SUBROUTINE GARDAT(H,H0,H1,T,S,PZ,EP,DX,DY,DTO,RO,NITER,ERROR,NMAX,
     1KFIELD,KAQSUP,FMT,FMS,FMPZ,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **DATGAR READS THE INPUT DATA NECESSARY TO MODEL PROCESSING,    C
C       WHICH CONSIST OF:                                             C
C         -GEOMETRIC DATA:                                            C
C             ,KFIELD(I,J,K):FIELD DESCRIPTION INDEX                  C
C             ,DX,DY:SPACE INCREMENTS                                 C
C             ,DTO:INITIAL TIME STEP                                  C
C         -HYDRODYNAMIC DATA                                          C
C             ,H(I,J,K):INITIAL HEAD                                  C
C             ,H1(I,J):CONSTANT HEAD OF UPPER LAYER                   C
C             ,T(I,J,K):AVERAGE MESH TRANSMISSIVITY                   C
C             ,S(I,J,K):STORAGE COEFFICIENT                           C
C             ,PZ(I,J,K):VERTICAL PERMEABILITY OF UPPER CONFINING     C
C                        BED.                                         C
C             ,EP(I,J,K):THICKNESS OF UPPER CONFINING BED             C
C         -MISCELLANEOUS                                              C
C             ,FMT,FMS,FMPZ:AMPLIFICATION FACTORS MULTIPLYING T,S     C
C                           AND PZ                                    C
C       DATGAR CHECKS THE CONFORMITY OF HYDRODYNAMIC DATA WITH FIELD  C
C       DESCRIPTION AND VERTICAL AQUIFER CONNECTION INDICES KFIELD(I  C
C       ,J,K),KAQSUP(I,J,K) AND KAQINF(I,J,K)                         C
C         -SUCCESSIVE OVER RELAXATION PARAMETERS                      C
C             ,RO:INITIAL S.O.R.COEFFICIENT                           C
C             ,NITER:MAXIMUM NUMBER OF ITERATIONS                     C
C             ,ERROR:ERROR TOLERATED FROM S.O.R.                      C
C             ,NMAX:NUMBER OF ITERATIONS AFTER WHICH RO IS REEVALUA   C
C                   -TED                                              C
C       -NL,NC,NAQ ARE THE NUMBER OF ROWS,COLUMNS AND AQUIFERS        C
C                                                                     C
C       SUB-PROGRAMS CALLED:NONE                                      C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

SUBROUTINE SINGUL 76/76 OPT=1 FTN 4.1+373 15/

```
      SUBROUTINE SINGUL(ISING,JSING,NPSING,NSING,SINGNA,KFSING,KFIELD,HS
     1ING,H,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **SINGUL READS THE FIELD SINGULARITIES(SUCH AS RIVERS,LAKES, C
C     GRAVEL-POOLS,ETC.,. CONNECTED TO AQUIFERS)FIGURES THEN PRINTSC
C     THEM OUT                                                      C
C             ,SINGNA(L,LL):FIELD SINGULARITY NAME                  C
C             ,NPSING(L):NUMBER OF MESHES PER F.S.                  C
C             ,ISING(L,K),JSING(L,K):F.S, LOCATION INDICES          C
C             ,HSING(L,K):INITIAL HEAD                              C
C                                                                   C
C       SUB-PROGRAMS CALLED:NONE                                    C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

SUBROUTINE MATCH3 76/76 OPT=1 FTN 4.1+373 15/1

```
      SUBROUTINE MATCH3(ICP,JCP,KCP,NCP,NTS,CPNOM,IYST,ZERO,HCPIN,HCP,HC
     1,IYINC,BLANK,STAR,ZERO0,CHARI)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **MATCH3 READS AND PRINTS(IN TERMS OF TABLES AND GRAPHS) THE  C
C     CHARACTERISTICS OF NON STEADY STATE CHECK BORES               C
C             ,CPNOM(L,K):BORE NAME                                 C
C             ,KCP(L),ICP(L),JCP(L):BORE COORDINATES                C
C             ,IYST(L):INITIAL YEAR OF MEASUREMENTS                 C
C             ,HCPIN(L):INITIAL HEAD                                C
C             ,ZERO(L):ZERO ELEVATION                               C
C             ,HCP(L,LL):BORE HEAD VS TIME SEQUENCE                 C
C             ,NTS:TOTAL NUMBER OF TIME STEPS (SIMULATION PERIOD)   C
C             ,NCP:NUMBER OF CHECK BORES                            C
C             ,BLANK,STAR,ZERO0,CHARI=ALPHANUMERIC PRINTING SYMBOLS C
C             ,HC(L):GRAPH PRINTING DUMMY VARIABLE                  C
C                                                                   C
C       SUB PROGRAMS CALLED:                                        C
C                   ,CURVER:PLOTS ON LINE PRINTER GRAPHS OF OBSERVED C
C                           HEAD TIME SERIES                        C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

SUBROUTINE CONTR3 76/76 OPT=1 FTN 4.1+373 15

```
      SUBROUTINE CONTR3(ICP,JCP,KCP,HCP,HZERO,CPNOM,IYEAR,NCP)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **CONTR3 READS AND PRINTS THE CHARACTERISTICS OF STEADY-STATE C
C       CHECK BORES                                                 C
C             ,CPNOM(L,K):BORE NAME                                 C
C             ,KCP(L),ICP(L),JCP(L):BORE COORDINATES                C
C             ,HCP(L):STEADY HEAD                                   C
C             ,HZERO(L):ELEVATION OF ORIGIN OF HEAD MEASUREMENTS    C
C             ,IYEAR IS THE CHECKING YEAR                           C
C             ,NCP IS THE NUMBER OF CHECK BORES                     C
C                                                                   C
C       SUB PROGRAMS CALLED:NONE                                    C
C                                                                   C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
      SUBROUTINE CLIM(NLV,NLD,NLF,NAQ)
C
C     **CLIM READS THE CHARACTERISTICS OF THE LATERAL BOUNDARY
C     MESHES ON WHICH A TIME VARIANT HEAD CONDITION IS APPLIED
C     ,NLV(K) IS THE NUMBER OF DISTINCT HEAD LAWS PER
C             AQUIFER
C     ,NLD(K) AND NLF(K) ARE THE EXTREME MESH(ORDERED
C             CLOCKWISE)NUMBERS BETWEEN WHICH THE SAME
C             HEAD LAW APPLIES
C
C        SUB PROGRAMS CALLED:NONE
C
```

SUBROUTINE VARSIN 76/76 OPT=1 FTN 4.1+373 15/1

```
      SUBROUTINE VARSIN(ISING,JSING,NPSING,NSING,HVSING,H,IHEAD,HINI,NL,
     1NC,NAQ)
C
C     **VARSIN READS,AT A GIVEN TIME,THE HEAD VARIATION APPLIED TO
C     ANY TYPE OF FIELD SINGULARITY DEFINED PREVIOUSLY IN SINGUL AND
C     MODIFIES CONSEQUENTLY THE HEADS OF CORRESPONDING FIELD LOCATIO
C     NS.
C             ,ISING(L,LL),JSING(L,LL):F.S. LOCATION
C             ,NPSING(L)=NUMBER OF F.S. MESHES
C             ,NSING:NUMBER OF FIELD SINGULARITIES
C             ,HVSING(L,LL)=VARIATION IN HEAD ON A F.S. MESH
C             ,H(I,J,K):MESH HEAD
C             ,HINI(L,LL):INITIAL HEAD
C             ,NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS
C             ,IHEAD IS AN INDEX SET TO:
C                     =0 IF A VARIATION IN HEAD IS READ
C                     =1 IF A HEAD IS READ
C                NB:VARIATIONS REFER TO INITIAL HEADS
C
C        SUB PROGRAMS CALLED:NONE
C
```

SUBROUTINE LIMVA 76/76 OPT=1 FTN 4.1+373 15

```
      SUBROUTINE LIMVA(H,ILIM,JLIM,HLIM,NLV,NLD,NLF,IHEAD,HINI,NL,NC,NAQ
     1,NPLIM)
C     **LIMVA READS,AT A GIVEN TIME,THE VARIATIONS IN HEAD ON GIVENC
C     BOUNDARY LOCATIONS AND APPLIES THE NEW HEADS.                  C
C             ,H(I,J,K):HEAD                                         C
C             ,ILIM(L,LL),JLIM(L,LL):BOUNDARY LOCATION INDICES       C
C             ,HLIM(L,K) :VARIATION IN HEAD                          C
C             ,NLD(L,K),NLF(L,K):EXTREME MESH NUMBERS BETWEEN WHIC,  C
C                                HLIM APPLIES                        C
C             ,NLV(K):NUMBER OF DISTINCT HEAD VARIATION LAWS         C
C             ,HINI(L,LL):INITIAL BOUNDARY HEADS PER AQUIFER         C
C             ,NPLIM(K):NUMBER OF LATERAL BOUNDARY MESHES PER AQUIF  C
C                       ER.                                          C
C             ,NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS         C
C             ,IHEAD IS AN INDEX SET TO:                             C
C                     =0 IF A VARIATION IN HEAD IS READ              C
C                     =1 IF A HEAD IS READ                           C
C                NB:VARIATIONS REFER TO INITIAL HEADS                C
C                                                                    C
C        SUB PROGRAMS CALLED:NONE                                    C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

SUBROUTINE QPUMP 76/76 OPT=1 FTN 4.1+373 15/

```
      SUBROUTINE QPUMP(IP,JP,KP,QP,Q,NP,NL,NC,NAQ,TEMPO,YEAR,IPREL)
C
C     **QPUMP READS,AT A GIVEN TIME,THE WELL DISCHARGE RATES,EXPRESS
C     ED IN L/S,THEN APPLIES THEM TO THE ADEQUATE FIELD LOCATIONS
C     AND PRINTS OUT THE WELL DISCHARGE FIGURES.
C             ,QP(I):WELL DISCHARGE RATE
C             ,IP(L),JP(I),KP(I):WELL LOCATION
C             ,TEMPO:TIME SINCE SIMULATION STARTS.
C             ,YEAR:YEAR
C             ,Q(I):MESH POINT FLOW
C             ,NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS
C             ,NP:NUMBER OF WELLS
C             ,IPREL SPECIFIES THE TYPE OF FLOW APPLIED:
C                     -IF IPREL=+1 DISCHARGE FLOW
C                     -IF IPREL=-1 RECHARGE FLOW
C
C        SUB PROGRAMS CALLED:NONE
C
```

SUBROUTINE CHECK3 76/76 OPT=1 FTN 4.1+373 15/1

```
      SUBROUTINE CHECK3(ICP,JCP,KCP,CPNOM,HCP,HORIG,H,NCP,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **CHECK3 PRINTS OUT,ON A LINE PRINTER,THE COMPUTED             C
C             ,H(I,J,K) IS THE COMPUTED HEAD                         C
C     AND OBSERVED STEADY STATE HEADS ON CHECK BORES**               C
C             ,HCP(I) IS THE HEAD RECORDED ON A CHECK BORE           C
C             ,ICP(I),JCP(L),KCP(L) ARE THE CHECK BORE COOR          C
C              DINATES                                               C
C             ,NCP IS THE NUMBER OF CHECK BORES                      C
```

```
SUBROUTINE PSORMC     76/76   OPT=1                    FTN 4.1+373        15/1

                      SUBROUTINE PSORMC(H,HO,HCR,TE,TS,S,PZ,EP,O,IDEB,IFIN,JD,JF,KFIELD,
                     1KAQSUP,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,IREG,ISCHEM,IERR,TETA,N
                     2L,NC,NAQ)
                      DIMENSION H(1),HO(1),HCR(1),TE(1),TS(1),S(1),O(1),PZ(1),EP(1),KFIE
                     1LD(1),KAQSUP(1),KAQINF(1),IDEB(1),IFIN(1),JD(1),JF(1)
                      COMMON IN,IO
C
C        **PSORMC SOLVES THE SET OF LINEAR EQUATIONS DERIVED FR
C     OM THE DISCRETIZATION (PERFORMED BY FINITE DIFFERENCES) OF THE FLO
C     W PARTIAL DIFFERENTIAL EQUATIONS IN A MULTILAYERED AQUIFER SYSTEM
C     UNDER HANTUSH LEAKY ARTESIAN AQUIFER ASSUMPTIONS,THE SOLVING TECHN
C     IC USED IS THE POINT SUCCESSIVE OVER-RELAXATION PROCEDURE,THE OPTI
C     MUM C.R.FACTOR BEING COMPUTED THROUGH THE MODIFIED CARRE ALGORITHM
C
C           -RO IS THE O.R. FACTOR WHICH INITIAL VALUE IS SET TO ROO
C           -NITER IS THE MAXIMUM NUMBER OF ITERATIONS ALLOCATED
C           -ERROR IS THE ERROR TOLERATED FROM THE ITERATIVE PROCESS.
C            WHICH IS A MAXIMUM POINT ERROR IF IERR=0 ,OR AN AVERAGE
C            POINT ERROR IF IERR=1
C           -NMAX IS THE NUMBER OF ITERATIONS AFTER WHICH WE COMPUTE
C            THE NEW VALUE OF THE O.R. FACTOR
C           -TETA IS A WEIGHTING FACTOR OF THE FINITE DIFFERENCE EQUAT
C            ION SET TO=
C                        0 (EXPLICIT SCHEME)
C                        1 (TOTALLY IMPLICIT SCHEME)
C                        0.5 (CRANK-NICOLSON IMPLICIT SCHEME)
C                        0<TETA<1 (IMPLICIT-EXPLICIT SCHEME)
C           -IREG DEFINES THE MOTION REGIME=
C                        1 MEANS A STEADY STATE MOTION
C                        0 MEANS A NON-STEADY STATE MOTION
C           -ISCHEM CHARACTERIZES THE HYDRODYNAMIC PICTURE CHOOSEN(FO
C            R FURTHER DETAILS REFER TO EXPLANATORY NOTE)
C
C        OTHER ARGUMENTS ARE DEFINED IN MAIN
C
C        SUBPROGRAMS CALLED=CARRE(CALCULATION OF OPTIMUM O.R. FACTOR)
C
```

```
SUBROUTINE GEOMMC     76/76   OPT=1                    FTN 4.1+373        15/

                      SUBROUTINE GEOMMC(IDEB,IFIN,JD,JF,KFIELD,KAQSUP,KAQINF,NL,NC,NAQ)
CCCC
```

SUBROUTINE DEBRV 76/76 OPT=1 FTN 4.1+373 15.

```
      SUBROUTINE DEBRV(H,TE,TS,RIVNOM,IRIV,JRIV,NPRIV,DX,DY,DT,QRIV,QTOT
     1,TEMPO,YEAR,NRIV,KFIELD,KFRIV,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **DEBRV COMPUTES,AT A GIVEN TIME,THE EXCHANGE FLOW              C
C     BETWEEN RIVERS AND AQUIFER HYDRAULICALLY CONNECTED              C
C          ,H(I,J,K) IS THE HEAD                                      C
C          ,TE(I,J,K),TS(I,J,K) ARE THE DIRECTIONAL TRAN              C
C          SMISSIVITIES                                               C
C          ,RIVNOM(L) IS THE RIVER NAME                               C
C          ,NPRIV(L) IS THE NUMBER OF MESHES PER RIVER                C
C          ,IRIV(L,200),JRIV(L,200) ARE THE COORDINATES               C
C          OF A RIVER MESH                                            C
C          ,NRIV IS THE NUMBR OF RIVERS                               C
C          ,DX,DY,DT ARE THE SPACE AND TIME INCREMENTS                C
C          ,QRIV(L) IS THE TOTAL EXCHANGE FLOW PER RIVER              C
C          ,QTOT IS THE TOTAL AMOUNT OF EXCHANGE FLOW                 C
C          ,KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX              C
C          ,KFRIV IS THE VALUE ASSIGNED TO KFIELD(I,J,K)              C
C          ON A RIVER MESH                                            C
C          ,TEMPO IS THE TIME SINCE SIMULATION STARTED                C
C          ,YEAR IS THE YEAR OF CALCULATION                           C
C          ,NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL               C
C          TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS                 C
C                                                                     C
C          -SUB-PROGRAMS CALLED:NONE                                  C
C                                                                     C
C          NOTE:THE RIVERS OCCUR ONLY ON AQUIFER NO 1                 C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

SUBROUTINE DEBLA3 76/76 OPT=1 FTN 4.1+373 15/

```
      SUBROUTINE DEBLA3(H,XE,XS,KFIELD,DX,DY,TEMPO,YEAR,SIGQAQ,SIGQT,KNO
     1DE,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **DEBLA COMPUTES,AT A GIVEN TIME,THE LATERAL BOUNDARY           C
C     IN(OUT)FLOW.                                                    C
C          ,H(I,J,K) IS THE HEAD                                      C
C          ,XE(I,J,K),SX(I,J,K)ARE THE DIRECTIONAL TRANSMI            C
C          SSIVITIES                                                  C
C          ,KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX              C
C          ,DX,DY ARE THE SPACE INCREMENTS                            C
C          ,TEMPO IS THE TIME SINCE SIMULATION STARTED                C
C          ,YEAR IS THE YEAR OF CALCULATION                           C
C          ,SIGQAQ(K) IS THE TOTAL BOUNDARY FLOW PER AQUI             C
C          FER                                                        C
C          ,KNODE(K) IS THE NUMBER OF BOUNDARY MESHES PER             C
C          AQUIFER                                                    C
C          ,NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL TO            C
C          THE NUMBER OF ROWS,COLUMNS AND AQUIFERS                    C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          SUB PROGRAMS CALLED:NONE                                   C
C                                                                     C
C                                                                     C
```

SUBROUTINE FLUXES 76/76 OPT=1 FTN 4.1+373 15.

```
      SUBROUTINE FLUXES(Q,QAQ,QTOT,KFIELD,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **FLUXES COMPUTES ,AT A GIVEN TIME,THE TOTAL AMOUNT             C
C     OF FIELD FLOW                                                   C
C          ,Q(I,J,K) IS THE POINT FIELD FLOW                          C
C          ,QAQ(K) IS THE TOTAL FIELD FLOW PER AQUIFER                C
C          ,QTOT IS THE TOTAL FIELD FLOW                              C
C          ,KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX              C
C          ,NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL               C
C          TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS                 C
C                                                                     C
C          -SUB-PROGRAMS CALLED:NONE                                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

SUBROUTINE STORAG 76/76 OPT=1 FTN 4.1+373 15.

```
      SUBROUTINE STORAG(S,H,H0,DX,DY,DT,TEMPO,YEAR,QELAS,QTOTFL,KFIELD,
     1NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **STORAG COMPUTES,AT A GIVEN TIME,THE RELEASE FROM              C
C     STORAGE                                                         C
C          ,H0(I,J,K),H(I,J,K) ARE THE INITIAL AND FINAL              C
C          HEADS                                                      C
C          ,S(I,J,K) IS THE STORAGE COEFFICIENT                       C
C          ,DX,DY,DT ARE THE SPACE AND TIME INCREMENTS                C
C          ,TEMPO IS THE TIME SINCE SIMULATION STARTED                C
C          ,YEAR IS THE YEAR OF CALCULATION                           C
C          ,QELAS(K) IS THE RELEASE FROM STORAGE PER AQU              C
C          IFER                                                       C
C          ,QTOTFL IS THE TOTAL RELEASE FROM STORAGE                  C
C          ,KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX              C
C          ,NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL               C
C          TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS,                C
C                                                                     C
C          -SUB PROGRAM CALLED:NONE                                   C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
      SUBROUTINE LEAKAG(H,HCR,PZ,EP,KFIELD,KAQSUP,KAQINF,DX,DY,TEMPO,YE
     1EAR,SIGQLE,SIGLUP,SIGLDO,KNLEAK,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C                                                                     C
C     **LEAKAG COMPUTES,AT A GIVEN TIME,THE VERTICAL LEA              C
C     KAGE FLOWS OCCURING BETWEEN AQUIFERS.                           C
C              ,H(I,J,K) IS THE HEAD OF AN AQUIFER                    C
C              ,HCR(I,J) IS THE HEAD OF AN OUTCROPPING CONFI          C
C              NING BED                                               C
C              ,PZ(I,J,K) IS THE VERTICAL PERMEABILITY OF A           C
C              CONFINING BED                                          C
C              ,EP(I,J,K) IS THE THICKNESS OF A CONFINING BED         C
C              ,KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX          C
C              ,KAQINF(I,J,K),KAQSUP(I,J,K) ARE THE VERTICAL          C
C              AQUIFER CONNECTION INDICES                             C
C              ,DX,DY ARE THE SPACE INCREMENTS                        C
C              ,TEMPO IS THE TIME SINCE SIMULATION STARTS             C
C              ,YEAR IS THE YEAR OF CALCULATION                       C
C              ,SIGQLE(K) IS THE TOTAL LEAKAGE FOW PER AQUI           C
C              FER                                                    C
C              ,SIGLUP(K),SIGLDO(K) ARE THE UPWARD AND DOWNW          C
C              ARD LEAKAGE FLOWS PER AQUIFER                          C
C              ,KNLEAK(K) IS THE NUMBER OF AQUIFER MESHES CO          C
C              NCERNED WITH LEAKAGE                                   C
C                                                                     C
C              -SUB-PROGRAMS CALLED:NONE                              C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```



```
      SUBROUTINE BUDGET(QLEAKO,QLEAKF,QRAOO,QRAOF,QLABOO,QLABOF,QSTORE,Q
     1FIELD,QLEAKT,QRAOT,QLABOT,QSTORT,QFIELT,SIGQAQ,QTOTAL,NAQ)
C
C     **BUDGET COMPUTES THE WATER BALANCE PER AQUIFER AND FOR THE
C     OVERALL GROUND WATER SYSTEM AND CHECKS THE ACCURACY OF THE
C     TOTAL WATER BALANCE.
C              ITEMS CONSIDERED ARE:
C                 -QLEAKO,QLEAKF=INITIAL AND FINAL (ON A TIME STEP)
C                                VERTICAL LEAKAGE FLOW PER AQUIFER
C                 -QRAOO,QRAOF=INITIAL AND FINAL RIVER-AQUIFER FLOW
C                              OCCURING WITHIN THE FIRST AQUIFER
C                 -QLABOO,QLABOF=INITIAL LATERAL BOUNDARIES IN(OUT)
C                                FLOW PER AQUIFER
C                 -QSTORE=RELEASE FROM STORAGE PER AQUIFER AT THE
C                         END OF A TIME STEP
C                 -QFIELD=POINT FIELD DIS(RE)CHARGE OCCURING WITHIN
C                         A TIME STEP AND AN AQUIFER
C                 -QLEAKT,QRAOT,QLABOT,QSTORT,QFIELT REFER TO THE
C                 RESULTING TOTALS OF PREVIOUS ITEMS PERF
C                 ORMED OVER OVER ONE TIME STEP AND THE
C                 TOTAL GROUND-WATER SYSTEM
C              SIGAQ AND QTOTAL ARE THE WATER BALANCES CONSIDERING
C                A SINGLE AQUIFER AND THE OVERALL SYSTEM
C              IREQ IS AN INDEX SET TO:
C                 1 IF STEADY STATE IS CONSIDERED
C                 0 IF OCCURENCE OF NON STEADY STATE
C              NAQ IS THE TOTAL NUMBER OF AQUIFERS
C
```

```
SUBROUTINE FRAMMC     76/76   OPT=1                    FTN 4.1+373        15/

      SUBROUTINE FRAMMC(XX,BLANK,STAR,PCINT,ZERO,WLETER,RLETER,ALETER,
     1KFIELD,KFR,IW,JW,KW,IR,JR,IA,JA,KA,K,NW,NR,NPR,NA,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **FRAMC PRINTS OUT ON A LINE PRINTER THE AQUIFER                  C
C     GEOMETRIES**                                                      C
C               ,XX(NC) IS A DUMMY PRINTING VARIABLE                    C
C               ,BLANK,STAR,POINT,ZERO,WLETER,RLETER,ALETER             C
C                ARE ALPHANUMERIC PRINTING SYMBOLS                      C
C               ,KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX           C
C               ,KFR IS THE VALUE ASSIGNED TO KFIELD(I,J,K)             C
C                ON A RIVER MESH                                        C
C               ,IA(L),JA(L),KA(L) ARE THE COORDINATES OF OUT           C
C                CROP AREAS                                             C
C               ,IW(N),JW(N),KW(N) ARE THE WELL COORDINATES             C
C               ,NA IS THE NUMBER OF OUTCROP MESHES                     C
C               ,NW IS THE NUMBER OF WELLS                              C
C               ,NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL            C
C                TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS             C
C                                                                       C
C               =SUB-PROGRAMS CALLED:NONE                               C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
SUBROUTINE MAPXY      76/76   OPT=1                    FTN 4.1+373        15/

      SUBROUTINE MAPXY(X,XOUT,XMIN,STEP,NL,NC,LOGAR,IFACT)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C                                                                       C
C          MAPXY PRINTS,ON A LINE PRINTER,MAPS OF TWO DIMENSIONAL       C
C               NUMERICAL ARRAYS UNDER AN ALPHANUMERIC FORM             C
C                                                                       C
C               X(1) =ARGUMENT(NUMERIC)TO BE MAPPED                     C
C               XOUT =VALUE OF X OUTSIDE THE BOUNDARIES                 C
C               XMIN =X MINIMUM VALUE                                   C
C               STEP =MAGNITUDE OF EACH CLASS OF VALUES TO BE MAPPED    C
C                     CAREFUL:STEP MAY BE MULTIPLIED BY 2,4,8,ETC...    C
C                             CHOOSE RATHER STEP=2,5 THAN STEP=2,       C
C                             IF LOGAR<1,STEP=1, MEANS LIMITS AT 1,10,..C
C               NL   =NUMBER OF LINES(ROWS) (LIMITED TO 99)             C
C               NC   =NUMBER OF COLUMNS (LIMITED TO 99)                 C
C               LOGAR=TYPE OF REPRESENTATION                            C
C                     LOGAR=1 LOG(X) IS MAPPED                          C
C                     LOGAR=0  X IS MAPPED                              C
C               IFACT=SCALE OF THE MAP(=1,2,...)                        C
C                     IF ONE WANTS TO SUPERIMPOSE THE DIGITAL MAP TO THEC
C                     INPUT GRID PROTOTYPE(USING SQUARE MESHES),THE MESHC
C                     SIZE MUST BE SET TO:                              C
C                          1.275 CM   (IFACT=1)                         C
C                          2.550 CM   (IFACT=2)                         C
C                          3.825 CM   (IFACT=3)                         C
C                          5.100 CM   (IFACT=4)                         C
C                                                                       C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
SUBROUTINE IMPRE1     76/76   OPT=1                    FTN 4.1+373        15/

      SUBROUTINE IMPRE1(X,NL,NC,FACT,INTX,ISCALE)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **IMPRE1 PRINTS,ON A LINE PRINTER,A MAP OF A TWO-DIMENSIONAL C
C     NUMERIC ARRAY PRELIMINARLY TRANSFORMED IN AN ALPHANUMERIC FORM** C
C               ,X(1) IS THE ARRAY(DIMENSIONNED NL*NC) TO BE MAPPED     C
C               ,FACT IS THE AMPLIFICATION(ATTENUATION) FACTOR APPLIED  C
C                TO X                                                   C
C               ,INTX IS AN INDEX SPECIFYING WHETHER X IS:              C
C                     -INTEGER(INT=0)                                   C
C                     -REAL(INT=1)                                      C
C               ,ISCALE AN INDEX SPECIFYING THE SCALE OF THE MAP E.G.:  C
C                A SQUARE GRID SIZE EQUAL TO=                           C
C                     -1.275 CM  (ISCALE=1)                             C
C                     -2.550 CM  (ISCALE=2)                             C
C               ,NL,NC ARE THE USUAL ARRAY INDICES REFERRING TO THE NUMBC
C                ER OF ROWS(NL) AND COLUMNS(NC)                         C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
SUBROUTINE IMPRE2     76/76   OPT=1                    FTN 4.1+373        15/

      SUBROUTINE IMPRE2(X,Y,NL,NC,FACTX,FACTY,INTX,INTY)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **IMPRE2 PRINTS,ON A LINE PRINTER,A MAP OF TWO ORTHOGONAL BI-C
C          DIMENSIONAL DIRECTIONAL PARAMETERS X AND Y,NUMERICAL VALUES  C
C          AREACONVERTED INTO ALPHANUMERIC FORM BEFORE BEING MAPPED*    C
C               ,X(1) AND Y(1) ARE THE ARRAYS(DIMENSIONED NL*NC)TO BE MAC
C               PPED.                                                   C
C               ,FACTX,FACTY ARE THE AMPLIFICATION(ATTENUATION) FACTORS C
C                APPLIED TO X AND Y                                     C
C               ,INTX,INTY ARE INDICES SPECIFYING WETHER X OR Y IS:     C
C                     -INTEGER(INTX=0 OR INTY=0)                        C
C                     -REAL(INTX=1 OR INTY=0)                           C
C               ,NL,NC ARE THE USUAL ARRAY INDICES REFERRING TO THE NUMC
C                RER OF ROWS(NL) AND COLUMNS(NC)                        C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
SUBROUTINE CURVE2     76/76   OPT=1                    FTN 4.1+373        15/

      SUBROUTINE CURVE2(X,XC,BLANK,STAR,ZERO,CHARI,NPOINT,ISPACE)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **CURVE2 PLOTS,ON A LINE PRINTER ,A SET OF TWO X-Y GRAPHS ONE C
C     REPRESENTING A REFERENCE RECORD AND THE OTER A COMPUTED RECORC
C     D NUMERICAL VALUES OF RECORDS AND DIFFERENCES ARE LISTED APARC
C     T IN A TABLE FORM.IF ONLY ONE RECORD(OBSERVED OR COMPUTED) ISC
C     TO BE PLOTTTED XC(OR X) IS SET EUQAL(IN CALLING SEQUENCE) TO XC
C     (OR XC).                                                        C
C               ,X(1) IS THE REFERENCE RECORD DIMENSIONED NPOINT       C
C               ,XC(1) IS THE COMPUTED RECORD DIMENSIONED NPOINT       C
C               ,NPOINT IS THE NUMBER OF VALUES PER RECORD             C
C               ,ISPACE IS THE WIDTH OF THE GRAPH PLOT(MAXIMUM OF 130 CHC
C                ARACTERS ALLOWED)                                     C
C               ,BLANK,STAR,ZERO,CHARI ARE ALPHANUMERIC PRINTING SYMBOLSC
C               ,XX(1),XINT(1) ARE DUMMY PRINTING VARIABLES            C
C                                                                      C
C               SUB PROGRAMS CALLED NONE                               C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

```
SUBROUTINE CLIM       76/76   OPT=1                    FTN 4.1+373

      SUBROUTINE CLIM(NLV,NLD,NLF,NAQ)
C
C     **CLIM READS THE CHARACTERISTICS OF THE LATERAL BOUNDARY
C     MESHES ON WHICH A TIME VARIANT HEAD CONDITION IS APPLIED
C     ,NLV(K) IS THE NUMBER OF DISTINCT HEAD LAWS PER
C     AQUIFER
C     ,NLD(K) AND NLF(K) ARE THE EXTREME MESH(ORDERED
C     CLOCKWISE)NUMBERS BETWEEN WHICH THE SAME
C     HEAD LAW APPLIES
C
C     SUB PROGRAMS CALLED:NONE
C

SUBROUTINE VARSIN     76/76   OPT=1                    FTN 4.1+373     15/1

      SUBROUTINE VARSIN(ISING,JSING,NPSING,NSING,HVSING,H,IHEAD,HINI,NL,
     1NC,NAQ)
C
C     **VARSIN READS,AT A GIVEN TIME,THE HEAD VARIATION APPLIED TO
C     ANY TYPE OF FIELD SINGULARITY DEFINED PREVIOUSLY IN SINGUL AND
C     MODIFIES CONSEQUENTLY THE HEADS OF CORRESPONDING FIELD LOCATIO
C     NS.
C     ,ISING(L,LL),JSING(L,LL):F.S. LOCATION
C     ,NPSING(L)=NUMBER OF F.S. MESHES
C     ,NSING:NUMBER OF FIELD SINGULARITIES
C     ,HVSING(L,LL)=VARIATION IN HEAD ON A F.S. MESH
C     ,H(I,J,K):MESH HEAD
C     ,HINI(L,LL):INITIAL HEAD
C     ,NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS
C     ,IHEAD IS AN INDEX SET TO:
C           =0 IF A VARIATION IN HEAD IS READ
C           =1 IF A HEAD IS READ
C     NB:VARIATIONS REFER TO INITIAL HEADS
C
C     SUB PROGRAMS CALLED:NONE
C

SUBROUTINE LIMVA      76/76   OPT=1                    FTN 4.1+373     15

      SUBROUTINE LIMVA(H,ILIM,JLIM,HLIM,NLV,NLD,NLF,IHEAD,HINI,NL,NC,NAQ
     1,NPLIM)
C     **LIMVA READS,AT A GIVEN TIME,THE VARIATIONS IN HEAD ON GIVENC
C     BOUNDARY LOCATIONS AND APPLIES THE NEW HEADS.                 C
C     ,H(I,J,K):HEAD                                                C
C     ,ILIM(L,LL),JLIM(L,LL):BOUNDARY LOCATION INDICES              C
C     ,HLIM(L,K) :VARIATION IN HEAD                                 C
C     ,NLD(L,K),NLF(L,K):EXTREME MESH NUMBERS BETWEEN WHIC,         C
C                        HLIM APPLIES                               C
C     ,NLV(K):NUMBER OF DISTINCT HEAD VARIATION LAWS                C
C     ,HINI(L,LL):INITIAL BOUNDARY HEADS PER AQUIFER                C
C     ,NPLIM(K):NUMBER OF LATERAL BOUNDARY MESHES PER AQUIF         C
C           ER.                                                     C
C     ,NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS                C
C     ,IHEAD IS AN INDEX SET TO:                                    C
C           =0 IF A VARIATION IN HEAD IS READ                       C
C           =1 IF A HEAD IS READ                                    C
C     NB:VARIATIONS REFER TO INITIAL HEADS                          C
C                                                                   C
C     SUB PROGRAMS CALLED:NONE                                      C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

SUBROUTINE QPUMP      76/76   OPT=1                    FTN 4.1+373     15/

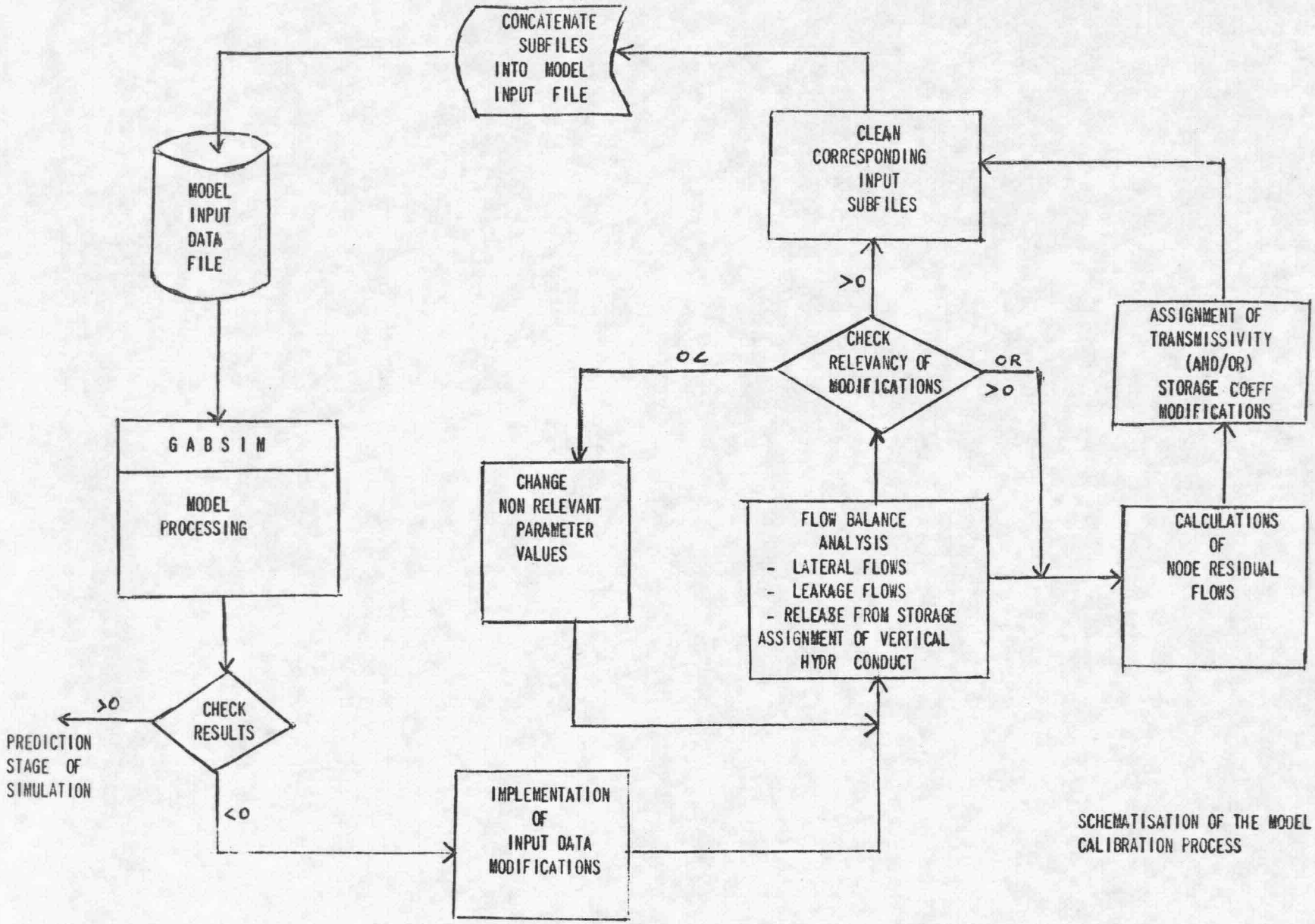
      SUBROUTINE QPUMP(IP,JP,KP,QP,Q,NP,NL,NC,NAQ,TEMPO,YEAR,IPREL)
C
C     **QPUMP READS,AT A GIVEN TIME,THE WELL DISCHARGE RATES,EXPRESS
C     ED IN L/S,THEN APPLIES THEM TO THE ADEQUATE FIELD LOCATIONS
C     AND PRINTS OUT THE WELL DISCHARGE FIGURES.
C     ,QP(I):WELL DISCHARGE RATE
C     ,IP(L),JP(I),KP(I):WELL LOCATION
C     ,TEMPO:TIME SINCE SIMULATION STARTS.
C     ,YEAR:YEAR
C     ,Q(I):MESH POINT FLOW
C     ,NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS
C     ,NP:NUMBER OF WELLS
C     ,IPREL SPECIFIES THE TYPE OF FLOW APPLIED:
C           =IF IPREL=+1 DISCHARGE FLOW
C           =IF IPREL=-1 RECHARGE FLOW
C
C     SUB PROGRAMS CALLED:NONE
C

SUBROUTINE CHECK3     76/76   OPT=1                    FTN 4.1+373     15/1

      SUBROUTINE CHECK3(ICP,JCP,KCP,CPNOM,HCP,HORIG,H,NCP,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     **CHECK3 PRINTS OUT,ON A LINE PRINTER,THE COMPUTED            C
C     ,H(I,J,K) IS THE COMPUTED HEAD                                C
C     AND OBSERVED STEADY STATE HEADS ON CHECK BORES**              C
C     ,HCP(I) IS THE HEAD RECORDED ON A CHECK BORE                  C
C     ,ICP(I),JCP(L),KCP(L) ARE THE CHECK BORE COOR                 C
C     DINATES                                                       C
C     ,NCP IS THE NUMBER OF CHECK BORES                             C
C     ,CPNOM(L,3) IS THE CHECK BORE DENOMINATION                    C
CC    ,HORIG(L) IS THE CHECK BORE ZERO ELEVATION                    C
C     ,NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL                  C
C     TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS                    C
C                                                                   C
C     =SUB-PROGRAMS CALLED:NONE                                     C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

APPENDIX 5

SCHEMATIC DIAGRAM OF THE MODEL CALIBRATION PROCESS



SCHEMATISATION OF THE MODEL CALIBRATION PROCESS

```
      PROGRAM GABSIM(INPUT,OUTPUT,TAPE60=INPUT,TAPE61=OUTPUT)
C
C                          ****************
C                          *PROGRAM GABSIM*
C                          ****************
C
C                           *************
C                           *DESCRIPTION*
C                           *************
C
C
C     ************************************************
C     *       GABSIM SIMULATION MODEL CALCULATES THE *
C     *GROUND WATER HEADS,WITHIN TIME AND SPACE,OF A *
C     *MULTILAYERED AQUIFER SYSTEM GOVERNED BY HANTU *
C     *SH HYDRODYNAMIC ASSUMPTIONS                   *
C     *       FLOW IS LINEAR(E.G. DUPUIT-FORCHEIMER  *
C     *ASSUMPTIONS HOLD EVERYWHERE,NO FREE SURFACE CO*
C     *NDITIONS NOR TIME VARIANT TRANSMISSIVITIES IN *
C     *THE UPPER WATER-TABLE AQUIFER),MONOPHASIC,STEA*
C     *DY AND NON STEADY STATE.                      *
C     *       GABSIM CAN HANDLE ANY GEOMETRIC AND HYD*
C     *RODYNAMIC CONFIGURATION AS LONG AS THE HANTUSH*
C     *SCHEME IS A RELIABLE AQUIFER DESCRIPTION.TIME *
C     *IS SWEPT FROM AN INITIAL STEADY STATE,EITHER C*
C     *OMPUTED OR INPUTED,PRECEEDING THE TRANSIENT HE*
C     *AD CALCULATIONS.HEADS ARE PROCESSED EITHER IN *
C     *TERMS OF DRAWDOWNS OR OF ABSOLUTE HEADS.      *
C     *       MODEL BRIEF CHARACTERISTICS.           *
C     *       ---------------------------            *
C     *          .GRID=RECTANGULAR UNIFORM MESHES,WIT*
C     *           HOUT SWEEPING INTERRUPTIONS        *
C     *          .TRANSMISSIV=TIES=DIRECTIONAL EASTWA*
C     *           RDS AND SOUTHWARDS.                *
C     *          .DISCRETISATION SCHEME=FINITE DIFFER*
C     *           ENCES(SEVEN POINTS APPROXIMATION). *
C     *           EXPLICIT,TOTALLY IMPLICIT,CRANK-NIC*
C     *           OLSON IMPLICIT,IMPLICIT-EXPLICIT(OP*
C     *           TIONAL)                            *
C     *          .COMPUTING TECHNICS=POINT SUCCESSIVE*
C     *           OVER-RELAXATION (SEE:VARGA R.S. MAT*
C     *           -RIX ITERATIVE ANALYSIS PRENTICE HA*
C     *           LL 1963) INCLUDING THE COMPUTATION *
C     *           OF THE OPTIMUM S.O.R. FACTOR BY THE*
C     *           MODIFIED CARRE ALGORITHM.CONVERGENC*
C     *           E SPEED IS FASTENED BY USE OF A HEA*
C     *           D PREDICTOR.                       *
C     *          .SPECIAL EFFECTS:RIVERS,OUTCROPPING *
C     *           AREAS,VARIOUS UPPER WATER TABLE /OU*
C     *           IFER FIGURES.                      *
C     *          .INPUTS=PUNCHED CARDS,MAGNETIC DISCS*
C     *           OR DRUMS.NUMERICAL DATA ARE CODED  *
C     *          .IN FIXED FORMATS.                  *
C     *          .OUTPUT=LINE PRINTER                *
C     *          .PROGRAMMING LANGUAGE:FORTRAN IV COM*
C     *           PATIBLE WITH CDC 3000,6000 AND CYBE*
```

```
C     *          R 76 COMPILERS                          *
C     *         .COMPUTER(S) USED=CYBER 76 (C.S.I.R.     *
C     *          O. CANBERRA ACT)                        *
C     *         .PROGRAM AUTHOR=P.UNGEMACH B.R.G.M.      *
C     *          FRANCE                                  *
C     ****************************************************
C
C
C                  **********************
C                  *SUB-PROGRAMS CALLED*
C                  **********************
C
C
C     ******************************************************
C     *   READ-IN ITEM:                                    *
C     *   -------------                                    *
C     *       CONSTANT INPUT-DATA                          *
C     *           1/DATGAB:AQUIFERS GEOMETRY AND HYDRODYNAM*
C     *             MIC FIGURES,COMPUTING PARAMETERS(S.O.R)*
C     *           2/SINGUL:FIELD SINGULARITIES FEATURES    *
C     *           3/COORD2:BI-DIMENSIONAL LOCATION INDICES *
C     *           4/COORD3:THREE-DIMENSIONS LOCATION IND.  *
C     *           5/CONTR3:LOCATIONS AND STEADY STATE HEADS*
C     *             OF CHECK BORE HOLES                    *
C     *           6/MATCH3:LOCATIONS AND NON STEADY STATE  *
C     *             HEAD RECORDS ON CHECK BORE HOLES       *
C     *       TIME VARIANT INPUT DATA                      *
C     *           1/QPUMP:WELL DISCHARGE RATES             *
C     *           2/LIMVA:VARIATIONS IN HEADS ON LATERAL BO*
C     *             UNDARIES                               *
C     *           3/VARSIN:VARIATIONS IN HEADS ON FIELD SIN*
C     *             GULARITIES                             *
C     *                                                    *
C     *   COMPUTING ITEM:                                  *
C     *   ---------------                                  *
C     *       PRELIMINARY CALCULATIONS:                    *
C     *           1/GEOMMC:GENERATION OF FIELD SWEEPING AND*
C     *             VERTICAL AQUIFER CONNECTIONS INDICES   *
C     *           2/COORBO:GENERATION OF LATERAL BOUNDARIES*
C     *             LOCATION INDICES                       *
C     *           3/TDIRMC:GENERATION OF DIRECTIONAL TRANS *
C     *             MISSIVITIES                            *
C     *       WATER BALANCE                                *
C     *           1/LEAKAG:VERTICAL LEAKAGE FLOW RATES     *
C     *           2/DEBLA3:LATERAL BOUNDARIES IN(OUT)FLOW  *
C     *           3/FLUXES:FIELD  DIS(RE)CHARGE FLOWS      *
C     *           4/STORAG:WATER RELEASE FROM STORAGE      *
C     *           5/DEBRN:RIVER-AQUIFER EXCHANGE FLOW RATES*
C     *           6/BUDGET:COMPUTING THE OVERALL WATER BAL *
C     *             ANCE                                   *
C     *       SOLVING THE LINEAR SET OF FINITE DIFF. EQUAT.*
C     *           1/PSORMC:COMPUTING OF HEAD DISTRIBUTION  *
C     *             VS TIME AND SPACE USING EITHER EXPLICIT*
C     *             TOTALLY IMPLICIT,CRANK-NICOLSON IMPLICI*
C     *             T OR IMPLICIT-EXPLICIT SCHEMES BY SUCCE*
C     *             SSIVE OVER-RELAXATION TECHNICS.PSORMC  *
C     *             COMPUTES ALSO STEADY-STATE HEADS.      *
C
```

```
C     *            2/CARRE ROUTING OF THE OPTIMUM O.R. FAC*
C     *              TOR USING THE MODIFIED CARRE ALGORITHM *
C     *                                                     *
C     *    PRINT-OUT ITEM:                                  *
C     *    ---------------                                  *
C     *        TABLES                                       *
C     *            1/CHECK3:COMPUTED AND OBSERVED HEADS ON  *
C     *              CHECK BORE HOLES                       *
C     *        GRAPHS                                       *
C     *            1/CURVE2:PLOTS TWO SETS OF VARIABLES VS  *
C     *              TIME OR SPACE                          *
C     *        MAPS                                         *
C     *            1/FRAME:AQUIFER GEOMETRY AND FIELD SINGU*
C     *              LARITIES                               *
C     *            2/IMPRE1:TWO DIMENSIONAL ARRAY OF A NUME *
C     *              RIC FORM(ONE SINGLE PARAMETER)         *
C     *            3/IMPRE2:SAME AS IMPRE1 WITH TWO ORTHOGO *
C     *              NAL PARAMETERS                         *
C     *            4/MAPXY:TWO DIMENSIONAL ARRAY OF A SYMBO *
C     *              LIC FORM.CALLS JOSE AND FORMI:         *
C     *                  JOSE=INTERPOLATES                  *
C     *                 FORMI=CONVERTS REAL TO ALPHANUMERIC*
C     *               NOTE=IMPRE1,IMPRE2,MAPXY USE A SQUARE*
C     *                    GRID REPRESENTATION ALLOWING SU *
C     *                    PEROSITION OVER PROTOTYPE DOCUM *
C     *                   MENTS(IF MAPPED)                  *
C     *                                                     *
C     *******************************************************
C
C                      **********************
C                      *DEFINITION OF SYMBOLS*
C                      **********************/
C
C    ************************************************************
C    *   -I:ROW INDEX(OY)                                       *
C    *   -J:COLUMN INDEX(OX)                                    *
C    *   -K:AQUIFER INDEX(OZ)                                   *
C    *   -NL:NUMBER OF ROWS                                     *
C    *   -NC:NUMBER OF COLUMNS                                  *
C    *   -NAQ:NUMBER OF AQUIFERS                                *
C    *   -KFIELD(I,J,K):FIELD GEOMETRY INDEX                    *
C    *   -KAQSUP(I,J,K):UPPER AQUIFER CONNECTION                *
C    *   -KAQINF(I,J,K):BOTTOM AQUIFER CONNECTION               *
C    *   -IDEB(K):STARTING ROW                                  *
C    *   -IFIN(K):ENDING ROW                                    *
C    *   -JD(I,K):STARTING SWEEPING COLUMN INDEX/ROW            *
C    *   -JF(I,K):ENDING SWEEPING COLUMN INDEX/ROW              *
C    *   -DX,DY:SPACE DISCRETISATION INCREMENTS                 *
C    *   -DT:TIME DISCRETISATION INCREMENT                      *
C    *   -DT0:INITIAL TIME STEP                                 *
C    *   -NTS:TOTAL NUMBER OF MAIN TIME STEPS                   *
C    *   -T(I,J,K):MESH AVERAGE TRANSMISSIVITY(M2/S)            *
C    *   -TE(I,J,K):MESH DIRECTIONAL TRANSMISSIVITY(EAST)       *
C    *   -TS(I,J,K):MESH DIRECTIONAL TRANSMISSIVITY(SOUTH)      *
C    *   -S(I,J,K):STORAGE COEFFICIENT                          *
C    *   -Q(I,J,K):FLOW RATE(M3/S)                              *
```

```
C     *   -H(I,J,K):FINAL HEAD(M)                                          *     C
C     *   -H0(I,J,K):INITIAL HEAD(M)                                       *     C
C     *   -HCB1(I,J)):HEAD  OF THE SEMI-PERVIOUS CONF.LAY.(OUTCROP)*     C
C     *   -DT:TIME DISCRETISATION INCREMENT                                *     C
C     *   -DT0:INITIAL TIME STEP                                           *     C
C     *   -NTS:TOTAL NUMBER OF MAIN TIME STEPS                             *     C
C     *   -XMAP(I,J):PRINT OUT DUMMY VARIABLE                              *     C
C     *   -IWELL(L),JWELL(L):WELL COORDINATES                              *     C
C     *   -QWELL(L):WELL DISCHARGE(M3/S)                                   *     C
C     *   -NWELL:NUMBER OF WELLS                                           *     C
C     *   -IRIV(L,LL),JRIV(L,LL):RIVER LOCATION COORDINATES                *     C
C     *   -RIVNOM(L,L):RIVER NAME                                          *     C
C     *   -HRIV(L,LL):RIVER HEAD(M)                                        *     C
C     *   -HVRIV(L,LL):VARIATION IN HEAD  ON A RIVER(M)                    *     C
C     *   -NPRIV(L):NUMBER OF DISCRETIZED MESHES PER RIVER                 *     C
C     *   -NRIV:NUMBER OF RIVERS                                           *     C
C     *   -ILIM(K),JLIM(K):LATERAL BOUNDARIES COORDINATES                  *     C
C     *   -NPLIM(K):NUMBER OF LATERAL BOUDARY MESHES                       *     C
C     *   -NLV(K):NUMBER OF BOUNDARY HEAD VARIATIONS LAWS                  *     C
C     *   -NLD(K,LL),NLF(K,LL):INDICES(START,END) OF HEAD VAR. LAWS*     C
C     *   -HLIM(K,LL):HEAD ON LATERAL BOUNDARY                             *     C
C     *   -IPCST(L),JPCST(L):LOCATION OF A CHECK BORE HOLE(STEADY )*     C
C     *   -KPCST(L):AQUIFER NO                                             *     C
C     *   -CPNOM(L,3):CHECK BORE HOLE NAME                                 *     C
C     *   -HCPST(L):STEADY HEAD ON A CHECK B.H.                            *     C
C     *   -IPCNS(L),JPCNS(L):LOCATION OF A CHECK BORE HOLE(NON-ST.)*     C
C     *   -KPCNS(L):AQUIFER NO                                             *     C
C     *   -HPCNS(L):NON STEADY HEAD ON A CHECK B.H.                        *     C
C     *   -EP(I,J,K):THICKNESS OF A CONFINING LAYER(M)                     *     C
C     *   -PZ(I,J,K):VERTICAL HYDR.CONDUCT. OF A CONFINING LAYER           *     C
C     *   -RO:SUCCESSIVE OVER RELAXATION COEEFICIENT                       *     C
C     *   -RO0:INITIAL S.O.R. COEFFICIENT                                  *     C
C     *   -NITER:NUMBER OF ITERATIONS ALLOCATED TO O.R.                    *     C
C     *   -ERROR:ERROR ALLOWED                                             *     C
C     *   -NMAX:NUMBER OF ITERATIONS AFTER WHICH RO IS COMPUTED            *     C
C     *   -IREG:REGIME(STEADY OR NON STEADY) INDEX                         *     C
C     *   -IERROR:ERROR CHECK  INDEX                                       *     C
C     *   -ISCHEM:HYDRAULIC SCHEME INDEX                                   *     C
C     *                                                                    *     C
C     **********************************************************************     C
C                                                                                 C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION KFIELD(22,22,4),KAQSUP(22,22,4),KAQINF(22,22,4),IDEB(4),
     1IFIN(4),JD(22,4),JF(22,4)
      DIMENSION XMAP(22,22,4),YMAP(22,22,4)
      DIMENSION T(22,22,4),TE(22,22,4),TS(22,22,4),H0(22,22,4)
      DIMENSION TK(4)
      DIMENSION RIVNAM(2,4),IRIV(2,200),JRIV(2,200),NPRIV(2),QRIV(2),
     1H(22,22,4),IW(100),JW(100),KW(100),QW(100),Q(22,22,4),HRIV(2,200)
      DIMENSION XX(22),IA(36),JA(36),KA(36)
      DIMENSION ICP(15),JCP(15),KCP(15),HCP(15),CPNOM(15,3),HZERO(15)
      DIMENSION SK(4),PZK(4),S(22,22,4),PZ(22,22,4),EP(22,22,4),HCB(22,2
     12),HCHECK(15,15),HC(15)
      COMMON IN,IO
      COMMON BLANK,STAR
      IN=60
      IO=61
```

```
                NL=22
230             NC=22
                NAQ=4
                NRIV=2
                NW=45
                TEMPO=9562000.
235             DX=1000.
                DY=1000.
                DT=2592000.
                NCP=15
                NA=36
240             RO=1.
                NITER=50
                ERROR=0.001
                NMAX=5
                NPT=15
245             LFREQ=5
                LINT=5
                KFRIV=5
                READ(IN,100)BLANK,STAR,POINT,ZERO,WLETER,RLETER,ALETER,CHARI
            100 FORMAT(80A1)
250             DO 880 K=1,NAQ
                DO 880 I=1,NL
            880 READ(IN,250)(KFIELD(I,J,K),J=1,NC)
            250 FORMAT(36I2)
                CALL GEOMMC(IDEB,IFIN,JD,JF,KFIELD,KAQSUP,KAQINF,NL,NC,NAQ)
255             TK(1)=0.05
                TK(2)=0.01
                TK(3)=0.001
                TK(4)=0.005
                SK(1)=0.05
260             SK(2)=0.005
                SK(3)=0.001
                SK(4)=0.0005
                PZK(1)=0.
                PZK(2)=0.00000001
265             PZK(3)=0.000000005
                PZK(4)=0.000000001
                DO 1 K=1,NAQ
                DO 1 I=1,NL
                DO 1 J=1,NC
270             T(I,J,K)=TK(K)
                S(I,J,K)=SK(K)
                PZ(I,J,K)=PZK(K)
                EP(I,J,K)=100.
                IF(KFIELD(I,J,K).EQ.2.OR.KFIELD(I,J,K).EQ.-1)T(I,J,K)=0.
275           1 CONTINUE
                DO 2 K=1,NAQ
                DO 2 I=1,NL
                DO 2 J=1,NC
                IF(KFIELD(I,J,K).NE.2)GO TO 2
280             S(I,J,K)=0.
                PZ(I,J,K)=0.
                EP(I,J,K)=0.
              2 CONTINUE
                DO 50 I=1,NL
285             DO 50 J=1,NC
```

```
     50 H(I,J ,1)=91.70
        TRIV1=0.08
        TRIV2=0.03
        TRIV3=0.10
290     T(3,9,1)=TRIV1
        T(4,9,1)=TRIV1
        T(5,10,1)=TRIV1
        T(6,11,1)=TRIV1
        T(7,11,1)=TRIV1
295     T(8,12,1)=TRIV1
        T(8,13,1)=TRIV1
        T(9,14,1)=TRIV1
        T(10,14,1)=TRIV1
        T(3,17,1)=TRIV2
300     T(4,16,1)=TRIV2
        T(5,16,1)=TRIV2
        T(6,15,1)=TRIV2
        T(7,15,1)=TRIV2
        T(8,16,1)=TRIV2
305     T(9,16,1)=TRIV2
        T(10,15,1)=TRIV3
        T(11,14,1)=TRIV3
        T(12,13,1)=TRIV3
        T(13,12,1)=TRIV3
310     T(13,11,1)=TRIV3
        T(14,11,1)=TRIV3
        T(14,10,1)=TRIV3
        CALL TDIRMC(T,TE,TS,KFIELD,1,NL,NC,NAQ)
        DO 51 I=1,NL
315     DO 51 J=1,NC
     51 H(I,J,1)=91.70
        DO 52 I=1,NL
        DO 52 J=1,NC
     52 H(I,J,2)=98.03
320     DO 53 I=1,NL
        DO 53 J=1,NC
     53 H(I,J,3)=102.27
        DO 54 I=1,NL
        DO 54 J=1,NC
325  54 H(I,J,4)=105.93
        DO 55 K=1,NAQ
        DO 55 I=1,NL
        DO 55 J=1,NC
        IF(KFIELD(I,J,K).EQ.2.OR.KFIELD(I,J,K).EQ.-1)H(I,J,K)=0.
330  55 CONTINUE
        CALL SINGUL(IRIV,JRIV,NPRIV,NRIV,RIVNAM,KFRIV,KFIELD,HRIV,H,NL,NC,
       1NAQ)
        CALL COORD3(IW,JW,KW,NW)
        CALL COORD3(IA,JA,KA,NA)
335     DO 22 K=1,NAQ
        WRITE(IO,3333)K
3333 FORMAT(1H1//43X,34(1H*)/43X,1H*,9X,11HAQUIFER NO=,I3,9X,1H*/43X,34
       1H*GEOMETRY AND FIELD SINGULARITIES*/43X,1H*,12X,7HFIGURES,13X,1H*/
       243X,34(1H*)//)
340     CALL FRAMMC(XX,BLANK,STAR,POINT,ZERO,WLETER,RLETER,ALETER,KFIELD,
       1KFRIV,IW,JW,KW,IR,JR,IA,JA,KA,K,NW,NRIV,NPRIV,NA,NL,NC,NAQ)
     22 CONTINUE
```

```
      DO 80 K=1,NAQ
CCCC
```

```
      Z2(1H*)/52(1H*),3H  *,3X,13(1H*),4X,3H*  ,52(1H*)/52(1H*),26H  *POI
     3NT TRANSMISSIVITY*  ,52(1H*)/52(1H*),3H  *,8X,3HMAP,9X,3H*  ,52(1H
     4*)/52(1H*),2H  ,22(1H*),2H  ,52(1H*)/2(52(1H*),26(1H ),52(1H*)/),2
     54(130(1H*)/))
      DO 14 I=1,NL
      DO 14 J=1,NC
      XMAP(I,J)=0.
   14 XMAP(I,J)=T(I,J,K)
      CALL IMPRE1(XMAP,NL,NC,10000.,1,1)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C                5/DIRECTIONAL TRANSMISSIVITIES                       C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      WRITE(IO,1400)K
 1400 FORMAT(1H1,24(130(1H*)/),3(49(1H*),32(1H ),49(1H*)/),49(1H*),2H  ,
     128(1H*),2H  ,49(1H*)/49(1H*),3H  *,6X,11HAQUIFER NO:,I2,7X,3H*  ,4
     29(1H*)/49(1H*),3H  *,6X,13(1H*),7X,3H*  ,49(1H*)/49(1H*),32H  *DIR
     3ECTIONAL TRANSMISSIVITY*  ,49(1H*)/49(1H*),3H  *,11X,3HMAP,12X,3H*
     4  ,49(1H*)/49(1H*),2H  ,28(1H*),2H  ,49(1H*)/2(49(1H*),32(1H ),49(
     51H*)/),24(130(1H*)/))
      DO 15 I=1,NL
      DO 15 J=1,NC
      XMAP(I,J)=0.
      YMAP(I,J)=0.
      XMAP(I,J)=TE(I,J,K)
   15 YMAP(I,J)=TS(I,J,K)
      CALL IMPRE2(XMAP,YMAP,NL,NC,10000.,10000.,1,1)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C                       6/STORAGE COEFFICIENTS                        C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      WRITE(IO,1500)K
 1500 FORMAT(1H1,24(130(1H*)/),2(52(1H*),26(1H ),52(1H*)/),52(1H*),2H  ,
     122(1H*),2H  ,52(1H*)/52(1H*),3H  *,3X,11HAQUIFER NO:,I2,4X,3H*  ,5
     Z2(1H*)/52(1H*),3H*  ,3X,13(1H*),4X,3H*  ,52(1H*)/52(1H*),26H  *STO
     3RAGE COEFFICIENT *  ,52(1H*)/52(1H*),3H  *,8X,3HMAR,9X,3H*  ,52(1H
     4*)/52(1H*),2H  ,22(1H*),2H  ,52(1H*)/2(52(1H*),26(1H ),52(1H*)/),2
     54(130(1H*)/))
      DO 16 I=1,NL
      DO 16 J=1,NC
      XMAP(I,J)=0.
   16 XMAP(I,J)=S(I,J,K)
      CALL IMPRE1(XMAP,NL,NC,100000.,1,1)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     7/UPPER CONFINING LAYER VERTICAL HYDRAULIC CONDUCTIVITIES      C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      WRITE(IO,1600)K
 1600 FORMAT(1H1,24(130(1H*)/),2(46(1H*),38(1H ),46(1H*)/),46(1H*),2H  ,
     134(1H*),2H  ,46(1H*)/46(1H*),3H  *,10X,11HAQUIFER NO:,I2,11X,3H*
     2,46(1H*)/46(1H*),3H  *,6X,19HUPPER CONFINING BED,7X,3H*  ,46(1H*)/
     346(1H*),38H  *VERTICAL HYDRAULIC CONDUCTIVITY *  ,46(1H*)/46(1H*),
     43H  *,14X,3HMAP,15X,3H*  ,46(1H*)/46(1H*),2H  ,34(1H*),2H  ,46(1H*
     5)/2(46(1H*),38(1H ),46(1H*)/),24(130(1H*)/))
      DO 17 I=1,NL
      DO 17 J=1,NC
      XMAP(I,J)=0.
   17 XMAP(I,J)=PZ(I,J,K)
      CALL IMPRE1(XMAP,NL,NC,1000000000.,1,1)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

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C              8/UPPER CONFINING LAYER THICKNESSES                      C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      WRITE(IO,1700)K
 1700 FORMAT(1H1,24(130(1H*)/),2(47(1H*),36(1H ),47(1H*)/),47(1H*),2H  ,
     132(1H*),2H  ,47(1H*)/47(1H*),3H  *,9X,11HAQUIFER NO:,I2,10X,3H*  ,
     247(1H*)/47(1H*),3H  *,9X,13(1H*),10X,3H*  ,47(1H*)/47(1H*),36H  *U
     3PPER CONFINING BED THICKNESS *  ,47(1H*)/47(1H*),3H  *,13X,3HMAR,1
     44X,3H*  ,47(1H*)/47(1H*),2H  ,32(1H*),2H  ,47(1H*)/2(47(1H*),36(1H
     5 ),47(1H*)/),24(130(1H*)/))
      DO 18 I=1,NL
      DO 18 J=1,NC
      XMAP(I,J)=0.
   18 XMAP(I,J)=EP(I,J,K)
      CALL IMPRE1(XMAP,NL,NC,1.,1,1)
   80 CONTINUE
      CALL OPUMP(IW,JW,KW,QW,Q,NW,NL,NC,NAQ,TEMPO,1958,1)
      CALL CONTR3(ICP,JCP,KCP,HCP,HZERO,CPNOM,1958,NCP)
      CALL CHECK3(ICP,JCP,KCP,CPNOM,HCP,0.,H,NCP,NL,NC,NAQ)
      CALL DEBRN(H,TE,TS,RIVNAM,IRIV,JRIV,NPRIV,DX,DY,DT,QRIV,QRTOT,TEMP
     1O,1958,NRIV,KFIELD,KFRIV,NL,NC,NAQ)
      DO 60 I=1,NL
      DO 60 J=1,NC
      XMAP(I,J)=0.
      YMAP(I,J)=0.
      XMAP(I,J)=TE(I,J,1)
      YMAP(I,J)=TS(I,J,1)
   60 CONTINUE
      CALL IMPRE2(XMAP,YMAP,NL,NC,1000.,1000.,1,1)
      CALL IMPRE1(XMAP,NL,NC,1000.,1,1)
      CALL IMPRE1(YMAP,NL,NC,1000.,1,1)
      TEMPS=0.
      DO 10 K=1,NAQ
      DO 10 I=1,NL
      DO 10 J=1,NC
   10 H(I,J,K)=0.
      DO 11 I=1,NL
      DO 11 J=1,NC
   11 HCB(I,J)=0.
      NYEAR=1950
      LINT=5
      DT0=1004051.6
      DO 40 K=1,NAQ
      WRITE(IO,8000)K
 8000 FORMAT(1H1,25(/)  ,38X,43(1H*)/38X,43H*DISTRIBUTION OF FIELD DESCR
     1IPTION INDICES*/38X,1H*,14X,11HAQUIFER NO:,I2,14X,1H*/38X,43(1H*))
      DO 41 I=1,NL
      DO 41 J=1,NC
      XMAP(I,J)=0.
      XMAP(I,J)=KFIELD(I,J,K)
   41 CONTINUE
      CALL IMPRE1(XMAP,NL,NC,1.,0,1)
   40 CONTINUE
      DO 42 K=1,NAQ
      WRITE(IO,2500)K
 2500 FORMAT(1H1,25(/)  ,45X,30(1H*)/45X,30H*VERTICAL AQUIFER CONNECTION
     1S*/45X,1H*,7X,12HAQUIFER NO: ,I2,7X,1H*/45X,30(1H*))
      WRITE(IO,3000)
```

```
      3000 FORMAT(1H0//52X,17(1H*)/52X,17H*TOP CONNECTIONS*/52X,17(1H*))
515        DO 43 I=1,NL
           DO 43 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQSUP(I,J,K)
        43 CONTINUE
520        CALL IMPRE1(XMAP,NL,NC,1.,0,1)
           WRITE(IO,3500)
      3500 FORMAT(1H1,25(/),50X,20(1H*)/50X,20H*BOTTOM CONNECTIONS*/50X,20(1H
          1*))
           DO 44 I=1,NL
525        DO 44 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQINF(I,J,K)
        44 CONTINUE
           CALL IMPRE1(XMAP,NL,NC,1.,0,1)
530     42 CONTINUE
           DO 45 K=1,NAQ
           WRITE(IO,4000)K,K,IDEB(K),K,IFIN(K),K,K
      4000 FORMAT(1H1//48X,23(1H*)/48X,23H*LINE SWEEPING INDICES*/48X,1H*,4X,
          111HAQUIFER NO:,I2,4X,1H*/48X,23(1H*)//45X,29(1H*)/45X,22H*STARTING
535       2 AT ROW IDEB(,I2,2H)=,I2,1H*/45X,22H*  ENDING AT ROW IFIN(,I2,2H)=
          3,I2,1H*/45X,29(1H*)/49X,22(1H*)/49X,9H* I*JD(I,I2,7H)*JF(I,I2,2H)*
          4/49X,22(1H*))
           I1=IDEB(K)
           I2=IFIN(K)
540        DO 46 I=I1,I2
           WRITE(IO,4500)I,JD(I,K),JF(I,K)
      4500 FORMAT(49X,1H*,I2,1H*,2(3X,I2,3X,1H*))
        46 CONTINUE
           WRITE(IO,5000)
545   5000 FORMAT(49X,22(1H*))
        45 CONTINUE
           DO 20 LTIME=1,NPT
           DT=DTO/2.
           NYEAR=NYEAR+1
550        DO 25 LT=1,LINT
           DT=DT*2.
           TEMPS=TEMPS+DT
           DO 26 K=1,NAQ
           DO 26 I=1,NL
555        DO 26 J=1,NC
        26 HO(I,J,K)=H(I,J,K)
           CALL PSORMC(H,HO,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,KAQSUP
          1,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,0,1,1,1.,NL,NC,NAQ)
        25 CONTINUE
560        DO 24 L=1,NCP
           I1=ICP(L)
           J1=JCP(L)
           K1=KCP(L)
        24 HCHECK(L,LTIME)=H(I1,J1,K1)
565        IF((LTIME/LFREQ)*LFREQ.NE.LTIME)GO TO 20
           DO 27 K=1,NAQ
           WRITE(IO,5555)K,NYEAR
      5555 FORMAT(1H1,25(/),53X,15(1H*)/53X,12H*AQUIFER NO:,I2,1H*/53X,15(1H*
          1)/53X,15H*DRAWDOWN  MAP*/53X,1H*,2X,5HYEAR:,I4,2X,1H*/53X,15(1H*))
570        DO 28 I=1,NL
```

```
      3000 FORMAT(1H0//52X,17(1H*)/52X,17H*TOP CONNECTIONS*/52X,17(1H*))
515        DO 43 I=1,NL
           DO 43 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQSUP(I,J,K)
        43 CONTINUE
520        CALL IMPRE1(XMAP,NL,NC,1.,0,1)
           WRITE(IO,3500)
      3500 FORMAT(1H1,25(/),50X,20(1H*)/50X,20H*BOTTOM CONNECTIONS*/50X,20(1H
          1*))
           DO 44 I=1,NL
525        DO 44 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQINF(I,J,K)
        44 CONTINUE
           CALL IMPRE1(XMAP,NL,NC,1.,0,1)
530     42 CONTINUE
           DO 45 K=1,NAQ
           WRITE(IO,4000)K,K,IDEB(K),K,IFIN(K),K,K
      4000 FORMAT(1H1//48X,23(1H*)/48X,23H*LINE SWEEPING INDICES*/48X,1H*,4X,
          111HAQUIFER NO:,I2,4X,1H*/48X,23(1H*)//45X,29(1H*)/45X,22H*STARTING
535       2 AT ROW IDEB(,I2,2H)=,I2,1H*/45X,22H*  ENDING AT ROW IFIN(,I2,2H)=
          3,I2,1H*/45X,29(1H*)/49X,22(1H*)/49X,9H* I*JD(I,I2,7H)*JF(I,I2,2H)*
          4/49X,22(1H*))
           I1=IDEB(K)
           I2=IFIN(K)
540        DO 46 I=I1,I2
           WRITE(IO,4500)I,JD(I,K),JF(I,K)
      4500 FORMAT(49X,1H*,I2,1H*,2(3X,I2,3X,1H*))
        46 CONTINUE
           WRITE(IO,5000)
545   5000 FORMAT(49X,22(1H*))
        45 CONTINUE
           DO 20 LTIME=1,NPT
           DT=DTO/2.
           NYEAR=NYEAR+1
550        DO 25 LT=1,LINT
           DT=DT*2.
           TEMPS=TEMPS+DT
           DO 26 K=1,NAQ
           DO 26 I=1,NL
555        DO 26 J=1,NC
        26 HO(I,J,K)=H(I,J,K)
           CALL PSORMC(H,HO,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,KAQSUP
          1,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,0,1,1,1.,NL,NC,NAQ)
        25 CONTINUE
560        DO 24 L=1,NCP
           I1=ICP(L)
           J1=JCP(L)
           K1=KCP(L)
        24 HCHECK(L,LTIME)=H(I1,J1,K1)
565        IF((LTIME/LFREQ)*LFREQ.NE.LTIME)GO TO 20
           DO 27 K=1,NAQ
           WRITE(IO,5555)K,NYEAR
      5555 FORMAT(1H1,25(/),53X,15(1H*)/53X,12H*AQUIFER NO:,I2,1H*/53X,15(1H*
          1)/53X,15H*DRAWDOWN  MAP*/53X,1H*,2X,5HYEAR:,I4,2X,1H*/53X,15(1H*))
570        DO 28 I=1,NL
```

```
      3000 FORMAT(1H0//52X,17(1H*)/52X,17H*TOP CONNECTIONS*/52X,17(1H*))
515        DO 43 I=1,NL
           DO 43 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQSUP(I,J,K)
        43 CONTINUE
520        CALL IMPRE1(XMAP,NL,NC,1.,0,1)
           WRITE(IO,3500)
      3500 FORMAT(1H1,25(/),50X,20(1H*)/50X,20H*BOTTOM CONNECTIONS*/50X,20(1H
          1*))
           DO 44 I=1,NL
525        DO 44 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQINF(I,J,K)
        44 CONTINUE
           CALL IMPRE1(XMAP,NL,NC,1.,0,1)
530     42 CONTINUE
           DO 45 K=1,NAQ
           WRITE(IO,4000)K,K,IDEB(K),K,IFIN(K),K,K
      4000 FORMAT(1H1//48X,23(1H*)/48X,23H*LINE SWEEPING INDICES*/48X,1H*,4X,
          111HAQUIFER NO:,I2,4X,1H*/48X,23(1H*)//45X,29(1H*)/45X,22H*STARTING
535       2 AT ROW IDEB(,I2,2H)=,I2,1H*/45X,22H*  ENDING AT ROW IFIN(,I2,2H)=
          3,I2,1H*/45X,29(1H*)/49X,22(1H*)/49X,9H* I*JD(I,I2,7H)*JF(I,I2,2H)*
          4/49X,22(1H*))
           I1=IDEB(K)
           I2=IFIN(K)
540        DO 46 I=I1,I2
           WRITE(IO,4500)I,JD(I,K),JF(I,K)
      4500 FORMAT(49X,1H*,I2,1H*,2(3X,I2,3X,1H*))
        46 CONTINUE
           WRITE(IO,5000)
545   5000 FORMAT(49X,22(1H*))
        45 CONTINUE
           DO 20 LTIME=1,NPT
           DT=DTO/2.
           NYEAR=NYEAR+1
550        DO 25 LT=1,LINT
           DT=DT*2.
           TEMPS=TEMPS+DT
           DO 26 K=1,NAQ
           DO 26 I=1,NL
555        DO 26 J=1,NC
        26 HO(I,J,K)=H(I,J,K)
           CALL PSORMC(H,HO,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,KAQSUP
          1,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,0,1,1,1.,NL,NC,NAQ)
        25 CONTINUE
560        DO 24 L=1,NCP
           I1=ICP(L)
           J1=JCP(L)
           K1=KCP(L)
        24 HCHECK(L,LTIME)=H(I1,J1,K1)
565        IF((LTIME/LFREQ)*LFREQ.NE.LTIME)GO TO 20
           DO 27 K=1,NAQ
           WRITE(IO,5555)K,NYEAR
      5555 FORMAT(1H1,25(/),53X,15(1H*)/53X,12H*AQUIFER NO:,I2,1H*/53X,15(1H*
          1)/53X,15H*DRAWDOWN  MAP*/53X,1H*,2X,5HYEAR:,I4,2X,1H*/53X,15(1H*))
570        DO 28 I=1,NL
```

```
      3000 FORMAT(1H0//52X,17(1H*)/52X,17H*TOP CONNECTIONS*/52X,17(1H*))
515        DO 43 I=1,NL
           DO 43 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQSUP(I,J,K)
        43 CONTINUE
520        CALL IMPRE1(XMAP,NL,NC,1.,0,1)
           WRITE(IO,3500)
      3500 FORMAT(1H1,25(/),50X,20(1H*)/50X,20H*BOTTOM CONNECTIONS*/50X,20(1H
          1*))
           DO 44 I=1,NL
525        DO 44 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQINF(I,J,K)
        44 CONTINUE
           CALL IMPRE1(XMAP,NL,NC,1.,0,1)
530     42 CONTINUE
           DO 45 K=1,NAQ
           WRITE(IO,4000)K,K,IDEB(K),K,IFIN(K),K,K
      4000 FORMAT(1H1//48X,23(1H*)/48X,23H*LINE SWEEPING INDICES*/48X,1H*,4X,
          111HAQUIFER NO:,I2,4X,1H*/48X,23(1H*)//45X,29(1H*)/45X,22H*STARTING
535       2 AT ROW IDEB(,I2,2H)=,I2,1H*/45X,22H*  ENDING AT ROW IFIN(,I2,2H)=
          3,I2,1H*/45X,29(1H*)/49X,22(1H*)/49X,9H* I*JD(I,I2,7H)*JF(I,I2,2H)*
          4/49X,22(1H*))
           I1=IDEB(K)
           I2=IFIN(K)
540        DO 46 I=I1,I2
           WRITE(IO,4500)I,JD(I,K),JF(I,K)
      4500 FORMAT(49X,1H*,I2,1H*,2(3X,I2,3X,1H*))
        46 CONTINUE
           WRITE(IO,5000)
545   5000 FORMAT(49X,22(1H*))
        45 CONTINUE
           DO 20 LTIME=1,NPT
           DT=DTO/2.
           NYEAR=NYEAR+1
550        DO 25 LT=1,LINT
           DT=DT*2.
           TEMPS=TEMPS+DT
           DO 26 K=1,NAQ
           DO 26 I=1,NL
555        DO 26 J=1,NC
        26 HO(I,J,K)=H(I,J,K)
           CALL PSORMC(H,HO,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,KAQSUP
          1,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,0,1,1,1.,NL,NC,NAQ)
        25 CONTINUE
560        DO 24 L=1,NCP
           I1=ICP(L)
           J1=JCP(L)
           K1=KCP(L)
        24 HCHECK(L,LTIME)=H(I1,J1,K1)
565        IF((LTIME/LFREQ)*LFREQ.NE.LTIME)GO TO 20
           DO 27 K=1,NAQ
           WRITE(IO,5555)K,NYEAR
      5555 FORMAT(1H1,25(/),53X,15(1H*)/53X,12H*AQUIFER NO:,I2,1H*/53X,15(1H*
          1)/53X,15H*DRAWDOWN  MAP*/53X,1H*,2X,5HYEAR:,I4,2X,1H*/53X,15(1H*))
570        DO 28 I=1,NL
```

```
      3000 FORMAT(1H0//52X,17(1H*)/52X,17H*TOP CONNECTIONS*/52X,17(1H*))
515        DO 43 I=1,NL
           DO 43 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQSUP(I,J,K)
        43 CONTINUE
520        CALL IMPRE1(XMAP,NL,NC,1.,0,1)
           WRITE(IO,3500)
      3500 FORMAT(1H1,25(/),50X,20(1H*)/50X,20H*BOTTOM CONNECTIONS*/50X,20(1H
          1*))
           DO 44 I=1,NL
525        DO 44 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQINF(I,J,K)
        44 CONTINUE
           CALL IMPRE1(XMAP,NL,NC,1.,0,1)
530     42 CONTINUE
           DO 45 K=1,NAQ
           WRITE(IO,4000)K,K,IDEB(K),K,IFIN(K),K,K
      4000 FORMAT(1H1//48X,23(1H*)/48X,23H*LINE SWEEPING INDICES*/48X,1H*,4X,
          111HAQUIFER NO:,I2,4X,1H*/48X,23(1H*)//45X,29(1H*)/45X,22H*STARTING
535       2 AT ROW IDEB(,I2,2H)=,I2,1H*/45X,22H*  ENDING AT ROW IFIN(,I2,2H)=
          3,I2,1H*/45X,29(1H*)/49X,22(1H*)/49X,9H* I*JD(I,I2,7H)*JF(I,I2,2H)*
          4/49X,22(1H*))
           I1=IDEB(K)
           I2=IFIN(K)
540        DO 46 I=I1,I2
           WRITE(IO,4500)I,JD(I,K),JF(I,K)
      4500 FORMAT(49X,1H*,I2,1H*,2(3X,I2,3X,1H*))
        46 CONTINUE
           WRITE(IO,5000)
545   5000 FORMAT(49X,22(1H*))
        45 CONTINUE
           DO 20 LTIME=1,NPT
           DT=DTO/2.
           NYEAR=NYEAR+1
550        DO 25 LT=1,LINT
           DT=DT*2.
           TEMPS=TEMPS+DT
           DO 26 K=1,NAQ
           DO 26 I=1,NL
555        DO 26 J=1,NC
        26 HO(I,J,K)=H(I,J,K)
           CALL PSORMC(H,HO,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,KAQSUP
          1,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,0,1,1,1.,NL,NC,NAQ)
        25 CONTINUE
560        DO 24 L=1,NCP
           I1=ICP(L)
           J1=JCP(L)
           K1=KCP(L)
        24 HCHECK(L,LTIME)=H(I1,J1,K1)
565        IF((LTIME/LFREQ)*LFREQ.NE.LTIME)GO TO 20
           DO 27 K=1,NAQ
           WRITE(IO,5555)K,NYEAR
      5555 FORMAT(1H1,25(/),53X,15(1H*)/53X,12H*AQUIFER NO:,I2,1H*/53X,15(1H*
          1)/53X,15H*DRAWDOWN  MAP*/53X,1H*,2X,5HYEAR:,I4,2X,1H*/53X,15(1H*))
570        DO 28 I=1,NL
```

```
      3000 FORMAT(1H0//52X,17(1H*)/52X,17H*TOP CONNECTIONS*/52X,17(1H*))
515        DO 43 I=1,NL
           DO 43 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQSUP(I,J,K)
        43 CONTINUE
520        CALL IMPRE1(XMAP,NL,NC,1.,0,1)
           WRITE(IO,3500)
      3500 FORMAT(1H1,25(/),50X,20(1H*)/50X,20H*BOTTOM CONNECTIONS*/50X,20(1H
          1*))
           DO 44 I=1,NL
525        DO 44 J=1,NC
           XMAP(I,J)=0.
           XMAP(I,J)=KAQINF(I,J,K)
        44 CONTINUE
           CALL IMPRE1(XMAP,NL,NC,1.,0,1)
530     42 CONTINUE
           DO 45 K=1,NAQ
           WRITE(IO,4000)K,K,IDEB(K),K,IFIN(K),K,K
      4000 FORMAT(1H1//48X,23(1H*)/48X,23H*LINE SWEEPING INDICES*/48X,1H*,4X,
          111HAQUIFER NO:,I2,4X,1H*/48X,23(1H*)//45X,29(1H*)/45X,22H*STARTING
535       2 AT ROW IDEB(,I2,2H)=,I2,1H*/45X,22H*  ENDING AT ROW IFIN(,I2,2H)=
          3,I2,1H*/45X,29(1H*)/49X,22(1H*)/49X,9H* I*JD(I,I2,7H)*JF(I,I2,2H)*
          4/49X,22(1H*))
           I1=IDEB(K)
           I2=IFIN(K)
540        DO 46 I=I1,I2
           WRITE(IO,4500)I,JD(I,K),JF(I,K)
      4500 FORMAT(49X,1H*,I2,1H*,2(3X,I2,3X,1H*))
        46 CONTINUE
           WRITE(IO,5000)
545   5000 FORMAT(49X,22(1H*))
        45 CONTINUE
           DO 20 LTIME=1,NPT
           DT=DTO/2.
           NYEAR=NYEAR+1
550        DO 25 LT=1,LINT
           DT=DT*2.
           TEMPS=TEMPS+DT
           DO 26 K=1,NAQ
           DO 26 I=1,NL
555        DO 26 J=1,NC
        26 HO(I,J,K)=H(I,J,K)
           CALL PSORMC(H,HO,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,KAQSUP
          1,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,0,1,1,1.,NL,NC,NAQ)
        25 CONTINUE
560        DO 24 L=1,NCP
           I1=ICP(L)
           J1=JCP(L)
           K1=KCP(L)
        24 HCHECK(L,LTIME)=H(I1,J1,K1)
565        IF((LTIME/LFREQ)*LFREQ.NE.LTIME)GO TO 20
           DO 27 K=1,NAQ
           WRITE(IO,5555)K,NYEAR
      5555 FORMAT(1H1,25(/),53X,15(1H*)/53X,12H*AQUIFER NO:,I2,1H*/53X,15(1H*
          1)/53X,15H*DRAWDOWN  MAP*/53X,1H*,2X,5HYEAR:,I4,2X,1H*/53X,15(1H*))
570        DO 28 I=1,NL
```

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
373	22	*	K	335 342	7B	EXT REFS
403	80	*	K	343 471	221B	EXT REFS NOT INNER
406	81	*	I	359 362	15B	NOT INNER
415	81		J	360 362	3B	INSTACK
430	12	*	I	374 377	15B	NOT INNER
437	12		J	375 377	3B	INSTACK
452	13	*	I	389 392	15B	NOT INNER
461	13		J	390 392	3B	INSTACK
474	14	*	I	404 407	15B	NOT INNER
503	14		J	405 407	2B	INSTACK
515	15	*	I	419 424	17B	NOT INNER
524	15		J	420 424	5B	INSTACK
541	16	*	I	436 439	15B	NOT INNER
550	16		J	437 439	2B	INSTACK
562	17	*	I	451 454	15B	NOT INNER
571	17		J	452 454	2B	INSTACK
603	18	*	I	466 469	15B	NOT INNER
612	18		J	467 469	2B	INSTACK
634	60	*	I	477 483	15B	NOT INNER
641	60		J	478 483	4B	INSTACK
660	10	*	K	488 491	17B	NOT INNER
661	10	*	I	489 491	14B	NOT INNER
667	10		J	490 491	2B	INSTACK
700	11	*	I	492 494	13B	NOT INNER
705	11		J	493 494	2B	INSTACK
717	40	*	K	498 508	25B	EXT REFS NOT INNER
722	41	*	I	502 506	15B	NOT INNER
731	41		J	503 506	3B	INSTACK
745	42	*	K	509 530	51B	EXT REFS NOT INNER
752	43	*	I	515 519	15B	NOT INNER
761	43		J	516 519	3B	INSTACK
774	44	*	I	524 528	15B	NOT INNER
1003	44		J	525 528	3B	INSTACK
1017	45	*	K	531 546	30B	EXT REFS NOT INNER
1031	46	*	I	540 543	12B	EXT REFS
1050	20	*	LTIME	547 576	106B	EXT REFS NOT INNER
1054	25	*	LT	550 559	31B	EXT REFS NOT INNER
1060	26	*	K	553 556	20B	NOT INNER
1061	26	*	I	554 556	15B	NOT INNER
1067	26		J	555 556	3B	INSTACK
1112	24		L	560 564	10B	INSTACK
1127	27	*	K	566 575	24B	EXT REFS NOT INNER
1132	28	*	I	570 573	15B	NOT INNER
1141	28		J	571 573	2B	INSTACK
1157	29	*	L	577 586	27B	EXT REFS NOT INNER
1164	30		LTIME	578 581	6B	INSTACK

COMMON BLOCKS	LENGTH
/ /	4

STATISTICS

PROGRAM LENGTH	75072B	31290
BUFFER LENGTH	41B	33
SCM BLANK COMMON LENGTH	4B	4

```
      SUBROUTINE GABDAT(H,H0,H1,T,S,PZ,EP,DX,DY,DT0,R0,NITER,ERROR,NMAX,
     1KFIELD,KAQSUP,FMT,FMS,FMPZ,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **DATGAB READS THE INPUT DATA NECESSARY TO MODEL PROCESSING,  C
C            WHICH CONSIST OF:                                           C
C              -GEOMETRIC DATA:                                          C
C                   .KFIELD(I,J,K):FIELD DESCRIPTION INDEX               C
C                   .DX,DY:SPACE INCREMENTS                              C
C                   .DT0:INITIAL TIME STEP                               C
C              -HYDRONAMIC DATA                                          C
C                   .H(I,J,K):INITIAL HEAD                               C
C                   .H1(I,J):IONSTANT HEAD OF UPPER LAYER                C
C                   .T(I,J,K):AVERAGE MESH TRANSMISSIVITY                C
C                   .S(I,J,K):STORAGE COEFFICIENT                        C
C                   .PZ(I,J,K):VERTICAL PERMEABILITY OF UPPER CONFINING  C
C                              BED                                       C
C                   .EP(I,J,K):THICKNESS OF UPPER CONFINING BED          C
C              -MISCELLANEOUS                                            C
C                   .FMT,FMS,FMPZ:AMPLIFICATION FACTORS MULTIPLYING T,S  C
C                                 AND PZ                                 C
C            DATGAB CHECKS THE CONFORMITY OF HYDRODYNAMIC DATA WITH FIELD
C            DESCRIPTION AND VERTICAL AQUIFER CONNECTION INDICES KFIELD(I
C            ,J,K),KAQSUP(I,J,K) AND KAQINF(I,J,K)                       C
C              -SUCCESSIVE OVER RELAXATION PARAMETERS                    C
C                   .R0:INITIAL S.O.R.COEFFICIENT                        C
C                   .NITER:MAXIMUM NUMBER OF ITERATIONS                  C
C                   .ERROR:ERROR TOLERATED FROM S.O.R.                   C
C                   .NMAX:NUMBER OF ITERATIONS AFTER WHICH R0 IS REEVALUA
C                         -TED                                           C
C              -NL,NC,NAQ ARE THE NUMBER OF ROWS,COLUMNS AND AQUIFERS    C
C                                                                        C
C              SUB-PROGRAMS CALLED:NONE                                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION H(NL,NC,NAQ),H0(NL,NC,NAQ),H1(NL,NC),T(NL,NC,NAQ),S(NL,N
     1C,NAQ),PZ(NL,NC,NAQ),EP(NL,NC,NAQ),KFIELD(NL,NC,NAQ),KAQSUP(NL,NC,
     2NAQ)
      COMMON IN,IO
      LEVEL 2,H,H0,T,S,PZ,EP,KFIELD,KAQSUP
      EPSI=0.0000001
      READ(IN,100)DX,DY,DT0
  100 FORMAT(7F10.0)
      READ(IN,100)FMT,FMS,FMPZ
      READ(IN,200)R0,NITER,ERROR,NMAX
  200 FORMAT(2(F5.3,I5))
      DO 1 K=1,NAQ
      DO 10 I=1,NL
   10 READ(IN,300)(H(I,J,K),J=1,NC)
  300 FORMAT(10F7.2)
      DO 20 I=1,NL
   20 READ(IN,300)(T(I,J,K),J=1,NC)
      DO 30 I=1,NL
   30 READ(IN,300)(S(I,J,K),J=1,NC)
      DO 40 I=1,NL
   40 READ(IN,300)(PZ(I,J,K),J=1,NC)
      DO 50 I=1,NL
   50 READ(IN,300)(EP(I,J,K),J=1,NC)
    1 CONTINUE
```

```
                  DO 5 I=1,NL
                5 READ(IN,300)(H1(I,J),J=1,NC)
60                DO 15 K=1,NAQ
                  DO 15 I=1,NL
                  DO 15 J=1,NC
                  T(I,J,K)=T(I,J,K)/FMT
                  S(I,J,K)=S(I,J,K)/FMS
65                PZ(I,J,K)=PZ(I,J,K)/FMPZ
               15 CONTINUE
                  DO 25 K=1,NAQ
                  DO 26 I=1,NL
                  DO 26 J=1,NC
70                IF(KFIELD(I,J,K).EQ.2.AND.(ABS(H(I,J,K))).GT.EPSI)WRITE(IO,1000)K,
                 1I,J
               26 CONTINUE
                  DO 27 I=1,NL
                  DO 27 J=1,NC
75                IF(KFIELD(I,J,K).EQ.2.AND.T(I,J,K).GT.EPSI)WRITE(IO,2000)K,I,J
               27 CONTINUE
                  DO 28 I=1,NL
                  DO 28 J=1,NC
                  IF(KFIELD(I,J,K).EQ.2.AND.PZ(I,J,K).GT.EPSI)WRITE(IO,4000)K,I,J
80             28 CONTINUE
                  DO 29 I=1,NL
                  DO 29 J=1,NC
                  IF(KFIELD(I,J,K).EQ.2.AND.EP(I,J,K).GT.EPSI)WRITE(IO,5000)K,I,J
               29 CONTINUE
85                DO 31 I=1,NL
                  DO 31 J=1,NC
                  IF(KAQSUP(I,J,K).NE.0.OR.KAQSUP(I,J,K).NE.K)GO TO 41
                  IF(PZ(I,J,K).GT.EPSI)WRITE(IO,6000)K,I,J
                  GO TO 31
90             41 IF(PZ(I,J,K).LT.EPSI)WRITE(IO,6000)K,I,J
               31 CONTINUE
                  DO 32 I=1,NL
                  DO 32 J=1,NC
                  IF(KAQSUP(I,J,K).NE.0.OR.KAQSUP(I,J,K).NE.K)GO TO 42
95                IF(EP(I,K,J).GT.EPSI)WRITE(IO,7000)K,I,J
                  GO TO 32
               42 IF(EP(I,J,K).LT.EPSI)WRITE(IO,7000)K,I,J
               32 CONTINUE
               25 CONTINUE
100           1000 FORMAT(1H0/10X,19HHEAD OF AQUIFER NO=,I2,49H DOESN'T FIT THE FIELD
                  1 DESCRIPTION AT LOCATION I=,I3,3H,J=,I3)
              2000 FORMAT(1H0/10X,29HTRANSMISSIVITY OF AQUIFER NO=,I2,49H DOESN'T FIT
                  1 THE FIELD DESCRIPTION AT LOCATION I=,I3,3H,J=,I3)
              3000 FORMAT(1H0/10X,34HSTORAGE COEFFICIENT OF AQUIFER NO=,I2,49H DOESN'
105               1T FIT THE FIELD DESCRIPTION AT LOCATION I=,I3,3H,J=,I3)
              4000 FORMAT(1H0/10X,48HVERTICAL PERMEABILITY OF THE CONFINING LAYER NO=
                  1,I2,51H DOESN'T FIT THE AQUIFER DESCRIPTION AT LOCATION I=,I3,3H,J
                  2=,I3)
              5000 FORMAT(1H0/10X,36HTHICKNESS OF THE CONFINING LAYER NO=,I2,49H DOES
110               1N'T FIT THE AQUIFER DESCRIPTION AT LOCATION I=,I3,3H,J=,I3)
              6000 FORMAT(1H0/10X,48HVERTICAL PERMEABILITY OF THE CONFINING LAYER NO=
                  1,I2,52H DOESN'T FIT UPPER AQUIFER CONNECTION AT LOCATION I=,I3,3H,
                  2J=,I3)
              7000 FORMAT(1H0/10X,36HTHICKNESS OF THE CONFINING LAYER NO=,I2,52H DOES
```

```
115               1N"T FIT UPPER AQUIFER CONNECTION AT LOCATION I=,I3,3H,J=,I3)
                  RETURN
                  END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 GABDAT 1 116

VARIABLES	SN	TYPE		RELOCATION								
0	DTO	REAL		F.P.	DEFINED	1	40					
0	DX	REAL		F.P.	DEFINED	1	40					
0	DY	REAL		F.P.	DEFINED	1	40					
J	EP	REAL	ARRAY	F.P.	REFS	34	38	83	95	97		
					DEFINED	1	56					
1001	EPSI	REAL			REFS	70	75	79	83	88	90	95
					97	DEFINED	39					
0	ERROR	REAL		F.P.	DEFINED	1	43					
0	FMPZ	REAL		F.P.	REFS	65	DEFINED	1	42			
0	FMS	REAL		F.P.	REFS	64	DEFINED	1	42			
0	FMT	REAL		F.P.	REFS	63	DEFINED	1	42			
0	H	REAL	ARRAY	F.P.	REFS	34	38	70	DEFINED	1	47	
0	H0	REAL	ARRAY	F.P.	REFS	34	38	DEFINED	1			
0	H1	REAL	ARRAY	F.P.	REFS	34	DEFINED	1	59			
1003	I	INTEGER			REFS	47	50	52	54	56	58	2*63
					2*64	2*65	3*70	3*75	3*79	3*83	2*87	2*88
					2*90	2*94	2*95	2*97	DEFINED	46	49	51
					53	55	58	61	68	73	77	81
					85	92						
0	IN	INTEGER		/ /	REFS	37	I/O REFS	40	42	43	47	50
					52	54	56	59				
1	IO	INTEGER		/ /	REFS	37	I/O REFS	70	75	79	83	88
					90	95	97					
1004	J	INTEGER			REFS	47	50	52	54	56	59	2*63
					2*64	2*65	3*70	3*75	3*79	3*83	2*87	2*88
					2*90	2*94	2*95	2*97	DEFINED	47	50	52
					54	56	59	62	69	74	78	82
					86	93						
1002	K	INTEGER			REFS	47	50	52	54	56	2*63	2*64
					2*65	3*70	3*75	3*79	3*83	3*87	2*88	2*90
					3*94	2*95	2*97	DEFINED	45	60	67	
0	KAQSUP	INTEGER	ARRAY	F.P.	REFS	34	38	2*87	2*94	DEFINED	1	
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	34	39	70	75	79	83	
					DEFINED	1						
0	NAQ	INTEGER		F.P.	REFS	8*34	45	60	67	DEFINED	1	
0	NC	INTEGER		F.P.	REFS	9*34	47	50	52	54	56	59
					62	69	74	78	82	86	93	
					DEFINED	1						
0	NITER	INTEGER		F.P.	DEFINED	1	43					
0	NL	INTEGER		F.P.	REFS	9*34	46	49	51	53	55	58
					61	68	73	77	81	85	92	
					DEFINED	1						
0	NMAX	INTEGER		F.P.	DEFINED	1	43					

```
VARIABLES      SN  TYPE          RELOCATION
     0  PZ          REAL        ARRAY     F.P.       REFS          34        38        65        79        88        90
                                                     DEFINED        1        54        65
     0  RO          REAL                  F.P.       DEFINED        1        43
     0  S           REAL        ARRAY     F.P.       REFS          34        38        64   DEFINED        1        52        64
     0  T           REAL        ARRAY     F.P.       REFS          34        38        63        75   DEFINED        1        50
                                                       63
        VARIABLES USED AS FILE NAMES, SEE ABOVE

INLINE FUNCTIONS   TYPE   ARGS        DEF LINE  REFERENCES
       ABS         REAL      1  INTRIN              70

STATEMENT LABELS                    DEF LINE   REFERENCES
     0  1                               57         45
     0  5                               59         58
     0  10                              47         46
     0  15                              66         60        61        62
     0  20                              50         49
     0  25                              99         67
     0  26                              72         68        69
     0  27                              76         73        74
     0  28                              80         77        78
     0  29                              84         81        82
     0  30                              52         51
   404  31                              91         85        86        89
   444  32                              98         92        93        96
     0  40                              54         53
   373  41                              90         87
   433  42                              97         94
     0  50                              56         55
   466  100       FMT                   41         40        42
   507  200       FMT                   44         43
   521  300       FMT                   48         47        50        52        54        56        59
   646  1000      FMT                  100         70
   661  2000      FMT                  102         75
   675  3000      FMT   NO REFS        104
   712  4000      FMT                  106         79
   730  5000      FMT                  109         83
   745  6000      FMT                  111         88        90
   763  7000      FMT                  114         95        97

LOOPS  LABEL     INDEX      FROM-TO    LENGTH    PROPERTIES
    31  1      * K            45 57      141B              EXT REFS  NOT INNER
    32  10     * I            46 47       22B              EXT REFS  NOT INNER
    35         * J            47 47       13B              EXT REFS
    55  20     * I            49 50       22B              EXT REFS  NOT INNER
    60         * J            50 50       13B              EXT REFS
   100  30     * I            51 52       22B              EXT REFS  NOT INNER
   103         * J            52 52       13B              EXT REFS
   123  40     * I            53 54       22B              EXT REFS  NOT INNER
   126         * J            54 54       13B              EXT REFS
   146  50     * I            55 56       22B              EXT REFS  NOT INNER
   151         * J            56 56       13B              EXT REFS
   173  5      * I            58 59       20B              EXT REFS  NOT INNER
   176         * J            59 59       11B              EXT REFS
   214  15     * K            60 66       26B              NOT INNER
   215  15     * I            61 66       22B              NOT INNER
   226  15       J            62 66        6B    INSTACK
```

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
243	25	*	K	67 99	211B	EXT REFS NOT INNER
244	26	*	I	68 72	22B	EXT REFS NOT INNER
245	26	*	J	69 72	17B	EXT REFS
267	27	*	I	73 76	21B	EXT REFS NOT INNER
270	27	*	J	74 76	16B	EXT REFS
311	28	*	I	77 80	21B	EXT REFS NOT INNER
312	28	*	J	78 80	16B	EXT REFS
333	29	*	I	81 84	21B	EXT REFS NOT INNER
334	29	*	J	82 84	16B	EXT REFS
355	31	*	I	85 91	34B	EXT REFS NOT INNER
356	31	*	J	86 91	31B	EXT REFS
412	32	*	I	92 98	37B	EXT REFS NOT INNER
413	32	*	J	93 98	34B	EXT REFS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	1132B	602
SCM BLANK COMMON LENGTH	2B	2

```
      1               SUBROUTINE COORD2(IC,JC,NPC)
                C
                C         **COORD2 READS TWO DIMENSIONAL LOCATION INDICES  (L) AND JC
                C           IC(L) AND JC(L)
      5         C
                C
                C             SUB PROGRAMS CALLED:NONE
                C
                C
                      DIMENSION IC(NPC),JC(NPC)
     10               COMMON IN,IO
                      READ(IN,100)(IC(L),L=1,NPC)
                      READ(IN,100)(JC(L),L=1,NPC)
                  100 FORMAT(3612)
                      RETURN
     15               END
```

SYMBOLIC REFERENCE MAP (R=2)

```
ENTRY POINTS     DEF LINE     REFERENCES
    3  COORD2          1        14

VARIABLES     SN  TYPE          RELOCATION
    0  IC         INTEGER    ARRAY     F.P.        REFS          9    DEFINED       1        11
    0  IN         INTEGER               / /         REFS         10    I/O REFS     11        12
    1  IO         INTEGER               / /         REFS         10
    0  JC         INTEGER    ARRAY     F.P.        REFS          9    DEFINED       1        12
   35  L          INTEGER                          REFS         11         12    DEFINED       11        12
    0  NPC        INTEGER                F.P.      REFS        2*9         11         12    DEFINED        1
       VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS            DEF LINE   REFERENCES
   33  100     FMT             13         11        12

COMMON BLOCKS   LENGTH
       / /          2

STATISTICS
  PROGRAM LENGTH                 36B      30
  SCM BLANK COMMON LENGTH         2B       2
```

```
      SUBROUTINE COORD3     76/76   OPT=1                    FTN 4.4+R401       15/10/76  15.25.31       PAGE     1

     1                SUBROUTINE COORD3(IC,JC,KC,NC)
                      DIMENSION IC(1),JC(1),KC(1)
                      COMMON IN,IO
                C
     5          C       **COORTRS READS INTEGER COORDINATES OF FIELD SINGULARITIES**
                C
                C
                      READ(IN,100)(KC(I),I=1,NC)
                      READ(IN,100)(IC(I),I=1,NC)
    10                READ(IN,100)(JC(I),I=1,NC)
                  100 FORMAT(3612)
                      RETURN
                      END



      SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS     DEF LINE     REFERENCES
    3  COORD3          1        12

VARIABLES     SN  TYPE           RELOCATION
   50  I          INTEGER                          REFS          8         9        10   DEFINED        8         9        10
    0  IC         INTEGER    ARRAY     F.P.        REFS          2   DEFINED        1         9
    0  IN         INTEGER              / /         REFS          3   I/O REFS       8         9        10
    1  IO         INTEGER              / /         REFS          3
    0  JC         INTEGER    ARRAY     F.P.        REFS          2   DEFINED        1        10
    0  KC         INTEGER    ARRAY     F.P.        REFS          2   DEFINED        1         8
    0  NC         INTEGER              F.P.        REFS          8         9        10   DEFINED        1
      VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS              DEF LINE   REFERENCES
   46  100      FMT              11         8         9        10

COMMON BLOCKS   LENGTH
      / /          2

STATISTICS
  PROGRAM LENGTH                  51B      41
  SCM BLANK COMMON LENGTH          2B       2
```

```
      SUBROUTINE CLIM(NLV,NLD,NLF,NAQ)
C
C       **CLIM READS THE CHARACTERISTICS OF THE LATERAL BOUNDARY
C       MESHES ON WHICH A TIME VARIANT HEAD CONDITION IS APPLIED
C                .NLV(K) IS THE NUMBER OF DISTINCT HEAD LAWS PER
C                        AQUIFER
C                .NLD(K) AND NLF(K) ARE THE EXTREME MESH(ORDERED
C                        CLOCKWISE)NUMBERS BETWEEN WHICH THE SAME
C                        HEAD LAW APPLIES
C
C           SUB PROGRAMS CALLED:NONE
C
      DIMENSION NLV(NAQ),NLD(NAQ,20),NLF(NAQ,10)
      COMMON IN,IO
      READ(IN,100)(NLV(K),K=1,NAQ)
  100 FORMAT(36I2)
      DO 1 K=1,NAQ
      NV=NLV(K)
      READ(IN,100)(NLD(K,L),L=1,NV)
      READ(IN,100)(NLF(K,L),L=1,NV)
    1 CONTINUE
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

		DEF LINE	REFERENCES
3	CLIM	1	22

VARIABLES

	SN		TYPE		RELOCATION									
0		IN	INTEGER		/ /	REFS	14	I/O REFS	15	19	20			
1		IO	INTEGER		/ /	REFS	14							
113		K	INTEGER			REFS	15	18	19	20	DEFINED	15	17	
115		L	INTEGER			REFS	19	20	DEFINED	19	20			
0		NAQ	INTEGER		F.P.	REFS	3*13	15	17	DEFINED	1			
0		NLD	INTEGER	ARRAY	F.P.	REFS	13	DEFINED	1	19				
0		NLF	INTEGER	ARRAY	F.P.	REFS	13	DEFINED	1	20				
0		NLV	INTEGER	ARRAY	F.P.	REFS	13	18	DEFINED	1	15			
114		NV	INTEGER			REFS	19	20	DEFINED	18				

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS

			DEF LINE	REFERENCES		
0	1		21	17		
73	100	FMT	16	15	19	20

LOOPS

	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES		
26	1	*	K	17 21	37B	EXT REFS	NOT INNER	
33		*	L	19 19	11B	EXT REFS		
50		*	L	20 20	11B	EXT REFS		

COMMON BLOCKS

	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	126B	86
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE SINGUL(ISING,JSING,NPSING,NSING,SINGNA,KFSING,KFIELD,HS
     1ING,H,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **SINGUL READS THE FIELD SINGULARITIES(SUCH AS RIVERS,LAKES, C
C         GRAVEL-POOLS,ETC... CONNECTED TO AQUIFERS)FIGURES THEN PRINTSC
C         THEM OUT                                                      C
C                  .SINGNA(L,LL):FIELD SINGULARITY NAME                 C
C                  .NPSING(L):NUMBER OF MESHES PER F.S.                 C
C                  .ISING(L,K),JSING(L,K):F.S. LOCATION INDICES         C
C                  .HSING(L,K):INITIAL HEAD                             C
C                                                                       C
C              SUB-PROGRAMS CALLED:NONE                                 C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION ISING(NSING,100),JSING(NSING,100),SINGNA(NSING,4),HSING(
     1NSING,100),KFIELD(NL,NC,NAQ),NPSING(NSING),H(NL,NC,NAQ)
      COMMON IN,IO
C
C       **SINGUL READS THE FIELD SINGULARITIES(SUCH AS RIVERS,LAKES,
C         GRAVEL POOLS ETC    CONNECTED TO AQUIFERS) FEATURES AND
C         PRINTS OUT THE MAIN GEOMETRIC AND HYDRODYNAMIC FIGURES**
C
      WRITE(IO,1000)
 1000 FORMAT(1H1//50X,21(1H*)/50X,21H*WATER TABLE AQUIFER*/50X,21H*FIELD
     1 SINGULARITIES*/50X,1H*,3X,12HMAIN FIGURES,4X,1H*/50X,21(1H*)//)
      DO 1 L=1,NSING
      READ(IN,100)(SINGNA(L,LL),LL=1,4),NPSING(L)
  100 FORMAT(4A6,6X,I5)
      NPS=NPSING(L)
      READ(IN,200)(ISING(L,K),K=1,NPS)
      READ(IN,200)(JSING(L,K),K=1,NPS)
  200 FORMAT(36I2)
      READ(IN,300)(HSING(L,K),K=1,NPS)
  300 FORMAT(12F6.2)
      WRITE(IO,2000)(SINGNA(L,LL),LL=1,4)
 2000 FORMAT(36X,24HFIELD SINGULARITY NAME: ,4A6/36X,48(1H*)//41X,38(1H*
     1)/41X,38H*POINT NO*I(OY)*J(OX)*INITIAL HEAD(M)*/41X,38(1H*))
      DO 10 K=1,NPS
      WRITE(IO,3000)K,ISING(L,K),JSING(L,K),HSING(L,K)
 3000 FORMAT(41X,1H*,2X,I3,3X,1H*,2(2X,I2,2H *),4X,F7.2,4X,1H*)
      I1=ISING(L,K)
      J1=JSING(L,K)
      H(I1,J1,1)=HSING(L,K)
      KFIELD(I1,J1,1)=KFSING
   10 CONTINUE
      WRITE(IO,4000)
 4000 FORMAT(41X,38(1H*)//)
    1 CONTINUE
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 SINGUL 1 48

VARIABLES	SN	TYPE		RELOCATION								
0	H	REAL	ARRAY	F.P.	REFS	14	DEFINED	1	42			
0	HSING	REAL	ARRAY	F.P.	REFS	14	38	42	DEFINED	1	32	
0	IN	INTEGER		/ /	REFS	16	I/O REFS	26	29	30	32	
1	IO	INTEGER		/ /	REFS	16	I/O REFS	22	34	38	45	
0	ISING	INTEGER	ARRAY	F.P.	REFS	14	38	40	DEFINED	1	29	
325	I1	INTEGER			REFS	42	43	DEFINED	40			
0	JSING	INTEGER	ARRAY	F.P.	REFS	14	38	41	DEFINED	1	30	
326	J1	INTEGER			REFS	42	43	DEFINED	41			
324	K	INTEGER			REFS	29	30	32	4*38	40	41	42
					DEFINED	29	30	32	37			
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	14	DEFINED	1	43			
0	KFSING	INTEGER		F.P.	REFS	43	DEFINED	1				
321	L	INTEGER			REFS	2*26	28	29	30	32	34	3*38
						40	41	42	DEFINED	25		
322	LL	INTEGER			REFS	26	34	DEFINED	26	34		
0	NAQ	INTEGER		F.P.	REFS	2*14	DEFINED	1				
0	NC	INTEGER		F.P.	REFS	2*14	DEFINED	1				
0	NL	INTEGER		F.P.	REFS	2*14	DEFINED	1				
323	NPS	INTEGER			REFS	29	30	32	37	DEFINED	28	
0	NPSING	INTEGER	ARRAY	F.P.	REFS	14	28	DEFINED	1	26		
0	NSING	INTEGER		F.P.	REFS	5*14	25	DEFINED	1			
0	SINGNA	REAL	ARRAY	F.P.	REFS	14	34	DEFINED	1	26		

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS			DEF LINE	REFERENCES
0	1		47	25
0	10		44	37
220	100	FMT	27	26
240	200	FMT	31	29 30
251	300	FMT	33	32
173	1000	FMT	23	22
261	2000	FMT	35	34
305	3000	FMT	39	38
316	4000	FMT	46	45

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
24	1	* L	25 47	141B	EXT REFS NOT INNER
27		* LL	26 26	11B	EXT REFS
51		* K	29 29	11B	EXT REFS
66		* K	30 30	11B	EXT REFS
103		* K	32 32	11B	EXT REFS
120		* LL	34 34	11B	EXT REFS
133	10	* K	37 44	26B	EXT REFS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	367B	247
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE LIMVA(H,ILIM,JLIM,HLIM,NLV,NLD,NLF,IHEAD,HINI,NL,NC,NAQ
     1,NPLIM)
C          **LIMVA READS,AT A GIVEN TIME,THE VARIATIONS IN HEAD ON GIVENC
C          BOUNDARY LOCATIONS AND APPLIES THE NEW HEADS.                 C
C                   .H(I,J,K):HEAD                                       C
C                   .ILIM(L,LL),JLIM(L,LL):BOUNDARY LOCATION INDICES     C
C                   .HLIM(L,K) :VARIATION IN HEAD                        C
C                   .NLD(L,K),NLF(L,K):EXTREME MESH NUMBERS BETWEEN WHIC.
C                                      HLIM APPLIES                      C
C                   .NLV(K):NUMBER OF DISTINCT HEAD VARIATION LAWS       C
C                   .HINI(L,LL):INITIAL BOUNDARY HEADS PER AQUIFER       C
C                   .NPLIM(K):NUMBER OF LATERAL BOUNDARY MESHES PER AGUIF
C                      ER.                                               C
C                   .NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS       C
C                   .IHEAD IS AN INDEX SET TO:                           C
C                            .0 IF A VARIATION IN HEAD IS READ           C
C                            .1 IF A HEAD IS READ                        C
C                        NB:VARIATIONS REFER TO INITIAL HEADS            C
C                                                                        C
C              SUB PROGRAMS CALLED:NONE                                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION H(NL,NC,NAQ),ILIM(NAQ,200),JLIM(NAQ,200),HLIM(NAQ,20),
     1NLV(NAQ),NLD(NAQ,20),NLF(NAQ,20),HINI(NAQ,200),NPLIM(NAQ)
      COMMON IN,IO
      DO 1 K=1,NAQ
      NV=NLV(K)
      READ(IN,100)(HLIM(K,L),L=1,NV)
  100 FORMAT(12F6.2)
      DO 1 L=1,NV
      ND=NLD(K,L)
      NF=NLF(K,L)
      DO 1 M=ND,NF
      I1=ILIM(K,M)
      J1=JLIM(K,M)
      IF(IHEAD.EQ.0)H(I1,J1,K)=HINI(K,L)+HLIM(K,L)
      IF(IHEAD.EQ.1)H(I1,J1,K)=HLIM(K,L)
    1 CONTINUE
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

3	LIMVA	1

REFERENCES: 38

VARIABLES

	SN		TYPE		RELOCATION								
0	H	REAL	ARRAY	F.P.	REFS	22	DEFINED	1	35	36			
0	HINI	REAL	ARRAY	F.P.	REFS	22	35	DEFINED	1				
0	HLIM	REAL	ARRAY	F.P.	REFS	22	35	36	DEFINED	1	27		
0	IHEAD	INTEGER		F.P.	REFS	35	36	DEFINED	1				
0	ILIM	INTEGER	ARRAY	F.P.	REFS	22	33	DEFINED	1				
0	IN	INTEGER		/ /	REFS	24	I/O REFS	27					
1	IO	INTEGER		/ /	REFS	24							

```
      SUBROUTINE LIMVA(H,ILIM,JLIM,HLIM,NLV,NLD,NLF,IHEAD,HINI,NL,NC,NAQ
     1,NPLIM)
C          **LIMVA READS,AT A GIVEN TIME,THE VARIATIONS IN HEAD ON GIVENC
C          BOUNDARY LOCATIONS AND APPLIES THE NEW HEADS.                 C
C                   .H(I,J,K):HEAD                                       C
C                   .ILIM(L,LL),JLIM(L,LL):BOUNDARY LOCATION INDICES     C
C                   .HLIM(L,K) :VARIATION IN HEAD                        C
C                   .NLD(L,K),NLF(L,K):EXTREME MESH NUMBERS BETWEEN WHIC.
C                                      HLIM APPLIES                      C
C                   .NLV(K):NUMBER OF DISTINCT HEAD VARIATION LAWS       C
C                   .HINI(L,LL):INITIAL BOUNDARY HEADS PER AQUIFER       C
C                   .NPLIM(K):NUMBER OF LATERAL BOUNDARY MESHES PER AGUIF
C                      ER.                                               C
C                   .NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS       C
C                   .IHEAD IS AN INDEX SET TO:                           C
C                            .0 IF A VARIATION IN HEAD IS READ           C
C                            .1 IF A HEAD IS READ                        C
C                        NB:VARIATIONS REFER TO INITIAL HEADS            C
C                                                                        C
C              SUB PROGRAMS CALLED:NONE                                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION H(NL,NC,NAQ),ILIM(NAQ,200),JLIM(NAQ,200),HLIM(NAQ,20),
     1NLV(NAQ),NLD(NAQ,20),NLF(NAQ,20),HINI(NAQ,200),NPLIM(NAQ)
      COMMON IN,IO
      DO 1 K=1,NAQ
      NV=NLV(K)
      READ(IN,100)(HLIM(K,L),L=1,NV)
  100 FORMAT(12F6.2)
      DO 1 L=1,NV
      ND=NLD(K,L)
      NF=NLF(K,L)
      DO 1 M=ND,NF
      I1=ILIM(K,M)
      J1=JLIM(K,M)
      IF(IHEAD.EQ.0)H(I1,J1,K)=HINI(K,L)+HLIM(K,L)
      IF(IHEAD.EQ.1)H(I1,J1,K)=HLIM(K,L)
    1 CONTINUE
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

3	LIMVA	1

REFERENCES: 38

VARIABLES

	SN		TYPE		RELOCATION								
0	H	REAL	ARRAY	F.P.	REFS	22	DEFINED	1	35	36			
0	HINI	REAL	ARRAY	F.P.	REFS	22	35	DEFINED	1				
0	HLIM	REAL	ARRAY	F.P.	REFS	22	35	36	DEFINED	1	27		
0	IHEAD	INTEGER		F.P.	REFS	35	36	DEFINED	1				
0	ILIM	INTEGER	ARRAY	F.P.	REFS	22	33	DEFINED	1				
0	IN	INTEGER		/ /	REFS	24	I/O REFS	27					
1	IO	INTEGER		/ /	REFS	24							

```
      SUBROUTINE LIMVA(H,ILIM,JLIM,HLIM,NLV,NLD,NLF,IHEAD,HINI,NL,NC,NAQ
     1,NPLIM)
C          **LIMVA READS,AT A GIVEN TIME,THE VARIATIONS IN HEAD ON GIVENC
C          BOUNDARY LOCATIONS AND APPLIES THE NEW HEADS.                 C
C                   .H(I,J,K):HEAD                                       C
C                   .ILIM(L,LL),JLIM(L,LL):BOUNDARY LOCATION INDICES     C
C                   .HLIM(L,K) :VARIATION IN HEAD                        C
C                   .NLD(L,K),NLF(L,K):EXTREME MESH NUMBERS BETWEEN WHIC.
C                                      HLIM APPLIES                      C
C                   .NLV(K):NUMBER OF DISTINCT HEAD VARIATION LAWS       C
C                   .HINI(L,LL):INITIAL BOUNDARY HEADS PER AQUIFER       C
C                   .NPLIM(K):NUMBER OF LATERAL BOUNDARY MESHES PER AGUIF
C                      ER.                                               C
C                   .NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS       C
C                   .IHEAD IS AN INDEX SET TO:                           C
C                            .0 IF A VARIATION IN HEAD IS READ           C
C                            .1 IF A HEAD IS READ                        C
C                        NB:VARIATIONS REFER TO INITIAL HEADS            C
C                                                                        C
C              SUB PROGRAMS CALLED:NONE                                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION H(NL,NC,NAQ),ILIM(NAQ,200),JLIM(NAQ,200),HLIM(NAQ,20),
     1NLV(NAQ),NLD(NAQ,20),NLF(NAQ,20),HINI(NAQ,200),NPLIM(NAQ)
      COMMON IN,IO
      DO 1 K=1,NAQ
      NV=NLV(K)
      READ(IN,100)(HLIM(K,L),L=1,NV)
  100 FORMAT(12F6.2)
      DO 1 L=1,NV
      ND=NLD(K,L)
      NF=NLF(K,L)
      DO 1 M=ND,NF
      I1=ILIM(K,M)
      J1=JLIM(K,M)
      IF(IHEAD.EQ.0)H(I1,J1,K)=HINI(K,L)+HLIM(K,L)
      IF(IHEAD.EQ.1)H(I1,J1,K)=HLIM(K,L)
    1 CONTINUE
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

3	LIMVA	1

REFERENCES: 38

VARIABLES

	SN		TYPE		RELOCATION								
0	H	REAL	ARRAY	F.P.	REFS	22	DEFINED	1	35	36			
0	HINI	REAL	ARRAY	F.P.	REFS	22	35	DEFINED	1				
0	HLIM	REAL	ARRAY	F.P.	REFS	22	35	36	DEFINED	1	27		
0	IHEAD	INTEGER		F.P.	REFS	35	36	DEFINED	1				
0	ILIM	INTEGER	ARRAY	F.P.	REFS	22	33	DEFINED	1				
0	IN	INTEGER		/ /	REFS	24	I/O REFS	27					
1	IO	INTEGER		/ /	REFS	24							

```
                      4* YEAR * HEAD(M) */46X,28(1H*))
                       DO 25 LL=1,NTS
      60               IYEAR=IYIN+LL+1
                       HCP(L,LL)=HCP(L,LL)-ZERO(L)
                       HC(LL)=HCP(L,LL)
                       WRITE(IO,5000)LL,IYEAR,HCP(LL)
                 5000 FORMAT(46X,1H*,2X,I3,4X,1H*,1X,I4,1X,1H*,1X,F7.2,2H *)
      65             25 CONTINUE
                       WRITE(IO,6000)
                 6000 FORMAT(46X,28(1H*))
                       CALL CURVE2(HC,HC,BLANK,STAR,ZERO0,CHARI,NTS,100)
                     20 CONTINUE
      70               RETURN
                       END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

3	MATCH3	1 70

VARIABLES

		SN	TYPE		RELOCATION								
0	BLANK		REAL		F.P.	REFS	68	DEFINED	1				
0	CHARI		REAL		F.P.	REFS	68	DEFINED	1				
0	CPNOM		REAL	ARRAY	F.P.	REFS	21	45	53	DEFINED	1	30	
0	HC		REAL	ARRAY	F.P.	REFS	21	2*68	DEFINED	1	62		
0	HCP		REAL	ARRAY	F.P.	REFS	21	61	62	63	DEFINED	1	33
						61							
0	HCPIN		REAL	ARRAY	F.P.	REFS	21	43	45	DEFINED	1	30	44
435	HH		REAL			REFS	44	DEFINED	43				
0	ICP		INTEGER	ARRAY	F.P.	REFS	21	45	53	DEFINED	1	30	
0	IN		INTEGER		/ /	REFS	23	I/O REFS	30	33			
1	IO		INTEGER		/ /	REFS	23	I/O REFS	36	45	50	53	63
						66							
436	IYEAR		INTEGER			REFS	63	DEFINED	60				
0	IYIN		INTEGER		F.P.	REFS	60	DEFINED	1				
0	IYST		INTEGER	ARRAY	F.P.	REFS	21	53	DEFINED	1	30		
0	JCP		INTEGER	ARRAY	F.P.	REFS	21	45	53	DEFINED	1	30	
433	K		INTEGER			REFS	30	45	53	DEFINED	30	45	53
0	KCP		INTEGER	ARRAY	F.P.	REFS	21	45	53	DEFINED	1	30	
432	L		INTEGER			REFS	7*30	33	43	2*44	7*45	5*53	3*61
						62	DEFINED	29	42	52			
434	LL		INTEGER			REFS	33	60	2*61	2*62	2*63		
						DEFINED	33	59					
0	NCP		INTEGER		F.P.	REFS	8*21	29	42	52	DEFINED	1	
0	NTS		INTEGER		F.P.	REFS	2*21	33	59	68	DEFINED	1	
0	STAR		REAL		F.P.	REFS	68	DEFINED	1				
0	ZERO		REAL	ARRAY	F.P.	REFS	21	44	45	61	DEFINED	1	30
0	ZERO0		REAL		F.P.	REFS	68	DEFINED	1				

VARIABLES USED AS FILE NAMES, SEE ABOVE

EXTERNALS	TYPE	ARGS	REFERENCES
CURVE2		8	68

STATEMENT LABELS			DEF LINE	REFERENCES
0	1		35	29
0	10		49	42
0	20		69	52
0	25		65	59
234	100	FMT	32	30
246	200	FMT	34	33
253	1000	FMT	37	36
323	2000	FMT	47	45
337	3000	FMT	51	50
354	4000	FMT	54	53
416	5000	FMT	64	63
426	6000	FMT	67	66

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES	
21	1	* L	29 35	46B	EXT REFS	NOT INNER
24		* K	30 30	11B	EXT REFS	
52		* LL	33 33	11B	EXT REFS	
71	10	* L	42 49	33B	EXT REFS	NOT INNER
77		* K	45 45	11B	EXT REFS	
[illegible]	20	* L	52 69	57B	EXT REFS	NOT INNER
[illegible]		* K	53 53	11B	EXT REFS	
153	25	* LL	59 65	16B	EXT REFS	

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	524B	340
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE QPUMP(IP,JP,KP,QP,Q,NP,NL,NC,NAQ,TEMPO,YEAR,IPREL)
C
C       **QPUMP READS,AT A GIVEN TIME,THE WELL DISCHARGE RATES,EXPRESS
C         ED IN L/S,THEN APPLIES THEM TO THE ADEQUATE FIELD LOCATIONS
C         AND PRINTS OUT THE WELL DISCHARGE FIGURES.
C               .QP(1):WELL DISCHARGE RATE
C               .IP(L),JP(1),KP(1):WELL LOCATION
C               .TEMPO:TIME SINCE SIMULATION STARTS.
C               .YEAR:YEAR
C               .Q(1):MESH POINT FLOW
C               .NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS
C               .NP:NUMBER OF WELLS
C               .IPREL SPECIFIES THE TYPE OF FLOW APPLIED:
C                     -IF IPREL=+1 DISCHARGE FLOW
C                     -IF IPREL=-1 RECHARGE FLOW
C
C           SUB PROGRAMS CALLED:NONE
C
      DIMENSION IP(1),JP(1),KP(1),QP(1),Q(1)
      COMMON IN,IO
C
C       **QPUMP READS THE INPUT WELL DISCHARGE(OR FLOWING)RATES,
C         APPLIES THEM TO TOTAL FIELD FLOW,PRINTS OUT INPUT RATES
C         FLOWS ARE EXPRESSED IN L/S**
C
C         IPREL SPECIFIES THE TYPE OF FLOW APPLIED:
C                   -IPREL=-1 RECHARGE FLOW
C                   -IPREL=+1 DISCHARGE FLOW
      READ(IN,100)(QP(L),L=1,NP)
  100 FORMAT(15F5.0)
      WRITE(IO,1000)TEMPO,YEAR
 1000 FORMAT(1H1/42X,36(1H*)/42X,36H*WELL DISCHARGE (OR RECHARGE) FLOWS*
     1/42X,1H*,6X,9HAT TIME: ,F11.0,2H S,6X,1H*/42X,1H*,12X,6HYEAR: ,I4,
     212X,1H*/42X,36(1H*)//39X,42(1H*)/39X,42H*WELL NO*AQUIFER NO*I(OY)*
     3J(OX)*FLOW(L/S)*/39X,42(1H*))
      SIGQ=0.
      DO 1 L=1,NP
      QQ=QP(L)*IPREL
      SIGQ=SIGQ+QQ
      I1=IP(L)
      J1=JP(L)
      K1=KP(L)
      WRITE(IO,2000)L,K1,I1,J1,QQ
 2000 FORMAT(39X,1H*,2X,I4,1X,1H*,4X,I2,4X,1H*,2(1X,I3,2H *),1X,F7.1,2H
     1*)
      N=(K1-1)*NL*NC+(J1-1)*NL+I1
      Q(N)=0.
      Q(N)=Q(N)+IPREL*QQ/1000.
    1 CONTINUE
      WRITE(IO,3000)NP,K1,SIGQ
 3000 FORMAT(39X,42(1H*)/39X,1H*,17X,6HTOTALS,17X,1H*/39X,42(1H*)/39X,1H
     1*,2X,I4,1X,1H*,4X,I2,4X,1H*,11X,1H*,1X,F7.1,2H */39X,42(1H*))
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 QPUMP 1 53

VARIABLES	SN	TYPE		RELOCATION								
0	IN	INTEGER		/ /	REFS	20	I/O REFS	29				
1	IO	INTEGER		/ /	REFS	20	I/O REFS	31	43	50		
0	IP	INTEGER	ARRAY	F.P.	REFS	19	40	DEFINED	1			
0	IPREL	INTEGER		F.P.	REFS	38	48	DEFINED	1			
170	I1	INTEGER			REFS	43	46	DEFINED	40			
0	JP	INTEGER	ARRAY	F.P.	REFS	19	41	DEFINED	1			
171	J1	INTEGER			REFS	43	46	DEFINED	41			
0	KP	INTEGER	ARRAY	F.P.	REFS	19	42	DEFINED	1			
172	K1	INTEGER			REFS	43	46	50	DEFINED	42		
165	L	INTEGER			REFS	29	38	40	41	42	43	
					DEFINED	29	37					
173	N	INTEGER			REFS	47	2*48	DEFINED	46			
0	NAQ	INTEGER	*UNUSED	F.P.	DEFINED	1						
0	NC	INTEGER		F.P.	REFS	46	DEFINED	1				
0	NL	INTEGER		F.P.	REFS	2*46	DEFINED	1				
0	NP	INTEGER		F.P.	REFS	29	37	50	DEFINED	1		
0	Q	REAL	ARRAY	F.P.	REFS	19	48	DEFINED	1	47	48	
0	QP	REAL	ARRAY	F.P.	REFS	19	38	DEFINED	1	29		
167	QQ	REAL			REFS	39	43	48	DEFINED	38		
166	SIGQ	REAL			REFS	39	50	DEFINED	36	39		
0	TEMPO	REAL		F.P.	REFS	31	DEFINED	1				
0	YEAR	REAL		F.P.	REFS	31	DEFINED	1				

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS			DEF LINE	REFERENCES
0	1		49	37
66	100	FMT	30	29
75	1000	FMT	32	31
133	2000	FMT	44	43
150	3000	FMT	51	50

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
30	1	* L	37 49	25B	EXT REFS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	225B	149
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE CHECK3(ICP,JCP,KCP,CPNOM,HCP,HORIG,H,NCP,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **CHECK3 PRINTS OUT,ON A LINE PRINTER,THE COMPUTED          C
C               .H(I,J,K) IS THE COMPUTED HEAD                         C
C          AND OBSERVED STEADY STATE HEADS ON CHECK BORES**            C
C               .HCP(L) IS THE HEAD RECORDED ON A CHECK BORE           C
C               .ICP(L),JCP(L),KCP(L) ARE THE CHECK BORE COOR          C
C                DINATES                                               C
C               .NCP IS THE NUMBER OF CHECK BORES                      C
C               .CPNOM(L,3) IS THE CHECK BORE DENOMINATION             C
CC               .HORIG(L) IS THE CHECK BORE ZERO ELEVATION            C
C               .NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL           C
C                TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS            C
C                                                                      C
C               -SUB-PROGRAMS CALLED:NONE                              C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION ICP(NCP),JCP(NCP),KCP(NCP),CPNOM(NCP,3),HCP(NCP),H(NL,NC
     1,NAQ)
      COMMON IN,IO
C       **CHECK3 PRINTS OUT,FOR A THREE DIMENSIONAL GROUND WATER SYSTEM,
C         THE COMPUTED AND OBSERVED STEADY STATE HEADS ON AVAILABLE CHEC
C         K BORE HOLES**
C
C
      SIGDIF=0.
      SIGERR=0.
      WRITE(IO,1000)
 1000 FORMAT(1H1//39X,42(1H*)//39X,42H*COMPUTED AND OBSERVED STEADY STATE
     1 HEADS*/39X,1H*,10X,19HON CHECK BORE HOLES,11X,1H*/39X,42(1H*)//15
     2X,91(1H*)/15X,91H*BORE NO*    BORE NAME      *AQUIFER NO*I(OY)*J(OX
     3)*COMP.HEAD(M)*OBS. HEAD(M)*DIFFERENCE(M)*/15X,91(1H*))
      DO 1 L=1,NCP
      I1=ICP(L)
      J1=JCP(L)
      K1=KCP(L)
      HCOMP=H(I1,J1,K1)-HORIG
      HOBS=HCP(L)-HORIG
      DIFFH=HCOMP-HOBS
      SIGDIF=SIGDIF+DIFFH
      SIGERR=SIGERR+ABS(DIFFH)
      WRITE(IO,2000)L,(CPNOM(L,K),K=1,3),K1,I1,J1,HCOMP,HOBS,DIFFH
 2000 FORMAT(15X,1H*,1X,I3,3X,1H*,3A6,1H*,4X,I2,4X,1H*,2(1X,I3,2H *),2(3
     1X,F6.1,3X,1H*),3X,F7.2,3X,1H*)
    1 CONTINUE
      WRITE(IO,3000)
 3000 FORMAT(15X,91(1H*)//)
      ERR=SIGERR/L
      WRITE(IO,4000)SIGDIF,SIGERR,ERR
 4000 FORMAT(54X,14HRECAPITULATION/54X,14(1H*)//48X,17HTOTAL DIFFERENCE=
     1,F7.2,2H M/48X,12HTOTAL ERROR=,F7.2,2H M/48X,11HMEAN ERROR=,F7.2,2
     2H M)
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

```
ENTRY POINTS     DEF LINE     REFERENCES
   3  CHECK3          1         52

VARIABLES     SN  TYPE           RELOCATION
   0  CPNOM      REAL       ARRAY     F.P.        REFS        17        41     DEFINED         1
 224  DIFFH      REAL                               REFS        39        40          41     DEFINED        38
 226  ERR        REAL                               REFS        48   DEFINED          47
   0  H          REAL       ARRAY     F.P.        REFS        17        36     DEFINED         1
 222  HCOMP      REAL                               REFS        38        41     DEFINED        36
   0  HCP        REAL       ARRAY     F.P.        REFS        17        37     DEFINED         1
 223  HOBS       REAL                               REFS        38        41     DEFINED        37
   0  HORIG      REAL                 F.P.        REFS        36        37     DEFINED         1
   0  ICP        INTEGER    ARRAY     F.P.        REFS        17        33     DEFINED         1
   0  IN         INTEGER              / /         REFS        19
   1  IO         INTEGER              / /         REFS        19   I/O REFS          27          41          45          48
 217  I1         INTEGER                          REFS        36        41     DEFINED        33
   0  JCP        INTEGER    ARRAY     F.P.        REFS        17        34     DEFINED         1
 220  J1         INTEGER                          REFS        36        41     DEFINED        34
 225  K          INTEGER                          REFS        41   DEFINED          41
   0  KCP        INTEGER    ARRAY     F.P.        REFS        17        35     DEFINED         1
 221  K1         INTEGER                          REFS        36        41     DEFINED        35
 216  L          INTEGER                          REFS        33        34          35          37        2*41          47
                                                 DEFINED      32
   0  NAQ        INTEGER              F.P.        REFS        17   DEFINED           1
   0  NC         INTEGER              F.P.        REFS        17   DEFINED           1
   0  NCP        INTEGER              F.P.        REFS      5*17        32     DEFINED         1
   0  NL         INTEGER              F.P.        REFS        17   DEFINED           1
 214  SIGDIF     REAL                             REFS        39        48     DEFINED        25          39
 215  SIGERR     REAL                             REFS        40        47          48     DEFINED        26          40
      VARIABLES USED AS FILE NAMES, SEE ABOVE

INLINE FUNCTIONS   TYPE    ARGS        DEF LINE  REFERENCES
      ABS          REAL       1  INTRIN              40

STATEMENT LABELS                 DEF LINE   REFERENCES
   0  1                              44         32
 103  1000     FMT                   28         27
 151  2000     FMT                   42         41
 165  3000     FMT                   46         45
 176  4000     FMT                   49         48

LOOPS  LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
   27  1        * L          32 44        37B              EXT REFS  NOT INNER
   51           * K          41 41        11B              EXT REFS

COMMON BLOCKS    LENGTH
      / /            2

STATISTICS
  PROGRAM LENGTH                 255B      173
  SCM BLANK COMMON LENGTH          2B        2
```

```
      SUBROUTINE CONTR3(ICP,JCP,KCP,HCP,HZERO,CPNOM,IYEAR,NCP)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **CONTR3 READS AND PRINTS THE CHARACTERISTICS OF STEADY-STATEC
C            CHECK BORES                                                 C
C                  .CPNOM(L,K):BORE NAME                                 C
C                  .KCP(L),ICP(L),JCP(L):BORE COORDINATES                C
C                  .HCP(L):STEADY HEAD                                   C
C                  .HZERO(L):ELEVATION OF ORIGIN OF HEAD MEASUREMENTS    C
C                  .IYEAR IS THE CHECKING YEAR                           C
C                  .NCP IS THE NUMBER OF CHECK BORES                     C
C                                                                        C
C              SUB PROGRAMS CALLED:NONE                                  C
C                                                                        C
C                                                                        C
      DIMENSION ICP(NCP),JCP(NCP),KCP(NCP),HCP(NCP),HZERO(NCP),CPNOM(NCP
     1,3)
      COMMON IN,IO
C
C       **CONTR03 READS THE COORDINATES AND THE STEADY STATE
C         HEAD VALUES OF CHECKING BORE HOLES AND PRINTS OUT
C         THE CORRESPONDING ITEMS
C           HZERO REPRESENTS THE ORIGIN OF MEASUREMENTS(IF
C         SPECIFIED)**
C
      DO 1 L=1,NCP
    1 READ(IN,100)(CPNOM(L,K),K=1,3),KCP(L),ICP(L),JCP(L),HCP(L),HZERO(L
     1)
  100 FORMAT(3A6,2X,3I5,5X,2F10.2)
      WRITE(IO,1000)IYEAR
 1000 FORMAT(1H1//45X,30(1H*)/45X,1H*,5X,18HSTEADY STATE HEADS,5X,1H*/45
     1X,30H*MEASURED ON CHECK BORE HOLES*/45X,1H*,9X,6HYEAR: ,I4,9X,1H*/
     245X,30(1H*)/20X,81(1H*)/20X,81H*BORE NO*    BORE NAME     *AQUIFER
     3 NO*I(OY)*J(OX)*MEAS. HEAD(M)*ZERO(M)*HEAD(M)*/20X,81(1H*))
      DO 10 L=1,NCP
      HH=HCP(L)
      HCP(L)=HH-HZERO(L)
      WRITE(IO,2000)L,(CPNOM(L,K),K=1,3),KCP(L),ICP(L),JCP(L),HH,HZERO(L
     1),HCP(L)
 2000 FORMAT(20X,1H*,2X,I3,2X,1H*,3A6,1H*,4X,I2,4X,1H*,2(1X,I3,2H *),3X,
     1F7.2,3X,1H*,2(F7.2,1H*))
   10 CONTINUE
      WRITE(IO,3000)
 3000 FORMAT(20X,81(1H*))
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS	DEF LINE	REFERENCES
3 CONTR3	1	44

VARIABLES

	SN	TYPE	RELOCATION									
0	CPNOM	REAL	ARRAY	F.P.	REFS	15	37	DEFINED	1	26		
0	HCP	REAL	ARRAY	F.P.	REFS	15	35	37	DEFINED	1	26	36
223	HH	REAL			REFS	36	37	DEFINED	35			
0	HZERO	REAL	ARRAY	F.P.	REFS	15	36	37	DEFINED	1	26	
0	ICP	INTEGER	ARRAY	F.P.	REFS	15	37	DEFINED	1	26		
0	IN	INTEGER		/ /	REFS	17	I/O REFS	26				
1	IO	INTEGER		/ /	REFS	17	I/O REFS	29	37	42		
0	IYEAR	INTEGER		F.P.	REFS	29	DEFINED	1				
0	JCP	INTEGER	ARRAY	F.P.	REFS	15	37	DEFINED	1	26		
222	K	INTEGER			REFS	26	37	DEFINED	26	37		
0	KCP	INTEGER	ARRAY	F.P.	REFS	15	37	DEFINED	1	26		
221	L	INTEGER			REFS	6*26	35	2*36	7*37	DEFINED	25	34
0	NCP	INTEGER		F.P.	REFS	6*15	25	34	DEFINED	1		

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS

			DEF LINE	REFERENCES
0	1		26	25
0	10		41	34
126	100	FMT	28	26
135	1000	FMT	30	29
203	2000	FMT	39	37
216	3000	FMT	43	42

LOOPS

	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES		
21	1	* L	25 26	30B	EXT REFS	NOT INNER	
24		* K	26 26	11B	EXT REFS		
53	10	* L	34 41	33B	EXT REFS	NOT INNER	
61		* K	37 37	11B	EXT REFS		

COMMON BLOCKS

	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	255B	173
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE VARSIN(ISING,JSING,NPSING,NSING,HVSING,H,IHEAD,HINI,NL,
     1NC,NAQ)
C
C         **VARSIN READS,AT A GIVEN TIME,THE HEAD VARIATION APPLIED TO
C         ANY TYPE OF FIELD SINGULARITY DEFINED PREVIOUSLY IN SINGUL AND
C         MODIFIES CONSEQUENTLY THE HEADS OF CORRESPONDING FIELD LOCATIO
C         NS.
C                  .ISING(L,LL),JSING(L,LL):F.S. LOCATION
C                  .NPSING(L)=NUMBER OF F.S. MESHES
C                  .NSING:NUMBER OF FIELD SINGULARITIES
C                  .HVSING(L,LL)=VARIATION IN HEAD ON A F.S. MESH
C                  .H(I,J,K):MESH HEAD
C                  .HINI(L,LL):INITIAL HEAD
C                  .NL,NC,NAQ:NUMBER OF ROWS,COLUMNS AND AQUIFERS
C                  .IHEAD IS AN INDEX SET TO:
C                           .0 IF A VARIATION IN HEAD IS READ
C                           .1 IF A HEAD IS READ
C                      NB:VARIATIONS REFER TO INITIAL HEADS
C
C             SUB PROGRAMS CALLED:NONE
C
      DIMENSION ISING(NSING,200),JSING(NSING,200),NPSING(NSING),HVSING(N
     1SING,200),HINI(NSING,200),H(NL,NC,NAQ)
      COMMON IN,IO
      DO 1 K=1,NSING
      NPS=NPSING(K)
      READ(IN,100)(HVSING(K,L),L=1,NPS)
  100 FORMAT(12F6.2)
      DO 1 L=1,NPS
      I1=ISING(K,L)
      J1=JSING(K,L)
      IF(IHEAD.EQ.0)H(I1,J1,1)=HINI(K,L)+HVSING(K,L)
      IF(IHEAD.EQ.1)H(I1,J1,1)=HVSING(K,L)
    1 CONTINUE
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

		DEF LINE	REFERENCES
3	VARSIN	1	35

VARIABLES

	SN	TYPE		RELOCATION							
0	H	REAL	ARRAY	F.P.	REFS	22	DEFINED	1	32	33	
0	HINI	REAL	ARRAY	F.P.	REFS	22	32	DEFINED	1		
0	HVSING	REAL	ARRAY	F.P.	REFS	22	32	33	DEFINED	1	27
0	IHEAD	INTEGER		F.P.	REFS	32	33	DEFINED	1		
0	IN	INTEGER		/ /	REFS	24	I/O REFS	27			
1	IO	INTEGER		/ /	REFS	24					
0	ISING	INTEGER	ARRAY	F.P.	REFS	22	30	DEFINED	1		
114	I1	INTEGER			REFS	32	33	DEFINED	30		
0	JSING	INTEGER	ARRAY	F.P.	REFS	22	31	DEFINED	1		
115	J1	INTEGER			REFS	32	33	DEFINED	31		

```
VARIABLES     SN  TYPE           RELOCATION
  111  K          INTEGER                          REFS        26      27      30      31      2*32    33
                                                   DEFINED     25
  113  L          INTEGER                          REFS        27      30      31      2*32    33
                                                   DEFINED     27      29
    0  NAQ        INTEGER                F.P.      REFS        22    DEFINED    1
    0  NC         INTEGER                F.P.      REFS        22    DEFINED    1
    0  NL         INTEGER                F.P.      REFS        22    DEFINED    1
  112  NPS        INTEGER                          REFS        27      29    DEFINED   26
    0  NPSING     INTEGER    ARRAY       F.P.      REFS        22      26    DEFINED    1
    0  NSING      INTEGER                F.P.      REFS      5*22      25    DEFINED    1
       VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS              DEF LINE   REFERENCES
    0  1                         34        25      29
  107  100      FMT              28        27

LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
   22  1      * K          25 34       51B             EXT REFS  NOT INNER
   27         * L          27 27       11B             EXT REFS
   52  1        L          29 34       16B       OPT

COMMON BLOCKS   LENGTH
       / /          2

STATISTICS
  PROGRAM LENGTH                  150B     104
  SCM BLANK COMMON LENGTH          2L       2
```

```
      SUBROUTINE PSORMC(H,H0,HCB,TE,TS,S,PZ,EP,Q,IDEB,IFIN,JD,JF,KFIELD,
     1KAQSUP,KAQINF,DX,DY,DT,RO,NITER,ERROR,NMAX,IREG,ISCHEM,IERR,TETA,N
     2L,NC,NAQ)
      DIMENSION H(1),H0(1),HCB(1),TE(1),TS(1),S(1),Q(1),PZ(1),EP(1),KFIE
     1LD(1),KAQSUP(1),KAQINF(1),IDEB(1),IFIN(1),JD(1),JF(1)
      COMMON IN,IO
C
C         **PSORTMC SOLVES THE SET OF LINEAR EQUATIONS DERIVED FR
C     OM THE DISCRETIZATION (PERFORMED BY FINITE DIFFERENCES) OF THE FLO
C     W PARTIAL DIFFERENTIAL EQUATIONS IN A MULTILAYERED AQUIFER SYSTEM
C     UNDER HANTUSH LEAKY ARTESIAN AQUIFER ASSUMPTIONS.THE SOLVING TECHN
C     IC USED IS THE POINT SUCCESSIVE OVER-RELAXATION PROCEDURE.38E OPTI
C     MUM O.R.FACTOR BEING COMPUTED THROUGH THE MODIFIED CARRE ALGORITHM
C
C             -RO IS THE O.R. FACTOR WHICH INITIAL VALUE IS SET TO ROO
C             -NITER IS THE MAXIMUM NUMBER OF ITERATIONS ALLOCATED
C             -ERROR IS THE ERROR TOLERATED FROM THE ITERATIVE PROCESS,
C              WHICH IS A MAXIMUM POINT ERROR IF  IERR=0 ,OR AN AVERAGE
C              POINT ERROR IF IERR=1
C             -NMAX IS THE NUMBER OF ITERATIONS AFTER WHICH WE C6MPUTE
C              THE NEW VALUE OF THE O.R. FACTOR
C             -TETA IS A WEIGHTING FACTOR OF THE FINITE DIFFERENCE EQUAT
C              ION SET TO=
C                       0 (EXPLICIT SCHEME)
C                       1 (TOTALLY IMPLICIT SCHEME)
C                       0.5 (CRANK-NICOLSON IMPLICIT SCHEME)
C                       0<TETA<1 (IMPLICIT-EXPLICIT SCHEME)
C             -IREG DEFINES THE MOTION REGIME=
C                       1 MEANS A STEADY STATE MOTION
C                       0 MEANS A NON-STEADY ST1TE MOTION
C             -ISCHEM CHARACTERIZES THE HYDRODYNAMIC PICTURE CHO6SEN(FO
C              R FURTHER DETAILS REFER TO 5XPLAN1TORY NOTE"
C
C         OTHER ARGUMENTS ARE DEFINED IN MAIN
C
C         SUBPROGRAMS CALLED=CARRE(CALCULATION O6 OPTIM44 6=9= 6  T69"
C
C
C         **CONSERVATION OF THE EVALUATION OF THE O.R. FACTO9
C                   GIVEN IN INPUT**
C
      NAPPEL=0
      IF(NAPPEL.NE.0)GO TO 100
      NAPPEL=1
      ROO=RO
  100 CONTINUE
      IF(IREG.EQ.1)DT=1.
      XSUP=100000000.*10000000.
      EPSI=1./XSUP
      KK=0
      DO 1 LITER=1,NITER
      SOMERR=0.
      DIFMAX=0.
      DO 3 K=1,NAQ
      ID=IDEB(K)+1
      IF=IFIN(K)-1
      DO 2 I=ID,IF
```

```
                NN=(K-1)*NL+I
                JDD=JD(NN)+1
60              JFF=JF(NN)-1
                DO 2 J=JDD,JFF
                NNN=(J-1)*NL+I
                N=(K-1)*NL*NC+NNN
                KC=KFIELD(N)
65              IF(KC.NE.0)GO TO 2
                IF(LITER.EQ.1)KK=KK+1
                KSUP=KAQSUP(N)
                KS=K-KSUP
                IF(KSUP.EQ.0)KS=0
70              IF(KSUP.EQ.K)EP(N)=1.
                IF(KSUP.EQ.K)PZ(N)=0.
                KINF=KAQINF(N)
                IF(K.EQ.NAQ)KINF=0
                KI=KINF-K
75              IF(KINF.EQ.0)KI=0
                EPUP=EP(N)
                EPDOWN=EP(N+KI*NL*NC)
                IF(EPUP.LT.EPSI.OR.EPDOWN.LT.EPSI)GO TO 2
                IPHY1=(KSUP-K+1000)/((IABS(KSUP-K))+1000)
80              IKUP=KSUP-(10+K)
                IPHY2=(IKUP+1000)/((IABS(IKUP))+1000)
                NSUP=(1-IPHY1)*KS*NL*NC
                IF(K.GT.1)H(N)=HO(N)
                HCENT=H(N)
85              HOCENT=HO(N)
                HNORTH=H(N-1)
                HSOUTH=H(N+1)
                HWEST=H(N-NL)
                HEAST=H(N+NL)
90              HON=HO(N-1)
                HOS=HO(N+1)
                HOE=HO(N+NL)
                HOW=HO(N-NL)
                HOB=HO(N+KI*NL*NC)
95              HOT=(1-IPHY2)*HO(N-NSUP)+IPHY2*HCB(NNN)
                HSUP=(1-IPHY2)*H(N-NSUP)+IPHY2*HCB(NNN)
                HINF=H(N+KI*NL*NC)
                TNORTH=TS(N-1)
                TSOUTH=TS(N)
100             TWEST=TE(N-NL)
                TEAST=TE(N)
                SCENT=S(N)
                QCENT=Q(N)
                PZUP=PZ(N)
105             PZDOWN=PZ(N+KI*NL*NC)
                PZLSUP=PZUP/EPUP
                IF(EPUP.LT.EPSI)PZLSUP=0.
                PZLINF=PZDOWN/EPDOWN
                IF(K.EQ.NAQ)PZLINF=0.
110             IF(EPDOWN.LT.EPSI)PZLINF=0.
                AS=-TSOUTH*DX/DY
                AN=-TNORTH*DX/DY
                AE=-TEAST*DY/DX
                AW=-TWEST*DY/DX
```

```
      AB=-PZLINF*DX*DY
      AT=-PZLSUP*DX*DY
      SIGD=AN+AS+AW+AE+AB+AT
      AC=SCENT*(1-IREG)*DX*DY/DT-TETA*SIGD
      SIG=AS*HOS+AN*HON+AE*HOE+AW*HOW+AB*HOB+AT*HOT-SIGD*HOCENT
      B=SCENT*(1-IREG)*DX*DY*HOCENT/DT-QCENT+(1.-TETA)*SIG
      IF(AC.LT.EPSI)GO TO 2
      DIF=(B-TETA*(AN*HNORTH+AS*HSOUTH+AW*HWEST+AE*HEAST+AB*HINF+AT*HSUP
     1))/AC
      DIFI=DIF-HCENT
      IF(TETA.NE.0.)GO TO 20
      H(N)=DIF
      GO TO 2
   20 CONTINUE
      SOMERR=SOMERR+ABS(DIFI)
      IF(ABS(DIFI).GT.DIFMAX)DIFMAX=ABS(DIFI)
      H(N)=H(N)+RO*DIFI
    2 CONTINUE
    3 CONTINUE
C
      IF(TETA.NE.0.)CALL CARRE(RO,SOMERR,NITER,NMAX,LITER)
      IF(TETA.LT.EPSI)RETURN
      ERRP=SOMERR/KK
      IF(IERR.EQ.0.AND.DIFMAX.LT.ERROR)GO TO 50
      IF(IERR.EQ.1.AND.ERRP.LT.ERROR)GO TO 50
    1 CONTINUE
      RO=ROO
      GO TO 60
   50 CONTINUE
C
      RO=AMAX1(1.,RO-0.25*ABS(2.-RO))
   60 CONTINUE
      WRITE(IO,1000)LITER,DIFMAX,ERRP,ERROR,RO
 1000 FORMAT(1HO,20X,50HPOINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHI
     1N ,I3,11H ITERATIONS/24X,36HWITH A MAXIMUM POINT ERROR EQUAL TO ,E
     215.8/24X,36HAND AN AVERAGE POINT ERROR EQUAL TO ,E15.8/22X,28HTHE
     3ERROR CHECK IS EQUAL TO ,F5.3,7H METERS/22X,25HTHE O.R. FACTOR IS
     4WORTH ,F5.3/)
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
3	PSORMC	1	136 153

VARIABLES	SN	TYPE	RELOCATION						
556	AB	REAL		REFS	117	119	122	DEFINED	115
561	AC	REAL		REFS	121	122	DEFINED	118	
554	AE	REAL		REFS	117	119	122	DEFINED	113
553	AN	REAL		REFS	117	119	122	DEFINED	112
552	AS	REAL		REFS	117	119	122	DEFINED	111
557	AT	REAL		REFS	117	119	122	DEFINED	116

VARIABLES	SN	TYPE		RELOCATION								
555	AW	REAL			REFS	117	119	122	DEFINED	114		
563	B	REAL			REFS	122	DEFINED	120				
564	DIF	REAL			REFS	124	126	DEFINED	122			
565	DIFI	REAL			REFS	129	2*130	131	DEFINED	124		
474	DIFMAX	REAL			REFS	130	138	147	DEFINED	53	130	
0	DT	REAL		F.P.	REFS	118	120	DEFINED	1	47		
0	DX	REAL		F.P.	REFS	111	112	113	114	115	116	118
						120	DEFINED	1				
0	DY	REAL		F.P.	REFS	111	112	113	114	115	116	118
						120	DEFINED	1				
0	EP	REAL	ARRAY	F.P.	REFS	4	76	77	DEFINED	1	70	
515	EPDOWN	REAL			REFS	78	108	110	DEFINED	77		
470	EPSI	REAL			REFS	2*78	107	110	121	136		
					DEFINED	49						
514	EPUP	REAL			REFS	78	106	107	DEFINED	76		
0	ERROR	REAL		F.P.	REFS	138	139	147	DEFINED	1		
566	ERRP	REAL			REFS	139	147	DEFINED	137			
0	H	REAL	ARRAY	F.P.	REFS	4	84	86	87	88	89	96
						97	131	DEFINED	1	83	126	131
0	HCB	REAL	ARRAY	F.P.	REFS	4	95	96	DEFINED	1		
522	HCENT	REAL			REFS	124	DEFINED	84				
527	HEAST	REAL			REFS	122	DEFINED	89				
537	HINF	REAL			REFS	122	DEFINED	97				
524	HNORTH	REAL			REFS	122	DEFINED	86				
525	HSOUTH	REAL			REFS	122	DEFINED	87				
536	HSUP	REAL			REFS	122	DEFINED	96				
526	HWEST	REAL			REFS	122	DEFINED	88				
0	HO	REAL	ARRAY	F.P.	REFS	4	83	85	90	91	92	93
						94	95	DEFINED	1			
534	HOB	REAL			REFS	119	DEFINED	94				
523	HOCENT	REAL			REFS	119	120	DEFINED	85			
532	HOE	REAL			REFS	119	DEFINED	92				
530	HON	REAL			REFS	119	DEFINED	90				
531	HOS	REAL			REFS	119	DEFINED	91				
535	HOT	REAL			REFS	119	DEFINED	95				
533	HOW	REAL			REFS	119	DEFINED	93				
500	I	INTEGER			REFS	58	62	DEFINED	57			
476	ID	INTEGER			REFS	57	DEFINED	55				
0	IDEB	INTEGER	ARRAY	F.P.	REFS	4	55	DEFINED	1			
0	IERR	INTEGER		F.P.	REFS	138	139	DEFINED	1			
477	IF	INTEGER			REFS	57	DEFINED	56				
0	IFIN	INTEGER	ARRAY	F.P.	REFS	4	56	DEFINED	1			
517	IKUP	INTEGER			REFS	2*81	DEFINED	80				
0	IN	INTEGER		/ /	REFS	6						
1	IO	INTEGER		/ /	REFS	6	I/O REFS	147				
516	IPHY1	INTEGER			REFS	82	DEFINED	79				
520	IPHY2	INTEGER			REFS	2*95	2*96	DEFINED	81			
0	IREG	INTEGER		F.P.	REFS	47	118	120	DEFINED	1		
0	ISCHEM	INTEGER	*UNUSED	F.P.	DEFINED	1						
504	J	INTEGER			REFS	62	DEFINED	61				
0	JD	INTEGER	ARRAY	F.P.	REFS	4	59	DEFINED	1			
502	JDD	INTEGER			REFS	61	DEFINED	59				
0	JF	INTEGER	ARRAY	F.P.	REFS	4	60	DEFINED	1			
503	JFF	INTEGER			REFS	61	DEFINED	60				
475	K	INTEGER			REFS	55	56	58	63	68	70	71
						73	74	2*79	80	83	109	
					DEFINED	54						

VARIABLES	SN	TYPE	RELOCATION		
0	KAQINF	INTEGER	ARRAY	F.P.	
0	KAQSUP	INTEGER	ARRAY	F.P.	
507	KC	INTEGER			
0	KFIELD	INTEGER	ARRAY	F.P.	
513	KI	INTEGER			
512	KINF	INTEGER			
471	KK	INTEGER			
511	KS	INTEGER			
510	KSUP	INTEGER			
472	LITER	INTEGER			
506	N	INTEGER			
465	NAPPEL	INTEGER			
0	NAQ	INTEGER		F.P.	
0	NC	INTEGER		F.P.	
0	NITER	INTEGER		F.P.	
0	NL	INTEGER		F.P.	
0	NMAX	INTEGER		F.P.	
501	NN	INTEGER			
505	NNN	INTEGER			
521	NSUP	INTEGER			
0	PZ	REAL	ARRAY	F.P.	
547	PZDOWN	REAL			
551	PZLINF	REAL			
550	PZLSUP	REAL			
546	PZUP	REAL			
0	Q	REAL	ARRAY	F.P.	
545	QCENT	REAL			
0	RO	REAL		F.P.	
466	ROO	REAL			
0	S	REAL	ARRAY	F.P.	
544	SCENT	REAL			
562	SIG	REAL			
560	SIGD	REAL			
473	SOMERR	REAL			
0	TE	REAL	ARRAY	F.P.	
543	TEAST	REAL			
0	TETA	REAL		F.P.	
540	TNORTH	REAL			
0	TS	REAL	ARRAY	F.P.	
541	TSOUTH	REAL			
542	TWEST	REAL			
467	XSUP	REAL			

VARIABLES USED AS FILE NAMES, SEE ABOVE

EXTERNALS	TYPE	ARGS	REFERENCES
CARRE		5	135

KAQINF	REFS	4	72	DEFINED	1	
KAQSUP	REFS	4	67	DEFINED	1	
KC	REFS	65	DEFINED	64		
KFIELD	REFS	4	64	DEFINED	1	
KI	REFS	77	94	97	105	DEFINED
KINF	REFS	74	75	DEFINED	72	73
KK	REFS	66	137	DEFINED	50	66
KS	REFS	82	DEFINED	68	69	
KSUP	REFS	68	69	70	71	2*79
	DEFINED	67				
LITER	REFS	66	135	147	DEFINED	51
N	REFS	64	67	70	71	72
	2*83	84	85	86	87	88
	91	92	93	94	95	96
	99	100	101	102	103	104
	2*131	DEFINED	63			
NAPPEL	REFS	43	DEFINED	42	44	
NAQ	REFS	54	73	109	DEFINED	1
NC	REFS	63	77	82	94	97
	DEFINED	1				
NITER	REFS	51	135	DEFINED	1	
NL	REFS	58	62	63	77	82
	92	93	94	97	100	105
	DEFINED	1				
NMAX	REFS	135	DEFINED	1		
NN	REFS	59	60	DEFINED	58	
NNN	REFS	63	95	96	DEFINED	62
NSUP	REFS	95	96	DEFINED	82	
PZ	REFS	4	104	105	DEFINED	1
PZDOWN	REFS	108	DEFINED	105		
PZLINF	REFS	115	DEFINED	108	109	110
PZLSUP	REFS	116	DEFINED	106	107	
PZUP	REFS	106	DEFINED	104		
Q	REFS	4	103	DEFINED	1	
QCENT	REFS	120	DEFINED	103		
RO	REFS	45	131	135	2*145	147
	DEFINED	1	141	145		
ROO	REFS	141	DEFINED	45		
S	REFS	4	102	DEFINED	1	
SCENT	REFS	118	120	DEFINED	102	
SIG	REFS	120	DEFINED	119		
SIGD	REFS	118	119	DEFINED	117	
SOMERR	REFS	129	135	137	DEFINED	52
TE	REFS	4	100	101	DEFINED	1
TEAST	REFS	113	DEFINED	101		
TETA	REFS	118	120	122	125	135
	DEFINED	1				
TNORTH	REFS	112	DEFINED	98		
TS	REFS	4	98	99	DEFINED	1
TSOUTH	REFS	111	DEFINED	99		
TWEST	REFS	114	DEFINED	100		
XSUP	REFS	49	DEFINED	48		

KAQINF						
KAQSUP						
KC						
KFIELD						
KI						
KINF						
KK						
KS						
KSUP						
LITER						
N	74	75				
	89	90				
	97	98				
	105	126				
NAPPEL						
NAQ						
NC	105					
NITER						
NL	88	89				
NMAX						
NN						
NNN						
NSUP						
PZ	71					
PZDOWN						
PZLINF						
PZLSUP						
PZUP						
Q						
QCENT						
RO						
ROO						
S						
SCENT						
SIG						
SIGD						
SOMERR						
TE	129					
TEAST						
TETA	136					
TNORTH						
TS						
TSOUTH						
TWEST						
XSUP						

INLINE FUNCTIONS	TYPE	ARGS	DEF LINE	REFERENCES		
ABS	REAL	1	INTRIN	129	2*130	145
AMAX1	REAL	0	INTRIN	145		
IABS	INTEGER	1	INTRIN	79	81	

STATEMENT LABELS			DEF LINE	REFERENCES				
0	1		140	51				
333	2		132	57	61	65	78	121	127
0	3		133	54				
323	20		128	125				
370	50		143	138	139			
376	60		146	142				
22	100		46	43				
424	1000	FMT	148	147				

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES			
33	1	*	LITER	51 140	333B		EXT REFS	EXITS	NOT INNER
36	3	*	K	54 133	305B		NOT INNER		
42	2	*	I	57 132	276B		NOT INNER		
51	2		J	61 132	265B	OPT			

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	722B	466
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE CARRE(RO,ERROR,NITER,NMAX,L)
C
C      **CARRE COMPUTES THE OPTIMUM OVER-RELAXATION COEFFICIENT
C        BY-USE OF THE MODIFIED CARRE ALGORITHM**
C
C        RO IS INPUTED AS THE PRESENT VALUE OF THE O.R. FACTOR
C        IT CAN BE EVENTUALLY REEVALUATED AS AN OUTPUT
C        ERROR IS A NORM OF THE DIFFERENCE BETWEEN THE COMPUTED
C        FIELDS AT ITERATIONS L AND L-1
C        NITER IS THE MAXIMUM NUMBER OF ITERATIONS EXPECTED
C
      DIMENSION XNOR(3)
      COMMON IN,IO
      IF(L.GT.1)GO TO 10
      EPSI=0.000000001
C
C        **CALCULATION OF THE NUMBER OF ITERATIONS AT THE END OF WHICH
C                    THE O.R. FACTOR MAY BE REEVALUATED
C
      ERRORN=1.
      NIO=NITER/NMAX
      NIT=MAX0(NMAX,NITER/NIO)
C
C        **EVALUATION OF THE SPECTRAL RADIUS OF THE O.R. MATRIX
C
   10 CONTINUE
      XNORM=ERROR/ERRORN
      ERRORN=ERROR
      IF(XNORM.LT.EPSI)RETURN
C
C        **THE METHOD USED IS THE CARRE'S ONE SLIGHTLY MODIFIED**
C
      XNOR(1)=XNOR(2)
      XNOR(2)=XNOR(3)
      XNOR(3)=XNORM
C
C        **EVERY NIT ITERATIONS WE EVALUATE RO
C
      IF((NIT*(L/NIT)).NE.L)RETURN
      XNORM=(XNOR(1)+XNOR(2)+XNOR(3))/3.
      IF(XNORM.GE.1.)RETURN
      WK=1.-(XNORM+RO-1.)**2/(XNORM*RO**2)
      IF(WK.GT.0.)GO TO 5
      RO=RO**0.75
      GO TO 6
    5 CONTINUE
      OMEGA0=2./(1.+SQRT(WK))
      RO=OMEGA0-(2.-OMEGA0)/10.
    6 CONTINUE
      WRITE(IO,1000)L,ERROR,XNORM,WK,OMEGA0,RO
 1000 FORMAT(1H0/10X,23HCARRE TEST AT ITERATION,I4/10X,27(1H*)/20X,7HERR
     1OR= ,F10.5/20X,7HXNORM= ,F10.5/20X,4HWK= ,F10.5/20X,8HOMEGA0= ,F10
     2.5/20X,4HRO= ,F5.3)
C
C        **END OF THE CARRE METHOD**
C
      RETURN
```

```
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

SN	NAME	DEF LINE	REFERENCES
3	CARRE	1	29 39 41 57

VARIABLES

SN	NAME	TYPE	RELOCATION									
115	EPSI	REAL		REFS	29	DEFINED	15					
0	ERROR	REAL	F.P.	REFS	27	28	50	DEFINED	1			
116	ERRORN	REAL		REFS	27	DEFINED	20	28				
0	IN	INTEGER	/ /	REFS	13							
1	IO	INTEGER	/ /	REFS	13	I/O REFS	50					
0	L	INTEGER	F.P.	REFS	14	2*39	50	DEFINED	1			
120	NIT	INTEGER		REFS	2*39	DEFINED	22					
0	NITER	INTEGER	F.P.	REFS	21	22	DEFINED	1				
117	NIO	INTEGER		REFS	22	DEFINED	21					
0	NMAX	INTEGER	F.P.	REFS	21	22	DEFINED	1				
123	OMEGA0	REAL		REFS	2*48	50	DEFINED	47				
0	RO	REAL	F.P.	REFS	2*42	44	50	DEFINED	1	44	48	
122	WK	REAL		REFS	43	47	50	DEFINED	42			
124	XNOR	REAL	ARRAY	REFS	12	33	34	3*40	DEFINED	33	34	
					35							
121	XNORM	REAL		REFS	29	35	41	2*42	50			
				DEFINED	27	40						

VARIABLES USED AS FILE NAMES, SEE ABOVE

EXTERNALS

NAME	TYPE	ARGS		REFERENCES
SQRT	REAL	1	LIBRARY	47

INLINE FUNCTIONS

NAME	TYPE	ARGS		DEF LINE	REFERENCES
MAX0	INTEGER	0	INTRIN		22

STATEMENT LABELS

	NAME		DEF LINE	REFERENCES
46	5		46	43
54	6		49	45
20	10		26	14
70	1000	FMT	51	50

COMMON BLOCKS

NAME	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	127B	87
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE GEOMMC(IDEB,IFIN,JD,JF,KFIELD,KAQSUP,KAQINF,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **GEOMMC GENERATES,PER AQUIFER,FROM THE FIELD DESCRIPTION     C
C         INDEX KFIELD(I,J,K):                                          C
C                   .THE EXTREME ROWS BOUNDING THE AQUIFER:             C
C                        -NORTHWARDS :IDEB(K)                           C
C                        -SOUTHWARDS :IFIN(K)                           C
C                   .THE EXTREME COLUMNS BOUNDING,PER ROW THE AQUIFER:  C
C                        -WESTWARDS:JD(I,K)                             C
C                        -EASTWARDS:JF(I,K)                             C
C                     NB:THE JD+1 AND JF-1 MUST HAVEW THEIR FOUR NEIGHBOU
C                        RING MESHES IN THE FIELD OR ON LATERAL BOUNDARY
C                   .THE VERTICAL AQUIFER CONNECTIONS:                  C
C                        -UPWARDS:KAQSUP(I,J,K)                         C
C                        -DOWNWARDS:KAQINF(I,J,K)                       C
C                                                                       C
C               SUB PROGRAMS CALLED:NONE                                C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION KFIELD(NL,NC,NAQ),KAQSUP(NL,NC,NAQ),KAQINF(NL,NC,NAQ),JD
     1(NL,NAQ),JF(NL,NAQ),IDEB(NAQ),IFIN(NAQ)
      COMMON IN,IO
      NCF=NC-1
      DO 11 K=1,NAQ
      DO 2 I=1,NL
      DO 2 J=1,NC
      KC=KFIELD(I,J,K)
      IF((IABS(KC)).NE.1)GO TO 2
      IDEB(K)=I
      GO TO 3
    2 CONTINUE
    3 CONTINUE
      DO 4 I=1,NL
      DO 4 J=1,NC
      II=NL-I+1
      KC=KFIELD(II,J,K)
      IF((IABS(KC)).NE.1)GO TO 4
      IFIN(K)=II
      GO TO 5
    4 CONTINUE
    5 CONTINUE
      ID=IDEB(K)+1
      IF=IFIN(K)-1
      DO 10 I=ID,IF
      DO 20 J=2,NCF
      KC=KFIELD(I,J,K)
      IF((IABS(KC)).NE.1)GO TO 20
      KE=KFIELD(I,J+1,K)
      IF(KE.NE.0)GO TO 20
      JD(I,K)=J
      GO TO 15
   20 CONTINUE
   15 CONTINUE
      DO 25 J=2,NCF
      JJ=NC-J+1
      KC=KFIELD(I,JJ,K)
      IF((IABS(KC)).NE.1)GO TO 25
      KW=KFIELD(I,JJ-1,K)
```

```
                  IF(KW.NE.0)GO TO 25
                  JF(I,K)=JJ
      60          GO TO 16
                25 CONTINUE
                16 CONTINUE
                10 CONTINUE
                11 CONTINUE
      65          NAQF=NAQ-1
                  DO 30 I=1,NL
                  DO 30 J=1,NC
                  KCS=KFIELD(I,J,1)
                  KCB=KFIELD(I,J,NAQ)
      70          IF(KCS.NE.2)KAQSUP(I,J,1)=1
                  IF(KCB.NE.2)KAQINF(I,J,NAQ)=NAQ
                  DO 35 K=2,NAQ
                  KF=K-1
                  KC=KFIELD(I,J,K)
      75          IF(KC.EQ.2)GO TO 35
                  DO 40 L=1,KF
                  KCS=KFIELD(I,J,K-L)
                  IF(KCS.EQ.2)GO TO 40
                  KAQSUP(I,J,K)=K-L
      80          GO TO 35
                40 CONTINUE
                  IF(KCS.EQ.2)KAQSUP(I,J,K)=K
                35 CONTINUE
                  DO 45 K=1,NAQF
      85          KF=NAQ-1
                  KC=KFIELD(I,J,K)
                  IF(KC.EQ.2)GO TO 45
                  DO 50 L=1,KF
                  KCB=KFIELD(I,J,K+L)
      90          IF((K+L).GT.NAQ)KCB=KFIELD(I,J,NAQ)
                  IF(KCB.EQ.2)GO TO 50
                  KAQINF(I,J,K)=K+L
                  GO TO 45
                50 CONTINUE
      95          IF(KCB.EQ.2)KAQINF(I,J,K)=K
                45 CONTINUE
                30 CONTINUE
                  RETURN
                  END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
3	GEOMMC	1	98

VARIABLES	SN	TYPE	RELOCATION							
317	I	INTEGER		REFS	26	28	34	45	47	49	55
					57	59	68	69	70	71	74	77
					79	82	86	89	90	92	95	
				DEFINED	24	32	43	66				

VARIABLES	SN	TYPE	RELOCATION										
323	ID	INTEGER			REFS	43	DEFINED	41					
0	IDEB	INTEGER	ARRAY	F.P.	REFS	19	41	DEFINED	1	28			
324	IF	INTEGER			REFS	43	DEFINED	42					
0	IFIN	INTEGER	ARRAY	F.P.	REFS	19	42	DEFINED	1	37			
322	II	INTEGER			REFS	35	37	DEFINED	34				
0	IN	INTEGER		/ /	REFS	21							
1	IO	INTEGER		/ /	REFS	21							
320	J	INTEGER			REFS	26	35	45	47	49	54	68	
						69	70	71	74	77	79	82	86
						89	90	92	95	DEFINED	25	33	44
						53	67						
0	JD	INTEGER	ARRAY	F.P.	REFS	19	DEFINED	1	49				
0	JF	INTEGER	ARRAY	F.P.	REFS	19	DEFINED	1	59				
326	JJ	INTEGER			REFS	55	57	59	DEFINED	54			
316	K	INTEGER			REFS	26	28	35	37	41	42	45	
						47	49	55	57	59	73	74	77
						2*79	2*82	86	89	90	2*92	2*95	
					DEFINED	23	72	84					
0	KAQINF	INTEGER	ARRAY	F.P.	REFS	19	DEFINED	1	71	92	95		
0	KAQSUP	INTEGER	ARRAY	F.P.	REFS	19	DEFINED	1	70	79	82		
321	KC	INTEGER			REFS	27	36	46	56	75	87		
					DEFINED	26	35	45	55	74	86		
332	KCB	INTEGER			REFS	71	91	95	DEFINED	69	89	90	
331	KCS	INTEGER			REFS	70	78	82	DEFINED	68	77		
325	KE	INTEGER			REFS	48	DEFINED	47					
333	KF	INTEGER			REFS	76	88	DEFINED	73	85			
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	19	26	35	45	47	55	57	
						68	69	74	77	86	89	90	
					DEFINED	1							
327	KW	INTEGER			REFS	58	DEFINED	57					
334	L	INTEGER			REFS	77	79	89	90	92			
					DEFINED	76	88						
0	NAQ	INTEGER		F.P.	REFS	7*19	23	65	69	2*71	72	85	
						2*90	DEFINED	1					
330	NAQF	INTEGER			REFS	84	DEFINED	65					
0	NC	INTEGER		F.P.	REFS	3*19	22	25	33	54	67		
					DEFINED	1							
315	NCF	INTEGER			REFS	44	53	DEFINED	22				
0	NL	INTEGER		F.P.	REFS	5*19	24	32	34	66			
					DEFINED	1							

INLINE FUNCTIONS	TYPE	ARGS		DEF LINE	REFERENCES			
IABS	INTEGER	1	INTRIN		27	36	46	56

STATEMENT LABELS		DEF LINE	REFERENCES			
37	2	30	24	25	27	
44	3	31	29			
61	4	39	32	33	36	
66	5	40	38			
0	10	63	43			
0	11	64	23			
114	15	52	50			
140	16	62	60			
111	20	51	44	46	48	
135	25	61	53	56	58	
0	30	97	66	67		
231	35	83	72	75	80	

STATEMENT LABELS	DEF LINE	REFERENCES
217 40	81	76 78
303 45	96	84 87 93
271 50	94	88 91

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES	
24	11	*	K	23 64	121B		NOT INNER
25	2	*	I	24 30	17B		EXITS NOT INNER
26	2	*	J	25 30	14B	OPT	EXITS
45	4	*	I	32 39	21B		EXITS NOT INNER
46	4	*	J	33 39	16B	OPT	EXITS
72	10	*	I	43 63	51B		NOT INNER
73	20	*	J	44 51	21B	OPT	EXITS
115	25	*	J	53 61	23B	OPT	EXITS
150	30	*	I	66 97	143B		NOT INNER
151	30	*	J	67 97	137B		NOT INNER
173	35	*	K	72 83	41B		NOT INNER
204	40	*	L	76 81	16B	OPT	EXITS
235	45	*	K	84 96	51B		NOT INNER
246	50	*	L	88 94	26B	OPT	EXITS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	416B	270
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE TDIRMC(X,XE,XS,KFIELD,IDIR,NL,NC,NAQ)
CCCC
```

```
                    XE(I,J,K)=2.*X(I,J,K)*X(I,J+1,K)/(X(I,J,K)+X(I,J+1,K))
                  5 IF(DXS.EQ.0.)GO TO 1
     60             XS(I,J,K)=2.*X(I,J,K)*X(I+1,J,K)/(X(I,J,K)+X(I+1,J,K))
                  1 CONTINUE
                    RETURN
                    END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
3	TDIRMC	1	62

VARIABLES	SN	TYPE										
203	DXE	REAL			REFS	57	DEFINED	55				
204	DXS	REAL			REFS	59	DEFINED	56				
176	I	INTEGER			REFS	37	39	40	2*42	2*43	44	45
						3*47	3*48	49	50	2*51	2*52	2*55	2*56
						5*58	5*60	DEFINED	35				
0	IDIR	INTEGER		F.P.	REFS	41	46	53	DEFINED	1			
0	IN	INTEGER		/ /	REFS	21							
1	IO	INTEGER		/ /	REFS	21							
177	J	INTEGER			REFS	37	39	40	2*42	2*43	44	45
						3*47	3*48	49	50	2*51	2*52	2*55	2*56
						5*58	5*60	DEFINED	36				
175	K	INTEGER			REFS	37	39	40	2*42	2*43	44	45
						3*47	3*48	49	50	2*51	2*52	2*55	2*56
						5*58	5*60	DEFINED	34				
200	KC	INTEGER			REFS	38	54	DEFINED	37				
202	KE	INTEGER			REFS	44	49	51	DEFINED	40			
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	19	37	39	40	DEFINED	1		
201	KS	INTEGER			REFS	45	50	52	DEFINED	39			
0	NAQ	INTEGER		F.P.	REFS	4*19	34	DEFINED	1				
0	NC	INTEGER		F.P.	REFS	4*19	33	DEFINED	1				
174	NCF	INTEGER			REFS	36	DEFINED	33					
0	NL	INTEGER		F.P.	REFS	4*19	32	DEFINED	1				
173	NLF	INTEGER			REFS	35	DEFINED	32					
0	X	REAL	ARRAY	F.P.	REFS	19	42	43	2*47	2*48	2*55	2*56
						4*58	4*60	DEFINED	1				
0	XE	REAL	ARRAY	F.P.	REFS	19	51	DEFINED	1	42	44	47
						49	51	58				
0	XS	REAL	ARRAY	F.P.	REFS	19	52	DEFINED	1	43	45	48
						50	52	60				

INLINE FUNCTIONS	TYPE	ARGS		DEF LINE	REFERENCES
IABS	INTEGER	1	INTRIN		38

STATEMENT LABELS		DEF LINE	REFERENCES							
156	1	61	34	35	36	38	53	54	59	
145	5	59	57							
57	10	46	41							
126	20	53	46							

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
25	1	*	K	34 61	141B	NOT INNER
26	1	*	I	35 61	135B	NOT INNER
27	1		J	36 61	132B	OPT

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	247B	167
SCM BLANK COMMON LENGTH	2B	2

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
25	1	*	K	34 61	141B	NOT INNER
26	1	*	I	35 61	135B	NOT INNER
27	1		J	36 61	132B	OPT

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	247B	167
SCM BLANK COMMON LENGTH	2B	2

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
25	1	*	K	34 61	141B	NOT INNER
26	1	*	I	35 61	135B	NOT INNER
27	1		J	36 61	132B	OPT

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	247B	167
SCM BLANK COMMON LENGTH	2B	2

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
25	1	*	K	34 61	141B	NOT INNER
26	1	*	I	35 61	135B	NOT INNER
27	1		J	36 61	132B	OPT

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	247B	167
SCM BLANK COMMON LENGTH	2B	2

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
25	1	*	K	34 61	141B	NOT INNER
26	1	*	I	35 61	135B	NOT INNER
27	1		J	36 61	132B	OPT

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	247B	167
SCM BLANK COMMON LENGTH	2B	2

STATEMENT LABELS			DEF LINE	REFERENCES							
360	50		122	57	118						
163	51		68	60	62						
204	52		75	69							
224	53		83	59	77						
244	54		90	84							
266	55		98	75	92						
307	56		105	99							
332	57		113	90	107						
363	70		123	58							
353	75		120	65	66	72	73	80	81	87	88	95
				96	102	103	105	110	111	114	117	
433	1000	FMT	15	14								
454	2000	FMT	19	18								
475	2500	FMT	23	22								
516	3000	FMT	137	136								
527	3500	FMT	139	138								

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES	
26	1	*	K	17 140	376B		EXT REFS NOT INNER
37	10	*	I	27 42	41B		NOT INNER
54	10		J	28 42	21B	OPT	
114	5		L	49 53	13B	OPT	
135	50	*	L	57 122	226B	OPT	EXITS
364	30	*	L	124 136	34B		EXT REFS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	667B	439
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE DEBRN(H,TE,TS,RIVNOM,IRIV,JRIV,NPRIV,DX,DY,DT,QRIV,QTOT
     1,TEMPO,YEAR,NRIV,KFIELD,KFRIV,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **DEBRN COMPUTES,AT A GIVEN TIME,THE EXCHANGE FLOW          C
C          BETWEEN RIVERS AND AQUIFER HYDRAULICALLY CONNECTED          C
C               .H(I,J,K) IS THE HEAD                                  C
C               .TE(I,J,K),TS(I,J,K) ARE THE DIRECTIONAL TRAN          C
C                SMISSIVITIES                                          C
C               .RIVNOM(L) IS THE RIVER NAME                           C
C               .NPRIV(L) IS THE NUMBER OF MESHES PER RIVER            C
C               .IRIV(L,200),JRIV(L,200) ARE THE COORDINATES           C
C                OF A RIVER MESH                                       C
C               .NRIV IS THE NUMBE  OF RIVERS                          C
C               .DX,DY,DT ARE THE SPACE AND TIME INCREMENTS            C
C               .QRIV(L) IS THE TOTAL EXCHANGE FLOW PER RIVER          C
C               .QTOT IS THE TOTAL AMOUTN OF EXCHANGE FLOW             C
C               .KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX          C
C               .KFRIV IS THE VALUE ASSIGNED TO KFIELD(I,J,K)          C
C                ON A RIVER MESH                                       C
C               .TEMPO IS THE TIME SINCE SIMULATION STARTED            C
C               .YEAR IS THE YEAR OF CALCULATION                       C
C               .NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL           C
C                TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS            C
C                                                                      C
C               -SUB-PROGRAMS CALLED:NONE                              C
C                                                                      C
C          NOTE:THE RIVERS OCCUR ONLY ON AQUIFER NO 1                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION NPRIV(NRIV),RIVNOM(NRIV,4),IRIV(NRIV,200),JRIV(NRIV,200)
     1,QRIV(NRIV),H(NL,NC,NAQ),TE(NL,NC,NAQ),TS(NL,NC,NAQ),KFIELD(NL,NC,
     2NAQ)
      COMMON IN,IO
C
C       **DEBRN COMPUTES THE WATER EXCHANGES BETWEEN RIVERS AND AQUIFERS
C         HYDRAULICALLY CONNECTED**
C
      WRITE(IO,1000)TEMPO,YEAR
 1000 FORMAT(1H1//42X,35(1H*)/42X,35H*AQUIFER-RIVER EXCHANGE FLOW RATES*
     1/42X,20H* COMPUTED AT TIME: ,F11.0,4H S */42X,1H*,12X,5HYEAR:,I4,1
     22X,1H*/42X,35(1H*))
      QTOT=0.
      DO 1 K=1,NRIV
      SIGQ=0.
      NP=NPRIV(K)-1
      WRITE(IO,2000)(RIVNOM(K,J),J=1,4)
 2000 FORMAT(1H0/40X,12HRIVER NAME: ,4A6//33X,53(1H*)/33X,53H*POINT NO*
     1I * J *UNIT RATE(L/S)*CUMULATED RATE(L/S)*/33X,53(1H*))
      DO 5 L=2,NP
      QQ=0.
      I1=IRIV(K,L)
      J1=JRIV(K,L)
      TNORTH=TS(I1-1,J1,1)
      TSOUTH=TS(I1,J1,1)
      TWEST=TE(I1,J1-1,1)
      TEAST=TE(I1,J1,1)
      DHN=H(I1,J1,1)-H(I1-1,J1,1)
      DHS=H(I1,J1,1)-H(I1+1,J1,1)
```

```
                      DHW=H(I1,J1,1)-H(I1,J1-1,1)
                      DHE=H(I1,J1,1)-H(I1,J1+1,1)
      60              KFN=KFIELD(I1-1,J1,1)
                      KFS=KFIELD(I1+1,J1,1)
                      KFW=KFIELD(I1,J1-1,1)
                      KFE=KFIELD(I1,J1+1,1)
                      QW=TWEST*DHW*1000.*DY/DX
      65              QE=TEAST*DHE*1000.*DY/DX
                      QN=TNORTH*DHN*1000.*DX/DY
                      QS=TSOUTH*DHS*1000.*DX/DY
                      IF(KFN.NE.KFRIV)QQ=QQ+QN
                      IF(KFS.NE.KFRIV)QQ=QQ+QS
      70              IF(KFW.NE.KFRIV)QQ=QQ+QW
                      IF(KFE.NE.KFRIV)QQ=QQ+QE
                      SIGQ=SIGQ+QQ
                      WRITE(IO,3000)L,I1,J1,QQ,SIGQ
                 3000 FORMAT(33X,1H*,I5,3X,1H*,2(I3,1H*),4X,F6.0,4X,1H*,6X,F7.0,6X,1H*)
      75            5 CONTINUE
                      QRIV(K)=SIGQ/1000.
                      QTOT=QTOT+SIGQ
                      WRITE(IO,4000)
                 4000 FORMAT(33X,53(1H*)/)
      80            1 CONTINUE
                      WRITE(IO,5000)QTOT
                 5000 FORMAT(1H0/36X,35HTOTAL AQUIFER-RIVER EXCHANGE FLOW= ,F8.0,4H L/S/
                     136X,47(1H*))
                      QTOT=QTOT/1000.
      85              RETURN
                      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

		DEF LINE	REFERENCES
3	DEBRN	1	85

VARIABLES

		SN	TYPE		RELOCATION								
320	DHE		REAL			REFS	65	DEFINED	59				
315	DHN		REAL			REFS	66	DEFINED	56				
316	DHS		REAL			REFS	67	DEFINED	57				
317	DHW		REAL			REFS	64	DEFINED	58				
0	DT		REAL	*UNUSED	F.P.	DEFINED	1						
0	DX		REAL		F.P.	REFS	64	65	66	67	DEFINED	1	
0	DY		REAL		F.P.	REFS	64	65	66	67	DEFINED	1	
0	H		REAL	ARRAY	F.P.	REFS	29	2*56	2*57	2*58	2*59		
						DEFINED	1						
0	IN		INTEGER		/ /	REFS	32						
1	IO		INTEGER		/ /	REFS	32	I/O REFS	37	45	73	78	81
0	IRIV		INTEGER	ARRAY	F.P.	REFS	29	50	DEFINED	1			
307	I1		INTEGER			REFS	52	53	54	55	2*56	2*57	2*58
						2*59	60	61	62	63	73		
						DEFINED	50						
304	J		INTEGER			REFS	45	DEFINED	45				
0	JRIV		INTEGER	ARRAY	F.P.	REFS	29	51	DEFINED	1			

VARIABLES	SN	TYPE	RELOCATION								
310	J1	INTEGER		REFS	52	53	54	55	2*56	2*57	2*58
				2*59	60	61	62	63	73		
				DEFINED	51						
301	K	INTEGER		REFS	44	45	50	51	76		
				DEFINED	42						
324	KFE	INTEGER		REFS	71	DEFINED	63				
0	KFIELD	INTEGER	ARRAY F.P.	REFS	29	60	61	62	63		
				DEFINED	1						
321	KFN	INTEGER		REFS	68	DEFINED	60				
0	KFRIV	INTEGER	F.P.	REFS	68	69	70	71	DEFINED	1	
322	KFS	INTEGER		REFS	69	DEFINED	61				
323	KFW	INTEGER		REFS	70	DEFINED	62				
305	L	INTEGER		REFS	50	51	73	DEFINED	48		
0	NAQ	INTEGER	F.P.	REFS	4*29	DEFINED	1				
0	NC	INTEGER	F.P.	REFS	4*29	DEFINED	1				
0	NL	INTEGER	F.P.	REFS	4*29	DEFINED	1				
303	NP	INTEGER		REFS	48	DEFINED	44				
0	NPRIV	INTEGER	ARRAY F.P.	REFS	29	44	DEFINED	1			
0	NRIV	INTEGER	F.P.	REFS	5*29	42	DEFINED	1			
326	QE	REAL		REFS	71	DEFINED	65				
327	QN	REAL		REFS	68	DEFINED	66				
306	QQ	REAL		REFS	68	69	70	71	72	73	
				DEFINED	49	68	69	70	71		
0	QRIV	REAL	ARRAY F.P.	REFS	29	DEFINED	1	76			
330	QS	REAL		REFS	69	DEFINED	67				
0	QTOT	REAL	F.P.	REFS	77	81	84	DEFINED	1	41	77
				84							
325	QW	REAL		REFS	70	DEFINED	64				
0	RIVNOM	REAL	ARRAY F.P.	REFS	29	45	DEFINED	1			
302	SIGQ	REAL		REFS	72	73	76	77	DEFINED	43	72
0	TE	REAL	ARRAY F.P.	REFS	29	54	55	DEFINED	1		
314	TEAST	REAL		REFS	65	DEFINED	55				
0	TEMPO	REAL	F.P.	REFS	37	DEFINED	1				
311	TNORTH	REAL		REFS	66	DEFINED	52				
0	TS	REAL	ARRAY F.P.	REFS	29	52	53	DEFINED	1		
312	TSOUTH	REAL		REFS	67	DEFINED	53				
313	TWEST	REAL		REFS	64	DEFINED	54				
0	YEAR	REAL	F.P.	REFS	37	DEFINED	1				

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS			DEF LINE	REFERENCES
0	1		80	42
0	5		75	48
176	1000	FMT	38	37
223	2000	FMT	46	45
247	3000	FMT	74	73
260	4000	FMT	79	78
267	5000	FMT	82	81

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES	
26	1	* K	42 80	130B	EXT REFS	NOT INNER
34		* J	45 45	11B	EXT REFS	
47	5	* L	48 75	77B	EXT REFS	

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	411B	265
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE STORAG(S,H,HO,DX,DY,DT,TEMPO,YEAR,QELAS,QTOTEL,KFIELD,
     1NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **STORAG COMPUTES,AT A GIVEN TIME,THE RELEASE FROM          C
C         STORAGE                                                     C
C              .HO(I,J,K),H(I,J,K) ARE THE INITIAL AND FINAL          C
C               HEADS                                                 C
C              .S(I,J,K) IS THE STORAGE COEFFICIENT                   C
C              .DX,DY,DT ARE THE SPACE AND TIME INCREMENTS            C
C              .TEMPO IS THE TIME SINCE SIMULATION STARTED            C
C              .YEAR IS THE YEAR OF CALCULATION                       C
C              .QELAS(K) IS THE RELEASE FROM STORAGE PER AQU          C
C               IFER                                                  C
C              .QTOTEL IS THE TOTAL RELEASE FROM STORAGE              C
C              .KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX          C
C              .NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL           C
C               TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS.           C
C                                                                     C
C              -SUB PROGRAM CALLED:NONE                               C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION S(NL,NC,NAQ),H(NL,NC,NAQ),HO(NL,NC,NAQ),QELAS(NAQ),
     1KFIELD(NL,NC,NAQ)
      COMMON IN,IO
C
C       **STORAGE COMPUTES THE INSTANTANEOUS RELEASE FROM STORAGE**
C
      QTOTEL=0.
      WRITE(IO,1000)TEMPO,YEAR
 1000 FORMAT(1H1//42X,36(1H*)/42X,36H*INSTANTANEOUS RELEASE FROM STORAGE
     1*/42X,1H*,8X,5HTIME:,F11.0,2H S,8X,1H*/42X,1H*,12X,6HYEAR: ,I4,12X
     2,1H*/42X,36(1H*))
      DO 1 K=1,NAQ
      SIGQ=0.
      DO 5 I=1,NL
      DO 5 J=1,NC
      KC=KFIELD(I,J,K)
      IF(KC.NE.0.OR.KC.NE.1)GO TO 5
      DHT=H(I,J,K)-HO(I,J,K)
      SCENT=S(I,J,K)
      AREA=DX*DY
      QQ=SCENT*AREA*DHT*1000./DT
      SIGQ=SIGQ+QQ
    5 CONTINUE
      QELAS(K)=SIGQ
      QTOTEL=QTOTEL+SIGQ
    1 CONTINUE
      WRITE(IO,2000)
 2000 FORMAT(1H0//41X,38(1H*)/41X,38H*AQUIFER NO*RELEASE FROM STORAGE(L/
     1S)*/41X,38(1H*))
      WRITE(IO,3000)K,QELAS(K)
 3000 FORMAT(41X,1H*,4X,I2,4X,1H*,9X,F7.1,9X,1H*)
      WRITE(IO,4000)K,QTOTEL
 4000 FORMAT(41X,38(1H*)/41X,1H*15X,6HTOTALS,15X,1H*/41X,38(1H*)/41X,1H
     1*,4X,I2,4X,1H*,9X,F7.1,9X,1H*/41X,38(1H*))
      QTOTEL=QTOTEL/1000.
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
3	STORAG	1	56

VARIABLES	SN	TYPE		RELOCATION								
207	AREA	REAL			REFS	41	DEFINED	40				
205	DHT	REAL			REFS	41	DEFINED	38				
0	DT	REAL		F.P.	REFS	41	DEFINED	1				
0	DX	REAL		F.P.	REFS	40	DEFINED	1				
0	DY	REAL		F.P.	REFS	40	DEFINED	1				
0	H	REAL	ARRAY	F.P.	REFS	21	38	DEFINED	1			
0	HO	REAL	ARRAY	F.P.	REFS	21	38	DEFINED	1			
202	I	INTEGER			REFS	36	2*38	39	DEFINED	34		
0	IN	INTEGER		/ /	REFS	23						
1	IO	INTEGER		/ /	REFS	23	I/O REFS	28	47	50	52	
203	J	INTEGER			REFS	36	2*38	39	DEFINED	35		
200	K	INTEGER			REFS	36	2*38	39	44	2*50	52	
					DEFINED	32						
204	KC	INTEGER			REFS	2*37	DEFINED	36				
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	21	36	DEFINED	1			
0	NAQ	INTEGER		F.P.	REFS	5*21	32	DEFINED	1			
0	NC	INTEGER		F.P.	REFS	4*21	35	DEFINED	1			
0	NL	INTEGER		F.P.	REFS	4*21	34	DEFINED	1			
0	QELAS	REAL	ARRAY	F.P.	REFS	21	50	DEFINED	1	44		
210	QQ	REAL			REFS	42	DEFINED	41				
0	QTOTEL	REAL		F.P.	REFS	45	52	55	DEFINED	1	27	45
					55							
0	S	REAL	ARRAY	F.P.	REFS	21	39	DEFINED	1			
206	SCENT	REAL			REFS	41	DEFINED	39				
201	SIGO	REAL			REFS	42	44	45	DEFINED	33	42	
0	TEMPO	REAL		F.P.	REFS	28	DEFINED	1				
0	YEAR	REAL		F.P.	REFS	28	DEFINED	1				

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS			DEF LINE	REFERENCES		
0	1		46	32		
55	5		43	34	35	37
113	1000	FMT	29	28		
134	2000	FMT	48	47		
152	3000	FMT	51	50		
163	4000	FMT	53	52		

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
25	1	* K	32 46	42B	NOT INNER
27	5	* I	34 43	33B	NOT INNER
40	5	J	35 43	17B	OPT

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	245B	165
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE LEAKAG(H,HCB,PZ,EP,KFIELD,KAQSUP,KAQINF,DX,DY,TEMPO,YE
     1EAR,SIGQLE,SIGLUP,SIGLDO,KNLEAK,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **LEAKAG COMPUTES,AT A GIVEN TIME,THE VERTICAL LEA          C
C          KAGE FLOWS OCCURING BETWEEN AQUIFERS.                       C
C               .H(I,J,K) IS THE HEAD OF AN AQUIFER                    C
C               .HCB(I,J) IS THE HEAD OF AN OUTCROPPING CONFI          C
C                NING BED                                              C
C               .PZ(I,J,K) IS THE VERTICAL PERMEABILITY OF A           C
C                CONFINING BED                                         C
C               .EP(I,J,K) IS THE THICKNESS OF A CONFINING BED         C
C               .KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX          C
C               .KAQINF(I,J,K),KAQSUP(I,J,K) ARE THE VERTICAL          C
C                AQUIFER CONNECTION INDICES                            C
C               .DX,DY ARE THE SPACE INCREMENTS                        C
C               .TEMPO IS THE TIME SINCE SIMULATION STARTS             C
C               .YEAR IS THE YEAR OF CALCULATION                       C
C               -SIGQLE(K) IS THE TOTAL LEAKAGE FOW PER AQUI           C
C                FER                                                   C
C               .SIGLUP(K),SIGLDO(K) ARE THE UPWARD AND DOWNW          C
C                ARD LEAKAGE FLOWS PER AQUIFER                         C
C               .KNLEAK(K) IS THE NUMBER OF AQUIFER MESHES CO          C
C                NCERNED WITH LEAKAGE                                  C
C                                                                      C
C               -SUB-PROGRAMS CALLED:NONE                              E
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION H(NL,NC,NAQ),PZ(NL,NC,NAQ),EP(NL,NC,NAQ),KFIELD(NL,NC,NA
     1Q),KAQSUP(NL,NC,NAQ),KAQINF(NL,NC,NAQ),SIGQLE(NAQ),KNLEAK(NAQ),
     2SIGLUP(NAQ),SIGLDO(NAQ),HCB(NL,NC)
      COMMON IN,IO
C       **THIS POUTINE COMPUTES VERTICAL LEAKAGE RATES BETWEEN AQUIFERS
C     IN UPWARDS AND DOWNWARDS DIRECTION UNDER THE HANTUSH HYDRODYNAMIC
C     ASSUMPTIONS**
C
      WRITE(IO,1000)TEMPO,YEAR
 1000 FORMAT(1H1,25(/),42X,44(1H*)/42X,44H*CALCULATION OF UPWARDS,DOWNWA
     1RDS AND TOTAL*/42X,1H*,12X,18HLEAKAGE FLOW RATES,12X,1H*/42X,1H*,1
     20X,8HAT TIME:,F12.0,2H S,10X,1H*/42X,1H*,16X,5HYEAR:,I5,16X,1H*/42
     3X,44(1H*))
      SIGQL=0.
      AREA=DX*DY
      KKK=0
      SIGU=0.
      SIGD=0.
      DO 1 K=1,NAQ
      SIGQ=0.
      KK=0
      WRITE(IO,2000)K
 2000 FORMAT(1H1//48X,24(1H*)/48X,24H*COMPUTED LEAKAGE RATES*/48X,1H*,7X
     1,8HAQUIFER:,I2,7X,1H*/48X,24(1H*)//26X,67(1H*)/26X,67H* NO * I*J *
     2KC*PZ(10-10)*EP(M)*KUP*QUP(L/S)*LDO*QDO(L/S)*QTOT(L/S)*/26X,67(1H*
     3))
      SIGTOT=0.
      SIGUP=0.
      SIGDO=0.
      DO 5 I=1,NL
      DO 5 J=2,NC
```

```
      KC=KFIELD(I,J,K)
      IF((IABS(KC)).EQ.2)GO TO 5
60    IF(KC.EQ.-1)GO TO 5
      KK=KK+1
      KKK=KKK+1
      IF(EP(I,J,K).LT.0.1)GO TO 5
      KINF=KAQINF(I,J,K)
65    KSUP=KAQSUP(I,J,K)
      BUP=PZ(I,J,K)/EP(I,J,K)
      IF(EP(I,J,KINF).LT.0.1)GO TO 5
      BDO=PZ(I,J,KINF)/EP(I,J,KINF)
      KSUP=KAQSUP(I,J,K)
70    IPHY1=(KSUP-K+1000)/((IABS(KSUP-K))+1000)
      IKUP=KSUP-(10+K)
      IPHY2=(IKUP+1000)/((IABS(IKUP))+1000)
      NSUP=(1-IPHY1)*KSUP
      HSUP=(1-IPHY2)*H(I,J,NSUP)+IPHY2*HCB(I,J)
75    DHUP=H(I,J,K)-HSUP
      DHDO=H(I,J,K)-H(I,J,KINF)
      QLUP=BUP*DHUP*AREA*1000.
      QLDO=BDO*DHDO*AREA*1000.
      QLTOT=QLUP+QLDO
80    PPZ=PZ(I,J,K)*10000000000.
      WRITE(IO,2500)KK,I,J,KC,PPZ,EP(I,J,K),KSUP,QLUP,KINF,QLDO,QLTOT
2500  FORMAT(26X,1H*,I3,1X,1H*,3(I2,1H*),F9.2,1H*,F5.0,1H*,2(I2,1H*,1X,F
     16.1,1X,1H*),1X,F7.1,1X,1H*)
      SIGUP=SIGUP+QLUP
85    SIGDO=SIGDO+QLDO
      SIGTOT=SIGTOT+QLTOT
    5 CONTINUE
      WRITE(IO,3000)KK,SIGUP,SIGDO,SIGTOT
3000  FORMAT(26X,67(1H*)//46X,37(1H*)/46X,1H*,11X,14HRECAPITULATION,10X,
90   11H*/46X,24H*NUMBER OF ACTIVE NODES:,I4,8X,1H*/46X,23H*TOTAL UPWARD
     25 LEAKAGE:,F7.0,4H L/S,2X,1H*/46X,25H*TOTAL DOWNWARDS LEAKAGE:,F7.
     30,5H L/S*/46X,20H*TOTAL LEAKAGE FLOW:,F7.0,4H L/S,5X,1H*/46X,37(1H
     4*)/)
      KNLEAK(K)=KK
95    SIGQLE(K)=SIGTOT
      SIGLUP(K)=SIGUP
      SIGLDO(K)=SIGDO
      SIGU=SIGU+SIGUP
      SIGD=SIGD+SIGDO
100   SIGQL=SIGQL+SIGTOT
    1 CONTINUE
      WRITE(IO,4000)
4000  FORMAT(1H1//42X,36(1H*)/42X,36H*SUMMARY OF MULTILAYERED SYSTEM*/42
     1X,1H* 9X,16HLEAKAGE FEATURES,9X,1H*/42X,36(1H*)/32X,55(1H*)/32X,55
105  2H*AQUIFER* NODE * UPWARDS * DOWNWARDS * TOTAL */32X,55H*
     3 NO *NUMBER*LEAKAGE(L/S)*LEAKAGE(L/S)*LEAKAGE(L/S)*/32X,55(1H*))
      DO 10 K=1,NAQ
      WRITE(IO,5000)K,KNLEAK(K),SIGLUP(K),SIGLDO(K),SIGQLE(K)
5000  FORMAT(32X,1H*,2X,I2,3X,1H*,1X,I3,2X,1H*,3(2X,F8.0,2X,1H*))
110   10 CONTINUE
      WRITE(IO,6000)K,KKK,SIGU,SIGD,SIGQL
6000  FORMAT(32X,55(1H*)/32X,1H*,24X,6HTOTALS,23X,1H*/32X,55(1H*)/32X,1H
     1*,2X,I2,3X,1H*,1X,I4,1X,1H*,3(2X,F8.0,2X,1H*)/32X,55(1H*))
      RETURN
```

```
115                END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 LEAKAG 1 114

VARIABLES	SN	TYPE	RELOCATION									
471	AREA	REAL			REFS	77	78	DEFINED	41			
511	BDO	REAL			REFS	78	DEFINED	68				
510	BUP	REAL			REFS	77	DEFINED	66				
520	DHDO	REAL			REFS	78	DEFINED	76				
517	DHUP	REAL			REFS	77	DEFINED	75				
0	DX	REAL		F.P.	REFS	41	DEFINED	1				
0	DY	REAL		F.P.	REFS	41	DEFINED	1				
0	EP	REAL	ARRAY	F.P.	REFS	27	63	66	67	68	81	
					DEFINED	1						
0	H	REAL	ARRAY	F.P.	REFS	27	74	75	2*76	DEFINED	1	
0	HCB	REAL	ARRAY	F.P.	REFS	27	74	DEFINED	1			
516	HSUP	REAL			REFS	75	DEFINED	74				
503	I	INTEGER			REFS	58	63	64	65	2*66	67	2*68
					69	2*74	75	2*76	80	2*81		
					DEFINED	56						
513	IKUP	INTEGER			REFS	2*72	DEFINED	71				
0	IN	INTEGER		/ /	REFS	30						
1	IO	INTEGER		/ /	REFS	30	I/O REFS	35	48	81	88	102
					108	111						
512	IPHY1	INTEGER			REFS	73	DEFINED	70				
514	IPHY2	INTEGER			REFS	2*74	DEFINED	72				
504	J	INTEGER			REFS	58	63	64	65	2*66	67	2*68
					69	2*74	75	2*76	80	2*81		
					DEFINED	57						
475	K	INTEGER			REFS	48	58	63	64	65	2*66	69
					2*70	71	75	76	80	81	94	95
					96	97	5*108	111	DEFINED	45	107	
0	KAQINF	INTEGER	ARRAY	F.P.	REFS	27	64	DEFINED	1			
0	KAQSUP	INTEGER	ARRAY	F.P.	REFS	27	65	69	DEFINED	1		
505	KC	INTEGER			REFS	59	60	81	DEFINED	58		
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	27	58	DEFINED	1			
506	KINF	INTEGER			REFS	67	2*68	76	81	DEFINED	64	
477	KK	INTEGER			REFS	61	81	88	94	DEFINED	47	61
472	KKK	INTEGER			REFS	62	111	DEFINED	42	62		
0	KNLEAK	INTEGER	ARRAY	F.P.	REFS	27	108	DEFINED	1	94		
507	KSUP	INTEGER			REFS	2*70	71	73	81	DEFINED	65	69
0	NAQ	INTEGER		F.P.	REFS	10*27	45	107	DEFINED	1		
0	NC	INTEGER		F.P.	REFS	7*27	57	DEFINED	1			
0	NL	INTEGER		F.P.	REFS	7*27	56	DEFINED	1			
515	NSUP	INTEGER			REFS	74	DEFINED	73				
524	PPZ	REAL			REFS	81	DEFINED	80				
0	PZ	REAL	ARRAY	F.P.	REFS	27	66	68	80	DEFINED	1	
522	QLDO	REAL			REFS	79	81	85	DEFINED	78		
523	QLTOT	REAL			REFS	81	86	DEFINED	79			
521	QLUP	REAL			REFS	79	81	84	DEFINED	77		

VARIABLES	SN	TYPE	RELOCATION										
474	SIGD		REAL			REFS	99	111	DEFINED	44	99		
502	SIGDO		REAL			REFS	85	88	97	99	DEFINED	55	85
0	SIGLDO		REAL	ARRAY	F.P.	REFS	27	108	DEFINED	1	97		
0	SIGLUP		REAL	ARRAY	F.P.	REFS	27	108	DEFINED	1	96		
476	SIGQ	*	REAL			DEFINED	46						
470	SIGQL		REAL			REFS	100	111	DEFINED	40	100		
0	SIGQLE		REAL	ARRAY	F.P.	REFS	27	108	DEFINED	1	95		
500	SIGTOT		REAL			REFS	86	88	95	100	DEFINED	53	86
473	SIGU		REAL			REFS	98	111	DEFINED	43	98		
501	SIGUP		REAL			REFS	84	88	96	98	DEFINED	54	84
0	TEMPO		REAL		F.P.	REFS	35	DEFINED	1				
467	YEAR	*	REAL	*UNDEF		REFS	35						
0	YEEAR		REAL	*UNUSED	F.P.	DEFINED	1						

VARIABLES USED AS FILE NAMES, SEE ABOVE

INLINE FUNCTIONS	TYPE	ARGS	DEF LINE	REFERENCES				
IABS	INTEGER	1 INTRIN		59	70	72		

STATEMENT LABELS			DEF LINE	REFERENCES					
0	1		101	45					
142	5		87	56	57	59	60	63	67
0	10		110	107					
222	1000	FMT	36	35					
252	2000	FMT	49	48					
314	2500	FMT	82	81					
334	3000	FMT	89	88					
371	4000	FMT	103	102					
433	5000	FMT	109	108					
451	6000	FMT	112	111					

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES	
31	1	*	K	45 101	136B	EXT REFS	NOT INNER
37	5	*	I	56 87	110B	EXT REFS	NOT INNER
40	5	*	J	57 87	105B	EXT REFS	
171	10	*	K	107 110	14B	EXT REFS	

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	603B	387
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE FLUXES(Q,QAQ,QTOT,KFIELD,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **FLUXES COMPUTES ,AT A GIVEN TIME,THE TOTAL AMOUNT          C
C         OF FIELD FLOW                                                C
C              .Q(I,J,K) IS THE POINT FIELD FLOW                       C
C              .QAQ(K) IS THE TOTAL FIELD FLOW PER AQUIFER             C
C              .QTOT IS THE TOTAL FIELD FLOW                           C
C              .KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX           C
C              .NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL            C
C               TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS             C
C                                                                      C
C              -SUB-PROGRAMS CALLED:NONE                               C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION Q(NL,NC,NAQ),KFIELD(NL,NC,NAQ),QAQ(NAQ)
      COMMON IN,IO
C
C       **FLUXES COMPUTES THE TOTAL AMOUNT OF FLOWS IMPOSED
C         WITHIN THE PRESSURE FIELD(EXCLUDING BOUNDARIES) AS
C         POINT FIELD SINGULARITIES**
C
      QTOT=0.
      WRITE(IO,1000)
 1000 FORMAT(1H1//34X,53(1H*)/34X,53H*TOTAL FLOW RATES OCCURING WITHIN T
     1HE PRESSURE FIELD*/34X,53(1H*)//43X,34(1H*)/43X,34H*AQUIFER NO*TOT
     2AL FLOW RATES(L/S)*/43X,34(1H*))
      DO 1 K=1,NAQ
      SIGQ=0.
      DO 5 I=1,NL
      DO 5 J=1,NC
      KC=KFIELD(I,J,K)
      IF(KC.NE.0)GO TO 5
      QCENT=Q(I,J,K)*1000.
      SIGQ=SIGQ+QCENT
    5 CONTINUE
      QAQ(K)=SIGQ
      QTOT=QTOT+QAQ(K)
      WRITE(IO,2000)K,QAQ(K)
 2000 FORMAT(43X,1H*,4X,I2,4X,1H*,7X,F7.0,7X,1H*)
    1 CONTINUE
      WRITE(IO,3000)K,QTOT
 3000 FORMAT(43X,34(1H*)/43X,1H*,13X,6HTOTALS,13X,1H*/43X,1H*,4X,I2,4X,1
     1H*,7X,F7.0,7X,1H*/43X,34(1H*))
      QTOT=QTOT/1000.
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS	DEF LINE	REFERENCES
3 FLUXES	1	44

```
VARIABLES     SN  TYPE            RELOCATION
  151  I          INTEGER                        REFS        30        32    DEFINED       28
    0  IN         INTEGER                 / /    REFS        15
    1  IO         INTEGER                 / /    REFS        15    I/O REFS      22        37        40
  152  J          INTEGER                        REFS        30        32    DEFINED       29
  147  K          INTEGER                        REFS        30        32        35        36      2*37        40
                                                 DEFINED     26
  153  KC         INTEGER                        REFS        31    DEFINED       30
    0  KFIELD     INTEGER   ARRAY       F.P.     REFS        14        30    DEFINED        1
    0  NAQ        INTEGER               F.P.     REFS      3*14        26    DEFINED        1
    0  NC         INTEGER               F.P.     REFS      2*14        29    DEFINED        1
    0  NL         INTEGER               F.P.     REFS      2*14        28    DEFINED        1
    0  Q          REAL      ARRAY       F.P.     REFS        14        32    DEFINED        1
    0  QAQ        REAL      ARRAY       F.P.     REFS        14        36        37    DEFINED        1        35
  154  QCENT      REAL                           REFS        33    DEFINED       32
    0  QTOT       REAL                  F.P.     REFS        36        40        43    DEFINED        1        21        36
                                                   43
  150  SIGQ       REAL                           REFS        33        35    DEFINED       27        33
       VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS              DEF LINE   REFERENCES
    0  1                          39        26
   45  5                          34        28        29        31
   75  1000     FMT               23        22
  123  2000     FMT               38        37
  134  3000     FMT               41        40

LOOPS  LABEL     INDEX     FROM-TO    LENGTH    PROPERTIES
   25  1       * K          26 39       37B             EXT REFS  NOT INNER
   27  5       * I          28 34       23B             NOT INNER
   40  5         J          29 34        7B     INSTACK

COMMON BLOCKS    LENGTH
       / /            2

STATISTICS
  PROGRAM LENGTH                 175B      125
  SCM BLANK COMMON LENGTH          2B        2
```

```
      SUBROUTINE DEBLA3(H,XE,XS,KFIELD,DX,DY,TEMPO,YEAR,SIGQAQ,SIGQT,KNO
     1DE,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **DEBLA COMPUTES,AT A GIBEN TIME,THE LATERAL BOUNDARY          C
C          IN(OUT)FLOW.                                                   C
C               .H(I,J,K) IS THE HEAD                                     C
C               .XE(I,J,K),SX(I,J,K)ARE THE DIRECTIONAL TRANSMI           C
C               SSIVITIES                                                 C
C               .KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX             C
C               .DX,DY ARE THE SPACE INCREMENTS                           C
C               .TEMPO IS THE TIME SINCE SIMULATION STARTED               C
C               .YEAR IS THE YEAR OF CALCULATION                          C
C               .SIGQAQ(K) IS THE TOTAL BOUNDARY FLOW PER AQUI            C
C                 FER                                                     C
C               .KNODE(K) IS THE NUMBER OF BOUNDARY MESHES PER            C
C                AQUIFER                                                  C
C               .NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL TO           C
C                THE NUMBER OF ROWS,COLUMNS AND AQUIFERS                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C               SUB PROGRAMS CALLED:NONE                                  C
C                                                                         C
C                                                                         C
      DIMENSION H(NL,NC,NAQ),XE(NL,NC,NAQ),XS(NL,NC,NAQ),KFIELD(NL,NC,NA
     1Q),SIGQAQ(NAQ),KNODE(NAQ)
      COMMON IN,IO                                                                20
      WRITE(IO,1000)TEMPO,YEAR
 1000 FORMAT(1H1,25(/),45X,30(1H*)/45X,1H*,3X,22HCALCULATION OF LATERAL,
     13X,1H*/45X,30H*BOUNDARIES INFLOW OR OUTFLOW*/45X,1H*,3X,8HAT TIME
     2,F12.0,2H 5,3X,1H*/45X,1H*,9X,5HYEAR:,I5,9X,1H*/45X,30(1H*))
      SIGQT=0.
      KKK=0
      DO 1 K=1,NAQ
      SIGQ=0.
      KK=0
      WRITE(IO,2000)K
 2000 FORMAT(1H1/35X,46(1H*)/35X,46H*NODAL,CUMULATED AND TOTAL LATERAL B       60
     1OUNDARIES*/35X,1H*,13X,17HINFLOW OR OUTFLOW,14X,1H*/35X,1H*,15X,11      65
     2HAQUIFER NO:,I2,16X,1H*/35X,46(1H*)//10X,99(1H*)/10X,99H* NO * I*J      70
     3 *KC*KN*  XN  *  QN  *KW*  XW  *  QW  *KS*  XS  *  QS  *KE*  XE  *     75
     4  QE  * QNOD *  QCUM */10X,99(1H*))                                     80
      NLF=NL-1                                                                 85
      NCF=NC-1
      DO 5 I=2,NLF
      DO 5 J=2,NCF
      KC=KFIELD(I,J,K)
      IF((IABS(KC)).NE.1)GO TO 5
      KK=KK+1
      KKK=KKK+1
      QQ=0.
      QN=0.
      QS=0.
      QW=0.
      QE=0.
      KNORTH=KFIELD(I-1,J,K)
      KSOUTH=KFIELD(I+1,J,K)
      KWEST=KFIELD(I,J-1,K)
      KEAST=KFIELD(I,J+1,K)
```

```
                HC=H(I,J,K)
                HNORTH=H(I-1,J,K)
60              HSOUTH=H(I+1,J,K)
                HWEST=H(I,J-1,K)
                HEAST=H(I,J+1,K)
                XNORTH=XS(I-1,J,K)
                XSOUTH=XS(I,J,K)
65              XWEST=XE(I,J-1,K)
                XEAST=XE(I,J,K)
                QNORTH=XNORTH*(HC-HNORTH)*1000.*DW/DY
                QSOUTH=XSOUTH*(HC-HSOUTH)*1000.*DX/DY
                QWEST=XWEST*(HC-HWEST)*1000.*DY/DX
70              QEAST=XEAST*(HC-HEAST)*1000.*DY/DX
                IF(KNORTH.EQ.0.OR.KNORTH.GT.5)QN=QNORTH
                QQ=QQ+QN
                IF(KSOUTH.EQ.0.OR.KSOUTH.GT.5)QS=QSOUTH
                QQ=QQ+QS
75              IF(KWEST.EQ.0.OR.KWEST.GT.5)QW=QWEST
                QQ=QQ+QW
                IF(KEAST.EQ.0.OR.KEAST.GT.5)QE=QEAST
                QQ=QQ+QE
                SIGQ=SIGQ+QQ
80              WRITE(IO,3000)KK,I,J,KC,KNORTH,XNORTH,QN,KWEST,QWEST,KSOUTH,XSOUTH
               1,QS,KEAST,XEAST,QE,QQ,SIGQ
            3000 FORMAT(10X,1H*,I3,1X,1H*,3(I2,1H*),4(I2,1H*,F6.0,1H*,F6.1,1H*),F6.
               11,1H*,F6.0,1H*)
               5 CONTINUE
85              KNODE(K)=KK
                SIGQAQ(K)=SIGQ
                SIGQT=SIGQT+SIGQ
                WRITE(IO,4000)K,KK,SIGQAQ(K)
            4000 FORMAT(10X,99(1H*)//40X,40(1H*)/40X,1H*,12X,11HAQUIFER NO:,I2,13X,
90             11H*/40X,40H*SUMMARY OF LATERAL BOUNDARIES FEATURES*/40X,1H*,5X,25H
               2NUMBER OF BOUNDARY NODES:,I4,4X,1H*/40X,1H*,5X,19HTOTAL LATERAL FL
               3OW:,F6.0,4H CFS,4X,1H*/40X,1H*,6X,25HINFLOW IS MARKED POSITIVE,7X,
               41H*/40X,1H*,26HOUTFLOW IS MARKED NEGATIVE,6X,1H*/40X,40(1H*)//)
               1 CONTINUE
95              WRITE(IO,5000)
            5000 FORMAT(1H1//40X,38(1H*)/40X,38H*RECAPITULATION OF TOTAL MULTILAYER
               1ED*/40X,1H*,7X,21HLATERAL BOUNDARY FLOW,8X,1H*/40X,38(1H*)/47X,25(
               21H*)/47X,25H*AQUIFER*BOUNDARY* FLOW */47X,25H* NO * NODES * L
               3/S */47X,25(1H*))
100             DO 10 K=1,NAQ
                WRITE(IO,6000)KNODE(K),SIGQAQ(K)
            6000 FORMAT(47X,1H*,2X,I2,3X,1H*,2X,I3,3X,1H*,F6.0,1H*)
              10 CONTINUE
                WRITE(IO,7000)NAQ,KKK,SIGQT
105         7000 FORMAT(47X,25(1H*)/47X,1H*,9X,6HTOTALS,8X,1H*/47X,25(1H*)/47X,1H*,
               12X,I2,3X,1H*,2X,I4,2X,1H*,F6.0,1H*/47X,25(1H*))
                RETURN
                END
```

```
                HC=H(I,J,K)
                HNORTH=H(I-1,J,K)
60              HSOUTH=H(I+1,J,K)
                HWEST=H(I,J-1,K)
                HEAST=H(I,J+1,K)
                XNORTH=XS(I-1,J,K)
                XSOUTH=XS(I,J,K)
65              XWEST=XE(I,J-1,K)
                XEAST=XE(I,J,K)
                QNORTH=XNORTH*(HC-HNORTH)*1000.*DW/DY
                QSOUTH=XSOUTH*(HC-HSOUTH)*1000.*DX/DY
                QWEST=XWEST*(HC-HWEST)*1000.*DY/DX
70              QEAST=XEAST*(HC-HEAST)*1000.*DY/DX
                IF(KNORTH.EQ.0.OR.KNORTH.GT.5)QN=QNORTH
                QQ=QQ+QN
                IF(KSOUTH.EQ.0.OR.KSOUTH.GT.5)QS=QSOUTH
                QQ=QQ+QS
75              IF(KWEST.EQ.0.OR.KWEST.GT.5)QW=QWEST
                QQ=QQ+QW
                IF(KEAST.EQ.0.OR.KEAST.GT.5)QE=QEAST
                QQ=QQ+QE
                SIGQ=SIGQ+QQ
80              WRITE(IO,3000)KK,I,J,KC,KNORTH,XNORTH,QN,KWEST,QWEST,KSOUTH,XSOUTH
               1,QS,KEAST,XEAST,QE,QQ,SIGQ
            3000 FORMAT(10X,1H*,I3,1X,1H*,3(I2,1H*),4(I2,1H*,F6.0,1H*,F6.1,1H*),F6.
               11,1H*,F6.0,1H*)
               5 CONTINUE
85              KNODE(K)=KK
                SIGQAQ(K)=SIGQ
                SIGQT=SIGQT+SIGQ
                WRITE(IO,4000)K,KK,SIGQAQ(K)
            4000 FORMAT(10X,99(1H*)//40X,40(1H*)/40X,1H*,12X,11HAQUIFER NO:,I2,13X,
90             11H*/40X,40H*SUMMARY OF LATERAL BOUNDARIES FEATURES*/40X,1H*,5X,25H
               2NUMBER OF BOUNDARY NODES:,I4,4X,1H*/40X,1H*,5X,19HTOTAL LATERAL FL
               3OW:,F6.0,4H CFS,4X,1H*/40X,1H*,6X,25HINFLOW IS MARKED POSITIVE,7X,
               41H*/40X,1H*,26HOUTFLOW IS MARKED NEGATIVE,6X,1H*/40X,40(1H*)//)
               1 CONTINUE
95              WRITE(IO,5000)
            5000 FORMAT(1H1//40X,38(1H*)/40X,38H*RECAPITULATION OF TOTAL MULTILAYER
               1ED*/40X,1H*,7X,21HLATERAL BOUNDARY FLOW,8X,1H*/40X,38(1H*)/47X,25(
               21H*)/47X,25H*AQUIFER*BOUNDARY* FLOW */47X,25H* NO * NODES * L
               3/S */47X,25(1H*))
100             DO 10 K=1,NAQ
                WRITE(IO,6000)KNODE(K),SIGQAQ(K)
            6000 FORMAT(47X,1H*,2X,I2,3X,1H*,2X,I3,3X,1H*,F6.0,1H*)
              10 CONTINUE
                WRITE(IO,7000)NAQ,KKK,SIGQT
105         7000 FORMAT(47X,25(1H*)/47X,1H*,9X,6HTOTALS,8X,1H*/47X,25(1H*)/47X,1H*,
               12X,I2,3X,1H*,2X,I4,2X,1H*,F6.0,1H*/47X,25(1H*))
                RETURN
                END
```

VARIABLES	SN	TYPE	RELOCATION						
0	XE	REAL	ARRAY	F.P.	REFS	23	65	66	DEFINED 1
542	XEAST	REAL			REFS	70	80	DEFINED 66	
537	XNORTH	REAL			REFS	67	80	DEFINED 63	
0	XS	REAL	ARRAY	F.P.	REFS	23	63	64	DEFINED 1
540	XSOUTH	REAL			REFS	68	80	DEFINED 64	
541	XWEST	REAL			REFS	69	DEFINED	65	
0	YEAR	REAL		F.P.	REFS	26	DEFINED	1	

VARIABLES USED AS FILE NAMES, SEE ABOVE

INLINE FUNCTIONS	TYPE	ARGS	DEF LINE	REFERENCES
IABS	INTEGER	1	INTRIN	46

STATEMENT LABELS			DEF LINE	REFERENCES		
0	1		94	32		
165	5		84	43	44	46
0	10		103	100		
240	1000	FMT	27	26		
266	2000	FMT	36	35		
347	3000	FMT	82	80		
365	4000	FMT	89	88		
427	5000	FMT	96	95		
461	6000	FMT	102	101		
474	7000	FMT	105	104		

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES	
26	1	* K	32 94	157B	EXT REFS	NOT INNER
35	5	* I	43 84	135B	EXT REFS	NOT INNER
36	5	* J	44 84	132B	EXT REFS	
207	10	* K	100 103	11B	EXT REFS	

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	616B	398
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE BUDGET(QLEAK0,QLEAKF,QRAQ0,QRAQF,QLABO0,Q   ,Q
     1FIELD,QLEAKT,QRAQT,QLABOT,QSTORT,QFIELT,SIGQAQ,QTOTAL,  )
C
C        **BUDGET COMPUTES THE WATER BALANCE PER AQUIFER AND FOR THE
C          OVERALL GROUND WATER SYSTEM AND CHECKS THE ACCURACY OF THE
C          TOTAL WATER WALANCE.
C                  ITEMS CONSIDERED ARE:
C                    -QLEAK0,QLEAKF=INITIAL AND FINAL (ON A TIME STEP)
C                                   VERTICAL LEAKAGE FLOW PER AQUIFER
C                    -QRAQ0,QRAQF=INITIAL AND FINAL RIVER-AQUIFER FLOW
C                                 OCCURING WITHIN THE FIRST AQUIFER
C                    -QLABO0,QLABOF=INITIAL LATERAL BOUNDARIES IN(OUT)
C                                   FLOW PER AQUIFER
C                    -QSTORE=RELEASE FROM STORAGE PER AQUIFER AT THE
C                            END OF A TIME STEP
C                    -QFIELD=POINT FIELD DIS(RE)CHARGE OCCURING WITHIN
C                            A TIME STEP AND AN AQUIFER
C                    -QLEAKT,QRAQT,QLABOT,QSTORT,QFIELT REFER TO THE
C                            RESULTING TOTALS OF PREVIOUS ITEMS PERF
C                            ORMED OVER OVER ONE TIME STEP AND THE
C                            TOTAL GROUND-WATER SYSTEM
C                  SIGAQ AND QTOTAL ARE THE WATER BALANCES CONSIDERING
C                       A SINGLE AQUIFER AND THE OVERALL SYSTEM
C                  IREG IS AN INDEX SET TO:
C                            1 IF STEADY STATE IS CONSIDERED
C                            0 IF OCCURENCE OF NON STEADY STATE
C                  NAQ IS THE TOTAL NUMBER OF AQUIFERS
C
      DIMENSION QLEAK0(NAQ),QLEAKF(NAQ),QRAQ0(NAQ),QRAQF(NAQ),QLABO0(NAQ
     1),QLABOF(NAQ),QSTORE(NAQ),QFIELD(NAQ),SIGQAQ(NAQ)
      COMMON IN,IO
      QTOTAL=0.
      QLEAKT=0.
      QRAQT=0.
      QLABOT=0.
      QSTORT=0.
      QFIELT=0.
      QT=0.
      WRITE(IO,1000)
 1000 FORMAT(1H1//50X,20HGROUND WATER BALANCE//50X,20(1H*)//21X,77(1H*)/2
     11X,1H*,10X,67H* VERTICAL * LATERAL * FIELD * RELEASE * RIVER
     2 * TOTAL */21X,77H*AQUIFER NO* LEAKAGE *BOUNDARIES*DISCHARGE
     3* FROM * AQUIFER * AQUIFER */21X,1H*,10X,67H* FLOW * F
     4LOW *(RECHARGE)* STORAGE * EXCHANGE * BALANCE */21X,77(1H*))
      DO 1 K=1,NAQ
      QLEAK=QLEAKF(K)-QLEAK0(K)
      QLABO=QLABOF(K)-QLABO0(K)
      QRAQ=QRAQF(K)-QRAQ0(K)
      SIGQ=QLEAK+QLABO+QRAQ+QSTORE(K)+QFIELD(K)
      SIGQAQ(K)=SIGQ
      QTOTAL=QTOTAL+SIGQAQ(K)
      QLEAKT=QLEAKT+QLEAK
      QLABOT=QLABOT+QLABO
      QRAQT=QRAQT+QRAQ
      QSTORT=QSTORT+QSTORE(K)
      QFIELT=QFIELT+QFIELD(K)
      QCOMPO=ABS(QLEAK)+ABS(QLABO)+ABS(QRAQ)+ABS(QFIELD(K))+ABS(QSTORE(K
```

```
     1))
      QT=QT+QCOMPO
60    WRITE(IO,2000)K,QLEAK,QLABO,QFIELD(K),QSTORE(K),QRAO,SIGQAQ(K)
2000 FORMAT(21X,1H*,4X,I2,4X,1H*,6(1X,F8.3,2H *))
   1 CONTINUE
      WRITE(IO,3000)NAO,QLEAKT,QLABOT,QFIELT,QSTORT,QRAOT,QTOTAL
3000 FORMAT(21X,78(1H*)/21X,1H*,21X,35HTOTALS FOR THE OVERALL WATER SYS
65   1TEM,22X,1H*/21X,78(1H*)/21X,1H*,4X,I2,4X,1H*,6(1X,F8.3,2H *)/21X,7
     28(1H*)//)
      WBERR=QTOTAL/QT
      WRITE(IO,4000) WBERR
4000 FORMAT(44X,24HERROR ON WATER BALANCE= ,F6.2,2H %/44X,32(1H*)//47X,
70   127HFLOWS ARE EXPRESSED IN M3/S/44X,33HPOSITIVE SIGNS INDICATE DISC
     2HARGE/44X,32HNEGATIVE SIGNS INDICATE RECHARGE)
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 BUDGET 1 72

VARIABLES SN TYPE RELOCATION

0	IN	INTEGER		/ /	REFS	31						
1	IO	INTEGER		/ /	REFS	31	I/O REFS	39	60	63	68	
247	K	INTEGER			REFS	2*46	2*47	2*48	2*49	50	51	55
						2*57	4*60	DEFINED	45			
0	NAO	INTEGER		F.P.	REFS	9*29	45	63	DEFINED	1		
254	QCOMPO	REAL			REFS	59	DEFINED	57				
0	QFIELD	REAL	ARRAY	F.P.	REFS	29	49	56	57	60		
					DEFINED	1						
0	QFIELT	REAL		F.P.	REFS	56	63	DEFINED	1	37	56	
251	QLABO	REAL			REFS	49	53	57	60	DEFINED	47	
0	QLABOF	REAL	ARRAY	F.P.	REFS	29	47	DEFINED	1			
0	QLABOT	REAL		F.P.	REFS	53	63	DEFINED	1	35	53	
0	QLABOO	REAL	ARRAY	F.P.	REFS	29	47	DEFINED	1			
250	QLEAK	REAL			REFS	49	52	57	60	DEFINED	46	
0	QLEAKF	REAL	ARRAY	F.P.	REFS	29	46	DEFINED	1			
0	QLEAKT	REAL		F.P.	REFS	52	63	DEFINED	1	33	52	
0	QLEAKO	REAL	ARRAY	F.P.	REFS	29	46	DEFINED	1			
252	QRAO	REAL			REFS	49	54	57	60	DEFINED	48	
0	QRAOF	REAL	ARRAY	F.P.	REFS	29	48	DEFINED	1			
0	QRAOT	REAL		F.P.	REFS	54	63	DEFINED	1	34	54	
0	QRAOO	REAL	ARRAY	F.P.	REFS	29	48	DEFINED	1			
0	QSTORE	REAL	ARRAY	F.P.	REFS	29	49	55	57	60		
					DEFINED	1						
0	QSTORT	REAL		F.P.	REFS	55	63	DEFINED	1	36	55	
249	QT	REAL			REFS	59	67	DEFINED	38	59		
0	QTOTAL	REAL		F.P.	REFS	51	63	67	DEFINED	1	32	51
253	SIGQ	REAL			REFS	50	DEFINED	49				
0	SIGQAQ	REAL	ARRAY	F.P.	REFS	29	51	60	DEFINED	1	50	
255	WBERR	REAL			REFS	68	DEFINED	67				

VARIABLES USED AS FILE NAMES, SEE ABOVE

```
INLINE FUNCTIONS   TYPE    ARGS        DEF LINE  REFERENCES
      ABS         REAL       1  INTRIN              5*57

STATEMENT LABELS              DEF LINE   REFERENCES
    0  1                          62         45
  110  1000     FMT               40         39
  163  2000     FMT               61         60
  202  3000     FMT               64         63
  224  4000     FMT               69         68

LOOPS  LABEL     INDEX     FROM-TO    LENGTH    PROPERTIES
   27  1      * K           45 62       50B              EXT REFS

COMMON BLOCKS   LENGTH
       / /           2

STATISTICS
  PROGRAM LENGTH                326B      214
  SCM BLANK COMMON LENGTH         2B        2
```

```
      SUBROUTINE FRAMMC(XX,BLANK,STAR,POINT,ZERO,WLETER,RLETER,ALETER,
     1KFIELD,KFR,IW,JW,KW,IR,JR,IA,JA,KA,K,NW,NR,NPR,NA,NL,NC,NAQ)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C          **FRAMC PRINTS OUT ON A LINE PRINTER THE AQUIFER           C
C          GEOMETRIES**                                               C
C               .XX(NC) IS A DUMMY PRINTING VARIABLE                  C
C               .BLANK,STAR,POINT,ZERO,WLETER,RLETER,ALETER           C
C                ARE ALPHANUMERIC PRINTING SYMBOLS                    C
C               .KFIELD(I,J,K) IS THE FIELD DESCRIPTION INDEX         C
C               .KFR IS THE VALUE ASSIGNED TO KFIELD(I,J,K)           C
C                ON A RIVER MESH                                      C
C               .IA(L),JA(L),KA(L) ARE THE COORDINATES OF OUT         C
C                CROP AREAS                                           C
C               .IW(N),JW(N),KW(N) ARE THE WELL COORDINATES           C
C               .NA IS THE NUMBER OF OUTCROP MESHES                   C
C               .NW IS THE NUMBER OF WELLS                            C
C               .NL,NC,NAQ ARE THE USUAL ARRAY INDICES EQUAL          C
C                TO THE NUMBER OF ROWS,COLUMNS AND AQUIFERS           C
C                                                                     C
C               -SUB-PROGRAMS CALLED:NONE                             C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION XX(NC),KFIELD(NL,NC,NAQ),IW(NW),JW(NW),KW(NW),IR(NR,200)
     1,JR(NR,200),IA(NA),JA(NA),KA(NA),NPR(NR)
      COMMON IN,IO
      WRITE(IO,1000)(J,J=1,NC)
 1000 FORMAT(3X,58I2)
      DO 1 I=1,NL
      DO 2 J=1,NC
      XX(J)=BLANK
      IF(KFIELD(I,J,k).EQ.1)XX(J)=STAR
      IF(KFIELD(I,J,K).EQ.-1)XX(J)=ZERO
      IF(KFIELD(I,J,K).EQ.KFR)XX(J)=RLETER
      DO 4 L=1,NA
      IF(KA(L).NE.K)GO TO 4
      IF(IA(L).NE.I)GO TO 4
      IF(JA(L).EQ.J)XX(J)=ALETER
    4 CONTINUE
      DO 3 L=1,NW
      IF(KW(L).NE.K)GO TO 3
      IF(IW(L).NE.I)GO TO 3
      IF(JW(L).EQ.J)XX(J)=WLETER
    3 CONTINUE
    2 CONTINUE
      WRITE(IO,2000)I,(XX(J),J=1,NC)
 2000 FORMAT(I3,58(A1,1X))
    1 CONTINUE
      WRITE(IO,1000)(J,J=1,NC)
      WRITE(IO,3000)STAR,ZERO,WLETER,ALETER,RLETER
 3000 FORMAT(1H0,55X,8H*LEGEND*/55X,8(1H*)/40X,A1,37H REPRESENTS A HEAD
     1CONDITION BOUNDARY/40X,A1,37H REPRESENTS A FLOW CONDITION BOUNDARY
     2/40X,A1,27H REPRESENTS A WELL LOCATION/40X,A1,27H REPRESENTS AN OU
     3TCROP AREA/40X,A1,28H REPRESENTS A RIVER LOCATION/)
      RETURN
      END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 FRAMMC 1 53

VARIABLES SN TYPE RELOCATION

0	ALETER	REAL		F.P.	REFS	36	48	DEFINED	1		
0	BLANK	REAL		F.P.	REFS	29	DEFINED	1			
241	I	INTEGER			REFS	30	31	32	35	40	44
					DEFINED	27					
0	IA	INTEGER	ARRAY	F.P.	REFS	22	35	DEFINED	1		
0	IN	INTEGER		F.P.	REFS	24					
1	IO	INTEGER		F.P.	REFS	24	I/O REFS	25	44	47	48
0	IR	INTEGER	ARRAY	F.P.	REFS	22	DEFINED	1			
0	IW	INTEGER	ARRAY	F.P.	REFS	22	40	DEFINED	1		
240	J	INTEGER			REFS	25	29	2*30	2*31	2*32	2*36 2*41
					44	47	DEFINED	25	28	44	47
0	JA	INTEGER	ARRAY	F.P.	REFS	22	36	DEFINED	1		
0	JR	INTEGER	ARRAY	F.P.	REFS	22	DEFINED	1			
0	JW	INTEGER	ARRAY	F.P.	REFS	22	41	DEFINED	1		
0	K	INTEGER		F.P.	REFS	30	31	32	34	39	
					DEFINED	1					
0	KA	INTEGER	ARRAY	F.P.	REFS	22	34	DEFINED	1		
0	KFIELD	INTEGER	ARRAY	F.P.	REFS	22	30	31	32	DEFINED	1
0	KFR	INTEGER		F.P.	REFS	32	DEFINED	1			
0	KW	INTEGER	ARRAY	F.P.	REFS	22	39	DEFINED	1		
242	L	INTEGER			REFS	34	35	36	39	40	41
					DEFINED	33	38				
0	NA	INTEGER		F.P.	REFS	3*22	33	DEFINED	1		
0	NAQ	INTEGER		F.P.	REFS	22	DEFINED	1			
0	NC	INTEGER		F.P.	REFS	2*22	25	28	44	47	
					DEFINED	1					
0	NL	INTEGER		F.P.	REFS	22	27	DEFINED	1		
0	NPR	INTEGER	ARRAY	F.P.	REFS	22	DEFINED	1			
0	NR	INTEGER		F.P.	REFS	3*22	DEFINED	1			
0	NW	INTEGER		F.P.	REFS	3*22	38	DEFINED	1		
0	POINT	REAL	*UNUSED	F.P.	DEFINED	1					
0	RLETER	REAL		F.P.	REFS	32	48	DEFINED	1		
0	STAR	REAL		F.P.	REFS	30	48	DEFINED	1		
0	WLETER	REAL		F.P.	REFS	41	48	DEFINED	1		
0	XX	REAL	ARRAY	F.P.	REFS	22	44	DEFINED	1	29	30 31
					32	36	41				
0	ZERO	REAL		F.P.	REFS	31	48	DEFINED	1		

VARIABLES USED AS FILE NAMES, SEE ABOVE

STATEMENT LABELS

			DEF LINE	REFERENCES		
0	1		46	27		
0	2		43	28		
116	3		42	38	39	40
100	4		37	33	34	35
157	1000	FMT	26	25	47	
166	2000	FMT	45	44		
207	3000	FMT	49	48		

LOOPS LABEL INDEX FROM-TO LENGTH PROPERTIES

24		* J	25 25	4B	EXT REFS
32	1	* I	27 46	102B	EXT REFS NOT INNER

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES
33	2	*	J	28 43	70B	NOT INNER
72	4		L	33 37	7B	INSTACK
110	3		L	38 42	7B	INSTACK
136		*	J	47 47	4B	EXT REFS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	346B	230
SCM BLANK COMMON LENGTH	2B	2

```
      SUBROUTINE IMPRE1(X,NL,NC,FACT,INTX,ISCALE)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **IMPRE1 PRINTS,ON A LINE PRINTER,A MAP OF A TWO-DIMENSIONAL C
C     NUMERIC ARRAY PRELIMINARLY TRANSFORMED IN AN ALPHANUMERIC FORM** C
C              .X(1) IS THE ARRAY(DIMENSIONNED NL*NC) TO BE MAPPED     C
C              .FACT IS THE AMPLIFICATION(ATTENUATION) FACTOR APPLIED  C
C               TO X                                                   C
C              .INTX IS AN INDEX SPECIFYING WHETHER X IS:              C
C                   -INTEGER(INT=0)                                    C
C                   -REAL(INT=1)                                       C
C              .ISCALE AN INDEX SPECIFYING THE SCALE OF THE MAP E.G.:  C
C               A SQUARE GRID SIZE EQUAL TO=                           C
C                   -1.275 CM  (ISCALE=1)                              C
C                   -2.550 CM  (ISCALE=2)                              C
C              .NL,NC ARE THE USUAL ARRAY INDICES REFERRING TO THE NUMBC
C               ER OF ROWS(NL) AND COLUMNS(NC)                         C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION X(1),XX(130),AB(8)
      COMMON IN,IO
      COMMON BLANK
      NTOT=NL*NC
      II=22-10*(ISCALE-1)
      MAX=4*ISCALE
      EPSI=0.0000000001
      DO 1 N=1,NTOT
      X(N)=X(N)*FACT
      XMAP=X(N)
      IF(INTX.EQ.0)X(N)=INT(XMAP)
    1 CONTINUE
      IP=(NC-1)/II+1
      DO 2 I=1,IP
      J1=(I-1)*II+1
      J2=(J1+II-1)*(1-I/IP)+(I/IP)*NC
      WRITE(IO,1001)
 1001 FORMAT(1HQ)
      IF(ISCALE.EQ.2)WRITE(IO,1000)(J,J=J1,J2)
 1000 FORMAT(1H1,5X,12(4X,I2,4X))
      IF(ISCALE.EQ.1)WRITE(IO,1500)(J,J=J1,J2)
 1500 FORMAT(1H1,5X,22(2X,I2,1X))
      IF(ISCALE.EQ.2)WRITE(IO,2000)
 2000 FORMAT(4X,123(1H*))
      IF(ISCALE.EQ.1)WRITE(IO,2500)
 2500 FORMAT(4X,113(1H*))
      DO 2 L=1,NL
      DO 3 K=1,130
    3 XX(K)=BLANK
      L1=(J1-1)*NL+L
      L2=(J2-1)*NL+L
      L3=7
      DO 4 J=L1,L2,NL
      A=X(J)
      IF(ISCALE.EQ.2)ENCODE(10,20,AA)A
   20 FORMAT(F8.2)
      IF(ISCALE.EQ.1)ENCODE(10,21,AA)A
   21 FORMAT(F4.0)
      IF(ISCALE.EQ.2)DECODE(10,30,AA)(AB(M),M=1,8)
   30 FORMAT(8A1)
```

```
                  IF(ISCALE.EQ.1)DECODE(10,31,AA)(AB(M),M=1,4)
                31 FORMAT(4A1)
    60            IF(ABS(X(J)).GT.EPSI)GO TO 40
                  DO 45 K=1,MAX
                45 AB(K)=BLANK
                40 CONTINUE
                   IF(INTX.NE.0)GO TO 50
    65            AB(MAX)=BLANK
                  IF(ISCALE.EQ.1)GO TO 50
                  AB(MAX-1)=BLANK
                  AB(MAX-2)=BLANK
                50 CONTINUE
    70            IF(AB(MAX).NE.0)GO TO 51
                  AB(MAX)=BLANK
                51 IF(ISCALE.EQ.2.AND.AB(MAX-1).EQ.0)AB(MAX-1)=BLANK
                   DO 25 K=1,MAX
                25 XX(L3+K)=AB(K)
    75             4 L3=L3+((MAX/ISCALE)+1)*ISCALE
                   IF(ISCALE.EQ.2)WRITE(IO,3000)L,(XX(LL),LL=8,127)
              3000 FORMAT(5(4X,1H*/),I3,4H *  ,120A1)
                   IF(ISCALE.EQ.1)WRITE(IO,3500)L,(XX(LL),LL=8,117)
              3500 FORMAT(2(4X,1H*/),I3,4H *  ,110A1)
    80             2 CONTINUE
                   WRITE(IO,4000)FACT
              4000 FORMAT(////10X,36H***VALUES OF ARGUMENT MULTIPLYED BY ,E15.8,4H **
                  1*)
                   DO 5 N=1,NTOT
    85             5 X(N)=X(N)/FACT
                   RETURN
                   END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS

		DEF LINE	REFERENCES
3	IMPRE1	1	86

VARIABLES

		SN	TYPE	RELOCATION									
434	A		REAL		REFS	52	54	DEFINED	51				
435	AA		REAL		REFS	56	58	DEFINED	52	54			
642	AB		REAL	ARRAY	REFS	18	70	72	74	DEFINED	56	58	
						62	65	67	68	71	72		
2	BLANK		REAL	/ /	REFS	20	46	62	65	67	68	71	
						72							
417	EPSI		REAL		REFS	60	DEFINED	24					
0	FACT		REAL	F.P.	REFS	26	81	85	DEFINED	1			
423	I		INTEGER		REFS	32	2*33	DEFINED	31				
415	II		INTEGER		REFS	30	32	33	DEFINED	22			
0	IN		INTEGER	/ /	REFS	19							
0	INTX		INTEGER	F.P.	REFS	28	64	DEFINED	1				
1	IO		INTEGER	/ /	REFS	19	I/O REFS	34	36	38	40	42	
						76	78	81					
422	IP		INTEGER		REFS	31	2*33	DEFINED	30				
0	ISCALE		INTEGER	F.P.	REFS	22	23	36	38	40	42	52	

VARIABLES	SN	TYPE	RELOCATION									
					54	56	58	66	72	2*75	76	78
					DEFINED	1						
426	J	INTEGER			REFS	36	38	51	60	DEFINED	36	38
					50							
424	J1	INTEGER			REFS	33	36	38	47	DEFINED	32	
425	J2	INTEGER			REFS	36	38	48	DEFINED	33		
430	K	INTEGER			REFS	46	62	2*74	DEFINED	45	61	73
427	L	INTEGER			REFS	47	48	76	78	DEFINED	44	
437	LL	INTEGER			REFS	76	78	DEFINED	76	78		
431	L1	INTEGER			REFS	50	DEFINED	47				
432	L2	INTEGER			REFS	50	DEFINED	48				
433	L3	INTEGER			REFS	74	75	DEFINED	49	75		
436	M	INTEGER			REFS	56	58	DEFINED	56	58		
416	MAX	INTEGER			REFS	61	65	67	68	70	71	2*72
					73	75	DEFINED	23				
420	N	INTEGER			REFS	2*26	27	28	2*85	DEFINED	25	84
0	NC	INTEGER		F.P.	REFS	21	30	33	DEFINED	1		
0	NL	INTEGER		F.P.	REFS	21	44	47	48	50		
					DEFINED	1						
414	NTOT	INTEGER			REFS	25	84	DEFINED	21			
0	X	REAL	ARRAY	F.P.	REFS	18	26	27	51	60	85	
					DEFINED	1	26	28	85			
421	XMAP	REAL			REFS	28	DEFINED	27				
440	XX	REAL	ARRAY		REFS	18	76	78	DEFINED	46	74	

VARIABLES USED AS FILE NAMES, SEE ABOVE

INLINE FUNCTIONS	TYPE	ARGS		DEF LINE	REFERENCES
ABS	REAL	1	INTRIN		60
INT	INTEGER	1	INTRIN		28

STATEMENT LABELS			DEF LINE	REFERENCES	
0	1		29	25	
0	2		80	31	44
0	3		46	45	
0	4		75	50	
0	5		85	84	
326	20	FMT	53	52	
335	21	FMT	55	54	
0	25		74	73	
344	30	FMT	57	56	
353	31	FMT	59	58	
167	40		63	60	
0	45		62	61	
175	50		69	64	66
200	51		72	70	
271	1000	FMT	37	36	
261	1001	FMT	35	34	
302	1500	FMT	39	38	
310	2000	FMT	41	40	
316	2500	FMT	43	42	
362	3000	FMT	77	76	
373	3500	FMT	79	78	
403	4000	FMT	82	81	

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
33	1	N	25 29	5B	INSTACK
46	2	* I	31 80	175B	EXT REFS NOT INNER

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES		
65		*	J	36 36	4B		EXT REFS	
100		*	J	38 38	4B		EXT REFS	
116	2	*	L	44 80	123B		EXT REFS	NOT INNER
121	3		K	45 46	3B	INSTACK		
133	4	*	J	50 75	73B		EXT REFS	NOT INNER
163	45		K	61 62	3B	INSTACK		
213	25		K	73 74	2B	INSTACK		
251	5		N	84 85	2B	INSTACK		

COMMON BLOCKS	LENGTH
/ /	3

STATISTICS

PROGRAM LENGTH	705B	453
SCM BLANK COMMON LENGTH	3B	3

```
      SUBROUTINE IMPRE2(X,Y,NL,NC,FACTX,FACTY,INTX,INTY)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **IMPRE2 PRINTS,ON A LINE PRINTER,A MAP OF TWO ORTHOGONAL BI.C
C         DIMENSIONAL DIRECTIONAL PARAMETERS X AND Y.NUMERICAL VALUES  C
C         AREACONVERTED INTO ALPHANUMERIC FORM BEFORE BEING MAPPED*    C
C              .X(1) AND Y(1) ARE THE ARRAYS(DIMENSIONED NL*NC)TO BE MAC
C               PPED.                                                  C
C              .FACTX,FACTY ARE THA AMPLIFICATION(ATTENUATION) FACTORS C
C               APPLIED TO X AND Y                                     C
C              .INTX,INTY ARE INDICES SPECIFYING WETHER X OR Y IS:     C
C                   -INTEGER(INTX=0 OR INTY=0)                         C
C                   -REAL(INTX=1 OR INTY=0)                            C
C              .NL,NC ARE THE USUAL ARRAY INDICES REFERRING TO THE NUMC
C               BER OF ROWS(NL) AND COLUMNS(NC)                        C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION X(1),Y(1),XX(130),ABX(6),ABY(12,6)
      COMMON IN,IO
      COMMON BLANK,STAR
      NTOT=NL*NC
      DO 1 N=1,NTOT
      X(N)=X(N)*FACTX
      Y(N)=Y(N)*FACTY
    1 CONTINUE
      EPSI=0.0000000001
      IP=(NC-1)/12+1
      DO 2 I=1,IP
      J1=(I-1)*12+1
      J2=(J1+11)*(1-I/IP)+(I/IP)*NC
      WRITE(IO,1001)
 1001 FORMAT(1HQ)
      WRITE(IO,1000)(J,J=J1,J2)
 1000 FORMAT(1H1,2X,12(4X,I2,4X))
      WRITE(IO,2000)
 2000 FORMAT(4X,123(1H*),2(/4X,1H*))
      DO 2 L=1,NL
      DO 3 K=1,130
    3 XX(K)=BLANK
      L1=(J1-1)*NL+L
      L2=(J2-1)*NL+L
      L3=11
      L4=L3-2
      JJ=0
      DO 4 J=L1,L2,NL
      JJ=JJ+1
      A=X(J)
      B=Y(J)
      ENCODE(10,20,AA)A
      ENCODE(10,20,BB)B
   20 FORMAT(F6.1)
      DECODE(10,30,AA)(ABX(M),M=1,6)
      DECODE(10,30,BB)(ABY(JJ,M),M=1,6)
   30 FORMAT(6A1)
      IF(ABS(A).GT.EPSI)GO TO 40
      DO 45 K=1,6
   45 ABX(K)=BLANK
   40 IF(ABS(B).GT.EPSI)GO TO 50
      DO 55 K=1,6
```

```
                55 ABY(JJ,K)=BLANK
                50 IF(INTX.NE.0)GO TO 60
60                 ABX(6)=BLANK
                   ABX(5)=BLANK
                60 IF(ABX(6).NE.0)GO TO 70
                   ABX(6)=BLANK
                70 IF(INTY.NE.0)GO TO 80
65                 ABY(JJ,6)=BLANK
                   ABY(JJ,5)=BLANK
                80 IF(ABY(JJ,6).NE.0)GO TO 90
                   ABY(JJ,6)=BLANK
                90 CONTINUE
70                 DO 25 K=1,6
                25 XX(L3+K)=ABX(K)
                   XX(L3-1)=STAR
                   XX(L4)=ABY(JJ,1)
                   L3=L3+10
75                 L4=L3-2
                 4 CONTINUE
                   WRITE(IO,2500)L,(XX(LL),LL=9,128)
              2500 FORMAT(I3,4H *  ,120A1)
                   L5=9
80                 DO 35 K=2,6
                   DO 36 LL=1,130
                36 XX(LL)=BLANK
                   DO 37 JJ=1,12
                   KK=(JJ-1)*10
85                 XX(L5+KK)=ABY(JJ,K)
                35 WRITE(IO,3000)(XX(LL),LL=9,128)
              3000 FORMAT(4X,1H*,3X,120A1)
                 2 CONTINUE
                   WRITE(IO,4000)FACTX,FACTY
90            4000 FORMAT(////42X,46HTHE VALUES OF THE ARGUMENTS ARE MULTIOLIED BY:/5
                  10X,15H-X(HORIZONTAL)=,E15.8/50X,15H-Y(VERTICAL )= ,E15.8)
                   DO 5 N=1,NTOT
                   X(N)=X(N)/FACTX
                 5 Y(N)=Y(N)/FACTY
95                 RETURN
                   END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 IMPRE2 1 95

VARIABLES	SN	TYPE	RELOCATION									
436 A		REAL		REFS	47	53	DEFINED	45				
440 AA		REAL		REFS	50	DEFINED	47					
650 ABX		REAL	ARRAY	REFS	16	62	71	DEFINED	50	55	60	
					61	63						
656 ABY		REAL	ARRAY	REFS	16	67	73	85	DEFINED	51	58	
					65	66	68					
437 B		REAL		REFS	48	56	DEFINED	46				

VARIABLES	SN	TYPE	RELOCATION									
441	BB	REAL		REFS	51	DEFINED	48					
2	BLANK	REAL	/ /	REFS	18	37	55	58	60	61	63	
					65	66	68	82				
421	EPSI	REAL		REFS	53	56	DEFINED	24				
0	FACTX	REAL	F.P.	REFS	21	89	93	DEFINED	1			
0	FACTY	REAL	F.P.	REFS	22	89	94	DEFINED	1			
423	I	INTEGER		REFS	27	2*28	DEFINED	26				
0	IN	INTEGER	/ /	REFS	17							
0	INTX	INTEGER	F.P.	REFS	59	DEFINED	1					
0	INTY	INTEGER	F.P.	REFS	64	DEFINED	1					
1	IO	INTEGER	/ /	REFS	17	I/O REFS	29	31	33	77	86	
					89							
422	IP	INTEGER		REFS	26	2*28	DEFINED	25				
426	J	INTEGER		REFS	31	45	46	DEFINED	31	43		
435	JJ	INTEGER		REFS	44	51	58	65	66	67	68	
					73	84	85	DEFINED	42	44	83	
424	J1	INTEGER		REFS	28	31	38	DEFINED	27			
425	J2	INTEGER		REFS	31	35	DEFINED	28				
430	K	INTEGER		REFS	37	55	58	2*71	85			
				DEFINED	36	54	57	70	80			
445	KK	INTEGER		REFS	85	DEFINED	84					
427	L	INTEGER		REFS	38	39	77	DEFINED	35			
443	LL	INTEGER		REFS	77	82	86	DEFINED	77	81	86	
431	L1	INTEGER		REFS	43	DEFINED	38					
432	L2	INTEGER		REFS	43	DEFINED	39					
433	L3	INTEGER		REFS	41	71	72	74	75			
				DEFINED	40	74						
434	L4	INTEGER		REFS	73	DEFINED	41	75				
444	L5	INTEGER		REFS	85	DEFINED	79					
442	M	INTEGER		REFS	50	51	DEFINED	50	51			
420	N	INTEGER		REFS	2*21	2*22	2*93	2*94	DEFINED	20	92	
0	NC	INTEGER	F.P.	REFS	19	25	28	DEFINED	1			
0	NL	INTEGER	F.P.	REFS	19	35	38	39	43			
				DEFINED	1							
417	NTOT	INTEGER		REFS	20	92	DEFINED	19				
3	STAR	REAL	/ /	REFS	18	72						
0	X	REAL	ARRAY F.P.	REFS	16	21	45	93	DEFINED	1	21	
				93								
446	XX	REAL	ARRAY	REFS	16	77	86	DEFINED	37	71	72	
				73	82	85						
0	Y	REAL	ARRAY F.P.	REFS	16	22	46	94	DEFINED	1	22	
				94								

VARIABLES USED AS FILE NAMES, SEE ABOVE

INLINE FUNCTIONS	TYPE	ARGS	DEF LINE	REFERENCES
.IBS	REAL	1 INTRIN	53	56

STATEMENT LABELS		DEF LINE	REFERENCES	
0 1		23	20	
0 2		88	26	35
0 3		37	36	
0 4		76	43	
0 5		94	92	
334 20	FMT	49	47	48
0 25		71	70	
352 30	FMT	52	50	51
0 35		86	80	

STATEMENT LABELS			DEF LINE	REFERENCES
0	36		82	81
0	37		85	83
146	40		56	53
0	45		55	54
162	50		59	56
0	55		58	57
165	60		62	59
170	70		64	62
174	80		67	64
177	90		69	67
310	1000	FMT	32	31
300	1001	FMT	30	29
316	2000	FMT	34	33
361	2500	FMT	78	77
370	3000	FMT	87	86
400	4000	FMT	90	89

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES		
27	1		N	20 23	3B	INSTACK		
41	2	*	I	26 88	217B		EXT REFS	NOT INNER
56		*	J	31 31	4B		EXT REFS	
66	2	*	L	35 88	167B		EXT REFS	NOT INNER
71	3		K	36 37	3B	INSTACK		
105	4	*	J	43 76	113B		EXT REFS	NOT INNER
122		*	M	51 51	11B		EXT REFS	
142	45		K	54 55	3B	INSTACK		
156	55		K	57 58	3B	INSTACK		
203	25		K	70 71	2B	INSTACK		
224	35	*	K	80 86	27B		EXT REFS	NOT INNER
227	36		LL	81 82	3B	INSTACK		
243	37		JJ	83 85	3B	INSTACK		
267	5		N	92 94	3B	INSTACK		

COMMON BLOCKS	LENGTH
/ /	4

STATISTICS

PROGRAM LENGTH	1010B	520
SCM BLANK COMMON LENGTH	4B	4

```
      SUBROUTINE MAPXY(X,XOUT,XMIN,STEP,NL,NC,LOGAR,IFACT)
      DIMENSION LETER(52),XINT(23),LIGNE(110),X(1),ICHIF(2)
      COMMON IN,IO
      DATA (LETER(L),L=1,52)/1HA,1H ,1HB,1H ,1HC,1H ,1HD,1H ,1HE,1H ,1HF
     1,1H ,1HG,1H ,1HH,1H ,1HI,1H ,1HJ,1H ,1HK,1H ,1HL,1H ,1HM,1H ,1HN,1
     2H ,1HO,1H ,1HP,1H ,1HQ,1H ,1HR,1H ,1HS,1H ,1HT,1H ,1HU,1H ,1HV,1H
     3,1HW,1H ,1HX,1H ,1HY,1H ,1HZ,1H /
      IV=3*IFACT
      IV1=IV-1
      IH=5*IFACT
      IL=110/1H
      XMAX=1.E-32
      NTOT=NL*NC
      GO TO(1021,1022),LOGAR
 1021 AOUT=XOUT
      DO 111 I=1,NTOT
      IF(X(I)-AOUT)113,112,113
  112 X(I)=-50.
      GO TO 111
  113 X(I)=ALOG(X(I))/2.30259
  111 CONTINUE
      XOUT=-50.
      XMIN=ALOG(XMIN)/2.30259
 1022 DO 100 I=1,NTOT
      IF(X(I)-XOUT)1017,100,1017
 1017 IF(X(I)-XMAX)100,100,1002
 1002 XMAX=X(I)
  100 CONTINUE
      STEP=STEP*(IFIX((XMAX-XMIN)/(STEP*51.))+1)
      NPAGE=(NC-1)/IL+1
      XMIN=XMIN+STEP*0.05
      WRITE(IO,1001)
 1001 FORMAT(1HQ)
      DO 101 IPAGE=1,NPAGE
      ICOLD=IL*(IPAGE-1)+1
      KPAGE=IPAGE/NPAGE
      ICOLF=NC*KPAGE+IL*IPAGE*(1-KPAGE)
      J3F=(ICOLF-ICOLD+1-KPAGE)*IH+KPAGE
      DO 2 I=1,110
    2 LIGNE(I)=LETER(2)
      K=ICOLD
      DO 1 K1=1,22,IFACT
      IFIN=2+5*(K1-1)
      CALL FORMI(K,2,IFIN,LIGNE)
    1 K=K+1
      WRITE(IO,3000)(LIGNE(I),I=1,110)
      DO 101 I=1,NL
      IVNL=IV-(I/NL)*(IV-1)
      JCOLD=NL*(ICOLD-1)+1
      JCOLF=NL*(ICOLF-ICOLF/NC)+1
      DO 101 IVDO=1,IVNL
      K1=I*(1/IVDO)
      J1=1
      DO 102 J2=JCOLD,JCOLF,NL
      J2NL=J2+1-I/NL
      CALL JOSE(X(J2),X(J2NL),XOUT,IV,IVDO,XINT(J1))
  102 J1=J1+1
```

```
                      J3=1
                      J1=J1-1
      60              DO 103 J4=1,J1
                      IHNC=IH-(J4/J1)*(IH-1)
                      DO 103 IHDO=1,IHNC
                      CALL JOSE(XINT(J4),XINT(J4+1),XOUT,IH,IHDO,XRES)
                      A=ABS(XRES-XOUT)
      65              IF(A-1.E-25)104,105,105
                  104 LIGN=52
                      GO TO 114
                  105 LIGN=(XRES-XMIN)/STEP+1.0001
                  114 LIGNE(J3)=LETER(LIGN)
      70          103 J3=J3+1
                      ICHIF(1)=LETER(2)
                      ICHIF(2)=LETER(2)
                      CALL FORMI(K1,2,2,ICHIF)
                  101 WRITE(IO,6000)(ICHIF(N),N=1,2),(LIGNE(J3),J3=1,J3F)
      75              WRITE(IO,8000)
                      XMIN=XMIN-STEP*0.05
                      LMAX=(XMAX-XMIN)/STEP+1
                      DO 106 I=1,LMAX
                      BORIN=XMIN+(FLOAT(I-1))*STEP
      80              BORSU=BORIN+STEP
                  106 WRITE(IO,9000)LETER(I),BORIN,BORSU
                      WRITE(IO,1500)
                      GO TO(401,402),LOGAR
                  401 DO 452 I=1,NTOT
      85              IF(X(I)-XOUT)115,116,115
                  116 X(I)=AOUT
                      GO TO 452
                  115 X(I)=10.**(X(I))
                  452 CONTINUE
      90              WRITE(IO,1300)
                  402 RETURN
                 3000 FORMAT(1H1,9X,110A1/7X,113(1H*)/7X,1H*)
                 6000 FORMAT(4X,2A1,4H *  ,110A1)
                 8000 FORMAT(1H1,54X,12H** LEGEND **/55X,12(1H*)//45X,32HSYMBOL   TOP VA
      95            1LUE  BOTTOM VALUE/)
                 9000 FORMAT(47X,A1,6X,E11.4,1X,E11.4)
                 1300 FORMAT(45X,24HNUMBERS INDICATED BELOW:/48X31H LOGARITHMS OF THE T
                     1RUE VALUES)
                 1500 FORMAT(/47X,1H*,2X,18HAREA OUT OF DOMAIN)
     100             END
```

```
CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

      14    1              AN IF STATEMENT MAY BE MORE EFFICIENT THAN A 2 OR 3 BRANCH COMPUTED GO TO STATEMENT.
      83    1              AN IF STATEMENT MAY BE MORE EFFICIENT THAN A 2 OR 3 BRANCH COMPUTED GO TO STATEMENT.
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
3 MAPXY 1 91

VARIABLES SN TYPE RELOCATION

550	A	REAL		REFS	65	DEFINED	64					
521	AOUT	REAL		REFS	17	86	DEFINED	15				
554	BORIN	REAL		REFS	80	81	DEFINED	79				
555	BORSU	REAL		REFS	81	DEFINED	80					
522	I	INTEGER		REFS	17	18	2*20	25	26	27	40	
					46	48	49	50	52	55	79	81
					85	86	2*88	DEFINED	16	24	39	46
					47	78	84					
1047	ICHIF	INTEGER	ARRAY	REFS	2	73	74	DEFINED	71	72		
525	ICOLD	INTEGER		REFS	38	41	49	DEFINED	35			
527	ICOLF	INTEGER		REFS	38	2*50	DEFINED	37				
0	IFACT	INTEGER	F.P.	REFS	8	10	42	DEFINED	1			
533	IFIN	INTEGER		REFS	44	DEFINED	43					
515	IH	INTEGER		REFS	11	38	2*61	63	DEFINED	10		
546	IHDO	INTEGER		REFS	63	DEFINED	62					
545	IHNC	INTEGER		REFS	62	DEFINED	61					
516	IL	INTEGER		REFS	30	35	37	DEFINED	11			
0	IN	INTEGER	/ /	REFS	3							
1	IO	INTEGER	/ /	REFS	3	I/O REFS	32	46	74	75	81	
					82	90						
524	IPAGE	INTEGER		REFS	35	36	37	DEFINED	34			
513	IV	INTEGER		REFS	9	2*48	56	DEFINED	8			
517	IVDO	INTEGER		REFS	52	56	DEFINED	51				
534	IVNL	INTEGER		REFS	51	DEFINED	48					
514	IV1	* INTEGER		DEFINED	9							
535	JCOLD	INTEGER		REFS	54	DEFINED	49					
536	JCOLF	INTEGER		REFS	54	DEFINED	50					
540	J1	INTEGER		REFS	56	57	59	60	61			
				DEFINED	53	57	59					
541	J2	INTEGER		REFS	55	56	DEFINED	54				
542	J2NL	INTEGER		REFS	56	DEFINED	55					
543	J3	INTEGER		REFS	69	70	74	DEFINED	58	70	74	
530	J3F	INTEGER		REFS	74	DEFINED	38					
544	J4	INTEGER		REFS	61	2*63	DEFINED	60				
531	K	INTEGER		REFS	44	45	DEFINED	41	45			
526	KPAGE	INTEGER		REFS	2*37	2*38	DEFINED	36				
532	K1	INTEGER		REFS	43	73	DEFINED	42	52			
556	LETER	INTEGER	ARRAY	REFS	2	40	69	71	72	81		
				DEFINED	4							
551	LIGN	INTEGER		REFS	69	DEFINED	66	68				
671	LIGNE	INTEGER	ARRAY	REFS	2	44	46	74	DEFINED	40	69	
553	LMAX	INTEGER		REFS	78	DEFINED	77					
0	LOGAR	INTEGER	F.P.	REFS	14	83	DEFINED	1				
552	N	INTEGER		REFS	74	DEFINED	74					
0	NC	INTEGER	F.P.	REFS	13	30	37	50	DEFINED	1		
0	NL	INTEGER	F.P.	REFS	13	47	48	49	50	54	55	
				DEFINED	1							
523	NPAGE	INTEGER		REFS	34	36	DEFINED	30				
520	NTOT	INTEGER		REFS	16	24	84	DEFINED	13			
0	STEP	REAL	F.P.	REFS	2*29	31	68	76	77	79	80	
				DEFINED	1	29						

```
VARIABLES     SN  TYPE          RELOCATION
    0  X          REAL      ARRAY     F.P.       REFS        2      17      20      25      26      27     2*56
                                                    85       88  DEFINED       1      18      20      86      88
  642  XINT       REAL      ARRAY                REFS        2      56   2*63
  517  XMAX       REAL                           REFS       26      29      77  DEFINED      12      27
    0  XMIN       REAL                F.P.       REFS       23      29      31      68      76      77      79
                                                DEFINED       1      23      31      76
    0  XOUT       REAL                F.P.       REFS       15      25      56      63      64      85
                                                DEFINED       1      22
  547  XRES       REAL                           REFS       63      64      68
       VARIABLES USED AS FILE NAMES, SEE ABOVE

EXTERNALS           TYPE   ARGS       REFERENCES
       ALOG         REAL      1 LIBRARY      20      23
       FORMI                  4              44      73
       JOSE                   6              56      63

INLINE FUNCTIONS    TYPE   ARGS       DEF LINE  REFERENCES
       ABS          REAL      1  INTRIN              64
       FLOAT        REAL      1  INTRIN              79
       IFIX         INTEGER   1  INTRIN              29

STATEMENT LABELS                    DEF LINE   REFERENCES
    0  1                                45        42
    0  2                                40        39
   73  100                              28        24      25      2*26
    0  101                              74        34      47      ,1
    0  102                              57        54
    0  103                              70        60      62
    0  104          INACTIVE            66        65
  240  105                              68       2*65
    0  106                              81        78
   53  111                              21        16      19
    0  112          INACTIVE            18        17
   47  113                              20       2*17
  245  114                              69        67
  341  115                              88       2*85
    0  116          INACTIVE            86        85
  334  401                              84        83
  350  402                              91        83
  344  452                              89        84      87
  405  1001    FMT                      33        32
    0  1002         INACTIVE            27        26
    0  1017         INACTIVE            26       2*25
   40  1021                             15        14
   63  1022                             24        14
  463  1300    FMT                      97        90
  473  1500    FMT                      99        82
  437  3000    FMT                      92        46
  443  6000    FMT                      93        74
  446  8000    FMT                      94        75
  457  9000    FMT                      96        81

LOOPS  LABEL     INDEX      FROM-TO     LENGTH    PROPERTIES
   43  111    * I            16 21        13B              EXT REFS
   67  100      I            24 28         5B     INSTACK
  113  101    * IPAGE        34 74       164B              EXT REFS  NOT INNER
  130  2        I            39 40         3B     INSTACK
```

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES	
136	1	*	K1	42 45	11B	EXT REFS	
152	101	*	I	47 74	122B	EXT REFS	NOT INNER
166	101	*	IVDO	51 74	104B	EXT REFS	NOT INNER
174	102	*	JZ	54 57	20B	EXT REFS	
216	103	*	J4	60 70	40B	EXT REFS	NOT INNER
224	103	*	IHDO	62 70	27B	EXT REFS	
310	106	*	I	78 81	14B	EXT REFS	
335	452	*	I	84 89	12B	EXT REFS	

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	1111B	585
SCM BLANK COMMON LENGTH	2B	2

```
      1              SUBROUTINE JOSE(X1,X2,XOUT,LONG,L,XRES)
                     XMULT=(X1-XOUT)*(X2-XOUT)
                     IF(XMULT-1.E-30)1,1,2
                   1 KLONG=((L-1)*2)/(LONG+1)
      5              XRES=KLONG*X2+(1-KLONG)*X1
                     RETURN
                   2 XRES=X1+FLOAT(L-1)*(X2-X1)/FLOAT(LONG)
                     RETURN
                     END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
3	JOSE	1	6 8

VARIABLES	SN	TYPE	RELOCATION							
36	KLONG	INTEGER			REFS	2*5	DEFINED	4		
0	L	INTEGER		F.P.	REFS	4	7	DEFINED	1	
0	LONG	INTEGER		F.P.	REFS	4	7	DEFINED	1	
35	XMULT	REAL			REFS	3	DEFINED	2		
0	XOUT	REAL		F.P.	REFS	2*2	DEFINED	1		
0	XRES	REAL		F.P.	DEFINED	1	5	7		
0	X1	REAL		F.P.	REFS	2	5	2*7	DEFINED	1
0	X2	REAL		F.P.	REFS	2	5	7	DEFINED	1

INLINE FUNCTIONS	TYPE	ARGS		DEF LINE	REFERENCES
FLOAT	REAL	1	INTRIN		2*7

STATEMENT LABELS		DEF LINE	REFERENCES
0 1	INACTIVE	4	2*3
24 2		7	3

STATISTICS

PROGRAM LENGTH	37B	31

```
      1              SUBROUTINE FORMI(N,KCHIF,IFIN,LIGNE)
                     DIMENSION LETER(11),LIGNE(1)
                     DATA (LETER(L),L=1,11)/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H
                    1/
      5              ISOMN=0
                     NMOIN=0
                     DO 1 K=1,KCHIF
                     I=IFIN-KCHIF+K
                     INO=N/10.**(KCHIF-K)-NMOIN
     10              ISOMN=ISOMN+INO
                     NO=INO+1+10*(1-MINO(1,ISOMN))
                     NMOIN=(NMOIN+INO)*10
                    1 LIGNE(I)=LETER(NO)
                     RETURN
     15              END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
3	FORMI	1	14

VARIABLES	SN	TYPE	RELOCATION								
55	I	INTEGER		REFS	13	DEFINED	8				
0	IFIN	INTEGER	F.P.	REFS	8	DEFINED	1				
56	INO	INTEGER		REFS	10	11	12	DEFINED	9		
52	ISOMN	INTEGER		REFS	10	11	DEFINED	5	10		
54	K	INTEGER		REFS	8	9	DEFINED	7			
0	KCHIF	INTEGER	F.P.	REFS	7	8	9	DEFINED	1		
60	LETER	INTEGER	ARRAY	REFS	2	13	DEFINED	3			
0	LIGNE	INTEGER	ARRAY F.P.	REFS	2	DEFINED	1	13			
0	N	INTEGER	F.P.	REFS	9	DEFINED	1				
53	NMOIN	INTEGER		REFS	9	12	DEFINED	6	12		
57	NO	INTEGER		REFS	13	DEFINED	11				

EXTERNALS	TYPE	ARGS	REFERENCES
MINO	INTEGER	2	11

STATEMENT LABELS	DEF LINE	REFERENCES
0 1	13	7

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
21	1	* K	7 13	24B	EXT REFS

STATISTICS

PROGRAM LENGTH	104B	68

```
      1              FUNCTION MINO(I,J)
                     IF(I-J)1,2,2
                   1 MINO=I
                     RETURN
      5            2 MINO=J
                     RETURN
                     END
```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS		DEF LINE	REFERENCES
4	MINO	1	4 6

VARIABLES	SN	TYPE	RELOCATION					
0	I	INTEGER	F.P.	REFS	2	3	DEFINED	1
0	J	INTEGER	F.P.	REFS	2	5	DEFINED	1
14	MINO	INTEGER		DEFINED	3	5		

STATEMENT LABELS			DEF LINE	REFERENCES
0	1	INACTIVE	3	2
12	2		5	2*2

STATISTICS

PROGRAM LENGTH	15B	13

```
      SUBROUTINE CURVE2(X,XC,BLANK,STAR,ZERO,CHARI,NPOINT,ISPACE)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         **CURVE2 PLOTS,ON ALINE PRINTER ,A SET OF TWO X Y GRAPHS ONE C
C         REPRESENTING A REFERENCE RECORD AND THE OTER A COMPUTED RECORC
C         D NUMERICAL VALUES OF RECORDS AND DIFFERENCES ARE LISTED APARC
C         T IN A TABLE FORM.IF ONLY ONE RECORD(OBSERVED OR COMPUTED) ISC
C         TO BE PLOTTTED XC(OR X) IS SET EUQAL(IN CALLING SEQUENCE) TO XC
C         (OR XC).                                                      C
C              .X(1) IS THE REFERENCE RECORD DIMENSIONED NPOINT          C
C              .XC(1) IS THE COMPUTED RECORD DIMENSIONED NPOINT          C
C              .NPOINT IS THE NUMBER OF VALUES PER RECORD                C
C              .ISPACE IS THE WIDTH OF THE GRAPH PLOT(MAXIMUM OF 130 CHC
C               ARACTERS ALLOWED)                                        C
C              .BLANK,STAR,ZERO,CHARI ARE ALPHANUMERIC PRINTING SYMBOLSC
C              .XX(1),XINT(1) ARE DUMMY PRINTING VARIABLES               C
C                                                                        C
C              SUB PROGRAMS CALLED NONE                                  C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DIMENSION X(1),XC(1),XX(120),XINT(11)
      COMMON IN,IO
      EPSI=0.0000000001
C
C         **SEARCH OF MAXIMA**
C
      XMAX1=X(1)
      XMAX2=XC(1)
      DO 1 I=2,NPOINT
      IF(X(I)-XMAX1)25,25,26
   26 XMAX1=X(I)
   25 IF(XC(I)-XMAX2)1,1,36
   36 XMAX2=XC(I)
    1 CONTINUE
      IF(XMAX1-XMAX2)2,2,3
    2 XMAX=XMAX2
      GO TO 4
    3 XMAX=XMAX1
    4 CONTINUE
C
C         **SEARCH OF MINIMA**
C
      XMIN1=X(1)
      XMIN2=XC(1)
      DO 5 I=2,NPOINT
      IF(X(I)-XMIN1)55,56,56
   55 XMIN1=X(I)
   56 IF(XC(I)-XMIN2)65,5,5
   65 XMIN2=XC(I)
    5 CONTINUE
      IF(XMIN1-XMIN2)6,6,7
    6 XMIN=XMIN1
      GO TO 8
    7 XMIN=XMIN2
    8 CONTINUE
      DXM=XMIN-XMAX
      IF((ABS(DXM)).LT.EPSI)GO TO 50
C
```

```
      C         **PRINT OUT THE UPPER FRAME**
      C
      60        DO 100 L=1,11
        100 XINT(L)=XMIN+(L-1)*(XMAX-XMIN)/10
            WRITE(IO,1001)
        1001 FORMAT(1HQ)
            WRITE(IO,1000)(XINT(L),L=1,11)
      65    1000 FORMAT(1H1//5X,11(F7.2,3X)/9X,10(1HI,9(1H.)),1HI/9X,10(1HI,9(1H ))
           1,1HI)
      C
      C         **SEARCH OF THE ABCISS OF THE POINTS TO PLOT**
      C
      70        AMPLI=XMAX-XMIN
            PAS=AMPLI/ISPACE
            DO 10 I=1,NPOINT
            DO 15 L=1,ISPACE
            XX(L)=BLANK
      75    IF(((L/10)*10).EQ.L)XX(L)=CHARI
          15 CONTINUE
            DX1=X(I)-XMIN
            DX2=XC(I)-XMIN
            ABC1=DX1/PAS+1.
      80    ABC2=DX2/PAS+1.
            NABC1=1*ABC1
            NABC2=1*ABC2
            IF(NABC1.GT.ISPACE)NABC1=ISPACE
            IF(NABC2.GT.ISPACE)NABC2=ISPACE
      85    XX(NABC1)=STAR
            XX(NABC2)=ZERO
      C
      C         **PLOT THE POINTS ON THE LINE PRINTER**
      C
      90    WRITE(IO,2000)I,(XX(J),J=1,ISPACE),I
        2000 FORMAT(5X,I3,1X,1HI,100A1,1X,I3/9X,10(1HI,9(1H )),1HI)
          10 CONTINUE
            WRITE(IO,3000)(XINT(L),L=1,11),ZERO,STAR
        3000 FORMAT(9X,10(1HI,9(1H.)),1HI/5X,11(F7.2,3X)//55X,8H*LEGEND*/45X,A1
      95   1,25H REPRESENTS A CHECK POINT/45X,A1,28H REPRESENTS A COMPUTED POI
           2NT)
            WRITE(IO,4000)
        4000 FORMAT(1H1//42X,36(1H*)/42X,36H*TABLE OF ARGUMENTS AND DIFFERENCES
           1*/42X,36(1H*)//38X,45(1H*)/38X,45H*POINT*REFERENCE* COMPUTED*   DI
     100   2FFERENCES   */38X,45H*  NO *  VALUE  *  VALUE  *ABSOLUTE*RELATIVE*
           3/38X,45(1H*))
            DO 20 I=1,NPOINT
            ECARTA=X(I)-XC(I)
            ECARTR=(ABS(ECARTA))*100./(ABS(XC(I))+EPSI)
     105    IF((ABS(XC(I))).LT.EPSI)ECARTR=0.
            WRITE(IO,5000)I,XC(I),X(I),ECARTA,ECARTR
        5000 FORMAT(38X,1H*,1X,I3,1X,1H*,2(1X,F7.2,1X,1H*),2(F7.2,1X,1H*))
          20 CONTINUE
            WRITE(IO,6000)
     110    6000 FORMAT(38X,45(1H*))
            RETURN
          50 WRITE(IO,7000)
        7000 FORMAT(1H1///10X,30H**VARIATION IS EQUAL TO ZERO**)
            RETURN
```

```
      C         **PRINT OUT THE UPPER FRAME**
      C
      60        DO 100 L=1,11
        100 XINT(L)=XMIN+(L-1)*(XMAX-XMIN)/10
            WRITE(IO,1001)
        1001 FORMAT(1HQ)
            WRITE(IO,1000)(XINT(L),L=1,11)
      65    1000 FORMAT(1H1//5X,11(F7.2,3X)/9X,10(1HI,9(1H.)),1HI/9X,10(1HI,9(1H ))
           1,1HI)
      C
      C         **SEARCH OF THE ABCISS OF THE POINTS TO PLOT**
      C
      70        AMPLI=XMAX-XMIN
            PAS=AMPLI/ISPACE
            DO 10 I=1,NPOINT
            DO 15 L=1,ISPACE
            XX(L)=BLANK
      75    IF(((L/10)*10).EQ.L)XX(L)=CHARI
          15 CONTINUE
            DX1=X(I)-XMIN
            DX2=XC(I)-XMIN
            ABC1=DX1/PAS+1.
      80    ABC2=DX2/PAS+1.
            NABC1=1*ABC1
            NABC2=1*ABC2
            IF(NABC1.GT.ISPACE)NABC1=ISPACE
            IF(NABC2.GT.ISPACE)NABC2=ISPACE
      85    XX(NABC1)=STAR
            XX(NABC2)=ZERO
      C
      C         **PLOT THE POINTS ON THE LINE PRINTER**
      C
      90    WRITE(IO,2000)I,(XX(J),J=1,ISPACE),I
        2000 FORMAT(5X,I3,1X,1HI,100A1,1X,I3/9X,10(1HI,9(1H )),1HI)
          10 CONTINUE
            WRITE(IO,3000)(XINT(L),L=1,11),ZERO,STAR
        3000 FORMAT(9X,10(1HI,9(1H.)),1HI/5X,11(F7.2,3X)//55X,8H*LEGEND*/45X,A1
      95   1,25H REPRESENTS A CHECK POINT/45X,A1,28H REPRESENTS A COMPUTED POI
           2NT)
            WRITE(IO,4000)
        4000 FORMAT(1H1//42X,36(1H*)/42X,36H*TABLE OF ARGUMENTS AND DIFFERENCES
           1*/42X,36(1H*)//38X,45(1H*)/38X,45H*POINT*REFERENCE* COMPUTED*   DI
     100   2FFERENCES   */38X,45H*  NO *  VALUE  *  VALUE  *ABSOLUTE*RELATIVE*
           3/38X,45(1H*))
            DO 20 I=1,NPOINT
            ECARTA=X(I)-XC(I)
            ECARTR=(ABS(ECARTA))*100./(ABS(XC(I))+EPSI)
     105    IF((ABS(XC(I))).LT.EPSI)ECARTR=0.
            WRITE(IO,5000)I,XC(I),X(I),ECARTA,ECARTR
        5000 FORMAT(38X,1H*,1X,I3,1X,1H*,2(1X,F7.2,1X,1H*),2(F7.2,1X,1H*))
          20 CONTINUE
            WRITE(IO,6000)
     110    6000 FORMAT(38X,45(1H*))
            RETURN
          50 WRITE(IO,7000)
        7000 FORMAT(1H1///10X,30H**VARIATION IS EQUAL TO ZERO**)
            RETURN
```

INLINE FUNCTIONS	TYPE	ARGS	DEF LINE	REFERENCES	
ABS	REAL	1	INTRIN	56	2*104 105

STATEMENT LABELS			DEF LINE	REFERENCES	
36	1		33	28	2*31
0	2	INACTIVE	35	2*34	
44	3		37	34	
46	4		38	36	
64	5		49	44	2*47
0	6	INACTIVE	51	2*50	
72	7		53	50	
74	8		54	52	
0	10		92	72	
0	15		76	73	
0	20		108	102	
33	25		31	2*29	
0	26	INACTIVE	30	29	
0	36	INACTIVE	32	31	
227	50		112	56	
0	55	INACTIVE	46	45	
61	56		47	2*45	
0	65	INACTIVE	48	47	
0	100		61	60	
245	1000	FMT	65	64	
237	1001	FMT	63	62	
262	2000	FMT	91	90	
276	3000	FMT	94	93	
317	4000	FMT	98	97	
354	5000	FMT	107	106	
365	6000	FMT	110	109	
373	7000	FMT	113	112	

LOOPS	LABEL		INDEX	FROM-TO	LENGTH	PROPERTIES	
30	1		I	28 33	7B	INSTACK	
56	5		I	44 49	7B	INSTACK	
110	100		L	60 61	6B	INSTACK	
127	10	*	I	72 92	50B		EXT REFS NOT INNER
135	15		L	73 76	6B	INSTACK	
203	20	*	I	102 108	22B		EXT REFS

COMMON BLOCKS	LENGTH
/ /	2

STATISTICS

PROGRAM LENGTH	664B	436
SCM BLANK COMMON LENGTH	2B	2

S C O P E 2 L O A D M A P LOADER VERSION 1.0 15/10/76 15.26.14 PAGE 1

PROGRAM WILL BE ENTERED AT GABSIM (147) SCM LENGTH 121102 LCM LENGTH 0

BLOCK	ADDRESS	LENGTH
GABSIM	100	75133
GABDAT	75233	1132
COORD2	76365	36
COORD3	76423	51
CLIM	76474	126
SINGUL	76622	367
LIMVA	77211	202
MATCH3	77413	524
QPUMP	100137	225
CHECK3	100364	255
CONTR3	100641	255
VARSIN	101116	150
PSORMC	101266	722
CARRE	102210	127
GEOMMC	102337	416
TDIRMC	102755	247
COORBO	103224	667
DEBRN	104113	411
STORAG	104524	245
LEAKAG	104771	603
FLUXES	105574	175
DEBLA3	105771	616
BUDGET	106607	326
FRAMMC	107135	346
IMPRE1	107503	705
IMPRE2	110410	1010
MAPXY	111420	1111
JOSE	112531	37
FORMI	112570	104
MINO	112674	15
CURVE2	112711	664
/Q8.IO./	113575	134
/IOCON./	113731	42
COMIO=	113773	43
DECODE=	114036	115
ENCODE=	114153	142
FLTIN=	114315	154
FLTOUT=	114471	315
FMTAP=	115006	371
FORSYS=	115377	632
GETFIT=	116231	43
INCOM=	116274	256
INPC=	116552	203
KODER=	116755	470
KRAKER=	117445	453
OUTC=	120120	171
OUTCOM=	120311	202
GOTOER=	120513	14
ALOG	120527	77
EXP	120626	100
SQRT	120726	46
SYSAID=	120774	1

SYS=1ST	120775	62
XTOI=	121057	10
XTOY=	121067	7
//	121076	4

ENTRY	ADDRESS	REFERENCES
GABSIM		
TAPE60#	100	
INPUT#	100	
TAPE61#	120	
OUTPUT#	120	
GABSIM	147	
GABDAT		
GABDAT	75236	
COORD2		
COORD2	76370	
COORD3		
COORD3	76426	
CLIM		
CLIM	76477	
SINGUL		
SINGUL	76625	
LIMVA		
LIMVA	77214	
MATCH3		
MATCH3	77416	
QPUMP		
QPUMP	100142	
CHECK3		
CHECK3	100367	
CONTR3		
CONTR3	100644	
VARSIN		
VARSIN	101121	
PSORMC		
PSORMC	101271	
CARRE		
CARRE	102213	
GEOMMC		
GEOMMC	102342	
TDIRMC		
TDIRMC	102760	
COORBO		
COORBO	103227	
DEBRN		
DEBRN	104116	
STORAG		
STORAG	104527	
LEAKAG		
LEAKAG	104774	
FLUXES		
FLUXES	105577	
DEBL 3		
DE LA3	105774	
BUDGET		

```
  BUDGET      106612
FRAMMC
  FRAMMC      107140
IMPRE1
  IMPRE1      107506
IMPRE2
  IMPRE2      110413
MAPXY
  MAPXY       111423
JOSE
  JOSE        112534
FORMI
  FORMI       112573
MINO
  MINO        112700
CURVE2
  CURVE2      112714
FORSYS=
  Q8NTRY.     113616
COMIO=
  FECPRT.     113775
DECODE=
  DECODI.     114047
  DECODR.     114121
ENCODE=
  ENCODI.     114166
  ENCODR.     114250
FLTIN=
  FEIEXP.     114315
  FEIFSC.     114337
FLTOUT=
  FEOFAL.     114471
  FEOEOV.     114513
  FEOEXP.     114515
  FEORND.     114552
  FEOSCA.     114607
  FEOZRO.     114677
FMTAP=
  FECNAP.     115016
  FECAP.      115024
  FECFMT.     115043
  FECFMU.     115050
  FECJP=      115161
  FECLP.      115162
  FECRP.      115205
  FECEE.      115222
  FECV.       115300
  FECBUG.     115307
FORSYS=
  RANDOM.     115377
  LITE.       115401
  FLSCM.      115402
  FLLCM.      115403
  END.        115434
  EXIT        115456
  STOP.       115460
  ABNORM.     115467
```

```
  SYSARG=     115505
  IOERR.      115524
  SYSEND.     115547
  SYP=5       115550
  CLSLNK.     115564
  SYSERR.     115622
  SYST1A.     115660
  SYP=1       115664
  SYP=2       115672
  SYP=3       115741
  SYP=4       115747
  SYS=6       115776
  SYS2=       116021
  CDD.        116057
  CBD.        116066
  COD.        116073
  BFN.        116102
   ECOPE.     116107
  LINLIM.     116137
  MSGAD.      116153
  DBGFIT.     116164
GETFIT=
  GETFIT.     116234
  NAME.       116272
INCOM=
  FEIGNC.     116276
  FEISBL.     116315
  FEINUM.     116334
  FEIFSG.     116345
  FEIBLK=     116410
  FEIBLK.     116420
  FEIFST.     116434
  ERRSET      116437
  FEIERR.     116453
INPC=
  INPCI.      116574
  INPCR.      116660
KODER=
  KOJPT.      116756
  KODWRT=     117430
  KOREP.      117435
KRAKER=
  KRINIT.     120030
OUTC=
  OUTCI.      120135
  OUTCR.      120233
OUTCOM=
  FEOL.       120311
  FEOI.       120316
  FEOXFL.     120364
  FEOAFM.     120372
  FEOBLS.     120377
  FEOCNV.     120412
  FECCHR.     120456
  FEOR1F.     120467
  FEOR10.     120473
  FEONTL.     120500
```

```
GOTOER=
  GOTOER.     120514
ALOG
  ALOG        120530
  ALOG10      120536
  ALOG.       120545
  ALOG10.     120565
EXP
  EXP         120627
  EXP.        120650
SQRT
  SQRT        120727
  SQRT.       120751
SYSAID=
  SYSAID=     120774
SYS=1ST
  SYS1ST.     121000
  MORGUE.     121002
XTOI=
  XTOI.       121062
XTOY=
  XTOY.       121072
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****
WATER TABLE AQUIFER
FIELD SINGULARITIES
* MAIN FIGURES *
****

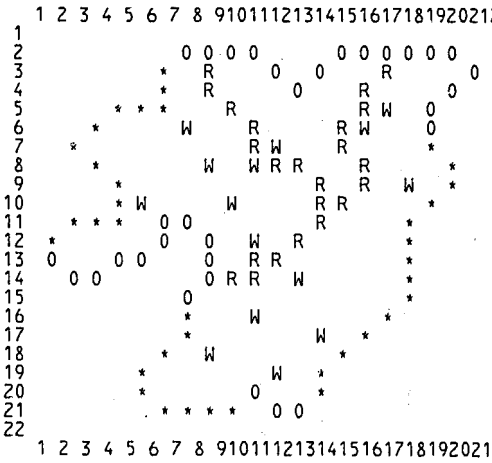
FIELD SINGULARITY NAME: THE GAB IMAGINARY RIVER

POINT NO	I(OY)	J(OX)	INITIAL HEAD(M)
1	3	17	100.20
2	4	16	95.60
3	5	16	94.15
4	6	15	92.75
5	7	15	90.05
6	8	16	88.00
7	9	16	86.62
8	10	15	85.03
9	11	14	81.90
10	12	13	80.55
11	13	12	79.00
12	13	11	75.44
13	14	11	73.83
14	14	10	70.61

FIELD SINGULARITY NAME: THE UNGEMACH TRIBUTARY

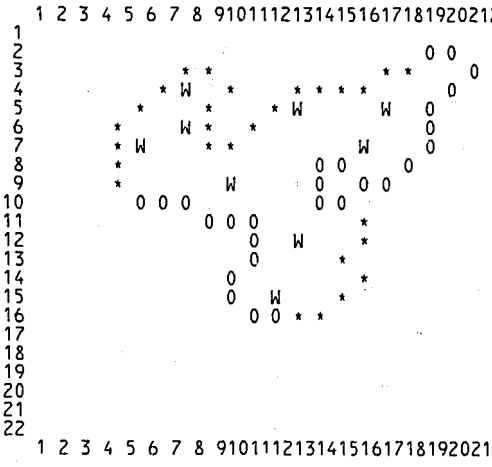
POINT NO	I(OY)	J(OX)	INITIAL HEAD(M)
1	3	9	95.75
2	4	9	93.24
3	5	10	92.15
4	6	11	91.60
5	7	11	90.05
6	8	12	89.35
7	8	13	88.60
8	9	14	87.44
9	10	14	86.48

****
* AQUIFER NO= 1 *
GEOMETRY AND FIELD SINGULARITIES
* FIGURES *
****



LEGEND
****
* REPRESENTS A HEAD CONDITION BOUNDARY
0 REPRESENTS A FLOW CONDITION BOUNDARY
W REPRESENTS A WELL LOCATION
A REPRESENTS AN OUTCROP AREA
R REPRESENTS A RIVER LOCATION

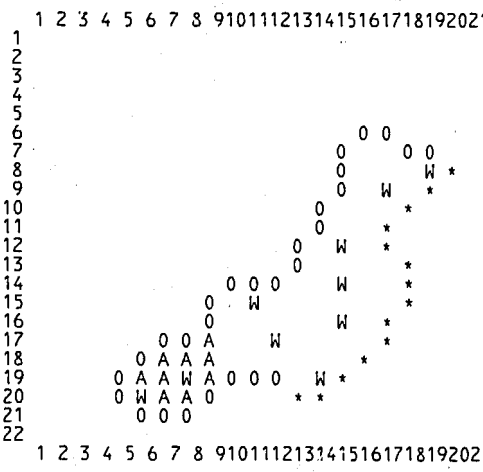
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**********************************
*         AQUIFER NO=  2         *
*GEOMETRY AND FIELD SINGULARITIES*
*              FIGURES           *
**********************************
```



LEGEND

* REPRESENTS A HEAD CONDITION BOUNDARY
0 REPRESENTS A FLOW CONDITION BOUNDARY
W REPRESENTS A WELL LOCATION
A REPRESENTS AN OUTCROP AREA
R REPRESENTS A RIVER LOCATION

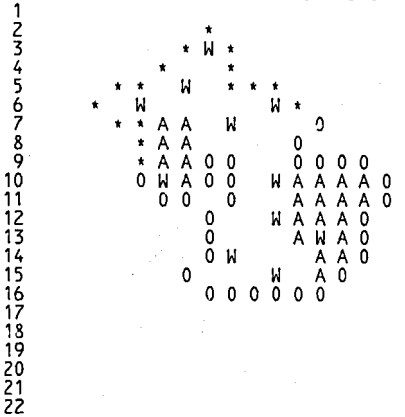
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*         AQUIFER NO=  3         *
*GEOMETRY AND FIELD SINGULARITIES*
*              FIGURES           *
**********************************
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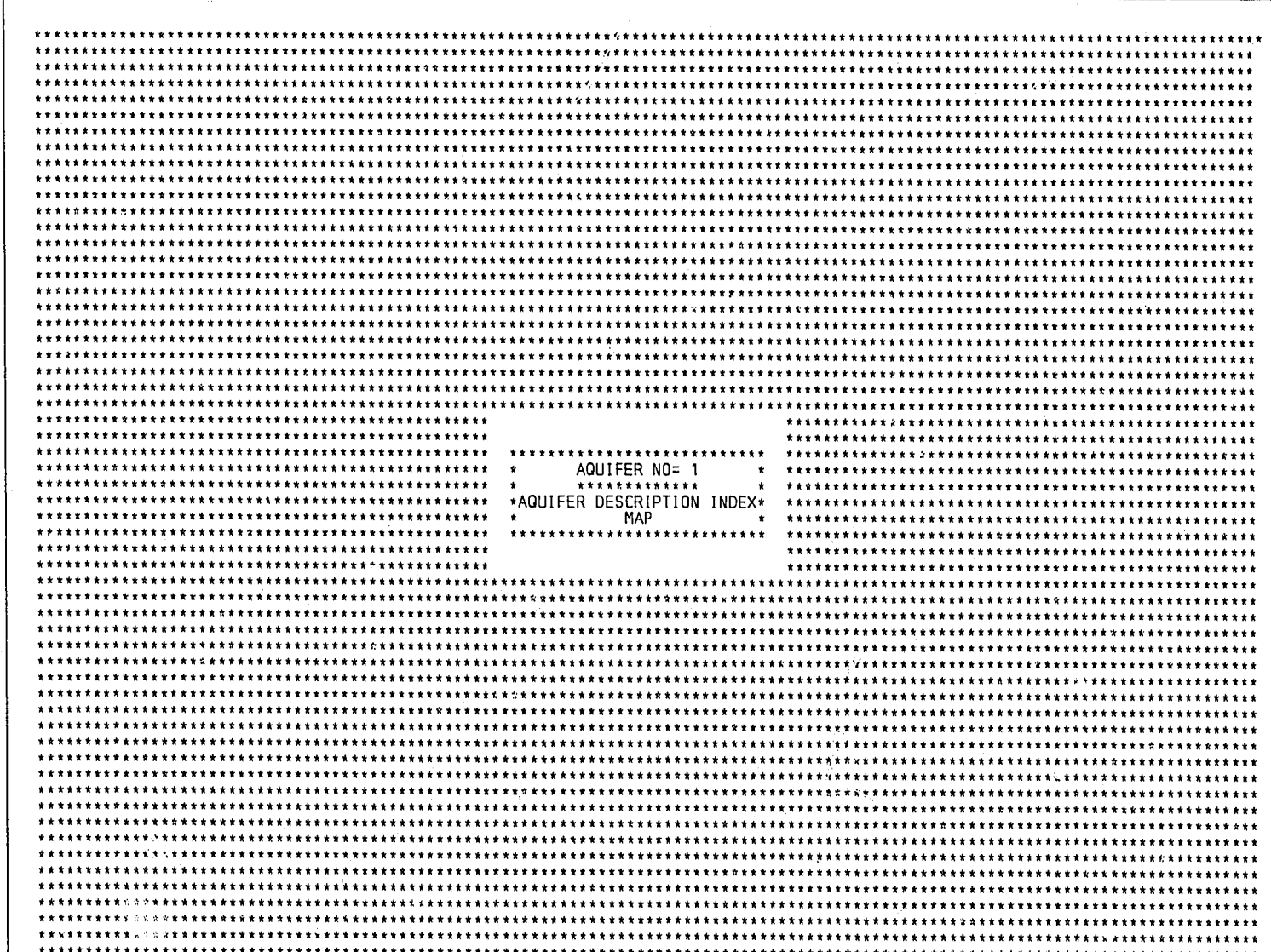
LEGEND

* REPRESENTS A HEAD CONDITION BOUNDARY
O REPRESENTS A FLOW CONDITION BOUNDARY
W REPRESENTS A WELL LOCATION
A REPRESENTS AN OUTCROP AREA
R REPRESENTS A RIVER LOCATION

****
* AQUIFER NO= 4 *
GEOMETRY AND FIELD SINGULARITIES
* FIGURES *
****



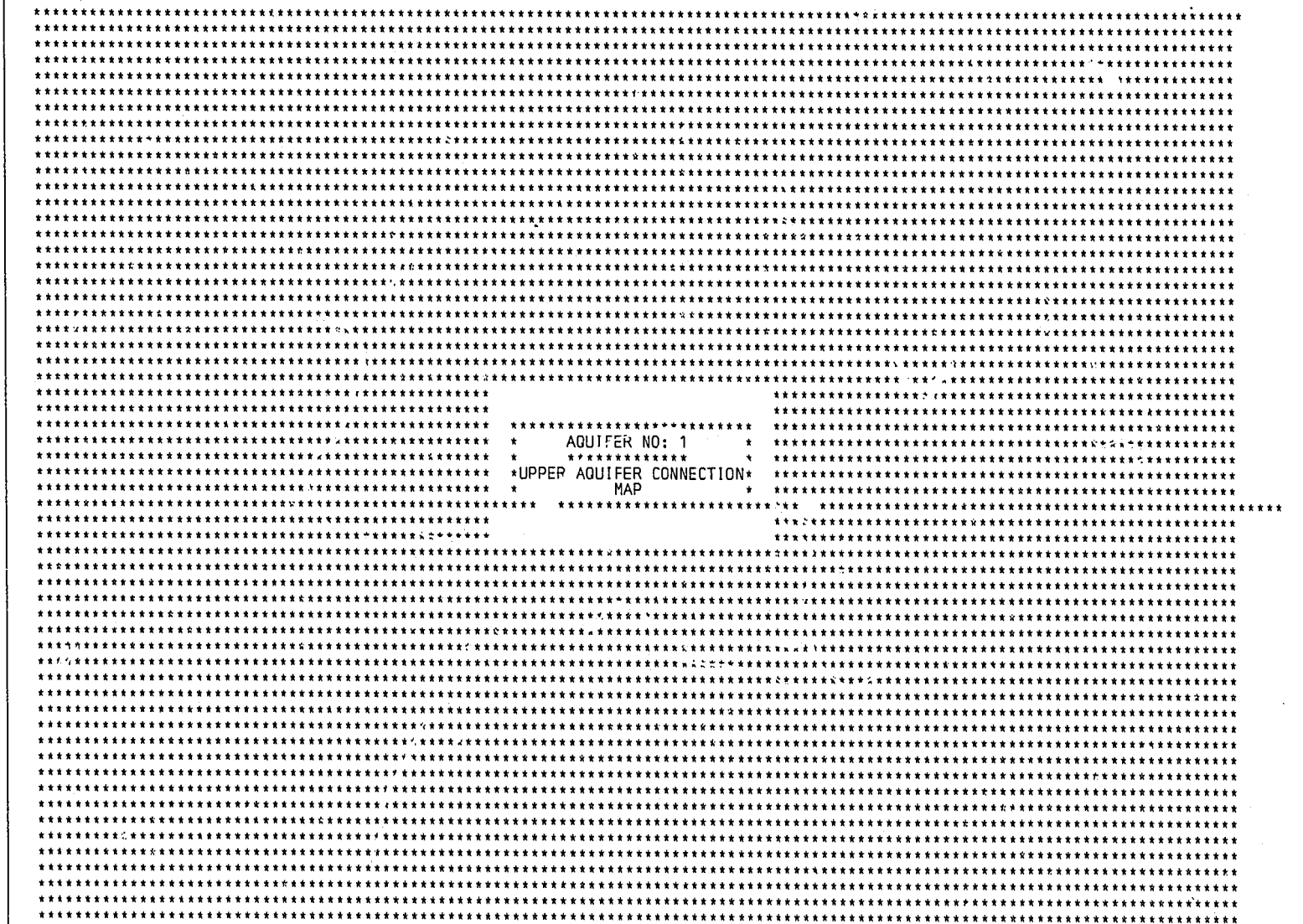
LEGEND
****
* REPRESENTS A HEAD CONDITION BOUNDARY
0 REPRESENTS A FLOW CONDITION BOUNDARY
W REPRESENTS A WELL LOCATION
A REPRESENTS AN OUTCROP AREA
R REPRESENTS A RIVER LOCATION


AQUIFER NO= 1
AQUIFER DESCRIPTION INDEX
MAP

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	-1	-1	-1	-1	2	2	2	-1	-1	-1	-1	-1	-1	2	2
3	2	2	2	2	2	2	1		5			-1	2	-1			5				-1	2
4	2	2	2	2	2	2	1		5				-1			5				-1	2	2
5	2	2	2	2	1	1	1			5						5			-1	2	2	2
6	2	2	2	1							5				5				-1	2	2	2
7	2	2	1								5				5				1	2	2	2
8	2	2	2	1								5	5			5				1	2	2
9	2	2	2	2	1									5		5				1	2	2
10	2	2	2	2	1									5	5				1	2	2	2
11	2	2	1	1	1		-1	-1						5				1	2	2	2	2
12	2	1					-1	2	-1				5					1	2	2	2	2
13	2	-1			-1	-1	2	2	-1		5	5						1	2	2	2	2
14	2	2	-1	-1	2	2	2	2	-1	5	5							1	2	2	2	2
15	2	2	2	2	2	2	2	-1										1	2	2	2	2
16	2	2	2	2	2	2	2	1									1	2	2	2	2	2
17	2	2	2	2	2	2	2	1								1	2	2	2	2	2	2
18	2	2	2	2	2	2	1								1	2	2	2	2	2	2	2
19	2	2	2	2	2	1								1	2	2	2	2	2	2	2	2
20	2	2	2	2	2	1					-1			1	2	2	2	2	2	2	2	2

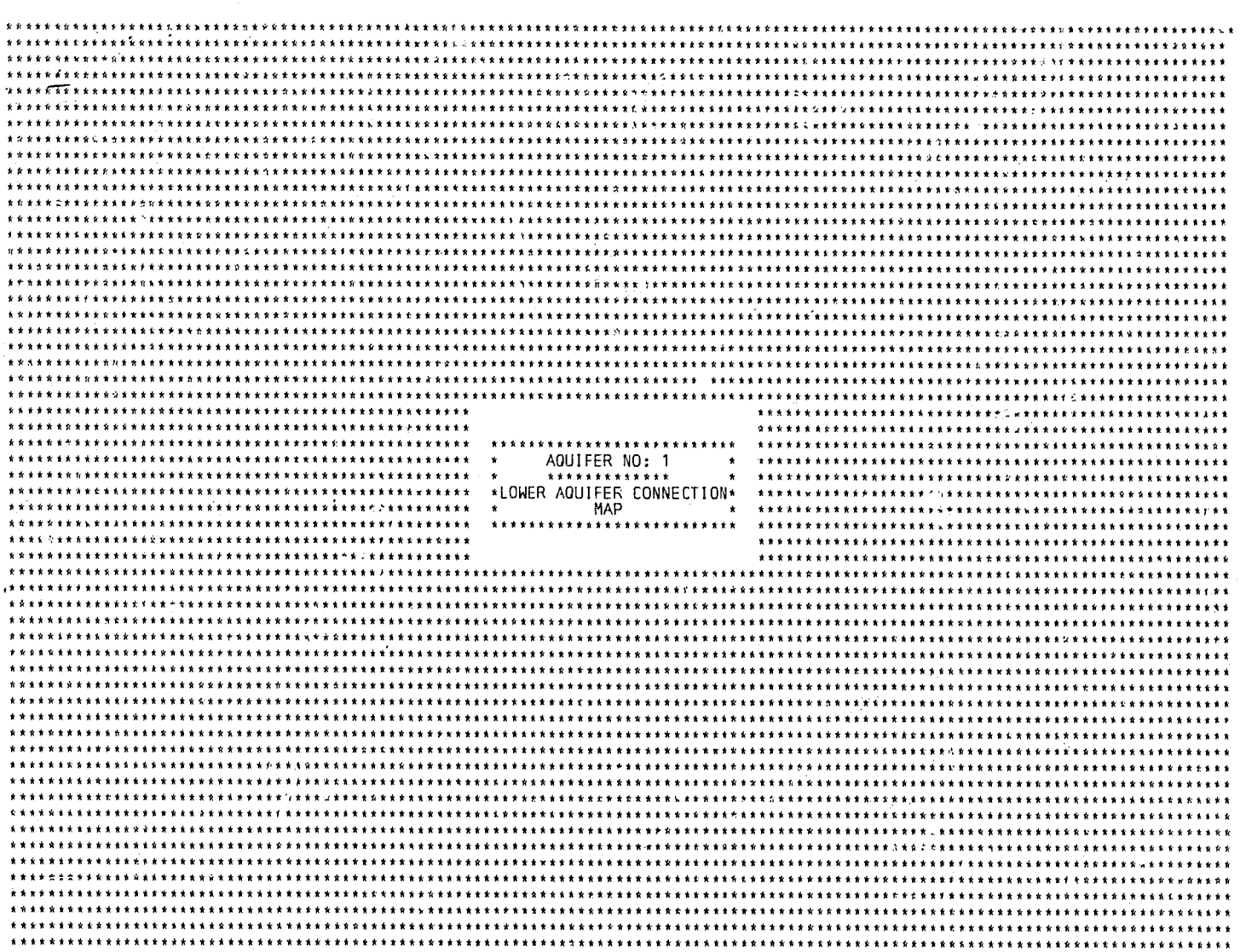
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21 *    2    2    2    2    2    2    1    1    1    1    2   -1   -1    2    2    2    2    2    2    2    2    2
   *
   *
22 *    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2

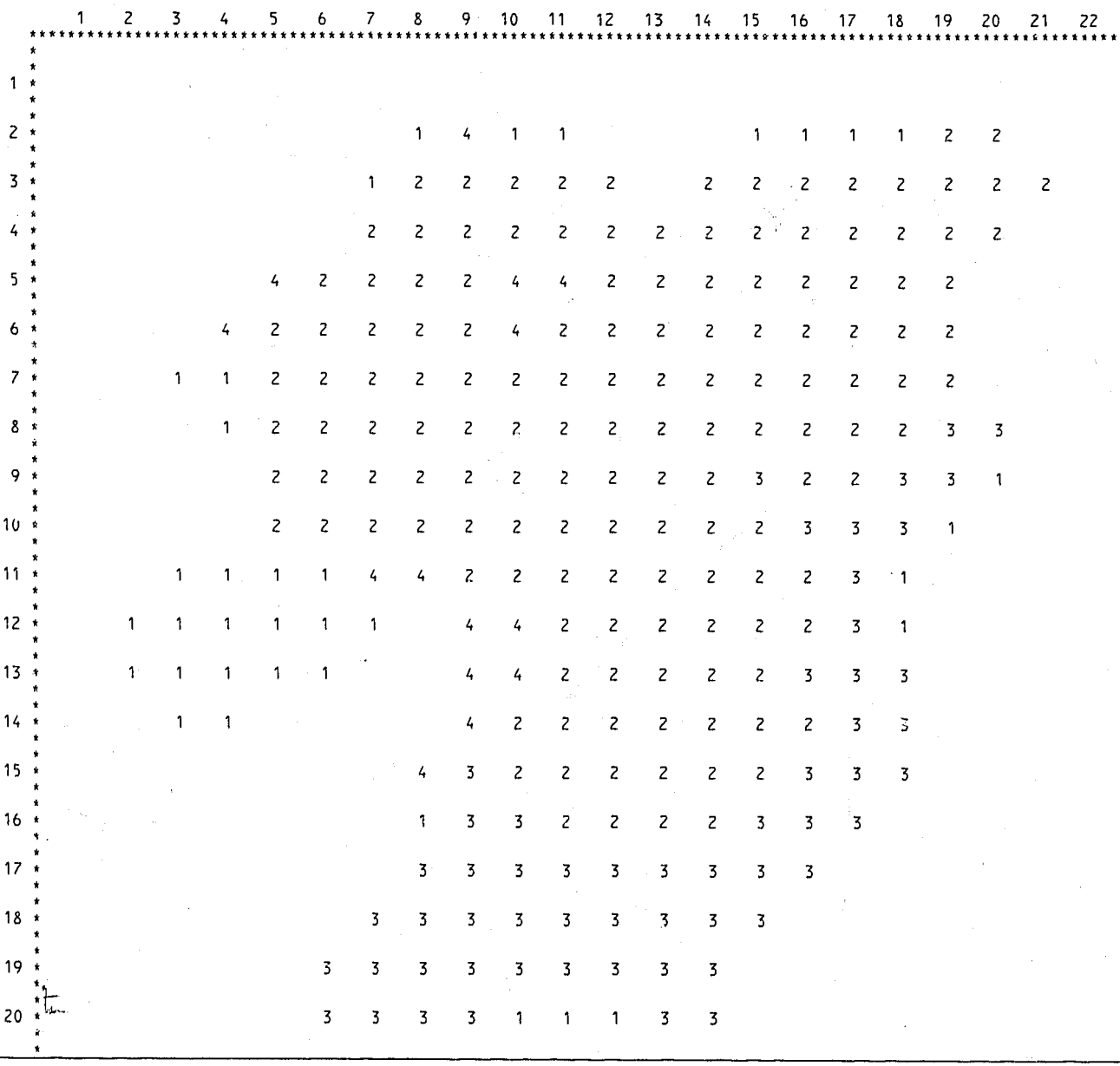
   ***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
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AQUIFER NO: 1
UPPER AQUIFER CONNECTION
MAP

```
21 *
   *
   *
22 *
```

***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***


AQUIFER NO: 1
LOWER AQUIFER CONNECTION
MAP

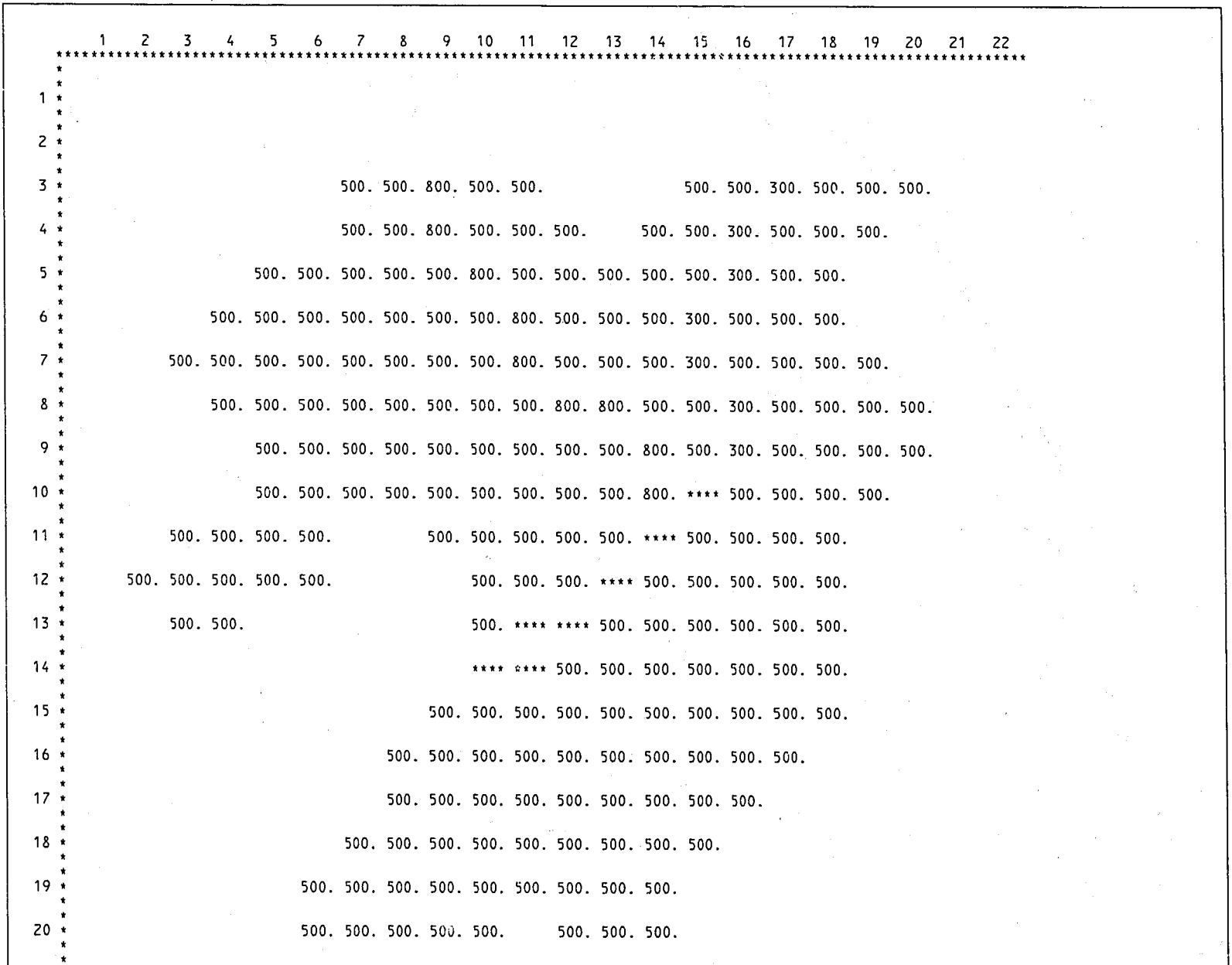

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *                          3   3   1   1       1   1
   *
   *
22 *
```

***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01 ***

AQUIFER NO: 1

POINT TRANSMISSIVITY MAP

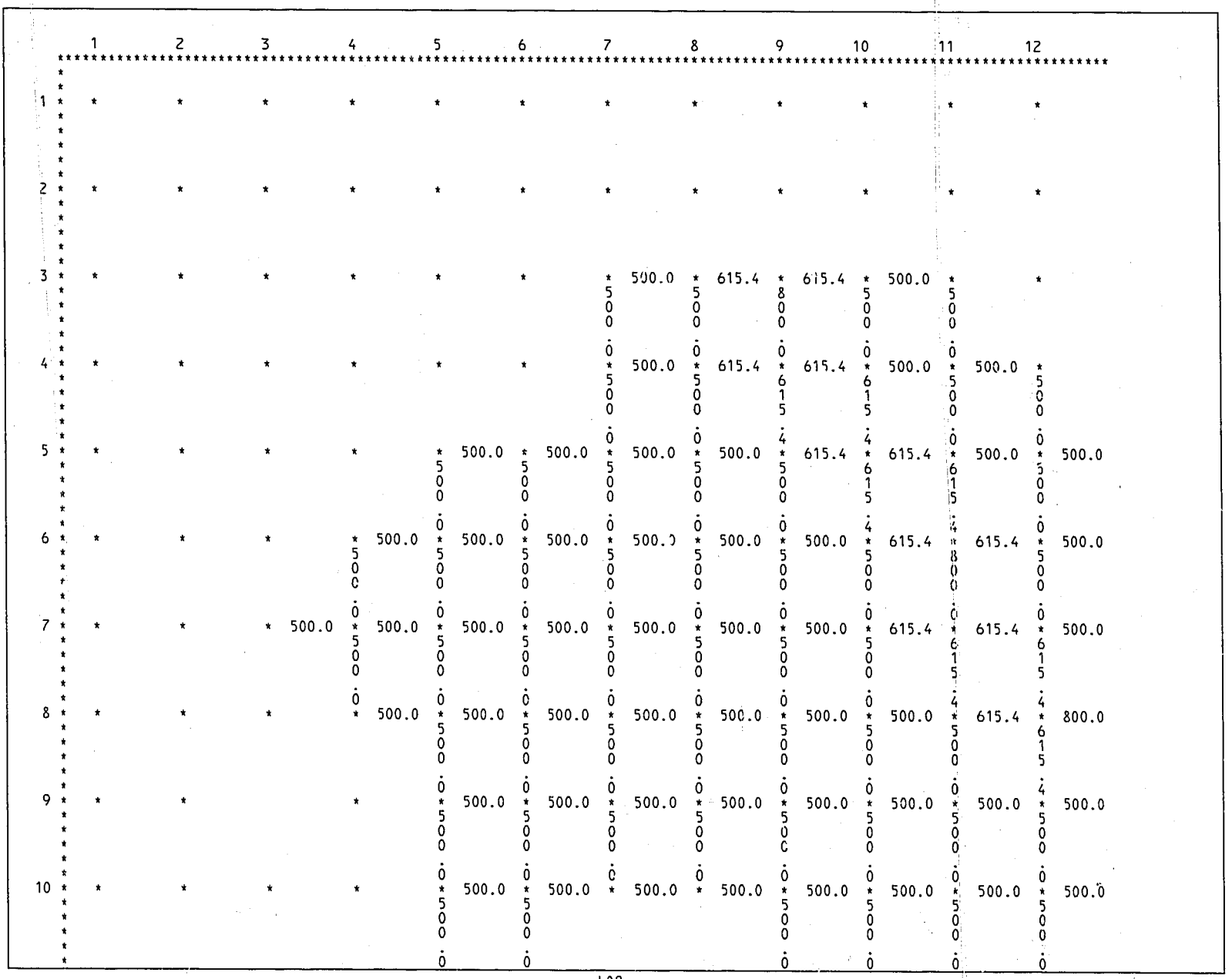

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1
2
3 500. 500. 800. 500. 500. 500. 500. 500. 300. 500. 500. 500.
4 500. 500. 800. 500. 500. 500. 500. 500. 300. 500. 500. 500.
5 500. 500. 500. 500. 500. 800. 500. 500. 500. 500. 500. 300. 500. 500.
6 500. 500. 500. 500. 500. 500. 500. 800. 500. 500. 500. 300. 500. 500. 500.
7 500. 500. 500. 500. 500. 500. 500. 500. 800. 500. 500. 500. 300. 500. 500. 500. 500.
8 500. 500. 500. 500. 500. 500. 500. 500. 800. 800. 500. 500. 300. 500. 500. 500. 500.
9 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 800. 500. 300. 500. 500. 500. 500.
10 500. 500. 500. 500. 500. 500. 500. 500. 500. 800. **** 500. 500. 500. 500.
11 500. 500. 500. 500. 500. 500. 500. 500. 500. **** 500. 500. 500. 500.
12 500. 500. 500. 500. 500. 500. 500. 500. **** 500. 500. 500. 500. 500.
13 500. 500. 500. **** **** 500. 500. 500. 500. 500. 500.
14 **** **** 500. 500. 500. 500. 500. 500. 500.
15 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
16 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
17 500. 500. 500. 500. 500. 500. 500. 500. 500.
18 500. 500. 500. 500. 500. 500. 500. 500. 500.
19 500. 500. 500. 500. 500. 500. 500. 500. 500.
20 500. 500. 500. 500. 500. 500. 500. 500.

```
21 *                          500. 500. 500. 500.
   *
   *
22 *
```

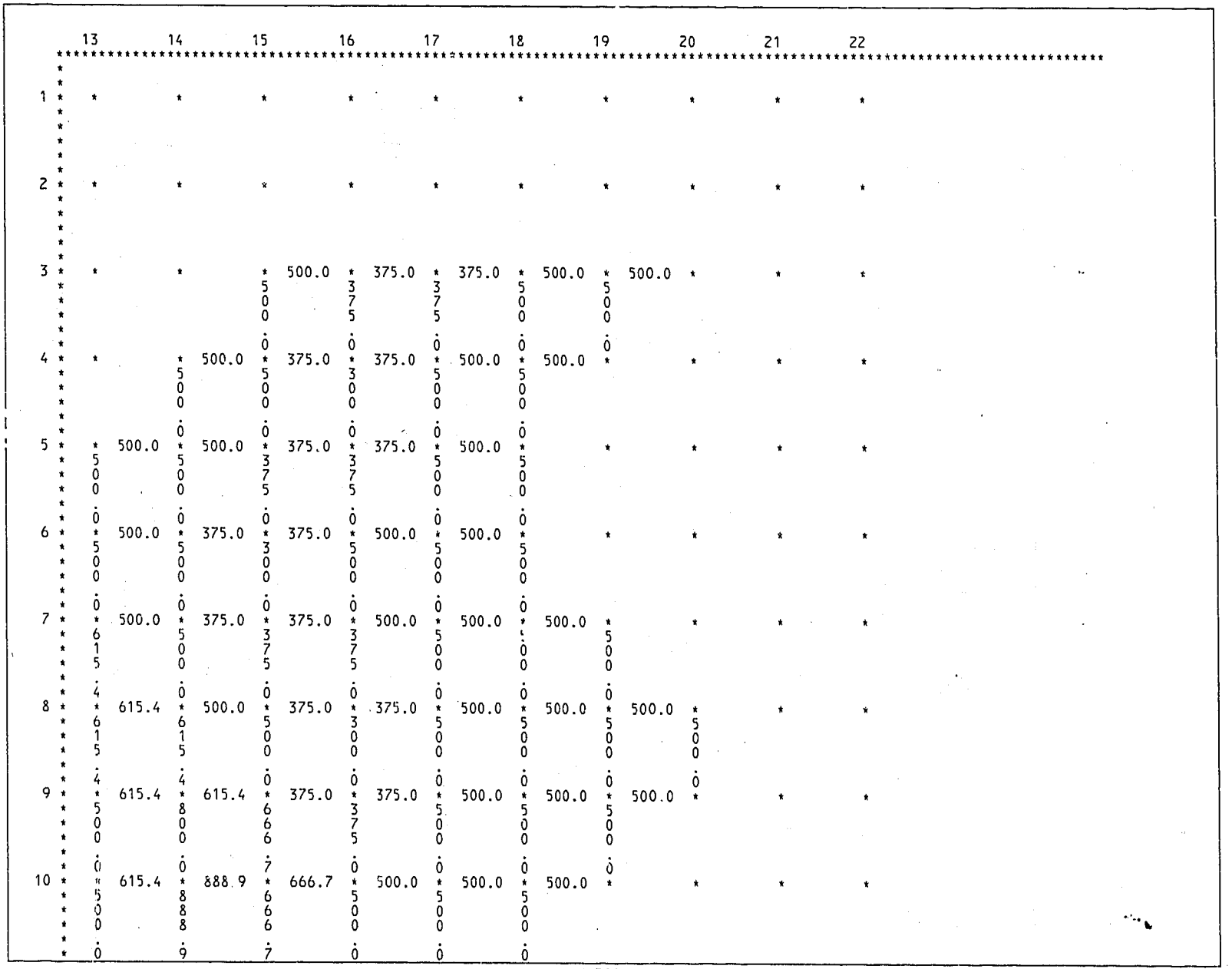
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+05 ***

AQUIFER NO: 1

DIRECTIONAL TRANSMISSIVITY MAP


1 2 3 4 5 6 7 8 9 10 11 12
500.0 615.4 615.4 500.0
500.0 615.4 615.4 500.0 500.0
500.0 500.0 500.0 500.0 500.0 615.4 615.4 500.0 500.0
500.0 500.0 500.0 500.0 500.0 500.0 615.4 615.4 500.0
500.0 500.0 500.0 500.0 500.0 500.0 500.0 615.4 615.4
500.0 500.0 500.0 500.0 500.0 500.0 500.0 500.0 615.4
500.0 500.0 500.0 500.0 500.0 500.0 500.0 500.0 500.0
500.0 500.0 500.0 500.0 500.0 500.0 500.0 500.0 500.0

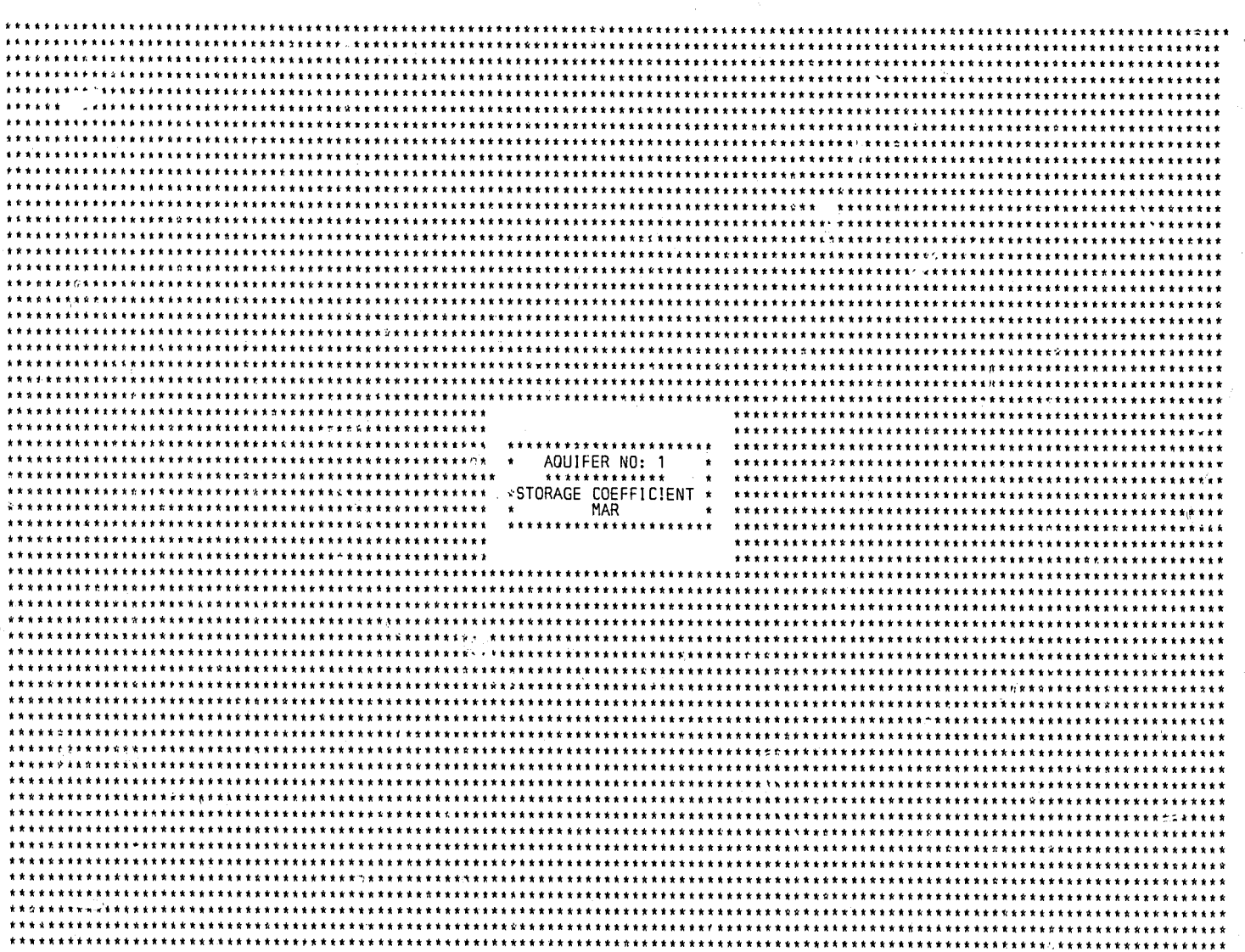
11	*	*	*	*	500.0	*	500.0	*	500.0	*		*		*		*	500.0	*	500.0	*	500.0	*	500.0
	*			*		*		*		*								*		*		*

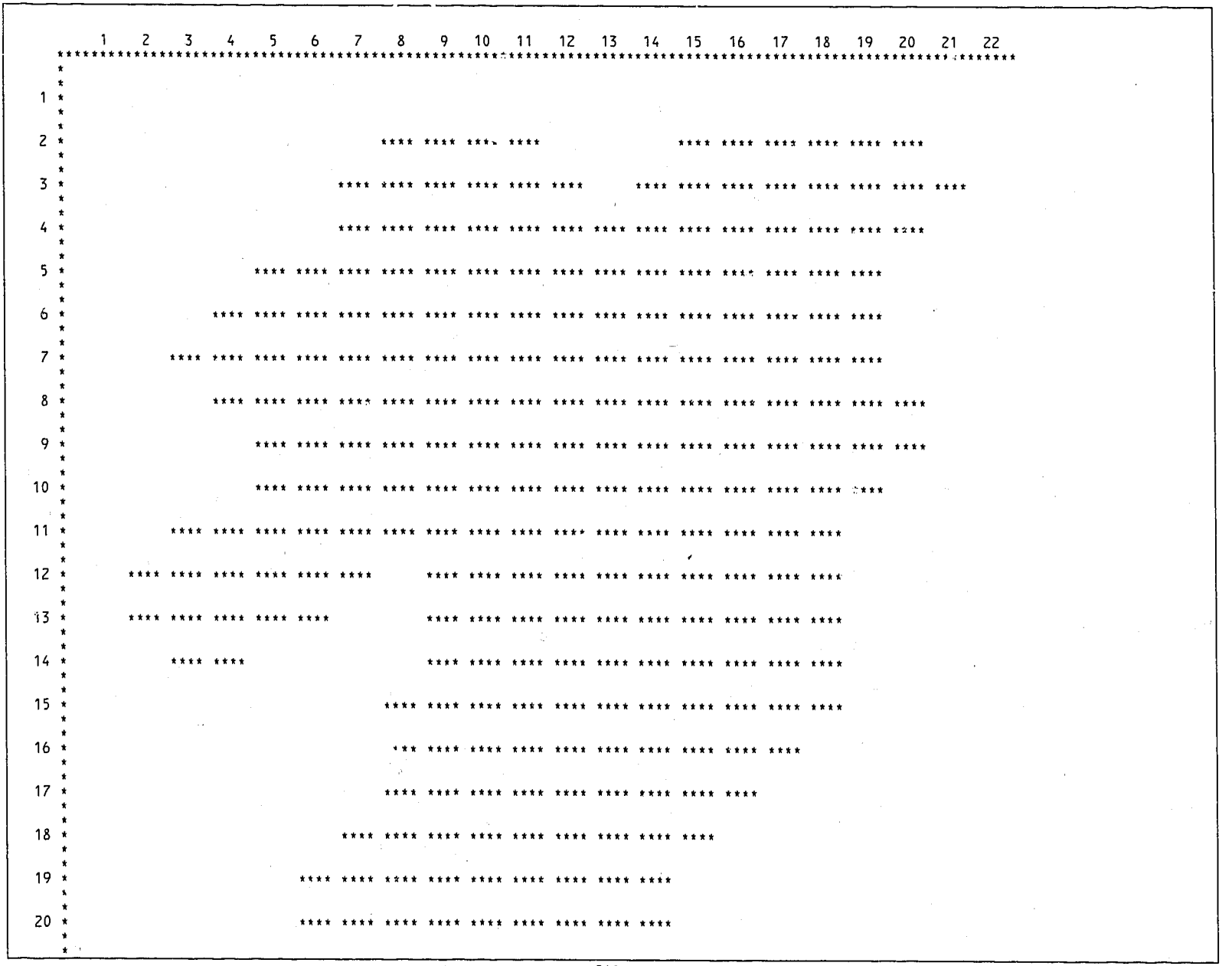

13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10
500.0 375.0 375.0 500.0 500.0
500.0 500.0 375.0 375.0 500.0 500.0
500.0 500.0 375.0 375.0 500.0 500.0
500.0 375.0 375.0 500.0 500.0 500.0
615.4 500.0 375.0 375.0 500.0 500.0 500.0
615.4 615.4 375.0 375.0 500.0 500.0 500.0
615.4 888.9 666.7 500.0 500.0 500.0

11	666.7	666.7	500.0	500.0	500.0	500.0								
12	666.7	500.0	500.0	500.0	500.0	500.0								
13	500.0	500.0	500.0	500.0	500.0	500.0								
14	500.0	500.0	500.0	500.0	500.0	500.0								
15	500.0	500.0	500.0	500.0	500.0									
16	500.0	500.0	500.0	500.0										
17	500.0	500.0	500.0											
18	500.0	500.0												
19	500.0													
20	500.0													
21														

22 * * * * * * * * * * * *
*
*
*
*
*
*

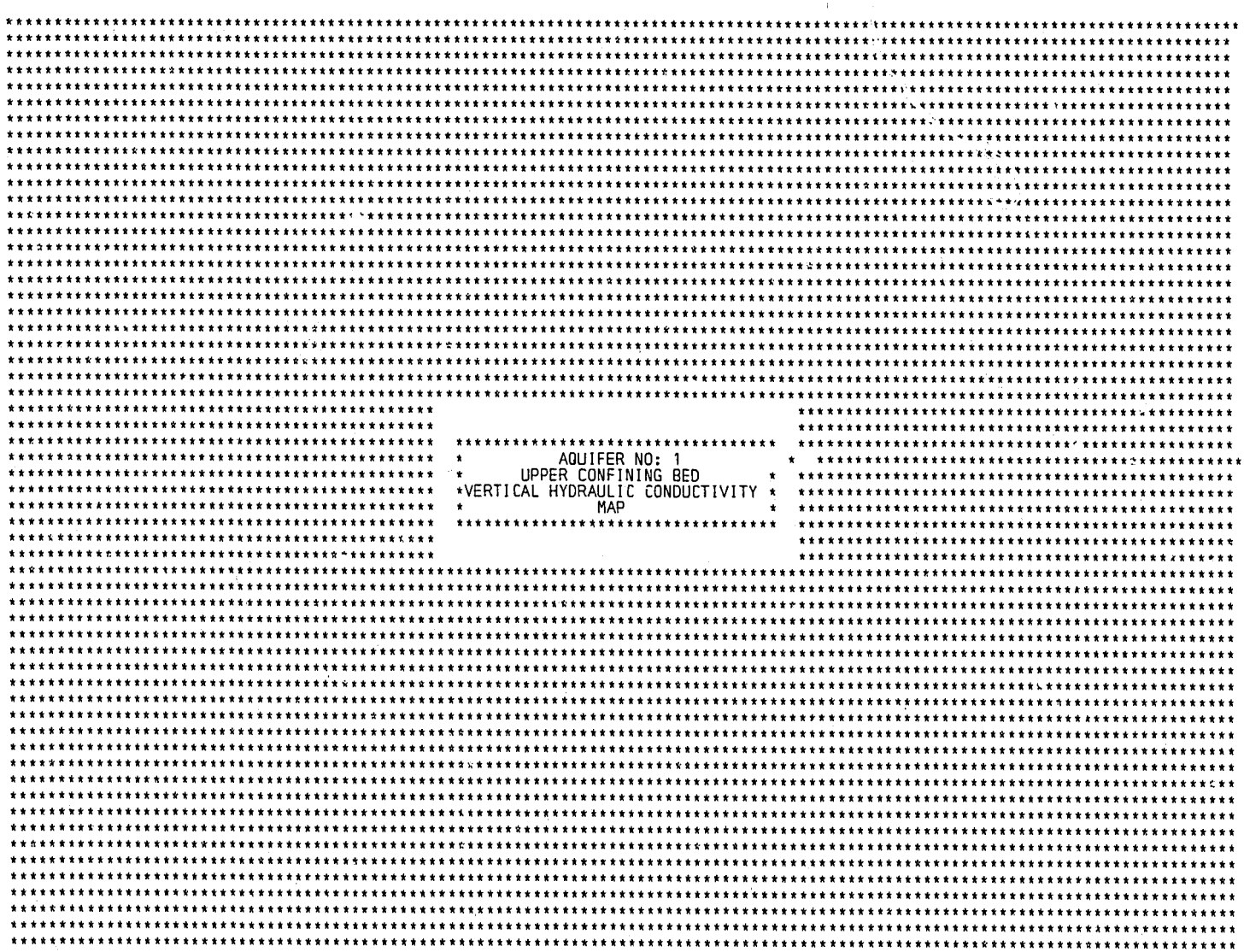
THE VALUES OF THE ARGUMENTS ARE MULTIOLIED BY:
-X(HORIZONTAL)= .10000000E+05
-Y(VERTICAL)= .10000000E+05

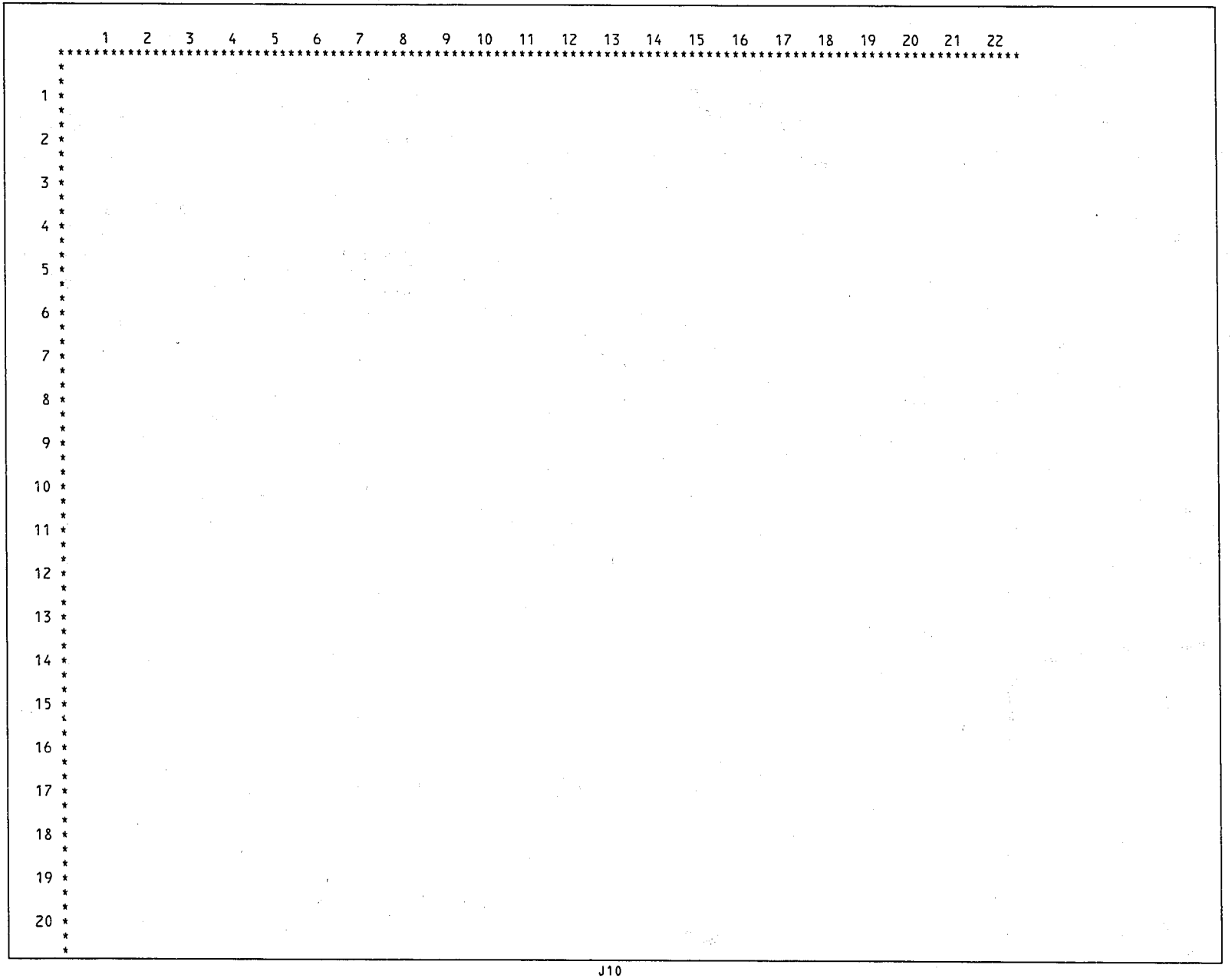

AQUIFER NO: 1
STORAGE COEFFICIENT
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

```
21 *                          **** **** **** ****       **** ****
   *
   *
22 *


         ***VALUES OF ARGUMENT MULTIPLYED BY    .10000000E+06 ***
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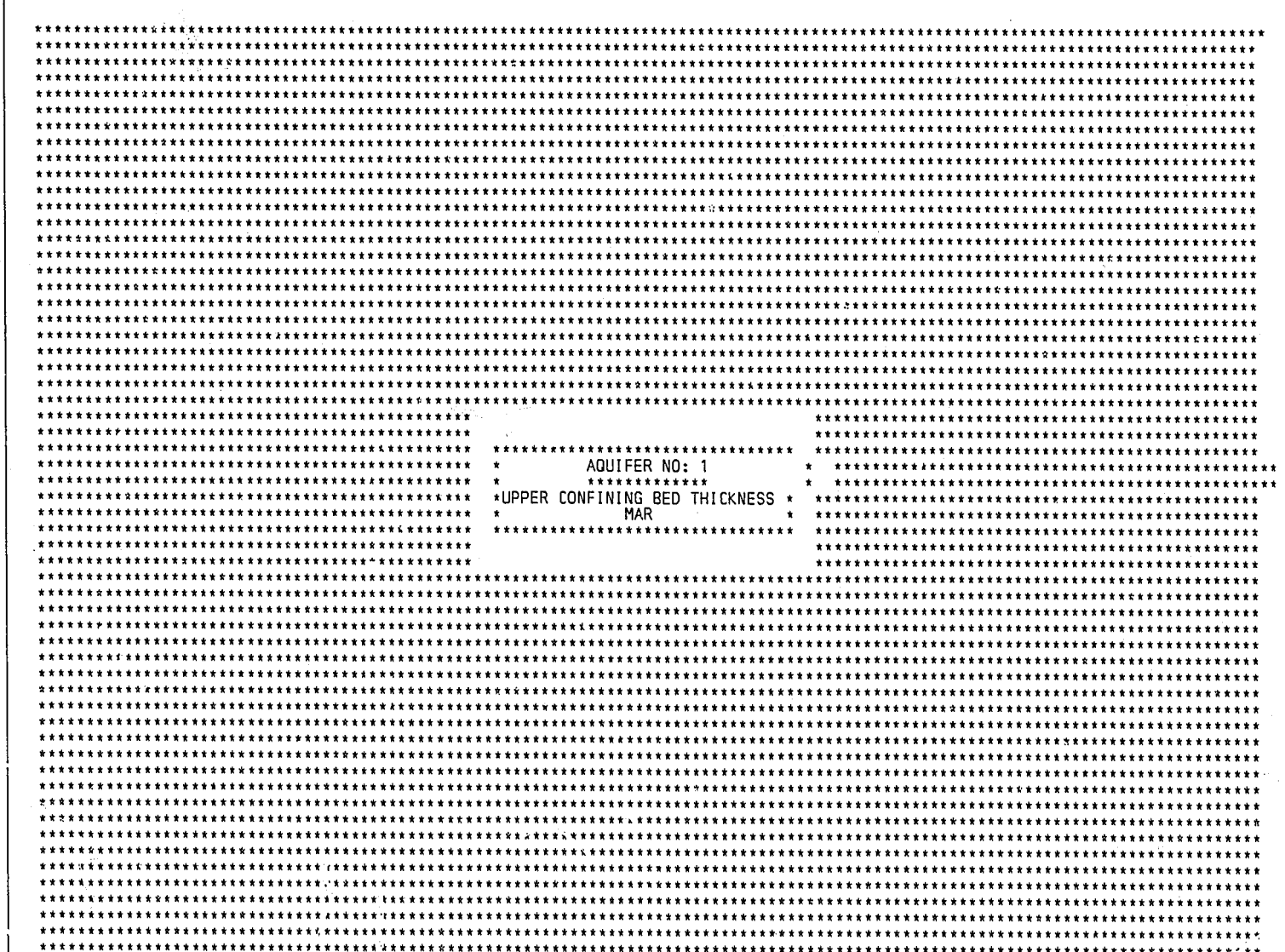

AQUIFER NO: 1
UPPER CONFINING BED
VERTICAL HYDRAULIC CONDUCTIVITY
MAP

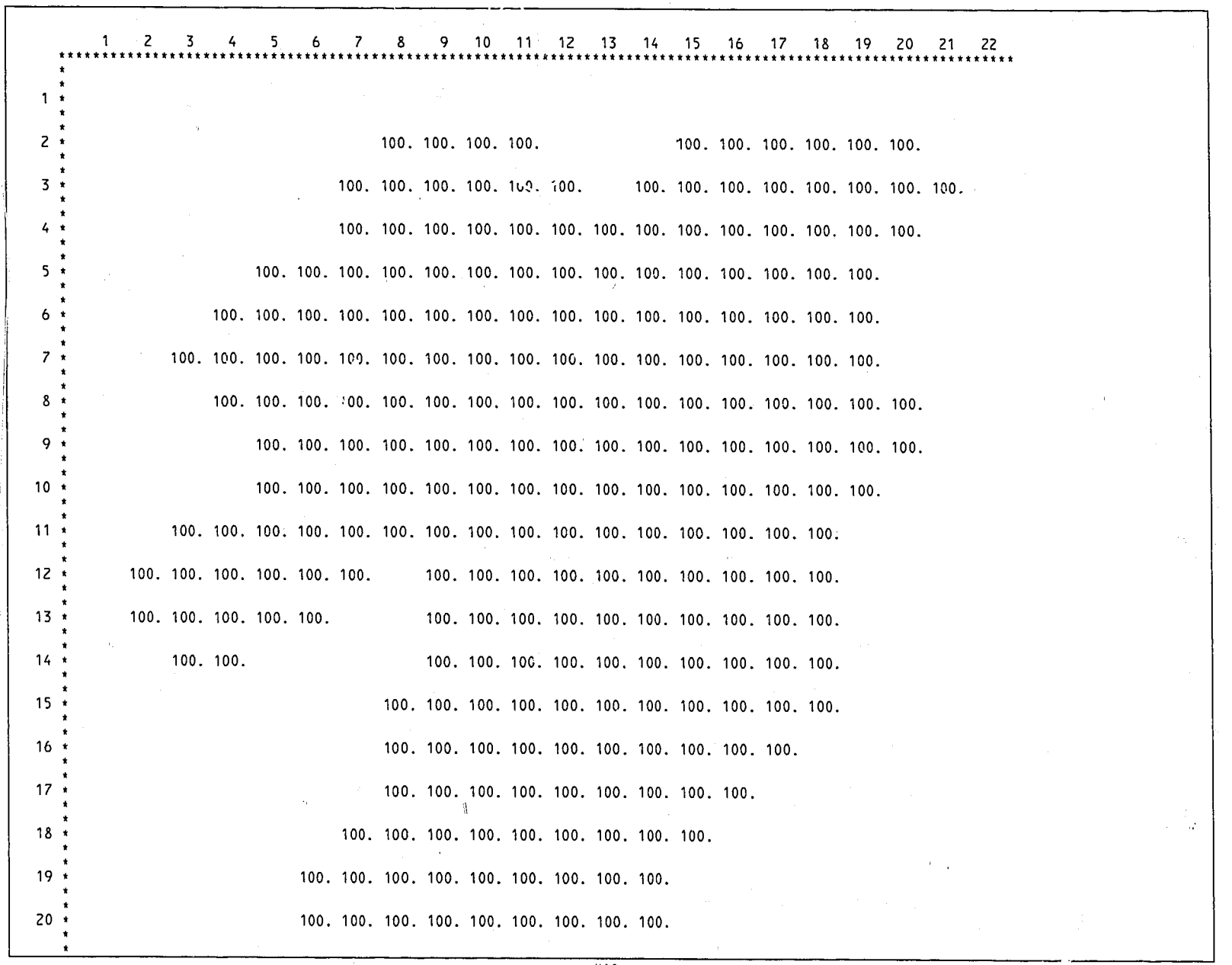

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

J10

```
21 *
   *
   *
22 *
```

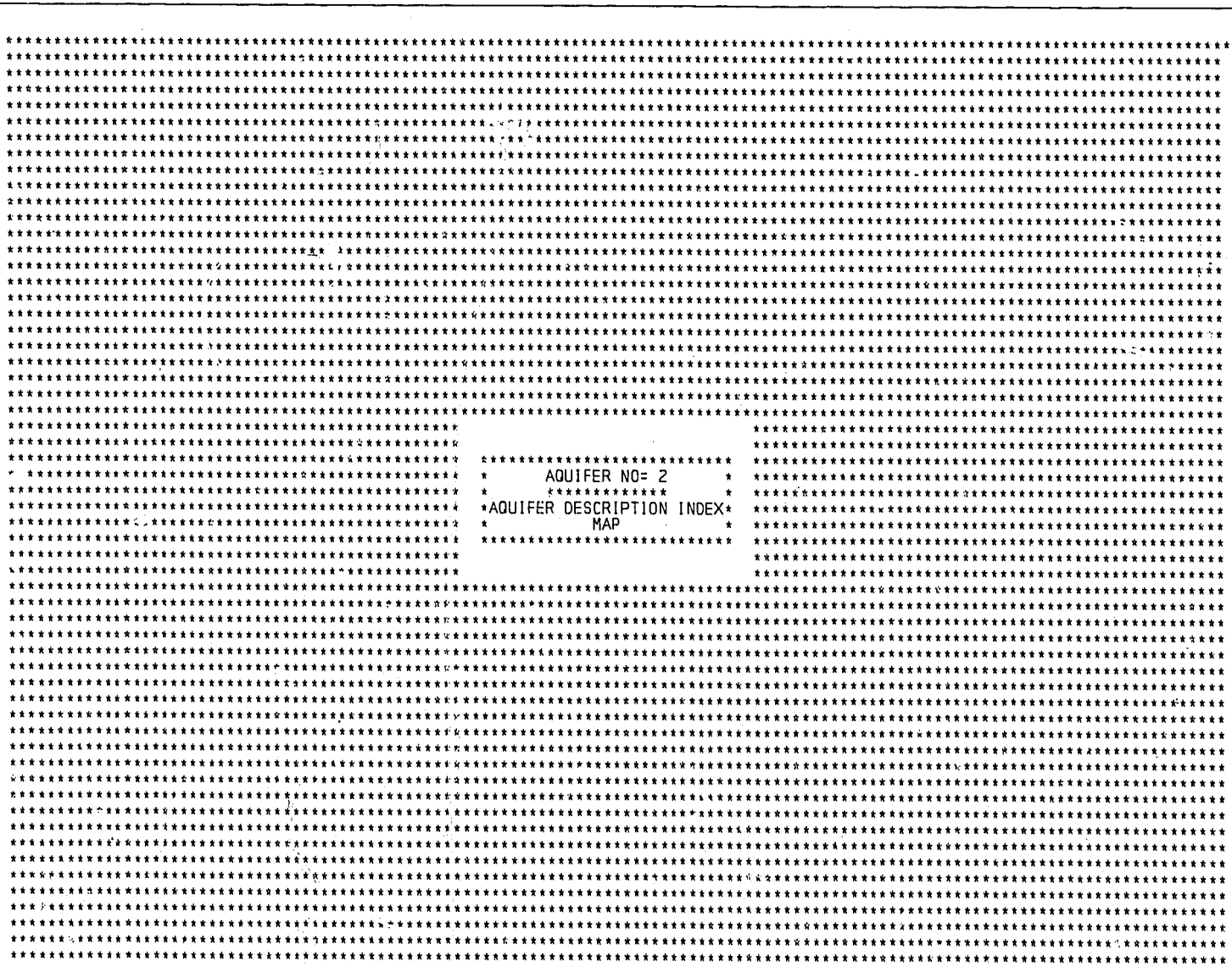
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+10 ***


AQUIFER NO: 1
UPPER CONFINING BED THICKNESS
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
2 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
3 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
4 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
5 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
6 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
7 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
8 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
9 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
10 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
11 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
12 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
13 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
14 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
15 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
16 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
17 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
18 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
19 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
20 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.

```
21 *                          100. 100. 100. 100.      100. 100.
   *
   *
22 *
```

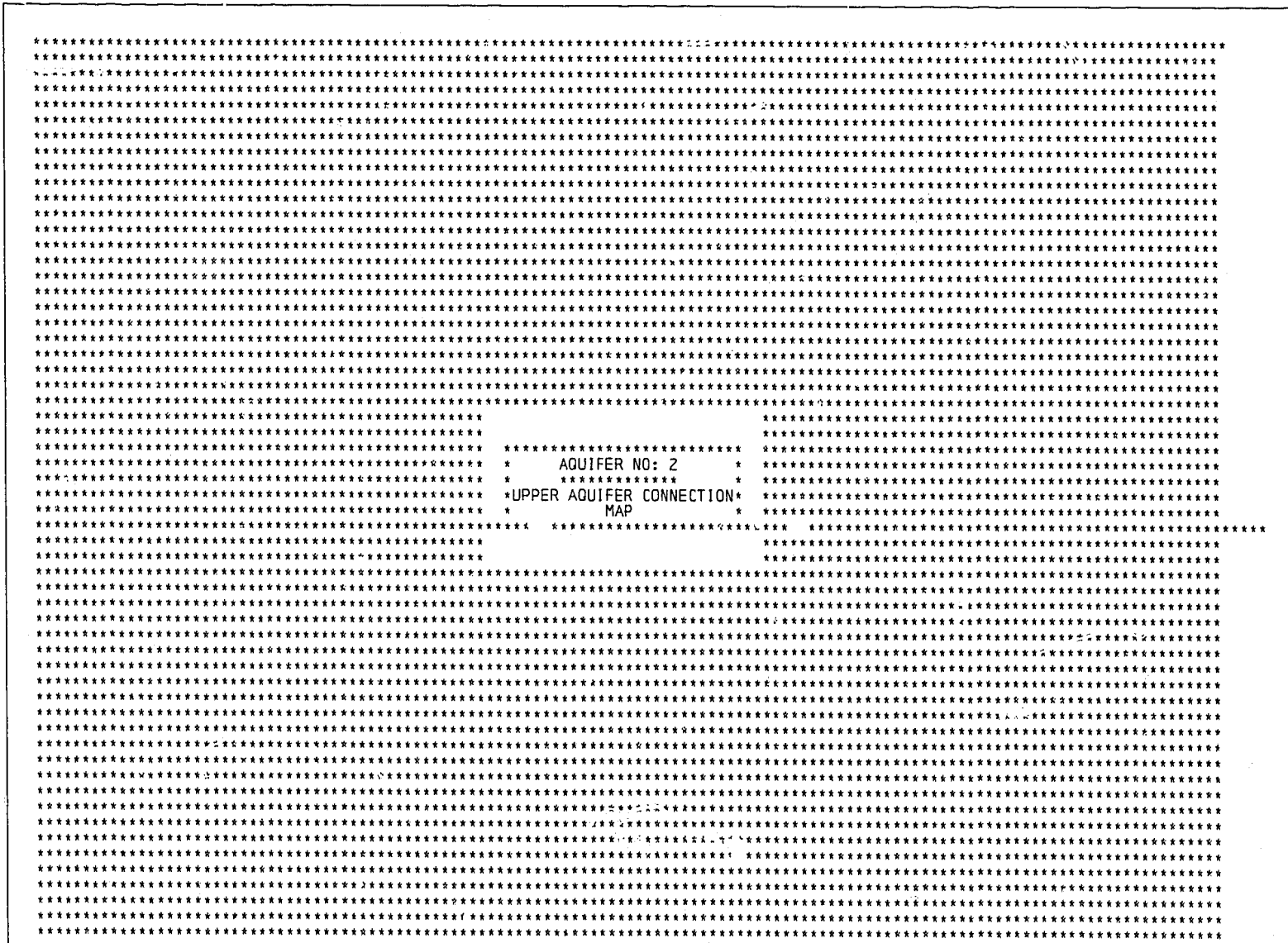
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***

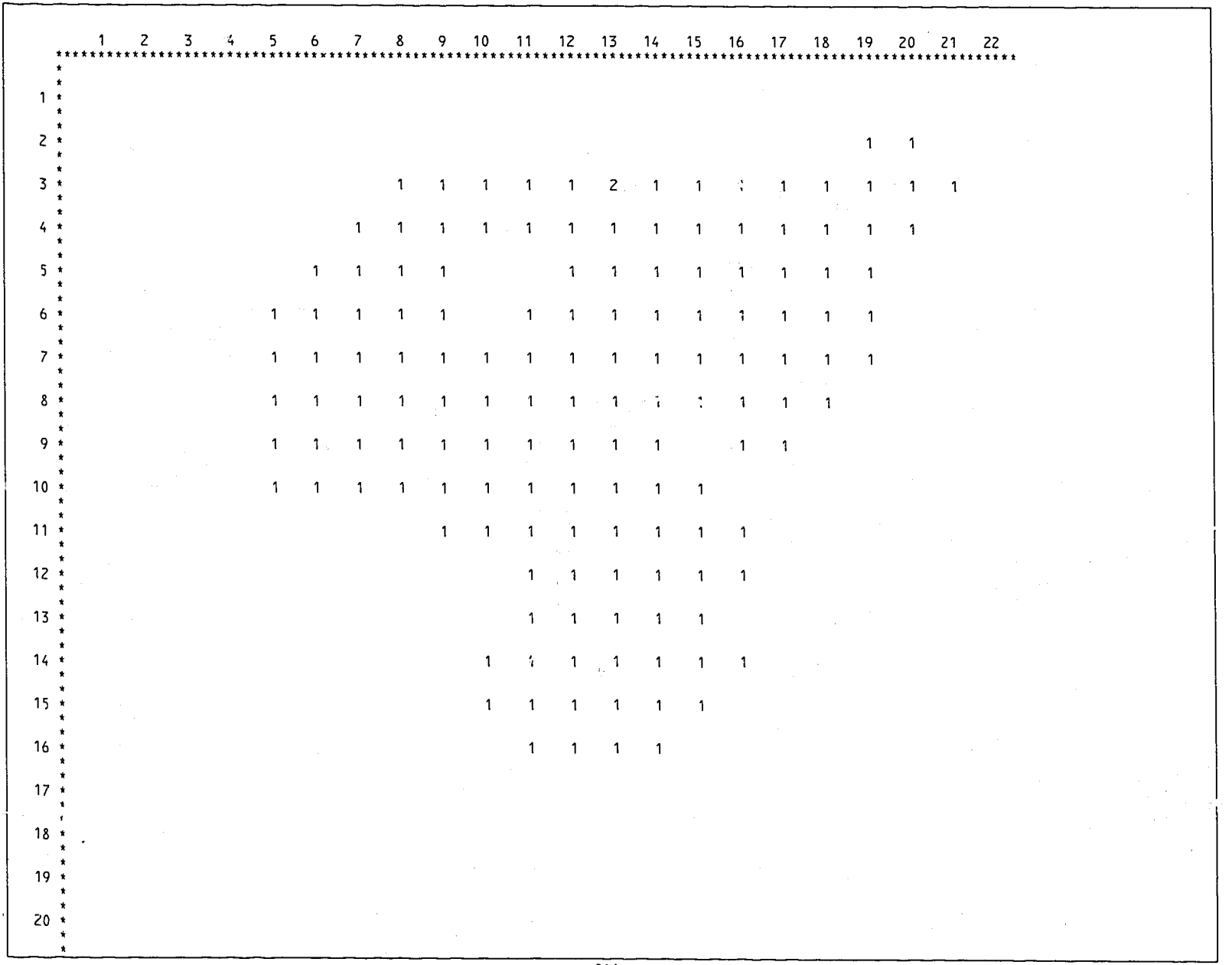

AQUIFER NO= 2
AQUIFER DESCRIPTION INDEX
MAP

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	-1	-1	2	2
3	2	2	2	2	2	2	2	1	1									1			-1	2
4	2	2	2	2	2	2	1			1			1	1	1	1				-1	2	2
5	2	2	2	2	2	1			1	2	2	1							-1	2	2	2
6	2	2	2	2	1				1	2	1								-1	2	2	2
7	2	2	2	2	1				1	1									-1	2	2	2
8	2	2	2	2	1									-1	-1			-1	2	2	2	2
9	2	2	2	2	1									-1	2	-1	-1	2	2	2	2	2
10	2	2	2	2		-1	-1	-1						-1	-1	2	2	2	2	2	2	2
11	2	2	2	2	2	2	2	2	-1	-1	-1					1	2	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	-1					1	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	2	2	-1				1	2	2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	2	-1						1	2	2	2	2	2	2
15	2	2	2	2	2	2	2	2	2	-1					1	2	2	2	2	2	2	2
16	2	2	2	2	2	2	2	2	2	2	-1	-1	1	1	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

```
 21 *    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2
    *
    *
 22 *    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2
```

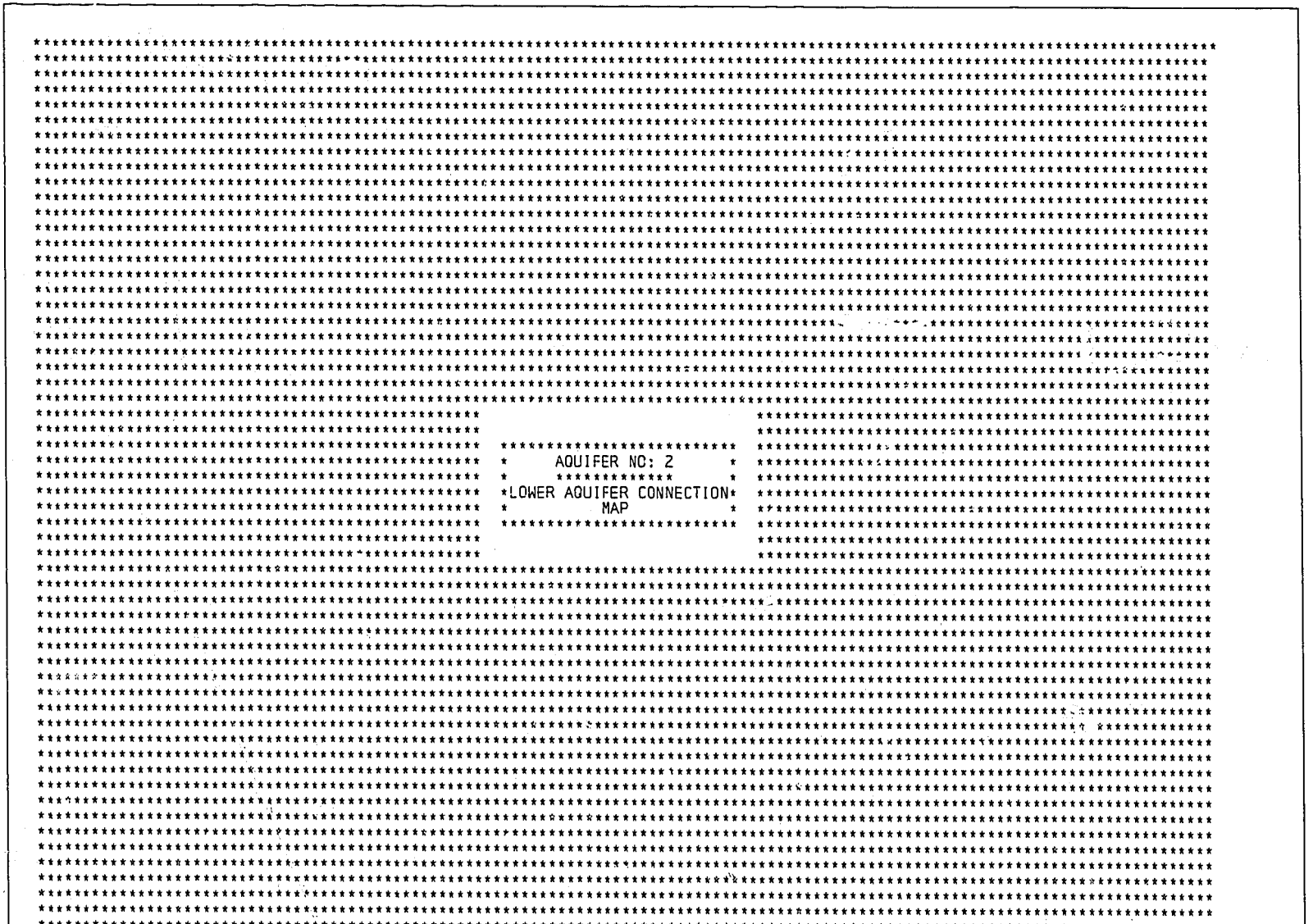
***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01 ***

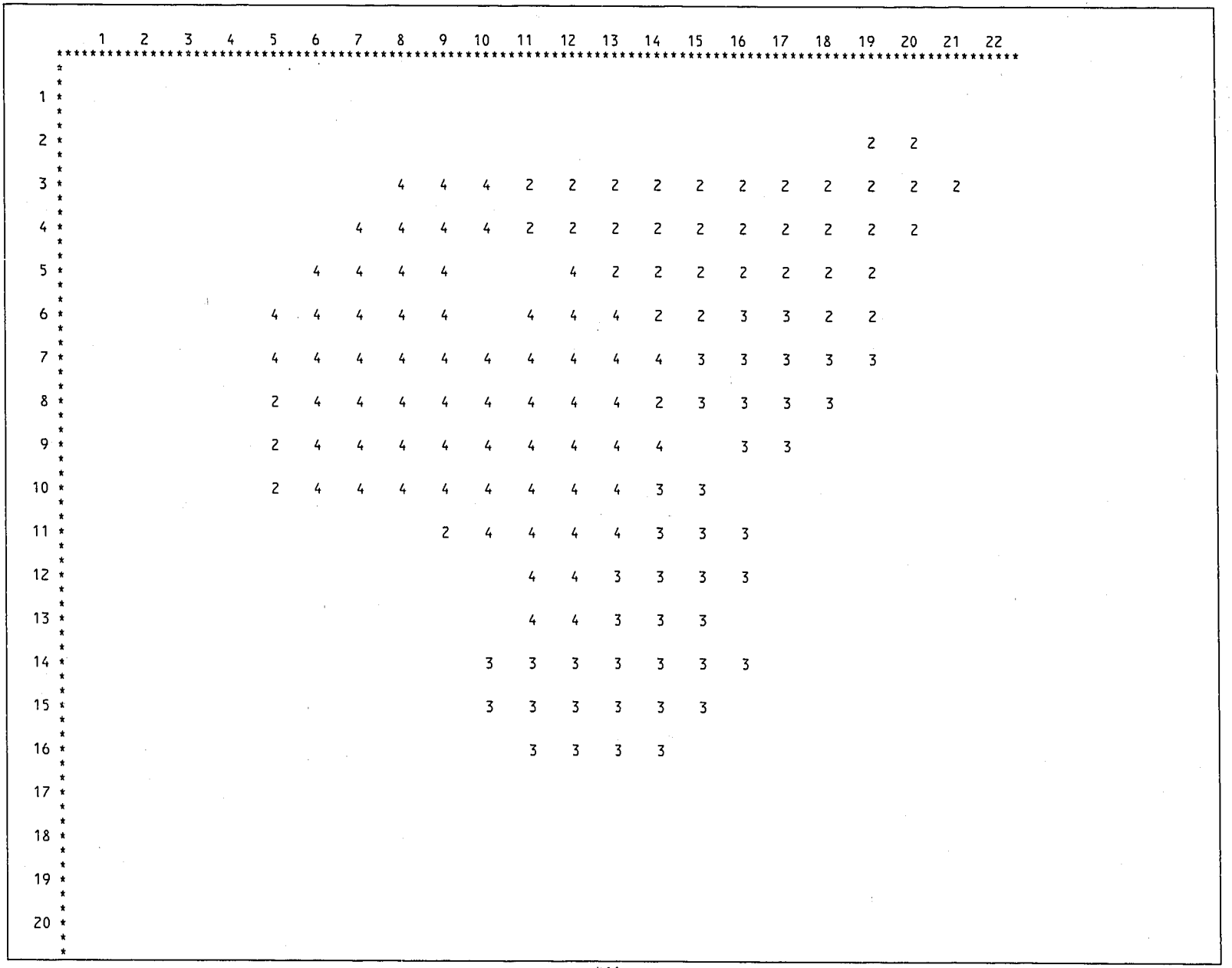

AQUIFER NO: 2
UPPER AQUIFER CONNECTION
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *
   *
   *
22 *

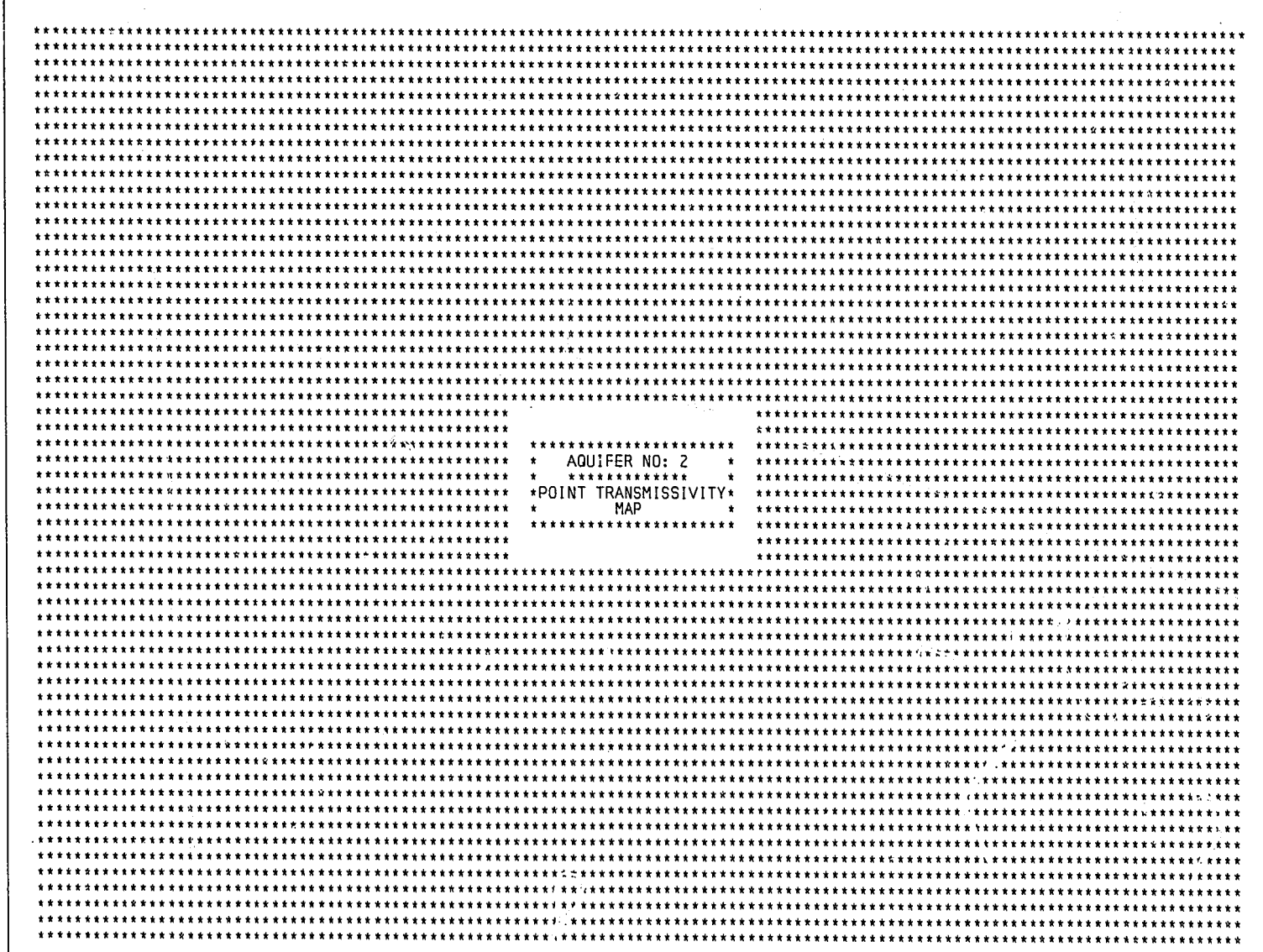

        ***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
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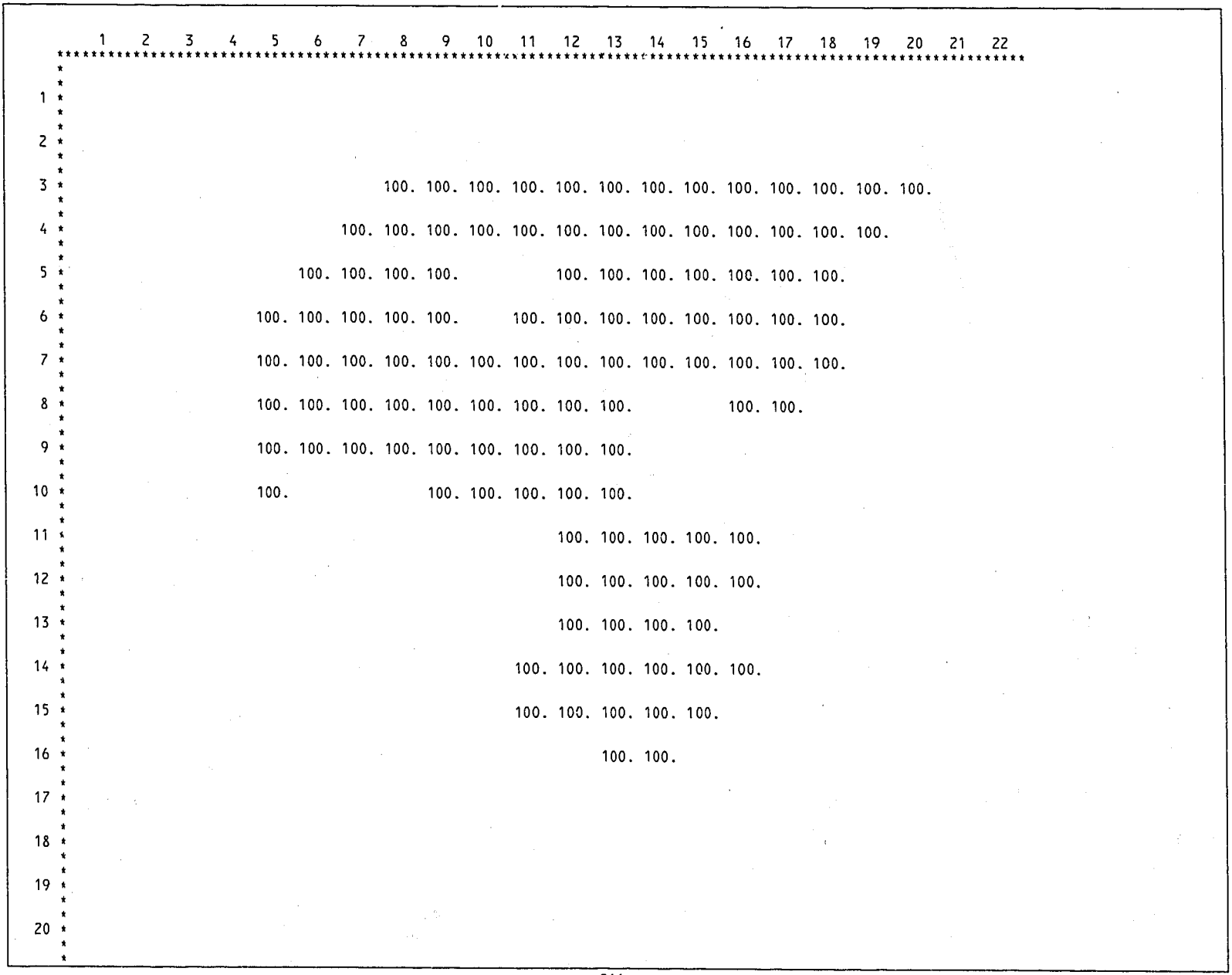

AQUIFER NO: 2
LOWER AQUIFER CONNECTION
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *
   *
   *
22 *

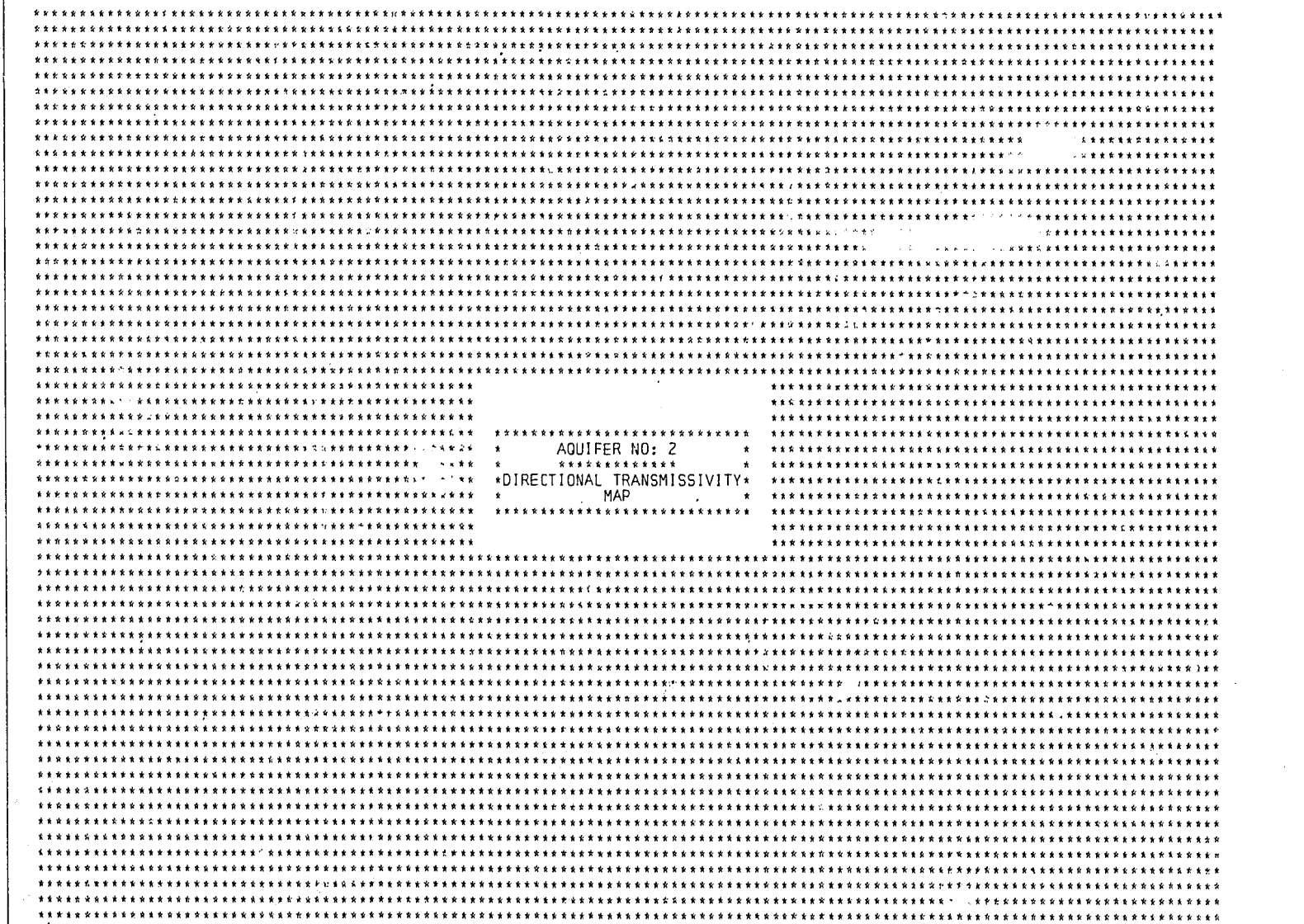

        ***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
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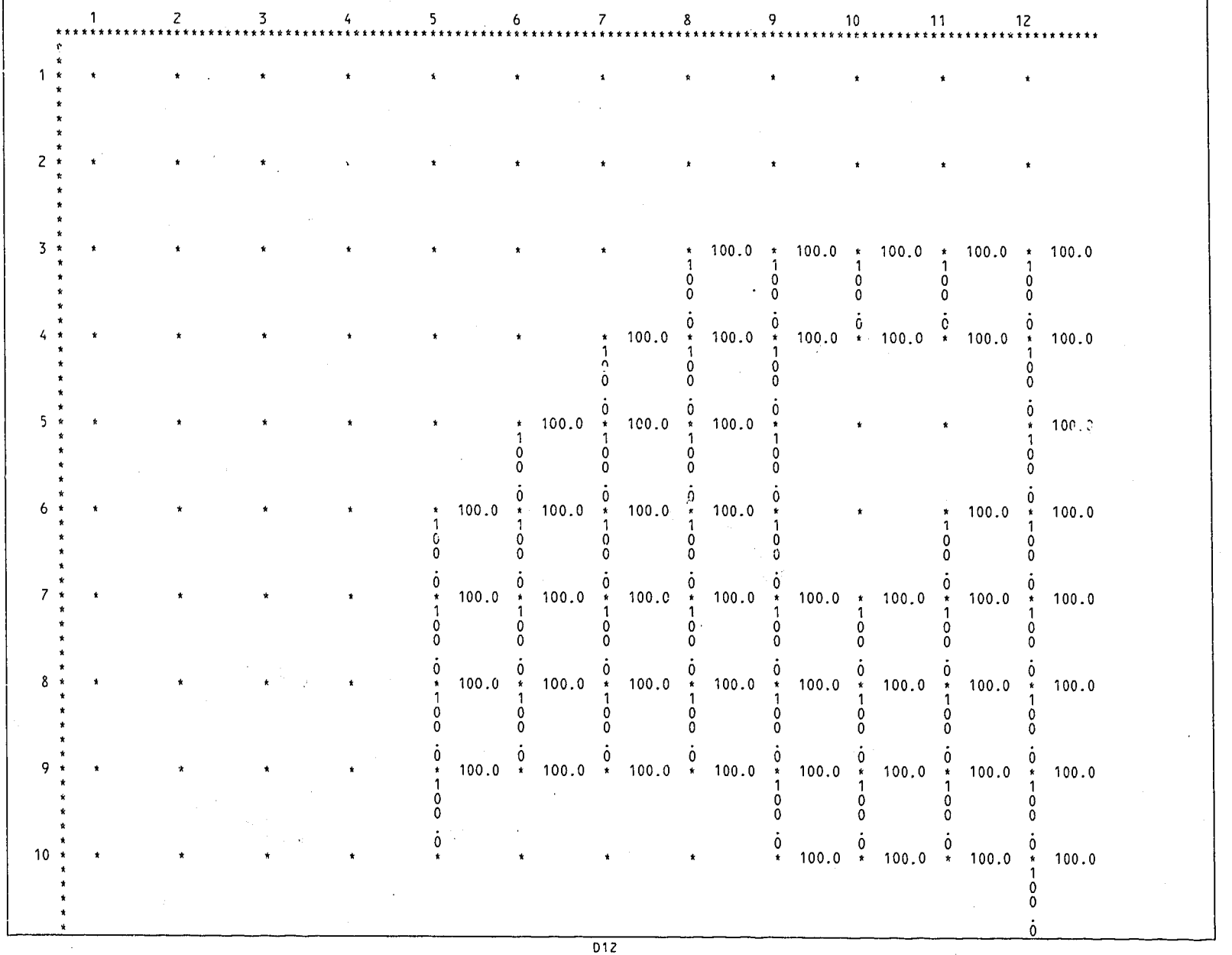

AQUIFER NO: 2
POINT TRANSMISSIVITY
MAP

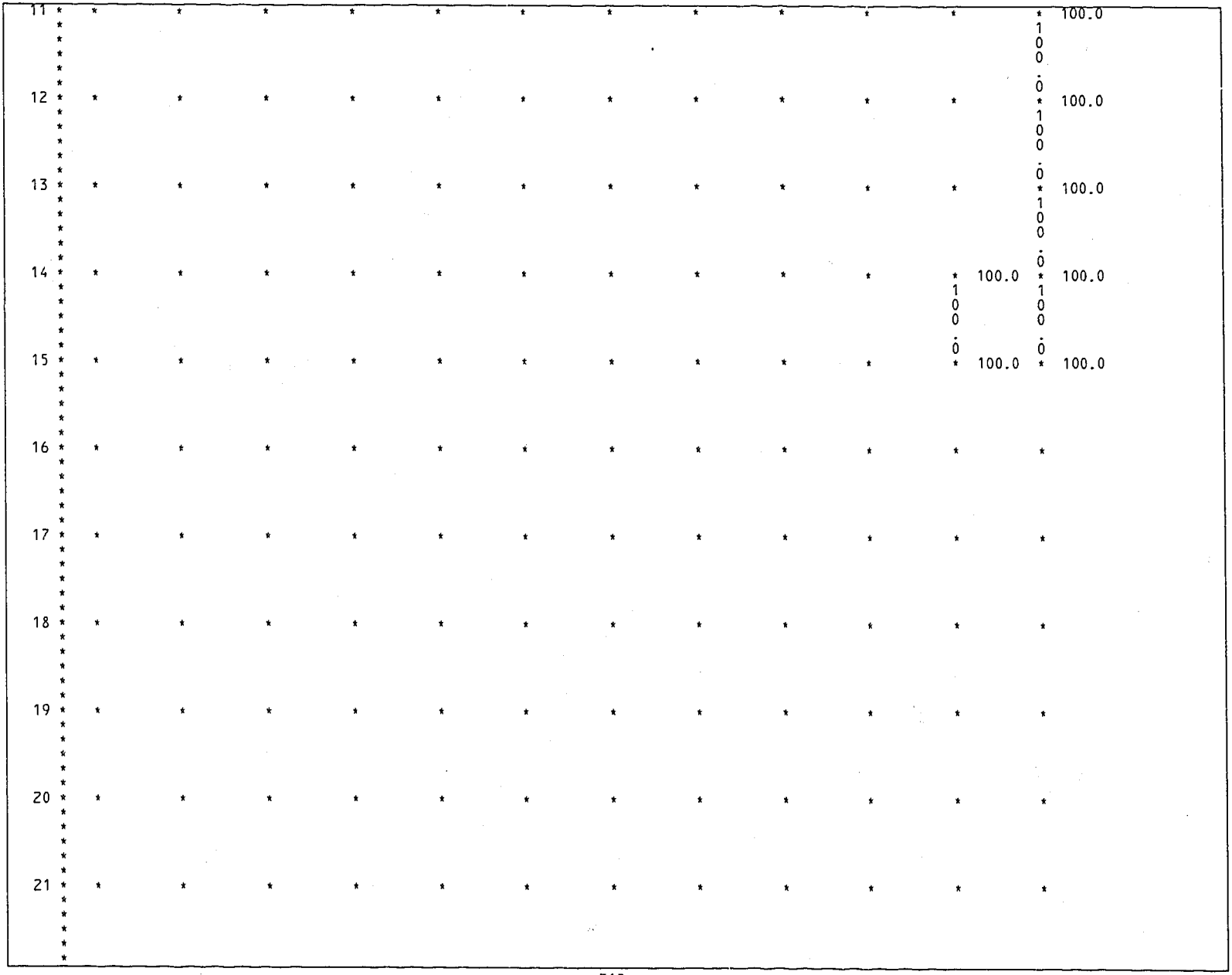

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
2 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
3 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
4 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
5 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
6 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
7 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
8 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
9 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
10 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
11 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
12 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
13 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
14 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
15 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
16 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
17 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
18 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
19 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
20 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.

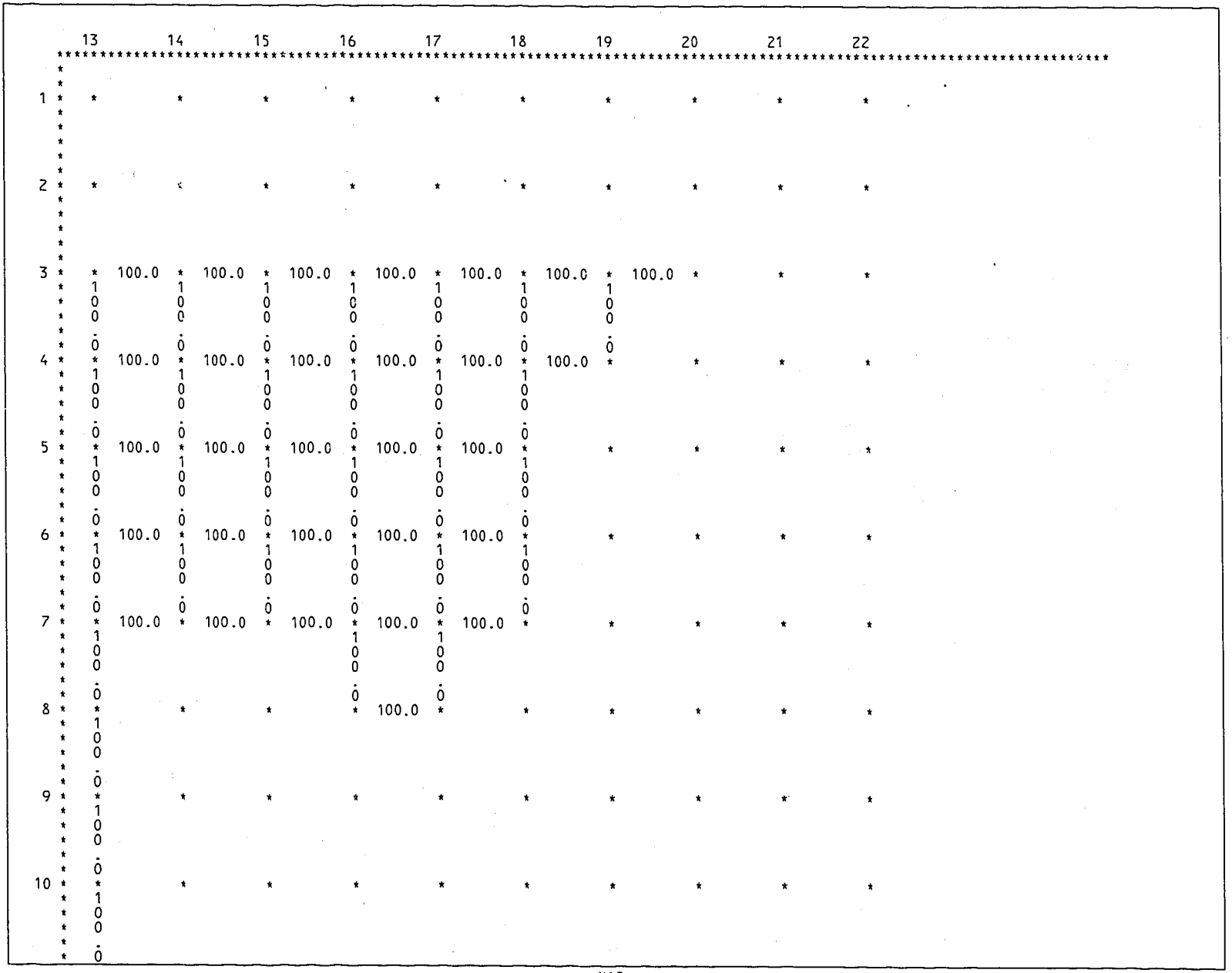
```
21 *
   *
   *
22 *
```

***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+05 ***


AQUIFER NO: 2
DIRECTIONAL TRANSMISSIVITY
MAP


1 2 3 4 5 6 7 8 9 10 11 12
1
2
3 100.0 100.0 100.0 100.0 100.0
4 100.0 100.0 100.0 100.0 100.0 100.0
5 100.0 100.0 100.0 100.0 100.0
6 100.0 100.0 100.0 100.0 100.0 100.0
7 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0
8 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0
9 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0
10 100.0 100.0 100.0 100.0

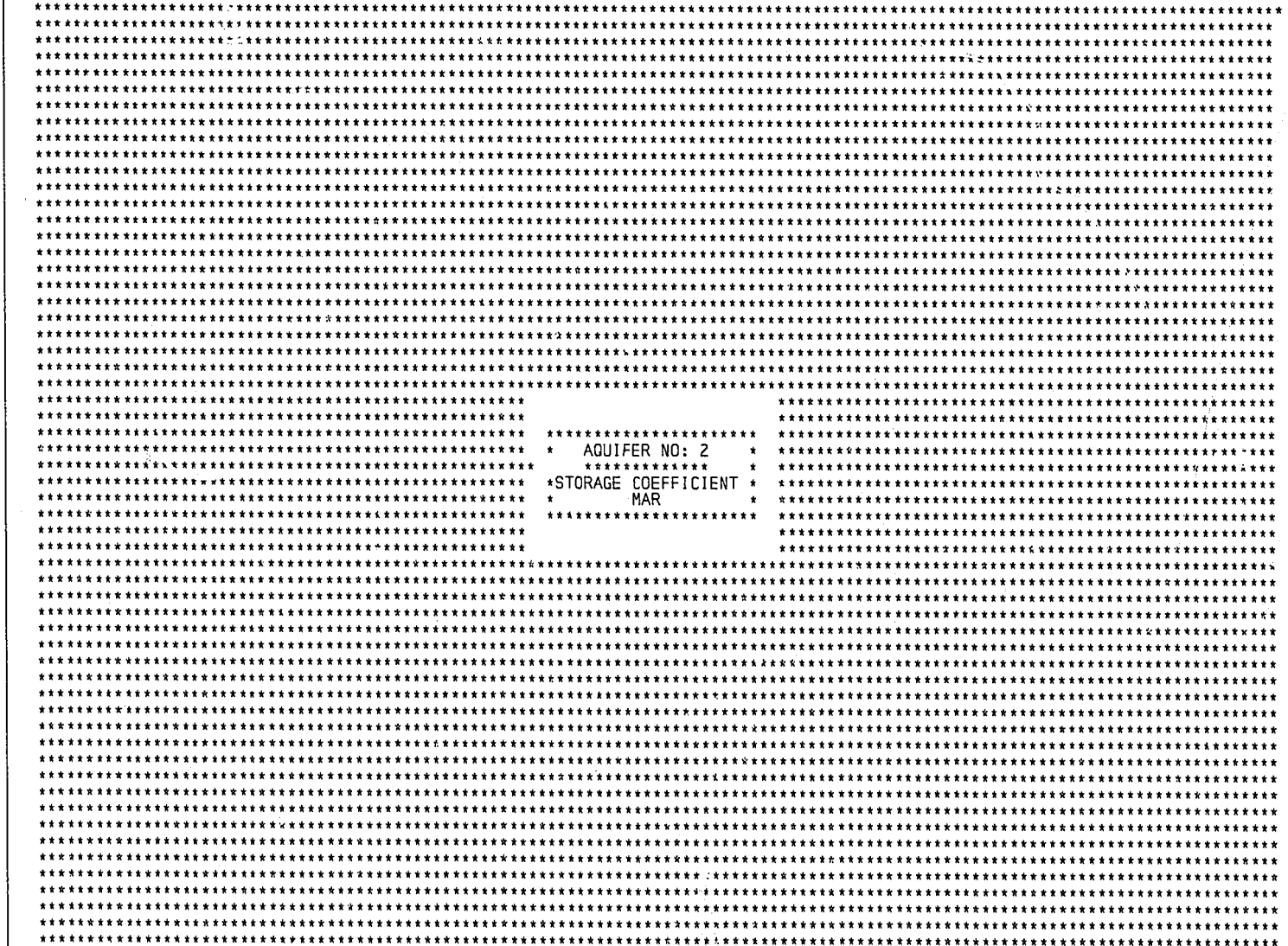

11
12
13
14
15
16
17
18
19
20
21
100.0
100.0
100.0
100.0
100.0
100.0
100.0
100.0
100.0
100.0

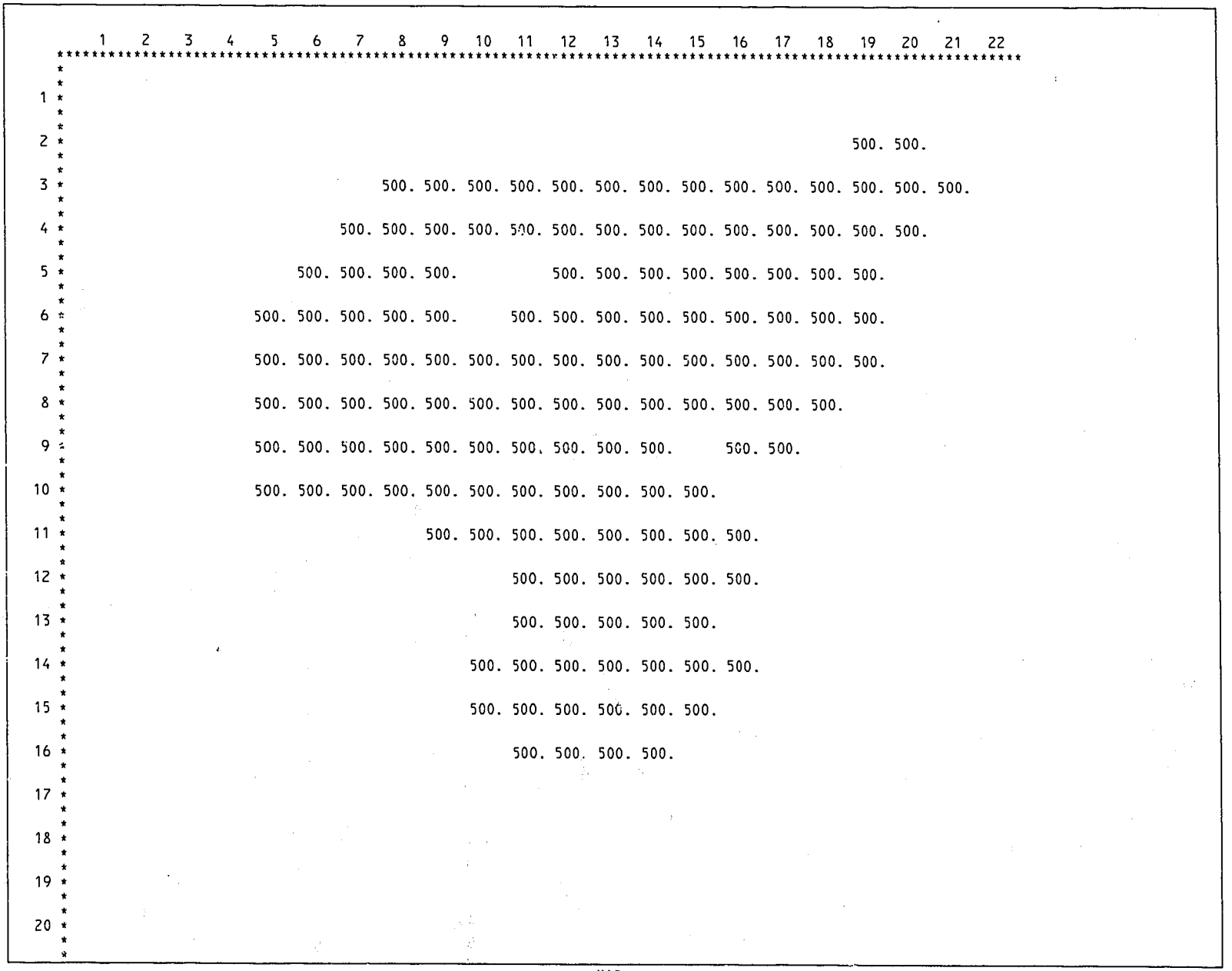

13 14 15 16 17 18 19 20 21 22
1
2
3 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0
4 100.0 100.0 100.0 100.0 100.0 100.0 100.0
5 100.0 100.0 100.0 100.0 100.0 100.0
6 100.0 100.0 100.0 100.0 100.0 100.0
7 100.0 100.0 100.0 100.0 100.0
8 100.0
9
10

11	100.0	100.0	100.0										
12	100.0	100.0	100.0										
13	100.0	100.0											
14	100.0	100.0	100.0										
15	100.0	100.0											
16	100.0												
17													
18													
19													
20													
21													

22 * * * * * * * * * * * *
*
*
*
*
*
*

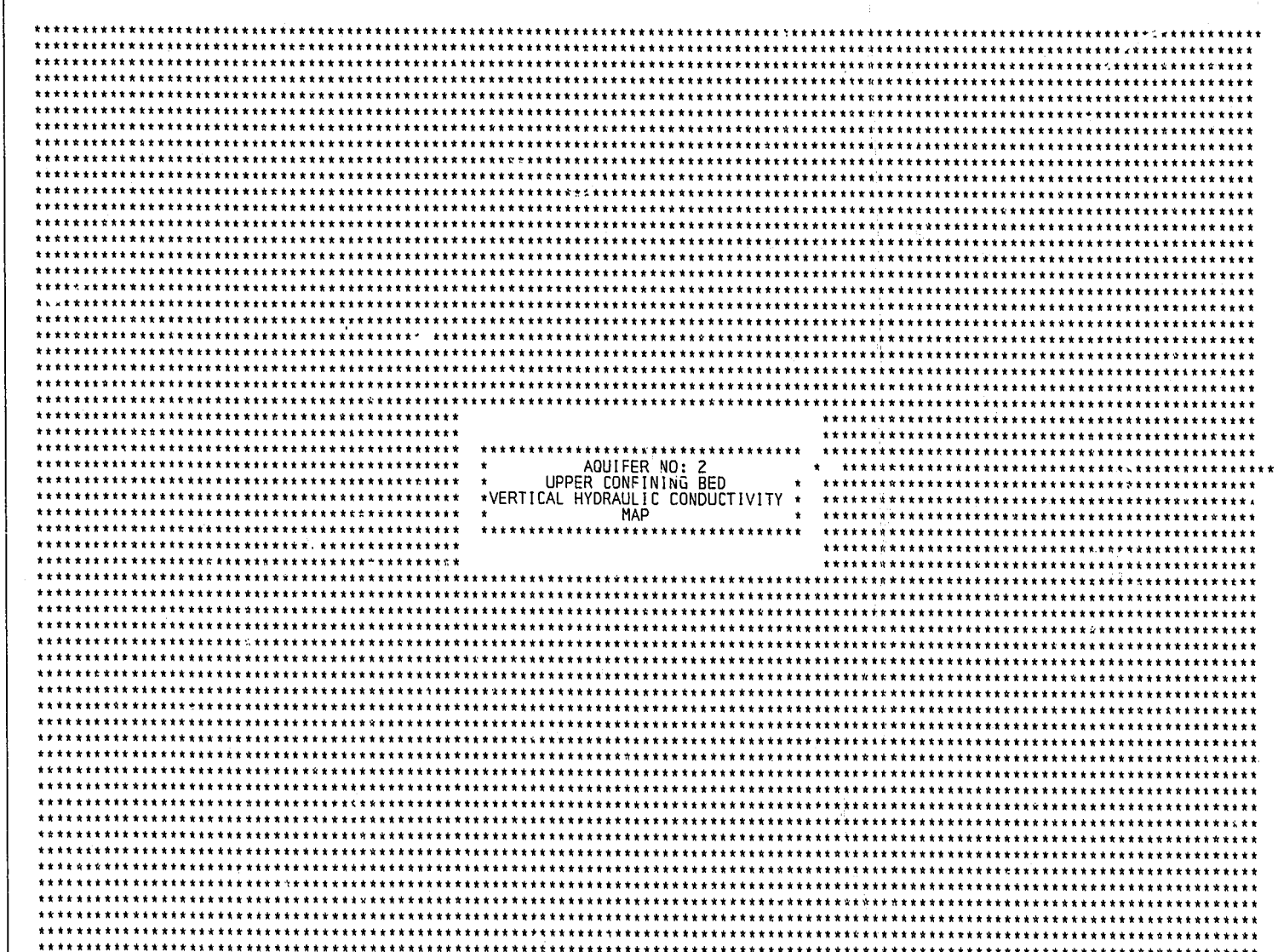
THE VALUES OF THE ARGUMENTS ARE MULTIOLIED BY:
-X(HORIZONTAL)= .10000000E+05
-Y(VERTICAL)= .10000000E+05

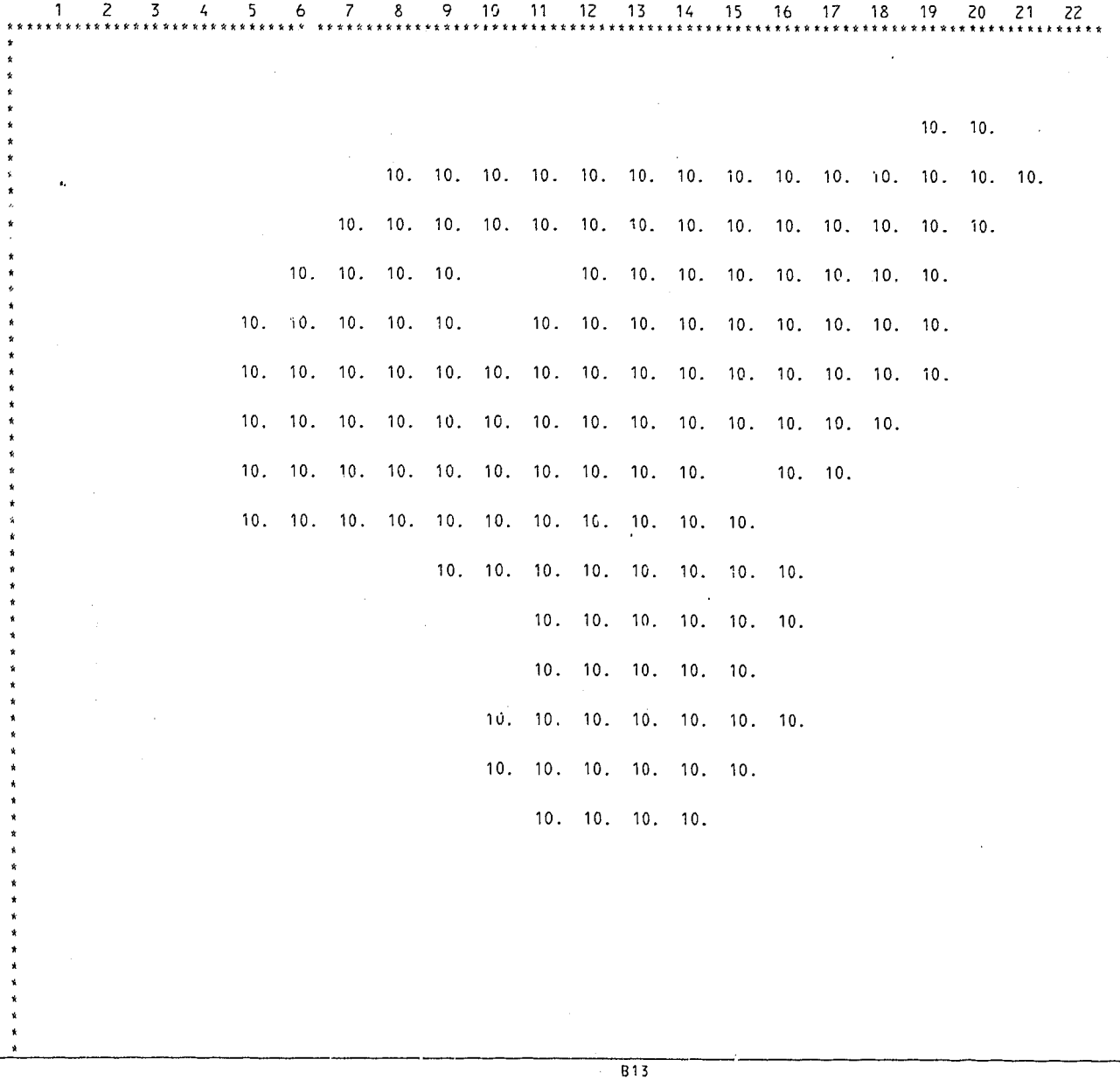

AQUIFER NO: 2
STORAGE COEFFICIENT
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500. 500.
500. 500. 500. 500. 500. 500.

```
21 *
   *
   *
22 *
```

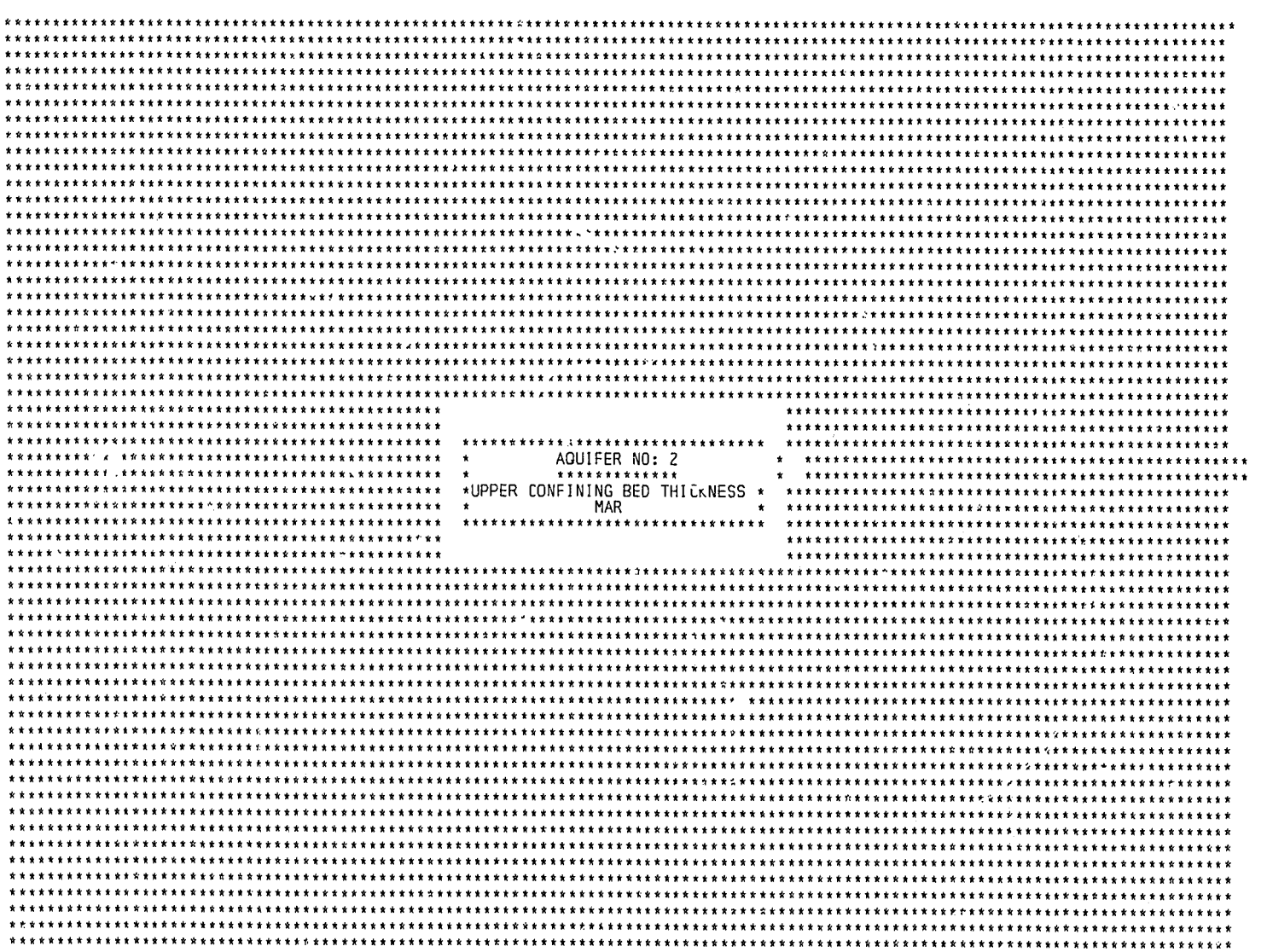
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+06 ***

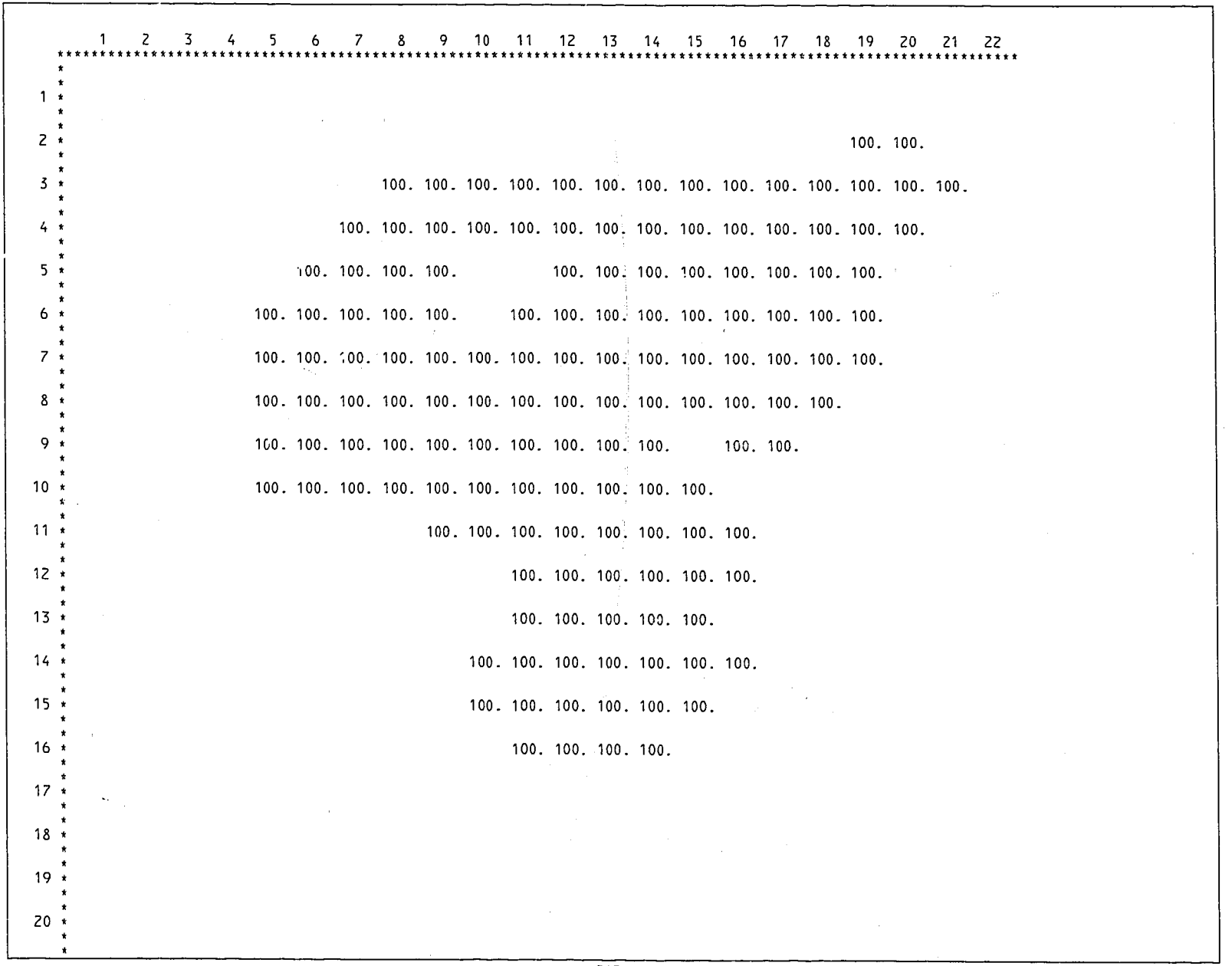

AQUIFER NO: 2
UPPER CONFINING BED
VERTICAL HYDRAULIC CONDUCTIVITY
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10.

```
21 *
   *
   *
22 *
```

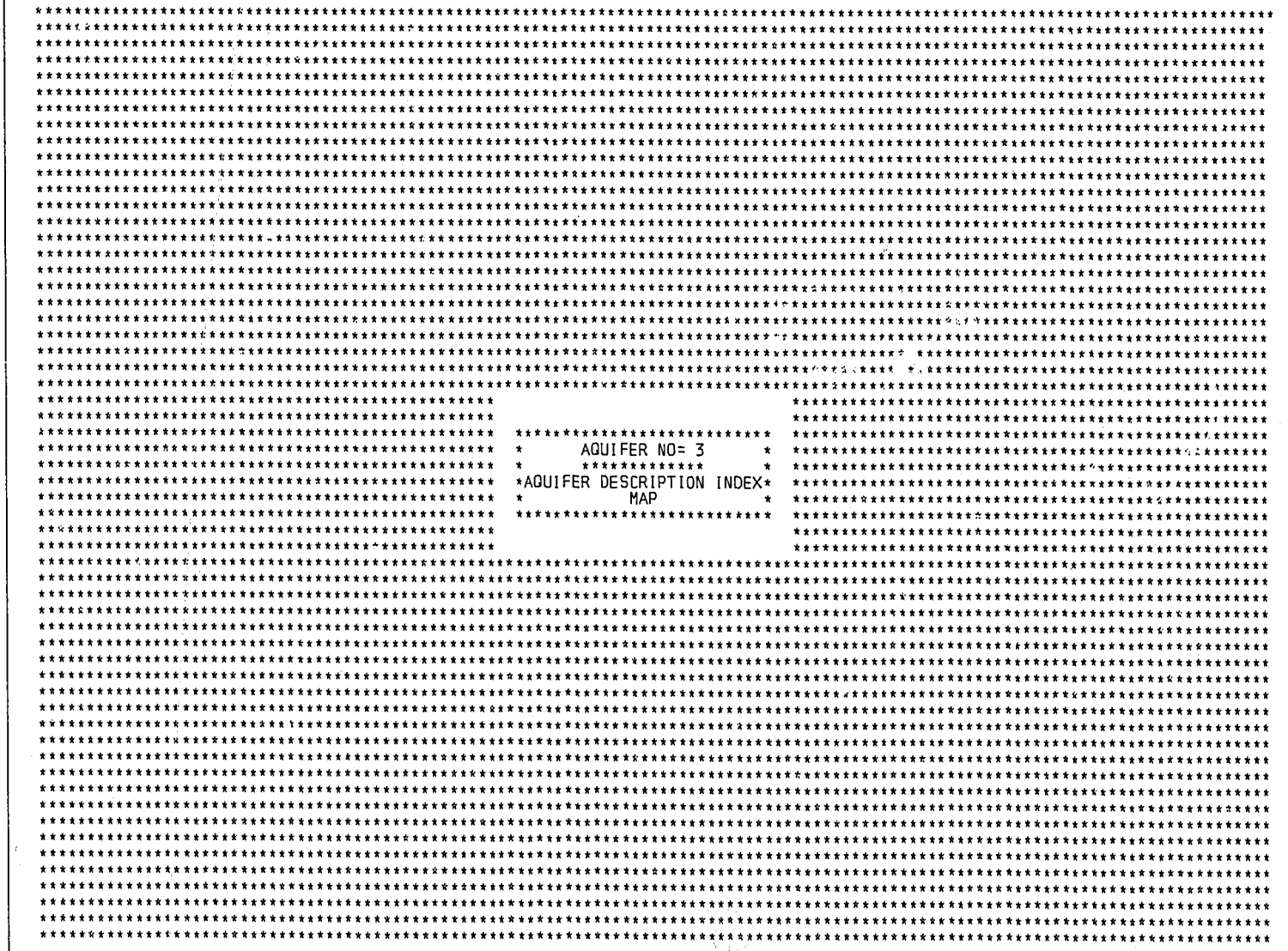
***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+10 ***

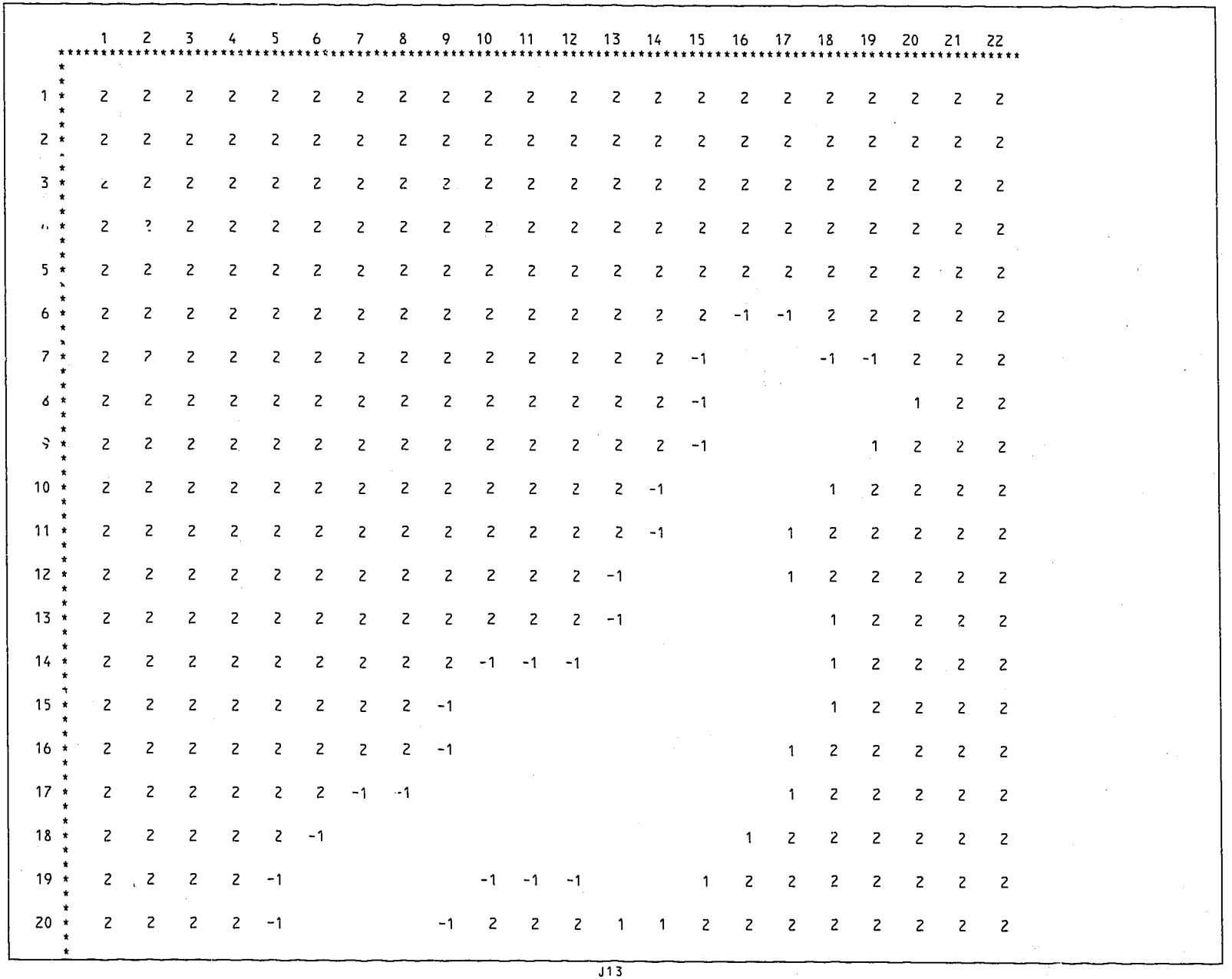

AQUIFER NO: 2
UPPER CONFINING BED THICKNESS
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1
2 100. 100.
3 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
4 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
5 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
6 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
7 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
8 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
9 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
10 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
11 100. 100. 100. 100. 100. 100. 100. 100.
12 100. 100. 100. 100. 100. 100.
13 100. 100. 100. 100. 100.
14 100. 100. 100. 100. 100. 100. 100.
15 100. 100. 100. 100. 100. 100.
16 100. 100. 100. 100.
17
18
19
20

```
21 *
   *
   *
22 *
```

***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***

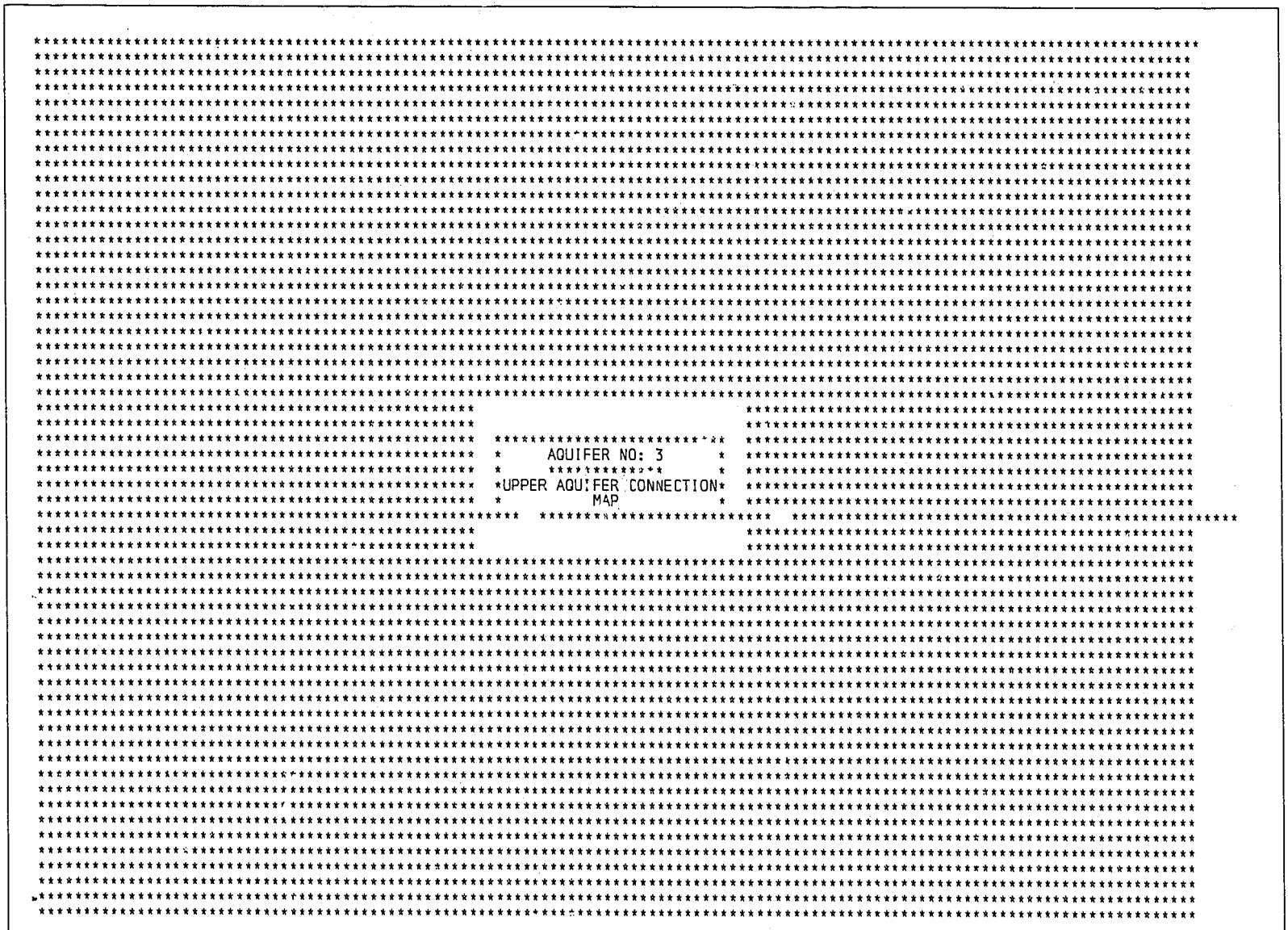

AQUIFER NO= 3
AQUIFER DESCRIPTION INDEX
MAP

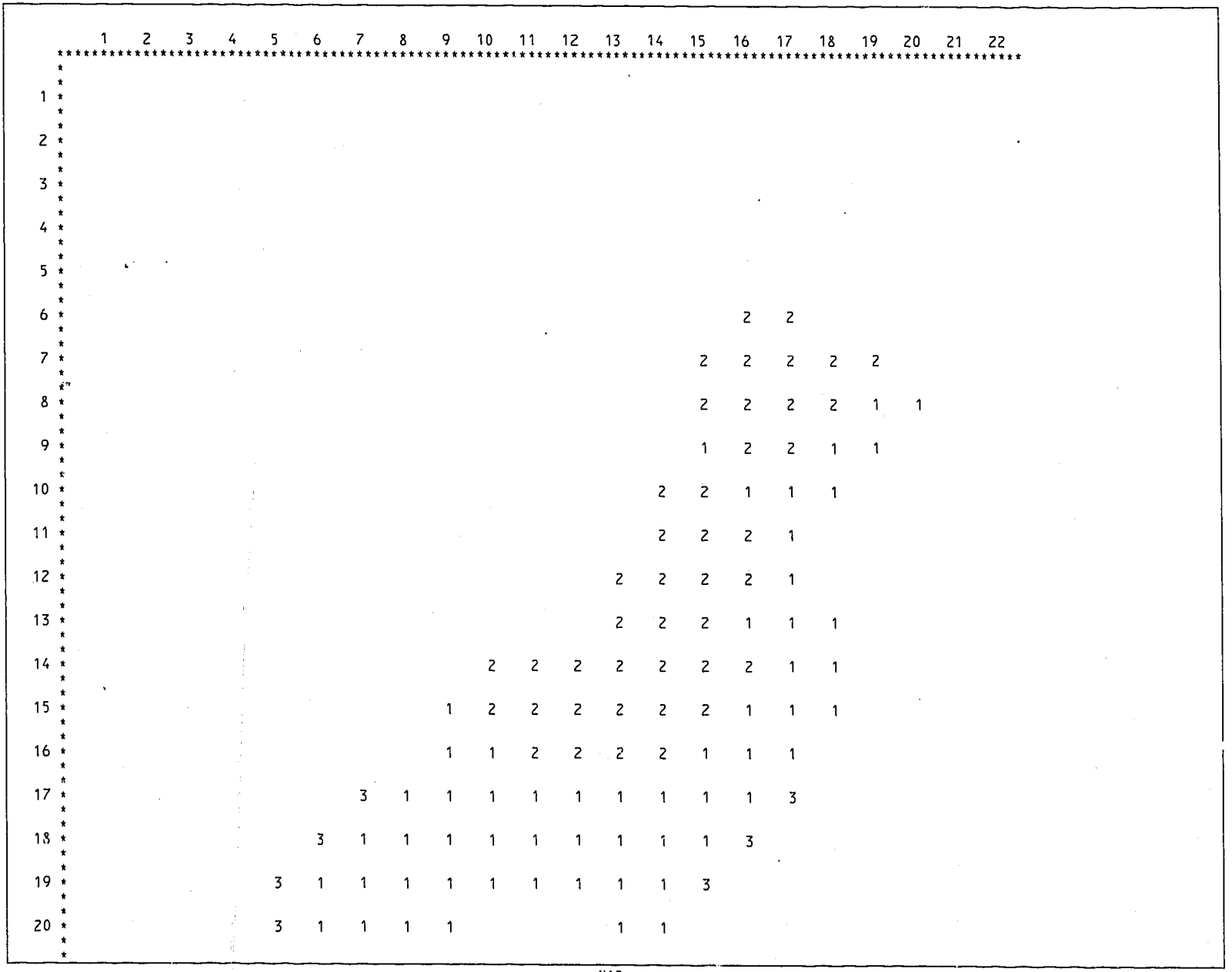


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	-1	-1	2	2	2	2	2
7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	-1			-1	-1	2	2	2
8	2	2	2	2	2	2	2	2	2	2	2	2	2	2	-1					1	2	2
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	-1				1	2	2	2
10	2	2	2	2	2	2	2	2	2	2	2	2	2	-1				1	2	2	2	2
11	2	2	2	2	2	2	2	2	2	2	2	2	2	-1			1	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	2	2	-1				1	2	2	2	2	2
13	2	2	2	2	2	2	2	2	2	2	2	2	-1					1	2	2	2	2
14	2	2	2	2	2	2	2	2	2	-1	-1	-1						1	2	2	2	2
15	2	2	2	2	2	2	2	2	-1									1	2	2	2	2
16	2	2	2	2	2	2	2	2	-1								1	2	2	2	2	2
17	2	2	2	2	2	2	-1	-1									1	2	2	2	2	2
18	2	2	2	2	2	-1										1	2	2	2	2	2	2
19	2	2	2	2	-1					-1	-1	-1			1	2	2	2	2	2	2	2
20	2	2	2	2	-1				-1	2	2	2	1	1	2	2	2	2	2	2	2	2

```
 21 *    2    2    2    2    2   -1   -1   -1    2    2    2    2    2    2    2    2    2    2    2    2    2    2
    *
    *
 22 *    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2


          ***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
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AQUIFER NO: 3
UPPER AQUIFER CONNECTION
MAP

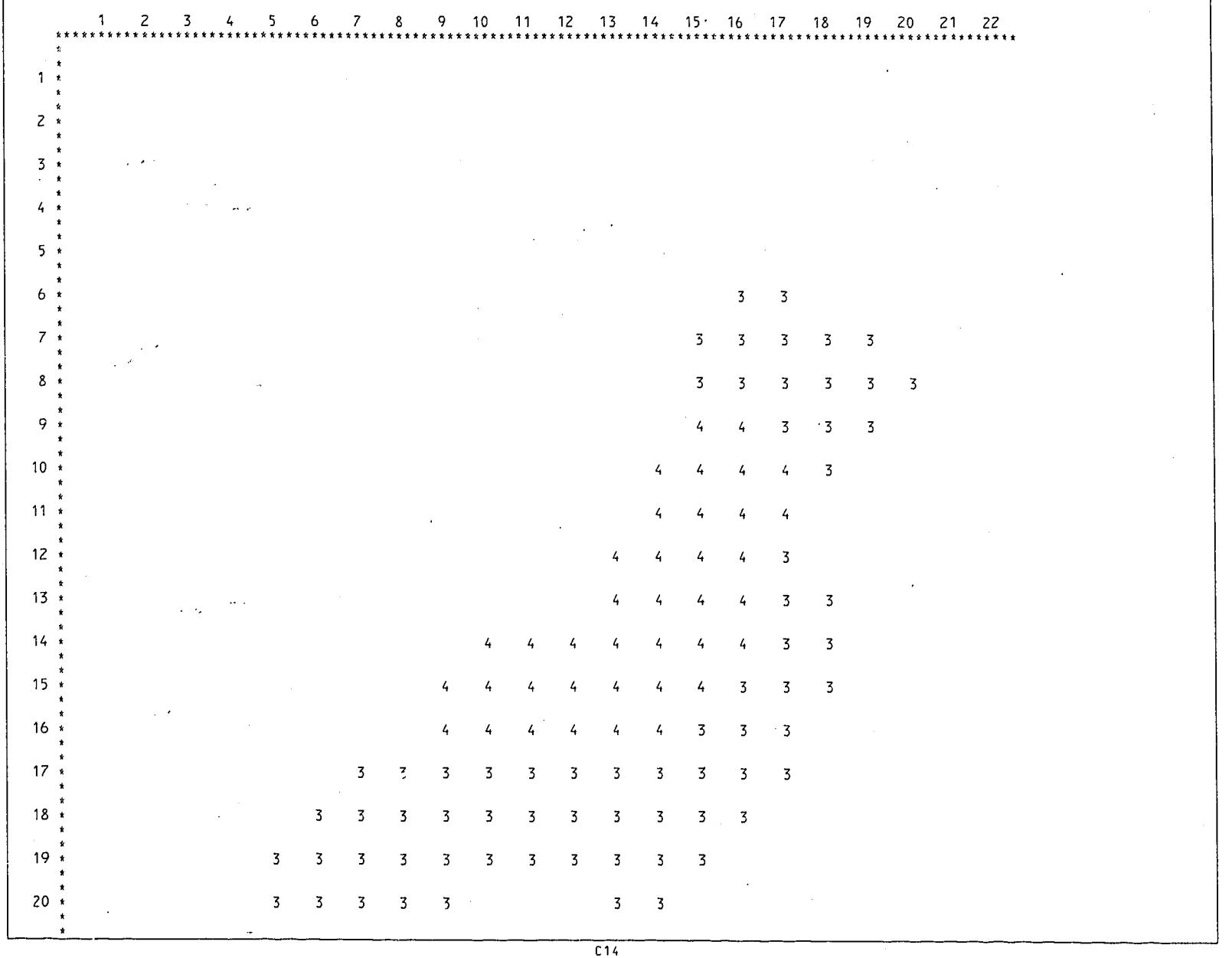

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
6 2 2
7 2 2 2 2 2
8 2 2 2 2 1 1
9 1 2 2 1 1
10 2 2 1 1 1
11 2 2 2 1
12 2 2 2 2 1
13 2 2 2 1 1 1
14 2 2 2 2 2 2 2 1 1
15 1 2 2 2 2 2 2 1 1 1
16 1 1 2 2 2 2 1 1 1
17 3 1 1 1 1 1 1 1 1 1 3
18 3 1 1 1 1 1 1 1 1 1 3
19 3 1 1 1 1 1 1 1 1 1 3
20 3 1 1 1 1 1 1

```
21 *                          3    1    1
   *
   *
22 *


         ***VALUES OF ARGUMENT MULTIPLYED BY    .10000000E+01 ***
```

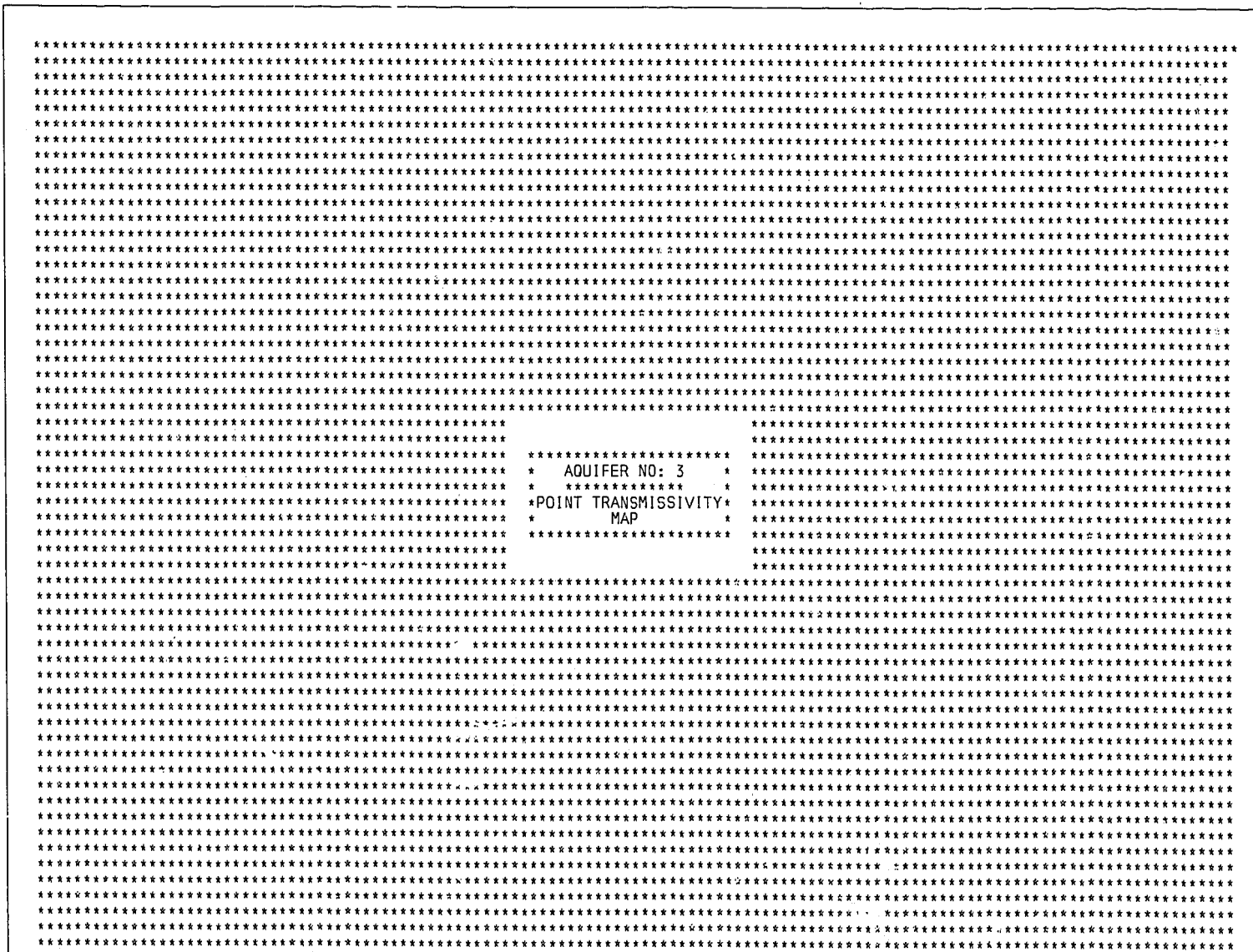
AQUIFER NO: 3

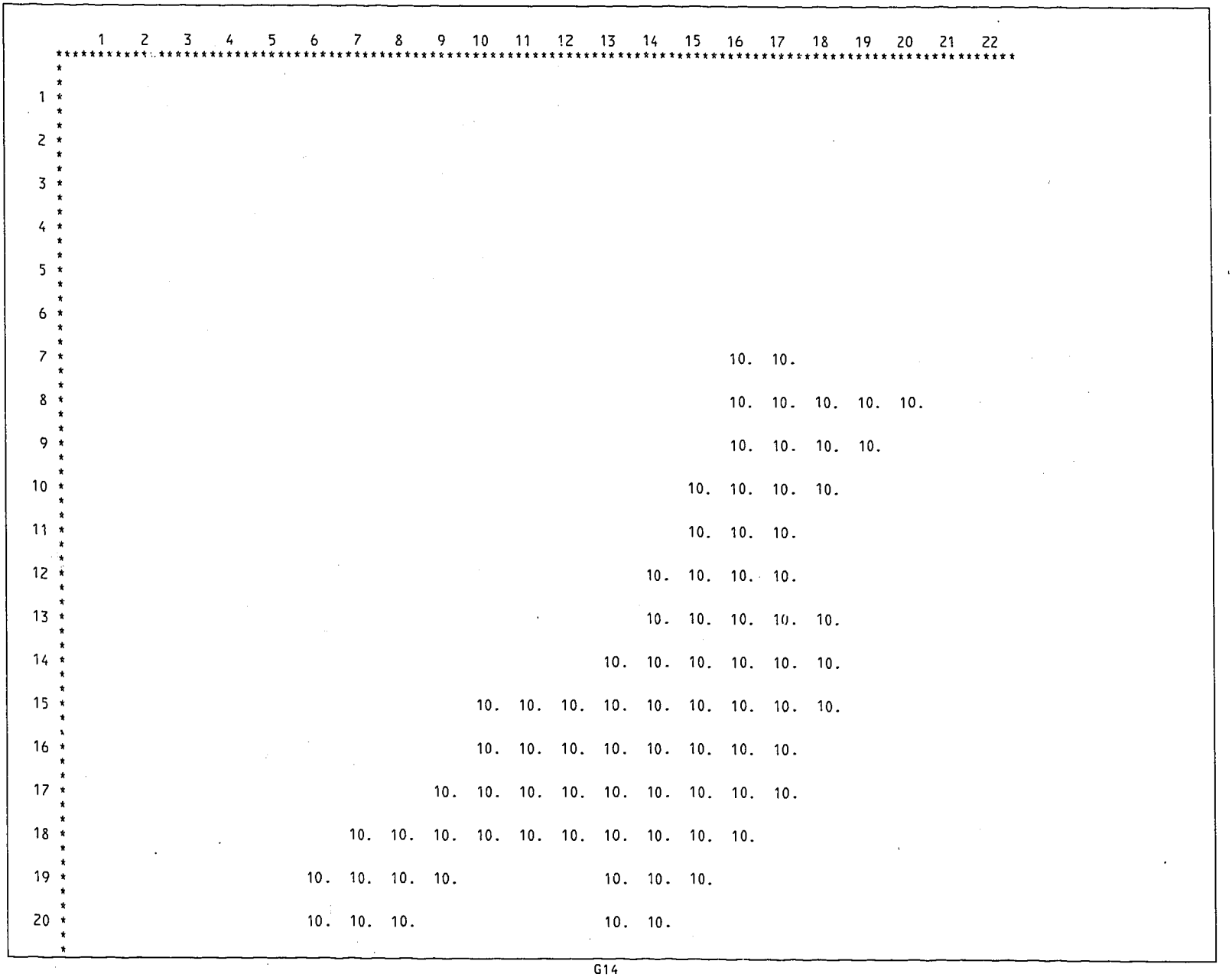
LOWER AQUIFER CONNECTION MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *                        3    3    3
   *
   *
22 *
```

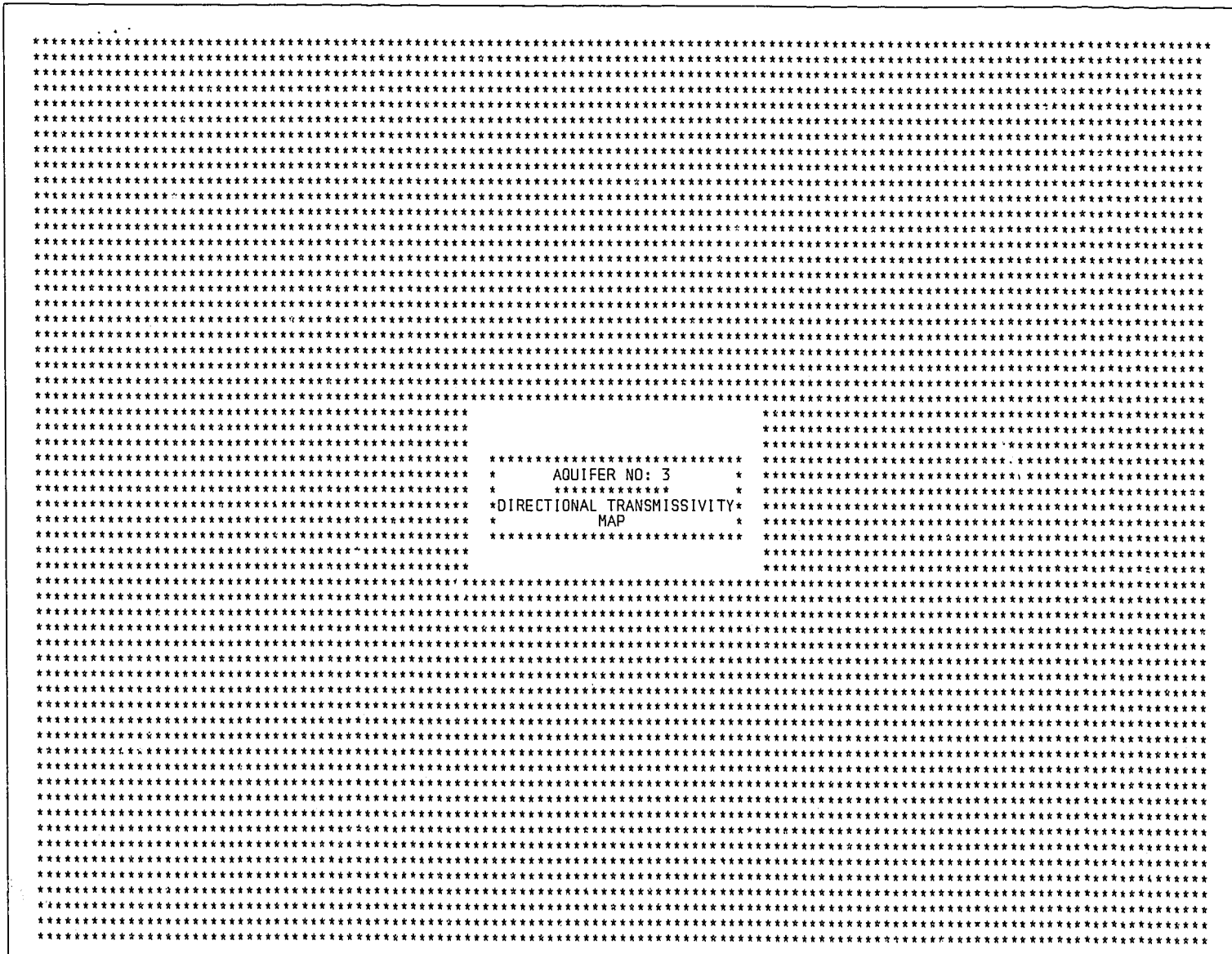
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***

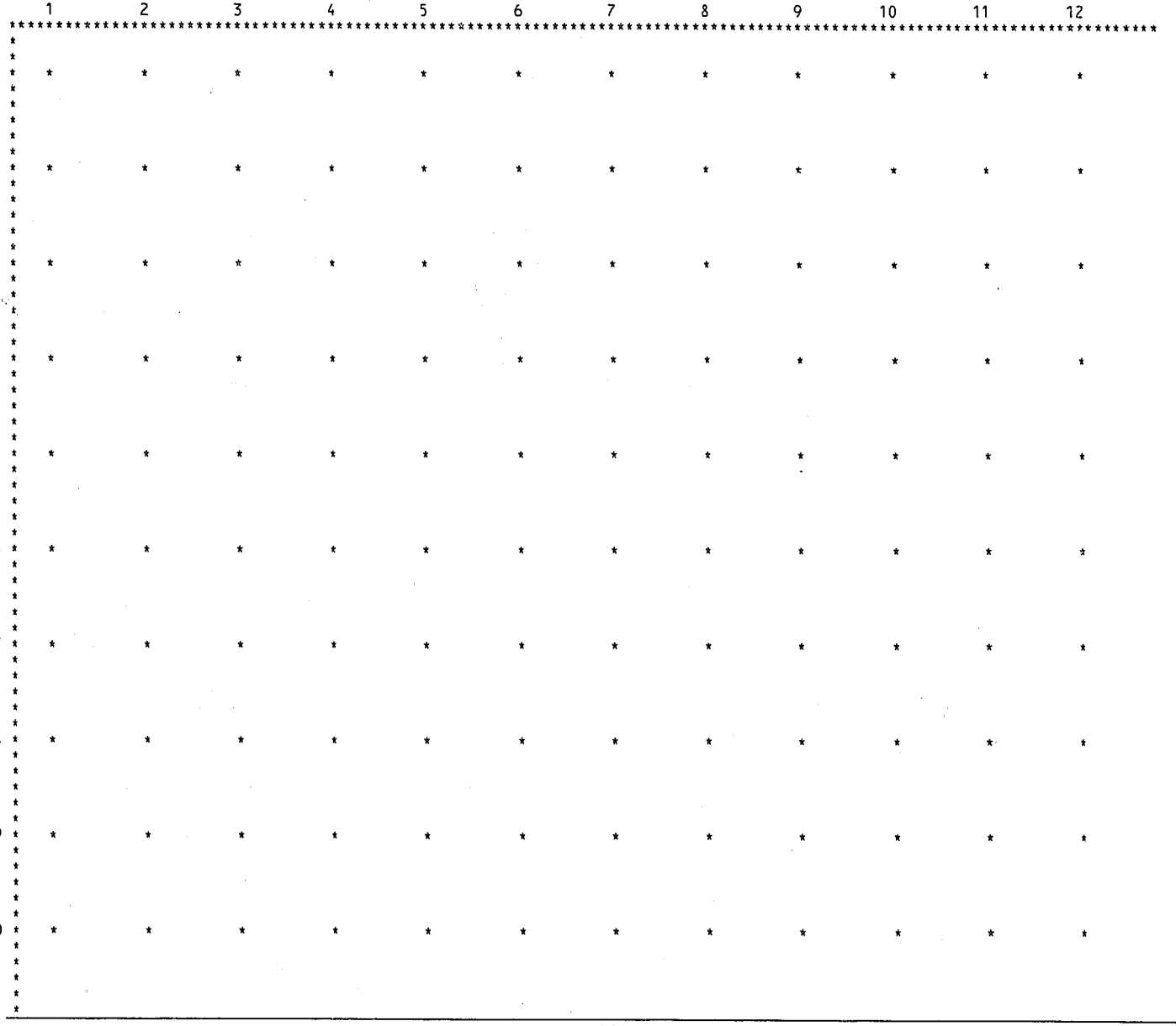

AQUIFER NO: 3
POINT TRANSMISSIVITY
MAP

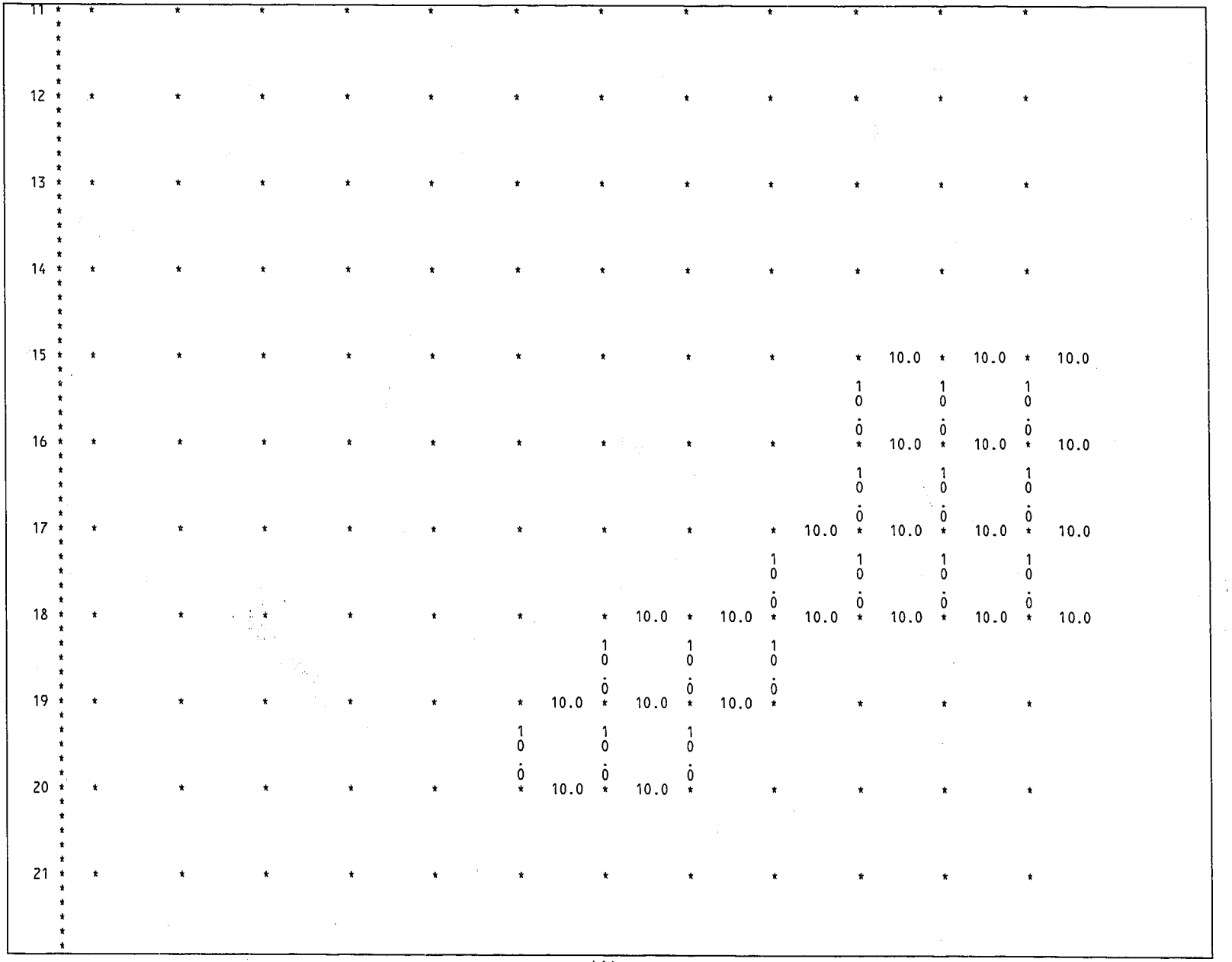

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
10. 10.
10. 10. 10. 10. 10.
10. 10. 10. 10.
10. 10. 10. 10.
10. 10. 10.
10. 10. 10. 10.
10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
10. 10. 10. 10. 10. 10. 10. 10. 10. 10.

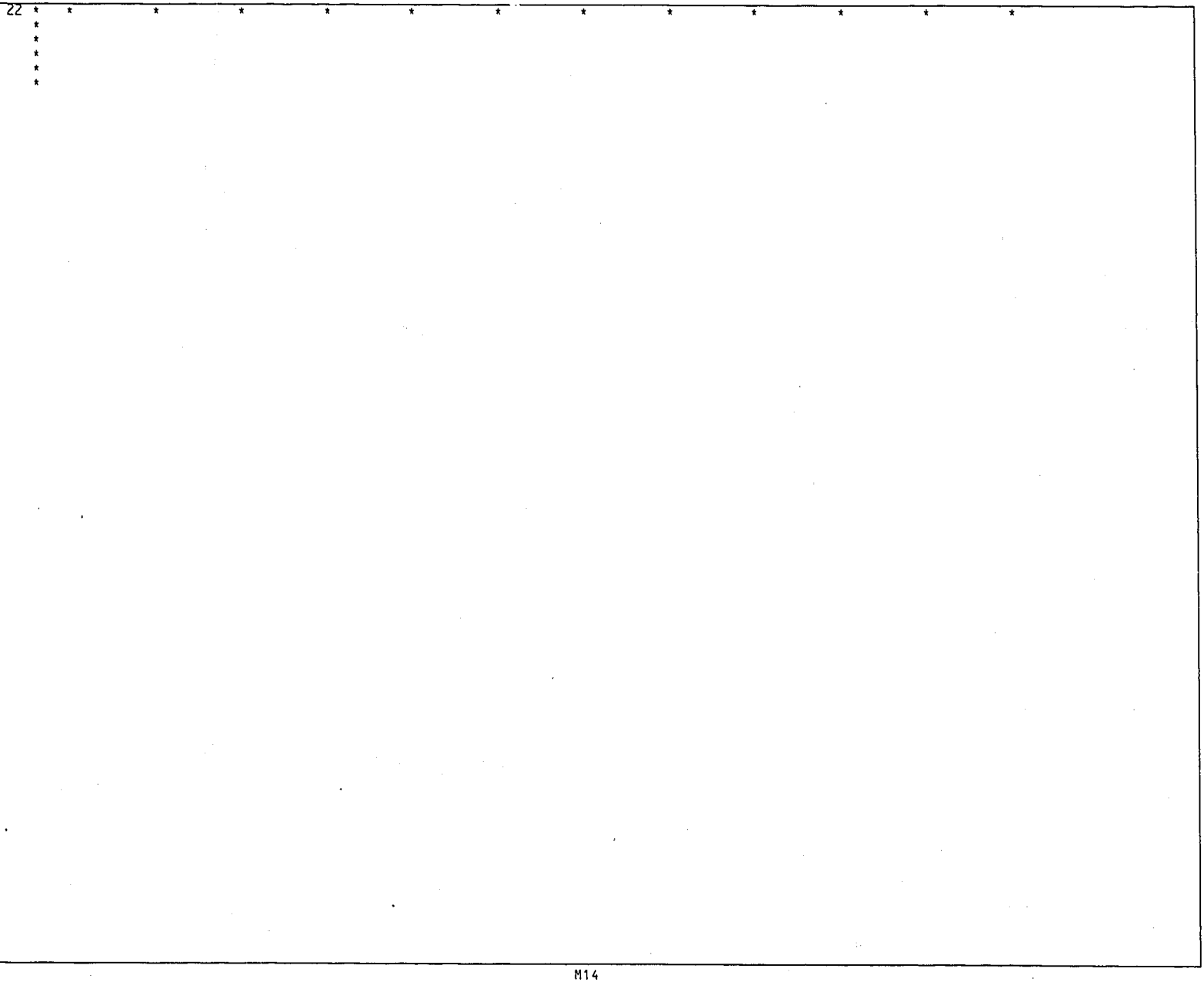
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21 *
   *
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22 *
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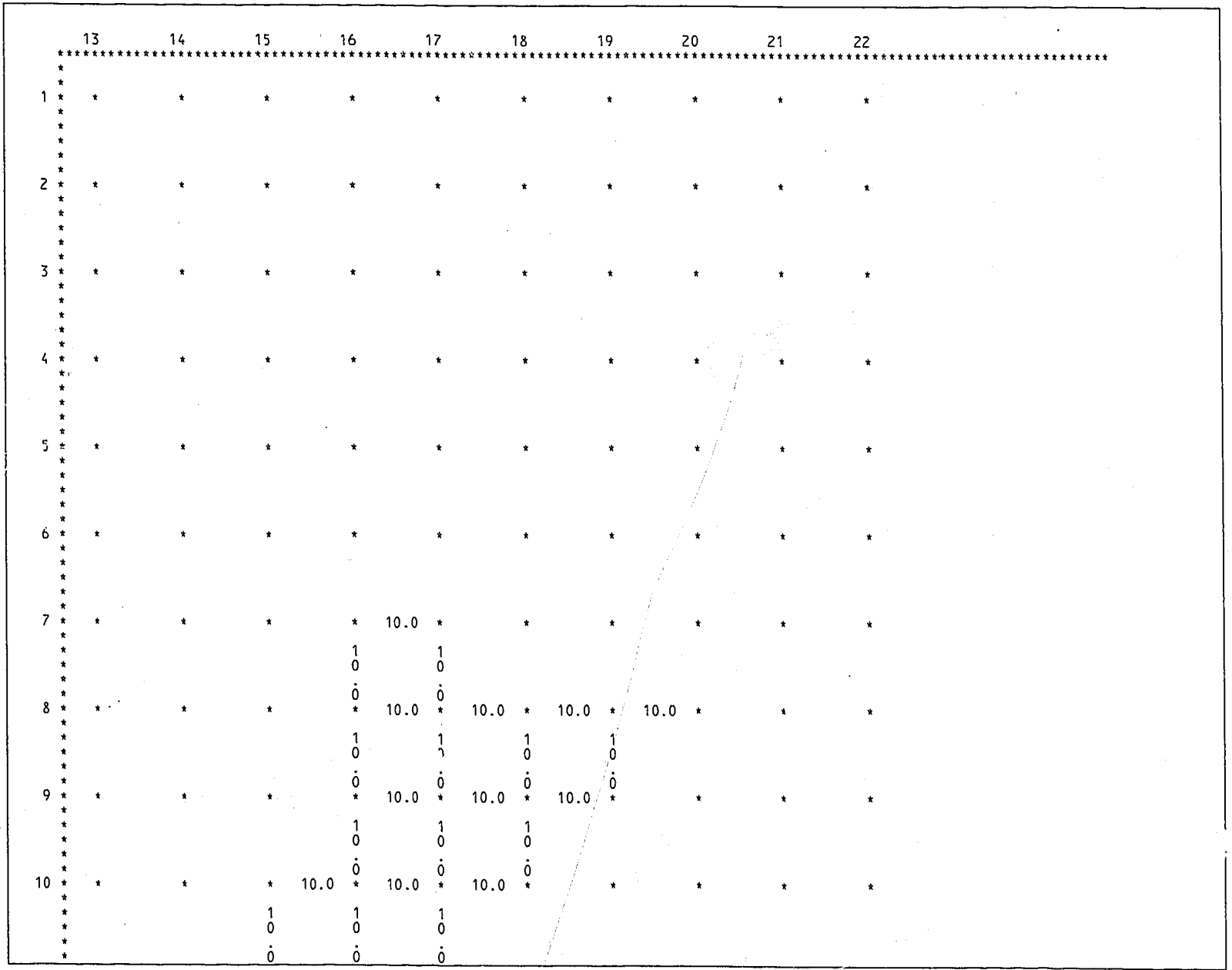
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+05 ***

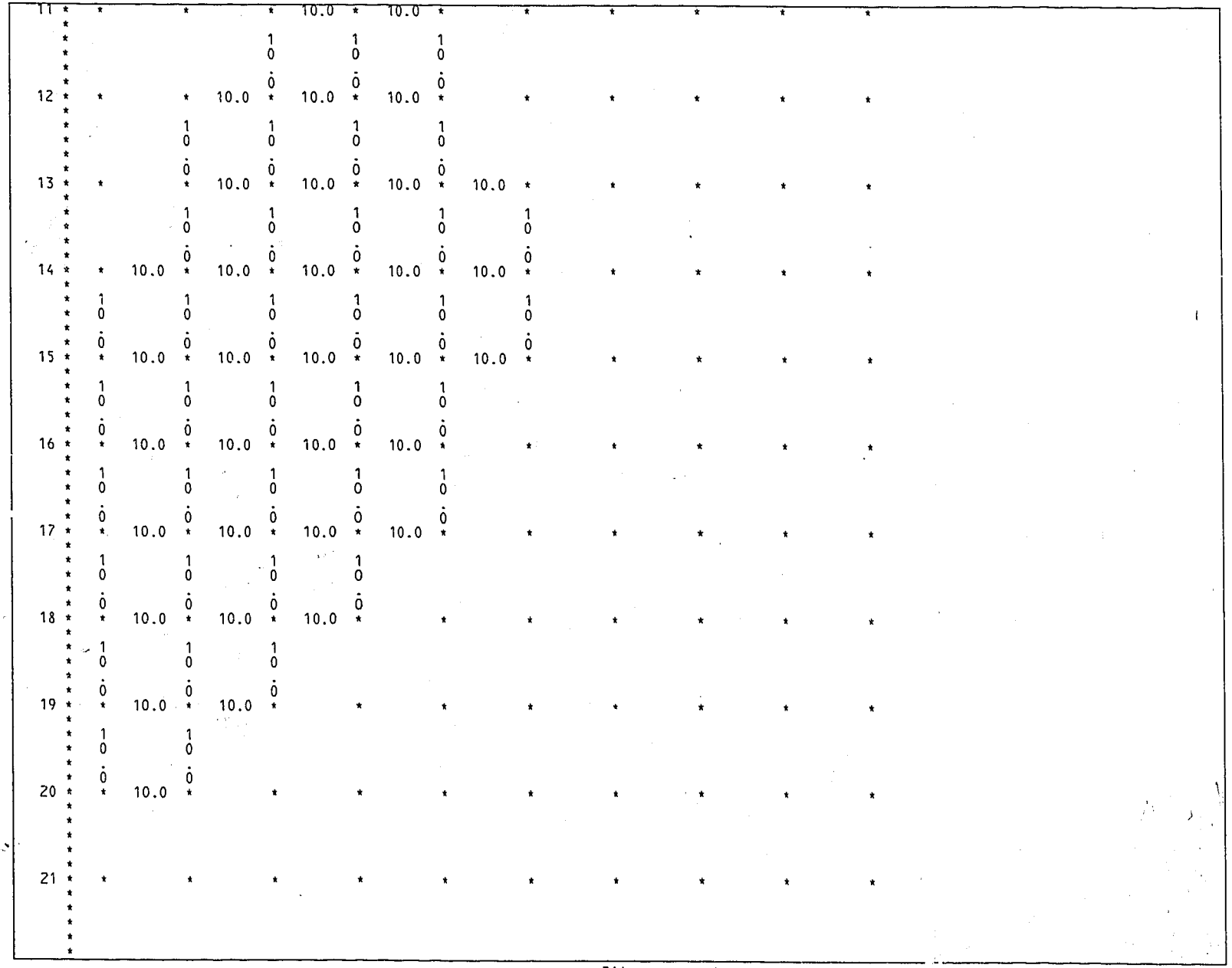

AQUIFER NO: 3
DIRECTIONAL TRANSMISSIVITY
MAP


1
2
3
4
5
6
7
8
9
10
11
12


11
12
13
14
15
16
17
18
19
20
21
10.0

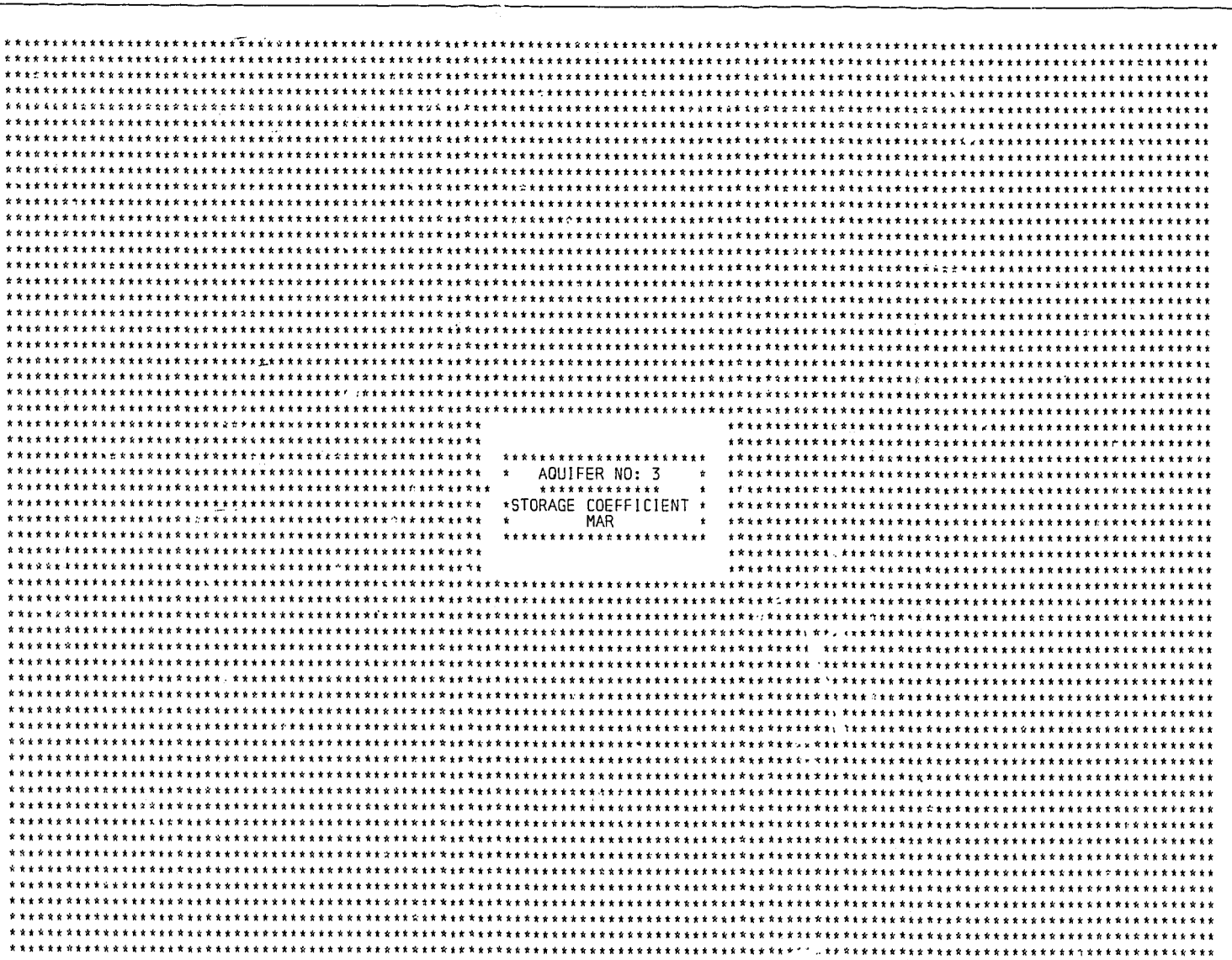

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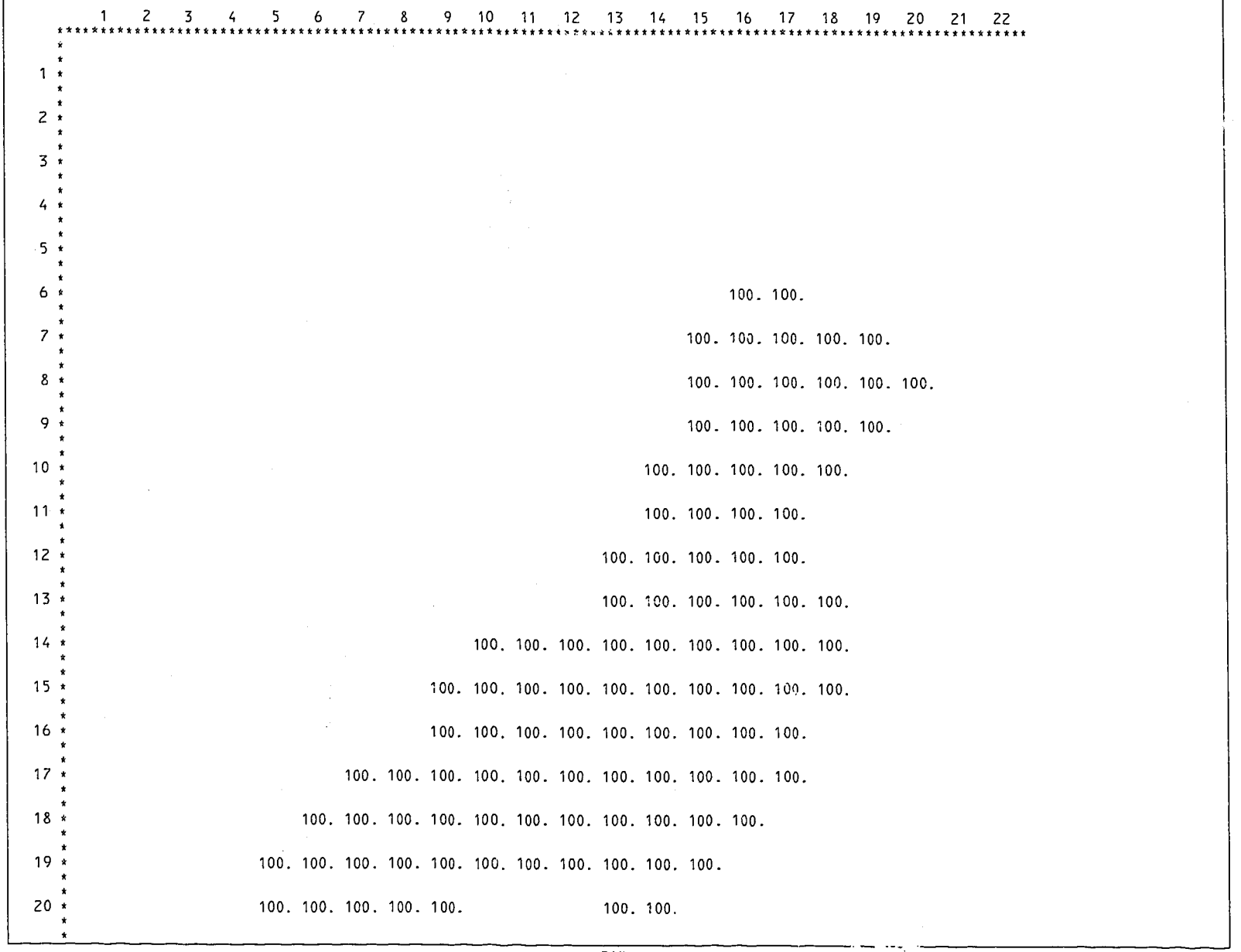

13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10
10.0



22 * * * * * * * * * * * *
*
*
*
*
*

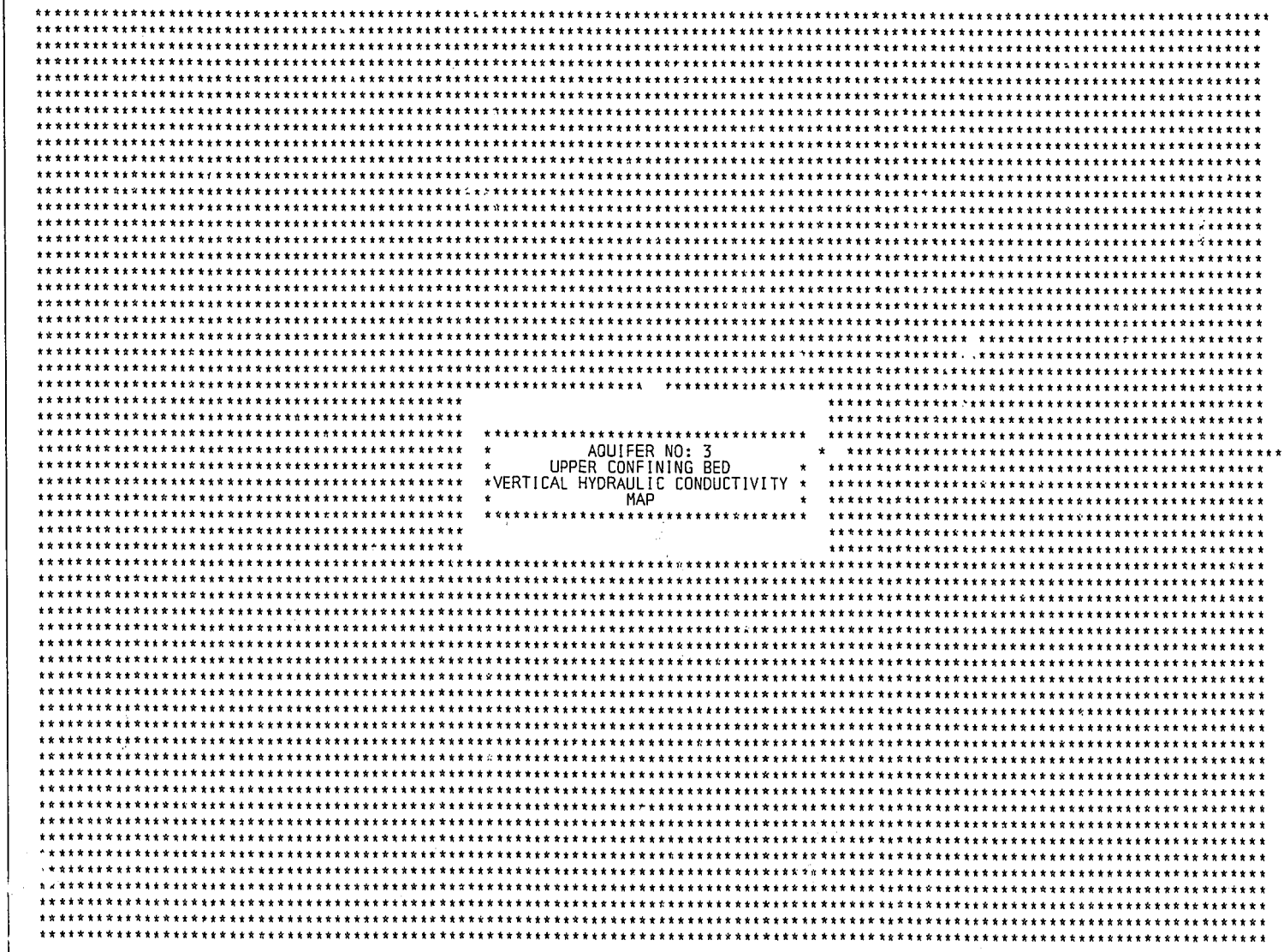
THE VALUES OF THE ARGUMENTS ARE MULTIOLIED BY:
-X(HORIZONTAL)= .10000000E+05
-Y(VERTICAL)= .10000000E+05

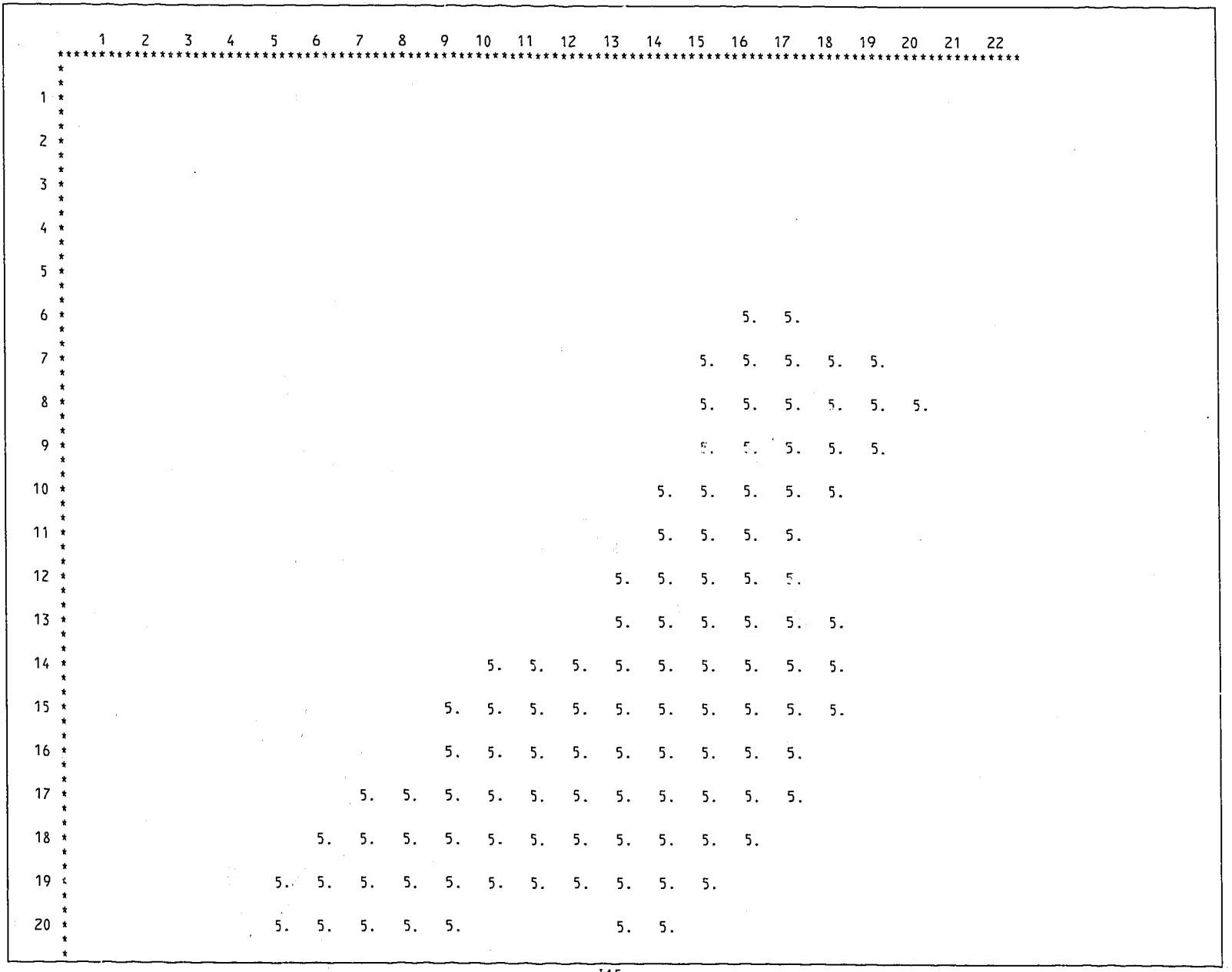

AQUIFER NO: 3
STORAGE COEFFICIENT
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100.

```
21 *                        100. 100. 100.
   *
   *
22 *

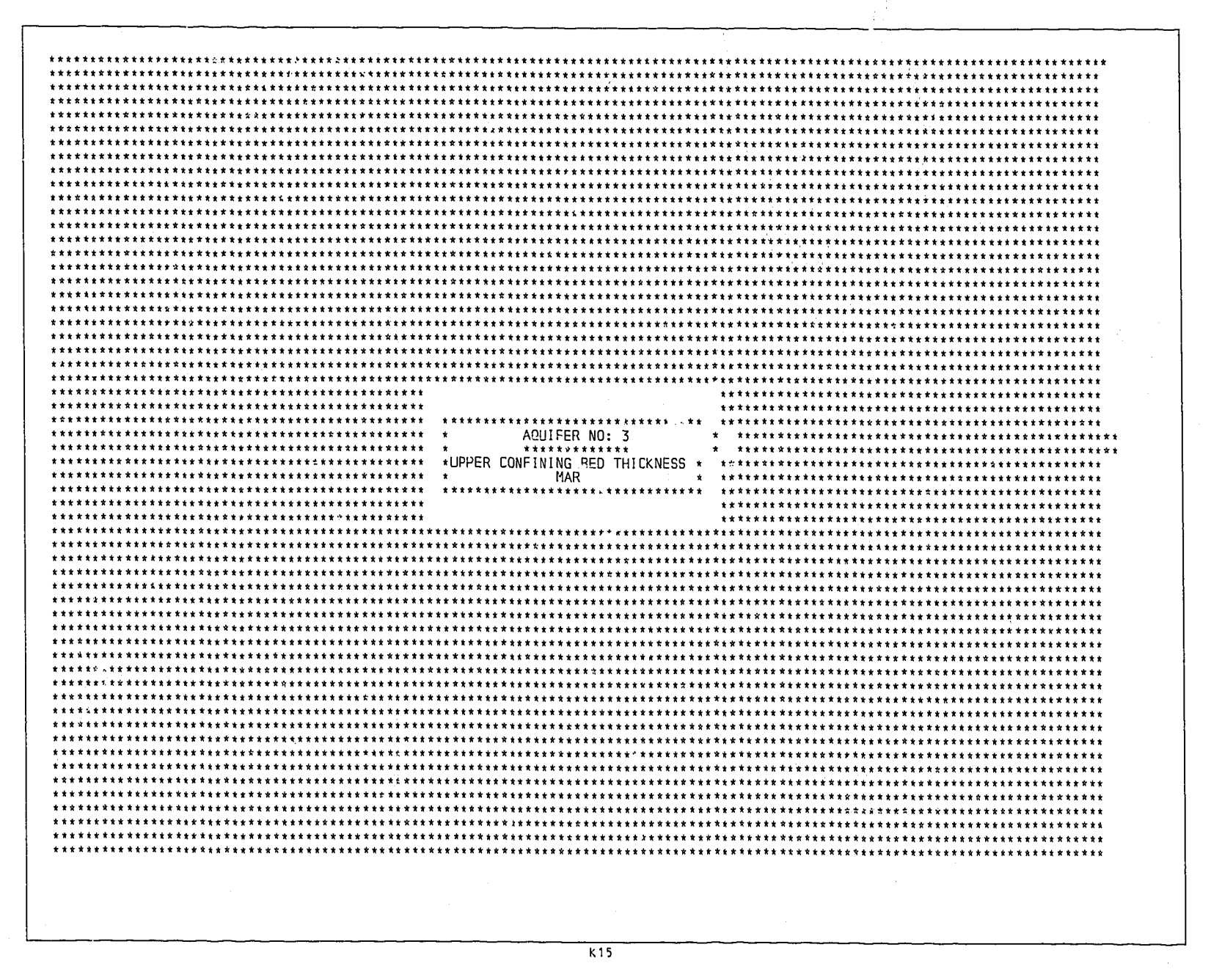

         ***VALUES OF ARGUMENT MULTIPLYED BY    .10000000E+06 ***
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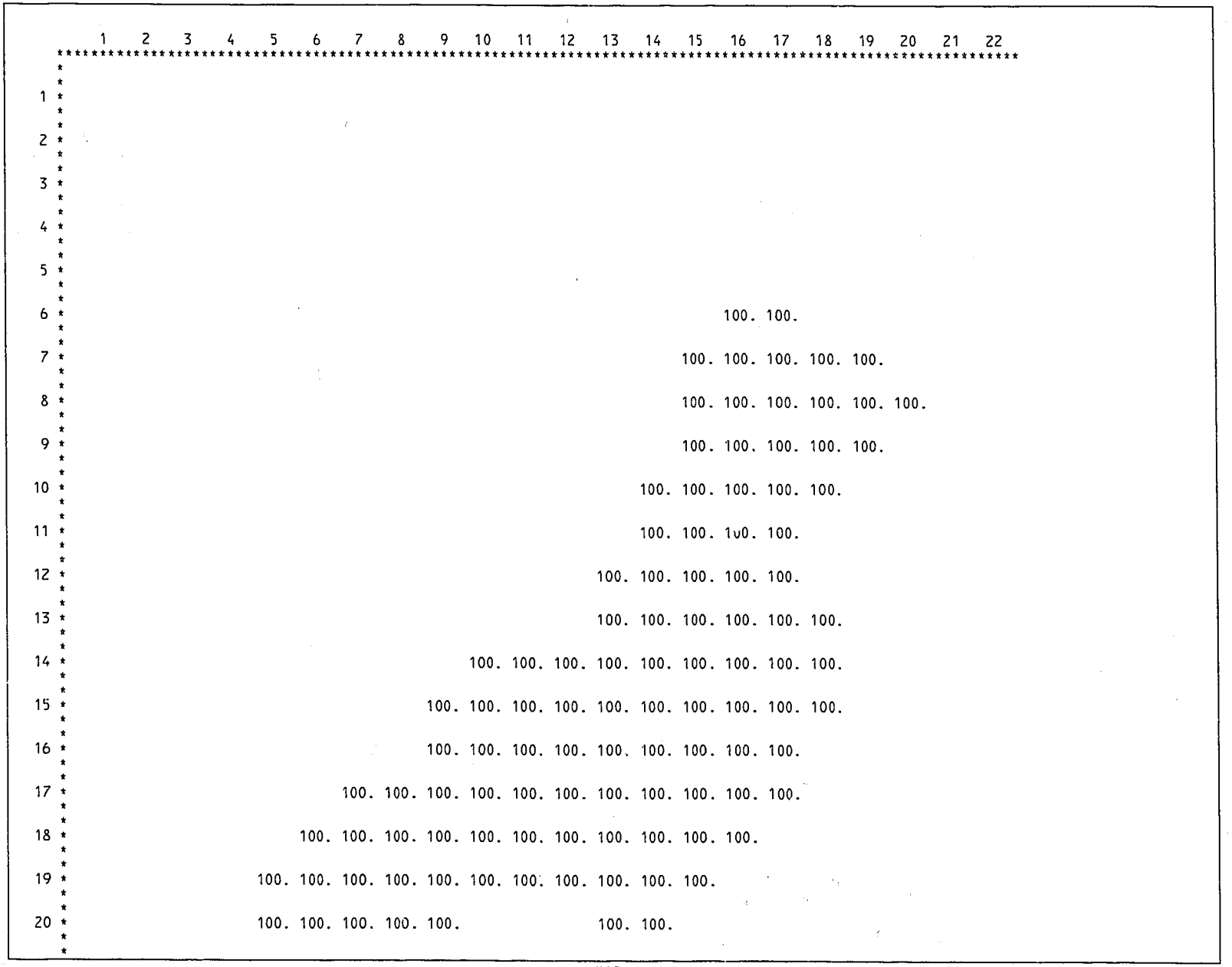

AQUIFER NO: 3
UPPER CONFINING BED
VERTICAL HYDRAULIC CONDUCTIVITY
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *                          5.   5.   5.
   *
   *
22 *
```

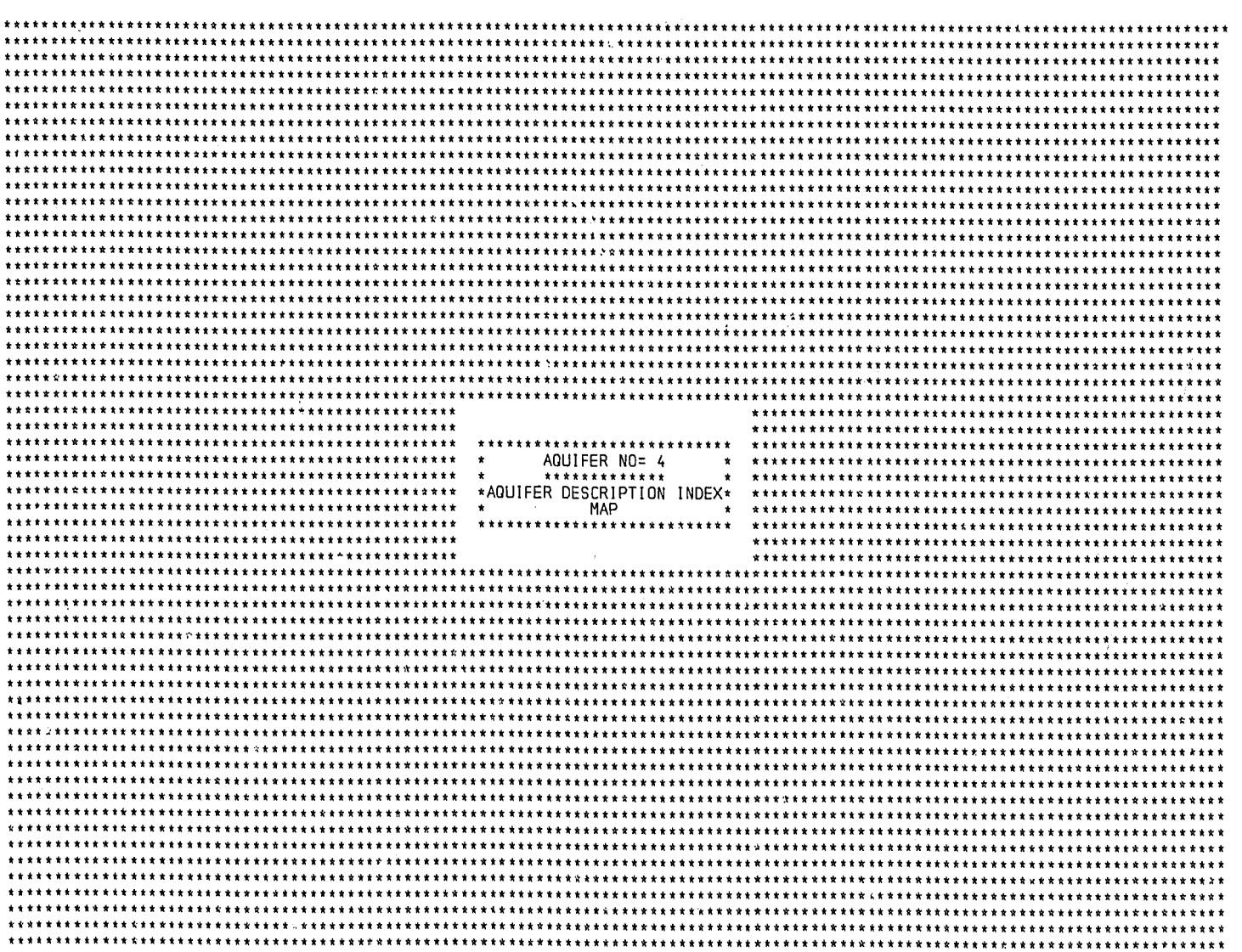
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+10 ***


AQUIFER NO: 3
UPPER CONFINING BED THICKNESS
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100.
100. 100.

```
21 *                    100. 100. 100.
   *
   *
22 *
```

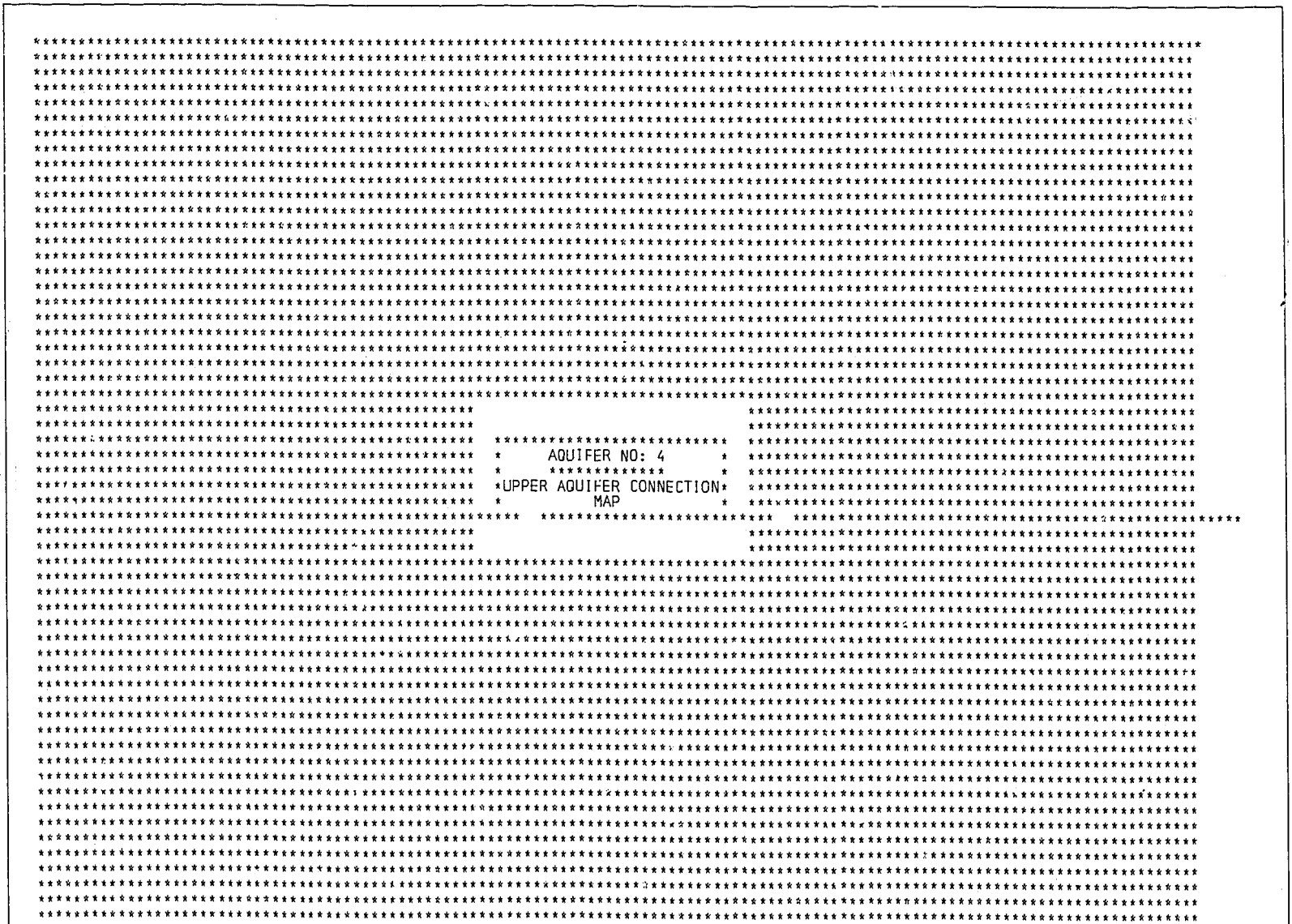
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***

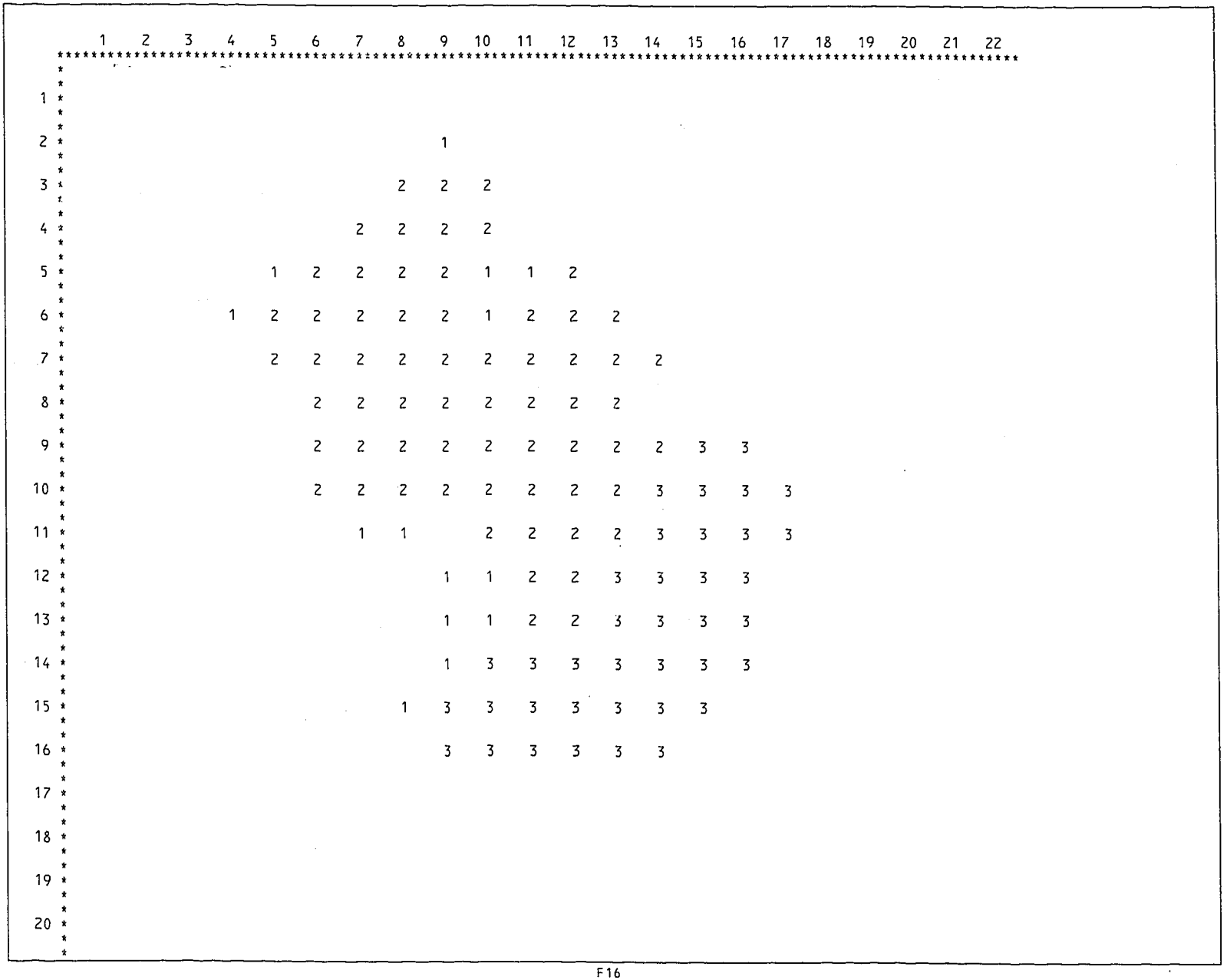

AQUIFER NO= 4
AQUIFER DESCRIPTION INDEX
MAP

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2
3	2	2	2	2	2	2	2	1		1	2	2	2	2	2	2	2	2	2	2	2	2
4	2	2	2	2	2	2	1			1	2	2	2	2	2	2	2	2	2	2	2	2
5	2	2	2	2	1	1				1	1	1	2	2	2	2	2	2	2	2	2	2
6	2	2	2	1									1	2	2	2	2	2	2	2	2	2
7	2	2	2	2	1	1								-1	2	2	2	2	2	2	2	2
8	2	2	2	2	2	1							-1	2	2	2	2	2	2	2	2	2
9	2	2	2	2	2	1			-1	-1			-1	-1	-1	-1	2	2	2	2	2	2
10	2	2	2	2	2	-1			-1	-1							-1	2	2	2	2	2
11	2	2	2	2	2	2	-1	-1	2	-1							-1	2	2	2	2	2
12	2	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2
15	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2	2
16	2	2	2	2	2	2	2	2	-1	-1	-1	-1	-1	-1	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

```
21 *    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2
   *
   *
22 *    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2
```

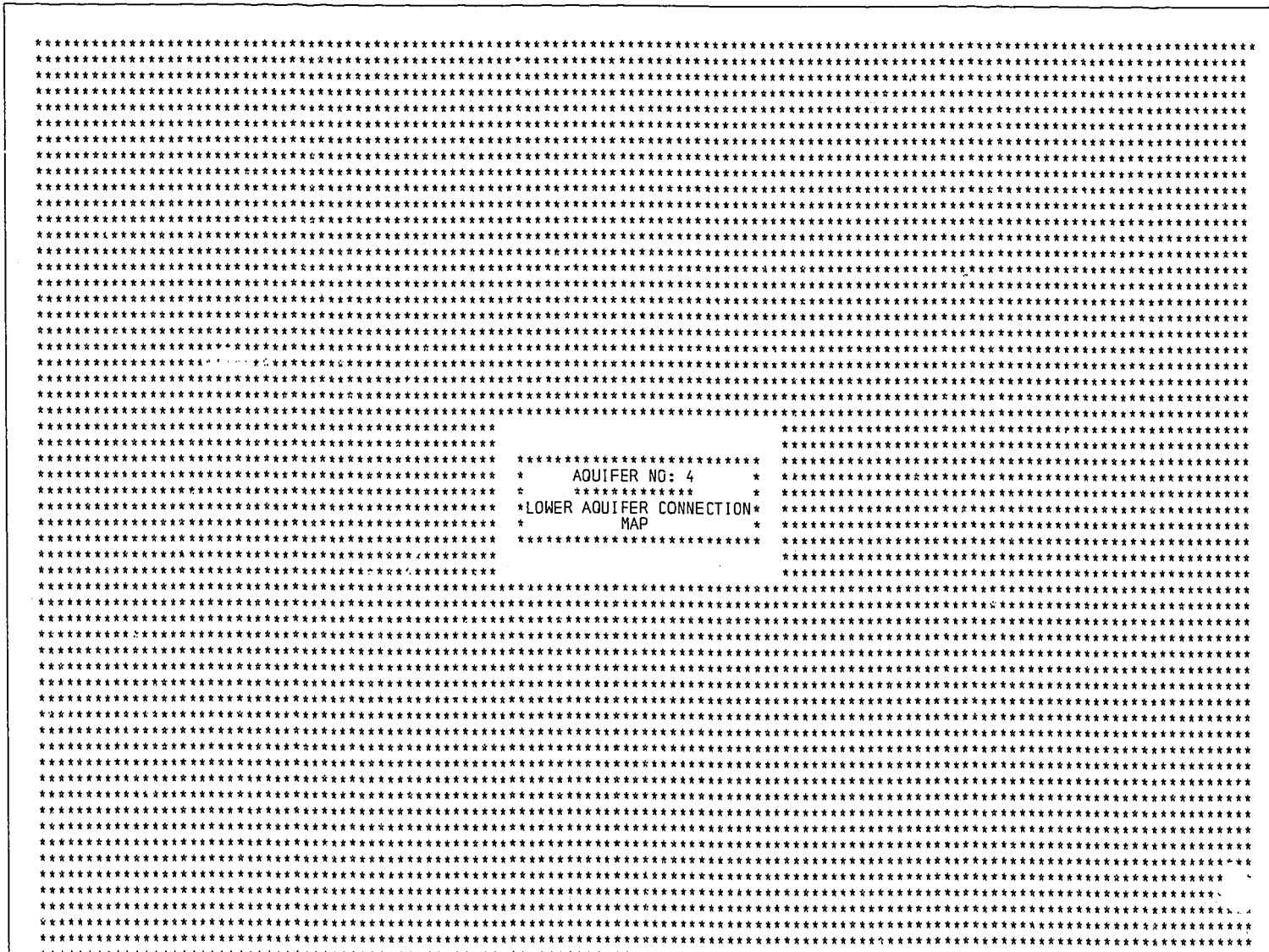
***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01 ***

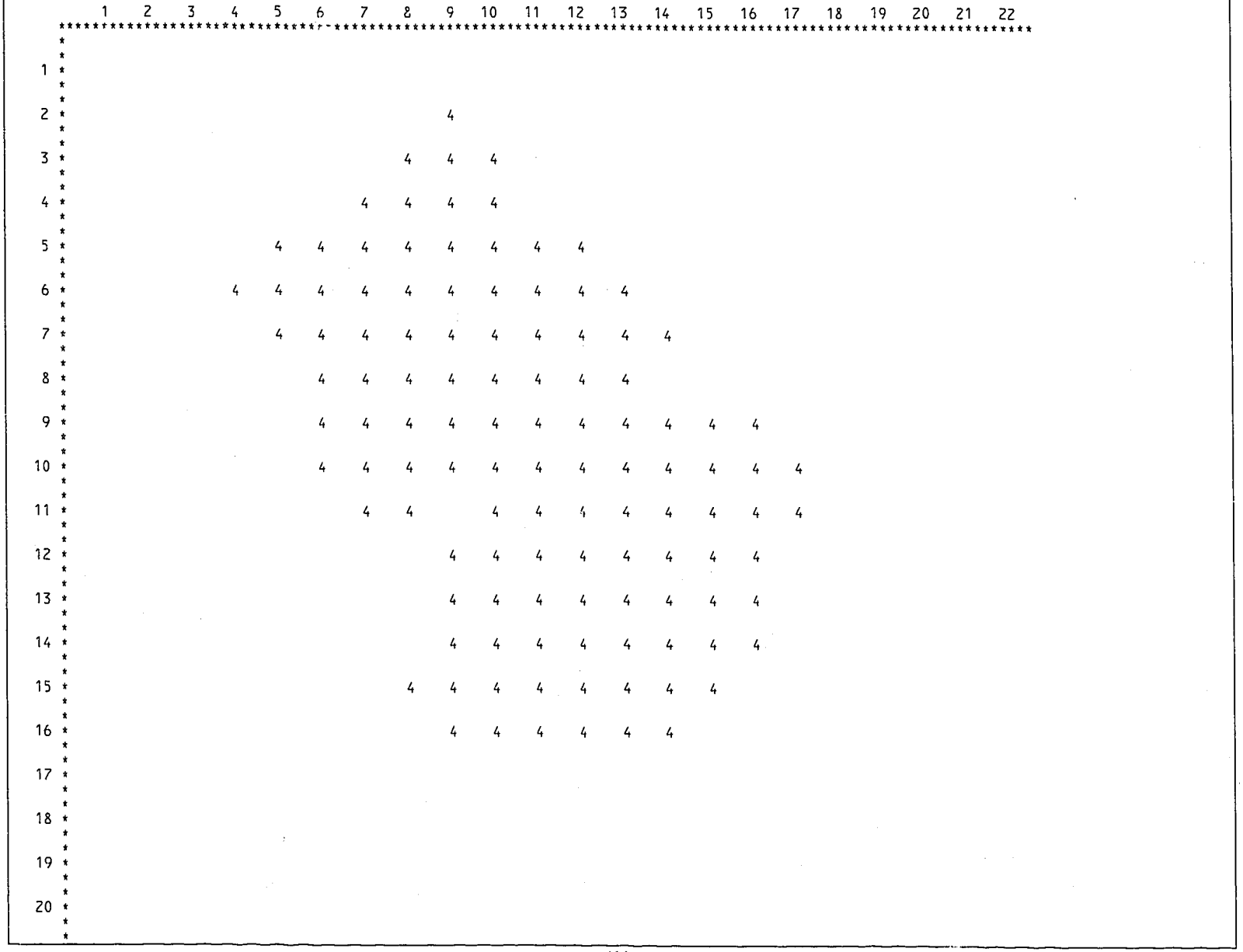

AQUIFER NO: 4
UPPER AQUIFER CONNECTION
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *
   *
   *
22 *
```

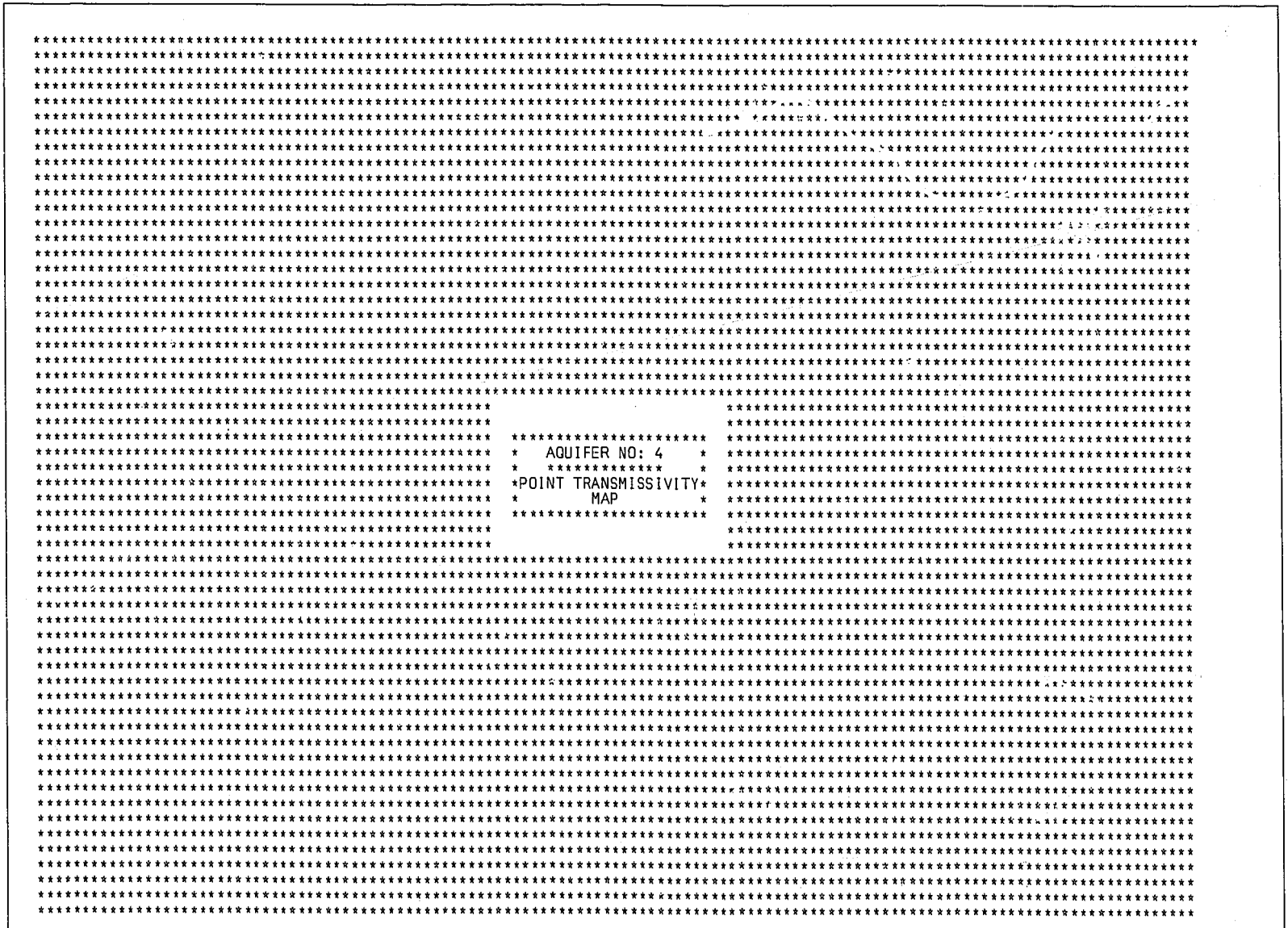
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***

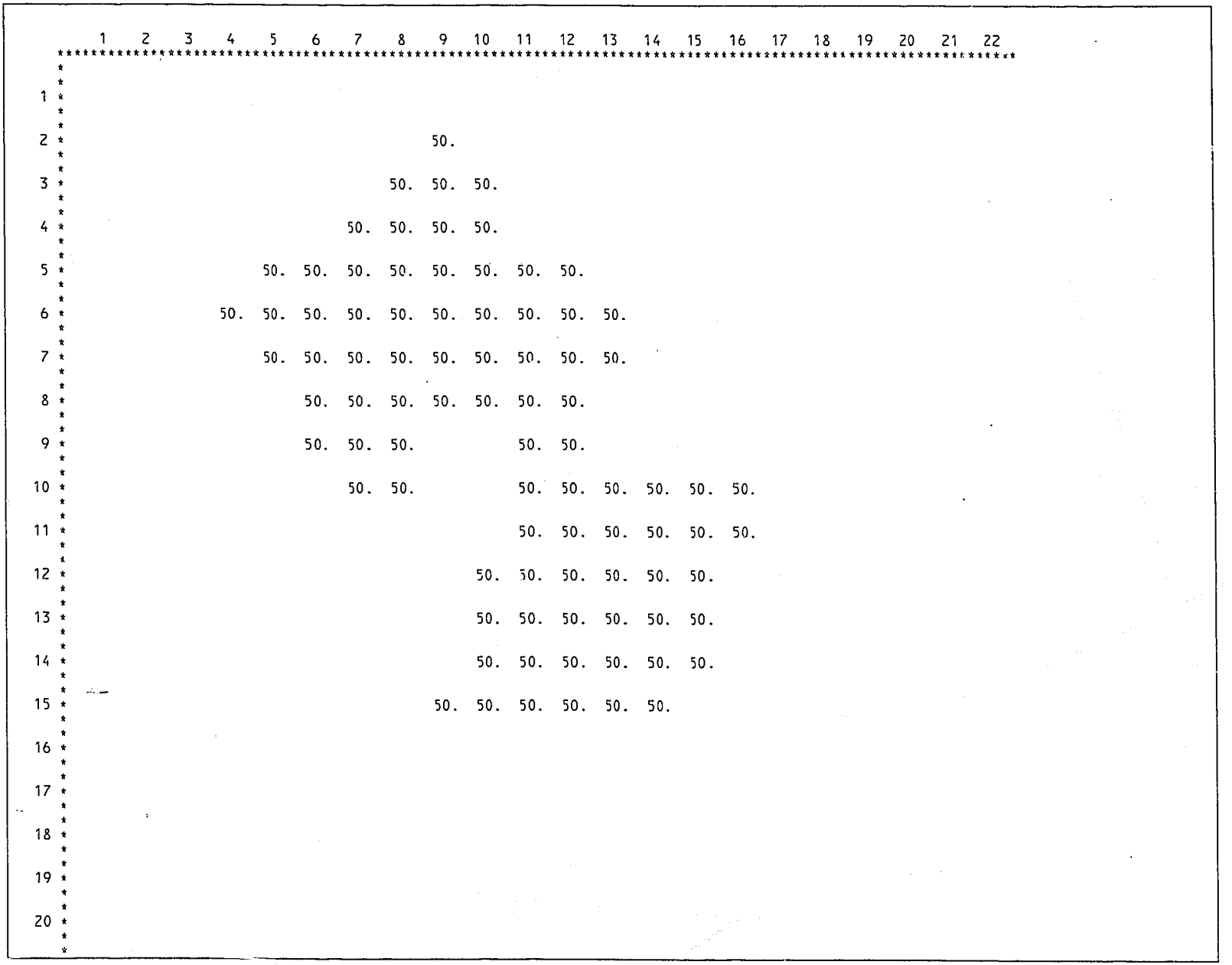

AQUIFER NO: 4
LOWER AQUIFER CONNECTION
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```
21 *
   *
   *
22 *

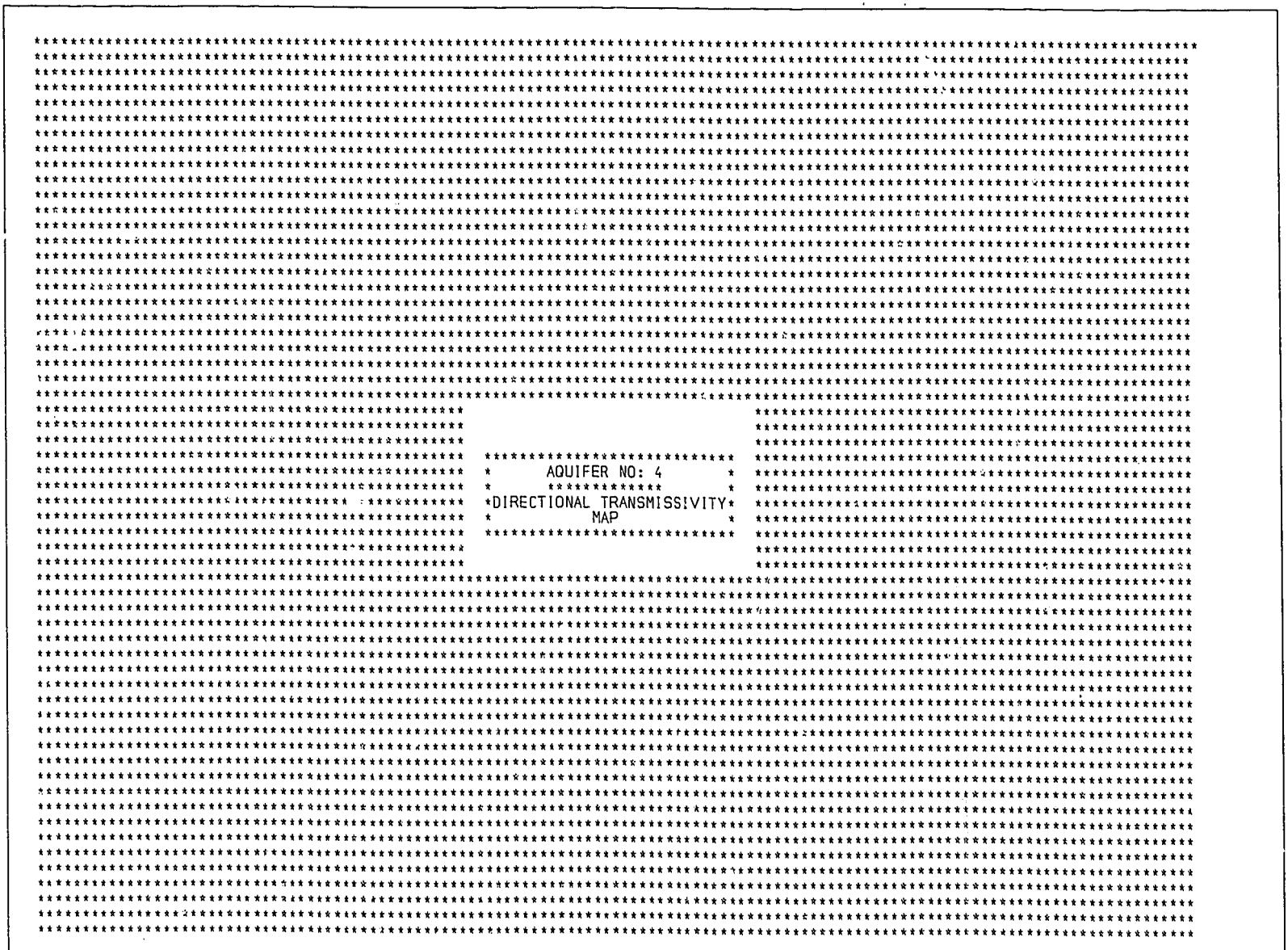

        ***VALUES OF ARGUMENT MULTIPLYED BY    .10000000E+01 ***
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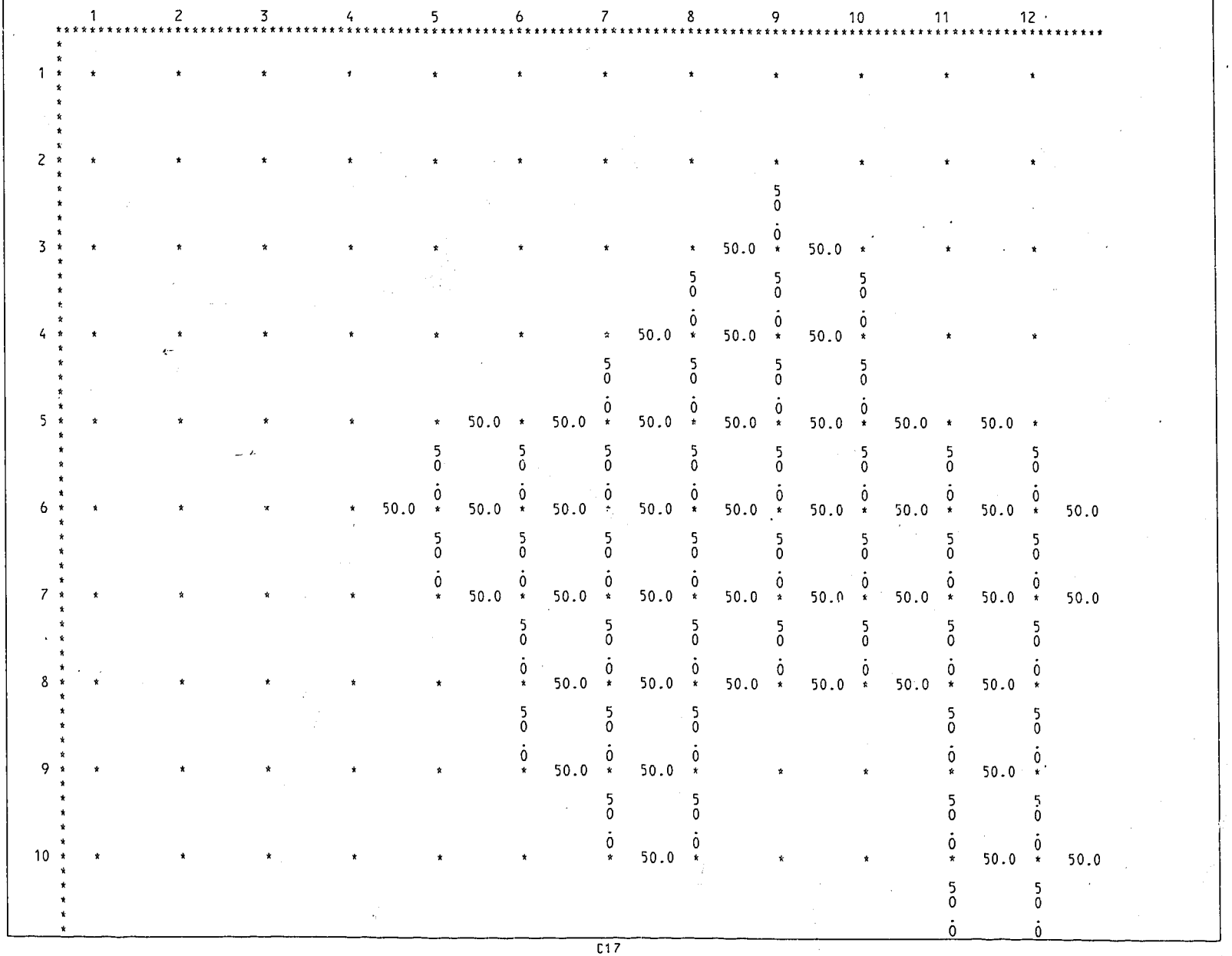

AQUIFER NO: 4
POINT TRANSMISSIVITY
MAP

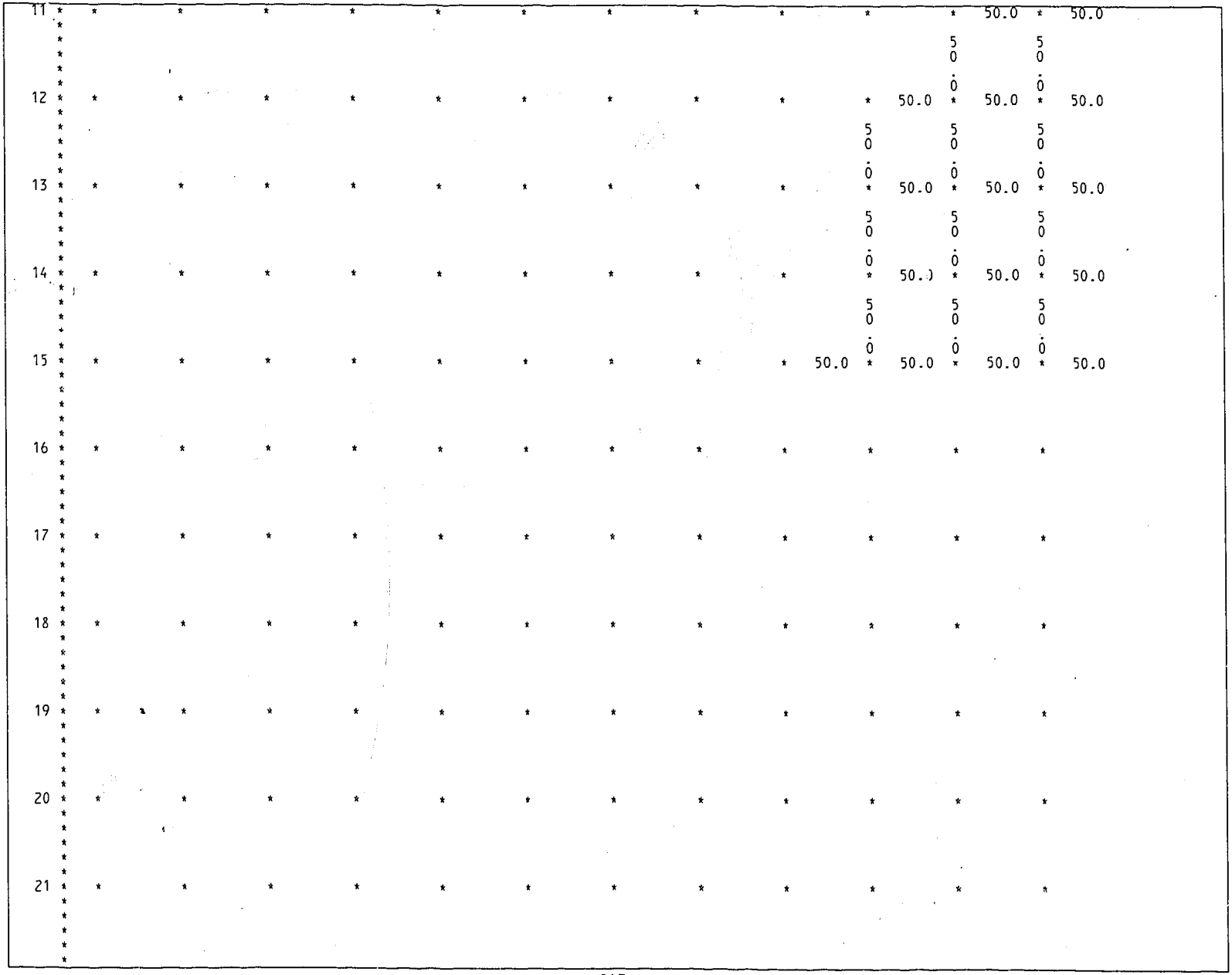

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 50.
2 50. 50. 50.
3 50. 50. 50. 50.
4 50. 50. 50. 50. 50. 50. 50. 50.
5 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
6 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
7 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
8 50. 50. 50. 50. 50. 50. 50. 50.
9 50. 50. 50. 50. 50. 50. 50.
10 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
11 50. 50. 50. 50. 50. 50. 50. 50.
12 50. 50. 50. 50. 50. 50. 50. 50.
13 50. 50. 50. 50. 50. 50. 50. 50.
14 50. 50. 50. 50. 50. 50. 50. 50.
15 50. 50. 50. 50. 50. 50. 50. 50.
16
17
18
19
20

```
21 *
   *
   *
22 *
```

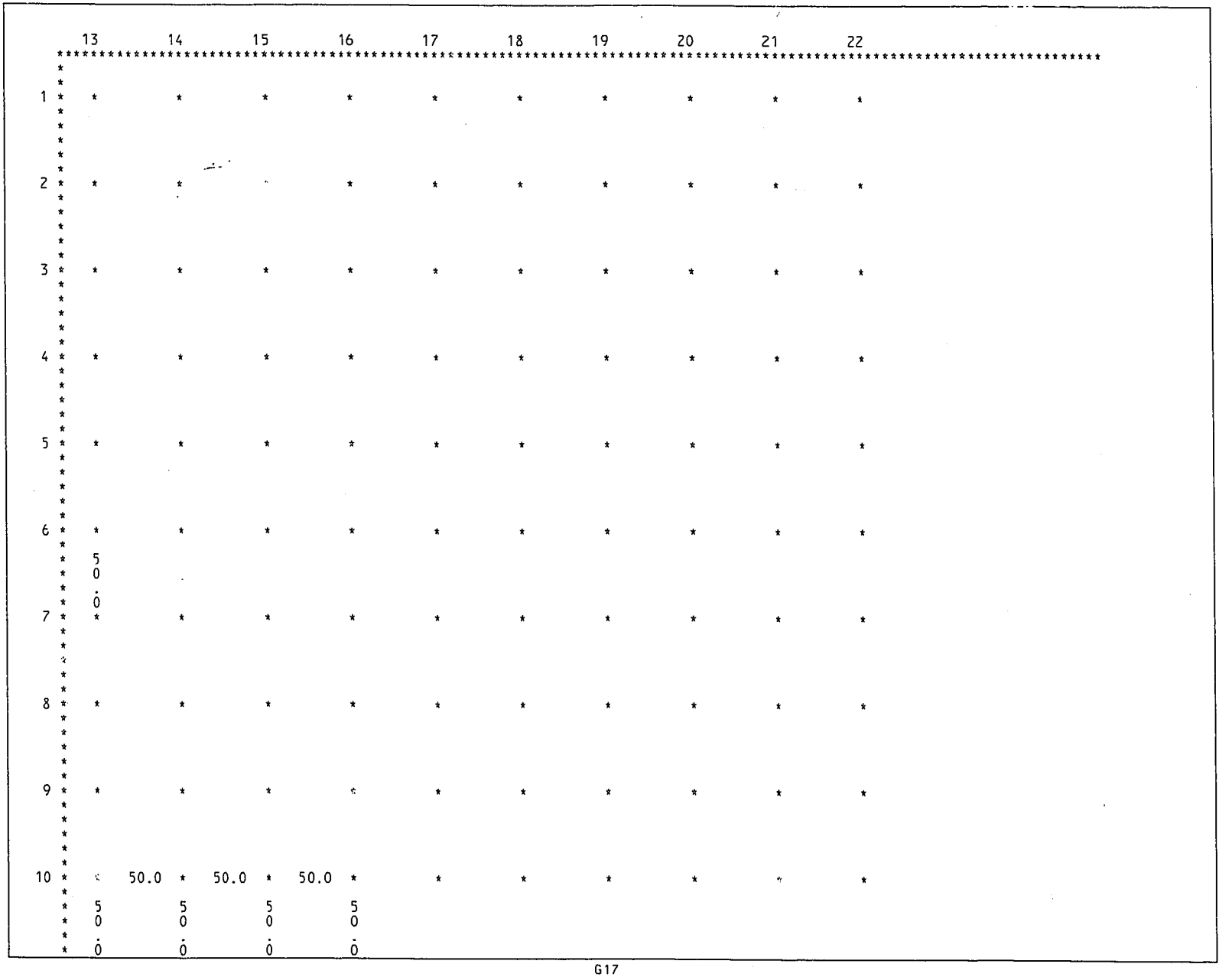
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+05 ***

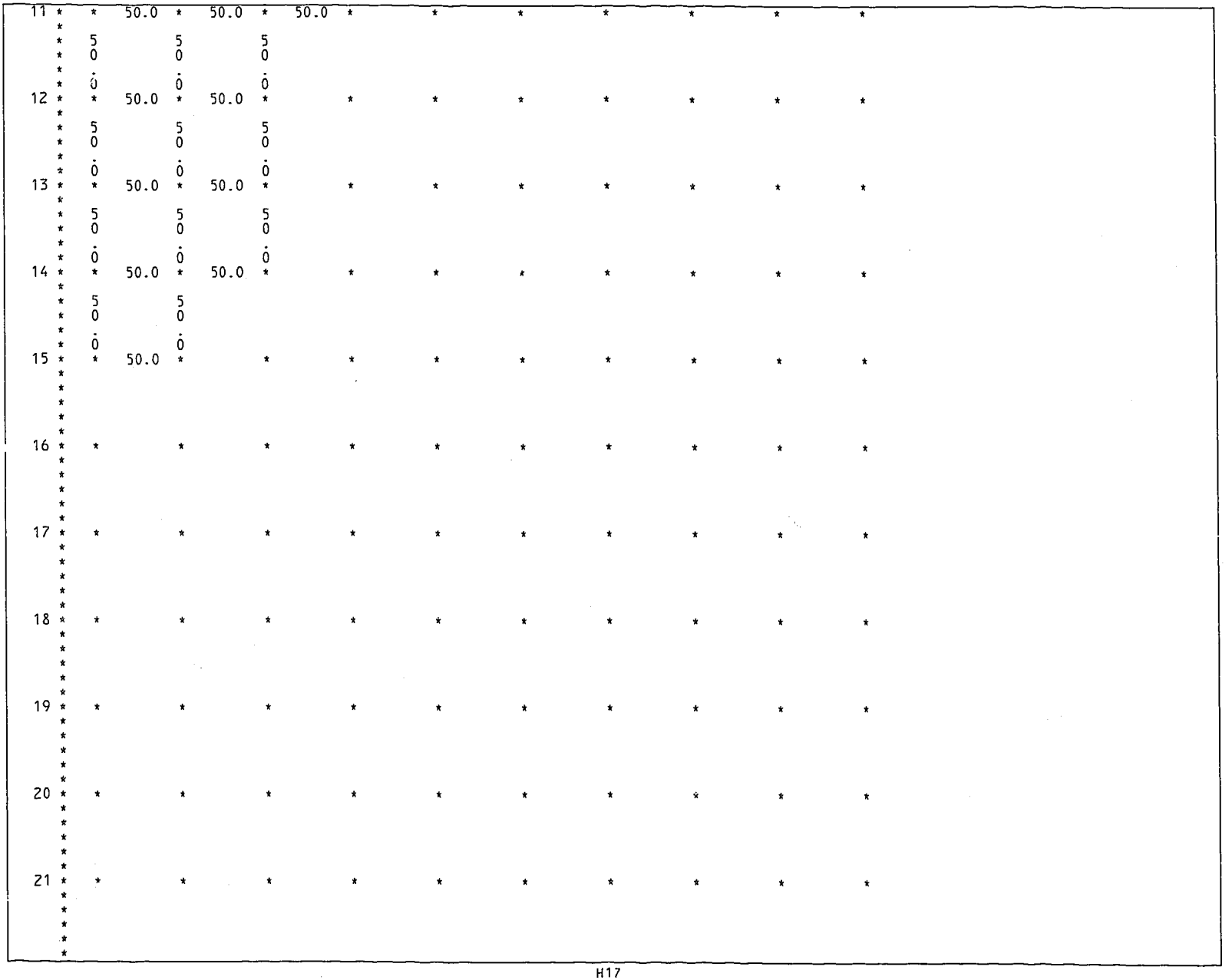

AQUIFER NO: 4
DIRECTIONAL TRANSMISSIVITY
MAP


1 2 3 4 5 6 7 8 9 10 11 12
1 2 3 4 5 6 7 8 9 10
50.0


11 50.0 50.0
12 50.0 50.0 50.0
13 50.0 50.0 50.0
14 50.0 50.0 50.0
15 50.0 50.0 50.0 50.0

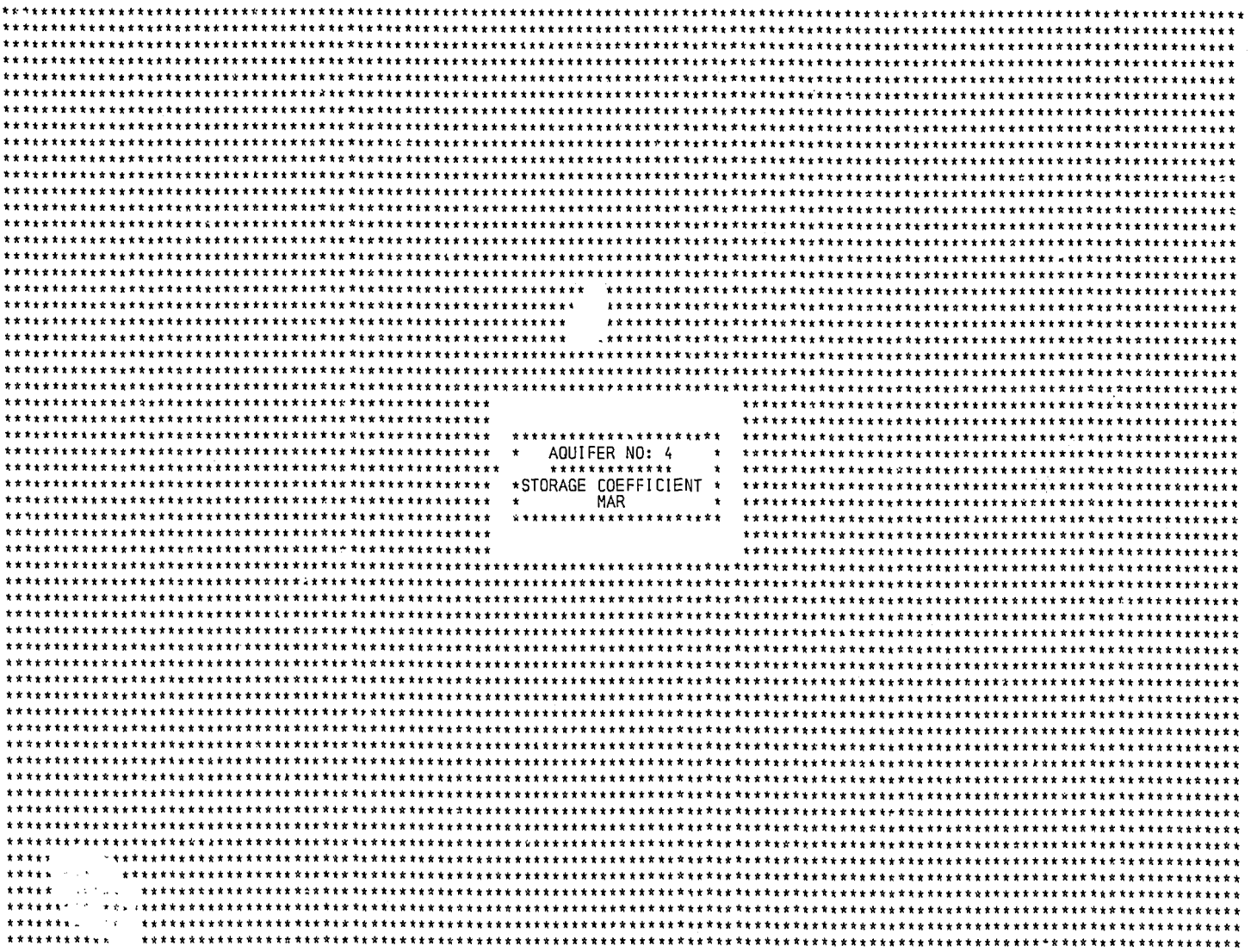
7.2 * * * * * * * * * * * * * *
*
*
*
*
*
*

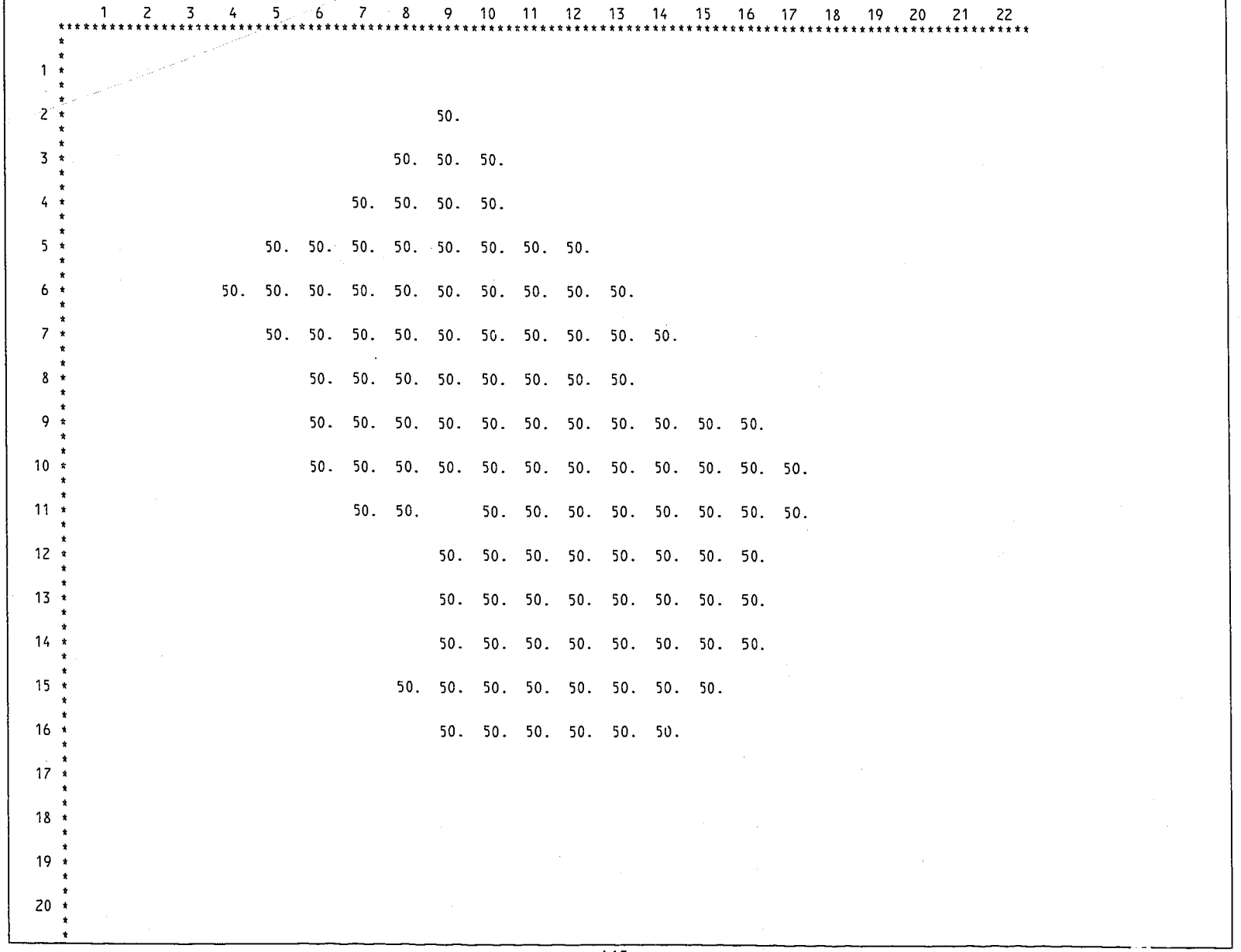

13
14
15
16
17
18
19
20
21
22
1
2
3
4
5
6
50.0
7
8
9
10
50.0
50.0
50.0


11
50.0
50.0
50.0
12
50.0
50.0
13
50.0
50.0
14
50.0
50.0
15
50.0
16
17
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19
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21

22 * * * * * * * * * * *
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*

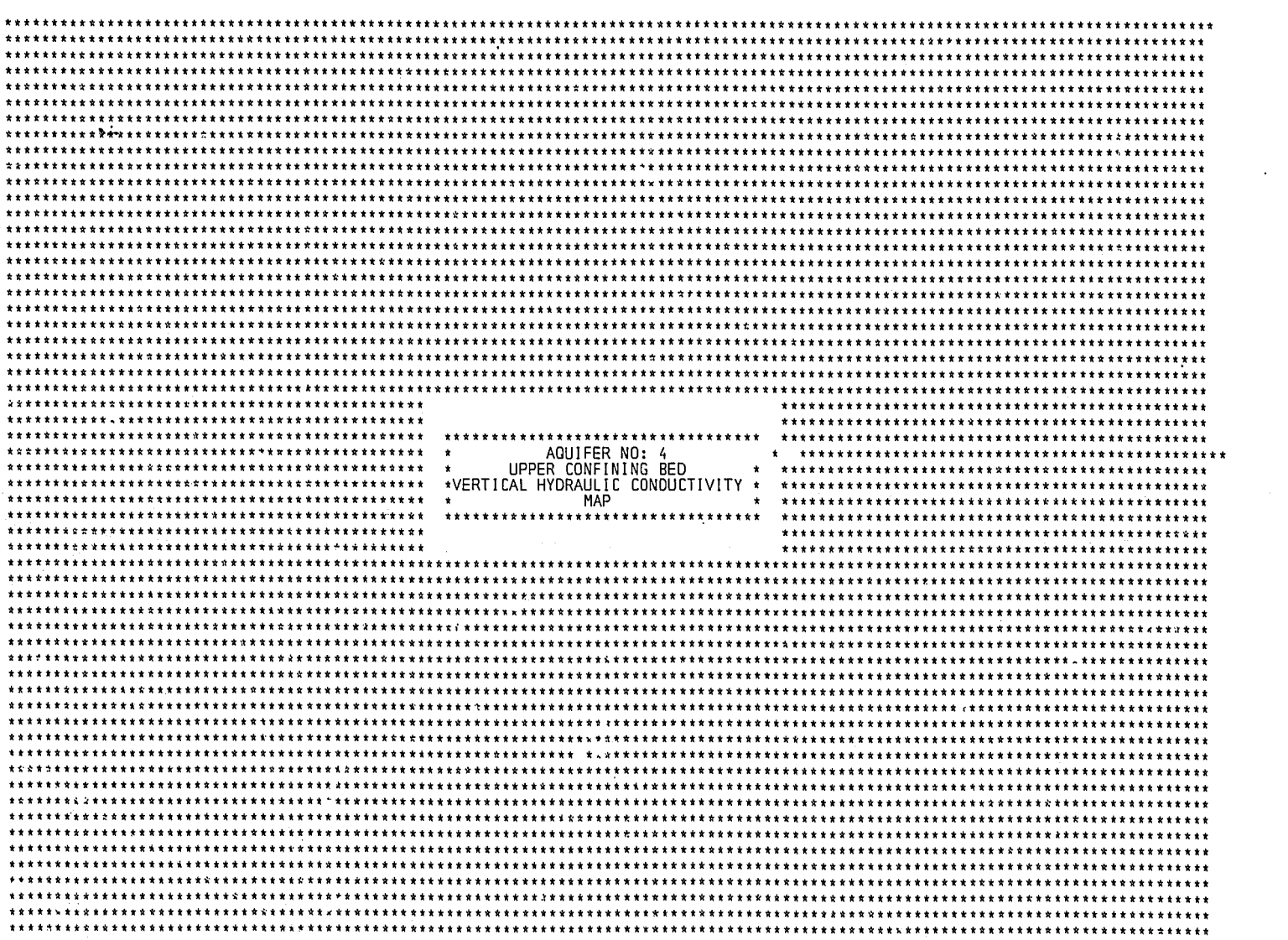
THE VALUES OF THE ARGUMENTS ARE MULTIOLIED BY:
-X(HORIZONTAL)= .10000000E+05
-Y(VERTICAL)= .10000000E+05

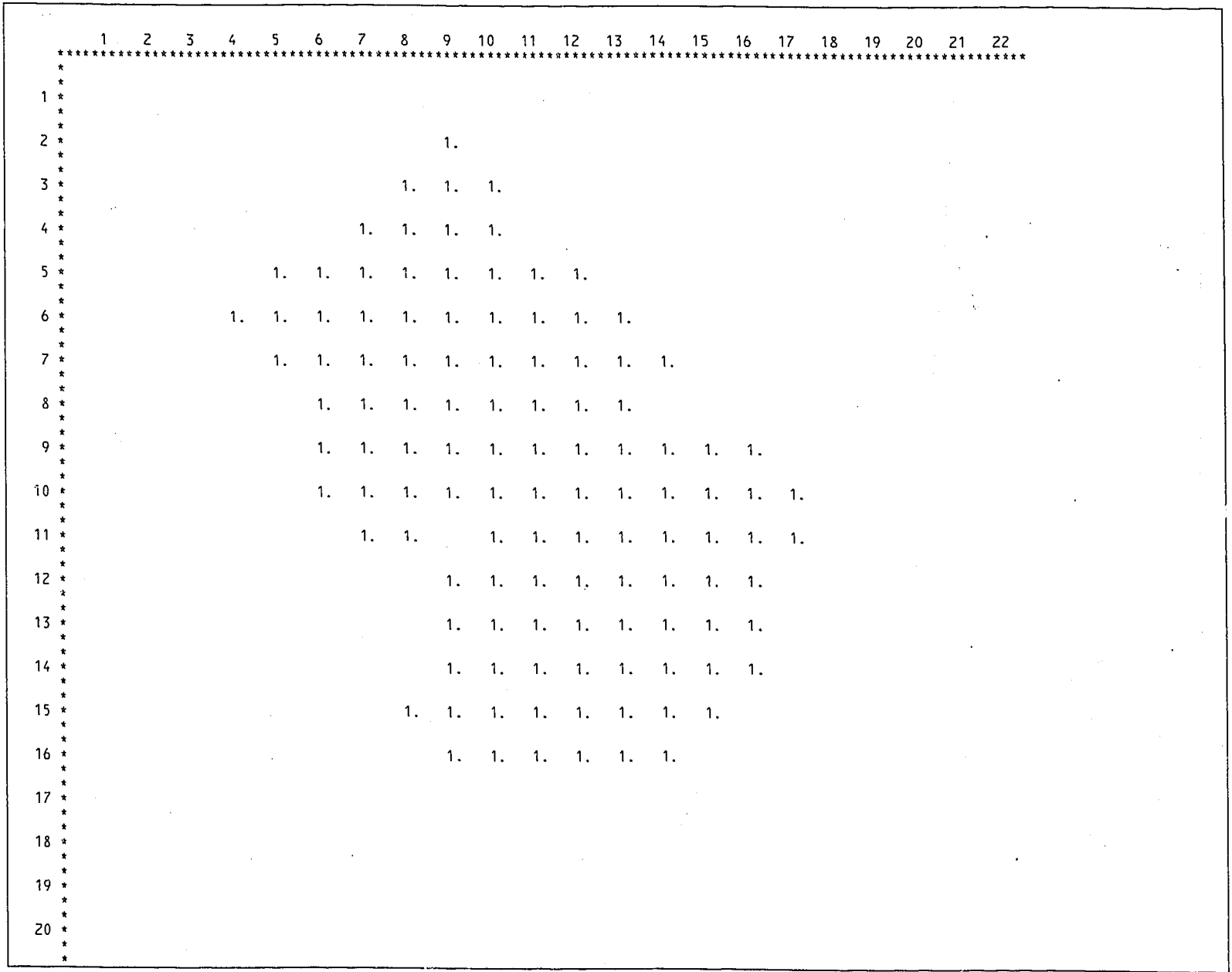

AQUIFER NO: 4
STORAGE COEFFICIENT
MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1 50.
2 50. 50. 50.
3 50. 50. 50. 50.
4 50. 50. 50. 50. 50. 50. 50. 50.
5 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
6 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
7 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
8 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
9 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
10 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
11 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
12 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
13 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
14 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
15 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
16 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.
17
18
19
20

```
21 *
   *
   *
22 *
```

***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+06 ***


AQUIFER NO: 4
UPPER CONFINING BED
VERTICAL HYDRAULIC CONDUCTIVITY
MAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1
2 1.
3 1. 1. 1.
4 1. 1. 1. 1.
5 1. 1. 1. 1. 1. 1. 1. 1.
6 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
7 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
8 1. 1. 1. 1. 1. 1. 1. 1. 1.
9 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
10 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
11 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
12 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
13 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
14 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
15 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
16 1. 1. 1. 1. 1. 1. 1. 1.
17
18
19
20

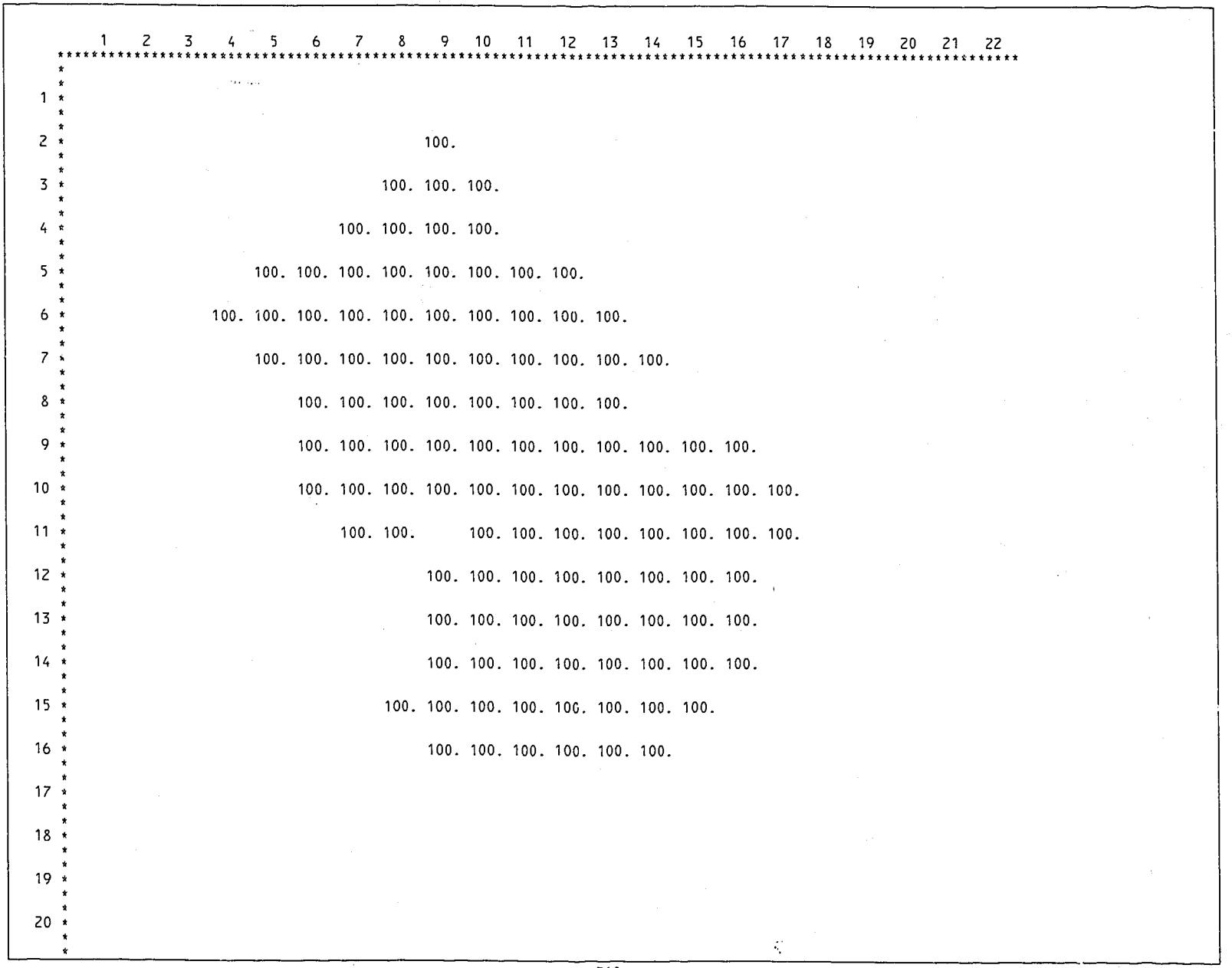
```
21 *
   *
   *
22 *
```

***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+10 ***

AQUIFER NO: 4

UPPER CONFINING BED THICKNESS

MAR


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
100.
100. 100. 100.
100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
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```
21 *
   *
   *
22 *


        ***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
```

WELL DISCHARGE (OR RECHARGE) FLOWS
AT TIME: 9562000. S
YEAR: 1958

WELL NO	AQUIFER NO	I(OY)	J(OX)	FLOW(L/S)
1	1	5	17	15.0
2	1	6	8	30.0
3	1	6	16	25.0
4	1	7	12	50.0
5	1	8	9	70.0
6	1	8	11	19.0
7	1	9	18	22.0
8	1	10	6	38.0
9	1	10	10	10.0
10	1	12	11	9.0
11	1	14	13	11.0
12	1	16	11	17.0
13	1	17	14	23.0
14	1	18	9	32.0
15	1	19	12	15.0
16	2	4	8	15.0
17	2	5	13	20.0
18	2	5	17	42.0
19	2	6	8	39.0
20	2	7	6	35.0
21	2	7	16	11.0
22	2	9	10	12.0
23	2	12	13	19.0
24	2	15	12	71.0
25	3	8	19	92.0
26	3	9	17	55.0
27	3	12	15	13.0
28	3	14	15	12.0
29	3	15	11	8.0
30	3	16	15	12.0
31	3	17	12	7.0
32	3	19	8	19.0
33	3	19	14	17.0
34	3	20	6	33.0
35	4	3	9	25.0
36	4	5	8	25.0
37	4	6	6	30.0
38	4	6	12	42.0
39	4	7	10	13.0
40	4	10	7	12.0
41	4	10	12	10.0
42	4	12	12	10.0
43	4	13	14	42.0
44	4	14	10	18.0
45	4	15	12	13.0
TOTALS				
45	4			1158.0

STEADY STATE HEADS
MEASURED ON CHECK BORE HOLES
YEAR: 1958

BORE NO	BORE NAME	AQUIFER NO	I(OY)	J(OX)	MEAS. HEAD(M)	ZERO(M)	HEAD(M)
1	CHECK POINT WT1	1	5	13	93.75	0.00	93.75
2	CHECK POINT WT1	1	7	7	95.39	0.00	95.39
3	CHECK POINT WT1	1	10	12	92.07	0.00	92.07
4	CHECK POINT WT1	1	12	16	101.15	0.00	101.15
5	CHECK POINT WT1	1	13	3	90.34	0.00	90.34
6	CHECK POINT WT1	1	15	13	85.61	0.00	85.61
7	CHECK POINT WT1	1	19	8	73.53	0.00	73.53
8	CHECK POINT CA2	2	3	19	103.07	0.00	103.07
9	CHECK POINT CA2	2	7	13	99.72	0.00	99.72
10	CHECK POINT CA2	2	9	7	103.07	0.00	103.07
11	CHECK POINT CA2	2	9	11	101.45	0.00	101.45
12	CHECK POINT CA3	3	8	17	110.88	0.00	110.88
13	CHECK POINT CA3	3	13	15	102.12	0.00	102.12
14	CHECK POINT CA3	3	16	12	97.25	0.00	97.25
15	CHECK POINT CA4	4	10	16	123.14	0.00	123.14

COMPUTED AND OBSERVED STEADY STATE HEADS ON CHECK BORE HOLES

BORE NO	BORE NAME	AQUIFER NO	I(OY)	J(OX)	COMP.HEAD(M)	OBS. HEAD(M)	DIFFERENCE(M)
1	CHECK POINT WT1 1	1	5	13	91.7	93.8	-2.05
2	CHECK POINT WT1 2	1	7	7	91.7	95.4	-3.69
3	CHECK POINT WT1 3	1	10	12	91.7	92.1	-.37
4	CHECK POINT WT1 4	1	12	16	91.7	101.2	-9.45
5	CHECK POINT WT1 5	1	13	3	91.7	90.3	1.36
6	CHECK POINT WT1 6	1	15	13	91.7	85.6	6.09
7	CHECK POINT WT1 7	1	19	8	91.7	73.5	18.17
8	CHECK POINT CA2 1	2	3	19	98.0	103.1	-5.04
9	CHECK POINT CA2 2	2	7	13	98.0	99.7	-1.69
10	CHECK POINT CA2 3	2	9	7	98.0	103.1	-5.04
11	CHECK POINT CA2 4	2	9	11	98.0	101.5	-3.42
12	CHECK POINT CA3 1	3	8	17	102.3	110.9	-8.61
13	CHECK POINT CA3 2	3	13	15	102.3	102.1	.15
14	CHECK POINT CA3 3	3	16	12	102.3	97.3	5.02
15	CHECK POINT CA4 1	4	10	16	105.9	123.1	-17.21

RECAPITULATION

TOTAL DIFFERENCE= -25.78 M
TOTAL ERROR= 87.36 M
MEAN ERROR= 5.46 M

AQUIFER-RIVER EXCHANGE FLOW RATES
COMPUTED AT TIME: 9562000. S
YEAR:1958

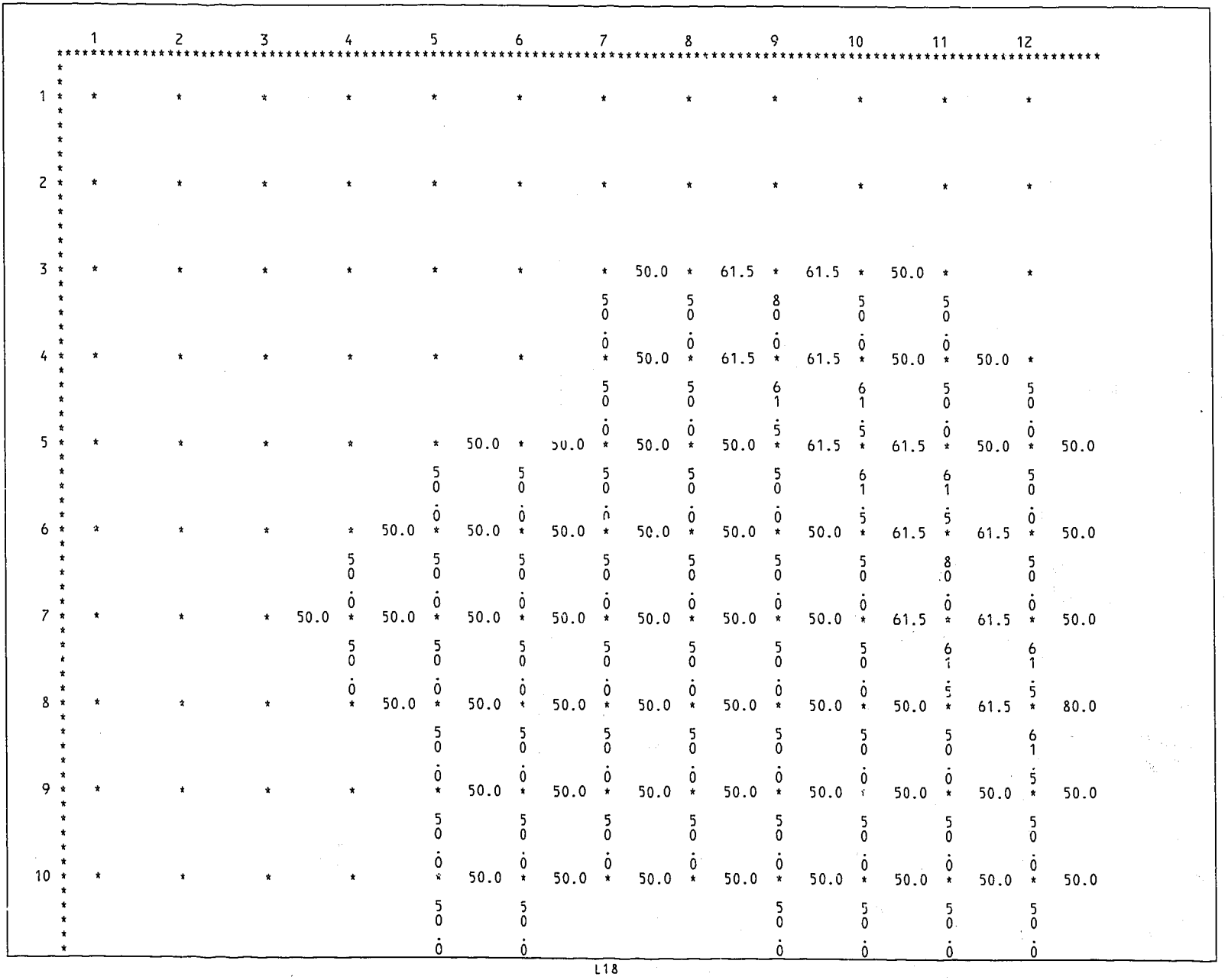
RIVER NAME: THE GAB IMAGINARY RIVER

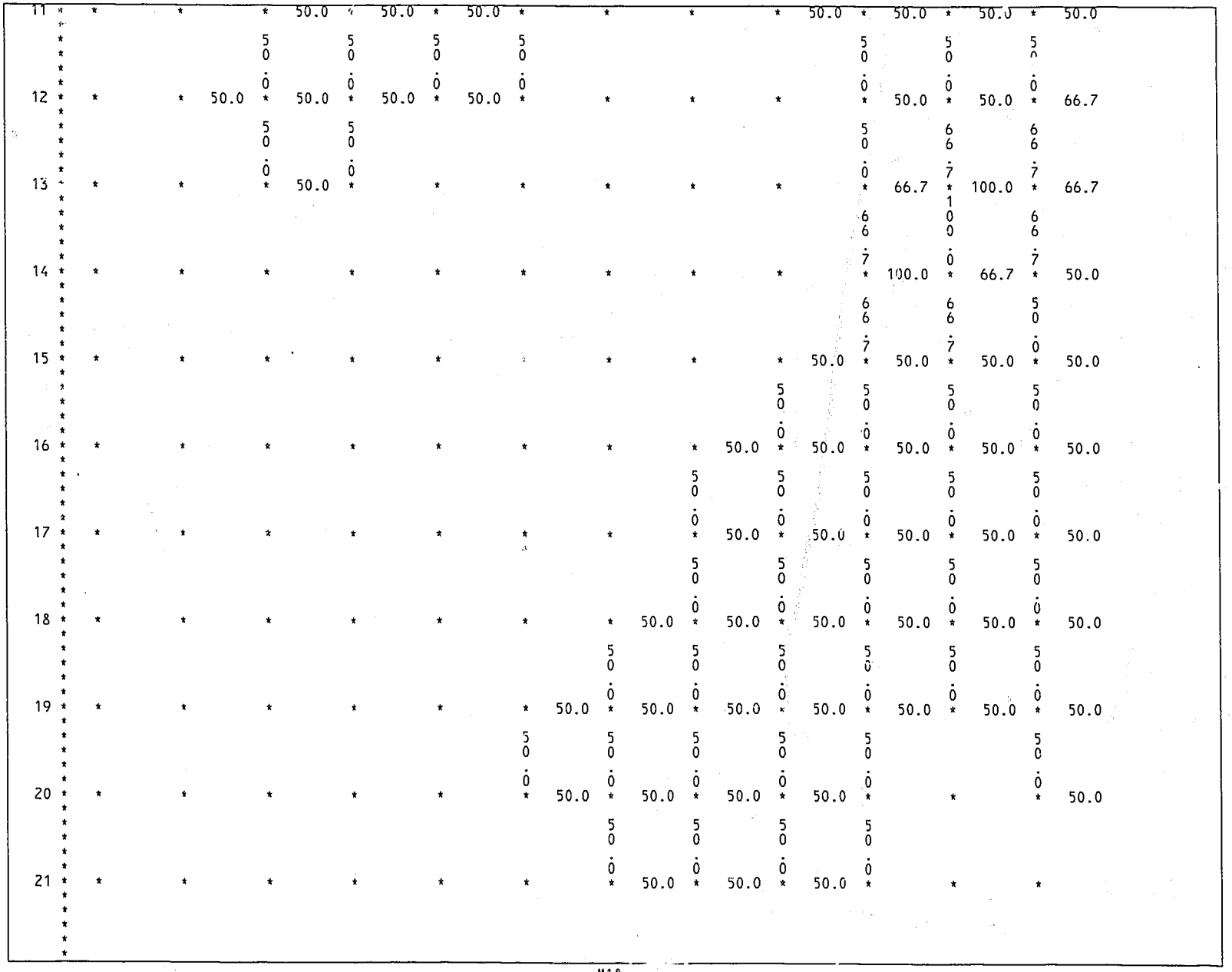
POINT NO	I	J	UNIT RATE(L/S)	CUMULATED RATE(L/S)
2	4	16	439.	439.
3	5	16	276.	714.
4	6	15	118.	833.
5	7	15	-186.	647.
6	8	16	-416.	231.
7	9	16	-571.	-341.
8	10	15	-1334.	-1675.
9	11	14	-1960.	-3635.
10	12	13	-2973.	-6608.
11	13	12	-2540.	-9148.
12	13	11	-2168.	-11316.
13	14	11	-2383.	-13699.

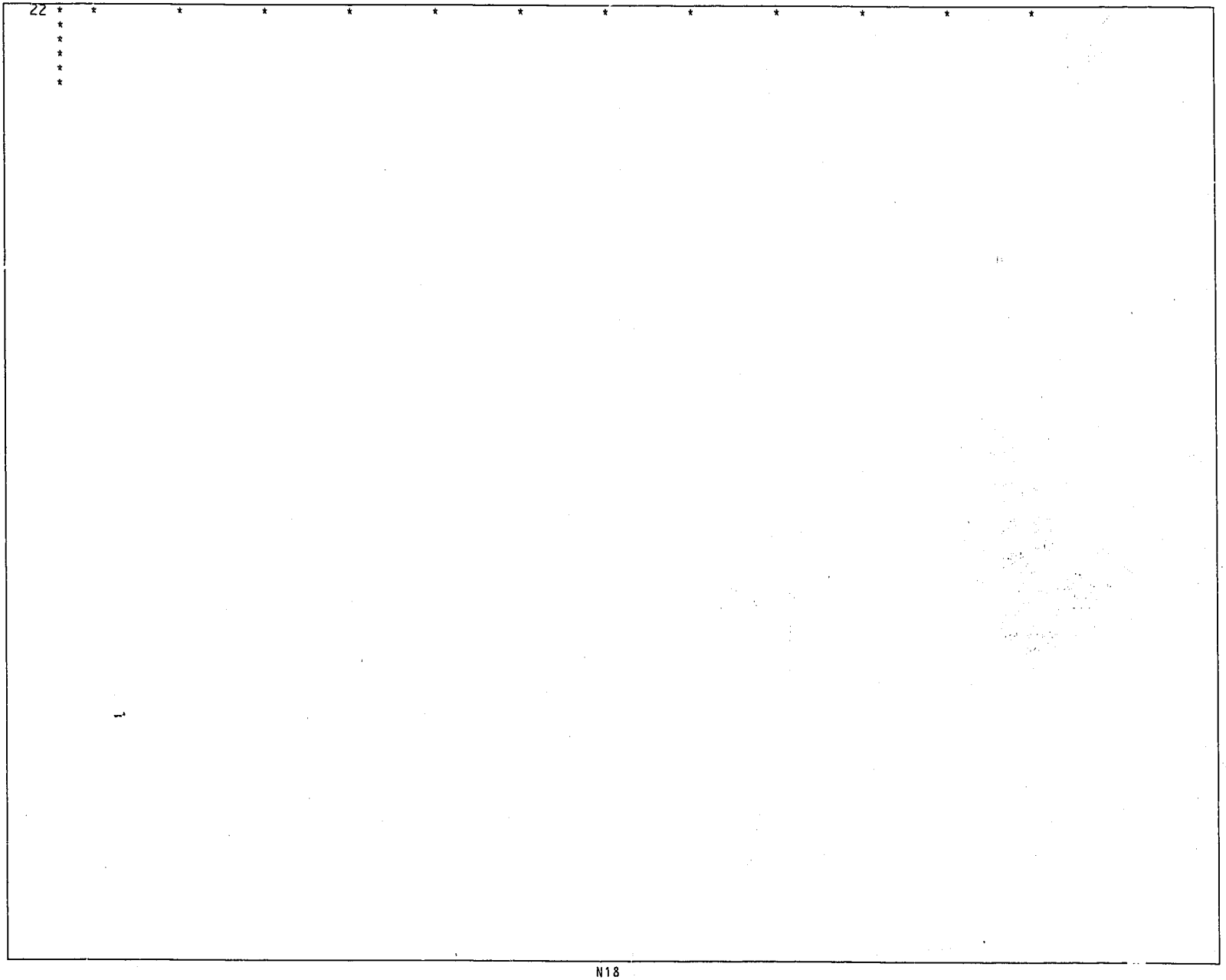
RIVER NAME: THE UNGEMACH TRIBUTARY

POINT NO	I	J	UNIT RATE(L/S)	CUMULATED RATE(L/S)
2	4	9	284.	284.
3	5	10	111.	395.
4	6	11	-18.	377.
5	7	11	-305.	72.
6	8	12	-434.	-362.
7	8	13	-572.	-934.
8	9	14	-786.	-1721.

TOTAL AQUIFER-RIVER EXCHANGE FLOW= -15419. L/S


1 2 3 4 5 6 7 8 9 10 11 12
1
2
3 50.0 61.5 61.5 50.0
4 50.0 61.5 61.5 50.0 50.0
5 50.0 50.0 50.0 50.0 61.5 61.5 50.0 50.0
6 50.0 50.0 50.0 50.0 50.0 50.0 61.5 61.5 50.0
7 50.0 50.0 50.0 50.0 50.0 50.0 50.0 61.5 61.5 50.0
8 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 61.5 80.0
9 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
10 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0




22

INDEX

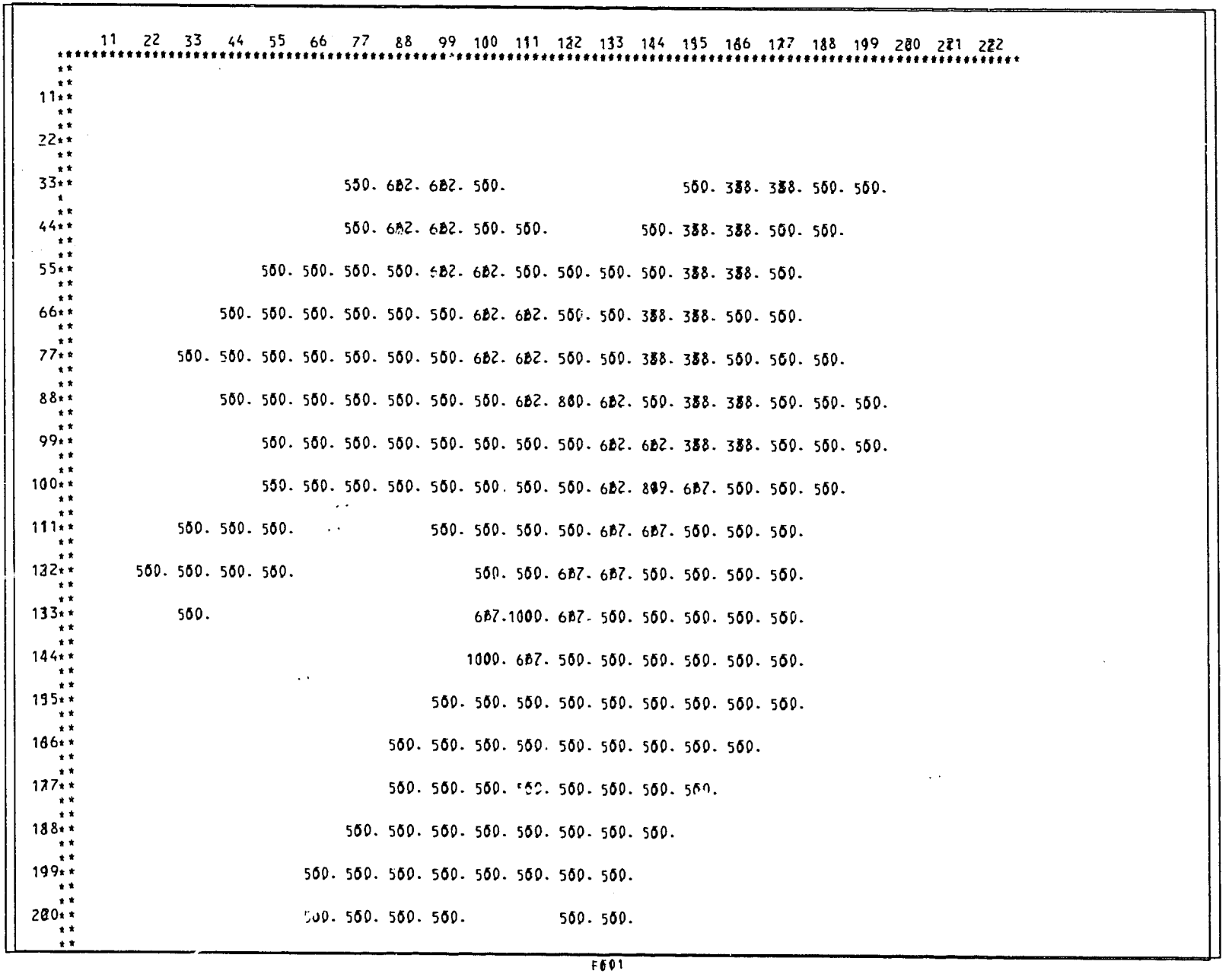
LOC	CONTENT
B01	
C01	
D01	
E01	
F01	PROGRAM GABSIM
G01	PROGRAM GABSIM
H01	PROGRAM GABSIM
I01	PROGRAM GABSIM
J01	PROGRAM GABSIM
K01	PROGRAM GABSIM
L01	PROGRAM GABSIM
M01	PROGRAM GABSIM
N01	PROGRAM GABSIM
O01	PROGRAM GABSIM
P01	PROGRAM GABSIM
B02	PROGRAM GABSIM
C02	
D02	SUBROUTINE GABDAT
E02	SUBROUTINE GABDAT
F02	SUBROUTINE GABDAT
G02	SUBROUTINE GABDAT
H02	SUBROUTINE COORD2
I02	SUBROUTINE COORD3
J02	SUBROUTINE CLIM
K02	SUBROUTINE CLIM
L02	SUBROUTINE SINGUL
M02	SUBROUTINE SINGUL
N02	SUBROUTINE LIMVA
O02	SUBROUTINE LIMVA
P02	SUBROUTINE MATCH3
B03	SUBROUTINE MATCH3
C03	SUBROUTINE MATCH3
D03	SUBROUTINE QPUMP
E03	SUBROUTINE QPUMP
F03	SUBROUTINE CHECK3
G03	SUBROUTINE CHECK3
H03	SUBROUTINE CONTR3
I03	SUBROUTINE CONTR3
J03	SUBROUTINE VARSIN
K03	SUBROUTINE VARSIN
L03	SUBROUTINE PSORMC
M03	SUBROUTINE PSORMC
N03	SUBROUTINE PSORMC
O03	SUBROUTINE PSORMC
P03	SUBROUTINE PSORMC
B04	SUBROUTINE PSORMC
C04	SUBROUTINE CARRE
D04	SUBROUTINE CARRE
E04	SUBROUTINE GEOMMC
F04	SUBROUTINE GEOMMC
G04	SUBROUTINE GEOMMC
H04	SUBROUTINE GEOMMC
I04	SUBROUTINE TDIRMC
J04	SUBROUTINE TDIRMC
K04	SUBROUTINE TDIRMC
L04	SUBROUTINE COORBO
M04	SUBROUTINE COORBO
N04	SUBROUTINE COORBO
O04	SUBROUTINE COORBO
P04	SUBROUTINE COORBO
B05	
C05	SUBROUTINE DEBRN
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E05	SUBROUTINE DEBRN
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G05	SUBROUTINE STORAG
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I05	SUBROUTINE LEAKAG
J05	SUBROUTINE LEAKAG
K05	SUBROUTINE LEAKAG
L05	SUBROUTINE FLUXES
M05	SUBROUTINE FLUXES
N05	SUBROUTINE DEBLA3
O05	SUBROUTINE DEBLA3
P05	SUBROUTINE DEBLA3
B06	SUBROUTINE DEBLA3
C06	SUBROUTINE BUDGET
D06	SUBROUTINE BUDGET
E06	SUBROUTINE BUDGET
F06	SUBROUTINE FRAMMC
G06	SUBROUTINE FRAMMC
H06	SUBROUTINE FRAMMC
I06	SUBROUTINE IMPRE1
J06	SUBROUTINE IMPRE1
K06	SUBROUTINE IMPRE1
L06	SUBROUTINE IMPRE1
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N06	SUBROUTINE IMPRE2
O06	SUBROUTINE IMPRE2
P06	SUBROUTINE IMPRE2
B07	SUBROUTINE MAPXY
C07	SUBROUTINE MAPXY
D07	SUBROUTINE MAPXY
E07	SUBROUTINE MAPXY
F07	SUBROUTINE MAPXY
G07	SUBROUTINE JOSE
H07	SUBROUTINE FORMI
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J07	SUBROUTINE CURVE2
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M07	SUBROUTINE CURVE2
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D10	**********
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O12	**********
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C13	
D13	**********
F13	1 2 3 4 5
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L13	**********
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P13	**********
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O15	**********
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D16	**********
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G16	
H16	**********
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P16	**********
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E17	
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N17	**********
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C18	**********
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G18	
H18	
I18	
J18	
L18	1 2 3
M18	5
N18	

	113	114	115	116	117	118	119	220	221	222
11	**	**	**	**	**	**	**	**	**	**
22	**	**	**	**	**	**	**	**	**	**
33	**	**	** 550.00	** 337.55	** 337.55	** 550.00	** 550.00	**	**	**
44	**	** 550.00	** 337.55	** 337.55	** 550.00	** 550.00	**	**	**	**
55	** 550.00	** 550.00	** 337.55	** 337.55	** 550.00	**	**	**	**	**
66	** 550.00	** 337.55	** 337.55	** 550.00	** 550.00	**	**	**	**	**
77	** 550.00	** 337.55	** 337.55	** 550.00	** 550.00	** 550.00	**	**	**	**
88	** 641.55	** 550.00	** 337.55	** 337.55	** 550.00	** 550.00	** 550.00	**	**	**
99	** 641.55	** 641.55	** 337.55	** 337.55	** 550.00	** 550.00	** 550.00	**	**	**
100	** 641.55	** 888.99	** 666.77	** 550.00	** 550.00	** 550.00	**	**	**	**

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111 ** **  66677 **  66677 **  50000 **  50000 **  50000 **      **      **      **
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    **  66      66      00      00      00      00
    **
    **  77      77      00      00      00      00
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    **
    **  66      55      55      55      55      55
    **  66      00      00      00      00      00
    **
    **  77      00      00      00      00      00
133 **  **  50000 **  50000 **  50000 **  50000 **  50000 **      **      **      **
    **
    **  55      55      55      55      55      55
    **  00      00      00      00      00      00
    **
    **  00      00      00      00      00      00
144 **  **  50000 **  50000 **  50000 **  50000 **  50000 **      **      **      **
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    **  55      55      55      55      55      55
    **  00      00      00      00      00      00
    **
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    **  55      55
    **  00      00
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    **
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    **
    **
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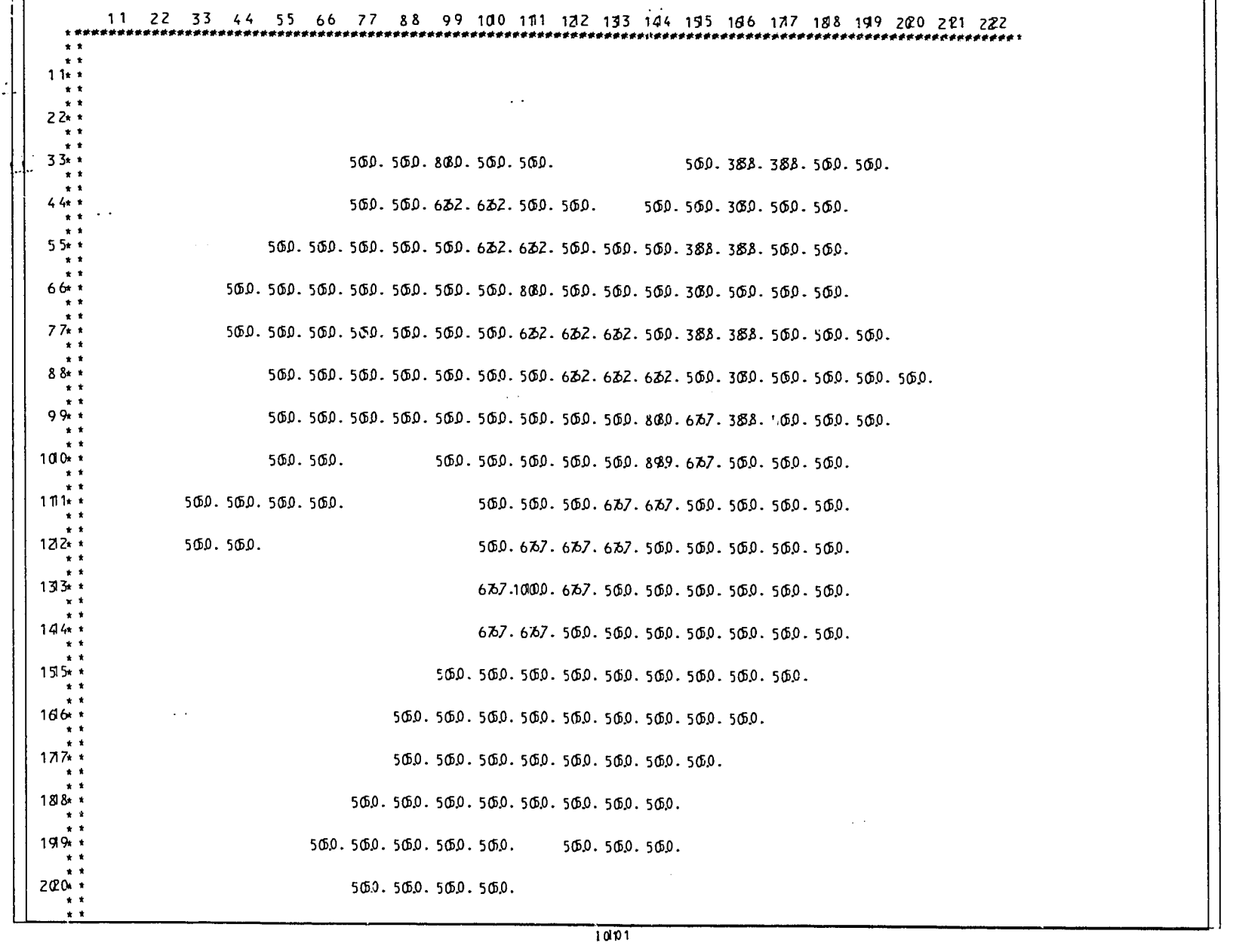
222 ** ** ** ** ** ** ** ** ** ** ** **
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**
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THE VALUES OF THE ARGUMENTS ARE MULTIPLIED BY:
-XXXXXXXXXX= .100000000E+04
-YYYYYYYYYY= .100000000E+04


11 22 33 44 55 66 77 88 99 100 111 122 133 144 155 166 177 188 199 200 211 222
11
22
33
44
55
66
77
88
99
100
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144
155
166
177
188
199
200

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222**

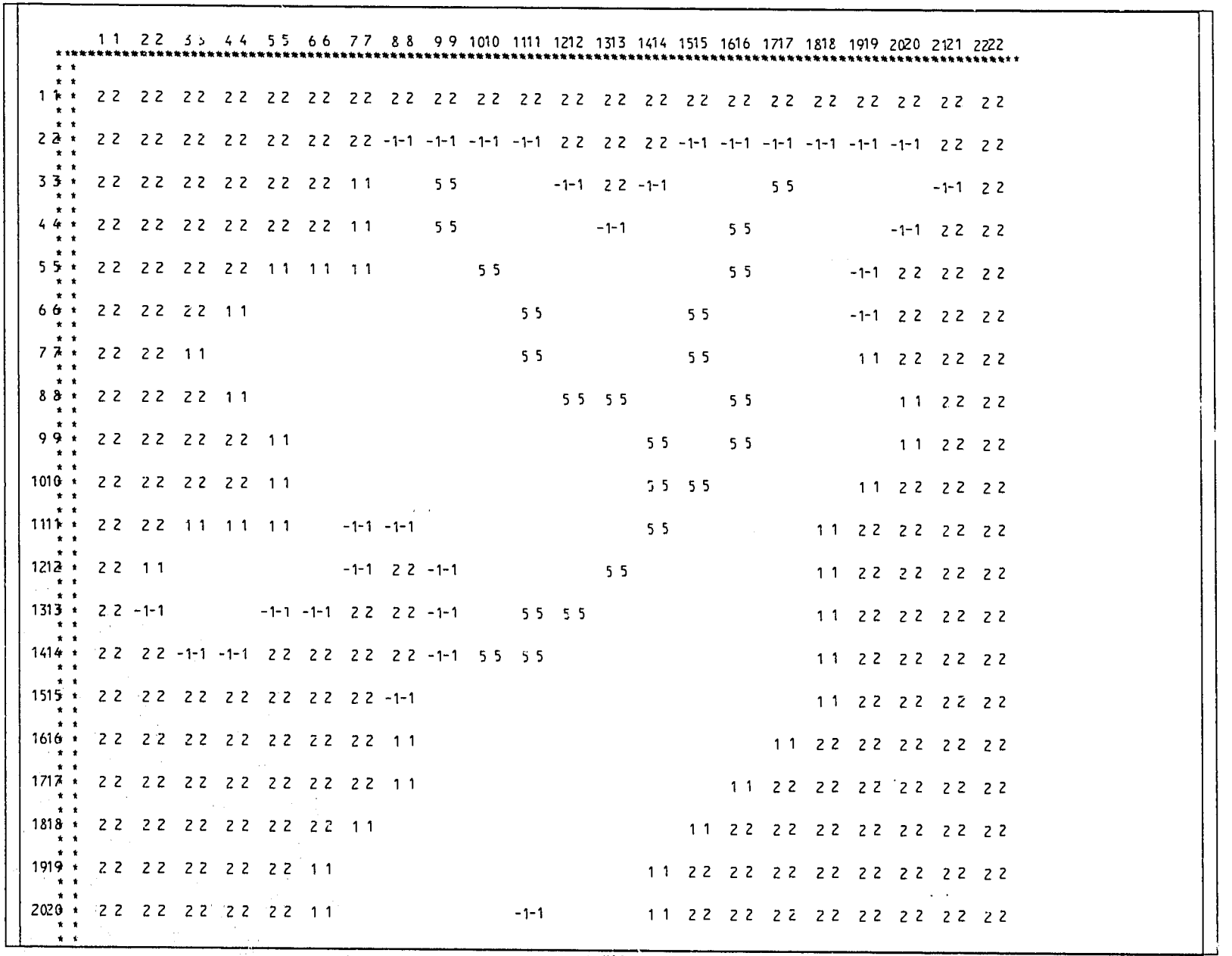

      ***VALUES OF ARGUMENT MULTIPLIED BY  .10000000E+04***
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11
22
33
44
55
66
77
88
99
100
111
122
133
144
155
166
177
188
199
200
1001

```
2121* *
    * *
    * *
2222* *


      * ***AAVAILABLESDIOFARRORUNENTMULULTIPLIEDBYBY   .1.0000000000BD+04* *** *
```

```
* ********************************************************** *
* D=IDENTIFICATION OF THE FIELD DESCRIPTION IN NON-ACCESS *
* *                  ACQUIFER NO.: 1  1                    * *
* ********************************************************** *
```



MOM01

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212* *  2 2  2 2  2 2  2 2  2 2  2 2  1 1  1 1  1 1  1 1  2 2 -1-1 -1-1  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2
   * *
   * *
2222 *  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2  2 2

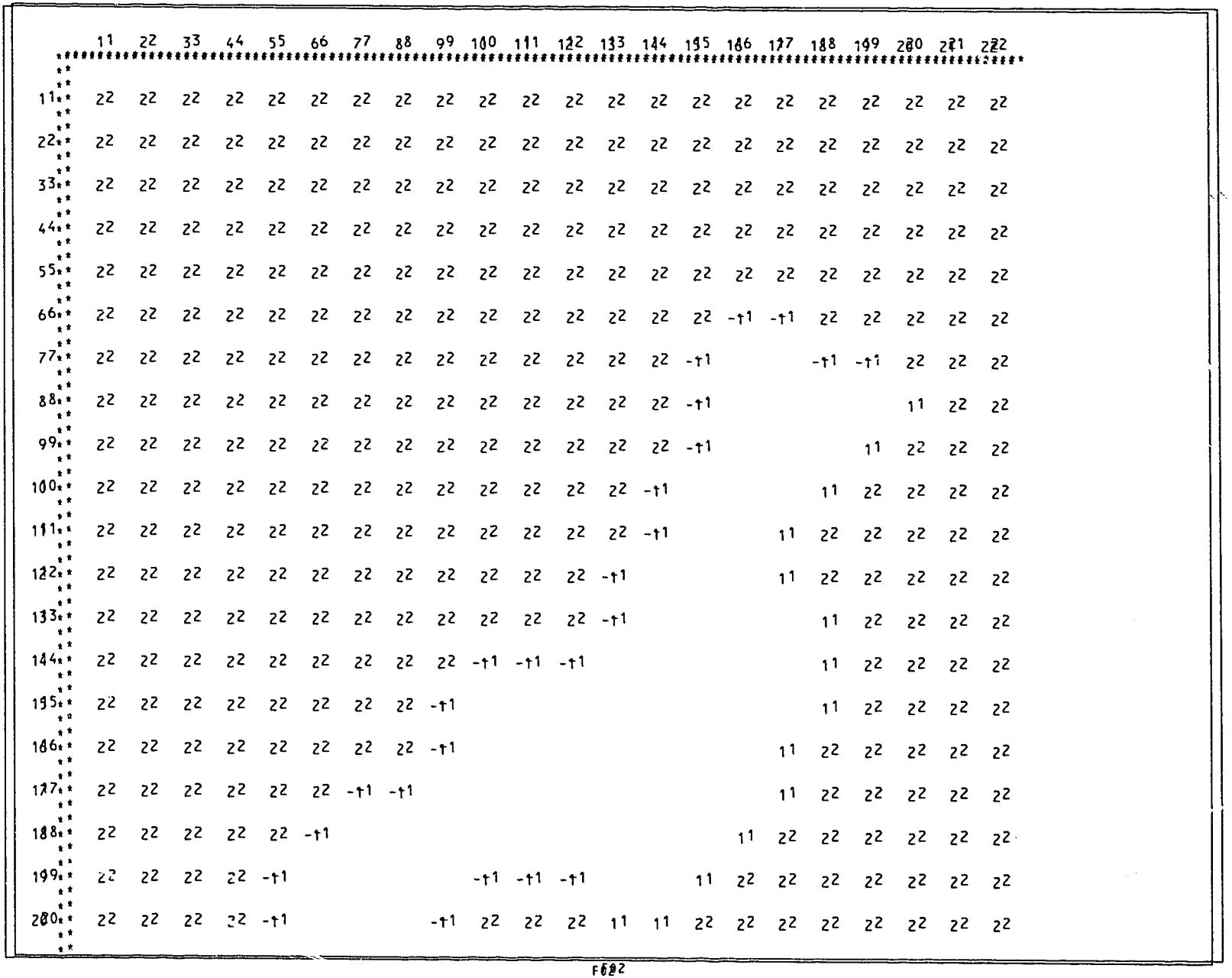
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3	2	2	2	2	2	2	2	1	1								1	1			-1	2
4	2	2	2	2	2	2	1			1			1	1	1	1				-1	2	2
5	2	2	2	2	2	1			1	2	2	1							-1	2	2	2
6	2	2	2	2	1				1	2	1								-1	2	2	2
7	2	2	2	2	1				1	1									-1	2	2	2
8	2	2	2	2	1									-1	-1			-1	2	2	2	2
9	2	2	2	2	1									-1	2	-1	-1	2	2	2	2	2
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13	2	2	2	2	2	2	2	2	2	2	-1				1	2	2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	2	-1					1	2	2	2	2	2	2	2
15	2	2	2	2	2	2	2	2	2	-1					1	2	2	2	2	2	2	2
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19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

```
 241 **  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22
     **
     **
 222 **  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22  22


      ****VALUES OF ARGUMENT MULTIPLIED BY   .10000000E+01****
```

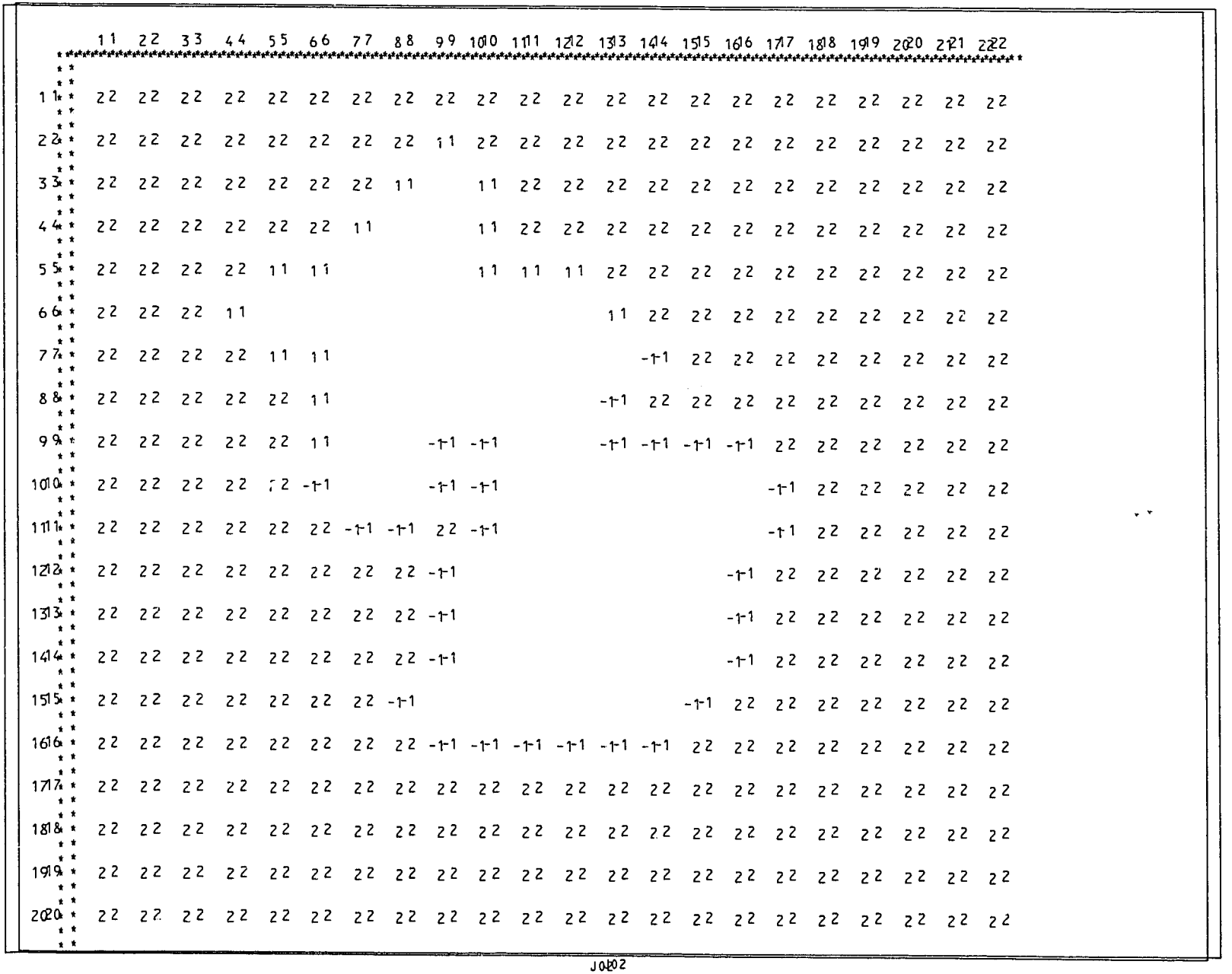

DISTRIBUTION OF FITTED DESCRIPTION INDICES
AQUIFER NO: 33



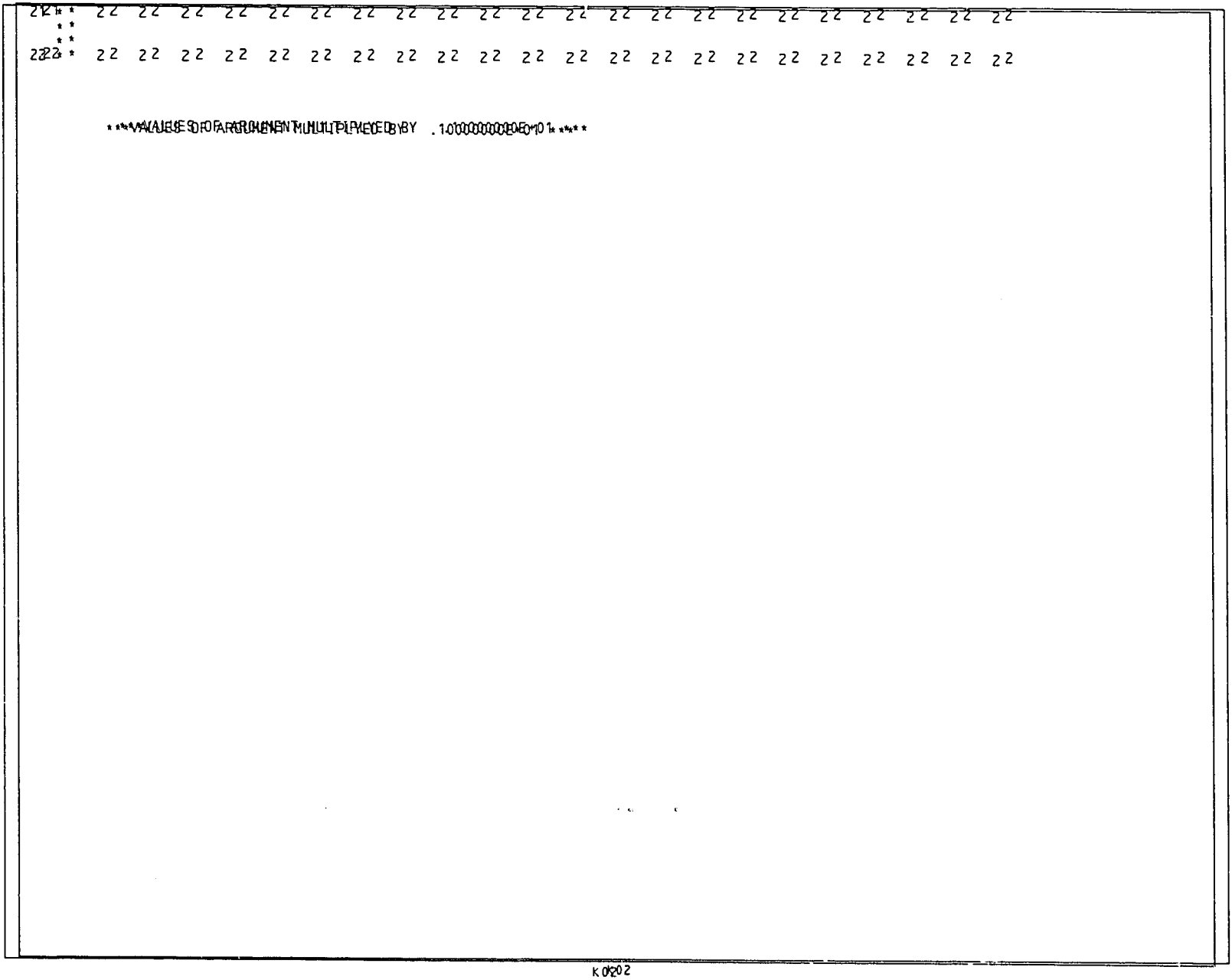
```
zz**  zz  zz  zz  zz  zz -ff -ff -ff  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz
  **
  **
zz**  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz  zz


      ***VALUES OF ARGUMENT MULTIPLIED BY  .10000000E+01***
```

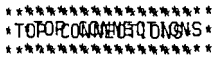

DISTRIBUTION OFFICE DESCRIPTION INDICES
ACCUTECH NO: 44

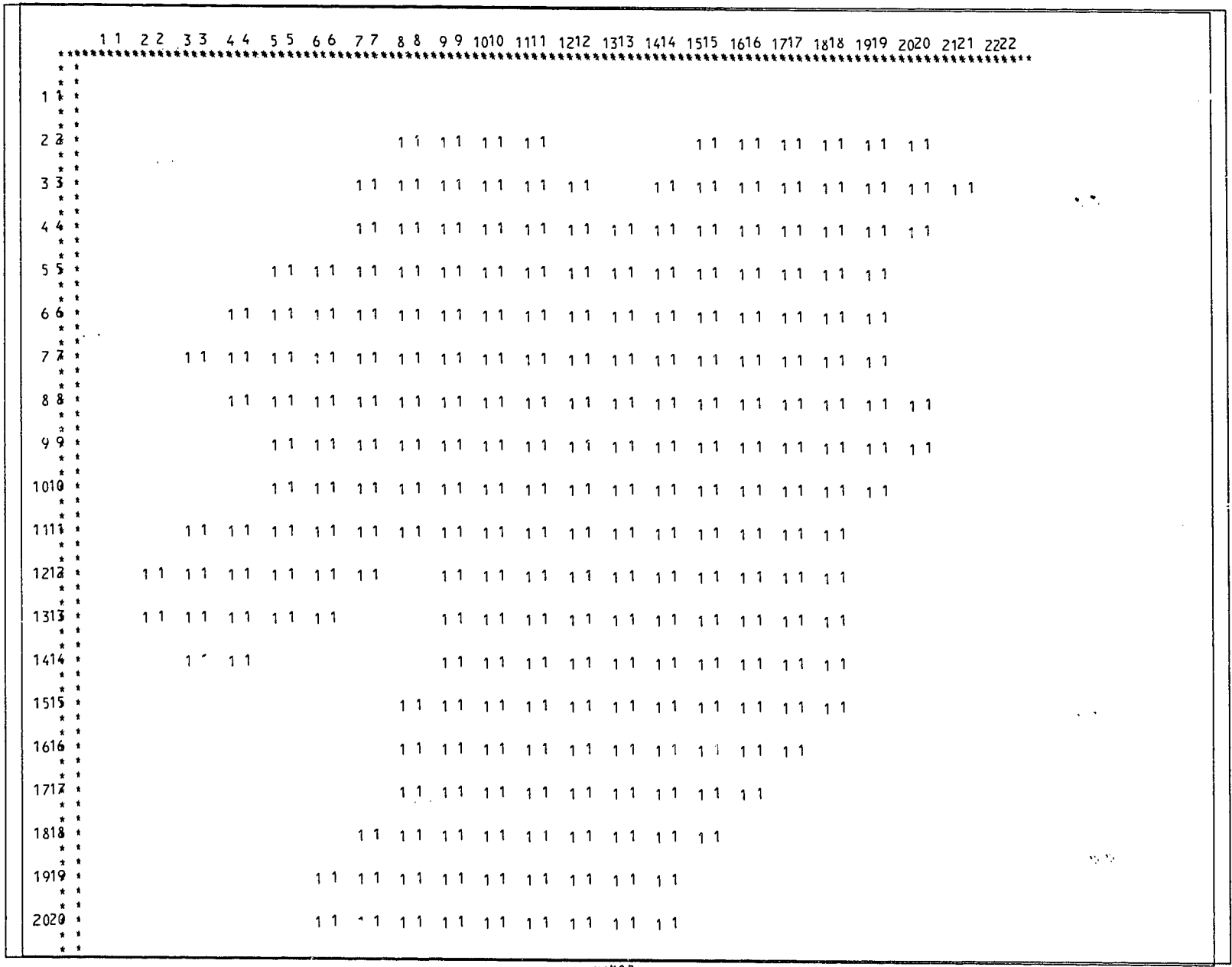


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2
3	2	2	2	2	2	2	2	1		1	2	2	2	2	2	2	2	2	2	2	2	2
4	2	2	2	2	2	2	1			1	2	2	2	2	2	2	2	2	2	2	2	2
5	2	2	2	2	1	1				1	1	1	2	2	2	2	2	2	2	2	2	2
6	2	2	2	1									1	2	2	2	2	2	2	2	2	2
7	2	2	2	2	1	1								-1	2	2	2	2	2	2	2	2
8	2	2	2	2	2	1							-1	2	2	2	2	2	2	2	2	2
9	2	2	2	2	2	1			-1	-1			-1	-1	-1	-1	2	2	2	2	2	2
10	2	2	2	2	2	-1			-1	-1							-1	2	2	2	2	2
11	2	2	2	2	2	2	-1	-1	2	-1							-1	2	2	2	2	2
12	2	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2
15	2	2	2	2	2	2	2	-1							-1	2	2	2	2	2	2	2
16	2	2	2	2	2	2	2	2	-1	-1	-1	-1	-1	-1	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2


22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22
22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22
VALUES OF ARGUMENT MULTIPLIED BY 1.0000000000E+01


VERTICAL AQUIFER CONNECTIONS
AQUIFER NO: 1 1

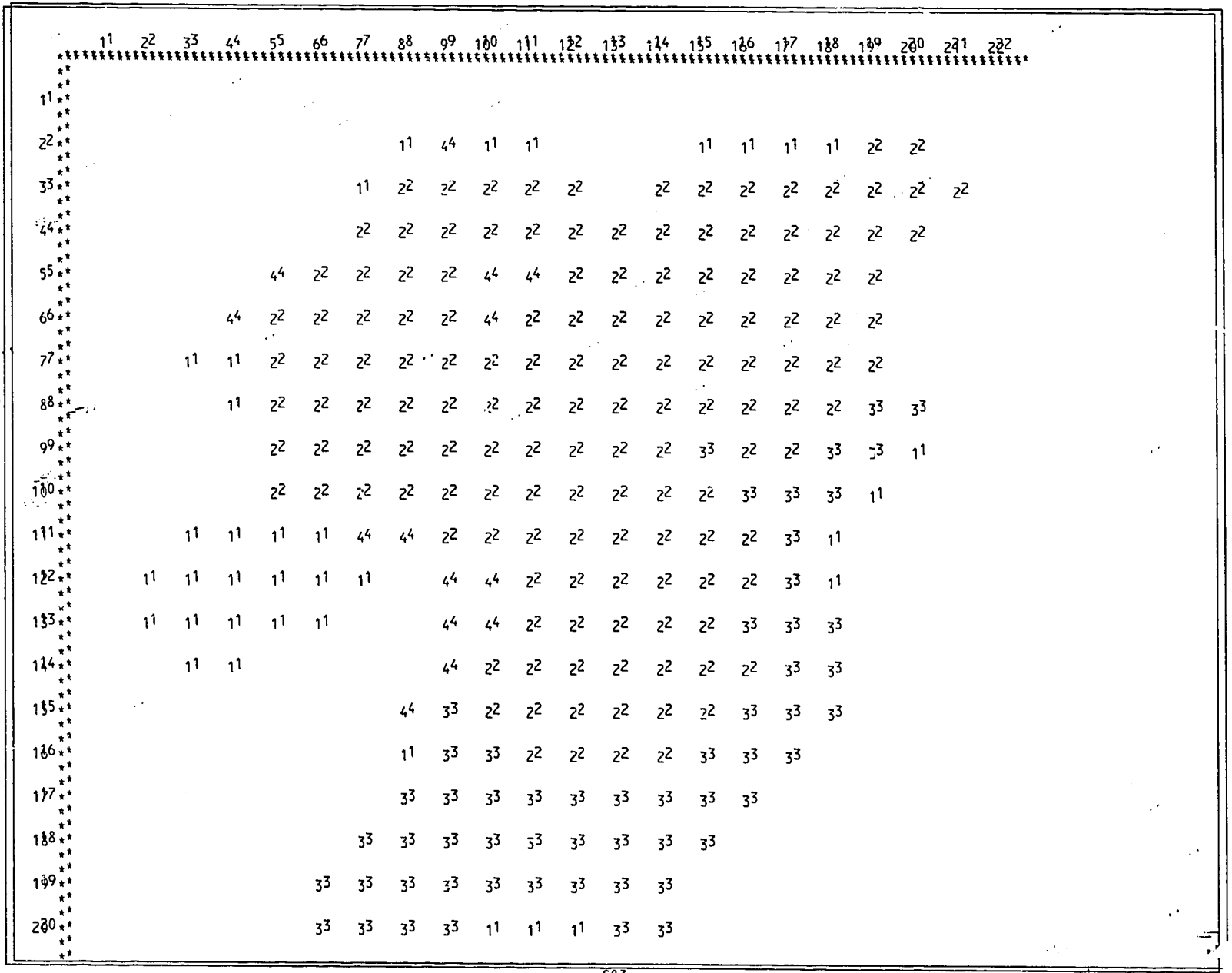

TOP CONNECTIONS



```
2121 *
   * *
   * *
2222 *
```

VALUE USED FOR ARGUMENT NUMBER 1 PASSED BY .1000000000000*

****
BOOMOUANNECTIONS
****

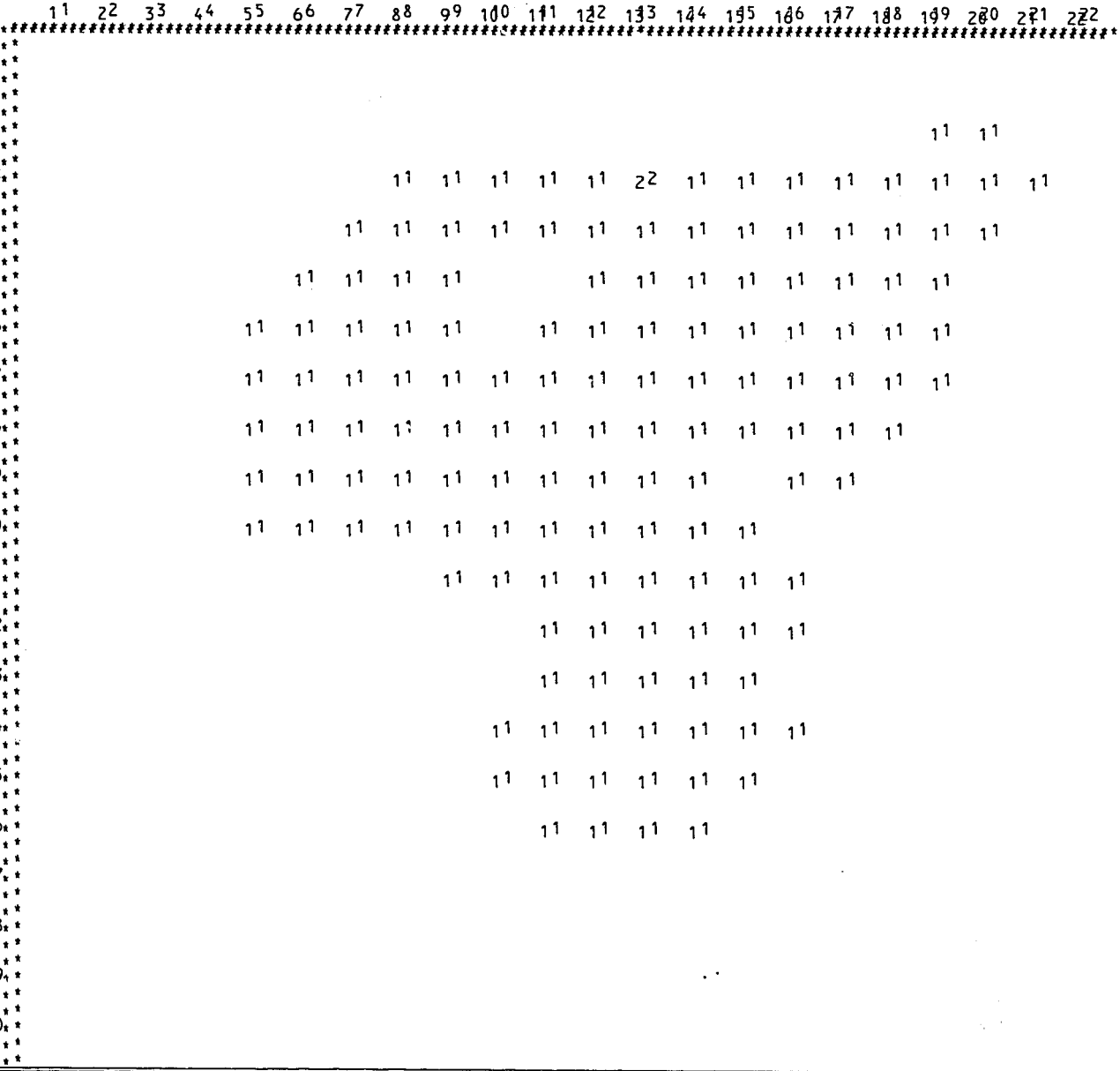


```
241 **                              33  33  11  11      11  11
    **
    **
222 **


    ***VALUES OF ARGUMENT MULTIPLIED BY  .10000000E-01***
```


VERTICAL AQUIFER CONNECTIONS
AQUIFER NO: 22

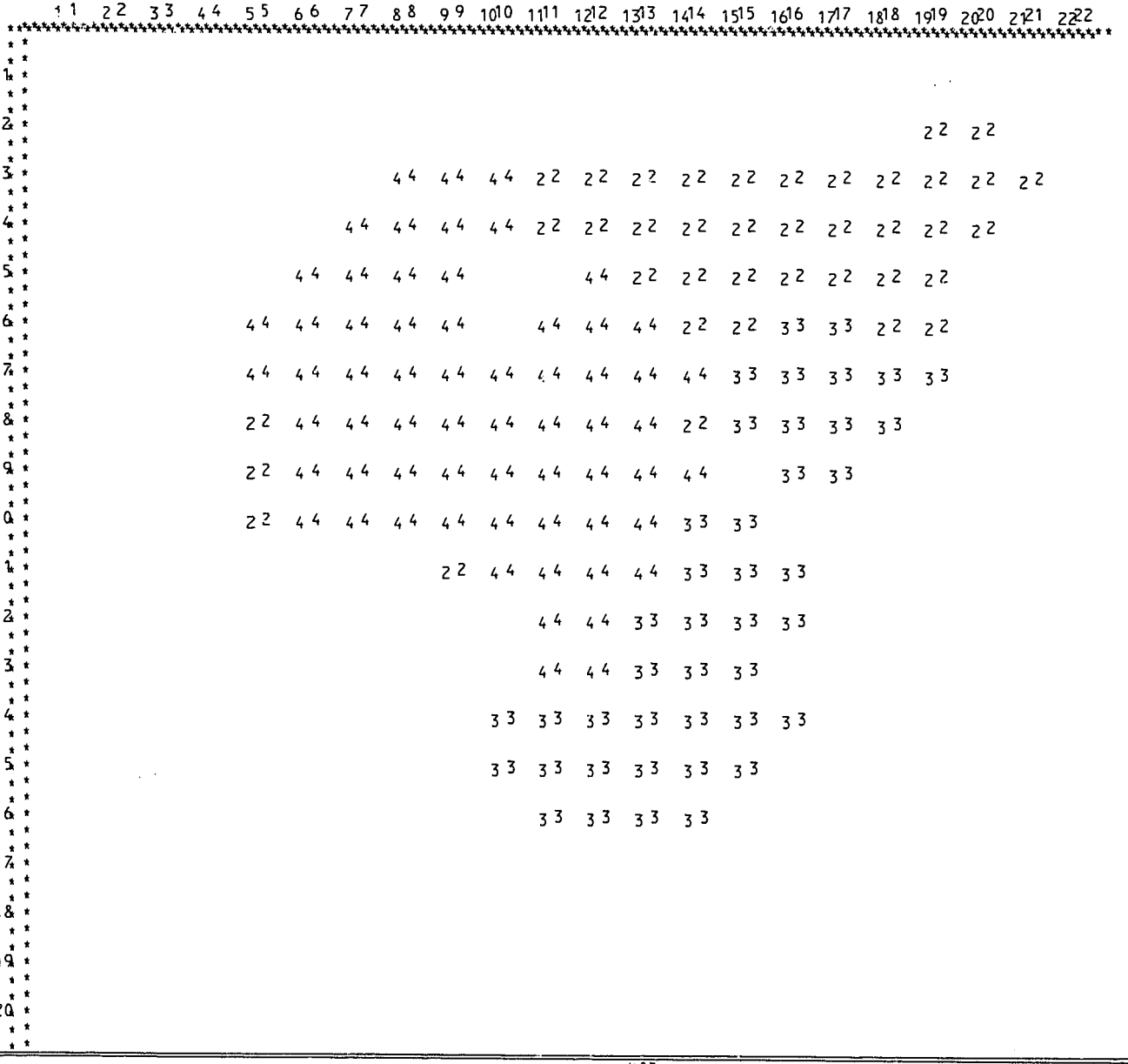

TOP CONNECTIONS



```
221 **
  **
  **
222 **
```

VALUES OF ARGUMENT MULTIPLIED BY .10000000E+01

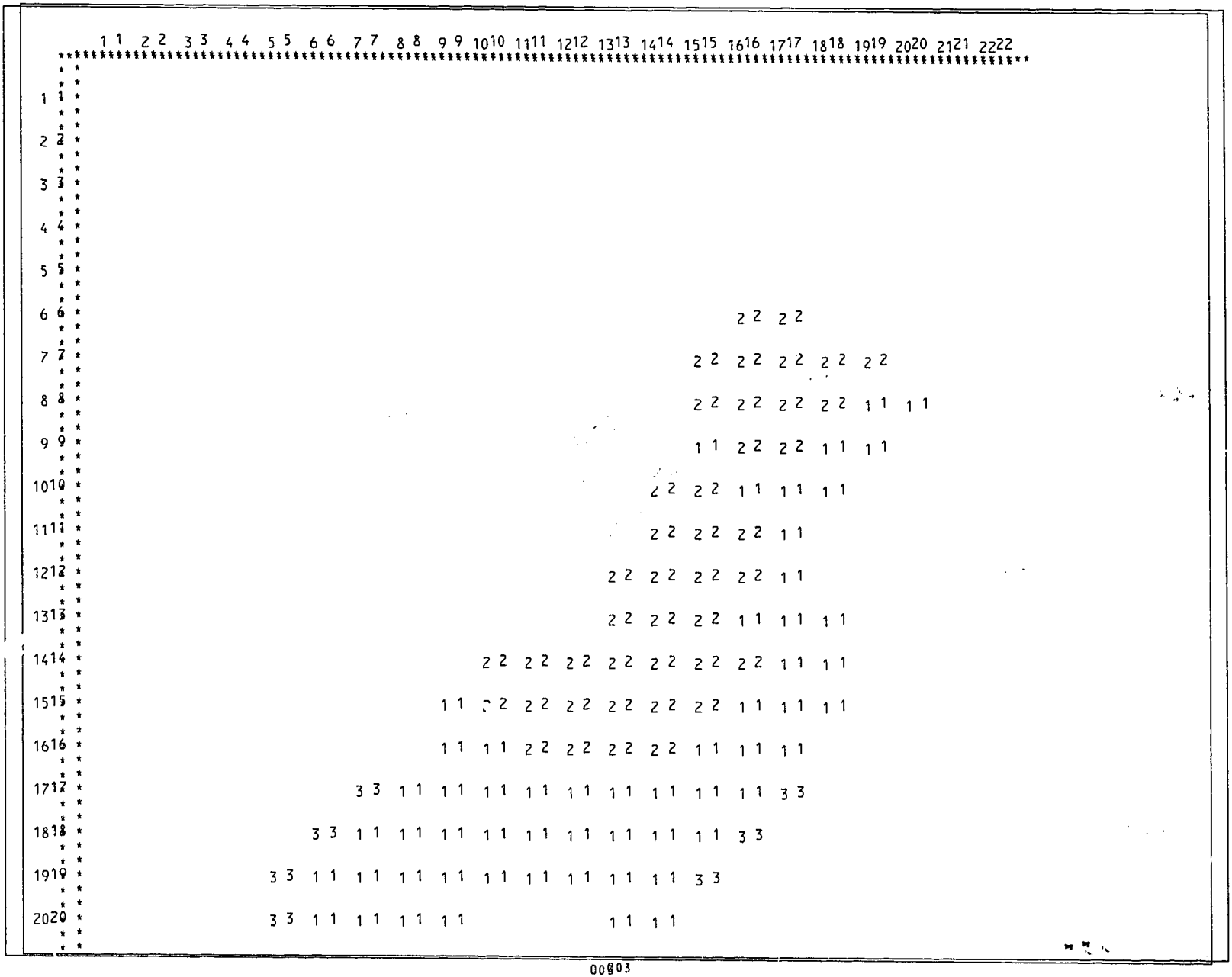
```
**********************
*BOTTOM CONNECTIONS  *
**********************
```


1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10 11 11 12 12 13 13 14 14 15 15 16 16 17 17 18 18 19 19 20 20 21 21 22 22
1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 8
9 9
10 10
11 11
12 12
13 13
14 14
15 15
16 16
17 17
18 18
19 19
20 20

```
212 *
    *
    *
222 *
```

VALUES OF ARGUMENT MULTIPLIED BY .10000000E+01


VERTICAL AQUIFER CONNECTIONS
AQUIFER NO: 3
TOP CONNECTIONS

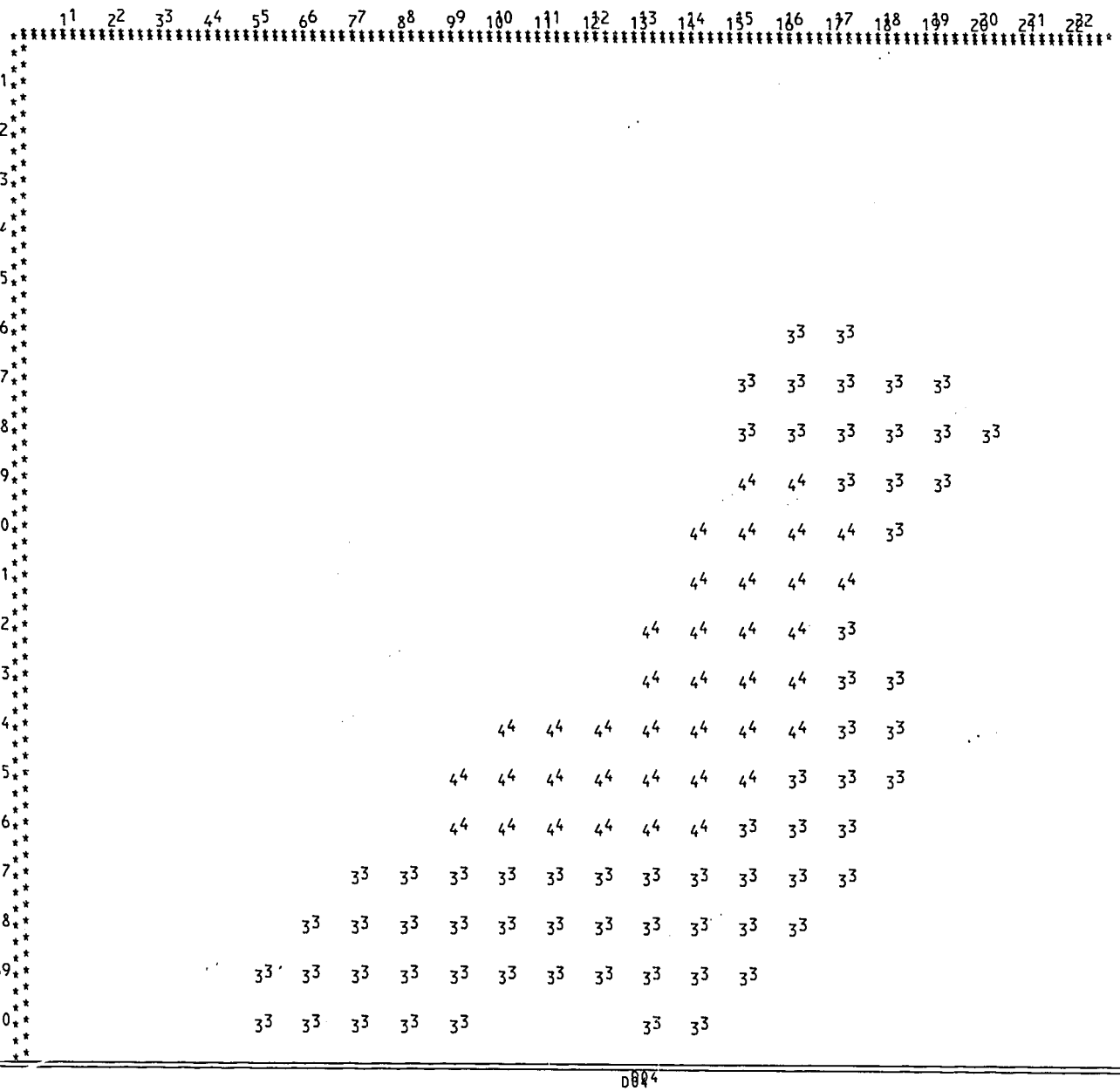

1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10 11 11 12 12 13 13 14 14 15 15 16 16 17 17 18 18 19 19 20 20 21 21 22 22
1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 8
9 9
10 10
11 11
12 12
13 13
14 14
15 15
16 16
17 17
18 18
19 19
20 20

2121 *
* *
* *
2222 *

3 3 1 1 1 1

VALUE ERROR ARGUMENT MULTIPLIED BY [v .10000000005101

****
BOTTOM CONNECTIONS
****

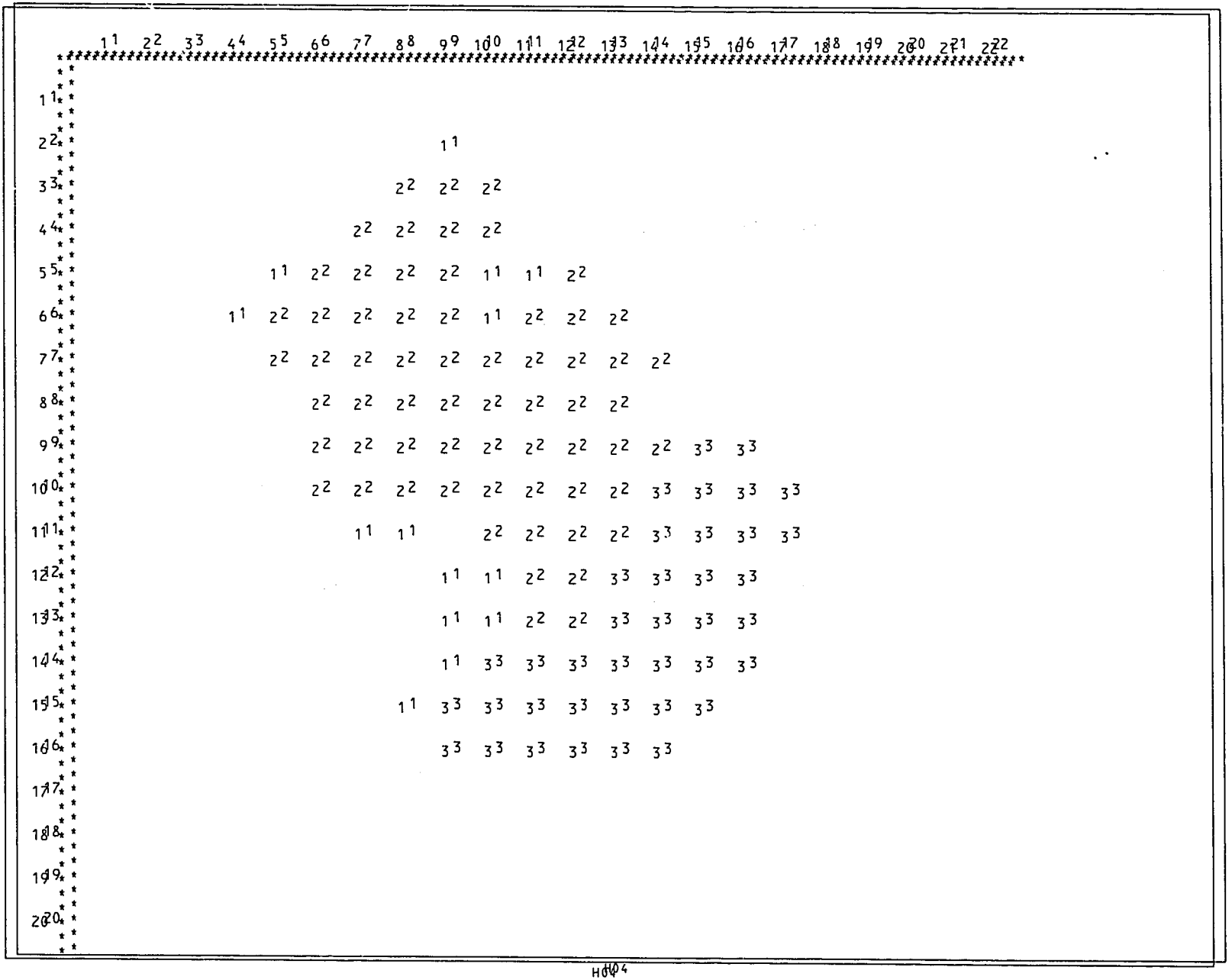


```
241 **                    33   33   33
    **
    **
222 **

    ***VALUES OF ARGUMENT MULTIPLIED BY  .10000000E+01***
```

****
VERTICAL AQUIFER CONNECTIONS
AQUIFER NO: 44
****

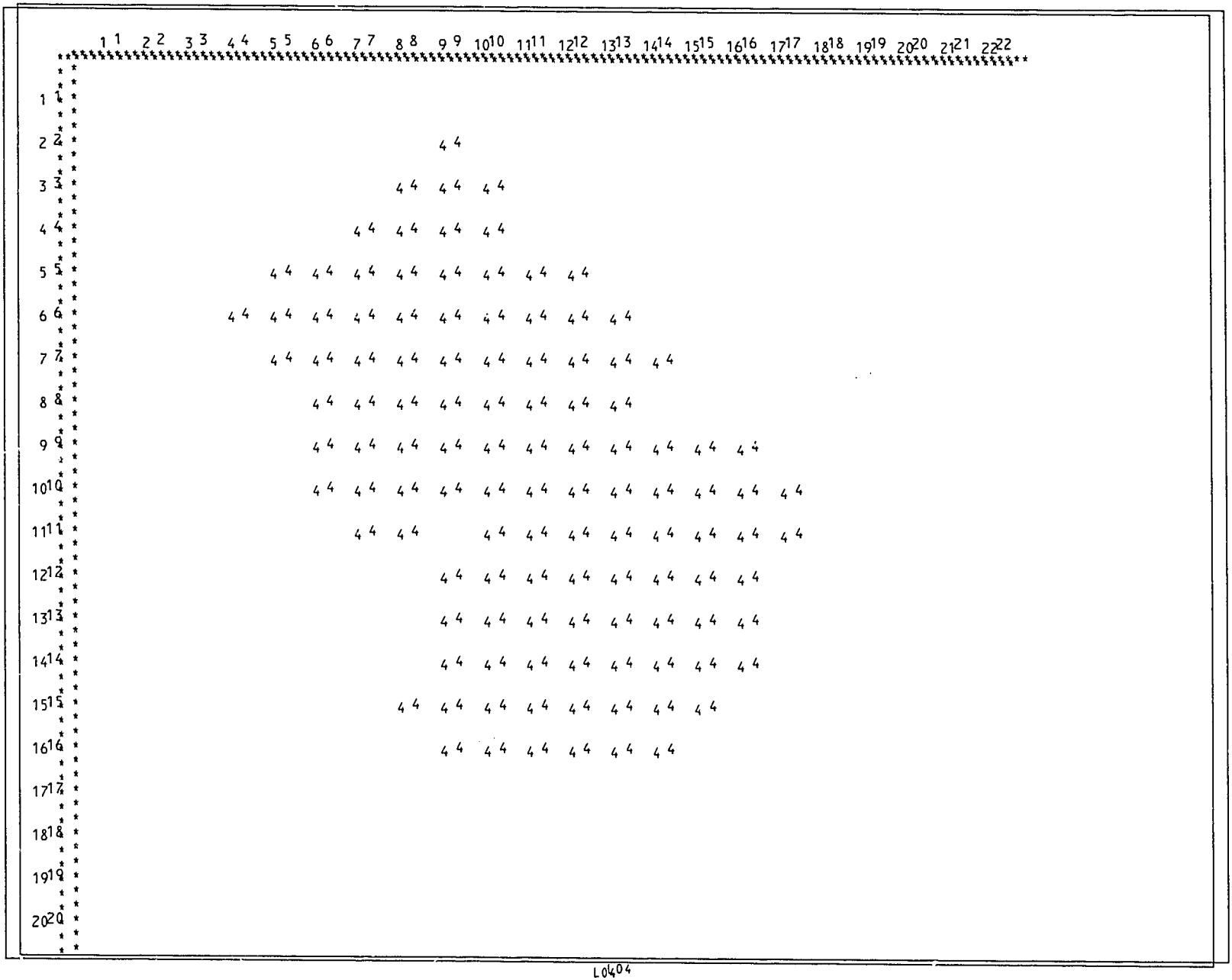
****
TOP CONNECTIONS
****



```
21 *
   *
   *
22 *
```

*** VALUES OF ARGUMENT MULTIPLIED BY .10000000E+01 ***


BOTTOM CONNECTIONS
BOTTOM CONNECTIONS



L0404

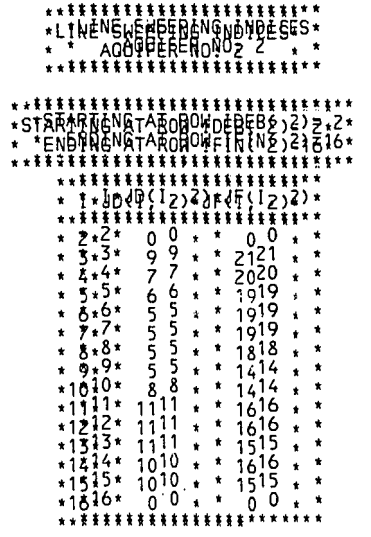
```
2121 *
     * *
     * *
2222 *

***VALUES OF ARGUMENT MULTIPLIED BY .10000000E+01***
```

```
*LINE SWEEPING ENDLESS*
*  ALGORITHM NO. 1  *
```

```
*STARTING AT ROW (DEB(1)+2)=2*
* ENDING AT ROW (FIN(1)+2)=21*
```

I	JD(I,1)	JF(I,1)
2	0	0
3	7	21
4	7	20
5	7	19
6	4	19
7	3	19
8	4	20
9	5	20
10	5	19
11	5	18
12	2	18
13	2	18
14	9	18
15	8	18
16	8	17
17	8	16
18	7	15
19	6	14
20	6	14
21	0	0


LINE SWEEPING INDICES
AGGREGATE NO 2
STARTING ROW INDEX(N2) 2
ENDING ROW INDEX(N2) 16
I JD(I2) IF(I2)
1 0 0
2 0 0
3 9 9 21 21
4 7 7 20 20
5 6 6 19 19
6 5 5 19 19
7 5 5 19 19
8 5 5 18 18
9 5 5 14 14
10 8 8 14 14
11 11 11 16 16
12 11 11 16 16
13 11 11 15 15
14 10 10 16 16
15 10 10 15 15
16 0 0 0 0

LINE SWEEP NODES
AOOPERATION 3

STARTING AT ROW DEBUG (NS) 3	6
ENDING AT ROW FINAL (NS) 21	21

I	JDD(I)	JDF(I)
6	0	0
7	15	18
8	15	20
9	15	19
10	14	18
11	14	17
12	13	17
13	13	18
14	12	18
15	9	18
16	9	17
17	8	17
18	6	16
19	5	15
20	5	9
21	0	0

```
*************************
*LINE SWEEPING INDICES  *
*  ADDITIVE NO: 24      *
*************************

*************************
*STARTING AT ROW IDEB(42)=24*
*ENDING AT ROW IFIN(42)=169*
*************************

*************************
*I    JDEB,42)  JFIN,42)*
*************************
*  24      0  *  0      *
*  33     88  *  100    *
*  43     77  *  100    *
*  51     66  *  100    *
*  69     44  *  133    *
*  74     66  *  144    *
*  88     66  *  133    *
*  89     66  *  132    *
*  92     66  *  132    *
*  101    66  *  177    *
*  111   100  *  177    *
*  122    99  *  176    *
*  123    99  *  166    *
*  131    99  *  166    *
*  144    99  *  166    *
*  153    88  *  155    *
*  166     0  *  0      *
*************************

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  51 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO   .2451557E+02
   AND AN AVERAGE POINT ERROR EQUAL TO   .1872018E+01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  51 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO   .1597279E+02
   AND AN AVERAGE POINT ERROR EQUAL TO   .1335243E+01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  51 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO   .1469710E+02
   AND AN AVERAGE POINT ERROR EQUAL TO   .1495417E+01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  51 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO   .1518069E+02
   AND AN AVERAGE POINT ERROR EQUAL TO   .1416866E+01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  51 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO   .1335258E+02
   AND AN AVERAGE POINT ERROR EQUAL TO   .1262885E+01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000
```

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .1338699E+01
AND AN AVERAGE POINT ERROR EQUAL TO .1833597E+00
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .2419255E+01
AND AN AVERAGE POINT ERROR EQUAL TO .2926762E+00
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .3310093E+01
AND AN AVERAGE POINT ERROR EQUAL TO .3317870E+00
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .3891222E+01
AND AN AVERAGE POINT ERROR EQUAL TO .3382072E+00
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .3303274E+01
AND AN AVERAGE POINT ERROR EQUAL TO .2830269E+00
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .3273388E+00
AND AN AVERAGE POINT ERROR EQUAL TO .4877140E-01
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .5500458E+00
AND AN AVERAGE POINT ERROR EQUAL TO .7175372OE-01
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .7925349E+00
AND AN AVERAGE POINT ERROR EQUAL TO .8727332E-01
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS
WITH MAXIMUM POINT ERROR EQUAL TO .9330671E+00
AND AN AVERAGE POINT ERROR EQUAL TO .8849878E-01
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN 51 ITERATIONS

```
 WITH A MAXIMUM POINT ERROR EQUAL TO   .8660676E+00
  AND AN AVERAGE POINT ERROR EQUAL TO   .7488473E-01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  51 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .8660676E+00
  AND AN AVERAGE POINT ERROR EQUAL TO   .7488473E-01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  51 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .1433812E+00
  AND AN AVERAGE POINT ERROR EQUAL TO   .1926312E-01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  51 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .2091426E+00
  AND AN AVERAGE POINT ERROR EQUAL TO   .2327392E-01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  51 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .2308306E+00
  AND AN AVERAGE POINT ERROR EQUAL TO   .2391294E-01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  51 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .2430707E+00
  AND AN AVERAGE POINT ERROR EQUAL TO   .1979941E-01
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  11 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .1331816E+01
  AND AN AVERAGE POINT ERROR EQUAL TO   .5478981E-03
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  11 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .1422412E+01
  AND AN AVERAGE POINT ERROR EQUAL TO   .6239868E-03
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  11 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .1428916E+01
  AND AN AVERAGE POINT ERROR EQUAL TO   .6898524E-03
THE ERROR CHECK IS EQUAL TO   .001 METERS
THE O.R. FACTOR IS WORTH 1.000


POINTS SUCCESSIVE OVERRELAXATION CONVERGES WITHIN  11 ITERATIONS
 WITH A MAXIMUM POINT ERROR EQUAL TO   .1332048E+01
  AND AN AVERAGE POINT ERROR EQUAL TO   .6903717E-03
THE ERROR CHECK IS EQUAL TO   .001 METERS
```

```
 THE O.R. FACTOR IS WORTH 1.000
THE O.R. FACTOR IS WORTH 1.000


POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO   .1327439E+01
   AND AN AVERAGE POINT ERROR EQUAL TO   .6922999E+03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
 THE O.R. FACTOR IS WORTH 1.000
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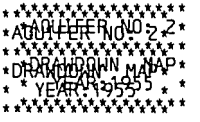

AQUIFER NO: 1
DRAWDOWN MAP
YEAR: 1995

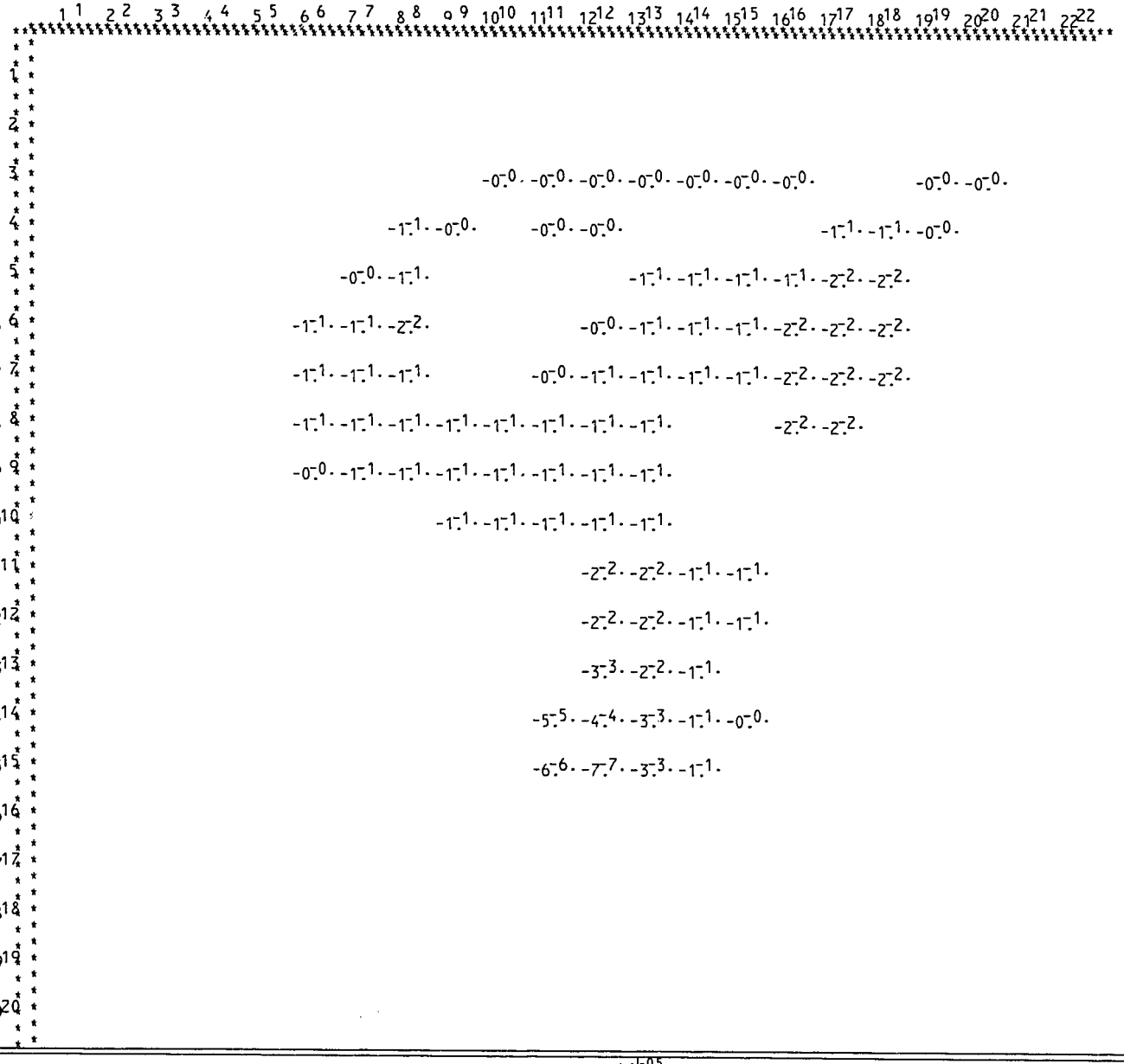
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

```
221 *
  *
  *
222 *
```

*** VALUES OF ARGUMENT MULTIPLIED BY 1.000000E+01 ***

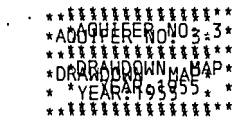
*** VALUES OF ARGUMENT MULTIPLIED BY 1.000000E+01 ***

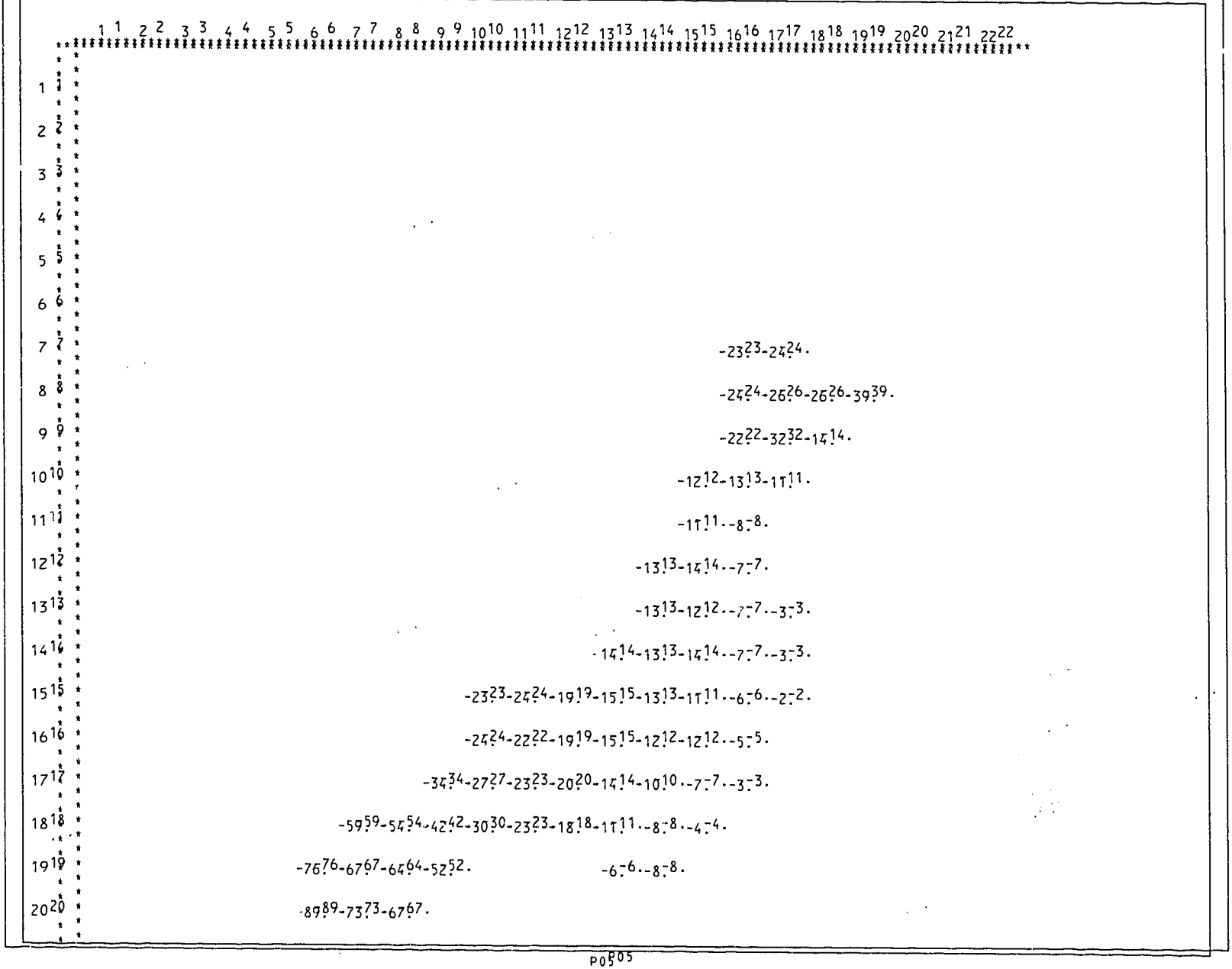

AQUIFER NO. 2
DRAWDOWN MAP
YEAR 1955


1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10 11 11 12 12 13 13 14 14 15 15 16 16 17 17 18 18 19 19 20 20 21 21 22 22
-0-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0-0.
-1-1. -0-0. -0-0. -0-0. -1-1. -1-1. -0-0.
-0-0. -1-1. -1-1. -1-1. -1-1. -1-1. -2-2. -2-2.
-1-1. -1-1. -2-2. -0-0. -1-1. -1-1. -1-1. -1-1. -2-2. -2-2. -2-2. -2-2.
-1-1. -1-1. -1-1. -0-0. -1-1. -1-1. -1-1. -1-1. -1-1. -2-2. -2-2. -2-2.
-1-1. -1-1. -1-1. -1-1. -1-1. -1-1. -1-1. -1-1. -1-1. -2-2. -2-2.
-0-0. -1-1. -1-1. -1-1. -1-1. -1-1. -1-1. -1-1. -1-1.
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-2-2. -2-2. -1-1. -1-1.
-2-2. -2-2. -1-1. -1-1.
-3-3. -2-2. -1-1.
-5-5. -4-4. -3-3. -1-1. -0-0.
-6-6. -7-7. -3-3. -1-1.

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21 *
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22 *


     ***VALUES OF ARGUMENT MULTIPLIED BY  .10000000E+01***
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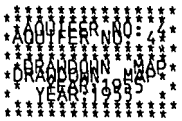

AQUIFER NO. 3
DRAWDOWN MAP
YEAR 1955

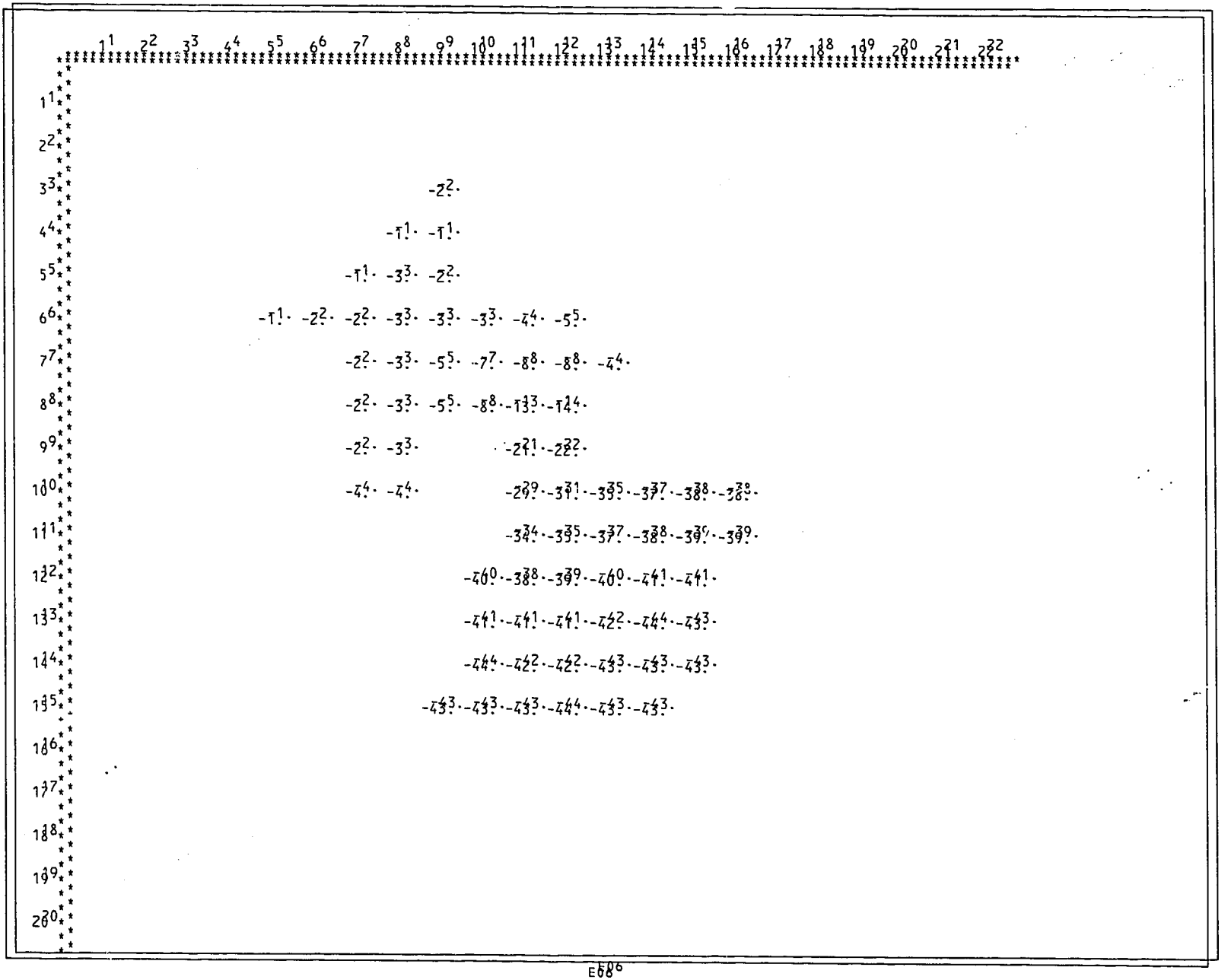

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-13 13 -12 12 -- 7 7 .-3 3 .
-14 14 -13 13 -14 14 -- 7 7 .-3 3 .
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-6 6 .-8 8 .
-89 89 -73 73 -67 67 .

241 ***
***
***
22 ***

***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01 ***

***VALUES OF ARGUMENT MULTIPLYED BY .15000000E+01 ***


AQUIFER NO: 44
DRAWDOWN MAP
YEAR: 1955



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21 **
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   **
22 **

***VALUES OF ARGUMENT MULTIPLYED BY  .10000000E+01***
***VALUES OF ARGUMENT MULTIPLYED BY  .10000000E+01***

          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .89382213E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .43797720E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .48707140E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .92833141E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .55310531E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .55310531E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .10062477E+01
             AND AN AVERAGE POINT ERROR EQUAL TO  .59076631E+03
             AND AN AVERAGE POINT ERROR EQUAL TO  .59076631E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .10033691E+01
             AND AN AVERAGE POINT ERROR EQUAL TO  .60139874E+03
             AND AN AVERAGE POINT ERROR EQUAL TO  .60139874E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .10026278E+01
             AND AN AVERAGE POINT ERROR EQUAL TO  .59800944E+03
             AND AN AVERAGE POINT ERROR EQUAL TO  .59800944E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .70976400E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .42458214E+03
             AND AN AVERAGE POINT ERROR EQUAL TO  .42458214E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .78173171E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .48080108E+03
             AND AN AVERAGE POINT ERROR EQUAL TO  .48080108E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
             WITH A MAXIMUM POINT ERROR EQUAL TO  .84000439E+02
             AND AN AVERAGE POINT ERROR EQUAL TO  .50963383E+03
             AND AN AVERAGE POINT ERROR EQUAL TO  .50963383E-03
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE ERROR CHECK IS EQUAL TO  .001 METERS
           THE O.R. FACTOR IS WORTH 1.000
           THE O.R. FACTOR IS WORTH 1.000
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POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.8427718E-02
AND AN AVERAGE POINT ERROR EQUAL TO .5177863E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.8428255E-02
AND AN AVERAGE POINT ERROR EQUAL TO .5144376E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.5667630E-02
AND AN AVERAGE POINT ERROR EQUAL TO .3708939E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.6283222E-02
AND AN AVERAGE POINT ERROR EQUAL TO .4170073E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.6626903E-02
AND AN AVERAGE POINT ERROR EQUAL TO .4408337E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.6769224E-02
AND AN AVERAGE POINT ERROR EQUAL TO .4471313E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.6678703E-02
AND AN AVERAGE POINT ERROR EQUAL TO .4408384E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.4888396E-02
AND AN AVERAGE POINT ERROR EQUAL TO .3235207E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.5465705E-02
AND AN AVERAGE POINT ERROR EQUAL TO .3634943E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO -.5279571E-02
AND AN AVERAGE POINT ERROR EQUAL TO .3824708E-03

THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .5388134E+02
AND AN AVERAGE POINT ERROR EQUAL TO .3870233E+03
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THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .5333003E+02
AND AN AVERAGE POINT ERROR EQUAL TO .5333003E+02
AND AN AVERAGE POINT ERROR EQUAL TO .3832382E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

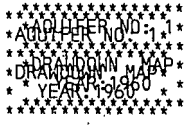
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POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .3241043E+02
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THE ERROR CHECK IS EQUAL TO .001 METERS
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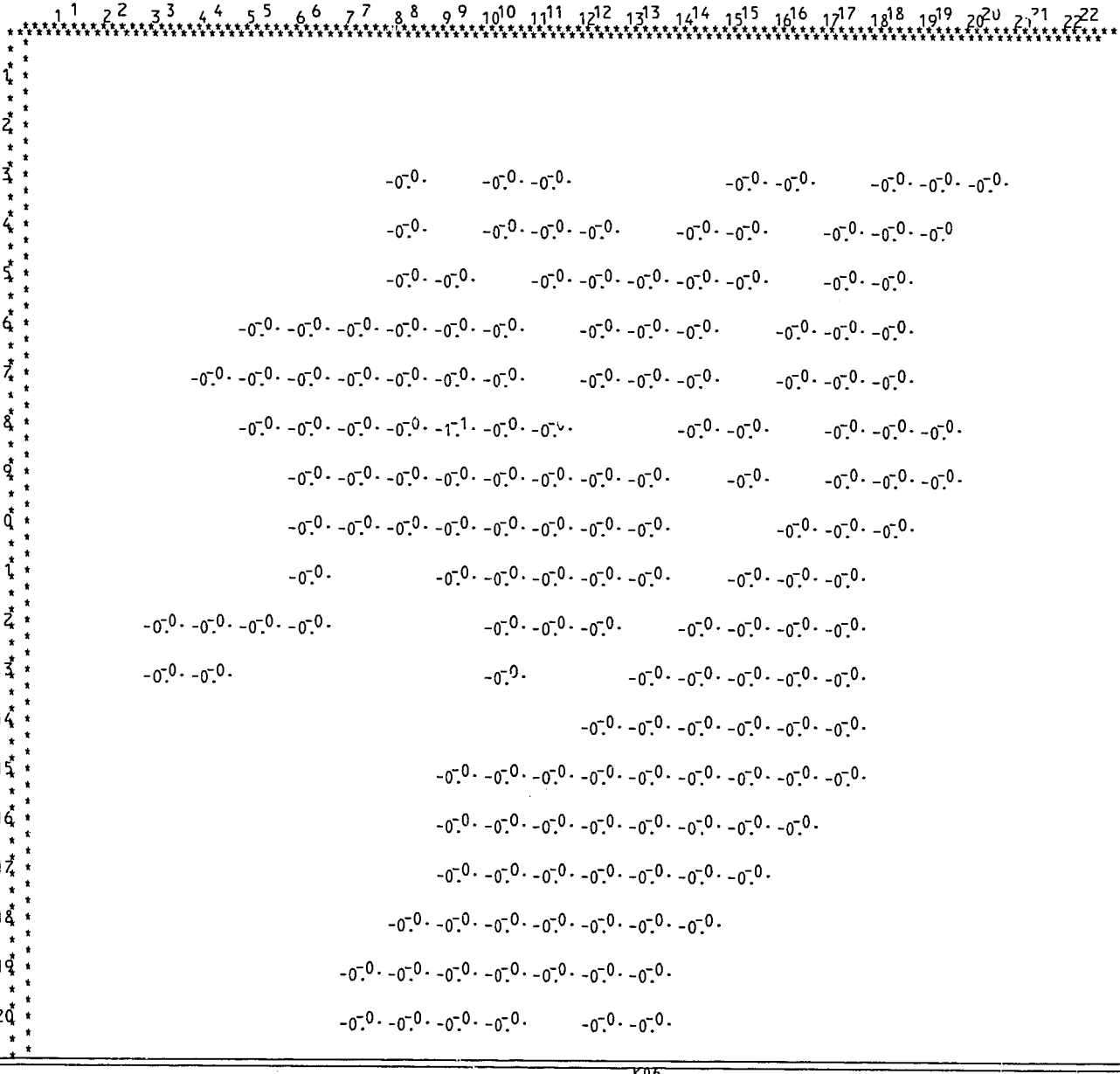
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .3972226E+02
AND AN AVERAGE POINT ERROR EQUAL TO .3216043E+03
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THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .4207689E+02
AND AN AVERAGE POINT ERROR EQUAL TO .3244772E+03
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THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .4240277E+02
AND AN AVERAGE POINT ERROR EQUAL TO .3238542E+03
AND AN AVERAGE POINT ERROR EQUAL TO .3383406E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .4238431E+02
AND AN AVERAGE POINT ERROR EQUAL TO .3236742E+03
AND AN AVERAGE POINT ERROR EQUAL TO .3361722E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
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THE O.R. FACTOR IS WORTH 1.000


AQUIFER NO. 1
DRAWDOWN MAP
YEAR 1960

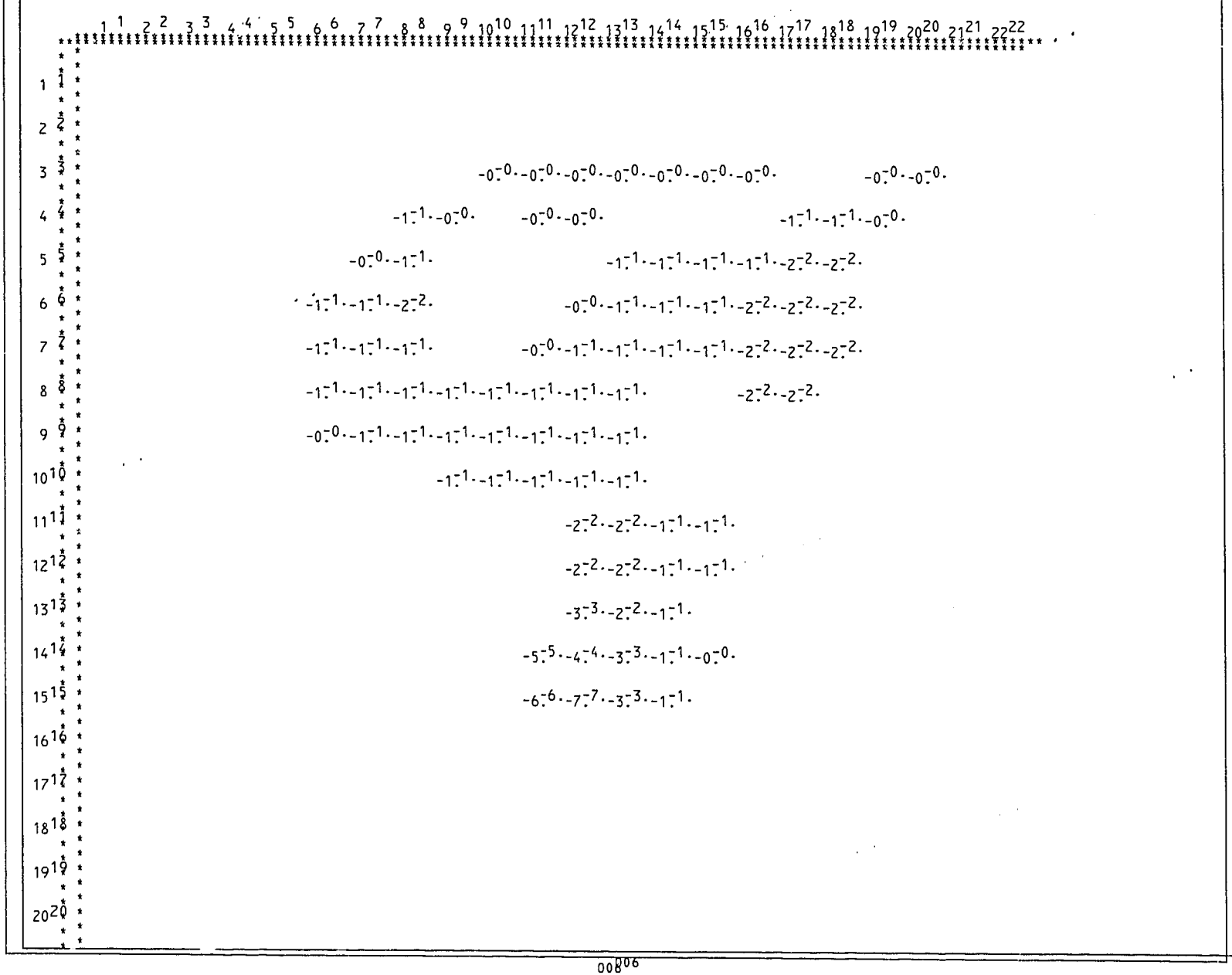

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8 8
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10 10
11 11
12 12
13 13
14 14
15 15
16 16
17 17
18 18
19 19
20 20

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21 *
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22 *
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VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01

VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01

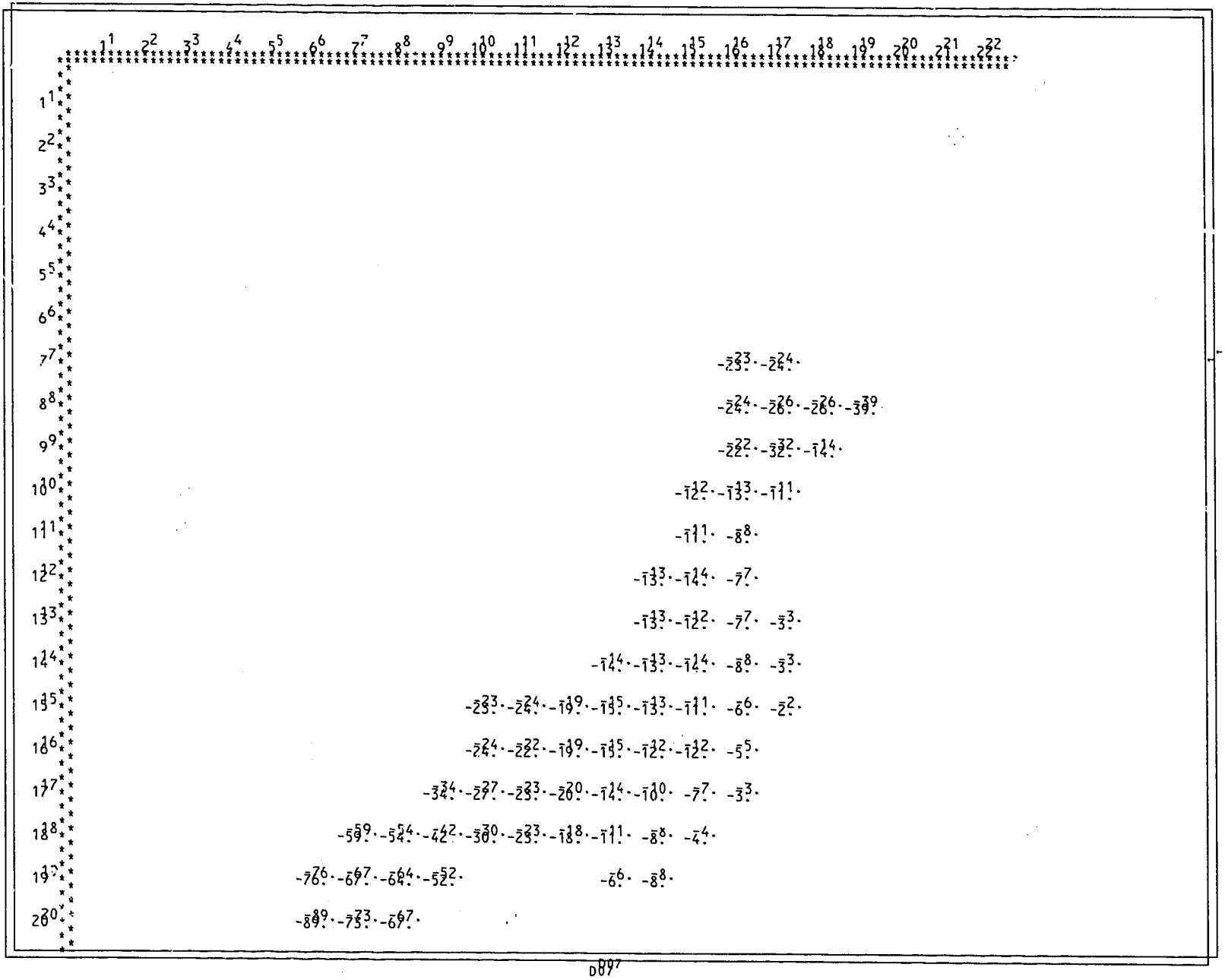

AQUIFER NO. 2
DRAWDOWN MAP
YEAR 1960


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-0-0.-0-0.
-1-1.-1-1.-0-0.
-0-0.-1-1.
-1-1.-1-1.-1-1.-1-1.-2-2.-2-2.
-1-1.-1-1.-2-2.
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-1-1.-1-1.-1-1.
-0-0.-1-1.-1-1.-1-1.-1-1.-2-2.-2-2.-2-2.
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-0-0.-1-1.-1-1.-1-1.-1-1.-1-1.-1-1.-1-1.
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22*  *

     **VALUES OF ARGUMENT MULTIPLIED BY   .10000000E+01**
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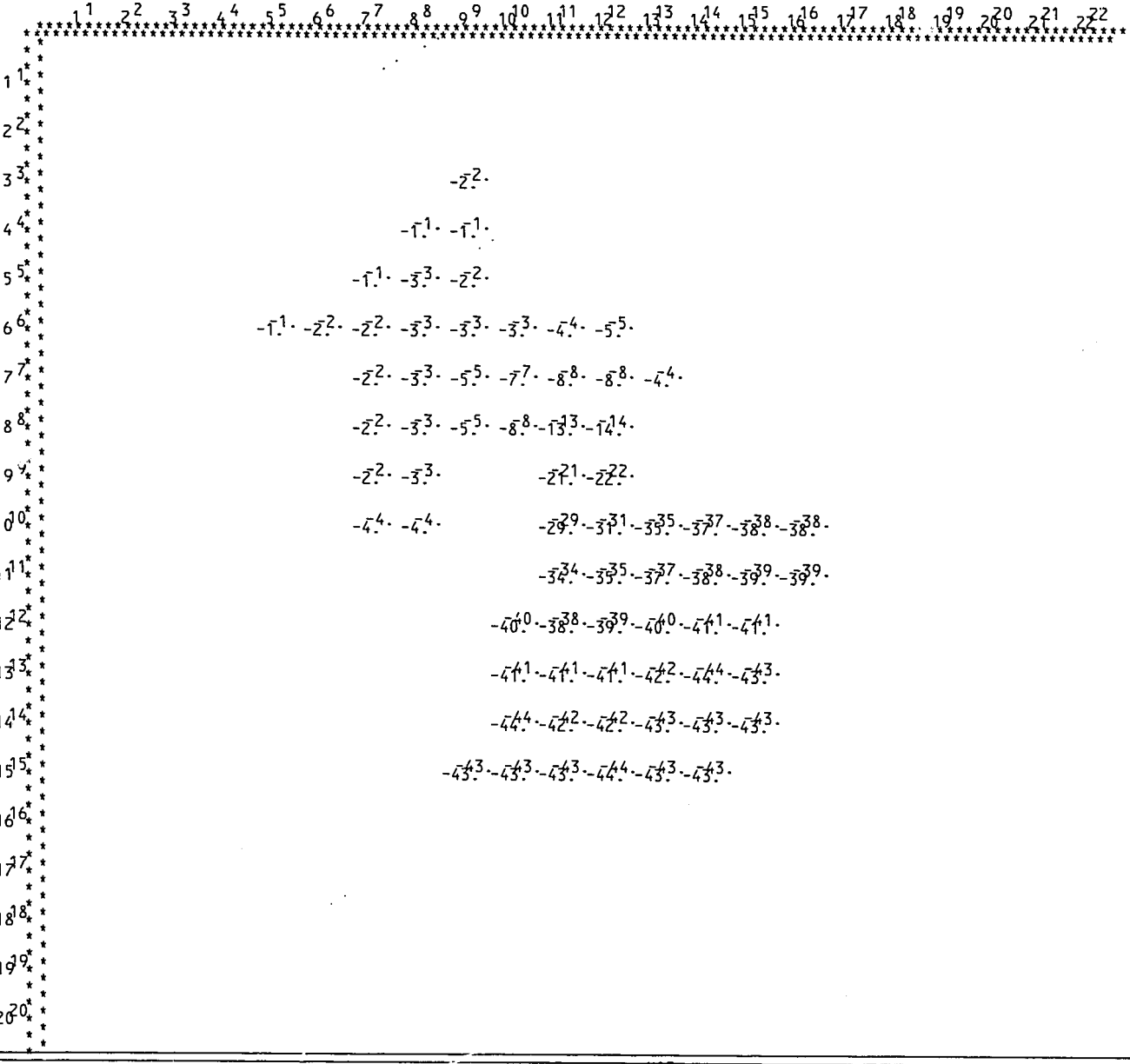

AQUIFER NO: 3
DRAWDOWN MAP
YEAR 1960



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21 ***
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22 ***
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VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01
VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01


AQUIFER NO: 3
AQUIFER NO: 4
DRAWDOWN MAP
YEAR 1960



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***VALUES OF ARGUMENT MULTIPLYED BY  .10000000E+01 ***
***VALUES OF ARGUMENT MULTIPLYED BY  .10000000E+01 ***

          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .2826997E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2858952E-03
   THE ERROR CHECK IS EQUAL TO  .2513462E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .3120723E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2824161E-03
   THE ERROR CHECK IS EQUAL TO  .2810716E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .3326809E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2838783E-03
   THE ERROR CHECK IS EQUAL TO  .2939783E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .3429659E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2853651E-03
   THE ERROR CHECK IS EQUAL TO  .2972874E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .3338870E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2869221E-03
   THE ERROR CHECK IS EQUAL TO  .2952116E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .3226536E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2865308E-03
   THE ERROR CHECK IS EQUAL TO  .2880983E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .2497574E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2792569E-03
   THE ERROR CHECK IS EQUAL TO  .2494959E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000


          POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN  1 ITERATIONS
   WITH A MAXIMUM POINT ERROR EQUAL TO  .2695124E-02
   AND AN AVERAGE POINT ERROR EQUAL TO  .2694135E-03
   THE ERROR CHECK IS EQUAL TO  .2601552E-03
  THE ERROR CHECK IS EQUAL TO  .001 METERS
  THE O.R. FACTOR IS WORTH 1.000
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POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2748699E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2745924E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2745929E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2760295E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2812336E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2051683E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2002487E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2230166E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2152826E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2318135E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2252097E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2339548E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .2132492E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2324086E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1457978E-02
AND AN AVERAGE POINT ERROR EQUAL TO .1857978E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1600323E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2007081E-03
THE ERROR CHECK IS EQUAL TO .0001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1732886E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2079052E-03

THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1742947E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1760976E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2097275E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1741403E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1750405E-02
AND AN AVERAGE POINT ERROR EQUAL TO .2083868E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

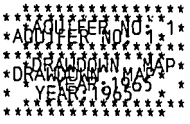
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1725217E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1749378E-02
AND AN AVERAGE POINT ERROR EQUAL TO .1693210E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

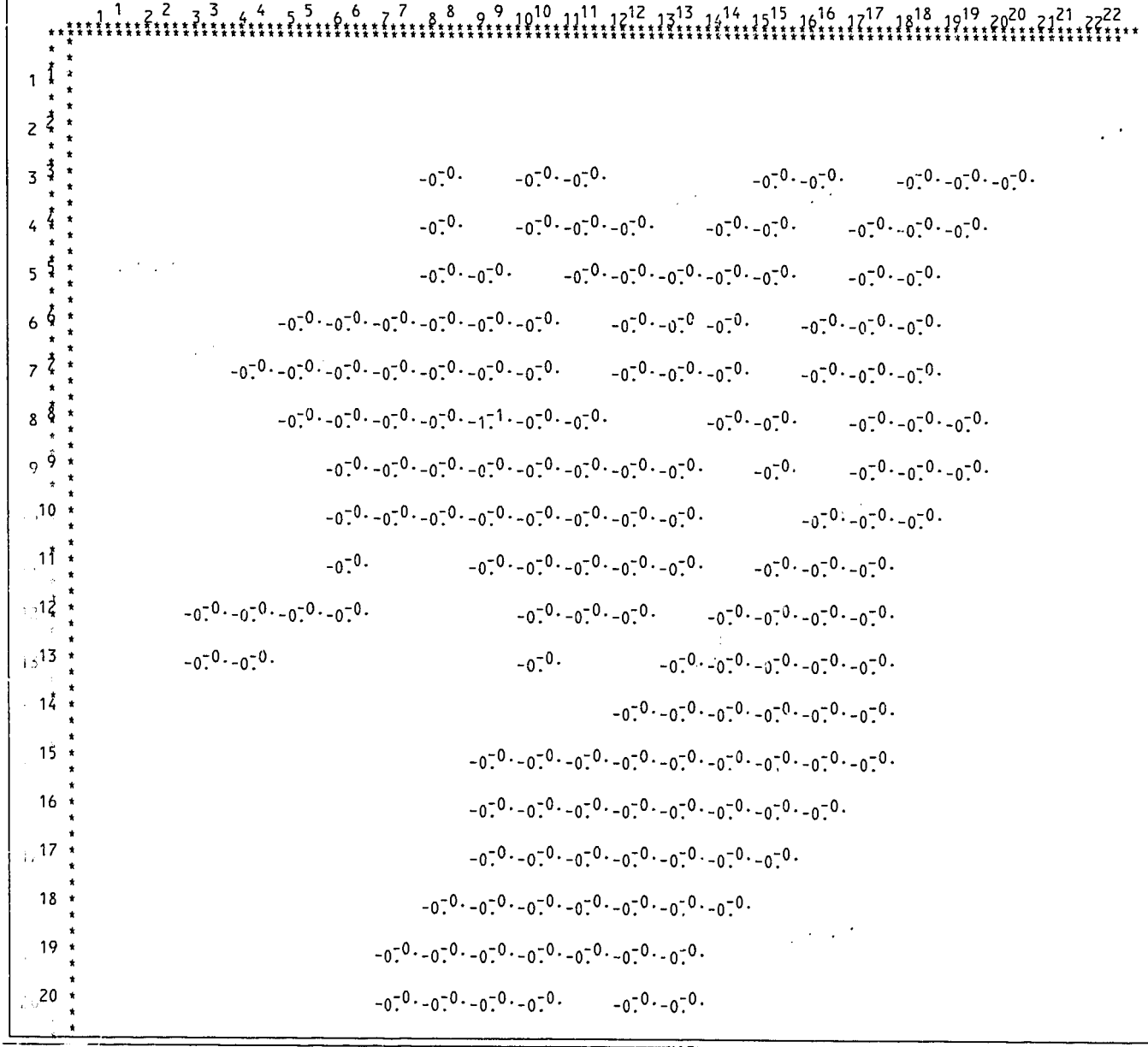
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1254783E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1481832E-02
AND AN AVERAGE POINT ERROR EQUAL TO .1818577E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1339302E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1582900E-02
AND AN AVERAGE POINT ERROR EQUAL TO .1879005E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1422838E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1693061E-02
AND AN AVERAGE POINT ERROR EQUAL TO .1893610E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
POINT SUCCESSIVE OVER-RELAXATION CONVERGES WITHIN 1 ITERATIONS
WITH A MAXIMUM POINT ERROR EQUAL TO .1408044E-02
AND A MAXIMUM POINT ERROR EQUAL TO .1684139E-02
AND AN AVERAGE POINT ERROR EQUAL TO .1881394E-03
THE ERROR CHECK IS EQUAL TO .001 METERS
THE ERROR CHECK IS EQUAL TO .001 METERS
THE O.R. FACTOR IS WORTH 1.000

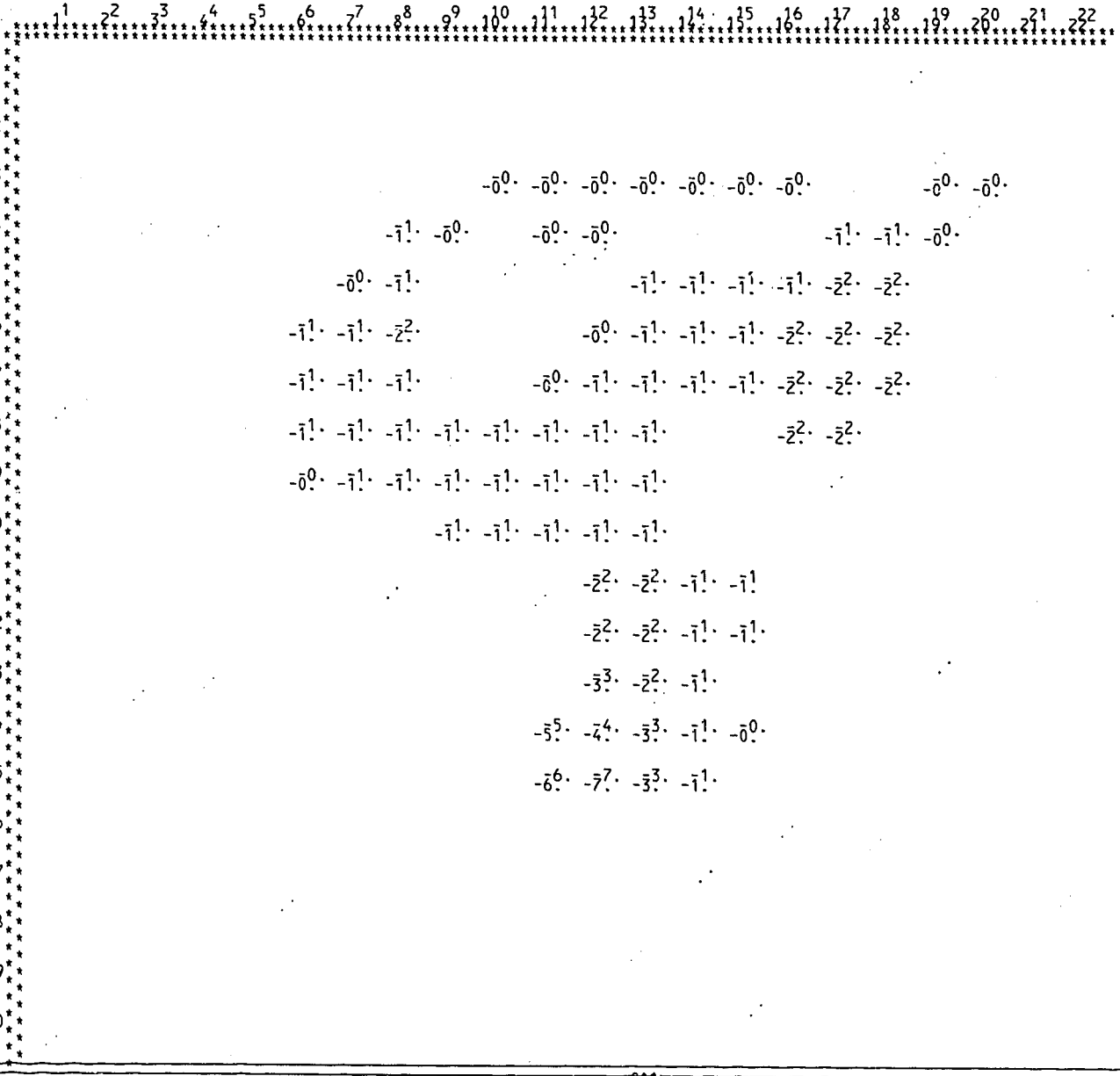

AQUIFER NO: 1
DRAWDOWN MAP
YEAR: 1965


1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10 11 11 12 12 13 13 14 14 15 15 16 16 17 17 18 18 19 19 20 20 21 21 22 22
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

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21 *
   *
   *
22 *
```

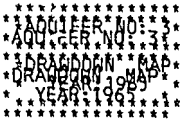
VALUES OF ARGUMENT MULTIPLIED BY .10000000E+01

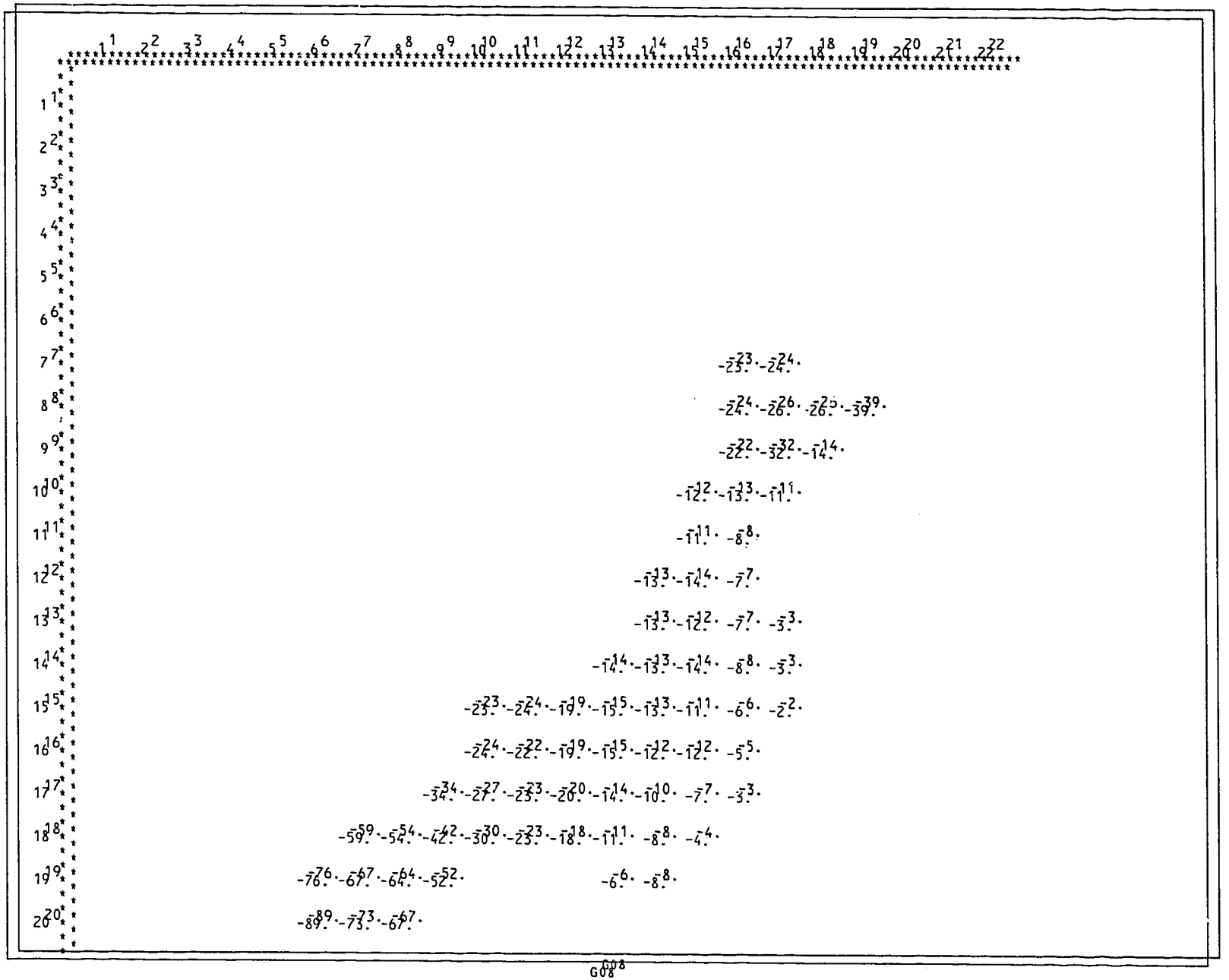

AQUIFER NO: 2
AQUIFER NO: 2
DRAWDOWN MAP
YEAR 1965



```
21 ***
   ***
   ***
22 ***
```

```
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
***VALUES OF ARGUMENT MULTIPLYED BY   .10000000E+01 ***
```


AQUIFER NO: 3
DRAWDOWN MAP
YEAR 1980
YEAR 1965

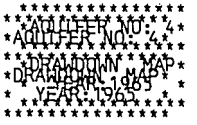

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
-23. -24.
-24. -26. -26. -39.
-22. -32. -14.
-12. -13. -11.
-11. -8.
-13. -14. -7.
-13. -12. -7. -3.
-14. -13. -14. -8. -3.
-23. -24. -19. -15. -13. -11. -6. -2.
-24. -22. -19. -15. -12. -12. -5.
-34. -27. -23. -20. -14. -10. -7. -3.
-59. -54. -42. -30. -23. -18. -11. -8. -4.
-76. -67. -64. -52.
-6. -8.
-89. -73. -67.

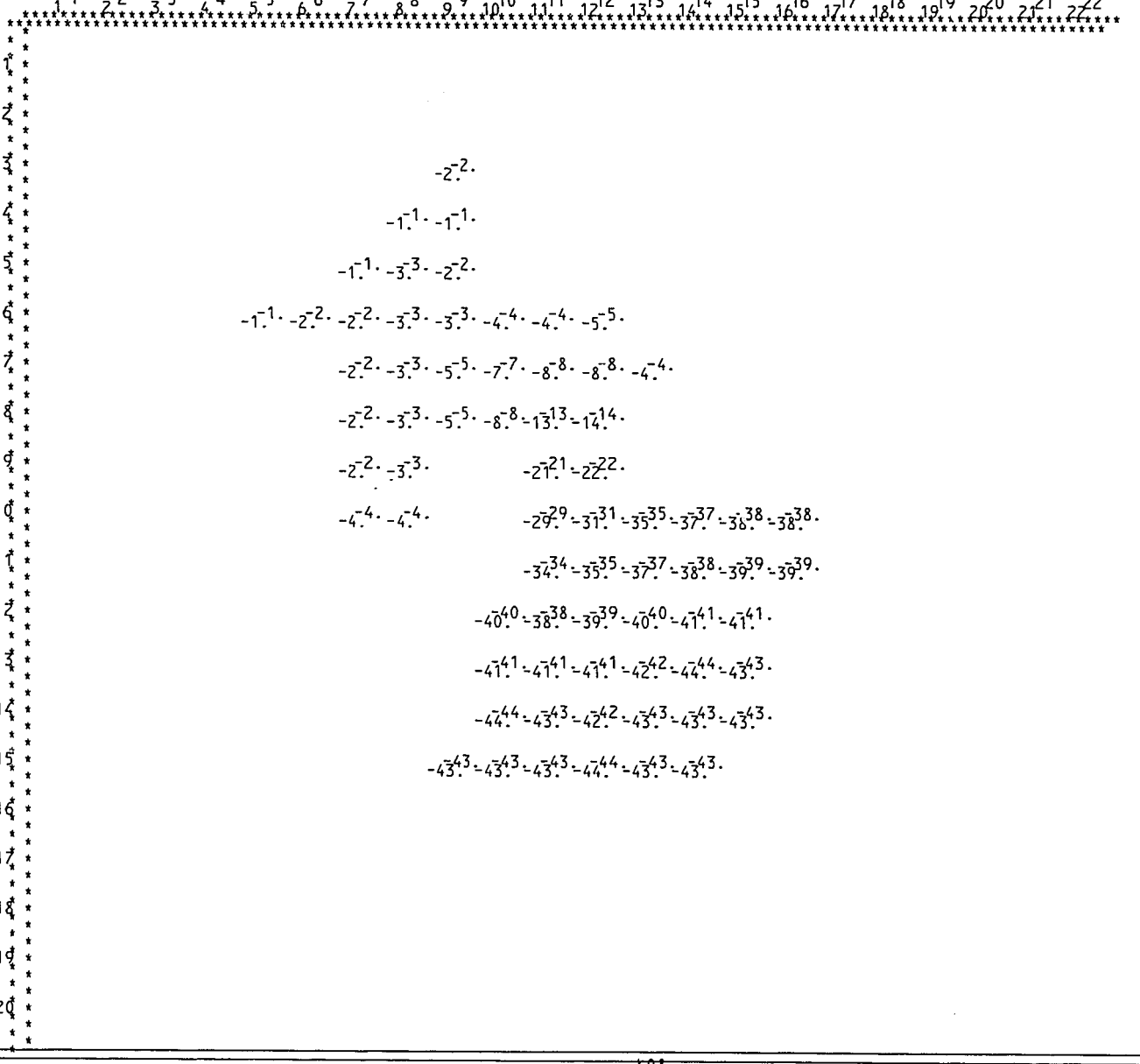
21 *
*
*
22 *

***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01 ***

***VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01 ***

H08


AQUIFER NO: 4
DRAWDOWN MAP
YEAR: 1965


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
-2.-2.
-1.-1. -1.-1.
-1.-1. -3.-3. -2.-2.
-1.-1. -2.-2. -2.-2. -3.-3. -3.-3. -4.-4. -4.-4. -5.-5.
-2.-2. -3.-3. -5.-5. -7.-7. -8.-8. -8.-8. -4.-4.
-2.-2. -3.-3. -5.-5. -8.-8. -13.-13. -14.-14.
-2.-2. -3.-3. -21.-21. -22.-22.
-4.-4. -4.-4. -29.-29. -31.-31. -35.-35. -37.-37. -36.-38. -38.-38.
-34.-34. -35.-35. -37.-37. -38.-38. -39.-39. -39.-39.
-40.-40. -38.-38. -39.-39. -40.-40. -41.-41. -41.-41.
-41.-41. -41.-41. -41.-41. -42.-42. -44.-44. -43.-43.
-44.-44. -43.-43. -42.-42. -43.-43. -43.-43. -43.-43.
-43.-43. -43.-43. -43.-43. -44.-44. -43.-43. -43.-43.

21 *
*
*
22 *

VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01
VALUES OF ARGUMENT MULTIPLYED BY .10000000E+01


TIME DRAWDOWN SEQUENCE
TIME DRAWDOWN SEQUENCE
CHECK POINT NO= 1
I= 5 J= 4 I3 K= 1

M08

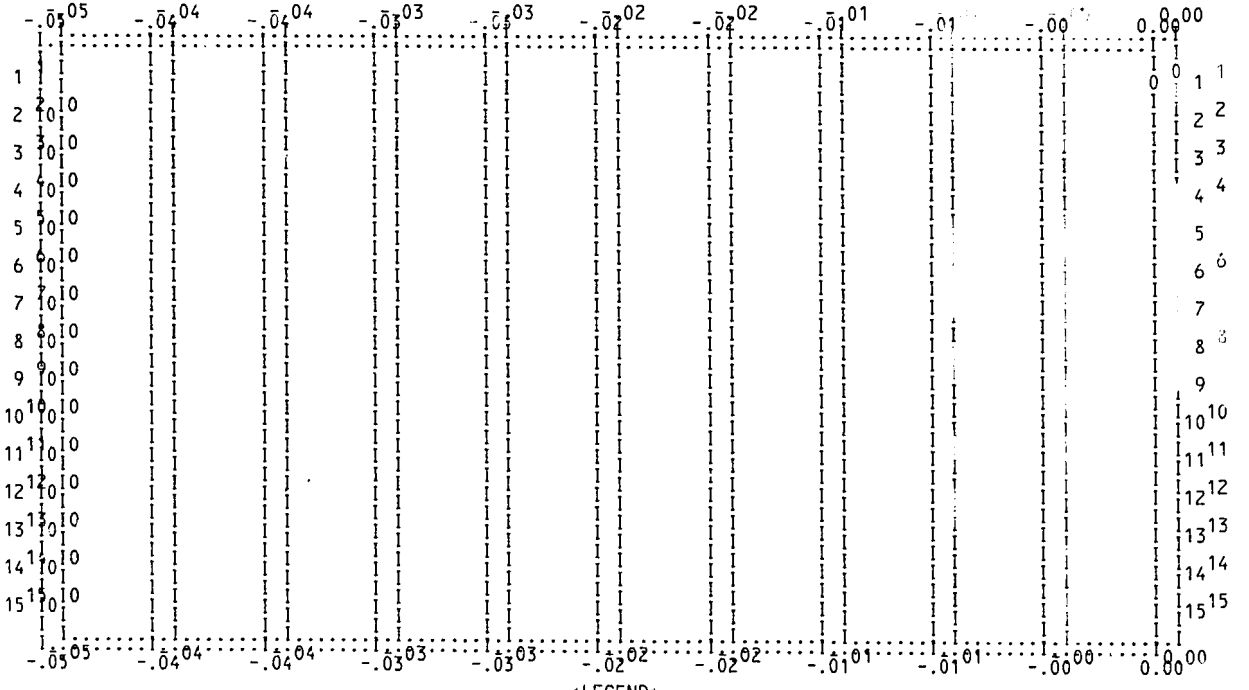
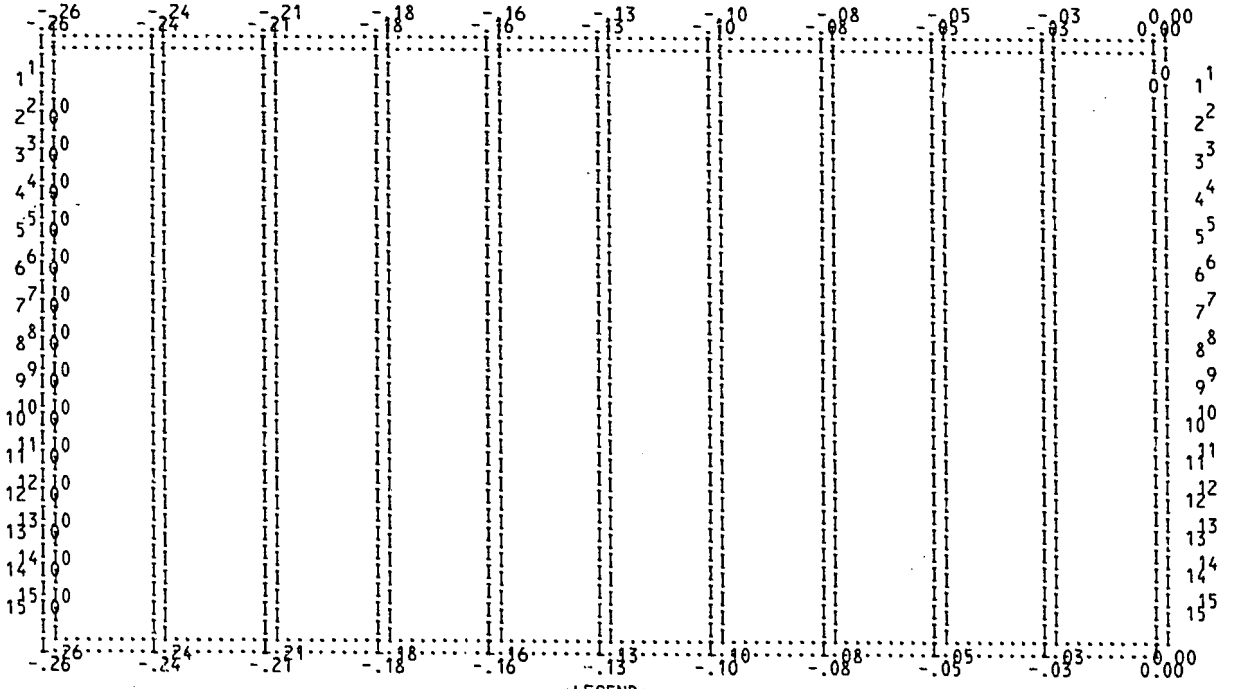

LEGEND
O REPRESENTS A CHECK POINT
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.0000	0.0000	0.0000	0.0000
2	-.0305	-.0305	0.0000	0.0000
3	-.0305	-.0305	0.0000	0.0000
4	-.0305	-.0305	0.0000	0.0000
5	-.0305	-.0305	0.0000	0.0000
6	-.0305	-.0305	0.0000	0.0000
7	-.0305	-.0305	0.0000	0.0000
8	-.0305	-.0305	0.0000	0.0000
9	-.0305	-.0305	0.0000	0.0000
10	-.0305	-.0305	0.0000	0.0000
11	-.0305	-.0305	0.0000	0.0000
12	-.0305	-.0305	0.0000	0.0000
13	-.0305	-.0305	0.0000	0.0000
14	-.0305	-.0305	0.0000	0.0000
15	-.03	-.03	0.00	0.00



809



LEGEND
0 REPRESENTS A CHECK POINT
0,* REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

LEGEND
0 REPRESENTS A CHECK POINT
0,* REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

D09

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
12	0.00	0.00	0.0000	0.0000
23	-.266	-.266	0.0000	0.0000
34	-.266	-.266	0.0000	0.0000
45	-.266	-.266	0.0000	0.0000
56	-.266	-.266	0.0000	0.0000
67	-.266	-.266	0.0000	0.0000
78	-.266	-.266	0.0000	0.0000
89	-.266	-.266	0.0000	0.0000
90	-.266	-.266	0.0000	0.0000
101	-.266	-.266	0.0000	0.0000
112	-.266	-.266	0.0000	0.0000
123	-.266	-.266	0.0000	0.0000
134	-.266	-.266	0.0000	0.0000
145	-.266	-.266	0.0000	0.0000
151	-.26	-.26	0.00	0.00


TIME DRAWDOWN SEQUENCE
CHECK POINT NO= 3
I=10 I=12 K= 1


TIME DRAWDOWN SEQUENCE
CHECK POINT NO= 3
I=10 I=12 K= 1


TIME DRAWDOWN SEQUENCE
CHECK POINT NO= 3
I=10 I=12 K= 1

TABLE OF ARGUMENTS AND DIFFERENCES

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
2	0.111	0.111	0.000	0.000
3	-.111	-.111	0.000	0.000
4	-.111	-.111	0.000	0.000
5	-.111	-.111	0.000	0.000
6	-.111	-.111	0.000	0.000
7	-.111	-.111	0.000	0.000
8	-.111	-.111	0.000	0.000
9	-.111	-.111	0.000	0.000
10	-.111	-.111	0.000	0.000
11	-.111	-.111	0.000	0.000
12	-.111	-.111	0.000	0.000
13	-.111	-.111	0.000	0.000
14	-.111	-.111	0.000	0.000
15	-.111	-.111	0.000	0.000

109


TIME DRAWDOWN SEQUENCE
TIME DRAWDOWN SEQUENCE
CHECK POINT NO= 4
CHECK POINT NO= 4
I=12 J=16 K= 1
I=12 J=16 K= 1

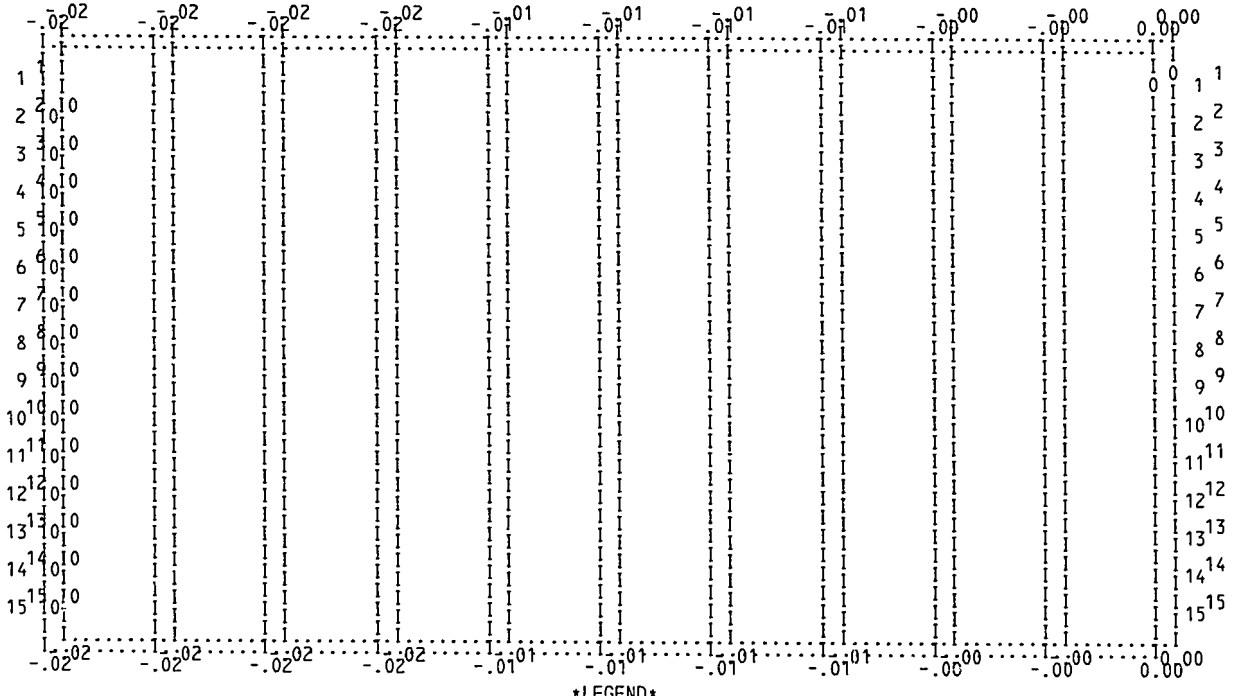

LEGEND
O REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	2	0.00 02	0.00 02	0.0000	0.0000
2	3	-.02 02	-.02 02	0.0000	0.0000
3	4	-.02 02	-.02 02	0.0000	0.0000
4	5	-.02 02	-.02 02	0.0000	0.0000
5	6	-.02 02	-.02 02	0.0000	0.0000
6	7	-.02 02	-.02 02	0.0000	0.0000
7	8	-.02 02	-.02 02	0.0000	0.0000
8	9	-.02 02	-.02 02	0.0000	0.0000
9	10	-.02 02	-.02 02	0.0000	0.0000
10	11	-.02 02	-.02 02	0.0000	0.0000
11	12	-.02 02	-.02 02	0.0000	0.0000
12	13	-.02 02	-.02 02	0.0000	0.0000
13	14	-.02 02	-.02 02	0.0000	0.0000
14	15	-.02 02	-.02 02	0.0000	0.0000
15	1	.02 02	.02 02	0.00	0.00

M09


TIME CHECK PROGRAM SEQUENCE
CHECK POINT NO. 5
I=13 J=3 K=1

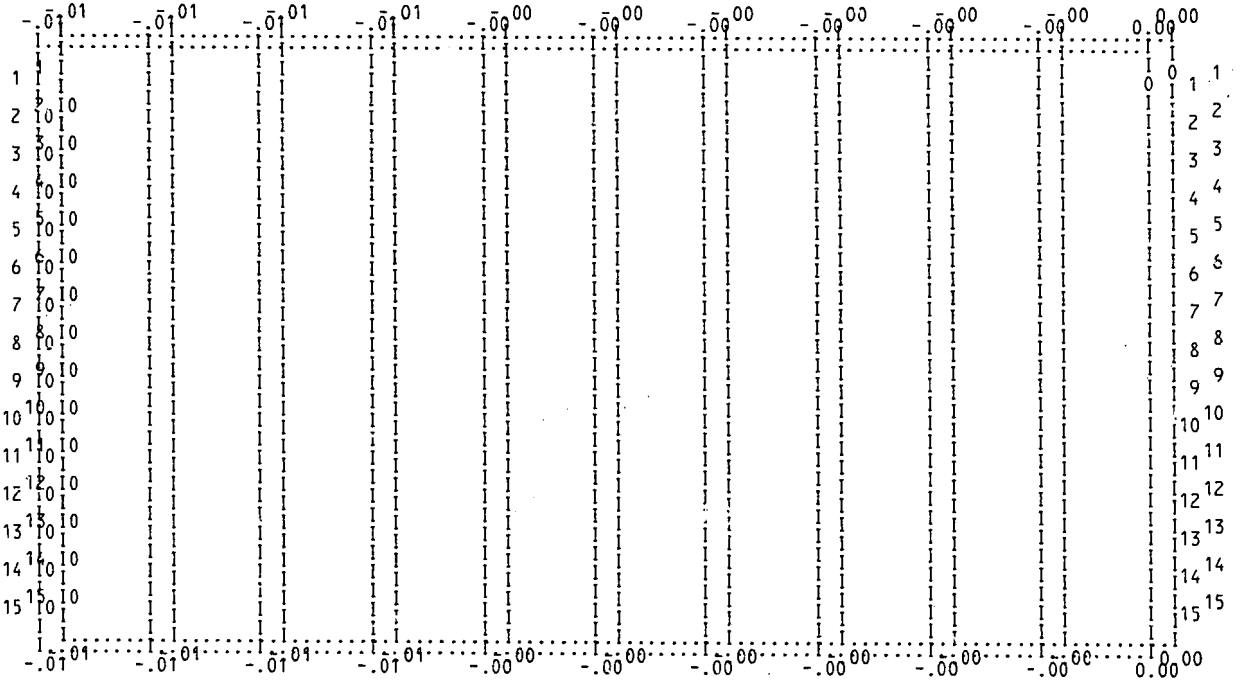

LEGEND
O REPRESENTS A CHECK POINT
O REPRESENTS A CHECKED POINT
* REPRESENTS A COMPUTED POINT

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
12	0.001	0.001	0.000	0.000
23	-.001	-.001	0.000	0.000
34	-.001	-.001	0.000	0.000
45	-.001	-.001	0.000	0.000
56	-.001	-.001	0.000	0.000
67	-.001	-.001	0.000	0.000
78	-.001	-.001	0.000	0.000
89	-.001	-.001	0.000	0.000
90	-.001	-.001	0.000	0.000
101	-.001	-.001	0.000	0.000
112	-.001	-.001	0.000	0.000
123	-.001	-.001	0.000	0.000
134	-.001	-.001	0.000	0.000
145	-.001	-.001	0.000	0.000
15	0.01	0.01	0.00	0.00



C10

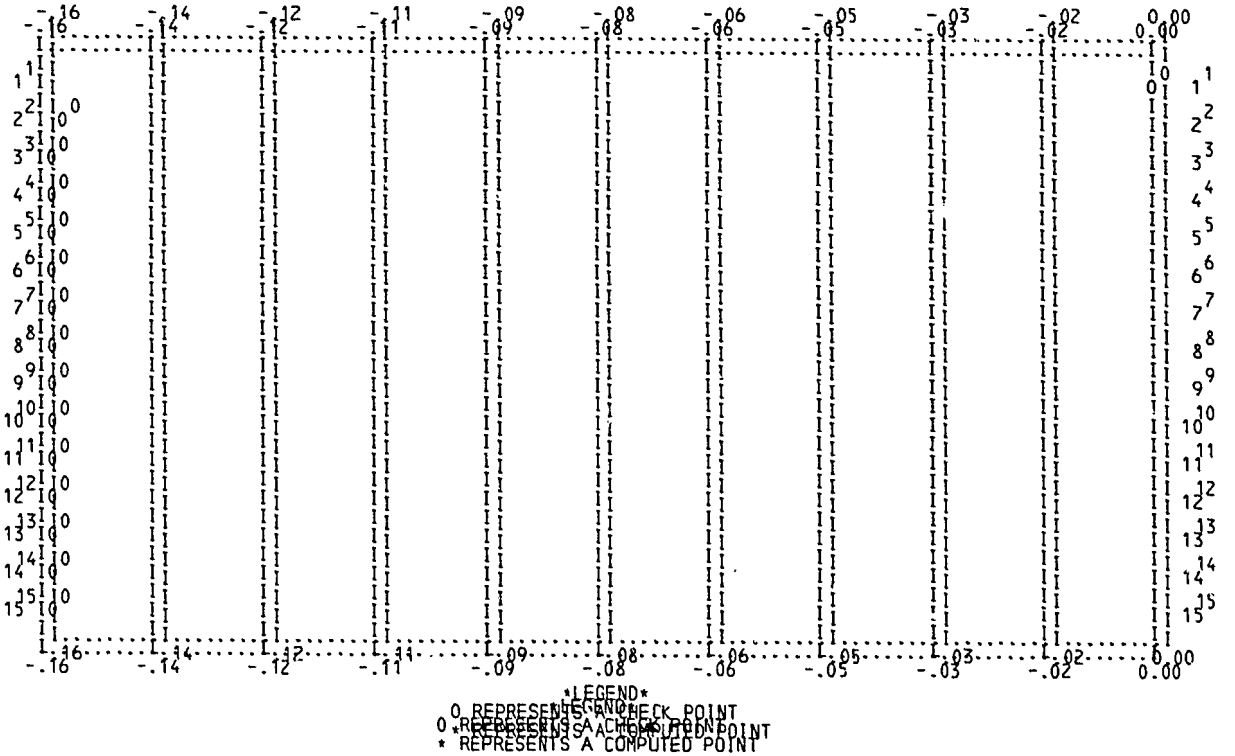

-.16 -.14 -.12 -.11 -.09 -.08 -.06 -.05 -.03 -.02 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
O REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
2	0.095	0.095	0.000	0.000
3	-.135	-.135	0.000	0.000
4	-.196	-.196	0.000	0.000
5	-.196	-.196	0.000	0.000
6	-.196	-.196	0.000	0.000
7	-.196	-.196	0.000	0.000
8	-.196	-.196	0.000	0.000
9	-.196	-.196	0.000	0.000
10	-.196	-.196	0.000	0.000
11	-.196	-.196	0.000	0.000
12	-.196	-.196	0.000	0.000
13	-.196	-.196	0.000	0.000
14	-.196	-.196	0.000	0.000
15	-.196	-.196	0.000	0.000

F10



G10

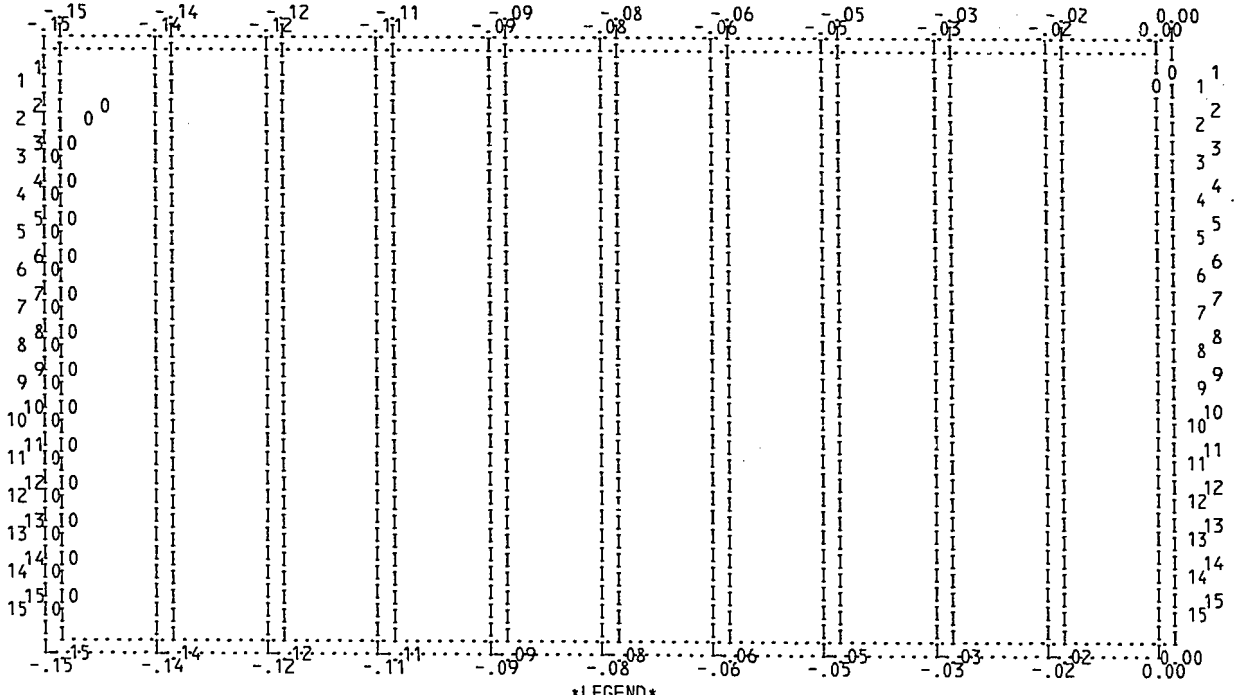

-.15 -.14 -.12 -.11 -.09 -.08 -.06 -.05 -.03 -.02 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
0 REPRESENTS A CHECK POINT
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

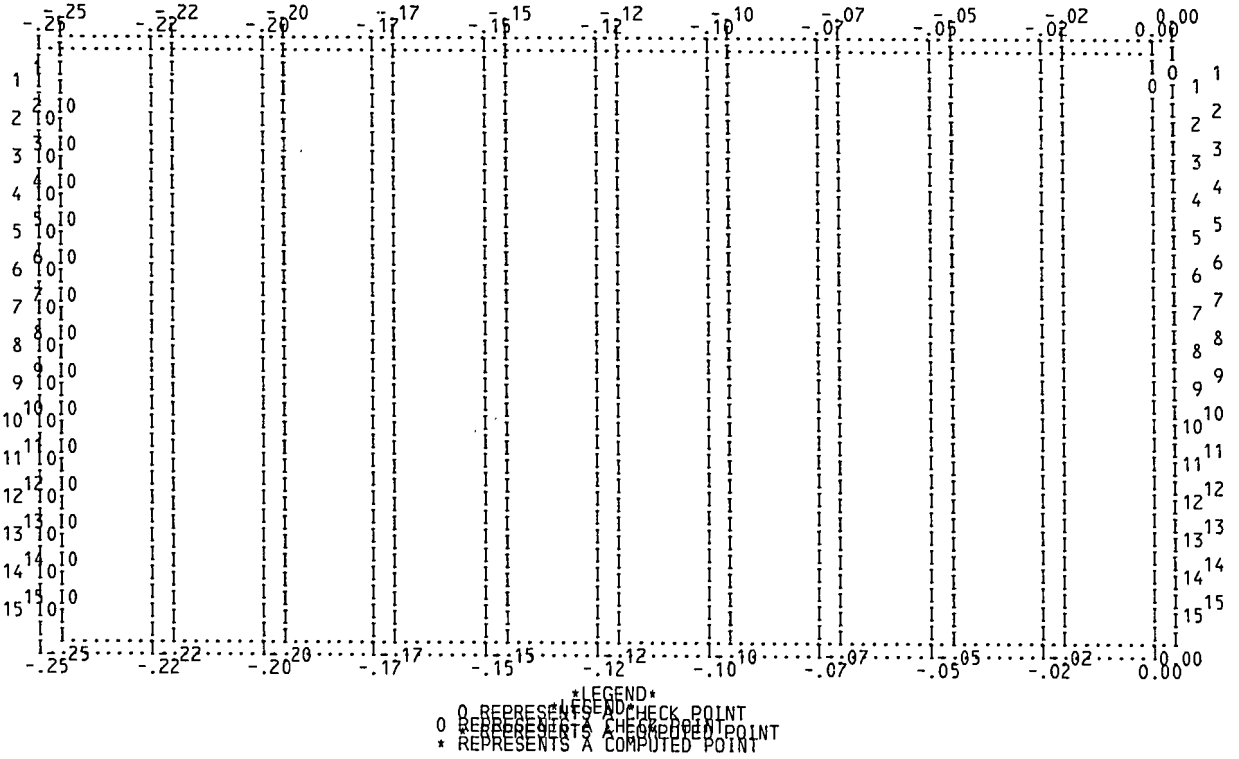
TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.0000	0.0000	0.0000	0.0000
2	-1.1515	-1.1515	0.0000	0.0000
3	-1.1515	-1.1515	0.0000	0.0000
4	-1.1515	-1.1515	0.0000	0.0000
5	-1.1515	-1.1515	0.0000	0.0000
6	-1.1515	-1.1515	0.0000	0.0000
7	-1.1515	-1.1515	0.0000	0.0000
8	-1.1515	-1.1515	0.0000	0.0000
9	-1.1515	-1.1515	0.0000	0.0000
10	-1.1515	-1.1515	0.0000	0.0000
11	-1.1515	-1.1515	0.0000	0.0000
12	-1.1515	-1.1515	0.0000	0.0000
13	-1.1515	-1.1515	0.0000	0.0000
14	-1.1515	-1.1515	0.0000	0.0000
15	-1.1515	-1.1515	0.0000	0.0000

J10


TIME DRAWDOWN SEQUENCE
TIME DRAWDOWN SEQUENCE
CHECK POINT 1 OF 8 2

K10


-.25 -.22 -.20 -.17 -.15 -.12 -.10 -.07 -.05 -.02 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
O REPRESENTS A CHECK POINT
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

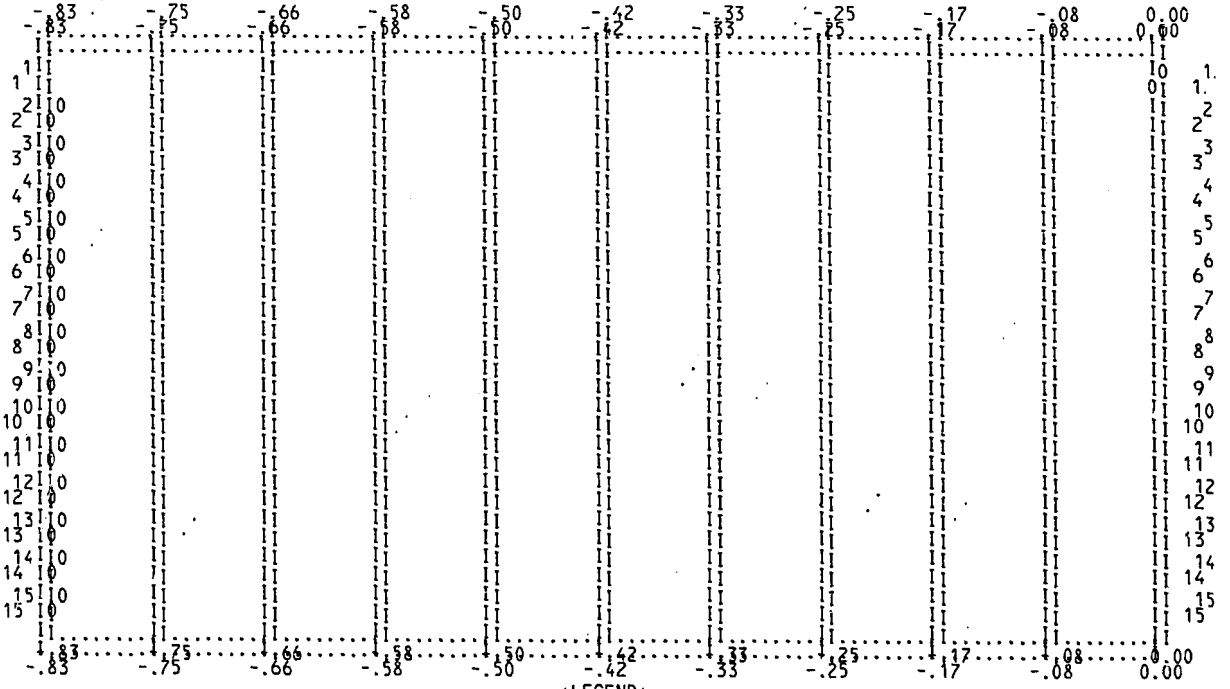
M10

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
2	0.0025	0.0025	0.0000	0.0000
3	-.2525	-.2525	0.0000	0.0000
4	-.2525	-.2525	0.0000	0.0000
5	-.2525	-.2525	0.0000	0.0000
6	-.2525	-.2525	0.0000	0.0000
7	-.2525	-.2525	0.0000	0.0000
8	-.2525	-.2525	0.0000	0.0000
9	-.2525	-.2525	0.0000	0.0000
10	-.2525	-.2525	0.0000	0.0000
11	-.2525	-.2525	0.0000	0.0000
12	-.2525	-.2525	0.0000	0.0000
13	-.2525	-.2525	0.0000	0.0000
14	-.2525	-.2525	0.0000	0.0000
15	.25	.25	0.00	0.00

N10


TIME PROGRAM SEQUENCE
CHECK POINT NO=9
I=7 J=13 K=2


-.83 -.75 -.66 -.58 -.50 -.42 -.33 -.25 -.17 -.08 0.00
LEGEND
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

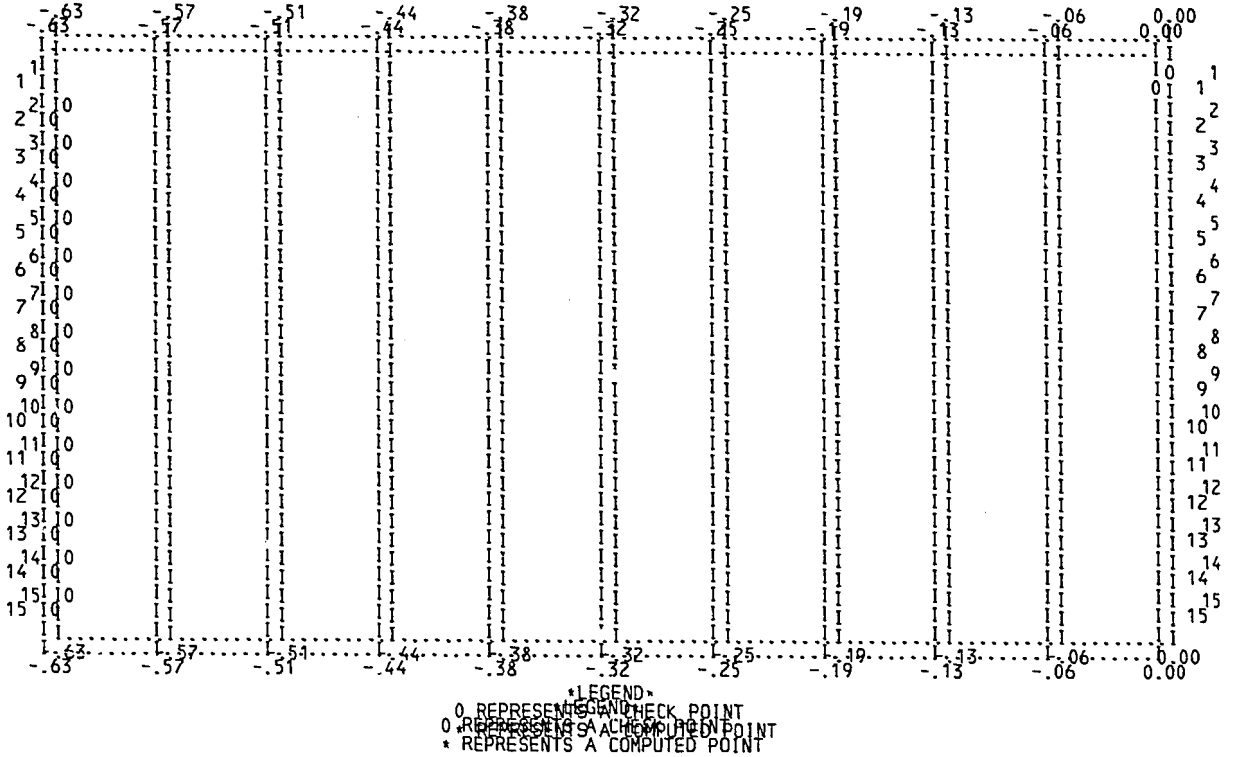
B11

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
12	0.083	0.083	0.0000	0.0000
23	0.083	0.083	0.0000	0.0000
34	0.083	0.083	0.0000	0.0000
45	0.083	0.083	0.0000	0.0000
56	0.083	0.083	0.0000	0.0000
67	0.083	0.083	0.0000	0.0000
78	0.083	0.083	0.0000	0.0000
89	0.083	0.083	0.0000	0.0000
90	0.083	0.083	0.0000	0.0000
101	0.083	0.083	0.0000	0.0000
112	0.083	0.083	0.0000	0.0000
123	0.083	0.083	0.0000	0.0000
134	0.083	0.083	0.0000	0.0000
145	0.083	0.083	0.0000	0.0000
15	1.00	1.00	0.00	0.00


TIME-DRAWDOWN SEQUENCE
TIME-DRAWDOWN SEQUENCE
CHECK POINT NR=10

D11

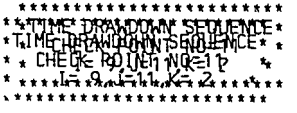

-.63 -.57 -.51 -.44 -.38 -.32 -.25 -.19 -.13 -.06 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

F11

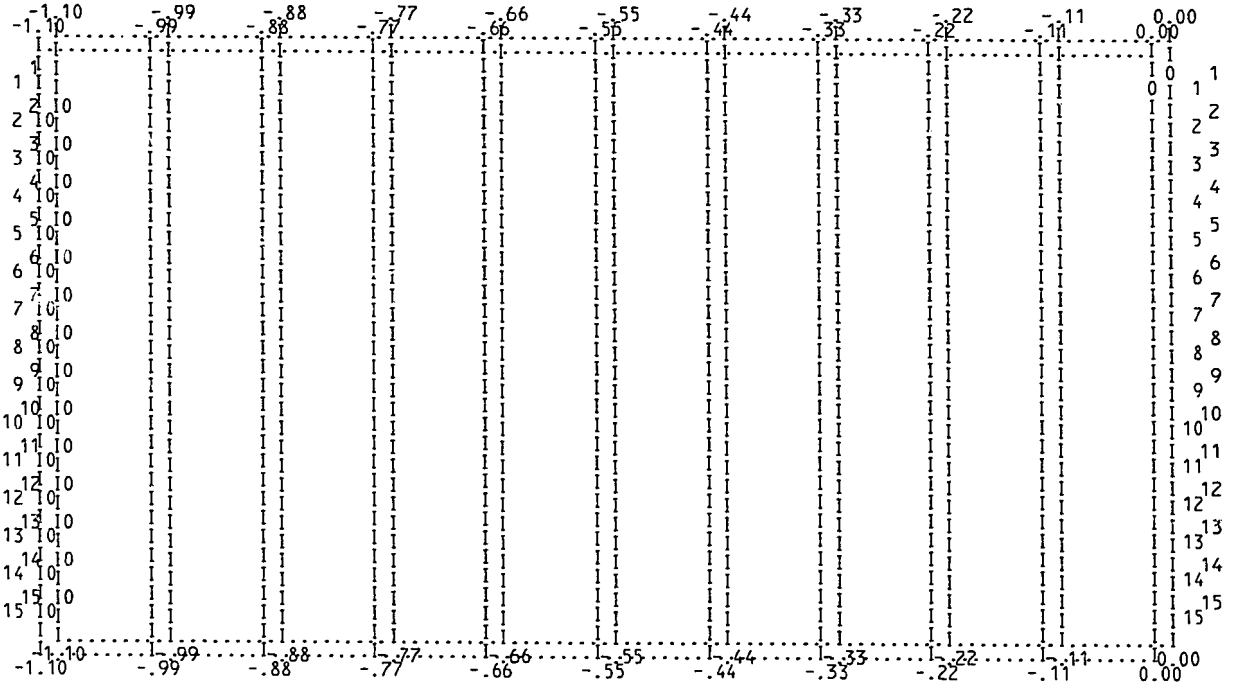
TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.0000	0.0000
2	-.633	-.633	0.0000	0.0000
3	-.633	-.633	0.0000	0.0000
4	-.633	-.633	0.0000	0.0000
5	-.633	-.633	0.0000	0.0000
6	-.633	-.633	0.0000	0.0000
7	-.633	-.633	0.0000	0.0000
8	-.633	-.633	0.0000	0.0000
9	-.633	-.633	0.0000	0.0000
10	-.633	-.633	0.0000	0.0000
11	-.633	-.633	0.0000	0.0000
12	-.633	-.633	0.0000	0.0000
13	-.633	-.633	0.0000	0.0000
14	-.633	-.633	0.0000	0.0000
15	-.63	-.63	0.00	0.00

G11



H11


-1.10 -.99 -.88 -.77 -.66 -.55 -.44 -.33 -.22 -.11 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

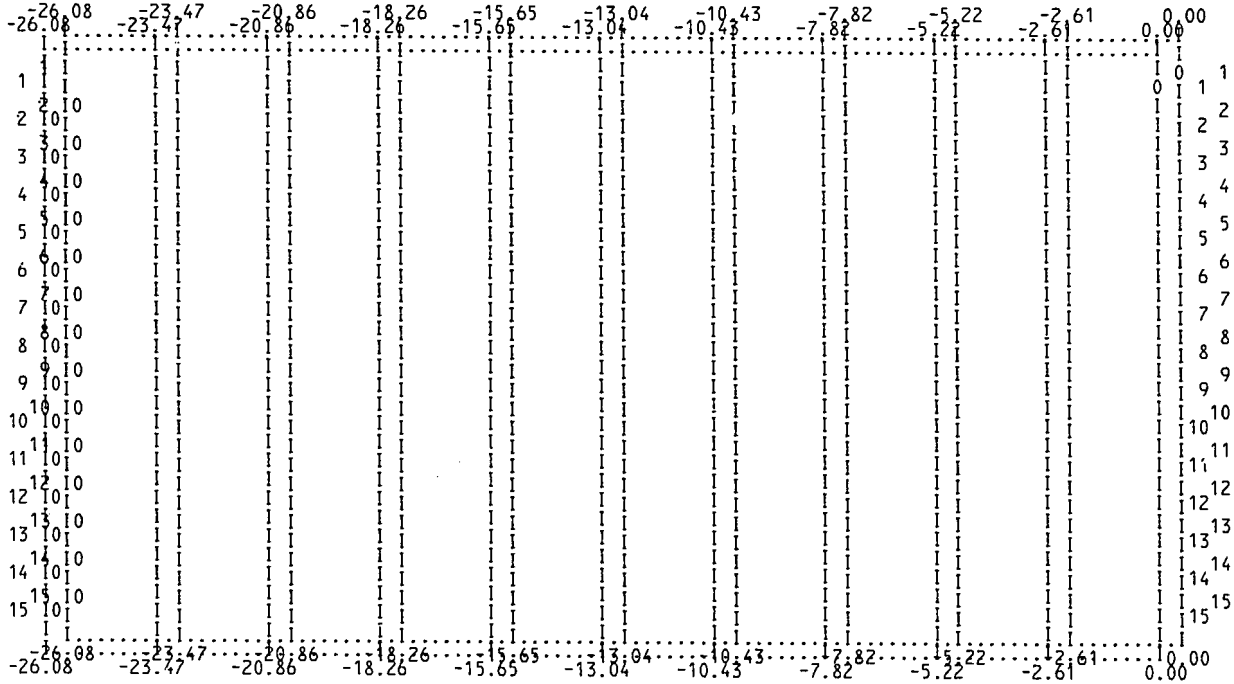
J11

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.0000	0.0000
2	-0.0997	-0.0997	0.0000	0.0000
3	-1.0910	-1.0910	0.0000	0.0000
4	-1.1010	-1.1010	0.0000	0.0000
5	-1.1010	-1.1010	0.0000	0.0000
6	-1.1010	-1.1010	0.0000	0.0000
7	-1.1010	-1.1010	0.0000	0.0000
8	-1.1010	-1.1010	0.0000	0.0000
9	-1.1010	-1.1010	0.0000	0.0000
10	-1.1010	-1.1010	0.0000	0.0000
11	-1.1010	-1.1010	0.0000	0.0000
12	-1.1010	-1.1010	0.0000	0.0000
13	-1.1010	-1.1010	0.0000	0.0000
14	-1.1010	-1.1010	0.0000	0.0000
15	-1.10	-1.10	0.00	0.00

K11

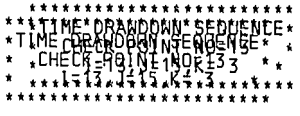

TIME DRAWDOWN SEQUENCE
CHECK-POINT NO. I=
I= 8, J= 7, K= 3


-26.08
-23.47
-20.86
-18.26
-15.65
-13.04
-10.43
-7.82
-5.22
-2.61
0.00
LEGEND
O REPRESENTS A CHECK POINT
O REPRESENTS A CHECKPOINT
* REPRESENTS A COMPUTED POINT

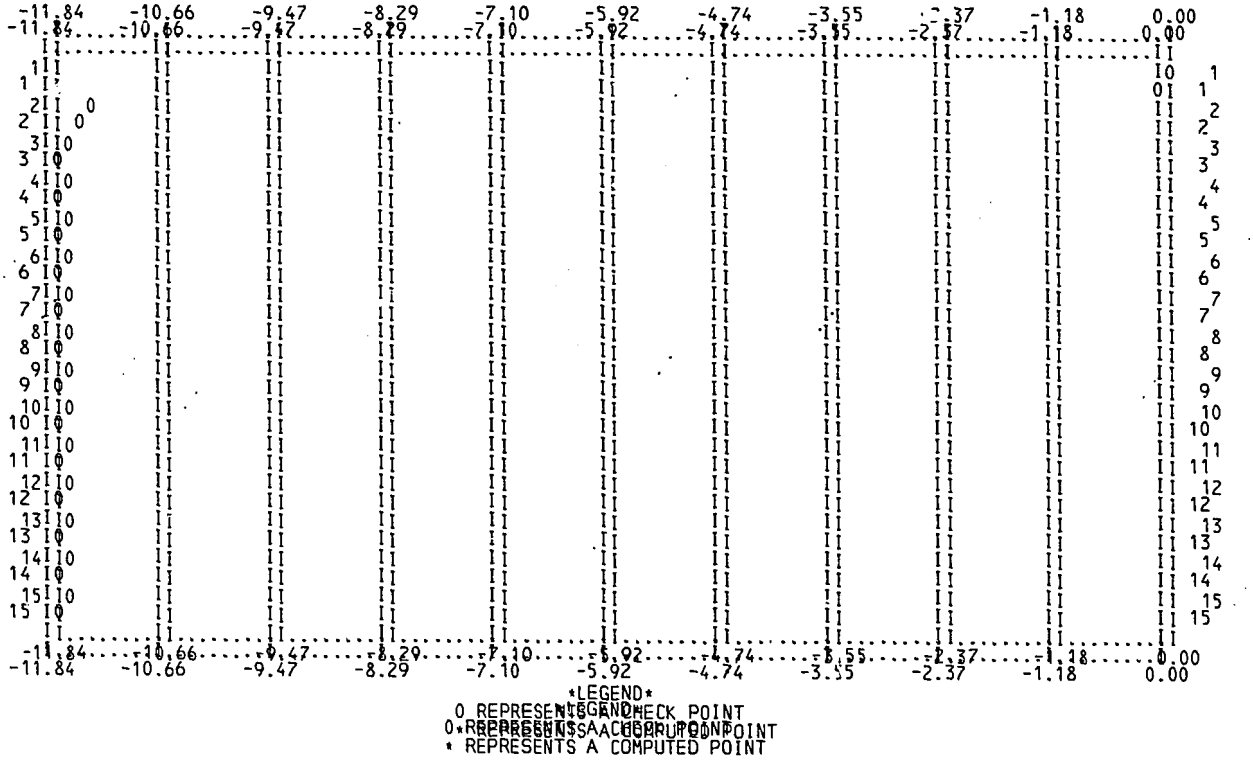
N11

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
2	0.20003	0.20003	0.0000	0.0000
3	-26.20307	-26.20307	0.0000	0.0000
4	-26.20708	-26.20708	0.0000	0.0000
5	-26.20808	-26.20808	0.0000	0.0000
6	-26.20808	-26.20808	0.0000	0.0000
7	-26.20808	-26.20808	0.0000	0.0000
8	-26.20808	-26.20808	0.0000	0.0000
9	-26.20808	-26.20808	0.0000	0.0000
10	-26.20808	-26.20808	0.0000	0.0000
11	-26.20808	-26.20808	0.0000	0.0000
12	-26.20808	-26.20808	0.0000	0.0000
13	-26.20808	-26.20808	0.0000	0.0000
14	-26.20808	-26.20808	0.0000	0.0000
15	-26.08	-26.08	0.00	0.00



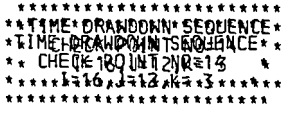
P11


-11.84 -10.66 -9.47 -8.29 -7.10 -5.92 -4.74 -3.55 -2.37 -1.18 0.00
LEGEND
0 REPRESENTS AN OK CHECK POINT
0* REPRESENTS A CORRUPTED POINT
* REPRESENTS A COMPUTED POINT

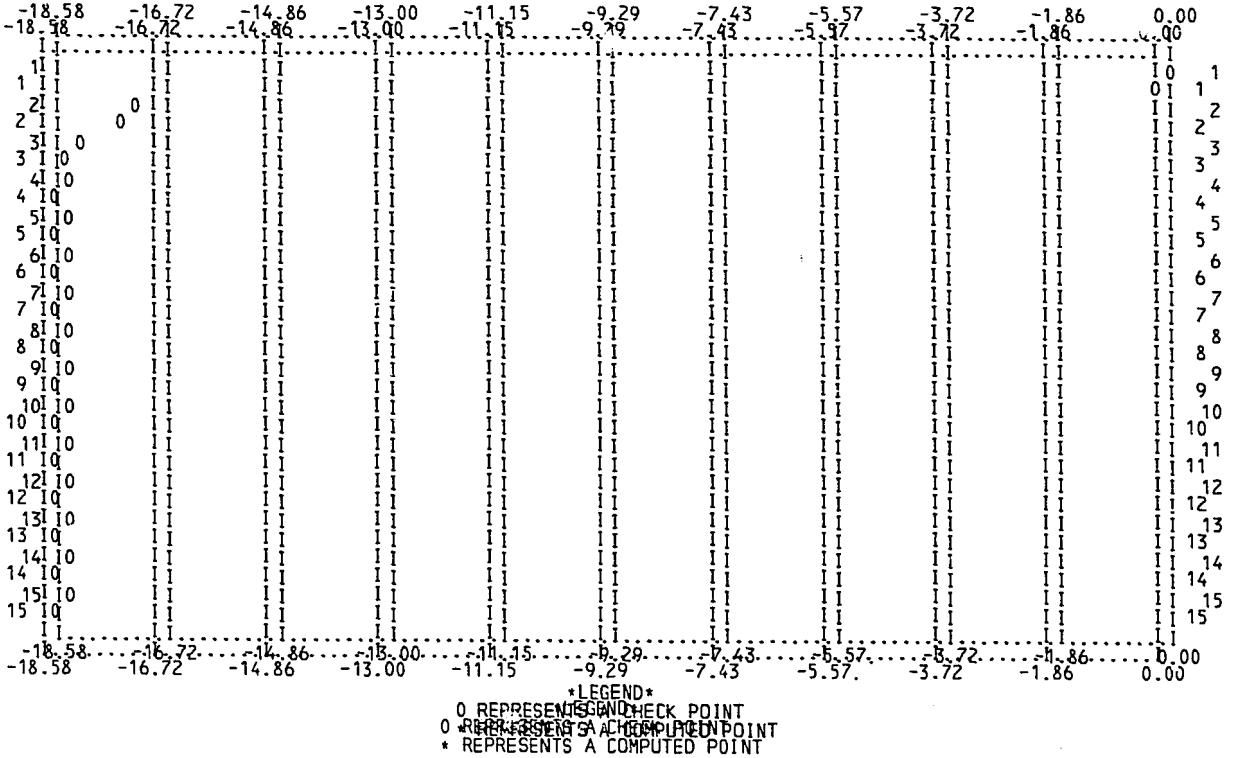
C12

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
2	-.01084	-.01084	.00000	.00000
3	-.11547	-.11547	.00000	.00000
4	-.11783	-.11783	.00000	.00000
5	-.11883	-.11883	.00000	.00000
6	-.11883	-.11883	.00000	.00000
7	-.11883	-.11883	.00000	.00000
8	-.11883	-.11883	.00000	.00000
9	-.11883	-.11883	.00000	.00000
10	-.11884	-.11884	.00000	.00000
11	-.11884	-.11884	.00000	.00000
12	-.11884	-.11884	.00000	.00000
13	-.11884	-.11884	.00000	.00000
14	-.11884	-.11884	.00000	.00000
15	-.11884	-.11884	0.00	0.00



E12


-18.58 -16.72 -14.86 -13.00 -11.15 -9.29 -7.43 -5.57 -3.72 -1.86 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

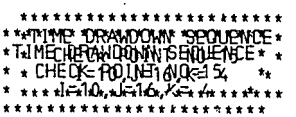
G12

TABLE OF ARGUMENTS AND DIFFERENCES

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1	0.00	0.00	0.00	0.00
2	-0.7034	-0.7034	0.0000	0.0000
3	-1.7827	-1.7827	0.0000	0.0000
4	-1.8275	-1.8275	0.0000	0.0000
5	-1.8505	-1.8505	0.0000	0.0000
6	-1.8525	-1.8525	0.0000	0.0000
7	-1.8534	-1.8534	0.0000	0.0000
8	-1.8545	-1.8545	0.0000	0.0000
9	-1.8555	-1.8555	0.0000	0.0000
10	-1.8556	-1.8556	0.0000	0.0000
11	-1.8566	-1.8566	0.0000	0.0000
12	-1.8567	-1.8567	0.0000	0.0000
13	-1.8575	-1.8575	0.0000	0.0000
14	-1.8575	-1.8575	0.0000	0.0000
15	-1.8578	-1.8578	0.0000	0.0000

H12


TIME DRAWDOWN SEQUENCE
TIME DRAWDOWN SEQUENCE
CHECK POINT NO. 5

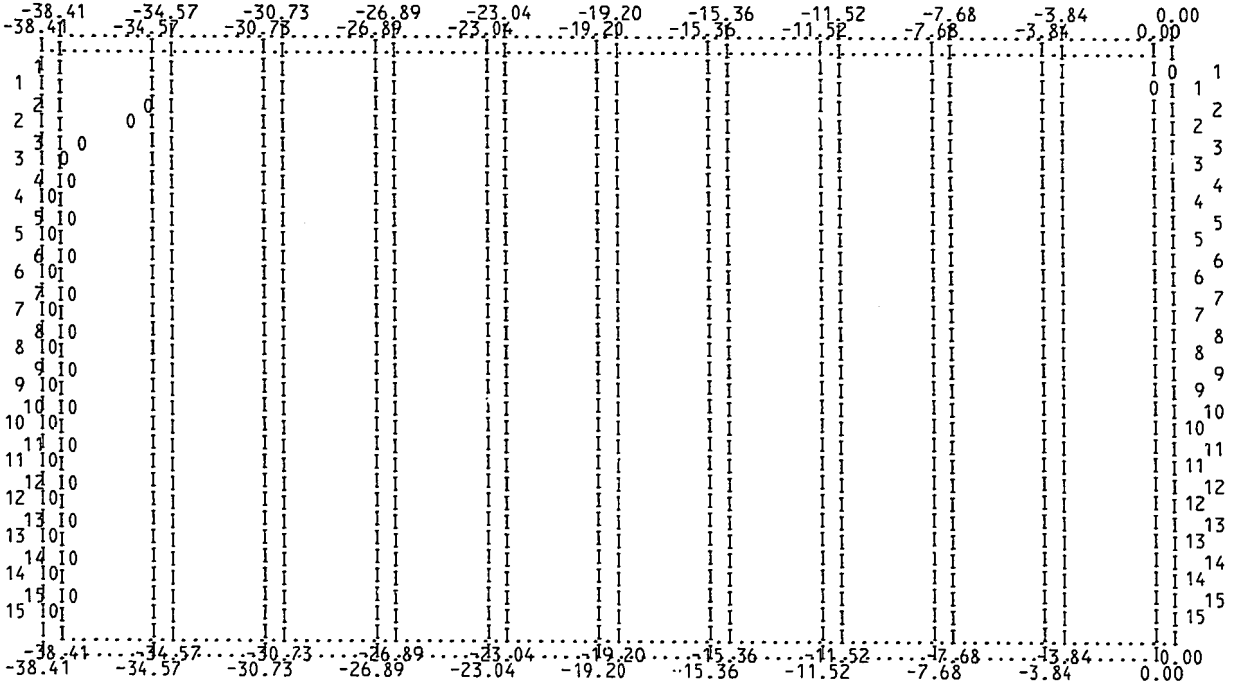

-38.41 -34.57 -30.73 -26.89 -23.04 -19.20 -15.36 -11.52 -7.68 -3.84 0.00
LEGEND
0 REPRESENTS A CHECK POINT
* REPRESENTS A COMPUTED POINT

TABLE OF ARGUMENTS AND DIFFERENCES

POINT NO.	REFERENCE VALUE	COMPUTED VALUE	DIFFERENCES ABSOLUTE	DIFFERENCES RELATIVE
1 2	0.39052	0.39052	0.0000	0.0000
2 3	-3532272	-3532272	0.0000	0.0000
3 4	-3738233	-3738233	0.0000	0.0000
4 5	-3838334	-3838334	0.0000	0.0000
5 6	-3838434	-3838434	0.0000	0.0000
6 7	-3838439	-3838439	0.0000	0.0000
7 8	-3838536	-3838536	0.0000	0.0000
8 9	-3838637	-3838637	0.0000	0.0000
9 10	-3838738	-3838738	0.0000	0.0000
10 11	-3838838	-3838838	0.0000	0.0000
11 12	-3838839	-3838839	0.0000	0.0000
12 13	-3838940	-3838940	0.0000	0.0000
13 14	-3839040	-3839040	0.0000	0.0000
14 15	-3839041	-3839041	0.0000	0.0000
15	38.41	38.41	0.00	0.00

L12

```
 ** 7000 SCOPE 2.1.3-205 MOD 13/10/76  19.12.31 ** 15/10/76      76289
** 7000 SCOPE 2.1.3-205 MOD 13/10/76  19.12.31 ** 15/10/76      76289
         SYSTEM BULLETIN 23 ---  1/ 6/76. USE -SYSBULL,LFN. OR -SYSBULL.  3333333
        SYSTEM BULLETIN 23 ---  1/ 6/76. USE -SYSBULL,LFN. OR -SYSBULL.  3333333
  HH.MM.SS CPU SECOND ORIGIN
HH.MM.SS CPU SECOND ORIGIN      DIOS  VERSION 10/08/76.
          1516525820ADAD.     DIOS ASSIGNMENT NAME
          1516525820ADAD.     DAD DOCUMENTATION
          1516525820ADAD.     -CATALOG,DIOS READ.
 15.25.30 1516602640ADYB.     -GABSIM.
1516525030000000404ŸBOB.     -GABSIM,T200. GABSIM DOCUMENTATION  EXT462
1516525030000000404ŸBOD.     -COMMENT,EL GABSIM.DOCUMENTATION  EXT462
1516526010000000424ŸOSR.     -FTN,SL,ELT95,REL.
1516624310000003424ŸUSR.       -LDSET,MAP=E.SECONDS COMPILATION TIME
1516624310000003424ŸOBOD.    -LDSET,MAP=E.
1516624310000003441ŸOBYB.    -LGO,P0620000.
1516624410000005141ŸBYB.       LDSET 1.0 FILES REQUIRED TO LOAD - 0012271 OU.COG
1516624410000005141ŸBSR.       LDSET 1.0 EXECUTION INITIATED 09.24.27
1516624410000005141ŸBSR.       LDSET TRANSFER VECTOR 400 INITIATED OS1EXP2/75
1516624400000031300ŸUSR.      FORTRAN LIBRARY 401          18/12/75
1516624840000030002ŸUSR.        STOP 9.583 CP SECONDS EXECUTION TIME
1516624840000030002ŸUSR.      -DISPOSE,OUTPUT,*PR=CFC,ST=COMCP.
1516624840000030004ŸOBYB.    -DISPOSE,OUTPUT,*PR=CFC,ST=COMCP.
1516624840000030006ŸBYB.        RM770 - MAXIMUM ACTIVE FILES                    5
1516624840000030006ŸBYB.        RM771 - MAXIMUM ACTIVE FILES                  520
1516624840000030006ŸBYB.        RM772 - OPERATOR REQUESTS                  432011
1516624840000030006ŸBYB.        RM773 - DAYFILE MESSAGES                 43,61204
1516624840000030006ŸBYB.        RM774 - CONTROL POINT SWAPPING CALLS       30433
1516624840000030006ŸBYB.        RM775 - MEMORY TRANSFER CALLS            3,13358
1516624840000030006ŸBYB.        RM776 - EMERGENCY ROLLOUT CALLS            25892
1516624840000030006ŸBYB.        RM777 - QUEUE MANAGER CALLS                59821
1516624840000030006ŸBYB.        RM778 - RECALL CALLS  31.641  BLOCKS         521
1516624840000030006ŸBYB.        MDRXWC          31.04436 BLOCKS
1516624840000030006ŸBYB.        DFQUEWT          258.2009 BLOCKS
1516624840000030006ŸBYB.        OUTPUT          258.8402 BLOCKS
1516624840000030006ŸBYB.        SC050 - 000077 SC/LC SWAPS
1516624840000030006ŸBYB.          JOB                31.008  SEC           10.336  $
1516624840000030006ŸBYB.        JOBSR             31.00277 SEC           10.336  $
1516624840000030006ŸBYB.        USRC              27.37882 SEC            1.294  $
1516624840000030006ŸBYB.        URCM           1 398.8612 SKWSEC          1.2939 $ $
1516624840000030006ŸBYB.        SCMS           1 190.6237 KWHSEC          7.0358 $ $
1516624840000030006ŸBYB.        RMS/O             1.0733 MWHC             0.0531 $ $
1516624840000030006ŸBYB.        I/OTOTAL          0.0203 MWS              0.0136 $ $
1516624840000030006ŸBYB.        TOTAL            59.2000 SK              19.936  $
1516624840000030006ŸBYB.        PRATE             2.0034 K $/SEC
1516624840000030006ŸBYB.        RATECHARGE        0.334  $/SEC            19.94   $
15.28.04 00031.009 CYB.         CHARGE                                  19.94   $
```

INDEX

LOC	CONTENT
B01	13 14 15
C01	13 6 14 6 15 5
D01	6 6 5
F01	1 2 3 4 5
G01	1 2 3 4 5
I01	1 2 3 4 5
J01	
K01	1 2 3 4 5
M01	1 2 3 4 5
N01	
O01	1 2 3 4 5
B02	1 2 3 4 5
C02	
D02	1 2 3 4 5
F02	1 2 3 4 5
G02	
H02	1 2 3 4 5
J02	1 2 3 4 5
K02	
L02	1 2 3 4 5
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O02	
P02	1 2 3 4 5
C03	1 2 3 4 5
D03	
E03	1 2 3 4 5
G03	1 2 3 4 5
H03	
I03	1 2 3 4 5
K03	1 2 3 4 5
L03	
M03	1 2 3 4 5
O03	1 2 3 4 5
P03	
B04	1 2 3 4 5
D04	1 2 3 4 5
E04	
F04	1 2 3 4 5
H04	1 2 3 4 5
I04	
J04	1 2 3 4 5
L04	1 2 3 4 5
M04	
N04	
O04	
P04	
B05	
C05	POINT SUCC
D05	THE ERROR
F05	POINT SUCC
H05	THE ERROR
I05	1 2 3 4 5
J05	
L05	1 2 3 4 5

LOC	CONTENT
M05	
N05	
P05	1 2 3 4 5
B06	1 2 3 4 5
C06	
E06	1 2 3 4 5
F06	1 2 3 4 5
G06	AND AN
H06	AND AN
I06	
K06	1 2 3 4 5
L06	1 2 3 4 5
M06	
O06	1 2 3 4 5
P06	
B07	1 2 3 4 5
D07	1 2 3 4 5
E07	
F07	1 2 3 4 5
H07	1 2 3 4 5
I07	AND AN
J07	AND AN
K07	
L07	1 2 3 4 5
N07	1 2 3 4 5
O07	
P07	1 2 3 4 5
C08	1 2 3 4 5
D08	
E08	1 2 3 4 5
G08	1 2 3 4 5
H08	
I08	1 2 3 4 5
K08	1 2 3 4 5
L08	
M08	
O08	
P08	
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H09	
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J09	
L09	
M09	
N09	
P09	
B10	
C10	
E10	
F10	
G10	

LOC	CONTENT
I10	
J10	
K10	
M10	
N10	
O10	
B11	
C11	
D11	
F11	
G11	
H11	
J11	
K11	
L11	
N11	
O11	
P11	
C12	
D12	
E12	
G12	
H12	
I12	
K12	
L12	00 SCOPE 2.1.3-205 MOD 13
M12	00 SCOPE 2.1.3-205 MOD 13