TR-157

# NUMERICAL MODELLING OF GROUNDWATER FOR BULANDSHAHAR AREA


NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE - 247 667
1992-93

# PREFACE

In December 1985 the governments of The Netherlands and India agreed on an Indo-Dutch Training Programme on Water Management (WAMATRA). Phase I was concluded in 1986-87. Phase II of WAMATRA started in August 1990. National Institute of Hydrology was associated along with other institutions in this project in a few areas. One of the items was Mathematical Groundwater Modelling. The International Institute for Land Reclammation and Improvement, Wageningen, from The Netherlands side was to provide training under this item.

Although the total amount of water on earth is generally assumed to have remained virtually constant, the rapid growth of population, together with the extension of irrigated agriculture and industrial development, is stressing the quantity and quality aspects of the natural system. Because of the increasing problems, man has begun to realize that he can no longer follow a "use and discard" philosophy - either with water resources or any other natural resource. Utilization of ground water has become a tenet in every nation's water resources development policy.

The rational limit of the rate of ground water exploitation should be such that protection from depletion is provided, protection from pollution is provided, negative ecological effects are reduced to a minimum, and economic efficiency of exploitation is attained. Determination of exploitable resources should be based upon hydrological investigations. These investigations logically necessitate use of a mathematical model of ground water system for analyzing and solving the problems.

This report on "Numerical Modelling of Ground Water Basin" has been prepared by Shri **Avinash Agarwal, Scientist** 'C' as a part of training under INDO-DUTCH TRAINING PROGRAMME ON WATER MANAGEMENT, (WAMATRA), PHASE II at International Institute of Land Reclammation & Improvement.

Satish Chandra
(SATISH CHANDRA)

CONTENTS

LIST OF TABLES

LIST OF FIGURES

## 1. INTRODUCTION

Mathematical models of groundwater basins and aquifer have been used in solving the hydrologic problems for many years by using equation of groundwater flow for the management of groundwater system. The management here defines the planning, implementation, and adaptive control of policies and programs related to the exploration, inventory, development and operation of water resources including groundwater. Numerical techniques include most of the methods which require a digital computer. Some of hand relaxation techniques are given by Todd (1959), Walton (1970).

In general relaxation techniques used for the groundwater models are finite difference methods. This means that at a given instant of time the solution is computed to approach a steady state solution and the calculation is repeated at successive time. One method of numerical solution of groundwater is a modified Gauss-Seidel relaxation technique which can be used for polygonal shaped network.

This report covers about the package (SGMP) based on the above technique and can be used to predict the impact of man's interference in the hydrological equilibrium of a groundwater basin. It can simulate the effects of new irrigation schemes, new patterns and rates of groundwater abstraction, and artificial recharge of the basin, and can do so for any desired length of time. The model can be applied to an unconfined aquifer, a semi-confined aquifer, or a confined aquifer for saturated flow only. The model allows wide variations in aquifer parameters as hydraulic conductivity and storage coefficient.

The details of the package, its operation in different modes and the interpretation of the results are described in this report. Two case studies are handled with the package provided by the ILRI. The one is the study of Hansi farm in Haryana with the objective of estimation of drainage requirement and amount of drain water. The study yielded that the area has a drainage requirement of only 2.0 mm/day, too less to provide any drain in the area. It is also estimated that the amount of drain water by top to bottom approach is higher than the amount of drain water by bottom to top approach thus normally over estimate the drain design. The other study is carried out on the Bulandshehar district of Uttar Pradesh.

## 2. DATA REQUIREMENTS

The numerical groundwater studies requires the collection of all existing geological and hydrological data on the groundwater basin. This include information on surface and subsurface geology, water tables, precipitation, evapotranspiration, pumped abstractions, stream flows, soils, land use, vegetation, irrigation, aquifer characteristics and boundaries and groundwater quality. The whole data can be divided in to two categories as physical frame work data and other the hydrological stress data. The data falling in these two categories are reported in Table 2.1. These two sets of data are than used to asses the groundwater balance of the basin.

Table 2.1. Data requirement for numerical groundwater modelling.

| Physical framework | | Hydrological Stress | |
|---|---|---|---|
| 1. | Topography | 1. | Water table elevation |
| 2. | Geology | 2. | Type and extent of recharge area |
| 3. | Type of aquifers | 3. | Rate of recharge |
| 4. | Aquifer thickness and lateral extent | 4. | Type and extent of discharge area |
| 5. | Aquifer boundaries | 5. | Rate of discharge |
| 6. | Lithological variations within the aquifer | | |
| 7. | Aquifer characteristics | | |

### 2.1. Data Related to Physical Framework

#### 2.1.1. Topography

An accurate topographical map of the groundwater basin to be modelled is a basic requirement. The topographical map should show all surface water bodies, streams and other natural and man made courses along with the contour lines of the land surface elevation. The scale of map depends on the size of basin and the aim of study. The inventory should be made of all the wells in the area i.e. pumped wells that withdraw substantial quantities of groundwater, observation wells. The location of wells and bores should be indicated on the topographical map.

#### 2.1.2 Geology

Intensive geological studies of the groundwater basin are required to delineate its geomorphological features of land forms and to evaluate the manner and degree in which they contribute to the basin's hydrology. Some of these are;

(a) Area open to deep percolation.
(b) Subsurface areas where inflow or outflow to or from the aquifer occurs.
(c) Location and nature of aquifer impermeable base.
(d) Hydraulic characteristics of the basin.
(e) Location of any structure affecting groundwater movement.

### 2.1.3. Type of aquifers

The type of aquifers that can be handled by model provided the flow is laminar are : Unconfined, Confined, Semi-confined.

### 2.1.4. Aquifer thickness and lateral extent

The lateral extent, thickness and depth of the aquifer may very from one place to another. The lateral extent of the aquifer, as found from the well and bore logs, and geological data should be indicated on the map. For an unconfined aquifer the net thickness of the aquifer can be calculated subtracting the local clay lenses within the aquifer.

### 2.1.5.5. Aquifer boundaries

The conditions and the boundaries of the aquifer must be properly defined. Different types of boundaries exists, which may or may not be a function of time. The boundary conditions which can be handled by package are; (a) zero flow boundary, (b) head controlled boundaries and (c) flow controlled boundaries.

A zero flow boundary is a boundary through which no flow occurs. In practice, zero flow boundaries can be defined as those places where flows are insignificant compared with the flows in the main aquifer. In mathematical terms, the condition at the zero flow boundary is $\partial h/\partial x = 0.0$, where h is the groundwater potential and x is the direction normal to the boundary. In the groundwater model, zero flow is simulated by setting the hydraulic conductivity at the boundary to zero ($k=0.0$).

A head controlled boundary may or may not be a function of time. Mathematically, a head controlled boundary that changes with time is expressed as $h = f(x,y,t)$, i.e. the head is function of both place and time. A fixed head at the boundary is expressed as $h = f(x,y)$, i.e. the head is a function of place only.

A flow controlled boundary is a boundary through which a certain volume of groundwater enters the aquifer per unit time. Flow controlled boundaries are simulated by setting the hydraulic conductivity at the boundary equal to zero ($k=0.0$), and entering the underflow in to the model as a recharge term.

### 2.1.6. Lithological variation within the aquifer

No aquifer is lithologically uniform over its entire extent. Both lateral and vertical variations occur, which can be recognized as facies changes. In one part of the basin the aquifer may be predominantly sand and gravel, whereas in other parts fine sand or even silt and clay may predominate. Since grain size has a great bearing on hydraulic conductivity and porosity, and thus on the flow and storage of groundwater, a study of facies changes forms an intrinsic part of the groundwater basin modelling.

### 2.1.7. Aquifer characteristics

The magnitude and spatial distribution of the aquifer characteristics must be specified. Depending on the type of aquifer these characteristics may be;

# hydraulic conductivity, k (for all types of aquifers)
# storage coefficient, S (for confined and semiconfined aquifers)
# specific yield, μ (for unconfined aquifers)
# hydraulic conductivity, k' (for the confining layer overlaying a semiconfined aquifer)
# specific yield, μ' (for the confining layer overlaying a semiconfined aquifer)

Various field, laboratory, and numerical methods are available to determine or estimate these characteristics.

## 2.2. Data Related to Hydrological Stress

Hydrological stress exerted on a groundwater basin, from the infiltration of rainfall, infiltration of irrigation water, from stream bed percolation, evapotranspiration, groundwater discharge by streams and springs, and pumping from wells, is reflected in the configuration and fluctuation of the water table in the basin. A part of the hydrogeological investigations, a water table survey should therefore be made.

### 2.2.1. Water table elevation

To study the magnitude and distribution of the hydraulic head in a basin, an appropriate network of observation wells and piezometers must be established throughout the basin and along its boundaries. In selecting proper sites for observation wells, one must consider variation in aquifer thickness, lateral and vertical variations in the aquifer's lithology, and the structural deformation of the aquifer, if any. Once the network of observation wells has been established, the water levels in all the wells should be measured. The water level data are used to draw the following maps;

# water table contour maps
# depth to water table maps
# water table change maps
# head difference maps.

### 2.2.2. Type and extent of recharge area

Estimating the recharge of an aquifer forms a basic part of any groundwater study, and it is not the easiest part. The difficulty is that the process by which rainfall or surface water infiltrates in to the soil, moves downward through the unsaturated zone, and eventually joins the groundwater as deep percolation, is not well understood. The type an extent of recharge area and the source of recharge should first be determined. Although they will differ for different types of aquifers, the main factors governing the recharge of all aquifers are topography, surface geology, and climate.

Besides percolation of rainfall, other sources of recharge can be stream bed percolation and surface runoff from adjacent hilly terrain. The amount of deep percolation of each component should be specified either by taking direct measurement or by determining the deep percolation as the residual of the amounts of surface water supply, use, and discharge.

### 2.2.3. Rate of recharge

Several methods can be used to estimate the recharge of unconfined aquifer. The use of groundwater flow, runoff hydrograph, rainfall water table relations, lysimeters, use of tensometers, use of isotopes and stream flow measurement are some of the methods for the estimation of rate of recharge.

2.2.4. Type and extent of discharge area

Discharge areas are areas where the aquifer loses water by overflow, evaporation diversion, migration through confining layers, and pumpage. A study of topographical maps and areal photographs, in addition to field surveys, will be of great help in determining the type of discharge areas and delineating them.

2.2.6. Rate of discharge

To determine the rate of discharge the total quantity of groundwater, discharge by springs, regular measurements of their flows must be taken.

Springs are the most obvious form of groundwater. They occur in all sizes. Some springs have fairly constant discharge, but most of them have variable discharge: high during and after rain, low or nil in the dry season. To determine the total quantity of groundwater discharge by springs must be taken.

Seepage of groundwater into a stream occurs when the water table adjacent to the stream is higher than the water level in the stream. The ground water discharge towards stream channels can also be estimated from the separation of hydrographs.

Evapotranspiration is the combined effect of evaporation of water from moist soil and the transpiration of water by natural vegetation and cultivated crops. Determining these water losses to atmosphere is not an easy task. In shallow water table areas, the ground water contributes to evapotranspiration through capillary rise. This discharge is determined by the depth of ground water below the root zone, the capillary and conductive properties of the soil, and the soil water content or soil water tension in the root zone.

An aquifer can lose water by upward seepage through an overlaying slightly permeable layer. This happens can be determine by placing piezometers in the aquifer and in the overlaying layer. All types of aquifers may lose ground water by lateral subsurface out flow through natural or imposed boundaries. The out flow rate must be determined or estimated, using the available methods.

Finally the tube wells and pumping stations that abstract ground water for domestic, industrial, or irrigation water supplies can be regarded as discharge areas. To estimate the total abstraction from the aquifer, an inventory of all pumped wells should be made.

3. DESCRIPTION OF MODEL

3.1 General

The present model has the following features and restrictions.

# . The aquifer is treated as a two-dimensional flow system i.e. in horizontal plane.

# The lower aquifer is bounded at the bottom by an impermeable layer.

# The upper boundary of the aquifer is a free water table (water table conditions) or impermeable layer (confined condition).

# The upper boundary of the aquifer is either an impermeable layer ( confined conditions ) or a free water table ( water table conditions ).

# The calculation procedures for both confined and unconfined conditions, depending on the relative position of the piezometric level with regard to the upper level of the aquifer, have been incorporated into the model. The model calculates the change in storage with either a specific yield coefficient (water table conditions) or a storage coefficient (confined conditions).

# Both specific yield and storage coefficients can vary in a horizontal direction.

# Transmissivity are calculated as the algebraic product of hydraulic conductivity and saturated thickness; both can vary in a horizontal direction.

# For unconfined aquifers the transmissivity varies with time; the model adjusts the saturated thickness according to the calculated water table elevation (nonlinear conditions) only the hydraulic conductivity and the bottom of the aquifer must be prescribed.

# Both unsteady and steady-state conditions can be simulated by the model.

# Darcy's law (linear resistance to laminar flow) and Dupuit's assumptions (vertical flow can be neglected) are applicable for each individual aquifer.

# The groundwater model can simulate head-controlled, flow controlled, and/or zero flow boundaries; the first two may vary with time.

# Limits between which the water-level in the aquifer is allowed to vary can be prescribed. If the water-level exceeds a certain limit, the model introduces an artificial flow rate that will keep the calculated water-level within that limit.

# The model can be run in the so-called increase mode. It will then calculate the nodal net recharge values as function of the prescribed watertable elevations.

# The processes of infiltration and percolation of rain and surface water and of capillary rise and evapotranspiration taking place in the unsaturated zone are not simulated by the model. This means that the net recharge to the aquifer system must be calculated manually and prescribed to the model.

# Featheredge boundary conditions, where the saturated

thickness reduces to zero as the water-level drops below the base of the aquifer, are included in the model.

### 3.2. Physical background of model

The model is based on the two well-known equations: Darcy's law and the equation of conservation of mass. The combination of these two equations results in a partial differential equation for unsteady flow as:

$$\frac{\partial}{\partial x}\left(k\,D\,\frac{\partial h}{\partial x}\right) + \frac{\partial}{\partial y}\left(k\,D\,\frac{\partial h}{\partial y}\right) = -N \qquad \text{---(1)}$$

( horizontal flow ) (Vertical flow)

where:

$k(x,y)$ = hydraulic conductivity of the aquifer for horizontal flow ($L\,T^{-1}$)

$D(x,y,t)$ = saturated thickness of the aquifer at time t ($L$)

$h(x,y,t)$ = hydraulic head in the aquifer at time t ($L$)

$N(x,y,t)$ = source or sink term at time t ($L\,T^{-1}$)

For unconfined aquifers N is the sum of three terms :

$$N = R - P - u\,\frac{\partial h}{\partial t} \qquad \text{---(2)}$$

where:

$R(x,y,t)$ = the net rate of recharge ($L\,T^{-1}$)

$P(x,y,t)$ = the net rate of abstraction ($L\,T^{-1}$)

$u\,(x,y)$ = specific yield of the aquifer (dimensionless)

$h(x,y)$ = hydraulic head in the aquifer ($L$)

$t$ = time ($T$)

The term $\mu\,\partial h/\partial t$ is related to the movement of the free water table in case of unsteady flow. When the water table moves downwards or upwards, water is released from or taken in to storage. The specific yield $\mu$ is defined as the volume of water released or stored per unit surface area of the aquifer per unit change in the component of head normal to that surface. In unconfined aquifers the saturated thickness D in not constant, but is a function of the position of the free water table at time t.

For confined aquifers N is the sum of only two terms :

$$N = - P - S \frac{\partial h}{\partial t} \qquad ---(3)$$

where:

S = the storage coefficient of the aquifer (dimensionless)

For confined aquifer S is called the storage coefficient and is defined in the same way as the specific yield for unconfined aquifers.

### 3.3. Numerical approaches

The solution of a partial differential equation can be obtained by using a finite difference method. This method requires that space be divided in to small but finite intervals. The sub areas thus formed are called nodal areas. It is assumed that all the recharge and abstraction in a nodal area occur at the node, in other words, each node is considered to be representative for that nodal area. An appropriate solution of the partial differential equation (1) can be obtained by replacing it with an equivalent system of difference equations, the simultaneous solution of which gives the function of h at a finite number of nodes. Since the water table at the nodes changes with time owing to change in recharge and abstraction, the model also requires a discritization of time.

### 3.4. Design of nodal network

To discretize a ground water basin in to small areas, a network of rectangles, squares, or polygons is superimposed upon it. It is impossible to give any hard and fast rules on what network to apply and how to design it. Because of different geological hydrogeological conditions, a network that is appropriate in one basin will be inappropriate in another. There is certain general procedure to be followed in designing a network considering the following factors;

(a) the type of problems to be solved,
(b) the required accuracy of the results,
(c) the homogeneity or heterogeneity of the aquifer,
(d) the availability of data,
(e) the shape of boundaries,
(f) the number of nodes.

## 4. PROGRAMME DESCRIPTION

### 4.1. Package description

The package consists of four computer programs, in which the calculation processes are recorded. The parts together form the 'Standard Groundwater Model Program, one-layer version (SGMP1)', which consists of :

SGMP11 (reading of input data/nodal network)
SGMP12 (calculation)
SGMP13 (printing of results)
SGMP14 (plotting of results)

One can choose to have the results of the calculations either printed out with SGMP13 or plotted out with SGMP14; if so desired, the results can be both printed and plotted. With printouts one obtains the groundwater balances of each nodal area. With plot-outs, one can compare the calculated watertable elevations with the historical ones; in addition, plot-outs are most useful in indicating the long-term behaviour of the watertable. The file operation flow chart is given in Figure 3.1.

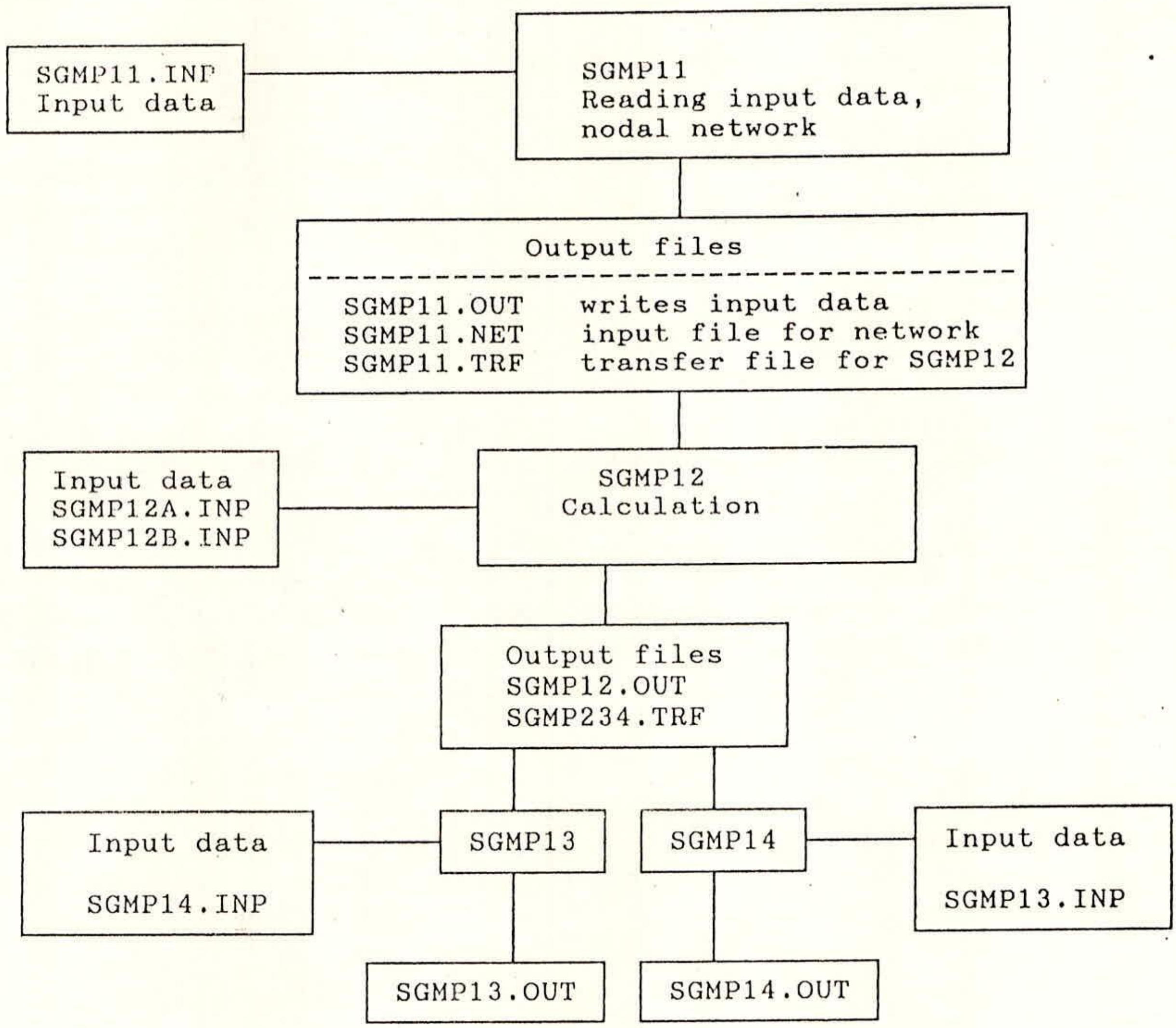



Fig.3.1: File operation flow chart of SGMP package.

### 4.2. Programme, SGMP11.EXE

The data required for SGMP11 are the data of the nodal network, and those of the hydrogeological parameters and other variables. For the design of a nodal network and for techniques to produce the data on hydrogeological parameters reference is made to ILRI-publication 29. SGMP11 reads the required input data from a file SGMP11.INP.

#### 4.2.1. Input file, SGMP11.INP

Each group of data is headed by an identification line, one or more lines with the actual data, and terminated with a blank line.

The structure of SGMP11.INP needs no specific explanation and is as follows :

```
---------------- line with text for identification --------------
---------------- line with text for identification --------------
<blank line>
NN    NSIDES
-- values -
<blank line>
TMBAS    DMTIM    T     DELTA      MINOR      MAJOR      LIST      DL
----------------------------values----------------------------------
<blank line>
SCALE    ERROR    COEFFA    PREDIC     DELQ    LSW1    LSW2    NITER
----------------------------values----------------------------------
<blank line>
K  NTYP(K)   CO(K,1)  CO(K,2)  SL(K)  TL(K)   BL(K)  UL(K)  LL(K)
---------------------NN lines with values--------------------------
<blank line>
K       AS(K)      ASC(K)
- NN lines values -
<blank line>
IB              IE           CONDU
- NSIDES lines values -
```

The input variables of SGMP11.INP are presented in the sequence in which they appear in this data set. Their definition is as follows :

TITLE 1 = name of basin, or any specification the user wishes
TITLE 2 = for identification (2 lines of 80 characters each).

NN = the total number of nodes in the nodal network. As has been explained, the area is split up into nodal areas, the nodes of which represents the specific aquifer characteristics in each area.

NSIDES = the total number of sides in the nodal network.

TMBAS = unit time of time step and boundary conditions. It is expressed as a word : week, month, etc.

DMTIM = number of days in the unit TMBAS.

T = actual time at the beginning of the calculation process, expressed as a numeric in the dimension TMBAS. If the computations start on 15 August and TMBAS has the dimension MONTH, T is equal to 7.5.

DELTA = time. The choice of the time step is initially arbitrarily, although it is influenced by two factors :

# If the time step is chosen too large, the approximation of finite difference to differentials will cease to vet valid and the ~results will be in error.

# An interaction exists between the amount of data for the boundary conditions and the size of the time step chosen; if, for example, the boundary conditions are known on a weekly basis, one will not take a time step of a month and vice versa.

# For any particular set of data, it is advisable to run the

program with various DELTA values. When the results are compared, it can readily be seen for what maximum value of DELTA the results do not appreciably change.

\# Common time steps are a week, a fortnight, or a month for regional studies and a day for local studies like aquifer tests.

The dimension of DELTA is the unit TMBAS.

MINOR = the number of DELTA periods in the first accumulation level.

MAJOR = the number of first accumulation level periods in the second accumulation level.

LIST = the number of second accumulation level periods in the total time period considered.

DL = a range in watertable elevation; it is included to make it possible that once a watertable has exceeded an upper limit and an additional abstraction rate is introduced by the package to keep the watertable below that level, this additional abstraction rate becomes smaller, (ultimately reduces to zero) once the watertable declines to a lower elevation. This reduction takes place when the watertable drops below the level UL(K) - DL. It is expressed in metres.

SCALE = scale of the map used for the nodal network and from which the coordinates of the nodes are read.

ERROR = a tolerance level that directly affects the accuracy of the final results. The dimension of ERROR is the same as for the other components of the water balance : a volume per time. The unit of volume depends on the value of the switch LSW1 (1 m3 or 1,000,000 m3) and the unit time is equal to TMBAS.

COEFFA = a relaxation coefficient. Tyson and Weber (1963) have suggested that such a coefficient can increase the speed of convergence. An optimum value for it can be obtained in the same way as for DELTA. The range of the coefficient is between 0.8 and 1.2.

PREDIC = coefficient which can increase the speed of calculations; especially in situations where there is a monotonous tendency in recharge or abstraction. Default value for PREDIC is 1; in the above described situations the value for PREDIC can be taken greater than 1.

DELQ = an additional percolation or abstraction rate which is introduced by the package once the watertable exceeds the UL(K) and LL(K) levels. Determining the value of DELQ is a matter of trial and error. When too high a value is used, the watertable will remain far from the prescribed limit. If it is too low, too many iterations will be needed before the watertable remains within the limit.

The unit of volume depends on the value of the switch LSW1 (1m or 1,000,000 m); the unit of time is TMBAS. NITER = prescribes the maximum number of iterations which are allowed, before the calculation process is terminated. In such a situation a message 'RELAXATION FAILS TO CONVERGE' is printed, and the calculations are started for the next time step. For unsteady state runs a value of 250 for NITER has been found to work satisfactorily.

LSW1 = an external switch that can be given two values. If the scale of the map is very large, the nodal areas become very large when expressed in square metres; the same applies to pumping rates expressed in cubic metres. These large values can be avoided by using LSW1.

Setting LSW1 equal to 1 means :
unit area = 1,000,000 square metres
unit volume = 1,000,000 cubic metres

Setting LSW1 equal to 2 means :
unit area = 1 square metre
unit volume = 1 cubic metre

Note : The unit length is always fixed (metre); it is used in the hydraulic conductivity values (metre/day) and in the elevation values (metres above a certain reference datum).

LSW2 = an external switch that can be given two values. Setting LSW2 equal to 2 means that no specific input values for UL(K) and LL(K) are needed. The program automatically attaches the values of BL(K) to LL(K) and the value of 9999 to UL(K). If the aquifer is unconfined (SL(K)=TL(K)), the package attaches the values of SL(K) to UL(K)>

Setting LSW2 equal to 1 means that the watertable elevations are prescribed within certain limits and that specific input values for these limits must be given for some or all of the nodal areas. For other nodal areas without prescribed limits, one must6 give UL(K) and LL(K) the values of respectively SL(K) and BL(K).

NITER = maximum number of iterations in each time step. A check has been included in the program: if, after the prescribed maximum number of iterations, the sum of the absolute values of all the residuals is still greater than the value of ERROR, the iterations are terminated: a message 'RELAXATION FAILS TO CONVERGE' is printed, and the calculations are started for the next time step.

NTYP(K) = a node type can be given three values. Setting NTYP(K) equal to 1 means a node at the boundary of the nodal network for which the watertable elevations must be prescribed.

Setting NTYP(K) equal to 2 means a node at the boundary of the nodal network for which the watertable elevations are calculated by the program. Setting NTYP(K) equal to 3 means a node inside the nodal network for which the watertable elevations are calculated by the program.

CO(K,1) = x and y coordinates of all the nodes. These are

CO(K,2) = measured in cm with regard to an arbitrarily chosen cartesian coordinate system laid on the map of the network configuration. When a triangle formed by three ~neighboring nodes possesses an angle greater than 90 degrees, a message is printed indicating which of the nodes this is.

SL(K) = elevation of the land surface in each nodal area, weighted over the nodal area (m above a reference level).

TL(K) = top boundary of the aquifer in each nodal area, weighted over the nodal area (m above a reference level).
If the shallow aquifer is unconfined, TL(K) must have the same value as that of SL(K).

BL(K) = bottom boundary of the aquifer in each nodal area, weighted over the nodal area (m above a reference level).

UL(K) = upper limit to which the watertable in each nodal area is allowed to rise. The dimension is m above a reference level.

LL(K) = lower limit to which the watertable in each nodal area is allowed to fall. The dimension is m above a reference level.

AS(K) = mean specific yield of the aquifer in each nodal area, weighted over the nodal area (dimensionless).

ASC(K) = mean storage coefficient of the aquifer in each nodal area, weighted over the nodal area (dimensionless).

CONDU = mean horizontal conductivity of the aquifer at each nodal side, weighted over the length of the side. The dimension is fixed: m/day. In the program the hydraulic conductivity for each nodal side is represented by the pair of node numbers in between which the side lies. the value of the hydraulic conductivity of a side needs only to be prescribed once. IB and IE representing pair of node numbers.

WARNING : the value of the node number IB must always be less than that of the node number IE.

#### 4.2.2. Output files

The output of SGMP11 consists of a reformatted playback of the input data and is stored on a file SGMP11.OUT. The data concerning the geometry of the nodal network are stored on a file SGMP11.NET to be used by NETWORK. With this program the user can visually check his design of the nodal network and make a plot of the network on paper. This file is unformatted and in binary. form.

The data are further processed and stored on another file SGMP12.TRF to be used by SGMP12. This file is unformatted and in binary form.

### 4.3. Programme, SGMP12.EXE

Apart from the data read from SGMP12.TRF (see previous section), initial and boundary conditions and three external switches are prescribed for this program. SGMP12 reads the required input data from two files SGMP12A.INP and SGMP12B.INP.

For SGMP12 the data sets have been split up in two parts for the following reason. Usually, the recharge QNET(K) consists of different kinds of recharge and abstraction rates, like effective rainfall, seepage losses from rivers, irrigation losses from main channels, minors and fields, pumping rates from shallow wells and deep tube wells, etc. To prepare these manually, it is often very time consuming. The user can then better use a computer program which produces the values of QNET(K). Because the various components will be different for each study, no standard program, however, can be given. Such a program should produce values of QNET(K) according to the specifications of SGMP12B.INP.

#### 4.3.1. Input file, SGMP12A.INP

Each group of data is headed by an identification line, one or more lines with the actual data, and terminated with a blank line. The structure of SGMP12A.INP is as follows :

```
LSW3             LSW4             LSW5                 LSW6
--------------------- values --------------------
<blank line>
HINIT(K)  :   initial    watertable    elevations
--------------------- NN values -----------------
<blank line>
H(K)   :    watertable  elevations  time  step  1
--------------------- NN values -----------------
<blank line>
DELTA : time step 1
------ value ------
<blank line>
H(K) :     watertable  elevations  time  step   2
--------------------- NN values -----------------
<blank line>
DELTA : time step 2
------ value ------
<blank line>
```

It must be noted that above structure is influenced by the values of the external switches LSW3, LSW4 and LSW5.

The set of H(K) is repeated LIST times if LSW3 = 1, LIST x MAJOR times if LSW3 = 2, and LIST x MAJOR x MINOR times if LSW3 = 3. This is the case for LSW4 = 2; for the combination of LSW4 = 1 and LSW3 = 2, the set of H(K) is repeated MAJOR times.

The set of DELTA must be skipped if LSW5 is equal to 1.

The input variables of SGMP12A.INP are presented in the sequence in which they appear in this data set. Their definition is as follows :

LSW3 = an external switch that can be given three values. Setting LSW3 equal to 3 means that for every time step DELTA the boundary conditions must be specified.

Setting LSW3 equal to 2 means that for every first accumulation level (MINOR time steps DELTA) the boundary conditions must be specified.

Setting LSW3 equal to 1 means that for every second accumulation level (MAJOR x MINOR time steps DELTA) the boundary conditions must be specified.

The actual value of LSW3 depends on the chosen time step DELTA and on the time basis for which the boundary conditions are available.

LSW4 = an external switch that can be given three values. Setting LSW4 equal to 2 means that the boundary conditions are read for each DELTA, first or second accumulation level depending upon the value of LSW3. LSW4 is equal to 2 in the calibration runs. In prediction runs the boundary conditions are usually prepared on a monthly basis for one year. For each year in the total time period, the same input data as given for the first year are used. LSW4 is then equal to 1 and LSW3 to 2. LIST then has the dimension year and MAJOR the dimension month.

LSW5 = switch that can be given two values. Setting LSW5 equal to 1 means that a fixed time step DELTA is used in the calculation process. Its value is read in the first program SGMP11.
Setting LSW5 equal to 2 means that a variable time step is used. For each time step the value of DELTA must now be prescribed, starting with the first time step, at the same time overruling the value of DELTA given in the first program SGMP11.
A variable time step is often used in simulating aquifer tests (logarithmic time step), but for regional groundwater flow problems a fixed time step is preferred.

LSW6 = an external switch that can be given two values. Setting LSW6 equal to 1 means that the model runs

in the so-called inverse mode. the UL(K) and LL(K) values are made equal to the prescribed H(K) values of each time step plus or minus half the DL value, at the same time overruling the values as they were prescribed in the first program SGMP11. The program will calculate the corresponding nodal net recharge values. It is advised to make the qnet(K) values equal to zero.
To simulate steady-state conditions, the user must repeat the initial watertable elevations a number of time steps. In this way it is not necessary to make the specific yield values or storage coefficients equal to zero.
Setting LSW6 equal to 0 means that the model runs in normal mode.

HINIT(K) = initial watertable elevations of the aquifer for all nodes, measured at the nodes themselves (m above a reference level).

H(K) = watertable elevations of the aquifer for all nodes.

If LSW6 equals zero, only values need to be prescribed for the nodes at the boundaries of the nodal network with prescribed watertable elevations (NTYP(K)=1); for the remaining nodes no specific value of H(K) is required (can be taken as zero). If LSW6 equals one, values of H(K) must be prescribed for all the nodes.

### 4.3.2. Input file, SGMP12B.INP

Each group of data is headed by an identification line, one or more lines with the actual data, and terminated with a blank line. The structure of SGMP12B.INP is as follows :

```
QNET(K)  :  net recharge time step 1
-------------- NN values -----------
<blank line>
QNET(K)  :  net recharge time step 2
-------------- NN values -----------
<blank line>
```

It must be noted that above structure is influenced by the values of the external switch LSW3 and LSW4.

The set of H(K) is repeated LIST times if LSW3 = 1. LIST x MAJOR times if LSW3 = 2, and LIST x MAJOR x MINOR times if LSW3 = 3. This is the case for LSW4 = 2; for the combination of LSW4 = 1 and LSW3 = 2, the set of H(K) is repeated MAJOR times.

The input variables of SGMP12B.INP are the net recharge values. Their definition is as follows :

GNET(K) = net recharge rate in each nodal area, being the sum of a number of external flows with the dimension volume per time. The unit of volume depends on the value of the switch LSW1 (1 m3 or 1,000,000 m3) and the unit time is equal to TMBAS. A positive sign means recharge to the aquifer.

Only values need to be prescribed for the nodes for which the parameter NTYP(K) has the value 2 or 3. For the remaining nodes (NTYP(K)) = 1) no specific value of QNET(K) is required (can be taken as zero).

#### 4.3.3. Output files

In SGMP12 the watertable elevations at the nodes and the groundwater balances of the nodal areas are calculated for each time step and the results are stored on a file SGMP234.TRF. This file is unformatted and in binary form.

As the results are stored on SGMP234.TRF, the only direct output is the heading, the values of the three external switches, and an overview of the subsurface in- and outflows along the head controlled boundary nodes of the nodal network.

Included in the calculation process is a check against certain situations. If they occur, one of the following messages will be printed.

'RELAXATION FAILS TO CONVERGE AT TIME .......'
'DELQ IS TOO SMALL AT TIME ......'
'WATER LEVEL AT NODE ....... IS AT ITS BASE AT TIME .......'

The above-mentioned output is stored in SGMP12.OUT. In addition, the calculated watertable elevations for each time step are stored in a file HCAL.PLT. These data can be used for making watertable contour maps with commercial available programs like SURFER.

### 4.4. Programme, SGMP13.EXE

In addition to the required calculated watertable elevations and groundwater balance components which are read from SGMP234.TRF, SGMP13 only requires values for three external switches.

#### 4.4.1. Input file, SGMP13.INP

The only input values are the values of three external switches. The structure of SGMP13.INP is as follows :

```
LSW7          LSW8          LSW9
----------- values ----------
```

The three switches are defined as follows :

LSW7 = an external switch that can be given three values. Setting LSW7 equal to 1 means that the watertable elevations are printed at each time step DELTA. Setting LSW7 equal to 2 means that the watertable elevations are printed at each first accumulation level (MINOR time steps DELTA).

LSW8 = an external switch that can be given three values. The meanings of the values 1, 2 and 3 for this switch are analogue to those of LSW7. Instead of printing watertable elevations at various time levels, the components of the water balance of the nodal areas are calculated over the various time levels and printed after each particular time level.

LSW9 = an external switch that can be given two values. Setting LSW9 equal to 1 means that only the watertable elevations of the internal nodes are printed.
Setting LSW9 equal to 2 means that the watertable elevations of all the nodes are printed. This is usually done only once to check the head controlled boundaries numerically.

### 4.4.2. Output files

SGMP13 stores the results of the calculations in tabular form in a file SGMP13.OUT.

## 4.5. Programme, SGMP14.EXE

In addition to the required calculated watertable elevations which are read from SGMP234.TRF, SGMP14 requires various signs for the plot, selection of plot nodes, values for two external switches and historical watertable elevations for the selected nodes.

### 4.5.1. Input file, SGMP14.INP

Each group of data is headed by an identification line, one or more lines with the actual data, and terminated with a blank line. The structure of SGMP14.INP is as follows :

```
BLNK   HI   HMINUS  HX   ASTRSK  HY   PLUS  LSW10  LSW11   NNS
----------- signs for plotting ------------  ------ values ------
<blank line>
NS(I) : internal node  numbers with historical w.t.e.  available
-------------------------- NNS values -------------------------
<blank line>
MINOR       MAJOR       LIST
--------- values ---------
<blank line>
HH(K)  :  historical watertable elevations time step 1
----------------------- NNS values -------------------
<blank line>
HH(K)  :  historical watertable elevations time step 2
----------------------- NNS values -------------------
<blank line>
```

It must be noted that above structure is influenced by the values of NNS and LSW10.

If NNS is equal to NN, the set of NS(I) must be skipped. When NNS is less than NN, a sequence of node numbers must be prescribed. It must be noted that in this sequence the nodes for which NTYP is equal to 1, are not required since they were already based on historical data.

Setting NNS equal to NN is usually done only once to provide a visual check on the head-controlled boundary nodes.

If LSW10 is equal to 1, the sequence of HH(K) is as follows:

historical watertable elevation at node NS(1) for time step 1; historical watertable elevation at node NS(2) for time step 2; till node NS(NNS). This sequence of historical watertable elevations must be repeated MAJOR times.

If LSW10 is equal to 2, the sequence of HH(K) must be skipped. The definition of these variables is as follows :

BLNK = always a blank.

HI = a sign that indicates the unit of scale.

HMINUS = a sign that indicates the tenth of the unit of scale.

HX = a sign that indicates when a calculated watertable elevation falls outside the maximum range of the scale.

ASTRSK = a sign that indicates the position of a calculated watertable elevation in the graph.

HY = a sign that indicates when a historical watertable elevation falls outside the maximum range of the scale.

PLUS = a sign that indicates the position of a historical watertable elevation in the graph.

LSW10 = an external switch that can be given two values. Setting LSW10 equal to 1 means that both calculated and historical watertable elevations will be plotted. This is required for the calibration process, in which the calculated watertable elevations are compared with the historical ones.
Setting LSW10 equal to 2 means that only the calculated watertable elevations are plotted. This is done in prediction runs, when no historical water levels are available.

LSW11 = an external switch that can be given two values. Setting LSW11 equal to 1 means that an error calculation is made of the deviations between the calculated and historical watertable elevations. For the selected nodes of the network, these deviations are calculated for each time step for which historical watertable elevations are available; the mean and standard deviation are then calculated and printed at the end of all the plots.

Setting LSW11 equal to 2 means that no error calculation is made.

NNS = total number of nodes for which groundwater hydrographs must be plotted.

| | | |
|---|---|---|
| NS(I) | = | sequence of node numbers, selected for plotting hydrographs. |
| MINOR<br>MAJOR<br>LIST | = | In prediction runs these parameters should be given values that differ from those prescribed in the calculation program. Suppose, the model is run for 30 years with a time step of a fortnight and the boundary conditions are prescribed on a monthly basis. The parameters of the time discretization are then :<br><br>TMBAS : month<br>DELTA : 0.5<br>MINOR : 2<br>MAJOR : 12<br>LIST : 30<br><br>Using the same values in the plot program would mean that the water levels are plotted for each month, because they are plotted at the end of each first accumulation level. In general one will not need that much information, and water levels plotted after each half year will usually suffice. The values of MINOR, MAJOR and LIST are then :<br>MINOR : 12<br>MAJOR : 60<br>LIST : 1 |
| H(NS(K),M) | = | historical watertable elevations of the aquifer for the selected nodes. It must be noted that these are not required for the nodes for which NTYP is equal to 1 since they were already based on historical data. |

4.5.2. Output files

SGMP14 stores the calculated and, when available, historical watertable elevations at the selected nodes in a file SGMP14.OUT.

## 5. CASE STUDY I

### 5.1. Case Study of Hansi Form in Haryana

A rectangular farm, 1600 m long and 860 m wide (area = 136 ha), is located in the flat alluvial plain on Haryana. An irrigation canal crosses the farm approximately in the middle. The crops cultivated on the farm are irrigated with the water from this canal. Rice is grown in the strip on both sides of the canal, and cereals and other field crops on the remaining parts of the farm. The land surrounded the farm is also cultivated, but because of the storage of irrigation water, they are not supplied with water from the canal. During the irrigation season it was found that the water table in the parts of the form was rather shallow, and the question arose whether the land need artificial drainage. Shallow piezometers were placed in a regular grid, and monthly readings were taken of there water tables and is reported in Figure 5.1. The location, where the aquifer transmissivity has been determined are located in Figure 5.1 along with the transmissivity as 250, 260, 350, 170 and 290 $m^2$/day respectively.

To run the programme SGMP11 the input data files SGMP11.INP, SGMP12A.INP, SGMP12B.INP and SGMP13.INP are required. In order to run the programme the following major steps are taken.

(a) To make a time descritization.
(b) To draw a nodal network and to estimate the coordinates of each node.
(c) To interpolate water table depth, depth to water table, ground level, electrical conductivity at each node and mean hydraulic conductivity by the sides of nodes.

### 5.2. Time discritization

Since the groundwater data is on monthly basis and only recorded during irrigation period the values of TMBAS is MONTHS and the average number of days on a unit DMTIM is 30.5. The calculation starts with beginning therefore value of T is equal to 0.0. According to the problem the values of DELTA, MINOR, MAJOR and LIST were taken as follows;

TMBAS = Month
DMTIM = 30.5
DELTA = 1
MINOR = 1
MAJOR = 12
LIST = 1

The time descritization should follow following relations:

Total simulation period in TMBAS = DELTA * MINOR * MAJOR * LIST

12 = 1 * 1 * 12 * 1

Since, only the monthly data, that too, after the irrigation period is available, it was assumed that the data remains unchanged at next time step i.e. next year at the same time and therefore, the problem becomes of a steady state condition.

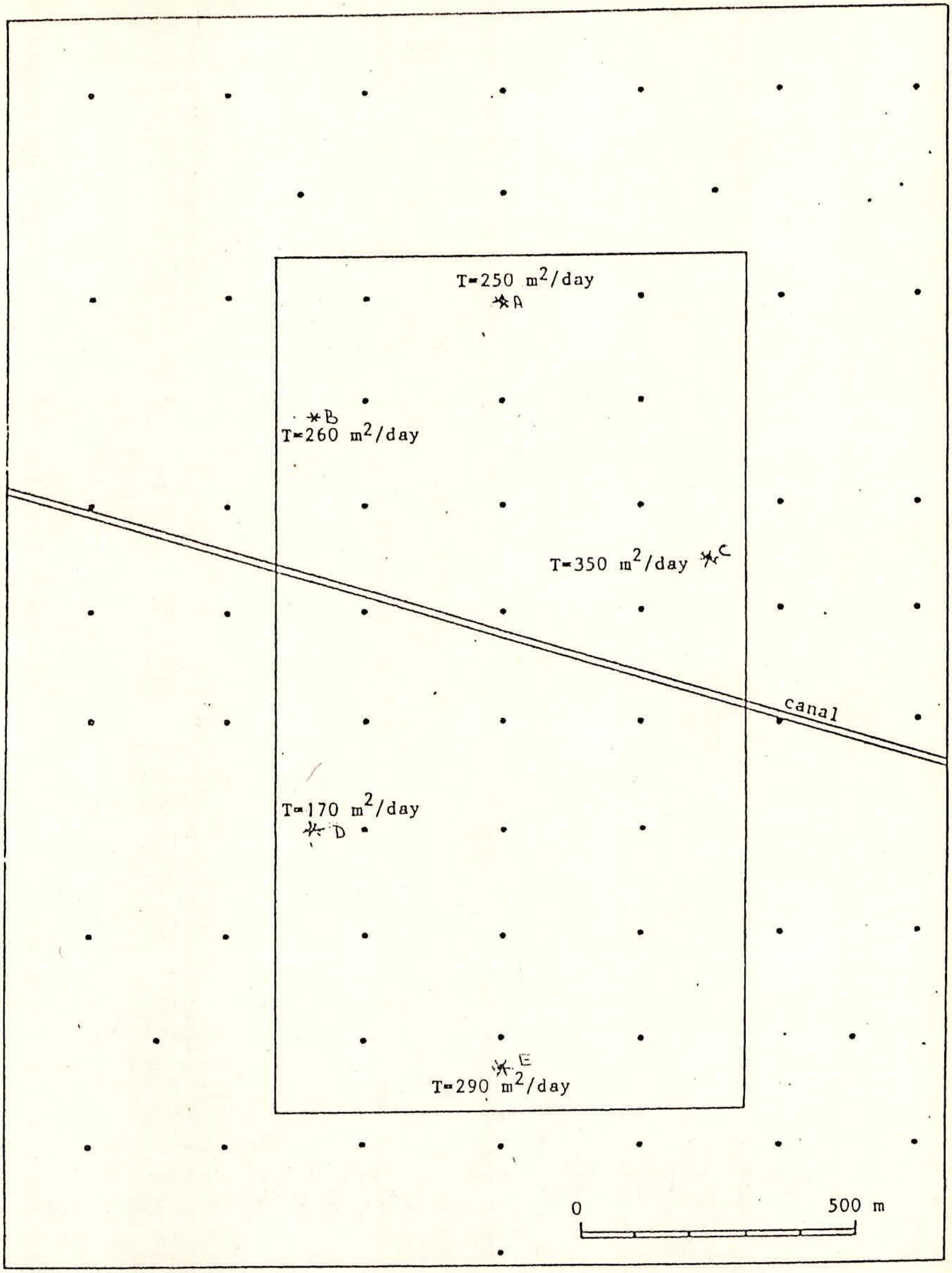



Fig. 5.1: Location of observation wells and transmissivity test sites.

• ; Location of observation well
* ; location of aquifer transmissivity site, A to E

Figure not to the scale.

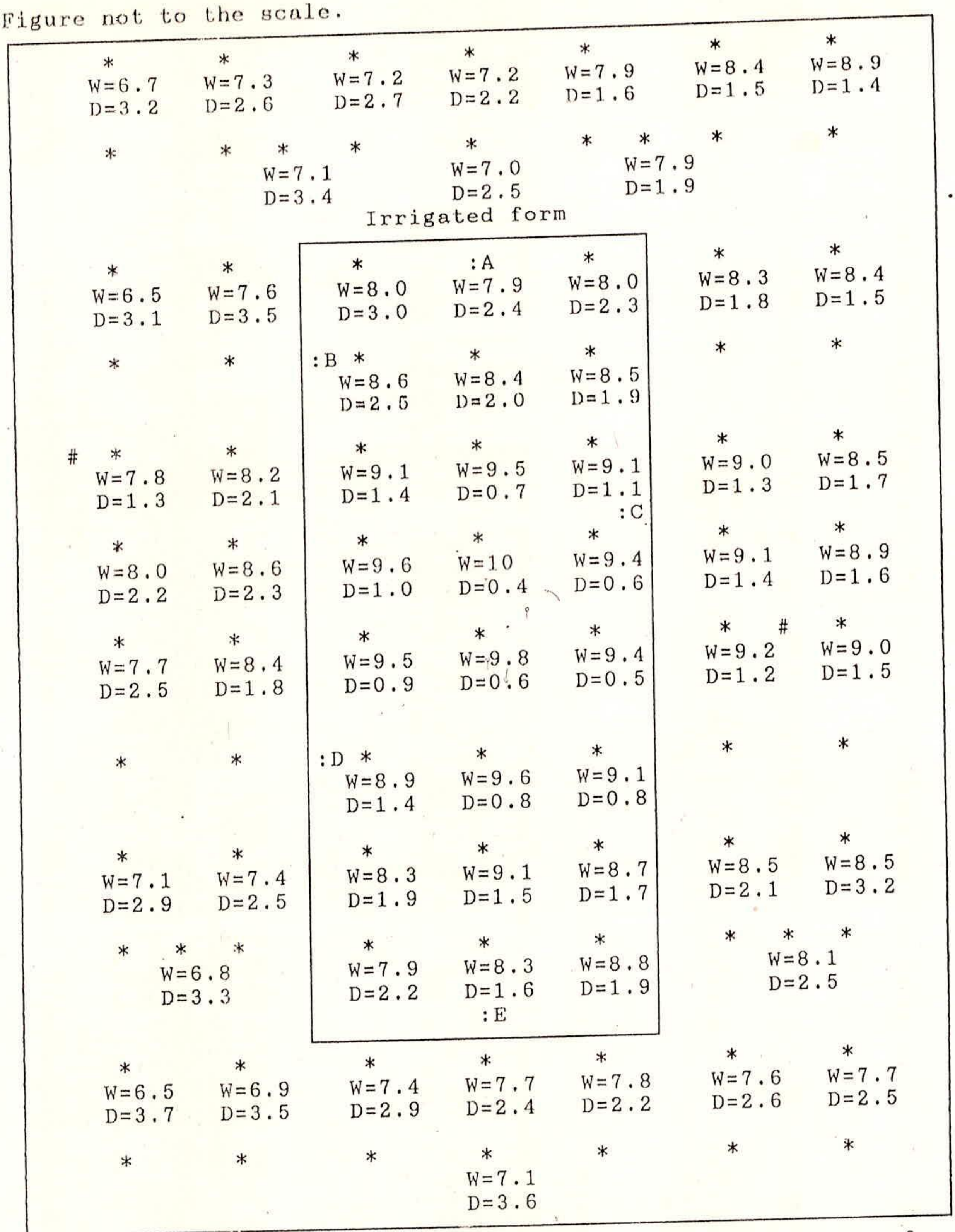



Fig. 5.2: Detailed observations during irrigation season of a rectangular farm of 1600 m long and 860 m wide in a flat alluvial plain with inner area irrigated by canal.

*; Location of observation well and nodes, #; straight canal runs between points, W; water table elevation, 8.0 m above sea level in m, D; depth of water level below ground surface in, :; location of aquifer transmissivity site, A to E

## 5.3. Design of nodel net work

Since the area and the piezometers are in rectangular shape, a regular grid system is imposed on the farm and is reported in Fig. 5.2. The total number of nodes (N=84) so formed are 84 and the number of sides (NSIDES = 149) observed are 149.

## 5.4. Interpolation of data

The interpolation of data at each node involves the plotting of contour maps. The contour maps are drawn for water table depths, water table, ground level, electrical conductivity and hydraulic conductivity with the help of commercially available soft were SURFER and are reported in Figures 5.3 to 5.5. The water table at each nodel point was also interpolated with the help of contours drawn by hand to check for any difference between the two drawn by hand and that drawn by SURFER. The interpolated values along with the coordinate as measured on Figure 5.1 are reported in Table 5.1. On comparing the interpolated data of the water table in column no. 6 and column no. 7 (Table 5.1), the differences can be observed. It is therefore in all subsequent calculations, the interpolated data of the water table by hand are used given in column no. 7.

## 5.5. Preparation of input files

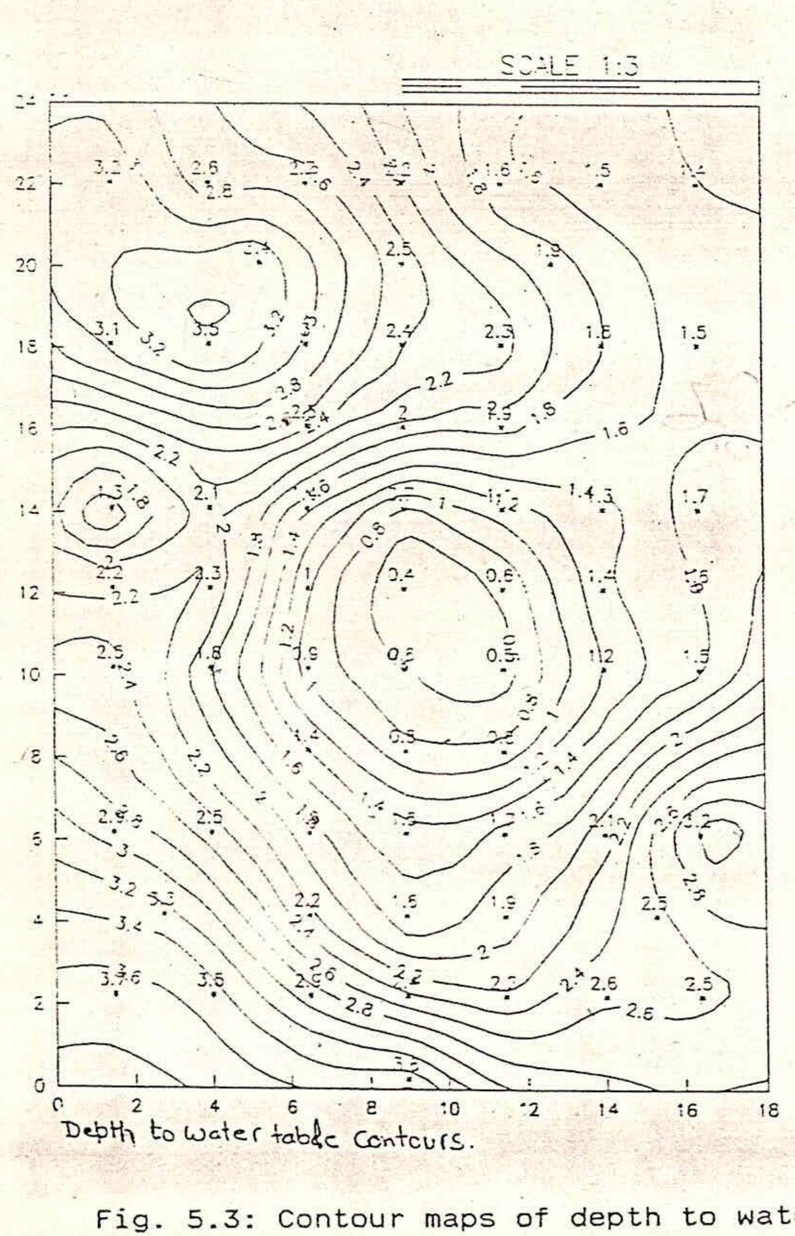
It involves the preparation of SGMP11.INP, SGMP12A.INP, SGMP12B.INP and SGMP13.INP as per the structure and specified format.

### 5.5.1. Preparation of input file SGMP11.INP

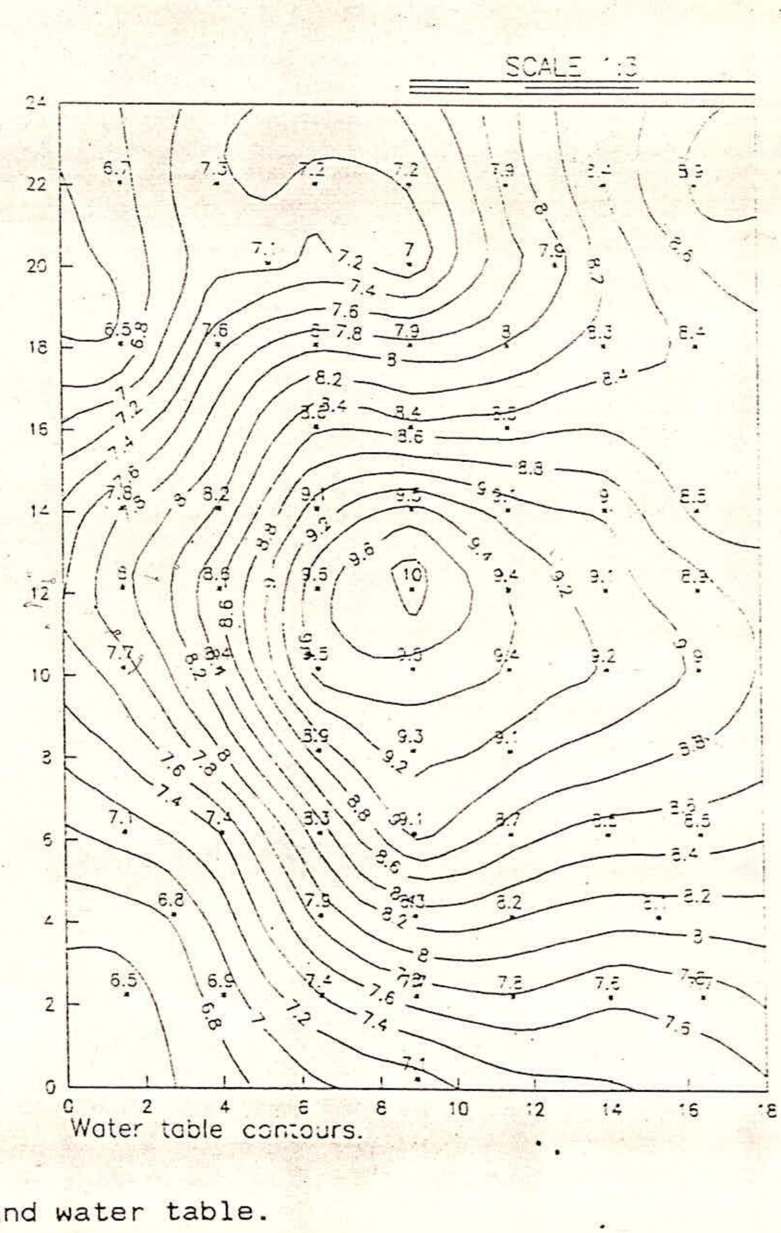
So for we have decided for the data of N, NSIDES, TMBAS, DMTIM, DELTA, MINOR, MAJOR and LIST. The values of DL, ERROR and DELQ are estimated by trial and error while running the package and will be discussed later. The scale of the map on which the coordinates were measured is 1 cm = 100 m and therefore, the input data to SCALE will be 10,000 (1 cm = 100x100 cm). The number of iteration is selected as 50 and LSW1=1. Since the problem is of unconfined aquifer, the top level TL to which the water can rise is equal to surface level (SL). In the problem the depth of aquifer is not given but the case is of the flat alluvial plane of Haryana. It is therefore, the depth of aquifer is assumed around 100 m. Suppose the depth of aquifer is 120 m instead of 100 m, the error is estimation of hydraulic conductivity will be only of the order of 0.83 percent. Therefore the bottom level (BL) will be equal to 100-TL. The prescribed values of UL and LL to which water table is allowed to rise and fall is same as TL and BL.

The specific yield (AS) and mean storage coefficient (ASC) of the aquifer are assumed as 0.2 and 0.001 respectively. The hydraulic conductivity at each nodal point is estimated by using the transmissivity data and the relationship used is T=kb. Since the transmissivity at one point is 250 $m^2$/day, the value of hydraulic conductivity will be as follows;

$$k = (T/b) = 250 \ m^2/day \ / \ 100 \ m \ (assumed) = 2.5 \ m/day$$




Depth to water table Contours.




Water table contours.

Fig. 5.3: Contour maps of depth to water table and water table.

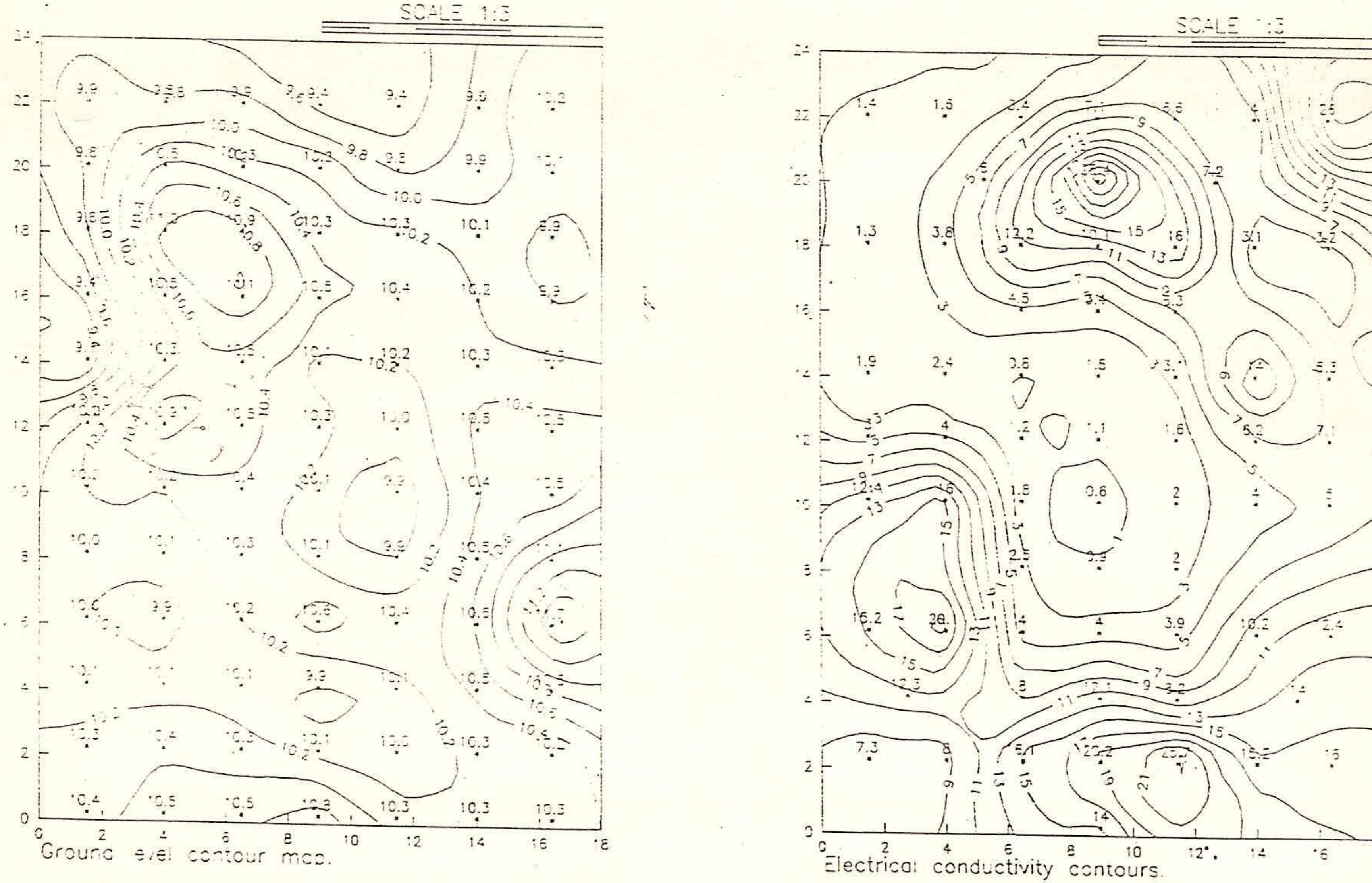



Fig. 5.4: Contour maps of ground level and electrical conductivity.

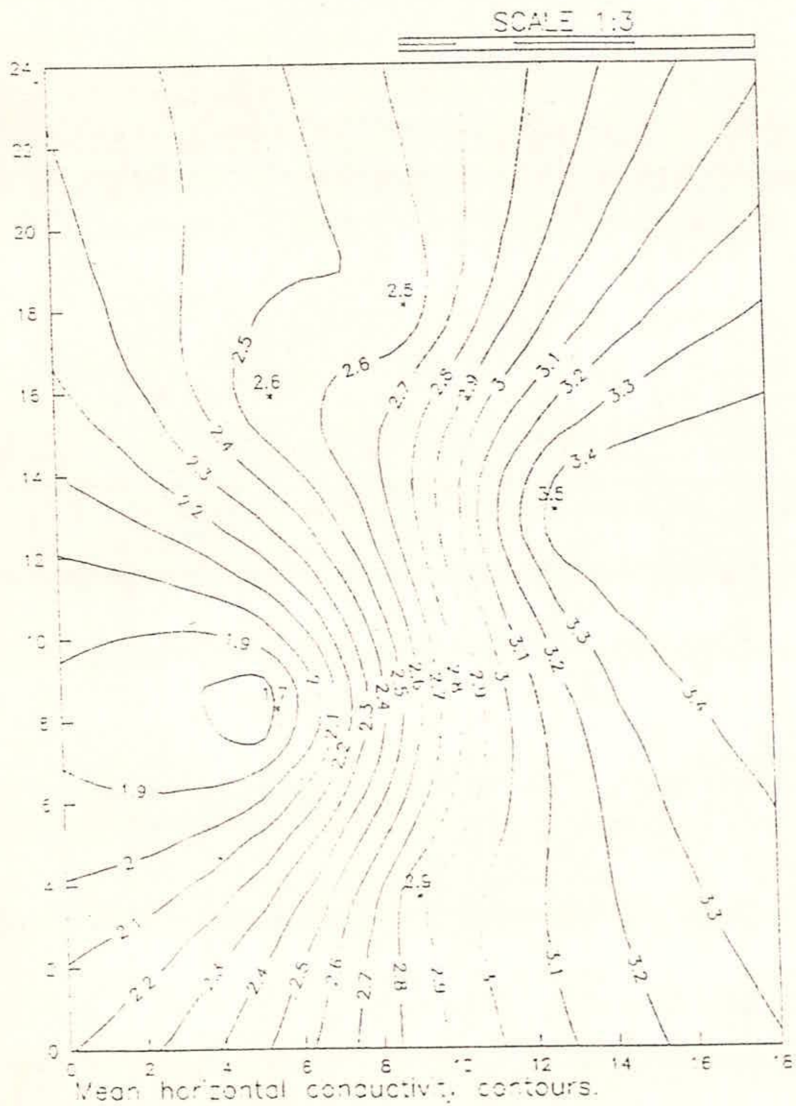



Fig. 5.5: Contour map of hydraulic conductivity.

Table 5.1: Node number its coordinates along with the interpolated values of depth to water table, water table by surfer and hand, ground level and electrical conductivity.

| Sl. No. | Node No. | X axis, cm. | Y axis, cm. | Depth to water table, m | Water table by SURFER, m | Water table by HANH, m | Ground level by HAND, m | Elec. condt. mimh/cm |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 1 | 1 | 1.5 | 22.05 | 3.2 | 6.75 | 6.7 | 9.9 | 1.4 |
| 2 | 2 | 4 | 22.05 | 2.6 | 7.15 | 7.3 | 9.9 | 1.6 |
| 3 | 3 | 6.5 | 22.05 | 2.7 | 7.18 | 7.2 | 9.9 | 3.4 |
| 4 | 4 | 8.95 | 22.05 | 2.2 | 7.25 | 7.2 | 9.4 | 7.1 |
| 5 | 5 | 11.45 | 22.05 | 1.6 | 7.85 | 7.9 | 9.5 | 6.6 |
| 6 | 6 | 14 | 22.05 | 1.5 | 8.37 | 8.4 | 9.9 | 4 |
| 7 | 7 | 16.4 | 22.05 | 1.4 | 8.83 | 8.9 | 10.3 | 26 |
| 8 | 8 | 1.5 | 20.1 | 3.15 | 6.67 | 6.54 | 9.69 | 1.3 |
| 9 | 9 | 4 | 20.1 | 3.3 | 7.15 | 7.01 | 10.31 | 4 |
| 10 | 10 | 6.5 | 20.1 | 3 | 7.25 | 7.07 | 10.07 | 11 |
| 11 | 11 | 8.95 | 20.1 | 2.5 | 7.08 | 7 | 9.5 | 25.4 |
| 12 | 12 | 11.45 | 20.1 | 2.05 | 7.7 | 7.55 | 9.6 | 13 |
| 13 | 13 | 14 | 20.1 | 1.7 | 8.2 | 8.15 | 9.85 | 6 |
| 14 | 14 | 16.4 | 20.1 | 1.5 | 8.57 | 8.605 | 10.105 | 13.2 |
| 15 | 15 | 1.5 | 18.1 | 3.1 | 6.65 | 6.5 | 9.6 | 1.3 |
| 16 | 16 | 4 | 18.1 | 3.5 | 7.5 | 7.6 | 11.1 | 3.8 |
| 17 | 17 | 6.5 | 18.1 | 3 | 7.93 | 8 | 11 | 12.2 |
| 18 | 18 | 8.95 | 18.1 | 2.4 | 7.87 | 7.9 | 10.3 | 10.1 |
| 19 | 19 | 11.45 | 18.1 | 2.3 | 8 | 8 | 10.3 | 16 |
| 20 | 20 | 14 | 18.1 | 1.8 | 8.3 | 8.3 | 10.1 | 3.1 |
| 21 | 21 | 16.4 | 18.1 | 1.5 | 8.45 | 8.4 | 9.9 | 3.2 |
| 22 | 22 | 1.5 | 16.1 | 2.25 | 7.2 | 7.19 | 9.44 | 1.3 |
| 23 | 23 | 4 | 16.1 | 2.6 | 7.9 | 7.95 | 10.55 | 3 |
| 24 | 24 | 6.5 | 16.1 | 2.5 | 8.55 | 8.6 | 11.1 | 4.5 |
| 25 | 25 | 8.95 | 16.1 | 2 | 8.5 | 8.4 | 10.4 | 3.4 |
| 26 | 26 | 11.45 | 16.1 | 1.9 | 8.5 | 8.5 | 10.4 | 6.3 |
| 27 | 27 | 14 | 16.1 | 1.61 | 8.6 | 8.61 | 10.22 | 8 |
| 28 | 28 | 16.4 | 16.1 | 1.5 | 8.45 | 8.3 | 9.8 | 5 |
| 29 | 29 | 1.5 | 14.1 | 1.3 | 7.8 | 7.8 | 9.1 | 1.9 |
| 30 | 30 | 4 | 14.1 | 2.1 | 8.2 | 8.2 | 10.3 | 2.4 |
| 31 | 31 | 6.5 | 14.1 | 1.4 | 9.1 | 9.1 | 10.5 | 0.8 |
| 32 | 32 | 8.95 | 14.1 | 0.7 | 9.4 | 9.5 | 10.2 | 1.5 |
| 33 | 33 | 11.45 | 14.1 | 1.1 | 9.1 | 9.1 | 10.2 | 3.1 |
| 34 | 34 | 14 | 14.1 | 1.3 | 8.95 | 9 | 10.3 | 14 |
| 35 | 35 | 16.4 | 14.1 | 1.7 | 8.57 | 8.5 | 10.2 | 5.3 |
| 36 | 36 | 1.5 | 12.15 | 2.2 | 7.95 | 8 | 10.2 | 3 |
| 37 | 37 | 4 | 12.15 | 2.3 | 8.55 | 8.6 | 10.9 | 4 |
| 38 | 38 | 6.5 | 12.15 | 1 | 9.5 | 9.6 | 10.6 | 1.2 |
| 39 | 39 | 8.95 | 12.15 | 0.4 | 9.9 | 10 | 10.4 | 1.1 |
| 40 | 40 | 11.45 | 12.15 | 0.6 | 9.4 | 9.4 | 10 | 1.6 |
| 41 | 41 | 14 | 12.15 | 1.4 | 9.1 | 9.1 | 10.5 | 6.2 |
| 42 | 42 | 16.4 | 12.15 | 1.6 | 8.86 | 8.9 | 10.5 | 7.1 |
| 43 | 43 | 1.5 | 10.2 | 2.5 | 7.73 | 7.7 | 10.2 | 12.4 |
| 44 | 44 | 4 | 10.2 | 1.8 | 8.4 | 8.4 | 10.2 | 16 |
| 45 | 45 | 6.5 | 10.2 | 0.9 | 9.45 | 9.5 | 10.4 | 1.8 |
| 46 | 46 | 8.95 | 10.2 | 0.6 | 9.5 | 9.8 | 10.4 | 0.6 |

Contd.

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|
| 47 | 47 | 11.45 | 10.2 | 0.5 | 9.37 | 9.4 | 9.9 | 2 |
| 48 | 48 | 14 | 10.2 | 1.2 | 9.17 | 9.2 | 10.4 | 4 |
| 49 | 49 | 16.4 | 10.2 | 1.5 | 8.96 | 9 | 10.5 | 5 |
| 50 | 50 | 1.5 | 8.2 | 2.6 | 7.44 | 7.39 | 9.99 | 15.2 |
| 51 | 51 | 4 | 8.2 | 2.1 | 8 | 8 | 10.1 | 15 |
| 52 | 52 | 6.5 | 8.2 | 1.4 | 8.9 | 8.9 | 10.3 | 2.5 |
| 53 | 53 | 8.95 | 8.2 | 0.8 | 9.27 | 9.6 | 10.4 | 0.9 |
| 54 | 54 | 11.45 | 8.2 | 0.8 | 9.1 | 9.1 | 9.9 | 2 |
| 55 | 55 | 14 | 8.2 | 1.6 | 8.9 | 8.9 | 10.5 | 6 |
| 56 | 56 | 16.4 | 8.2 | 2.3 | 8.77 | 8.9 | 11.2 | 8.2 |
| 57 | 57 | 1.5 | 6.2 | 2.9 | 7.1 | 7.1 | 10 | 15.2 |
| 58 | 58 | 4 | 6.2 | 2.5 | 7.4 | 7.4 | 9.9 | 20.1 |
| 59 | 59 | 6.5 | 6.2 | 1.9 | 8.3 | 8.3 | 10.2 | 4 |
| 60 | 60 | 8.95 | 6.2 | 1.5 | 9.05 | 9.1 | 10.6 | 4 |
| 61 | 61 | 11.45 | 6.2 | 1.7 | 8.7 | 8.7 | 10.4 | 3.9 |
| 62 | 62 | 14 | 6.2 | 2.1 | 8.5 | 8.5 | 10.6 | 10.2 |
| 53 | 53 | 16.4 | 6.2 | 3.2 | 8.5 | 8.5 | 11.7 | 12.4 |
| 64 | 64 | 1.5 | 4.2 | 3.36 | 6.75 | 6.8 | 10.16 | 11.5 |
| 65 | 65 | 4 | 4.2 | 3 | 7.1 | 7.194 | 10.2 | 12 |
| 66 | 66 | 6.5 | 4.2 | 2.2 | 7.87 | 7.9 | 10.1 | 8 |
| 67 | 67 | 8.95 | 4.2 | 1.6 | 8.3 | 8.3 | 9.9 | 12.1 |
| 68 | 68 | 11.45 | 4.2 | 1.9 | 8.2 | 8.2 | 10.1 | 8.2 |
| 69 | 69 | 14 | 4.2 | 2.35 | 8.1 | 8.05 | 10.4 | 12.6 |
| 70 | 70 | 16.4 | 4.2 | 2.7 | 8.1 | 8.06 | 10.76 | 14.5 |
| 71 | 71 | 1.5 | 2.25 | 3.7 | 6.55 | 6.6 | 10.3 | 7.3 |
| 72 | 72 | 4 | 2.25 | 3.5 | 6.9 | 6.9 | 10.4 | 8 |
| 73 | 73 | 6.5 | 2.25 | 2.9 | 7.4 | 7.4 | 10.3 | 16.1 |
| 74 | 74 | 8.95 | 2.25 | 2.4 | 7.7 | 7.7 | 10.1 | 20.2 |
| 75 | 75 | 11.45 | 2.25 | 2.2 | 7.79 | 7.8 | 10 | 25.7 |
| 76 | 76 | 14 | 2.25 | 2.6 | 7.65 | 7.6 | 10.2 | 15.2 |
| 77 | 77 | 16.4 | 2.25 | 2.5 | 7.7 | 7.7 | 10.2 | 16 |
| 78 | 78 | 1.5 | 0.25 | 3.85 | 6.5 | 6.36 | 10.21 | 6 |
| 79 | 79 | 4 | 0.25 | 3.7 | 6.75 | 6.71 | 10.41 | 9.5 |
| 80 | 80 | 6.5 | 0.25 | 3.5 | 7.03 | 7 | 10.5 | 13.5 |
| 81 | 81 | 8.95 | 0.25 | 3.6 | 7.15 | 7.1 | 10.7 | 14 |
| 82 | 82 | 11.45 | 0.25 | 2.95 | 7.35 | 7.25 | 10.2 | 20 |
| 83 | 83 | 14 | 0.25 | 2.85 | 7.4 | 7.14 | 9.99 | 17.2 |
| 84 | 84 | 16.4 | 0.25 | 2.78 | 7.5 | 7.25 | 10.03 | 18.5 |

The same method is used to calculate hydraulic conductivity at other points. With those values the contours were drawn (Fig. 5.5) and mean horizontal hydraulic conductivity of aquifer at each nodel side is interpolated. The data of SGMP11.inp is shown in Appendix A.

### 5.5.2. Preparation of input file SGMP12A.INP

LSW3, LSW4 and LSW5 are taken equal to one and LSW6 may be zero or one depending the package running in normal or inverse mode. The initial water table and the water table at time step 1 are the interpolated water table data. The input to SGMP12A.INP is reported in Appendix A.

### 5.5.3. Preparation of input file SGMP12B.INP

The file contains the values of net recharge. Since the problem does not give any value to net recharge, the net recharge is taken as zero at each nodel point. The data of SGMP12B.INP is reported in Appendix A.

### 5.5.4. Preparation of input file SGMP13.INP

This file contain the input data to have a desired format of out put data and the data of SGMP13.INP is reported in Appendix A.

## 5.6. Package output in different runs

The package SGMP11 is operated in different modes to have different out puts and to understand the working of the package. The running of package in different modes is described in subsequent sections.

### 5.6.1. Normal mode run

Running the package in normal mode requires the values of LSW2=2 and LSW6=0. Running the package in this mode describes about the behaviour of the aquifer i.e. wether the water table in the aquifer is rising of falling. While running the package, the values of DL, DELQ and ERROR were selected as 0.02, 0.001 and 0.001 respectively. The value of DL=0.02 means, the calculated heads will be adjusted within 1.0 cm to the prescribed head. The value of DELQ=0.001, means that at each iteration $0.001 \times 10^6$ $m^3$ of water will be added or subtracted in water balance. The value of ERROR=.001, means that the water balance at each node will be within 0.1 percent.

A positive value of net change in storage, in SGMP13.OUT water balance component, indicates that water level in the aquifer has lowered. It has happened only because the net recharge to the aquifer is prescribed as zero in SGMP12B.INP, however there would have been some recharge to the area. In a normal run the superiteration does not work and it will be zero at each time step. In package the, number of iteration works to adjust the water table and its value ranges within 2 to 50 and finally should reach to 2. The output files (SGMP11.OUT, SGMP12.OUT and SGMP13.OUT are reported in Appendix B.

### 5.6.2. Inverse mode run

Running the package in inverse mode requires the values of LSW2=2 and LSW6=1. The package in this mode describes about the artificial flow at each node for which the water table elevations are calculated keeping the initial head same as final, which is the assumption in the problem. While running the package, the values of DL, DELQ and ERROR remains same as prescribed in normal run or slightly can be modified. In this run the values are taken same and also in subsequent runs no change is made.

In this run the change in head will be zero and an artificial recharge will be introduced at each node to keep the head same with in one percent error. Both iteration and superiteration works in this run. The superiteration works to adjust the water balance and finally comes to zero from 50. The number of iteration works to adjust the water table and its value should work within 2 to 50 and finally should reach to 2. The water balance component of output file SGMP13.OUT is reported in Appendix C.

5.6.3. Runes with drains in aquifer

In this run the condition is imposed to obtain the results by providing a drain at 1.0 m and 1.5 m depths in irrigated form. To impose this condition and to run the package the following changes are required in SGMP11.INP.

a) The artificial recharge obtained by inverse mode run in section 5.6.2 is considered as the actual net recharge to the irrigated form and the output of net recharge becomes the input of net recharge in SGMP11.INP.

b) Now the package is operated in normal mode by changing LSW6=0. Under this condition the artificial recharge at each node in SGMP13.OUT should be zero and there should be no change in storage.

c) To impose the condition of placing the drain at 1.0 and 1.5 meters depth in irrigated form, the prescribed value of UL will be as follows; UL = SL - 1.0 or UL = SL - 1.5 to all the nodes within the irrigated form. To make the UL and LL values effective the value of LSW2 will be equal to 1 in SGMP11.INP. On running the package the water balance component of SGMP13.OUT will result in artificial net recharge at each node where the drainage is required. The results of water balance component for both the cases are reported in Appendix D.

5.7. Discussion

The nodal and average net recharge to the irrigated area is reported in Table 5.2. The net recharge is calculated in mm/day by multiplying the net recharge by $10^9$ and dividing it by area in $m^2$ and 30.5 number of days in a month.

The following conclusions can be drawn by this exercise.

a) The use of SURFER soft were introduces an error in plotting the contours. This may result an error in estimation of net recharge, septically when the hydraulic gradient in the area is high.

b) The average net recharge to the irrigated area, estimated by this package is based on bottom to top approach and is found as 2.18 mm/day. However, when it is calculated by traditional method it is 2.0 mm/day.

c) Since the average net recharge to the irrigated area is only 2.18 mm/day, there is no need to provide any drainage system to the area.

d) Even if the area has to be provided with drainage system to bring down the water level below 1.0 m to the land surface, the drainage will be designed considering 2.18 mm/day ne recharge. However, when the simulation of the drainage system is done by this package, which has basis of estimation by bottom to top approach, estimates the drainage should be designed considering 0.44 mm/day. This yields that the traditional method over estimates the drainage requirement and thus drain design. The similar results were drawn when the simulation was done for a drainage system to bring down the water level below 1.5 m. For this case the drainage requirement was only 0.99 mm/day.

Table 5.2: Estimated net recharge in irrigated area and drainage requirement for two depths at 1.0 and 1.5 m depths along with the nodal area.

| Sl. No. | Node No. | Nodal area | Net Recharge@ no drain | | Net Recharge# drain at 1.0 m | | Net Recharge$ drain at 1.5 m | |
|---|---|---|---|---|---|---|---|---|
| | | $m^2$ | mcm/ month | cm/ day | mcm/ month | cm/ day | mcm/ month | cm/ day |
| 1 | 17 | 49500 | 0.0060 | 3.97 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 2 | 18 | 49500 | 0.0026 | 1.72 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 3 | 19 | 50500 | -0.0022 | -1.42 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 4 | 24 | 49500 | 0.0062 | 4.10 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 5 | 25 | 49500 | -0.0086 | -5.69 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 6 | 26 | 50500 | -0.0018 | -1.16 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 7 | 31 | 48881 | 0.0026 | 1.74 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 8 | 32 | 48881 | 0.0116 | 7.78 | 0.0000 | 0.00 | -0.0038 | -2.54 |
| 9 | 33 | 49868 | 0.0012 | 0.78 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 10 | 38 | 48262 | 0.0082 | 5.57 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 11 | 39 | 48262 | 0.0142 | 9.64 | -0.0080 | -5.43 | -0.0098 | -6.65 |
| 12 | 40 | 49237 | 0.0018 | 1.19 | -0.0008 | -0.53 | -0.0052 | -3.46 |
| 13 | 45 | 48881 | 0.0072 | 4.82 | 0.0000 | 0.00 | -0.0008 | -0.53 |
| 14 | 46 | 48881 | 0.0044 | 2.95 | 0.0000 | 0.00 | -0.0008 | -0.53 |
| 15 | 47 | 49868 | 0.0024 | 1.57 | -0.0070 | -4.60 | -0.0102 | -6.70 |
| 16 | 52 | 49500 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 17 | 53 | 49500 | 0.0104 | 6.88 | 0.0000 | 0.00 | -0.0022 | -1.45 |
| 18 | 54 | 50500 | -0.0008 | -0.51 | 0.0000 | 0.00 | -0.0030 | -1.94 |
| 19 | 59 | 49500 | -0.0018 | -1.19 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 20 | 60 | 49500 | 0.0106 | 7.02 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 21 | 61 | 50500 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 22 | 66 | 48881 | 0.0024 | 1.60 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 23 | 67 | 48881 | 0.0018 | 1.20 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 24 | 68 | 49868 | -0.0004 | -0.26 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| Total, mm/day | | | | 52.30 | | -10.56 | | -23.79 |
| Average of 24 nodes, mm/day | | | | 2.18 | | -0.44 | | -0.99 |

@: Net recharge when no drainage is provided in irrigated area.
#: Net recharge when drainage is provided at 1.0 m depth.
$: Net recharge when drainage is provided at 1.5 m depth.

## 6. CASE STUDY II

### 6.1. A Case study of Bulandshehar District of Uttar Pradesh

The study area is the Bulandshar District of the Uttar Pradesh. This area is bounded by river Ganga and Yamuna on its two sides and falls in the command area of Upper Ganga Canal. The area has been provided by the canal irrigation system by three main canals as Mat, Upper Ganga Canal and Anupshar branch. The area has two drain rivers called Karwan and Kali Nadi. The study area has been shown in Figure 6.1, along with the available related details. Regarding availability of data, it will be discussed as and when it will come in picture. In order to prepare the input files the same steps are followed as discussed in the case study I of Hansi form in Haryana.

### 6.2. Time discritization

Since the groundwater data available is before and after the monsoon in a year i.e. for the month of June and October and the study period selected is of two years. Based on this information the following time discritization is done.

TMBAS = Month
DMTIM = 30.5
DELTA = 1
MINOR = 1
MAJOR = 2
LIST = 2

The time descritization should follow following relations:

Total simulation period = DELTA * MINOR * MAJOR * LIST
4 steps = 1 * 1 * 2 * 2

### 6.3. Design of nodel net work

A regular grid system is imposed on the area such that a node should fall in the middle of river at each side of the area. The grid system is shown in Figure 6.2. It is done keeping in mind that the water balance problem can be extended and the river elevations can also be considered when needed. The only drawback with this grid system is that the nodel area could not be representative of the Block area. Therefore, a irregular grid system as reported in Figure 6.3 is designed for the area such that the nodal area should cover a Block or a part of a Block. This design has an advantage that the nodel area can be a representative of the Block area and the Block average data can be an input to that node. With the irregular grid system, the total number of nodes (N) comes to be 100 and number of sides (NSIDES) as 263.

### 6.4. Interpolation of data

The contour maps are drawn with the help of SURFER for water table of June 76, October 76, June 77, October 77 and June 78 with the available data and the contours are shown in Figure 6.4 to 6.8. The contour plots are also drawn for aquifer thickness, specific yield and ground level and are reported in Figure 6.9 to 6.11. The interpolated vale at each nodel point is reported in Table 6.1.

With the interpolated data the contour plots are again drawn to check for any unavoidable error in interpolation and feeding the data. The contour plots with the interpolated data is reported in Figure 6.12 to 6.19

## 6.5. Preparation of input files

It involves the preparation of SGMP11.INP, SGMP12A.INP, SGMP12B.INP and SGMP13.INP as per the structure and specified format.

### 6.5.1. Preparation of input file SGMP11.INP

So for we have decided for the data of N, NSIDES, TMBAS, DMTIM, DELTA, MINOR, MAJOR and LIST. The values of DL, ERROR and DELQ are estimated by trial and error while running the package and will be discussed later. The scale of the map on which the coordinates were measured is 1 inch = 4 mile and therefore, the input data to SCALE will be 253439 (1 cm = 4 x 1.609 x $10^6$/2.539 = 253439 cm). Since the problem is of unsteady state case, the water table changing with time, the number of iteration is selected as 250 and LSW1=1. The aquifer is unconfined, the top level TL to which the water can rise is equal to surface level (SL). The depth of aquifer at each node is taken from the interpolated data.

The specific yield (AS) has been taken from interpolated data and mean storage coefficient (ASC) of the aquifer is as 0.001 because of unavailability of data. The hydraulic conductivity at each nodal point is also assumed as 3 since the transmissivity data is not available. The input file is reported in Appendix E.

### 6.5.2. Preparation of input file SGMP12A.INP

LSW3, LSW4 and LSW5 are taken equal to 3, 2, 2 respectively and LSW6 may be zero or one depending the package running in normal or inverse mode. The initial water table and the water table at each time step are the interpolated water table data in October and June. The input to SGMP12A.INP is reported in Appendix E.

### 6.5.3. Preparation of input file SGMP12B.INP

The file contains the values of net recharge. Since the problem does not give any value to net recharge, the net recharge is taken as zero at each nodel point. The data of SGMP12B.INP is reported in Appendix E.

### 6.5.4. Preparation of input file SGMP13.INP

This file contain the input data to have a desired format of out put data and the data of SGMP13.INP is reported in Appendix E.

## 6.6. Package output in different runs

The package SGMP11 is operated in different modes to have different out puts and to find out the net recharge in monsoon and non-monsoon period. The running of package in different modes is described in subsequent sections.

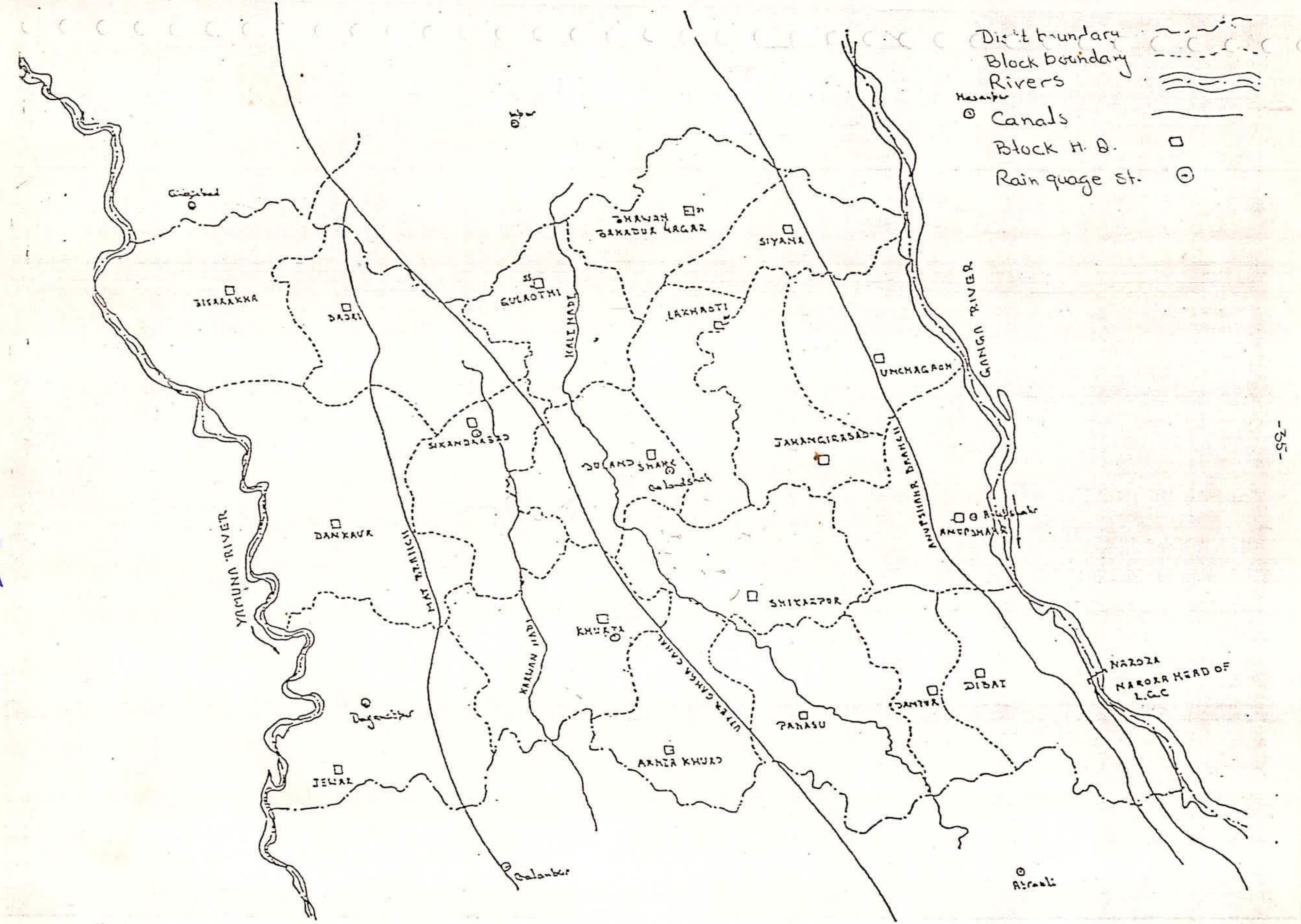



Fig. 6.1: Bulandshar District of Uttar Pradesh, the study area.

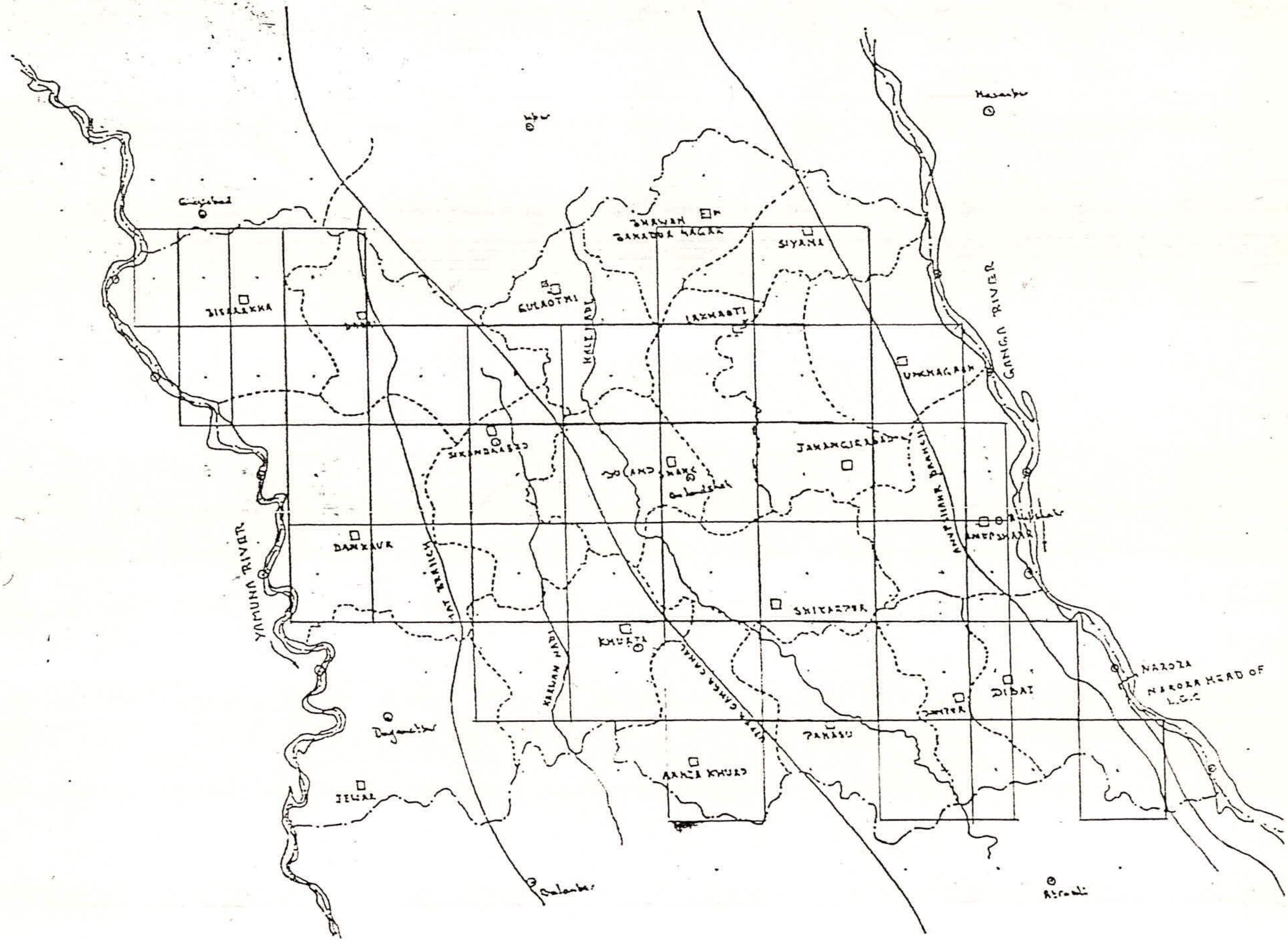



Fig. 6.2: Regular grid system on the study area.

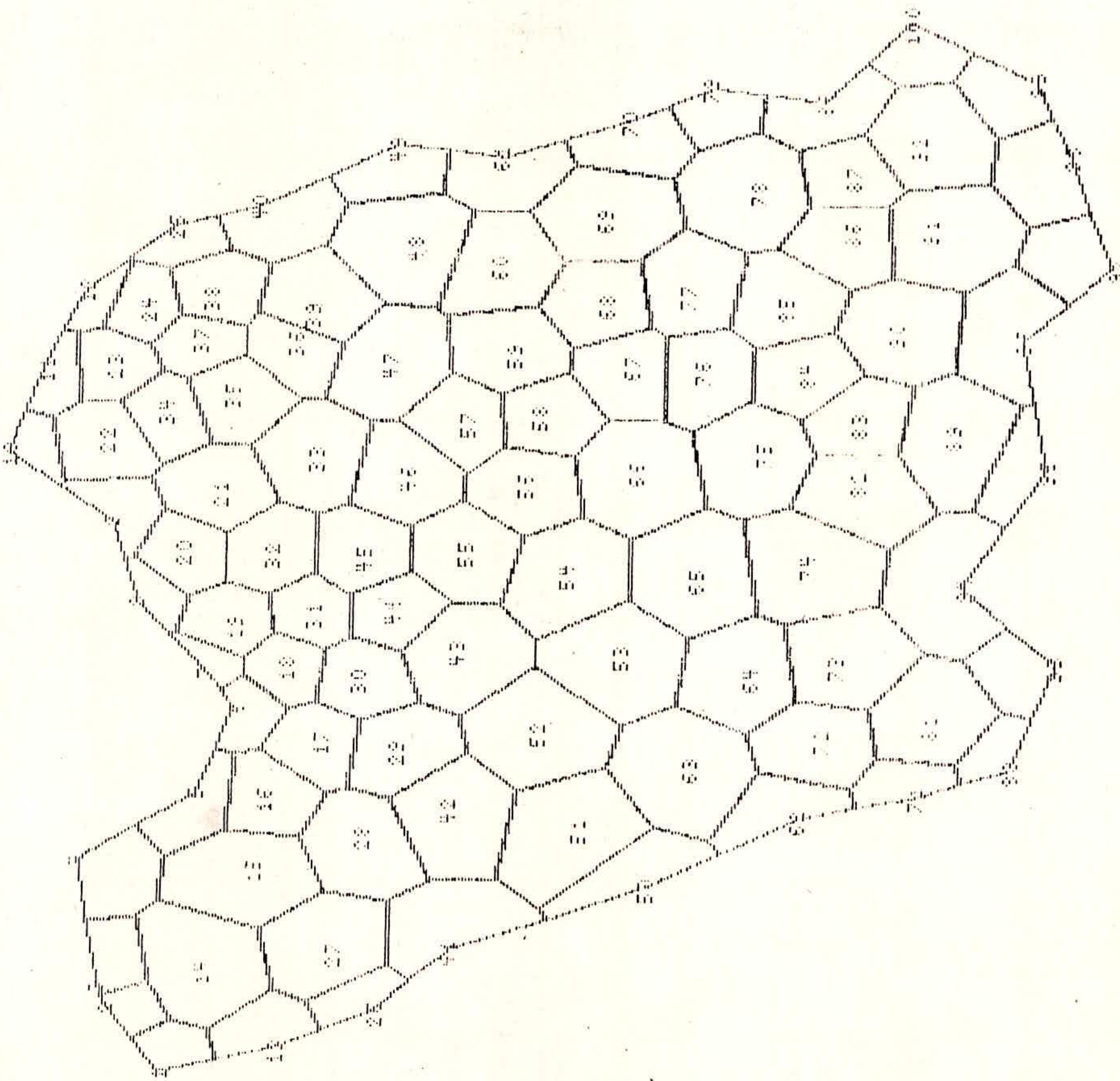


Fig. 6.3: Irregular grid system imposed on the study area.

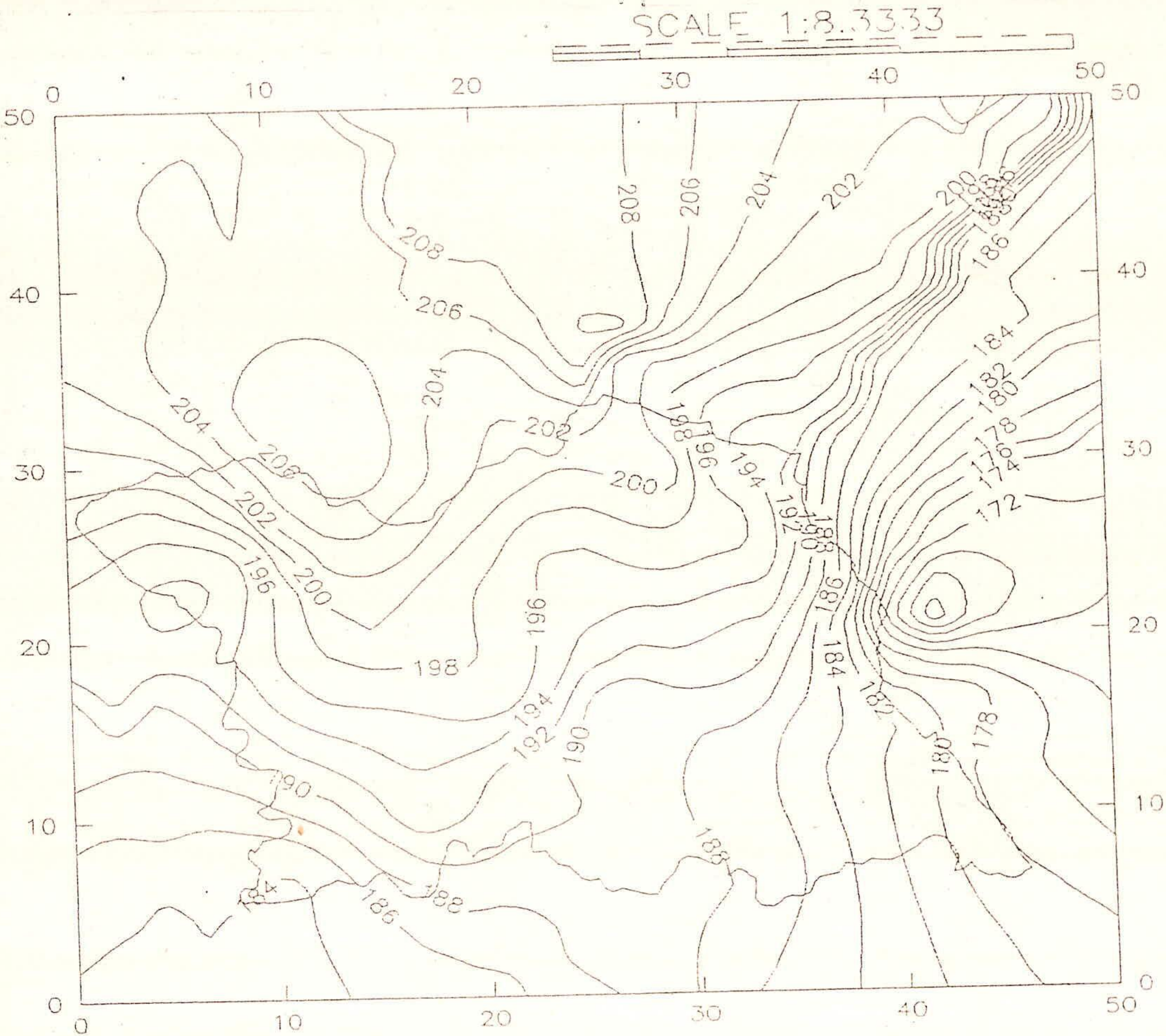



Fig. 6.4: Contour map of water table elevation in June 76, m.

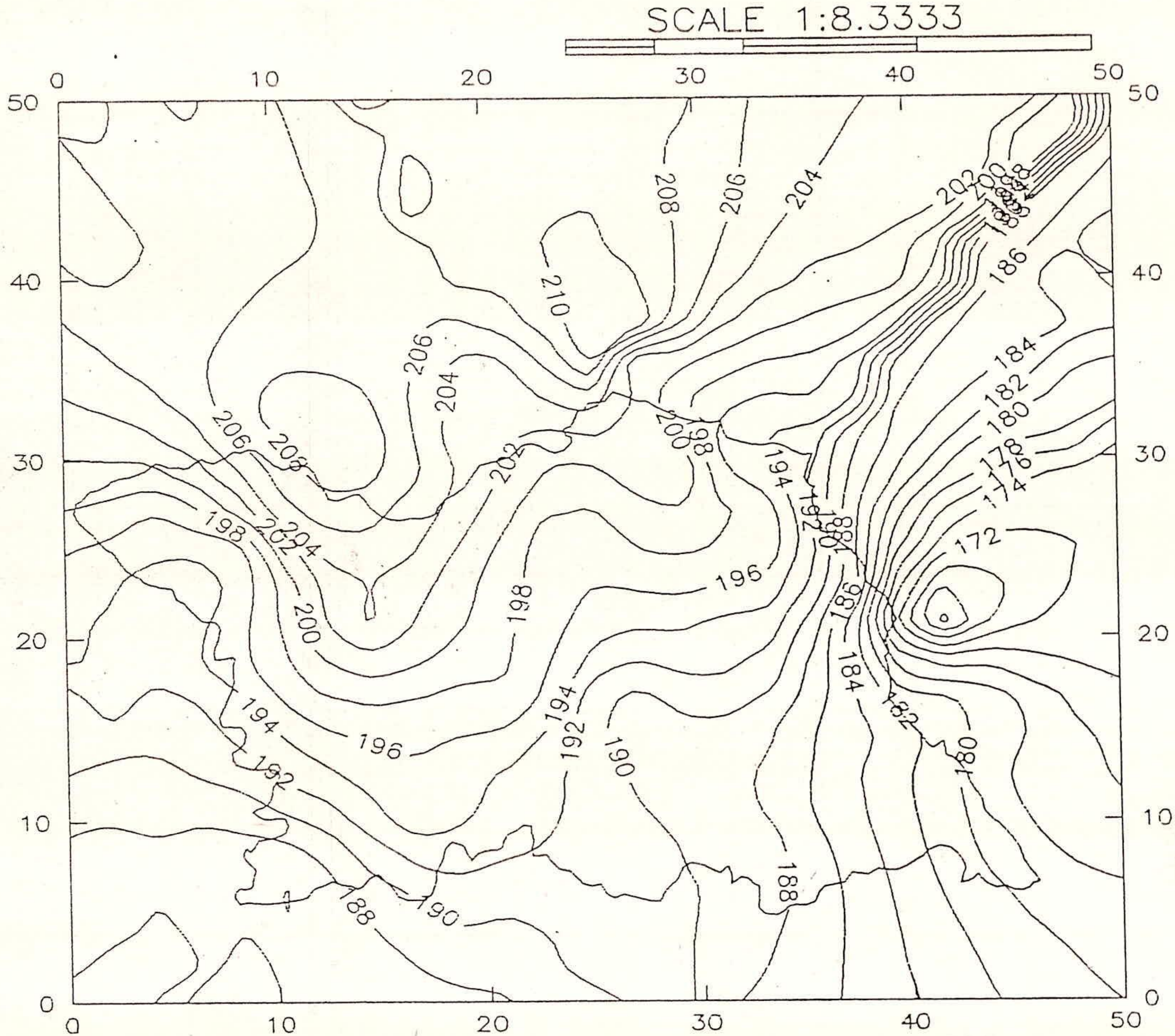



Fig. 6.5 : Contour map of water table elevation in October 76, m.

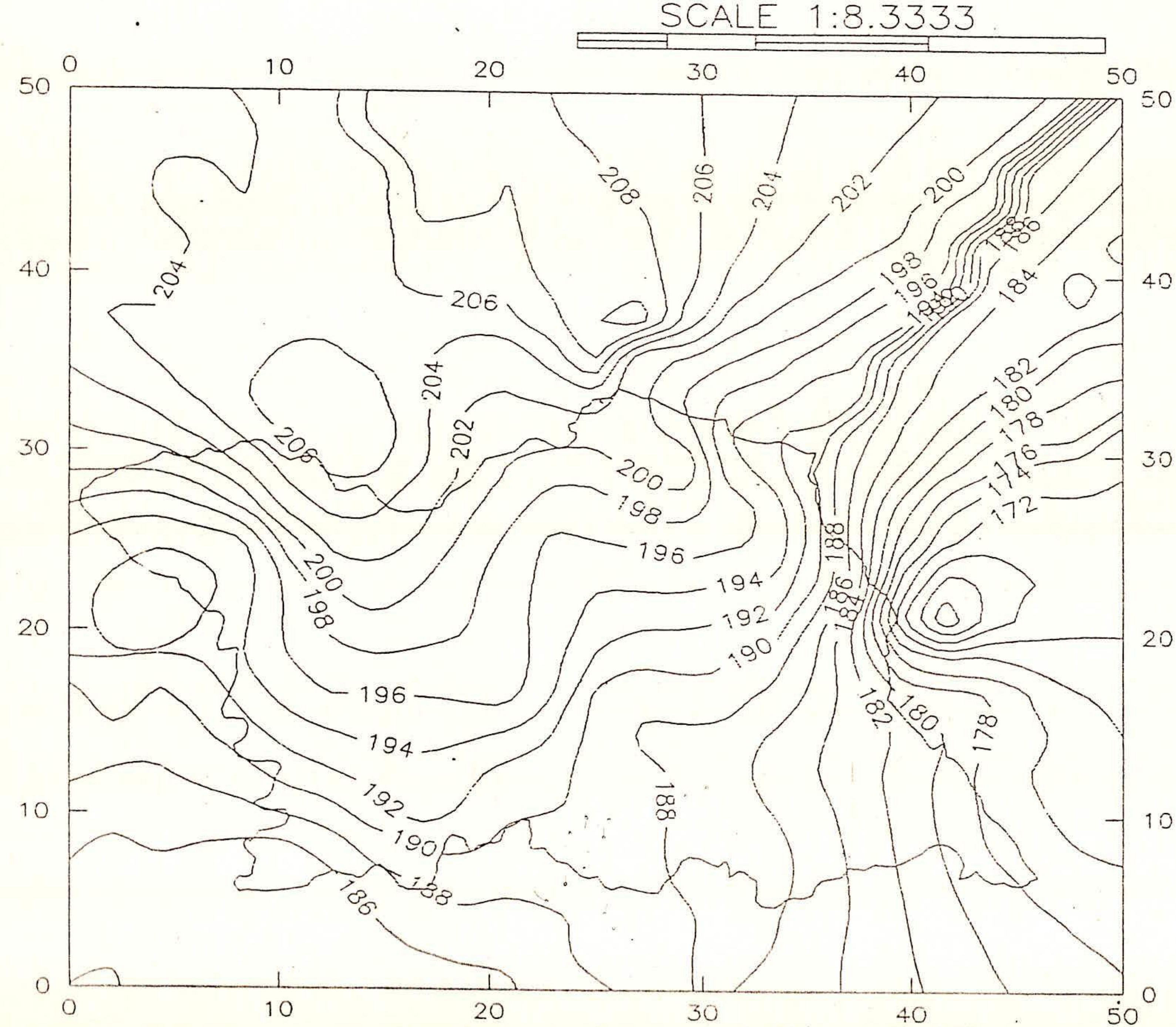



Fig. 6.6 : Contour map of water table elevation in June 77 m

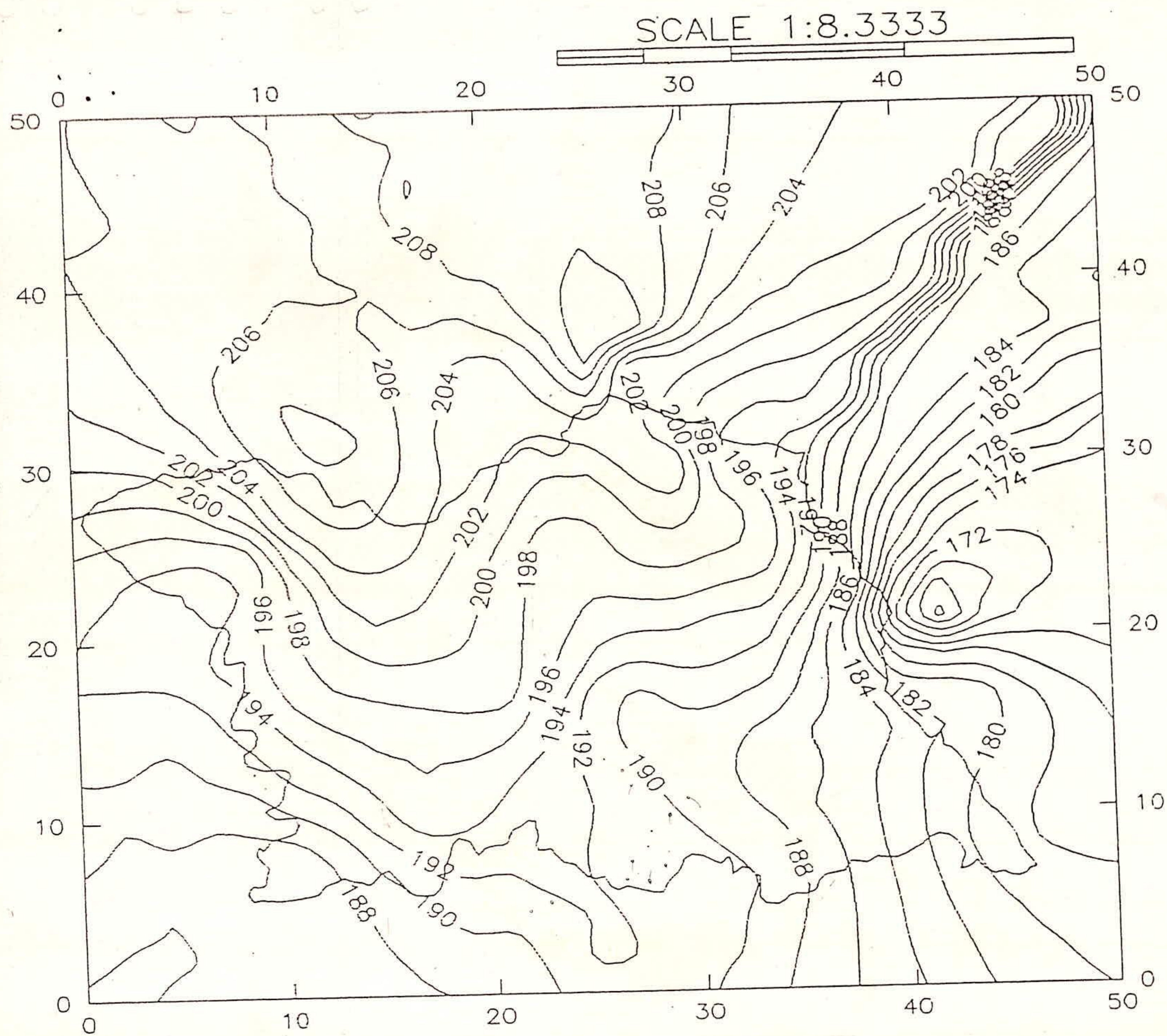



Fig. 6.7 : Contour map of water table elevation in October 77, m.

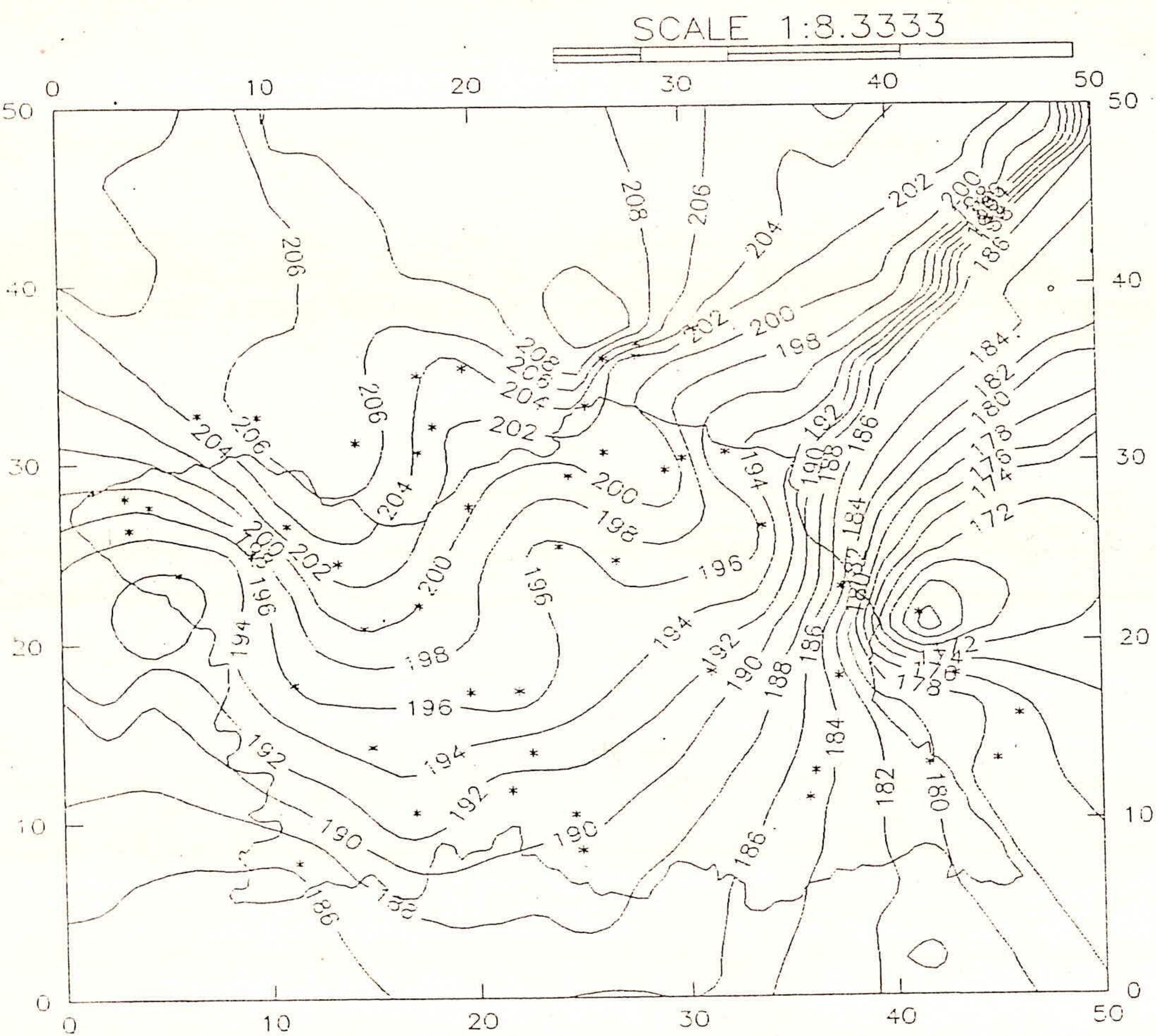



Fig. 6.8 : Contour map of water table elevation in June 78, m.

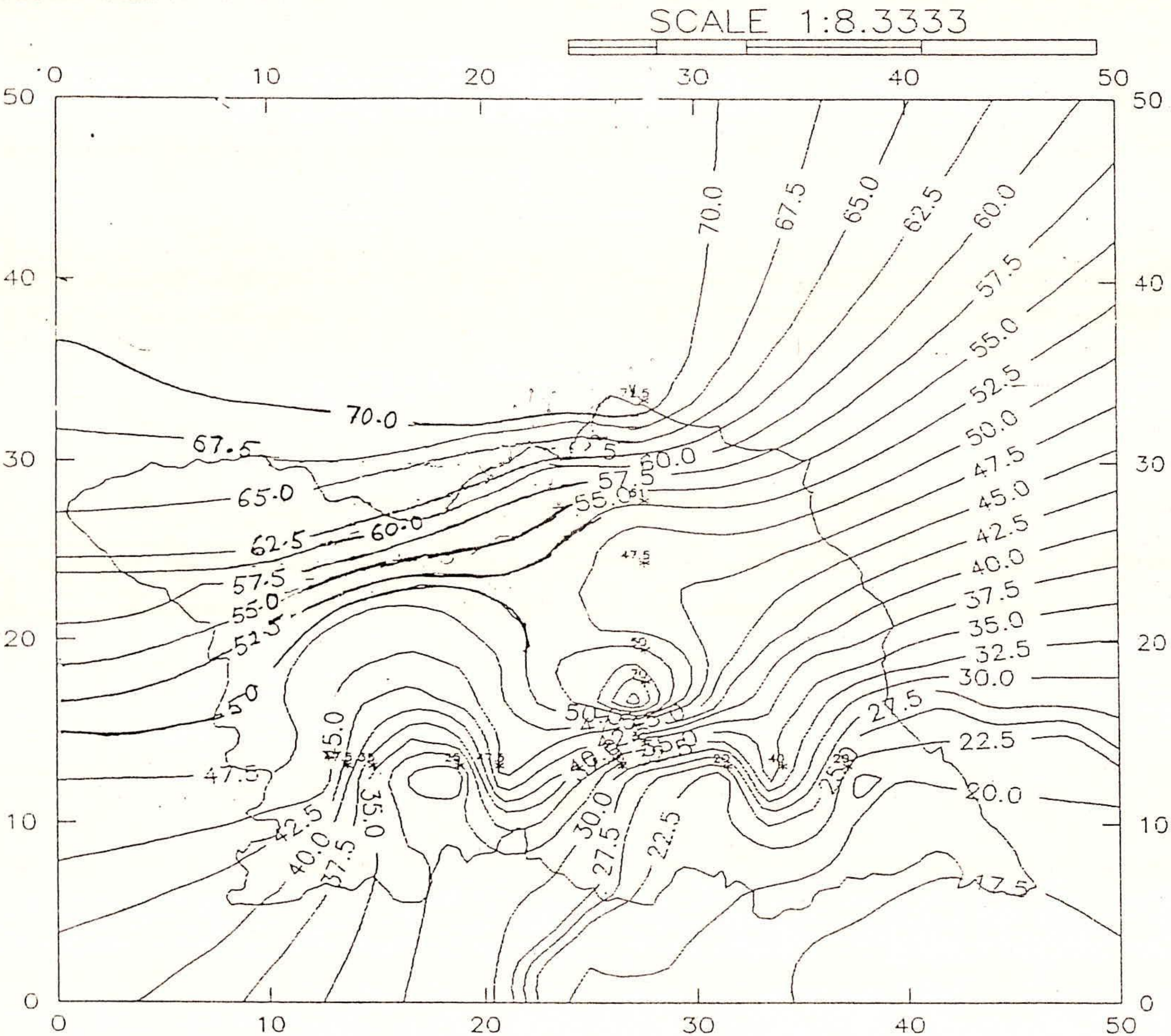



Fig. 6.9: Contour map of the aquifer thickness, m.

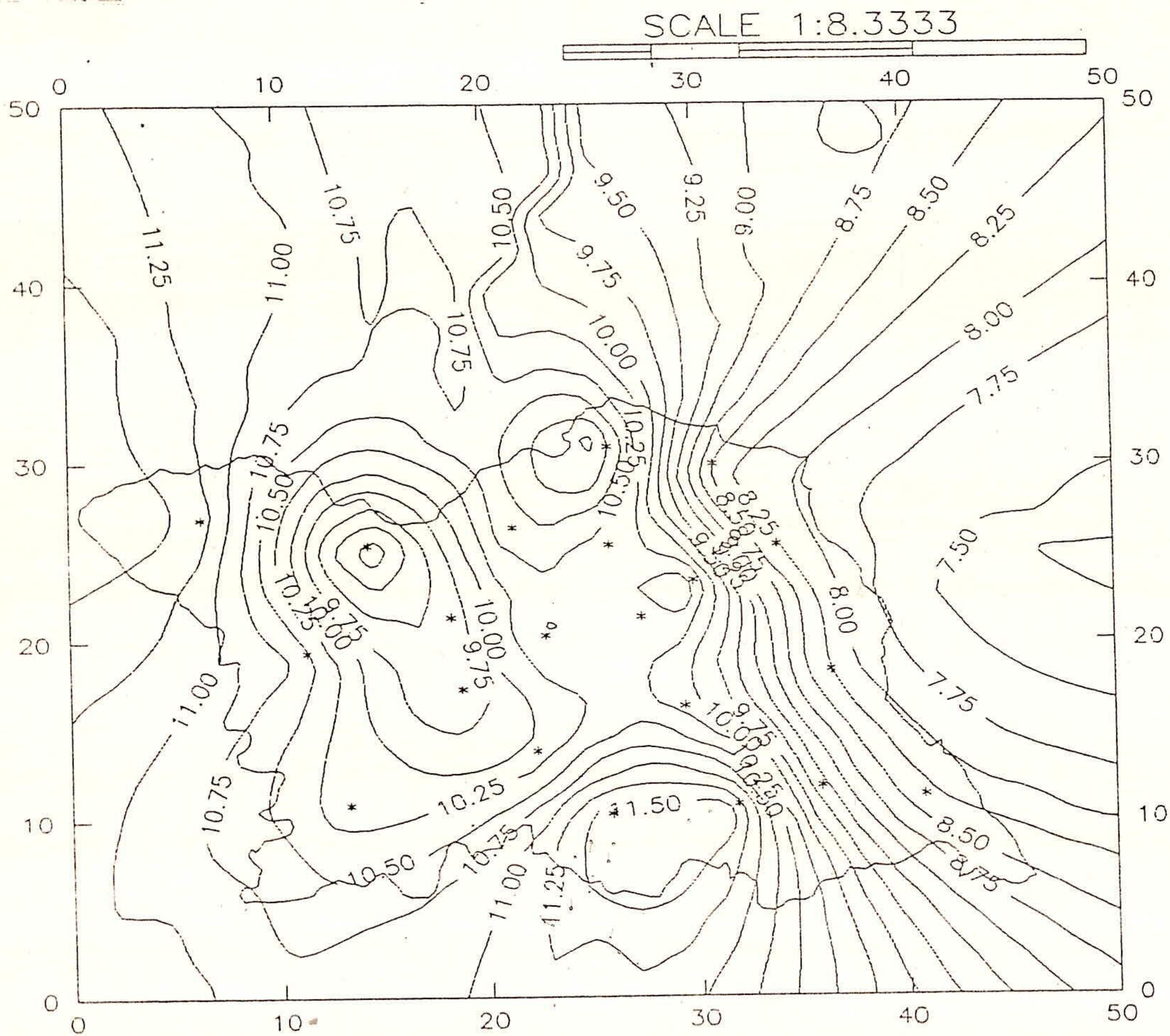



Fig. 6.10: Contour map of Block average specific yield, %.

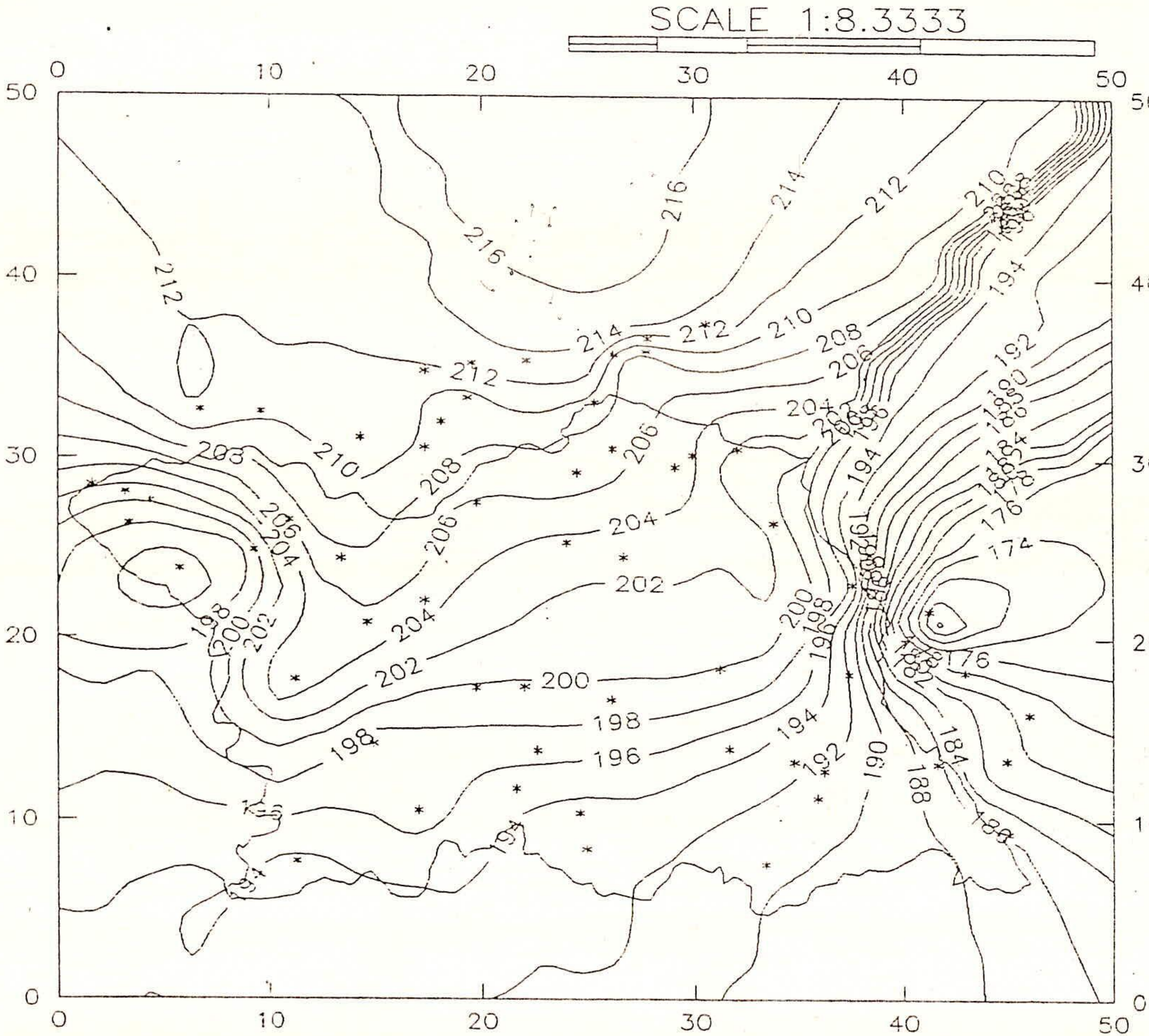



Fig. 6.11: Contour map of surface level, m.

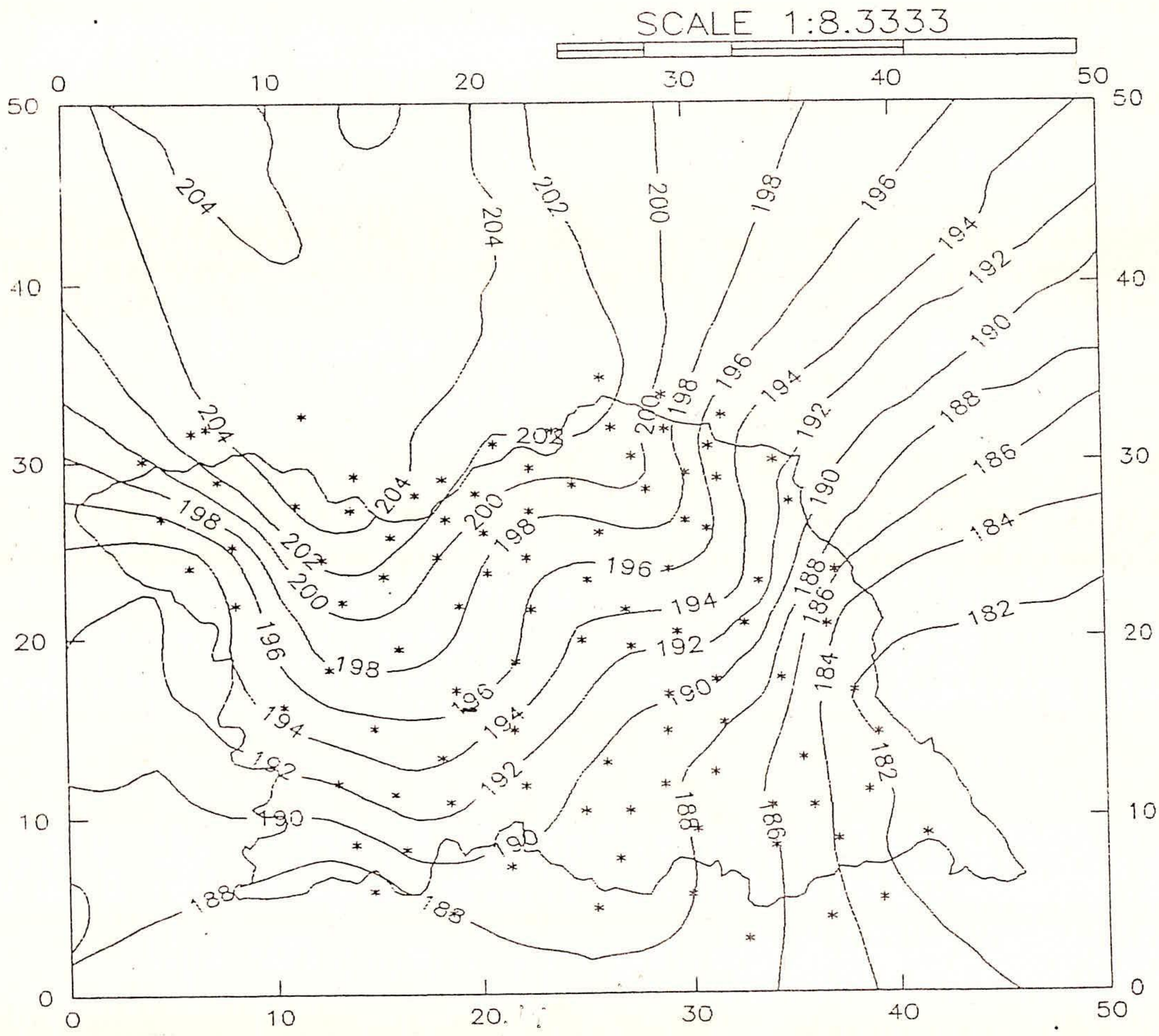



Fig.6.12 : Contour map of water table elevation with interpolated

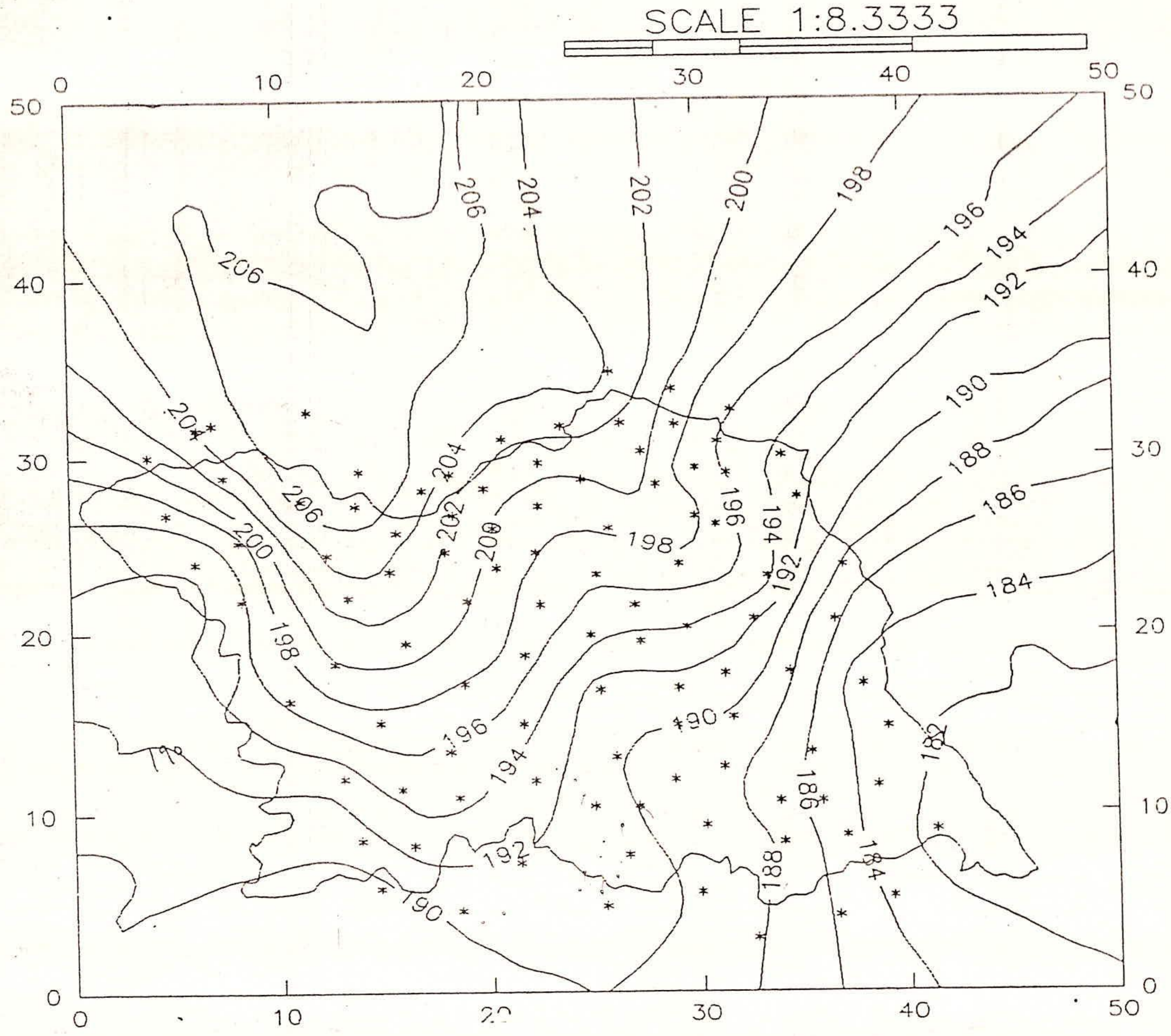



Fig.6.13 : Contour map of water table elevation with interpolated values in October 76, m.

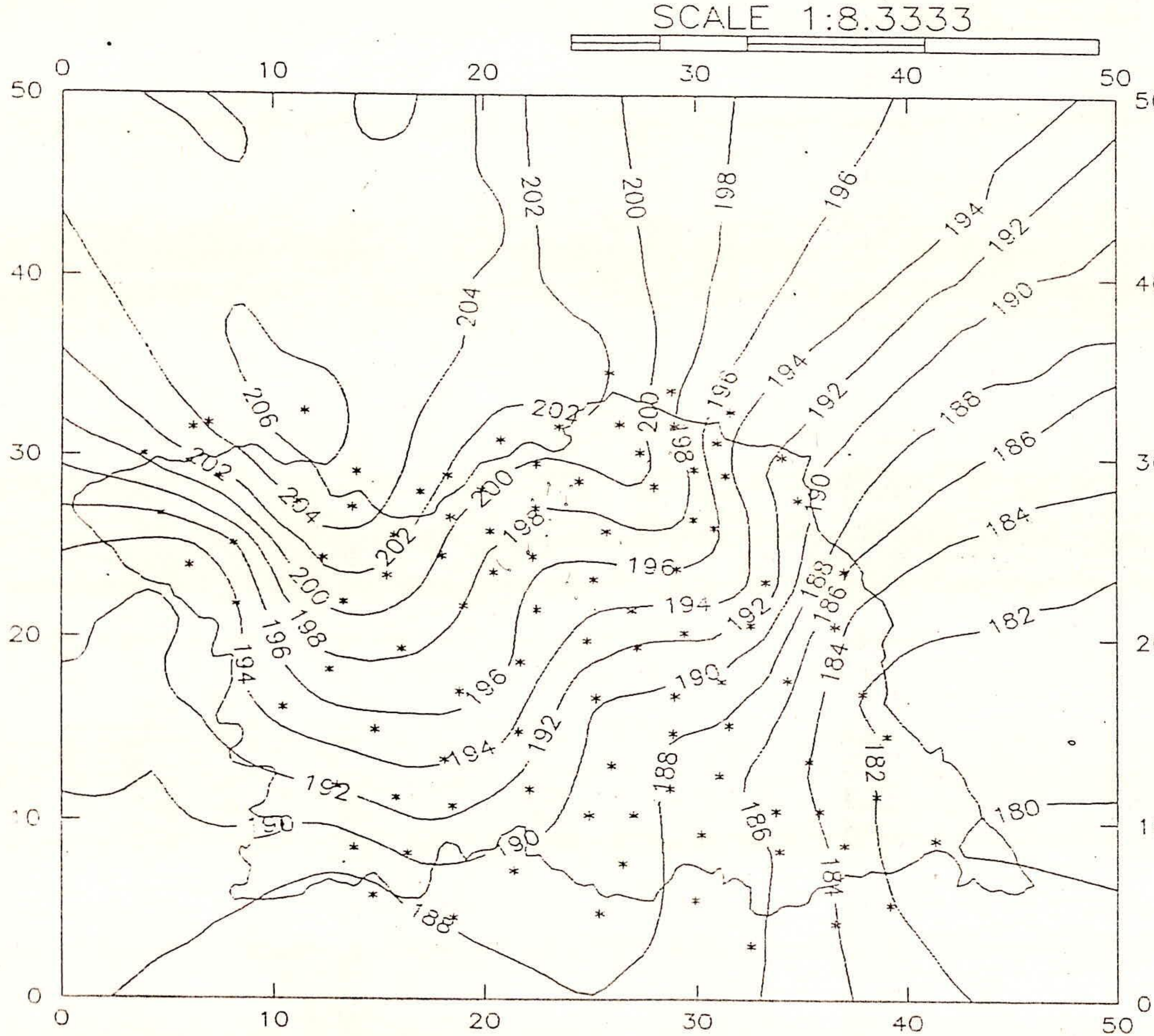



Fig.6.14 : Contour map of water table elevation with interpolated values in June 77, m.

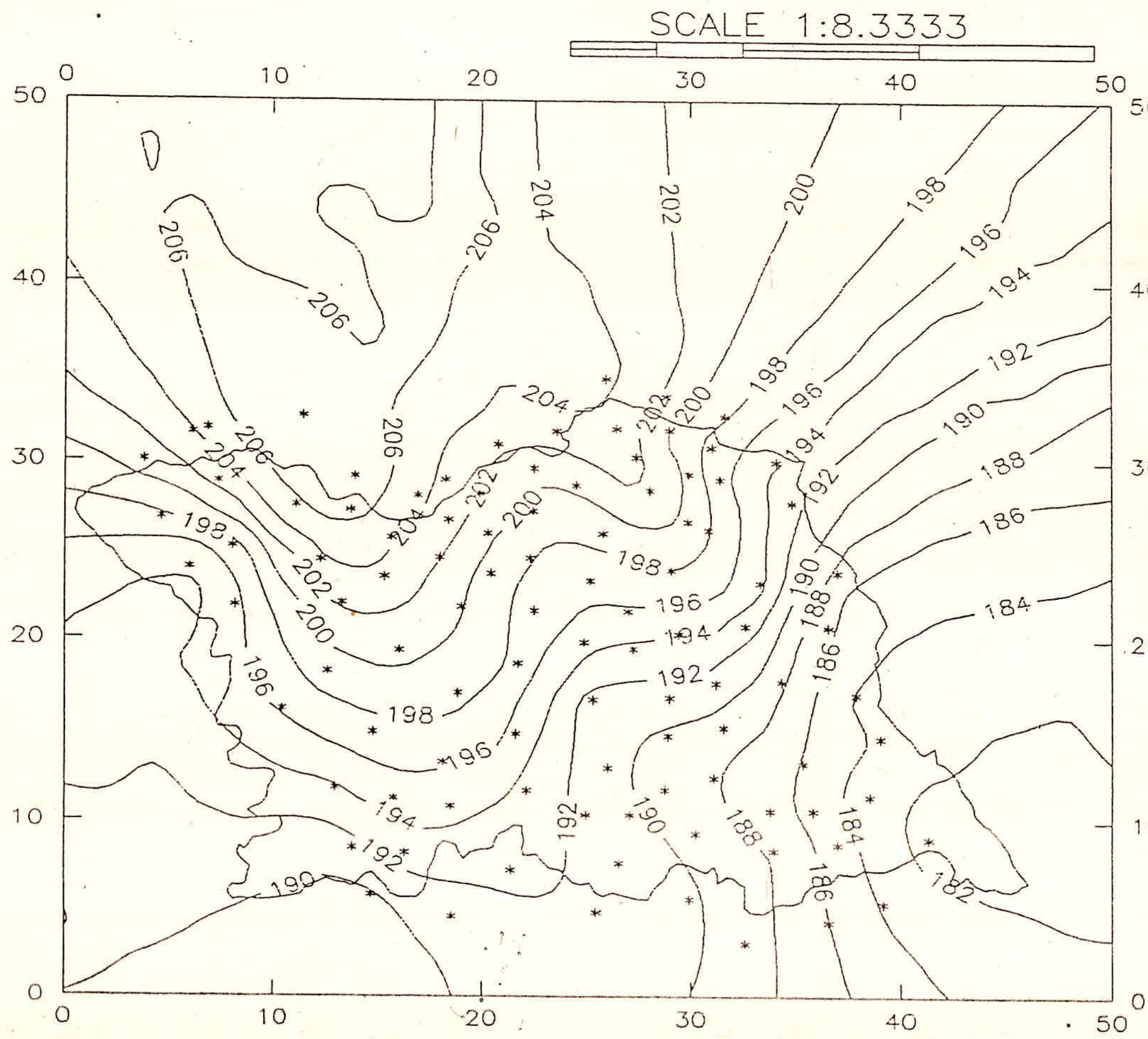



Fig.6.15 : Contour map of water table elevation with interpolated

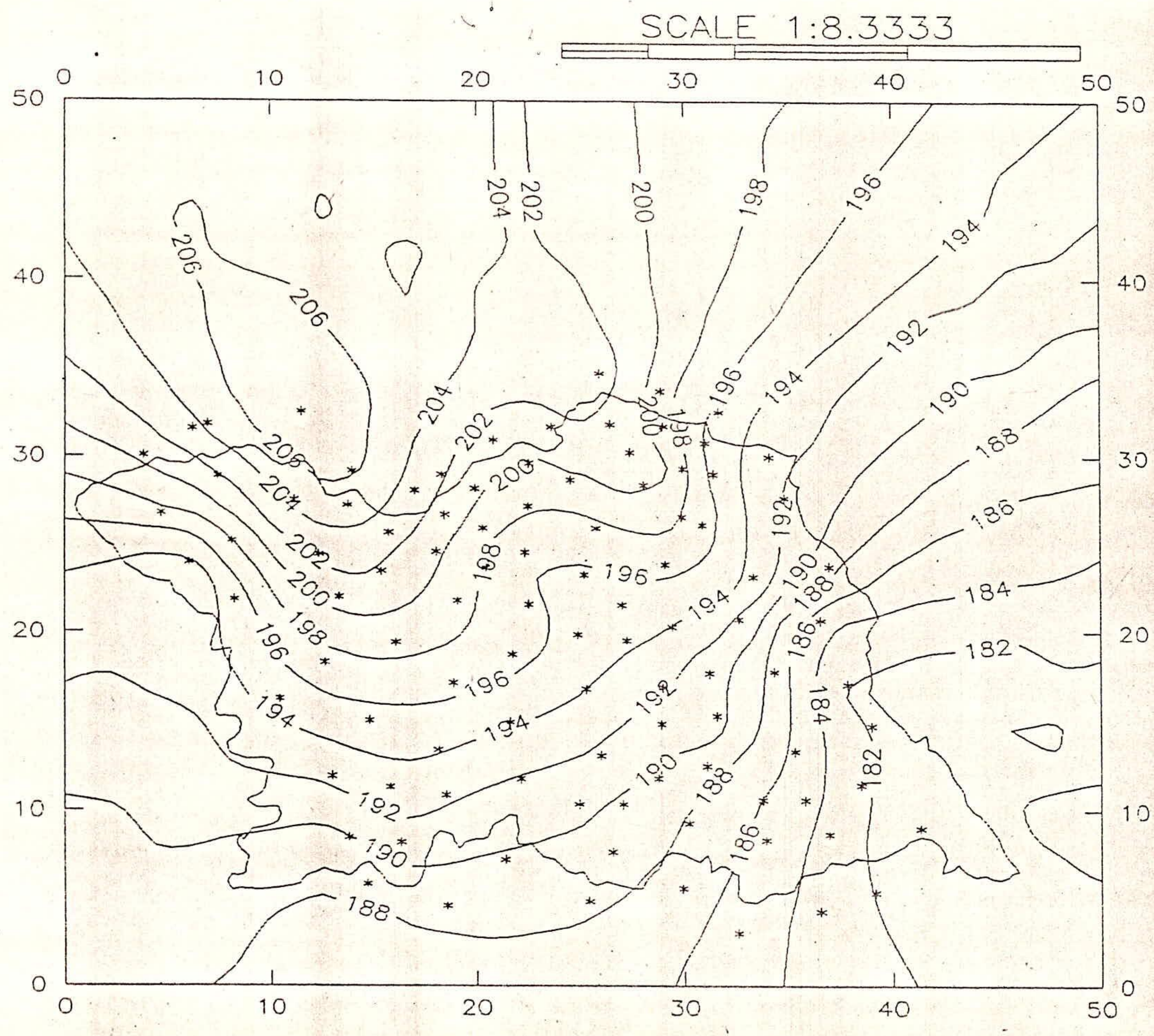



Fig.6.16 : Contour map of water table elevation with interpolated values in June 78, m.

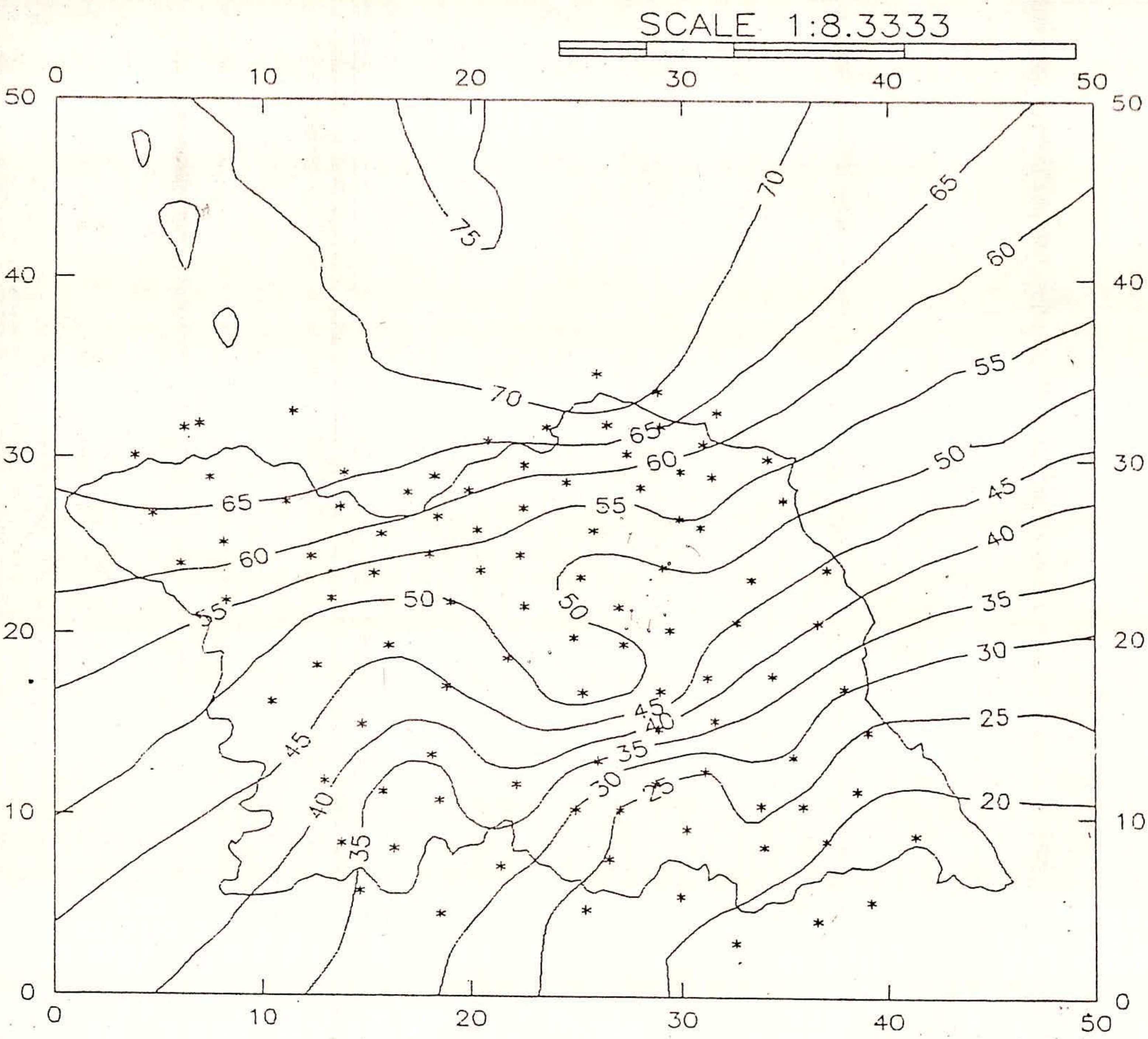



Fig. 6.17: Contour map of the aquifer thickness with interpolated values, m.

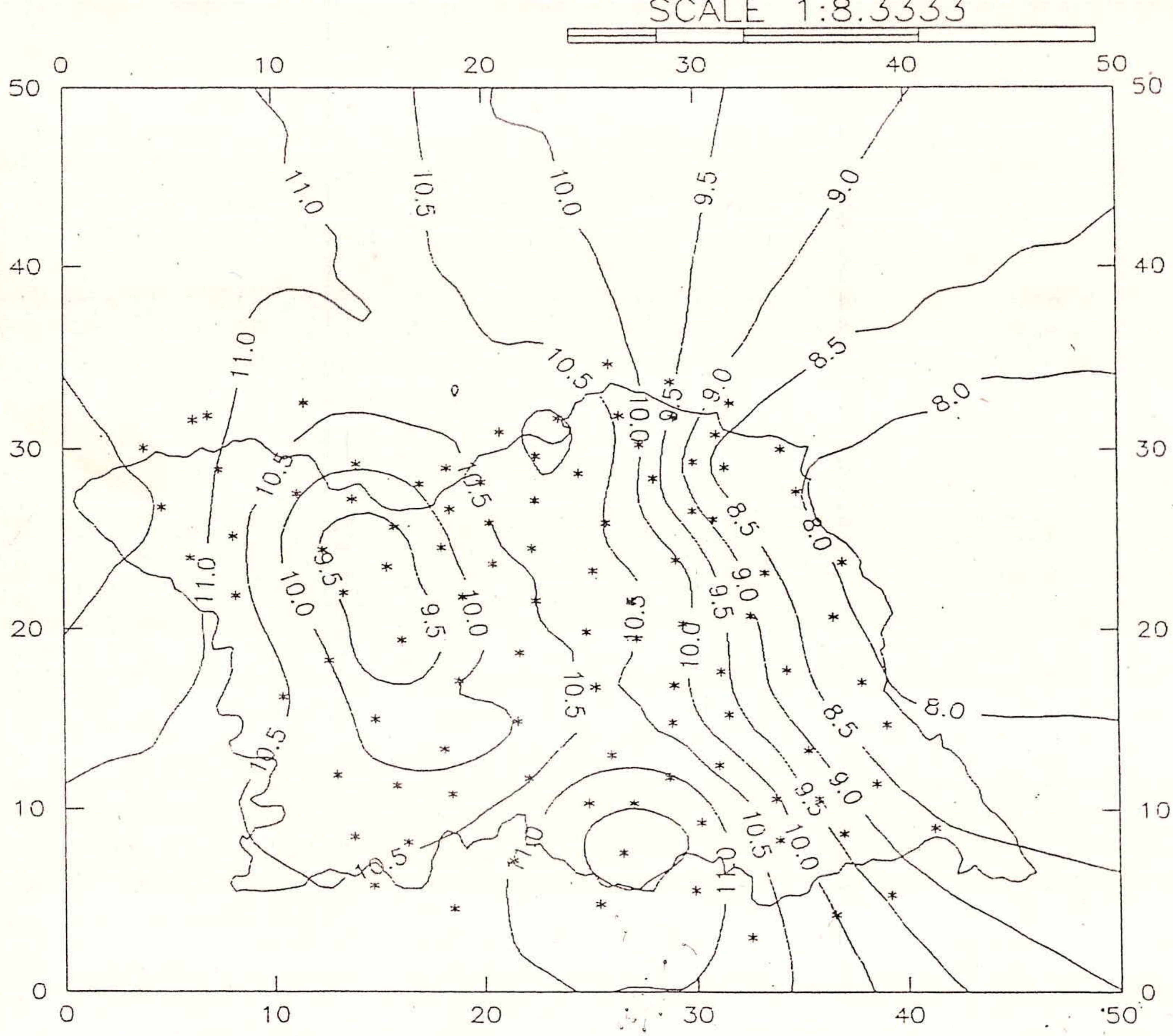



Fig. 6.18: Contour map of Block average specific yield with interpolated values, %.

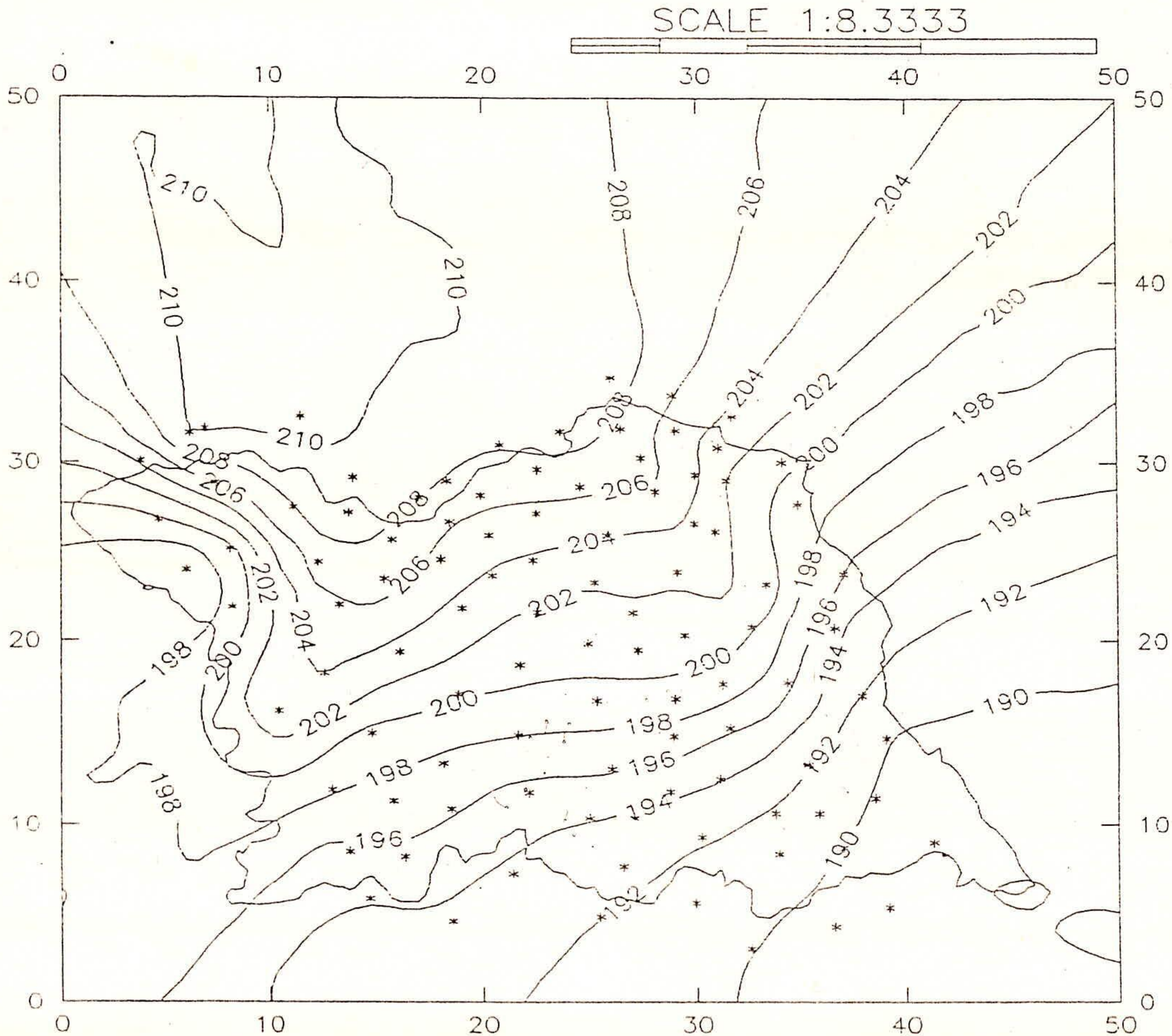



Fig. 6.19: Contour map of surface level with interpolated values, m.

Table 6.1: Nodal coordinates and interpolated values of water table in June 76, October 76, June 77, October 77, June 78, aquifer depth and specific yield.

| Sl. No. | Grid No. | X axis, | Y axis, | Ground level, | Water table in | | | | | Depth of aquifer, | Specific yield, |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | June 76 | Oct 76 | June 77 | Oct 77 | June 78 | | |
| | | cm | cm | m | m | m | m | m | m | m | % |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| 1 | 1 | 3.5 | 29.7 | 203 | 199.2 | 200.1 | 200 | 200.5 | 200 | 67 | 11.45 |
| 2 | 2 | 5.85 | 31.25 | 210 | 202.5 | 203.5 | 203 | 203 | 203 | 68 | 11.25 |
| 3 | 3 | 6.6 | 31.5 | 210.1 | 203.6 | 204.5 | 204 | 204.8 | 204 | 68.5 | 11.2 |
| 4 | 4 | 11.2 | 32.2 | 210.3 | 206 | 208 | 207 | 208 | 208 | 70 | 10.65 |
| 5 | 5 | 13.65 | 28.8 | 210 | 206 | 208 | 206 | 208 | 206.5 | 65 | 10 |
| 6 | 6 | 16.7 | 27.7 | 208 | 203.5 | 205.5 | 203.1 | 204.6 | 203.5 | 63 | 10 |
| 7 | 7 | 18 | 28.6 | 208 | 203 | 204.1 | 202.1 | 203.8 | 202.5 | 63.5 | 10.25 |
| 8 | 8 | 20.5 | 30.6 | 208 | 201.5 | 202.5 | 201 | 202.2 | 201 | 65 | 10.75 |
| 9 | 9 | 23.25 | 31.35 | 208.7 | 202 | 202.2 | 201.2 | 202.5 | 200.5 | 66.5 | 11.2 |
| 10 | 10 | 25.6 | 34.35 | 209.5 | 204 | 205 | 203 | 205 | 204 | 75 | 10.3 |
| 11 | 11 | 28.5 | 33.35 | 206.1 | 199.7 | 199.7 | 198.8 | 202 | 199 | 70 | 9.7 |
| 12 | 12 | 31.35 | 32.2 | 204 | 195 | 196 | 195 | 198.5 | 195.5 | 63 | 8.7 |
| 13 | 13 | 4.35 | 26.4 | 199 | 195 | 196 | 195.1 | 197 | 197 | 64.5 | 11.55 |
| 14 | 14 | 7.1 | 28.5 | 205 | 201 | 202 | 201 | 202 | 201 | 66 | 11.05 |
| 15 | 15 | 10.85 | 27.15 | 207.8 | 204.2 | 206.1 | 204.2 | 205.6 | 204.2 | 64.5 | 10.05 |
| 16 | 16 | 13.45 | 26.85 | 209 | 205 | 207 | 205 | 206.3 | 205 | 63.5 | 9.5 |
| 17 | 17 | 15.45 | 25.3 | 207.7 | 203 | 205 | 203 | 204.8 | 203 | 58 | 9.25 |
| 18 | 18 | 18.15 | 26.3 | 206 | 201.2 | 201 | 200 | 203 | 201 | 58 | 10 |
| 19 | 19 | 19.6 | 27.8 | 206.2 | 201 | 200.4 | 200.2 | 202.2 | 200.5 | 60 | 10.5 |
| 20 | 20 | 22.2 | 29.25 | 207.3 | 200.5 | 200.5 | 199.5 | 200.6 | 200 | 60.5 | 11 |
| 21 | 21 | 24.2 | 28.3 | 206.2 | 199 | 199.2 | 198.5 | 199.5 | 199 | 57.5 | 11.1 |
| 22 | 22 | 26.1 | 31.5 | 207.8 | 201.8 | 201.9 | 201.6 | 203.5 | 202 | 67.5 | 10.65 |
| 23 | 23 | 28.65 | 31.4 | 205 | 199 | 199.2 | 198.6 | 200 | 200 | 65 | 9.5 |
| 24 | 24 | 30.7 | 30.45 | 203 | 195.5 | 196 | 194.9 | 197 | 196 | 60 | 8.6 |
| 25 | 25 | 33.75 | 29.65 | 200.5 | 192.5 | 193.5 | 191.5 | 194 | 193 | 56 | 8.15 |
| 26 | 26 | 5.7 | 23.6 | 195.8 | 192 | 193.9 | 192 | 193.6 | 192 | 60 | 11.25 |
| 27 | 27 | 7.8 | 24.8 | 198.1 | 195 | 195.9 | 194.5 | 195.8 | 197 | 63 | 10.8 |
| 28 | 28 | 12.05 | 24.05 | 206.5 | 202 | 204 | 202 | 203.2 | 202 | 58 | 9.4 |
| 29 | 29 | 15.1 | 23.1 | 207 | 201.5 | 203.9 | 201.5 | 203.6 | 202 | 52.5 | 9.25 |
| 30 | 30 | 17.75 | 24.2 | 205.5 | 200 | 202.2 | 200 | 202.1 | 200.5 | 54 | 9.75 |
| 31 | 31 | 20 | 25.55 | 205 | 199 | 200.7 | 198.7 | 200.8 | 199 | 56 | 10.5 |
| 32 | 32 | 22.15 | 26.8 | 205.2 | 198.1 | 199 | 198 | 199 | 198 | 56 | 10.8 |
| 33 | 33 | 25.45 | 25.55 | 204 | 197 | 197.9 | 197 | 198.2 | 197 | 50.5 | 10.6 |
| 34 | 34 | 27.05 | 29.9 | 207 | 201 | 201.2 | 201 | 203 | 201.4 | 62 | 10.25 |
| 35 | 35 | 27.7 | 28 | 205 | 200 | 200.4 | 200.1 | 202 | 200.5 | 55 | 9.8 |
| 36 | 36 | 29.55 | 26.2 | 203.8 | 197.8 | 199 | 198 | 199.8 | 198.2 | 56 | 9.3 |
| 37 | 37 | 29.6 | 28.95 | 205.7 | 199 | 196.6 | 198.6 | 200.5 | 200 | 57 | 8.85 |
| 38 | 38 | 31.1 | 28.65 | 202 | 195.5 | 196.5 | 195 | 197.2 | 196 | 56 | 8.3 |
| 39 | 39 | 30.55 | 25.75 | 203.2 | 197 | 198.2 | 197.1 | 199 | 197.5 | 55.5 | 9.1 |
| 40 | 40 | 34.5 | 27.3 | 199 | 192 | 193 | 191.2 | 193 | 192 | 51.5 | 8 |
| 41 | 41 | 7.9 | 21.5 | 198 | 193.8 | 195 | 193.2 | 195 | 194.5 | 55 | 10.8 |
| 42 | 42 | 13.05 | 21.65 | 205.8 | 200.5 | 203 | 200.5 | 202 | 200.5 | 50 | 9.55 |
| 43 | 43 | 18.75 | 21.45 | 203.5 | 198.5 | 200.5 | 198.2 | 200.5 | 199 | 48.5 | 9.8 |
| 44 | 44 | 20.15 | 23.3 | 203.6 | 197.8 | 199.3 | 197.5 | 199.2 | 198 | 52.5 | 10.25 |
| 45 | 45 | 22 | 24.15 | 203.6 | 196.5 | 197.8 | 196 | 197.8 | 196 | 52.5 | 10.55 |
| 46 | 46 | 24.85 | 22.9 | 202 | 195 | 196.2 | 195 | 196.6 | 195.5 | 49 | 10.55 |
| 47 | 47 | 28.75 | 23.5 | 202.3 | 196 | 197.2 | 195.8 | 198 | 196.5 | 48 | 10.4 |
| 48 | 48 | 33 | 22.8 | 201.6 | 194 | 195 | 194 | 195.1 | 194 | 47 | 8.75 |

Contd.

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 49 | 36.65 | 23.4 | 196 | 186 | 187.5 | 186 | 187 | 189 | 44 | 7.95 |
| 50 | 50 | 10.15 | 15.85 | 203.5 | 194.4 | 195.9 | 194.5 | 195.9 | 194.5 | 48 | 10.6 |
| 51 | 51 | 12.35 | 17.9 | 204.3 | 197.5 | 199.6 | 197.2 | 198.7 | 197 | 46.5 | 10.25 |
| 52 | 52 | 15.8 | 19.05 | 203.3 | 198.7 | 201 | 198.2 | 200.5 | 198.6 | 45 | 8.65 |
| 53 | 53 | 18.55 | 16.75 | 200 | 197 | 197.8 | 196.6 | 198.6 | 196.5 | 44 | 10 |
| 54 | 54 | 21.4 | 19.35 | 200.7 | 196.5 | 197.3 | 196.1 | 197.8 | 197 | 49.5 | 10.2 |
| 55 | 55 | 22.2 | 21.25 | 201.5 | 196 | 197.2 | 195.5 | 197.3 | 196.5 | 51.5 | 10.55 |
| 56 | 56 | 24.55 | 19.5 | 200.8 | 193.5 | 194.5 | 193 | 194.6 | 195.5 | 51.5 | 10.55 |
| 57 | 57 | 26.65 | 21.2 | 201.5 | 194 | 195.1 | 193.5 | 195.5 | 195 | 48.5 | 10.55 |
| 58 | 58 | 26.9 | 19.15 | 200.8 | 192 | 193 | 191.5 | 193.1 | 194.3 | 52 | 10.55 |
| 59 | 59 | 29.1 | 19.95 | 201 | 192.6 | 193.9 | 192 | 194 | 194 | 48.5 | 10.25 |
| 60 | 60 | 32.3 | 20.4 | 200.8 | 192 | 192.2 | 191.7 | 193.2 | 192 | 45 | 9.25 |
| 61 | 61 | 36.25 | 20.35 | 194 | 184 | 186 | 184 | 186 | 184 | 40 | 8.2 |
| 62 | 62 | 12.7 | 11.55 | 198 | 191.5 | 192.2 | 191.5 | 193.2 | 192 | 42.5 | 10.15 |
| 63 | 63 | 14.5 | 14.65 | 199.2 | 195 | 197 | 195 | 197 | 195 | 42.5 | 9.9 |
| 64 | 64 | 17.85 | 13 | 197.3 | 194.1 | 195.6 | 194 | 196.1 | 194 | 33.5 | 9.85 |
| 65 | 65 | 21.3 | 14.55 | 197.8 | 193.2 | 195 | 194 | 195.8 | 194 | 47 | 9.9 |
| 66 | 66 | 24.95 | 16.4 | 199 | 190 | 191 | 189.9 | 191.2 | 194 | 52.5 | 10.6 |
| 67 | 67 | 28.65 | 16.5 | 199 | 189.9 | 191 | 189.4 | 190.8 | 192 | 50 | 10.2 |
| 68 | 68 | 30.9 | 17.3 | 199 | 190.2 | 191.6 | 189.5 | 191.2 | 191 | 42.5 | 9.75 |
| 69 | 69 | 34 | 17.4 | 197 | 187.8 | 189 | 187 | 188.7 | 188 | 37.5 | 8.75 |
| 70 | 70 | 37.55 | 16.7 | 192 | 182 | 183 | 182 | 184 | 182 | 30 | 8.15 |
| 71 | 71 | 13.5 | 8.15 | 195 | 188.2 | 190.6 | 188.5 | 190.7 | 189 | 37.5 | 10.35 |
| 72 | 72 | 15.5 | 10.95 | 197 | 192.7 | 194.5 | 192.5 | 194.7 | 193 | 32.5 | 10.15 |
| 73 | 73 | 18.2 | 10.5 | 196.2 | 192.4 | 194.4 | 192.3 | 194.6 | 192.2 | 33.5 | 10.25 |
| 74 | 74 | 21.8 | 11.4 | 195 | 191 | 193 | 191 | 193.5 | 191.5 | 40 | 10.45 |
| 75 | 75 | 25.65 | 12.7 | 196 | 189.5 | 190 | 189 | 190.6 | 191.6 | 32.5 | 10.85 |
| 76 | 76 | 28.55 | 14.45 | 197 | 189 | 189.7 | 188 | 189.5 | 191 | 37.5 | 10.5 |
| 77 | 77 | 31.25 | 14.9 | 196 | 188.2 | 189.6 | 187.6 | 189 | 191.2 | 36 | 9.75 |
| 78 | 78 | 35 | 12.95 | 192.2 | 185 | 186 | 184.1 | 186.1 | 186 | 30 | 9.25 |
| 79 | 79 | 38.7 | 14.35 | 190 | 182 | 183 | 182 | 184 | 182 | 23.5 | 8.2 |
| 80 | 80 | 14.4 | 5.5 | 193.8 | 186.5 | 189 | 187 | 189.3 | 188 | 35 | 10.6 |
| 81 | 81 | 16.05 | 7.85 | 195.5 | 190.1 | 192.5 | 190 | 192.7 | 191 | 33 | 10.45 |
| 82 | 82 | 24.6 | 10 | 193.8 | 189.7 | 191.2 | 189.7 | 191.8 | 190.5 | 30 | 11.5 |
| 83 | 83 | 26.7 | 10 | 193.8 | 189 | 190.2 | 188.7 | 190.5 | 189.6 | 25 | 11.55 |
| 84 | 84 | 28.4 | 11.45 | 194 | 188.3 | 189 | 188 | 189.5 | 189.6 | 23 | 11.25 |
| 85 | 85 | 30.8 | 12.15 | 194 | 187.5 | 188.7 | 186.8 | 188.2 | 188.5 | 23.5 | 10.5 |
| 86 | 86 | 33.45 | 10.25 | 191.7 | 186 | 187.3 | 185.5 | 187.2 | 185 | 26.5 | 10.25 |
| 87 | 87 | 35.5 | 10.25 | 191 | 184.5 | 185.5 | 184.2 | 185.7 | 185 | 23 | 9.5 |
| 88 | 88 | 38.2 | 11.1 | 190 | 183.4 | 183.5 | 182.1 | 182.8 | 182.5 | 20 | 8.7 |
| 89 | 89 | 26.2 | 7.3 | 192.6 | 189 | 190.8 | 189 | 191.3 | 189 | 25 | 11.65 |
| 90 | 90 | 29.9 | 8.95 | 192 | 188 | 189 | 187.3 | 189.6 | 188 | 22 | 11.6 |
| 91 | 91 | 33.6 | 8 | 190.8 | 186.5 | 188 | 186.1 | 188.2 | 185.5 | 22 | 10.3 |
| 92 | 92 | 36.65 | 8.35 | 190 | 184 | 185 | 183.8 | 185.5 | 183.5 | 20 | 9.5 |
| 93 | 93 | 18.25 | 4.25 | 193.5 | 187.8 | 190.2 | 188 | 190.6 | 188.3 | 32 | 10.65 |
| 94 | 94 | 21.05 | 6.9 | 193.5 | 189.5 | 191.7 | 189.2 | 192.3 | 189.6 | 31.5 | 11 |
| 95 | 95 | 25.1 | 4.5 | 192 | 188.6 | 191 | 189 | 192.1 | 188.3 | 22.5 | 11.4 |
| 96 | 96 | 29.6 | 5.25 | 191 | 188.3 | 189.9 | 187.5 | 190.6 | 187.2 | 21 | 11.3 |
| 97 | 97 | 32.25 | 2.7 | 190 | 186.8 | 188.3 | 186.5 | 189.2 | 185.2 | 19 | 10.85 |
| 98 | 98 | 36.25 | 3.95 | 189.5 | 185 | 186 | 184.3 | 186.3 | 183.4 | 17.5 | 10.1 |
| 99 | 99 | 38.85 | 5 | 189 | 183 | 183.8 | 182.4 | 184 | 182.1 | 17.5 | 9.5 |
| 100 | 100 | 41 | 3.65 | 188 | 180.5 | 181.2 | 180 | 181.3 | 180.5 | 18.5 | 8.6 |

### 6.6.1. Normal mode run

Running the package in normal mode requires the values of LSW2=2 and LSW6=0. Running the package in this mode describes about the behaviour of the aquifer i.e. wether the water table in the aquifer is rising of falling. While running the package, the values of DL, DELQ and ERROR were selected as 0.1, 0.05 and 0.08 respectively.

With no prescribed net recharge in SGMP12b.INP during the period of monsoon, a positive value of net change in storage, in SGMP13.OUT water balance component, indicates that water level in the aquifer has lowered and viz verse. It has happened only because the net recharge to the aquifer is prescribed as zero in SGMP12B.INP, however there would have been some recharge to the area.

### 6.6.2. Inverse mode run

Running the package in inverse mode requires the values of LSW2=2 and LSW6=1. The package in this mode describes about the artificial flow at each node for which the water table elevations are calculated keeping the initial head same as final, which is the assumption in the problem. While running the package, the values of DL, DELQ and ERROR remains same as prescribed in normal run.

In this run the change in head will be zero and an artificial recharge will be introduced at each node to keep the head same with in one percent error. Both iteration and superiteration works in this run. The water balance component of output file SGMP13.OUT is reported in Appendix F.

## 6.7. Discussion

The artificial nodal recharge in monsoon and non-monsoon period is given in Table 6.2. The following conclusions can be drawn by this exercise.

a) The introduced artificial recharge should have been the net recharge in monsoon and non-monsoon period.

b) During monsoon period the introduced artificial recharge is positive, indicates a recharge to the aquifer and during the non-monsoon period it is negative indicating a withdrawal from aquifer.

Table 6.2: Estimated net recharge in the study area for monsoon and non-monsoon period.

| Sl. No. | Node No. | Net artificial recharge during monsoon and non-monsoon | | | |
|---|---|---|---|---|---|
| | | monsoon mcm | non-monsoon mcm | monsoon mcm | non-monsoon mcm |
| 1 | 14 | 8.4000 | -8.4000 | 8.4000 | -8.4000 |
| 2 | 15 | 14.6000 | -14.0000 | 10.6000 | -10.4000 |
| 3 | 16 | 7.8000 | -7.6000 | 5.2000 | -5.2000 |
| 4 | 17 | 7.4000 | -7.2000 | 6.6000 | -6.8000 |
| 5 | 18 | 4.8000 | -6.0000 | 6.2000 | -5.6000 |
| 6 | 19 | 4.8000 | -8.4000 | 7.6000 | -5.6000 |
| 7 | 20 | .0000 | -4.0000 | 4.2000 | -2.0000 |
| 8 | 21 | .8000 | -3.6000 | 5.4000 | -2.8000 |
| 9 | 22 | .4000 | -1.2000 | 8.6000 | -6.8000 |
| 10 | 23 | 3.0000 | -4.0000 | 4.0000 | .0000 |
| 11 | 24 | 1.2000 | -2.8000 | 4.8000 | -2.4000 |
| 12 | 27 | 6.2000 | -10.8000 | 9.6000 | 9.2000 |
| 13 | 28 | 12.8000 | -12.4000 | 7.4000 | -7.2000 |
| 14 | 29 | 11.6000 | -11.6000 | 10.4000 | -7.6000 |
| 15 | 30 | 8.4000 | -8.4000 | 8.0000 | -6.0000 |
| 16 | 31 | 5.4000 | -6.4000 | 6.6000 | -5.6000 |
| 17 | 32 | 4.2000 | -4.8000 | 4.6000 | -4.8000 |
| 18 | 33 | 5.6000 | -5.6000 | 7.8000 | -8.0000 |
| 19 | 34 | .6000 | -.4000 | 6.8000 | -5.2000 |
| 20 | 35 | 1.8000 | -1.2000 | 8.0000 | -6.0000 |
| 21 | 36 | 4.0000 | -3.2000 | 5.8000 | -5.2000 |
| 22 | 37 | -5.8000 | 4.8000 | 4.6000 | -.8000 |
| 23 | 38 | 3.0000 | -4.8000 | 6.8000 | -3.6000 |
| 24 | 39 | 5.6000 | -4.8000 | 8.8000 | -6.8000 |
| 25 | 42 | 17.0000 | -16.8000 | 10.0000 | -10.0000 |
| 26 | 43 | 13.0000 | -15.2000 | 15.4000 | -9.6000 |
| 27 | 44 | 5.2000 | -6.4000 | 6.0000 | -4.4000 |
| 28 | 45 | 6.0000 | -8.4000 | 8.2000 | -8.4000 |
| 29 | 46 | 6.6000 | -6.4000 | 8.4000 | -6.0000 |
| 30 | 47 | 8.2000 | -9.6000 | 15.6000 | -10.4000 |
| 31 | 48 | 6.8000 | -6.4000 | 7.6000 | -7.2000 |
| 32 | 51 | 18.8000 | -21.6000 | 13.6000 | -15.2000 |
| 33 | 52 | 16.6000 | -20.0000 | 16.6000 | -13.6000 |
| 34 | 53 | 6.2000 | -9.6000 | 16.2000 | -16.8000 |
| 35 | 54 | 5.6000 | -8.4000 | 12.2000 | -5.2000 |
| 36 | 55 | 6.6000 | -9.2000 | 9.8000 | -4.4000 |
| 37 | 56 | 5.4000 | -8.0000 | 10.4000 | .0000 |
| 38 | 57 | 5.0000 | -7.2000 | 8.8000 | -2.4000 |
| 39 | 58 | 4.4000 | -6.8000 | 8.8000 | 4.0000 |
| 40 | 59 | 7.4000 | -10.8000 | 11.4000 | .0000 |
| 41 | 60 | 1.0000 | -2.8000 | 8.8000 | -6.8000 |
| 42 | 63 | 17.6000 | -18.0000 | 18.0000 | -18.0000 |
| 43 | 64 | 9.8000 | -10.4000 | 13.8000 | -13.6000 |
| 45 | 65 | 14.0000 | -7.6000 | 14.0000 | -14.0000 |
| 46 | 66 | 7.8000 | -9.2000 | 10.4000 | 14.8000 |
| 47 | 67 | 5.2000 | -7.6000 | 6.8000 | .8000 |
| 48 | 68 | 6.8000 | -10.0000 | 8.0000 | -1.2000 |
| 49 | 69 | 7.8000 | -13.2000 | 11.4000 | -4.4000 |
| 50 | 72 | 10.2000 | -11.2000 | 12.6000 | -9.6000 |
| 51 | 73 | 13.6000 | -14.0000 | 15.6000 | -16.4000 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 52 | 74 | 16.2000 | -16.4000 | 20.4000 | -16.4000 |
| 53 | 75 | 3.4000 | -7.2000 | 11.6000 | 7.6000 |
| 54 | 76 | 3.6000 | -8.8000 | 7.8000 | 7.6000 |
| 55 | 77 | 7.8000 | -11.2000 | 7.8000 | 12.4000 |
| 56 | 78 | 7.0000 | -13.6000 | 14.4000 | -4.4000 |
| 57 | 81 | 16.8000 | -17.6000 | 19.0000 | -11.6000 |
| 58 | 82 | 10.2000 | -10.0000 | 14.0000 | -8.4000 |
| 59 | 83 | 5.8000 | -7.2000 | 8.6000 | -4.4000 |
| 60 | 84 | 3.4000 | -4.8000 | 7.2000 | .4000 |
| 61 | 85 | 7.0000 | -10.8000 | 8.0000 | -1.2000 |
| 62 | 86 | 6.4000 | -8.8000 | 8.4000 | -6.0000 |
| 63 | 87 | 3.6000 | -4.8000 | 5.6000 | -2.8000 |
| 64 | 89 | 14.6000 | -14.8000 | 19.0000 | -18.8000 |
| 65 | 90 | 8.0000 | -14.0000 | 19.0000 | -8.8000 |
| 66 | 91 | 12.0000 | -15.2000 | 16.8000 | -22.0000 |
| 67 | 92 | 6.4000 | -7.6000 | 10.6000 | -12.4000 |
| Total | | 481.3997 | -584.3998 | 663.3997 | -380.7998 |

# APPENDIXES

APPENDIX A

1. Format of input file for normal run

2. Format of input file SGMP11.INP

'MONTHLY DATA OF HARYANA'
'HANDLING SGMP11.INP'

| N | NSIDES |
|---|---|
| 84 | 149 |

| TMBAS | DMTIM | T | DELTA | MINOR | MAJOR | LIST | DL |
|---|---|---|---|---|---|---|---|
| 'MONTH' | 30.5 | 0 | 1 | 1 | 12 | 1 | 0.02 |

| SCALE | ERROR | COEFFA | PREDIC | DELQ | LSW1 | LSW2 | NITER |
|---|---|---|---|---|---|---|---|
| 10000 | 0.001 | 1 | 1 | 0.0002 | 1 | 2 | 50 |

| K | NTYPE | CO(X,1) | CO(Y,1) | SL(K) | TL(K) | BL(K) | UL(K) | LL(K) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1.5 | 22.05 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 2 | 1 | 4 | 22.05 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 3 | 1 | 6.5 | 22.05 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 4 | 1 | 8.95 | 22.05 | 9.4 | 9.4 | -90.6 | 9.4 | -90.6 |
| 5 | 1 | 11.45 | 22.05 | 9.5 | 9.5 | -90.5 | 9.5 | -90.5 |
| 6 | 1 | 14 | 22.05 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 7 | 1 | 16.4 | 22.05 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 8 | 1 | 1.5 | 20.1 | 9.69 | 9.69 | -90.31 | 9.69 | -90.31 |
| 9 | 3 | 4 | 20.1 | 10.31 | 10.31 | -89.69 | 10.31 | -89.69 |
| 10 | 3 | 6.5 | 20.1 | 10.07 | 10.07 | -89.93 | 10.07 | -89.93 |
| 11 | 3 | 8.95 | 20.1 | 9.5 | 9.5 | -90.5 | 9.5 | -90.5 |
| 12 | 3 | 11.45 | 20.1 | 9.6 | 9.6 | -90.4 | 9.6 | -90.4 |
| 13 | 3 | 14 | 20.1 | 9.85 | 9.85 | -90.15 | 9.85 | -90.15 |
| 14 | 1 | 16.4 | 20.1 | 10.105 | 10.105 | -89.895 | 10.105 | -89.895 |
| 15 | 1 | 1.5 | 18.1 | 9.6 | 9.6 | -90.4 | 9.6 | -90.4 |
| 16 | 3 | 4 | 18.1 | 11.1 | 11.1 | -88.9 | 11.1 | -88.9 |
| 17 | 3 | 6.5 | 18.1 | 11 | 11 | -89 | 11 | -89 |
| 18 | 3 | 8.95 | 18.1 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 19 | 3 | 11.45 | 18.1 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 20 | 3 | 14 | 18.1 | 10.1 | 10.1 | -89.9 | 10.1 | -89.9 |
| 21 | 1 | 16.4 | 18.1 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 22 | 1 | 1.5 | 16.1 | 9.44 | 9.44 | -90.56 | 9.44 | -90.56 |
| 23 | 3 | 4 | 16.1 | 10.55 | 10.55 | -89.45 | 10.55 | -89.45 |
| 24 | 3 | 6.5 | 16.1 | 11.1 | 11.1 | -88.9 | 11.1 | -88.9 |
| 25 | 3 | 8.95 | 16.1 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 26 | 3 | 11.45 | 16.1 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 27 | 3 | 14 | 16.1 | 10.22 | 10.22 | -89.78 | 10.22 | -89.78 |
| 28 | 1 | 16.4 | 16.1 | 9.8 | 9.8 | -90.2 | 9.8 | -90.2 |
| 29 | 1 | 1.5 | 14.1 | 9.1 | 9.1 | -90.9 | 9.1 | -90.9 |
| 30 | 3 | 4 | 14.1 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 31 | 3 | 6.5 | 14.1 | 10.5 | 10.5 | -89.5 | 10.5 | -89.5 |
| 32 | 3 | 8.95 | 14.1 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 33 | 3 | 11.45 | 14.1 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 34 | 3 | 14 | 14.1 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 35 | 1 | 16.4 | 14.1 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 36 | 1 | 1.5 | 12.15 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 37 | 3 | 4 | 12.15 | 10.9 | 10.9 | -89.1 | 10.9 | -89.1 |
| 38 | 3 | 6.5 | 12.15 | 10.6 | 10.6 | -89.4 | 10.6 | -89.4 |
| 39 | 3 | 8.95 | 12.15 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 40 | 3 | 11.45 | 12.15 | 10 | 10 | -90 | 10 | -90 |

Contd.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 41 | 3 | 14 | 12.15 | 10.5 | 10.5 | -89.5 | 10.5 | -89.5 |
| 42 | 1 | 16.4 | 12.15 | 10.5 | 10.5 | -89.5 | 10.5 | -89.5 |
| 43 | 1 | 1.5 | 10.2 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 44 | 3 | 4 | 10.2 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 45 | 3 | 6.5 | 10.2 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 46 | 3 | 8.95 | 10.2 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 47 | 3 | 11.45 | 10.2 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 48 | 3 | 14 | 10.2 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 49 | 1 | 16.4 | 10.2 | 10.5 | 10.5 | -89.5 | 10.5 | -89.5 |
| 50 | 1 | 1.5 | 8.2 | 9.99 | 9.99 | -90.01 | 9.99 | -90.01 |
| 51 | 3 | 4 | 8.2 | 10.1 | 10.1 | -89.9 | 10.1 | -89.9 |
| 52 | 3 | 6.5 | 8.2 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 53 | 3 | 8.95 | 8.2 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 54 | 3 | 11.45 | 8.2 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 55 | 3 | 14 | 8.2 | 10.5 | 10.5 | -89.5 | 10.5 | -89.5 |
| 56 | 1 | 16.4 | 8.2 | 11.2 | 11.2 | -88.8 | 11.2 | -88.8 |
| 57 | 1 | 1.5 | 6.2 | 10 | 10 | -90 | 10 | -90 |
| 58 | 3 | 4 | 6.2 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 59 | 3 | 6.5 | 6.2 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 60 | 3 | 8.95 | 6.2 | 10.6 | 10.6 | -89.4 | 10.6 | -89.4 |
| 61 | 3 | 11.45 | 6.2 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 62 | 3 | 14 | 6.2 | 10.6 | 10.6 | -89.4 | 10.6 | -89.4 |
| 63 | 1 | 16.4 | 6.2 | 11.7 | 11.7 | -88.3 | 11.7 | -88.3 |
| 64 | 1 | 1.5 | 4.2 | 10.16 | 10.16 | -89.84 | 10.16 | -89.84 |
| 65 | 3 | 4 | 4.2 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 66 | 3 | 6.5 | 4.2 | 10.1 | 10.1 | -89.9 | 10.1 | -89.9 |
| 67 | 3 | 8.95 | 4.2 | 9.9 | 9.9 | -90.1 | 9.9 | -90.1 |
| 68 | 3 | 11.45 | 4.2 | 10.1 | 10.1 | -89.9 | 10.1 | -89.9 |
| 69 | 3 | 14 | 4.2 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 70 | 1 | 16.4 | 4.2 | 10.76 | 10.76 | -89.24 | 10.76 | -89.24 |
| 71 | 1 | 1.5 | 2.25 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 72 | 3 | 4 | 2.25 | 10.4 | 10.4 | -89.6 | 10.4 | -89.6 |
| 73 | 3 | 6.5 | 2.25 | 10.3 | 10.3 | -89.7 | 10.3 | -89.7 |
| 74 | 3 | 8.95 | 2.25 | 10.1 | 10.1 | -89.9 | 10.1 | -89.9 |
| 75 | 3 | 11.45 | 2.25 | 10 | 10 | -90 | 10 | -90 |
| 76 | 3 | 14 | 2.25 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 77 | 1 | 16.4 | 2.25 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 78 | 1 | 1.5 | 0.25 | 10.21 | 10.21 | -89.79 | 10.21 | -89.79 |
| 79 | 1 | 4 | 0.25 | 10.41 | 10.41 | -89.59 | 10.41 | -89.59 |
| 80 | 1 | 6.5 | 0.25 | 10.5 | 10.5 | -89.5 | 10.5 | -89.5 |
| 81 | 1 | 8.95 | 0.25 | 10.7 | 10.7 | -89.3 | 10.7 | -89.3 |
| 82 | 1 | 11.45 | 0.25 | 10.2 | 10.2 | -89.8 | 10.2 | -89.8 |
| 83 | 1 | 14 | 0.25 | 9.99 | 9.99 | -90.01 | 9.99 | -90.01 |
| 84 | 1 | 16.4 | 0.25 | 10.03 | 10.03 | -89.97 | 10.03 | -89.97 |

| K | AS(K) | ASC(K) |
|---|---|---|
| 1 | 0.2 | 0.001 |
| 2 | 0.2 | 0.001 |
| 3 | 0.2 | 0.001 |
| 4 | 0.2 | 0.001 |
| 5 | 0.2 | 0.001 |
| 6 | 0.2 | 0.001 |
| 7 | 0.2 | 0.001 |
| 8 | 0.2 | 0.001 |
| 9 | 0.2 | 0.001 |
| 10 | 0.2 | 0.001 |
| 11 | 0.2 | 0.001 |
| 12 | 0.2 | 0.001 |

Contd.

| | | |
|---|---|---|
| 13 | 0.2 | 0.001 |
| 14 | 0.2 | 0.001 |
| 15 | 0.2 | 0.001 |
| 16 | 0.2 | 0.001 |
| 17 | 0.2 | 0.001 |
| 18 | 0.2 | 0.001 |
| 19 | 0.2 | 0.001 |
| 20 | 0.2 | 0.001 |
| 21 | 0.2 | 0.001 |
| 22 | 0.2 | 0.001 |
| 23 | 0.2 | 0.001 |
| 24 | 0.2 | 0.001 |
| 25 | 0.2 | 0.001 |
| 26 | 0.2 | 0.001 |
| 27 | 0.2 | 0.001 |
| 28 | 0.2 | 0.001 |
| 29 | 0.2 | 0.001 |
| 30 | 0.2 | 0.001 |
| 31 | 0.2 | 0.001 |
| 32 | 0.2 | 0.001 |
| 33 | 0.2 | 0.001 |
| 34 | 0.2 | 0.001 |
| 35 | 0.2 | 0.001 |
| 36 | 0.2 | 0.001 |
| 37 | 0.2 | 0.001 |
| 38 | 0.2 | 0.001 |
| 39 | 0.2 | 0.001 |
| 40 | 0.2 | 0.001 |
| 41 | 0.2 | 0.001 |
| 42 | 0.2 | 0.001 |
| 43 | 0.2 | 0.001 |
| 44 | 0.2 | 0.001 |
| 45 | 0.2 | 0.001 |
| 46 | 0.2 | 0.001 |
| 47 | 0.2 | 0.001 |
| 48 | 0.2 | 0.001 |
| 49 | 0.2 | 0.001 |
| 50 | 0.2 | 0.001 |
| 51 | 0.2 | 0.001 |
| 52 | 0.2 | 0.001 |
| 53 | 0.2 | 0.001 |
| 54 | 0.2 | 0.001 |
| 55 | 0.2 | 0.001 |
| 56 | 0.2 | 0.001 |
| 57 | 0.2 | 0.001 |
| 58 | 0.2 | 0.001 |
| 59 | 0.2 | 0.001 |
| 60 | 0.2 | 0.001 |
| 61 | 0.2 | 0.001 |
| 62 | 0.2 | 0.001 |
| 63 | 0.2 | 0.001 |
| 64 | 0.2 | 0.001 |
| 65 | 0.2 | 0.001 |
| 66 | 0.2 | 0.001 |
| 67 | 0.2 | 0.001 |
| 68 | 0.2 | 0.001 |
| 69 | 0.2 | 0.001 |
| 70 | 0.2 | 0.001 |

Contd.

| | | |
|---|---|---|
| 71 | 0.2 | 0.001 |
| 72 | 0.2 | 0.001 |
| 73 | 0.2 | 0.001 |
| 74 | 0.2 | 0.001 |
| 75 | 0.2 | 0.001 |
| 76 | 0.2 | 0.001 |
| 77 | 0.2 | 0.001 |
| 78 | 0.2 | 0.001 |
| 79 | 0.2 | 0.001 |
| 80 | 0.2 | 0.001 |
| 81 | 0.2 | 0.001 |
| 82 | 0.2 | 0.001 |
| 83 | 0.2 | 0.001 |
| 84 | 0.2 | 0.001 |

| IB | IE | CONDU |
|---|---|---|
| 1 | 2 | 2.4 |
| 2 | 3 | 2.45 |
| 3 | 4 | 2.55 |
| 4 | 5 | 2.7 |
| 5 | 6 | 2.85 |
| 6 | 7 | 3 |
| 1 | 8 | 2.35 |
| 2 | 9 | 2.45 |
| 3 | 10 | 2.5 |
| 4 | 11 | 2.6 |
| 5 | 12 | 2.8 |
| 6 | 13 | 3 |
| 7 | 14 | 3.1 |
| 8 | 9 | 2.4 |
| 9 | 10 | 2.45 |
| 10 | 11 | 2.55 |
| 11 | 12 | 2.7 |
| 12 | 13 | 2.95 |
| 13 | 14 | 3.1 |
| 8 | 15 | 2.3 |
| 9 | 16 | 2.45 |
| 10 | 17 | 2.5 |
| 11 | 18 | 2.6 |
| 12 | 19 | 2.8 |
| 13 | 20 | 3.05 |
| 14 | 21 | 3.2 |
| 15 | 16 | 2.35 |
| 16 | 17 | 2.5 |
| 17 | 18 | 2.55 |
| 18 | 19 | 2.75 |
| 19 | 20 | 3 |
| 20 | 21 | 3.2 |
| 15 | 22 | 2.3 |
| 16 | 23 | 2.45 |
| 17 | 24 | 2.55 |
| 18 | 25 | 2.6 |
| 19 | 26 | 2.95 |
| 20 | 27 | 3.2 |
| 21 | 28 | 3.3 |
| 22 | 23 | 2.35 |
| 23 | 24 | 2.6 |
| 24 | 25 | 2.6 |

Contd.

| | | |
|---|---|---|
| 25 | 26 | 2.9 |
| 26 | 27 | 3.2 |
| 27 | 28 | 3.35 |
| 22 | 29 | 2.2 |
| 23 | 30 | 2.4 |
| 24 | 31 | 2.6 |
| 25 | 32 | 2.8 |
| 26 | 33 | 3.15 |
| 27 | 34 | 3.35 |
| 28 | 35 | 3.45 |
| 29 | 30 | 2.25 |
| 30 | 31 | 2.4 |
| 31 | 32 | 2.65 |
| 32 | 33 | 3 |
| 33 | 34 | 3.4 |
| 34 | 35 | 3.45 |
| 29 | 36 | 2.1 |
| 30 | 37 | 2.2 |
| 31 | 38 | 2.5 |
| 32 | 39 | 2.8 |
| 33 | 40 | 3.3 |
| 34 | 41 | 3.5 |
| 35 | 42 | 3.5 |
| 36 | 37 | 2.1 |
| 37 | 38 | 2.2 |
| 38 | 39 | 2.55 |
| 39 | 40 | 3 |
| 40 | 41 | 3.45 |
| 41 | 42 | 3.45 |
| 36 | 43 | 1.95 |
| 37 | 44 | 2 |
| 38 | 45 | 2.3 |
| 39 | 46 | 2.7 |
| 40 | 47 | 3.2 |
| 41 | 48 | 3.45 |
| 42 | 49 | 3.45 |
| 43 | 44 | 1.9 |
| 44 | 45 | 2 |
| 45 | 46 | 2.4 |
| 46 | 47 | 2.9 |
| 47 | 48 | 3.3 |
| 48 | 49 | 3.45 |
| 43 | 50 | 1.85 |
| 44 | 51 | 1.85 |
| 45 | 52 | 2.1 |
| 46 | 53 | 2.65 |
| 47 | 54 | 3.1 |
| 48 | 55 | 3.35 |
| 49 | 56 | 3.45 |
| 50 | 51 | 1.85 |
| 51 | 52 | 1.9 |
| 52 | 53 | 2.3 |
| 53 | 54 | 2.85 |
| 54 | 55 | 3.2 |
| 55 | 56 | 3.35 |
| 50 | 57 | 1.85 |
| 51 | 58 | 1.85 |
| 52 | 59 | 2.1 |


Contd.

| | | |
|---|---|---|
| 53 | 60 | 2.65 |
| 54 | 61 | 3.05 |
| 55 | 62 | 3.25 |
| 56 | 63 | 3.35 |
| 57 | 58 | 1.9 |
| 58 | 59 | 2 |
| 59 | 60 | 2.5 |
| 60 | 61 | 2.9 |
| 61 | 62 | 3.2 |
| 62 | 63 | 3.35 |
| 57 | 64 | 1.95 |
| 58 | 65 | 2.05 |
| 59 | 66 | 2.3 |
| 60 | 67 | 2.75 |
| 61 | 68 | 3.05 |
| 62 | 69 | 3.25 |
| 63 | 70 | 3.35 |
| 64 | 65 | 2.1 |
| 65 | 66 | 2.25 |
| 66 | 67 | 2.65 |
| 67 | 68 | 2.95 |
| 68 | 69 | 3.15 |
| 69 | 70 | 3.25 |
| 64 | 71 | 2.1 |
| 65 | 72 | 2.25 |
| 66 | 73 | 2.5 |
| 67 | 74 | 2.9 |
| 68 | 75 | 3.1 |
| 69 | 76 | 3.2 |
| 70 | 77 | 3.3 |
| 71 | 72 | 2.2 |
| 72 | 73 | 2.4 |
| 73 | 74 | 2.7 |
| 74 | 75 | 3 |
| 75 | 76 | 3.15 |
| 76 | 77 | 3.25 |
| 71 | 78 | 2.2 |
| 72 | 79 | 2.4 |
| 73 | 80 | 2.6 |
| 74 | 81 | 2.9 |
| 75 | 82 | 3.05 |
| 76 | 83 | 3.2 |
| 77 | 84 | 3.25 |
| 78 | 79 | 2.3 |
| 79 | 80 | 2.5 |
| 80 | 81 | 2.75 |
| 81 | 82 | 2.95 |
| 82 | 83 | 3.15 |
| 83 | 84 | 3.25 |

3. Format of input file SGMP12A.INP

| LSW3 | LSW4 | LSW5 | LSW6 |
|---|---|---|---|
| 1 | 1 | 1 | 0 |

H(K): initial water table elevations

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6.7 | 7.3 | 7.2 | 7.2 | 7.9 | 8.4 | 8.9 | 6.54 | 7.01 | 7.07 |
| 7 | 7.55 | 8.15 | 8.605 | 6.5 | 7.6 | 8 | 7.9 | 8 | 8.3 |
| 8.4 | 7.19 | 7.95 | 8.6 | 8.4 | 8.5 | 8.61 | 8.3 | 7.8 | 8.2 |
| 9.1 | 9.5 | 9.1 | 9 | 8.5 | 8 | 8.6 | 9.6 | 10 | 9.4 |
| 9.1 | 8.9 | 7.7 | 8.4 | 9.5 | 9.8 | 9.4 | 9.2 | 9 | 7.39 |
| 8 | 8.9 | 9.6 | 9.1 | 8.9 | 8.9 | 7.1 | 7.4 | 8.3 | 9.1 |
| 8.7 | 8.5 | 8.5 | 6.8 | 7.2 | 7.9 | 8.3 | 8.2 | 8.05 | 8.06 |
| 6.6 | 6.9 | 7.4 | 7.7 | 7.8 | 7.6 | 7.7 | 6.36 | 6.71 | 7 |
| 7.1 | 7.25 | 7.14 | 7.25 | | | | | | |

H(K): water table elevation time step 1

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6.7 | 7.3 | 7.2 | 7.2 | 7.9 | 8.4 | 8.9 | 6.54 | 7.01 | 7.07 |
| 7 | 7.55 | 8.15 | 8.605 | 6.5 | 7.6 | 8 | 7.9 | 8 | 8.3 |
| 8.4 | 7.19 | 7.95 | 8.6 | 8.4 | 8.5 | 8.61 | 8.3 | 7.8 | 8.2 |
| 9.1 | 9.5 | 9.1 | 9 | 8.5 | 8 | 8.6 | 9.6 | 10 | 9.4 |
| 9.1 | 8.9 | 7.7 | 8.4 | 9.5 | 9.8 | 9.4 | 9.2 | 9 | 7.39 |
| 8 | 8.9 | 9.6 | 9.1 | 8.9 | 8.9 | 7.1 | 7.4 | 8.3 | 9.1 |
| 8.7 | 8.5 | 8.5 | 6.8 | 7.2 | 7.9 | 8.3 | 8.2 | 8.05 | 8.06 |
| 6.6 | 6.9 | 7.4 | 7.7 | 7.8 | 7.6 | 7.7 | 6.36 | 6.71 | 7 |
| 7.1 | 7.25 | 7.14 | 7.25 | | | | | | |

4. Format of input file SGMP12A.INP

QNET(K): net recharge time step 1

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | | | | | | |

5. Format of input file SGMP12A.INP

| LSW7 | LSW8 | LSW9 |
|---|---|---|
| 2 | 2 | 2 |

APPENDIX B

1. Format of output files of normal run

2. Format of output file SGMP11.OUT

GROUNDWATER MODEL FOR MONTHLY DATA OF HARYANA
HANDLING SGMP11.INP

NODAL NETWORK INFORMATION AND HYDROGEOLOGICAL DATA

TOTAL NUMBER OF NODES IS 84

UNIT LENGTH : 1 METRE
UNIT AREA : 1,000,000 SQ .METRES
UNIT VOLUME : 1,000,000 CU. METRES

UNIT OF TIME FOR DELTA AND BOUNDARY CONDITIONS IS MONTH

| BETWEEN NODE | PERMEABILITY | NODE | EFFECTIVE POROSITY | STORAGE COEFF. | AREA |
|---|---|---|---|---|---|
| 1 AND 8 | 2.35 | 1 | .2000 | .001000 | .01 |
| 1 AND 2 | 2.40 | 2 | .2000 | .001000 | .02 |
| 2 AND 9 | 2.45 | 3 | .2000 | .001000 | .02 |
| 2 AND 3 | 2.45 | 4 | .2000 | .001000 | .02 |
| 3 AND 10 | 2.50 | 5 | .2000 | .001000 | .02 |
| 3 AND 4 | 2.55 | 6 | .2000 | .001000 | .02 |
| 4 AND 11 | 2.60 | 7 | .2000 | .001000 | .01 |
| 4 AND 5 | 2.70 | 8 | .2000 | .001000 | .02 |
| 5 AND 12 | 2.80 | 9 | .2000 | .001000 | .05 |
| 5 AND 6 | 2.85 | 10 | .2000 | .001000 | .05 |
| 6 AND 13 | 3.00 | 11 | .2000 | .001000 | .05 |
| 6 AND 7 | 3.00 | 12 | .2000 | .001000 | .05 |
| 7 AND 14 | 3.10 | 13 | .2000 | .001000 | .05 |
| 8 AND 15 | 2.30 | 14 | .2000 | .001000 | .02 |
| 8 AND 9 | 2.40 | 15 | .2000 | .001000 | .03 |
| 9 AND 10 | 2.45 | 16 | .2000 | .001000 | .05 |
| 9 AND 16 | 2.45 | 17 | .2000 | .001000 | .05 |
| 10 AND 11 | 2.55 | 18 | .2000 | .001000 | .05 |
| 10 AND 17 | 2.50 | 19 | .2000 | .001000 | .05 |
| 11 AND 12 | 2.70 | 20 | .2000 | .001000 | .05 |
| 11 AND 18 | 2.60 | 21 | .2000 | .001000 | .02 |
| 12 AND 13 | 2.95 | 22 | .2000 | .001000 | .03 |
| 12 AND 19 | 2.80 | 23 | .2000 | .001000 | .05 |
| 13 AND 14 | 3.10 | 24 | .2000 | .001000 | .05 |
| 13 AND 20 | 3.05 | 25 | .2000 | .001000 | .05 |
| 14 AND 21 | 3.20 | 26 | .2000 | .001000 | .05 |
| 15 AND 22 | 2.30 | 27 | .2000 | .001000 | .05 |
| 15 AND 16 | 2.35 | 28 | .2000 | .001000 | .02 |
| 16 AND 17 | 2.50 | 29 | .2000 | .001000 | .02 |
| 16 AND 23 | 2.45 | 30 | .2000 | .001000 | .05 |
| 17 AND 18 | 2.55 | 31 | .2000 | .001000 | .05 |

Contd.

| | | | |
|---|---|---|---|
| 17 | AND | 24 | 2.55 |
| 18 | AND | 19 | 2.75 |
| 18 | AND | 25 | 2.60 |
| 19 | AND | 20 | 3.00 |
| 19 | AND | 26 | 2.95 |
| 20 | AND | 21 | 3.20 |
| 20 | AND | 27 | 3.20 |
| 21 | AND | 28 | 3.30 |
| 22 | AND | 29 | 2.20 |
| 22 | AND | 23 | 2.35 |
| 23 | AND | 24 | 2.60 |
| 23 | AND | 30 | 2.40 |
| 24 | AND | 25 | 2.60 |
| 24 | AND | 31 | 2.60 |
| 25 | AND | 26 | 2.90 |
| 25 | AND | 32 | 2.80 |
| 26 | AND | 27 | 3.20 |
| 26 | AND | 33 | 3.15 |
| 27 | AND | 28 | 3.35 |
| 27 | AND | 34 | 3.35 |
| 28 | AND | 35 | 3.45 |
| 29 | AND | 36 | 2.10 |
| 29 | AND | 30 | 2.25 |
| 30 | AND | 31 | 2.40 |
| 30 | AND | 37 | 2.20 |
| 31 | AND | 32 | 2.65 |
| 31 | AND | 38 | 2.50 |
| 32 | AND | 33 | 3.00 |
| 32 | AND | 39 | 2.80 |
| 33 | AND | 34 | 3.40 |
| 33 | AND | 40 | 3.30 |
| 34 | AND | 35 | 3.45 |
| 34 | AND | 41 | 3.50 |
| 35 | AND | 42 | 3.50 |
| 36 | AND | 43 | 1.95 |
| 36 | AND | 37 | 2.10 |
| 37 | AND | 38 | 2.20 |
| 37 | AND | 44 | 2.00 |
| 38 | AND | 39 | 2.55 |
| 38 | AND | 45 | 2.30 |
| 39 | AND | 40 | 3.00 |
| 39 | AND | 46 | 2.70 |
| 40 | AND | 41 | 3.45 |
| 40 | AND | 47 | 3.20 |
| 41 | AND | 42 | 3.45 |
| 41 | AND | 48 | 3.45 |
| 42 | AND | 49 | 3.45 |
| 43 | AND | 50 | 1.85 |
| 43 | AND | 44 | 1.90 |
| 44 | AND | 45 | 2.00 |
| 44 | AND | 51 | 1.85 |
| 45 | AND | 46 | 2.40 |
| 45 | AND | 52 | 2.10 |
| 46 | AND | 47 | 2.90 |
| 46 | AND | 53 | 2.65 |
| 47 | AND | 48 | 3.30 |
| 47 | AND | 54 | 3.10 |
| 48 | AND | 49 | 3.45 |

| | | | |
|---|---|---|---|
| 32 | .2000 | .001000 | .05 |
| 33 | .2000 | .001000 | .05 |
| 34 | .2000 | .001000 | .05 |
| 35 | .2000 | .001000 | .02 |
| 36 | .2000 | .001000 | .02 |
| 37 | .2000 | .001000 | .05 |
| 38 | .2000 | .001000 | .05 |
| 39 | .2000 | .001000 | .05 |
| 40 | .2000 | .001000 | .05 |
| 41 | .2000 | .001000 | .05 |
| 42 | .2000 | .001000 | .02 |
| 43 | .2000 | .001000 | .02 |
| 44 | .2000 | .001000 | .05 |
| 45 | .2000 | .001000 | .05 |
| 46 | .2000 | .001000 | .05 |
| 47 | .2000 | .001000 | .05 |
| 48 | .2000 | .001000 | .05 |
| 49 | .2000 | .001000 | .02 |
| 50 | .2000 | .001000 | .03 |
| 51 | .2000 | .001000 | .05 |
| 52 | .2000 | .001000 | .05 |
| 53 | .2000 | .001000 | .05 |
| 54 | .2000 | .001000 | .05 |
| 55 | .2000 | .001000 | .05 |
| 56 | .2000 | .001000 | .02 |
| 57 | .2000 | .001000 | .03 |
| 58 | .2000 | .001000 | .05 |
| 59 | .2000 | .001000 | .05 |
| 60 | .2000 | .001000 | .05 |
| 61 | .2000 | .001000 | .05 |
| 62 | .2000 | .001000 | .05 |
| 63 | .2000 | .001000 | .02 |
| 64 | .2000 | .001000 | .02 |
| 65 | .2000 | .001000 | .05 |
| 66 | .2000 | .001000 | .05 |
| 67 | .2000 | .001000 | .05 |
| 68 | .2000 | .001000 | .05 |
| 69 | .2000 | .001000 | .05 |
| 70 | .2000 | .001000 | .02 |
| 71 | .2000 | .001000 | .02 |
| 72 | .2000 | .001000 | .05 |
| 73 | .2000 | .001000 | .05 |
| 74 | .2000 | .001000 | .05 |
| 75 | .2000 | .001000 | .05 |
| 76 | .2000 | .001000 | .05 |
| 77 | .2000 | .001000 | .02 |
| 78 | .2000 | .001000 | .01 |
| 79 | .2000 | .001000 | .03 |
| 80 | .2000 | .001000 | .02 |
| 81 | .2000 | .001000 | .02 |
| 82 | .2000 | .001000 | .03 |
| 83 | .2000 | .001000 | .02 |
| 84 | .2000 | .001000 | .01 |

| | | |
|---|---|---|
| 48 AND | 55 | 3.35 |
| 49 AND | 56 | 3.45 |
| 50 AND | 57 | 1.85 |
| 50 AND | 51 | 1.85 |
| 51 AND | 52 | 1.80 |
| 51 AND | 58 | 1.85 |
| 52 AND | 53 | 2.30 |
| 52 AND | 59 | 2.10 |
| 53 AND | 54 | 2.85 |
| 53 AND | 60 | 2.65 |
| 54 AND | 55 | 3.20 |
| 54 AND | 61 | 3.05 |
| 55 AND | 56 | 3.35 |
| 55 AND | 62 | 3.25 |
| 56 AND | 63 | 3.35 |
| 57 AND | 64 | 1.95 |
| 57 AND | 58 | 1.90 |
| 58 AND | 59 | 2.00 |
| 58 AND | 65 | 2.05 |
| 59 AND | 60 | 2.50 |
| 59 AND | 66 | 2.30 |
| 60 AND | 61 | 2.90 |
| 60 AND | 67 | 2.75 |
| 61 AND | 62 | 3.20 |
| 61 AND | 68 | 3.05 |
| 62 AND | 63 | 3.35 |
| 62 AND | 69 | 3.25 |
| 63 AND | 70 | 3.35 |
| 64 AND | 71 | 2.10 |
| 64 AND | 65 | 2.10 |
| 65 AND | 66 | 2.25 |
| 65 AND | 72 | 2.25 |
| 66 AND | 67 | 2.65 |
| 66 AND | 73 | 2.50 |
| 67 AND | 68 | 2.95 |
| 67 AND | 74 | 2.90 |
| 68 AND | 69 | 3.15 |
| 68 AND | 75 | 3.10 |
| 69 AND | 70 | 3.25 |
| 69 AND | 76 | 3.20 |
| 70 AND | 77 | 3.30 |
| 71 AND | 78 | 2.20 |
| 71 AND | 72 | 2.20 |
| 72 AND | 73 | 2.40 |
| 72 AND | 79 | 2.40 |
| 73 AND | 74 | 2.70 |
| 73 AND | 80 | 2.60 |
| 74 AND | 75 | 3.00 |
| 74 AND | 81 | 2.90 |
| 75 AND | 76 | 3.15 |
| 75 AND | 82 | 3.05 |
| 76 AND | 77 | 3.25 |
| 76 AND | 83 | 3.20 |
| 77 AND | 84 | 3.25 |
| 78 AND | 79 | 2.30 |
| 79 AND | 80 | 2.50 |
| 80 AND | 81 | 2.75 |
| 81 AND | 82 | 2.95 |

Contd.

82 AND 83 3.15
83 AND 84 3.25

TOTAL AREA 3.25

| NODE NO. | X-COORD. (CM) | Y-COORD. (CM) | SURFACE (M) | TOP (M) | BOTTOM (M) | THICKNESS (M) | UPPER LEVEL | LOWER LEVEL |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.50 | 22.05 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 2 | 4.00 | 22.05 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 3 | 6.50 | 22.05 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 4 | 8.95 | 22.05 | 9.40 | 9.40 | -90.60 | 100.00 | 9.40 | -90.60 |
| 5 | 11.45 | 22.05 | 9.50 | 9.50 | -90.50 | 100.00 | 9.50 | -90.50 |
| 6 | 14.00 | 22.05 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 7 | 16.40 | 22.05 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 8 | 1.50 | 20.10 | 9.69 | 9.69 | -90.31 | 100.00 | 9.69 | -90.31 |
| 9 | 4.00 | 20.10 | 10.31 | 10.31 | -89.69 | 100.00 | 10.31 | -89.69 |
| 10 | 6.50 | 20.10 | 10.07 | 10.07 | -89.93 | 100.00 | 10.07 | -89.93 |
| 11 | 8.95 | 20.10 | 9.50 | 9.50 | -90.50 | 100.00 | 9.50 | -90.50 |
| 12 | 11.45 | 20.10 | 9.60 | 9.60 | -90.40 | 100.00 | 9.60 | -90.40 |
| 13 | 14.00 | 20.10 | 9.85 | 9.85 | -90.15 | 100.00 | 9.85 | -90.15 |
| 14 | 16.40 | 20.10 | 10.10 | 10.10 | -89.89 | 100.00 | 10.10 | -89.89 |
| 15 | 1.50 | 18.10 | 9.60 | 9.60 | -90.40 | 100.00 | 9.60 | -90.40 |
| 16 | 4.00 | 18.10 | 11.10 | 11.10 | -88.90 | 100.00 | 11.10 | -88.90 |
| 17 | 6.50 | 18.10 | 11.00 | 11.00 | -89.00 | 100.00 | 11.00 | -89.00 |
| 18 | 8.95 | 18.10 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 19 | 11.45 | 18.10 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 20 | 14.00 | 18.10 | 10.10 | 10.10 | -89.90 | 100.00 | 10.10 | -89.90 |
| 21 | 16.40 | 18.10 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 22 | 1.50 | 16.10 | 9.44 | 9.44 | -90.56 | 100.00 | 9.44 | -90.56 |
| 23 | 4.00 | 16.10 | 10.55 | 10.55 | -89.45 | 100.00 | 10.55 | -89.45 |
| 24 | 6.50 | 16.10 | 11.10 | 11.10 | -88.90 | 100.00 | 11.10 | -88.90 |
| 25 | 8.95 | 16.10 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 26 | 11.45 | 16.10 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 27 | 14.00 | 16.10 | 10.22 | 10.22 | -89.78 | 100.00 | 10.22 | -89.78 |
| 28 | 16.40 | 16.10 | 9.80 | 9.80 | -90.20 | 100.00 | 9.80 | -90.20 |
| 29 | 1.50 | 14.10 | 9.10 | 9.10 | -90.90 | 100.00 | 9.10 | -90.90 |
| 30 | 4.00 | 14.10 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 31 | 6.50 | 14.10 | 10.50 | 10.50 | -89.50 | 100.00 | 10.50 | -89.50 |
| 32 | 8.95 | 14.10 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 33 | 11.45 | 14.10 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 34 | 14.00 | 14.10 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 35 | 16.40 | 14.10 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 36 | 1.50 | 12.15 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 37 | 4.00 | 12.15 | 10.90 | 10.90 | -89.10 | 100.00 | 10.90 | -89.10 |
| 38 | 6.50 | 12.15 | 10.60 | 10.60 | -89.40 | 100.00 | 10.60 | -89.40 |
| 39 | 8.95 | 12.15 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 40 | 11.45 | 12.15 | 10.00 | 10.00 | -90.00 | 100.00 | 10.00 | -90.00 |
| 41 | 14.00 | 12.15 | 10.50 | 10.50 | -89.50 | 100.00 | 10.50 | -89.50 |
| 42 | 16.40 | 12.15 | 10.50 | 10.50 | -89.50 | 100.00 | 10.50 | -89.50 |
| 43 | 1.50 | 10.20 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 44 | 4.00 | 10.20 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 45 | 6.50 | 10.20 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 46 | 8.95 | 10.20 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 47 | 11.45 | 10.20 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 48 | 14.00 | 10.20 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 49 | 16.40 | 10.20 | 10.50 | 10.50 | -89.50 | 100.00 | 10.50 | -89.50 |

Contd.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 50 | 1.50 | 8.20 | 9.99 | 9.99 | -90.01 | 100.00 | 9.99 | -90.01 |
| 51 | 4.00 | 8.20 | 10.10 | 10.10 | -89.90 | 100.00 | 10.10 | -89.90 |
| 52 | 6.50 | 8.20 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 53 | 8.95 | 8.20 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 54 | 11.45 | 8.20 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 55 | 14.00 | 8.20 | 10.50 | 10.50 | -89.50 | 100.00 | 10.50 | -89.50 |
| 56 | 16.40 | 8.20 | 11.20 | 11.20 | -88.80 | 100.00 | 11.20 | -88.80 |
| 57 | 1.50 | 6.20 | 10.00 | 10.00 | -90.00 | 100.00 | 10.00 | -90.00 |
| 58 | 4.00 | 6.20 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 59 | 6.50 | 6.20 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 60 | 8.95 | 6.20 | 10.60 | 10.60 | -89.40 | 100.00 | 10.60 | -89.40 |
| 61 | 11.45 | 6.20 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 62 | 14.00 | 6.20 | 10.60 | 10.60 | -89.40 | 100.00 | 10.60 | -89.40 |
| 63 | 16.40 | 6.20 | 11.70 | 11.70 | -88.30 | 100.00 | 11.70 | -88.30 |
| 64 | 1.50 | 4.20 | 10.16 | 10.16 | -89.84 | 100.00 | 10.16 | -89.84 |
| 65 | 4.00 | 4.20 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 66 | 6.50 | 4.20 | 10.10 | 10.10 | -89.90 | 100.00 | 10.10 | -89.90 |
| 67 | 8.95 | 4.20 | 9.90 | 9.90 | -90.10 | 100.00 | 9.90 | -90.10 |
| 68 | 11.45 | 4.20 | 10.10 | 10.10 | -89.90 | 100.00 | 10.10 | -89.90 |
| 69 | 14.00 | 4.20 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 70 | 16.40 | 4.20 | 10.76 | 10.76 | -89.24 | 100.00 | 10.76 | -89.24 |
| 71 | 1.50 | 2.25 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 72 | 4.00 | 2.25 | 10.40 | 10.40 | -89.60 | 100.00 | 10.40 | -89.60 |
| 73 | 6.50 | 2.25 | 10.30 | 10.30 | -89.70 | 100.00 | 10.30 | -89.70 |
| 74 | 8.95 | 2.25 | 10.10 | 10.10 | -89.90 | 100.00 | 10.10 | -89.90 |
| 75 | 11.45 | 2.25 | 10.00 | 10.00 | -90.00 | 100.00 | 10.00 | -90.00 |
| 76 | 14.00 | 2.25 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 77 | 16.40 | 2.25 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 78 | 1.50 | .25 | 10.21 | 10.21 | -89.79 | 100.00 | 10.21 | -89.79 |
| 79 | 4.00 | .25 | 10.41 | 10.41 | -89.59 | 100.00 | 10.41 | -89.59 |
| 80 | 6.50 | .25 | 10.50 | 10.50 | -89.50 | 100.00 | 10.50 | -89.50 |
| 81 | 8.95 | .25 | 10.70 | 10.70 | -89.30 | 100.00 | 10.70 | -89.30 |
| 82 | 11.45 | .25 | 10.20 | 10.20 | -89.80 | 100.00 | 10.20 | -89.80 |
| 83 | 14.00 | .25 | 9.99 | 9.99 | -90.01 | 100.00 | 9.99 | -90.01 |
| 84 | 16.40 | .25 | 10.03 | 10.03 | -89.97 | 100.00 | 10.03 | -89.97 |

MISCELLANEOUS CONSTANTS

| | | | | | |
|---|---|---|---|---|---|
| LIST = | 1 | SCALE = | 10000.00 | LSW1 = | 1 |
| MAJOR = | 12 | ERROR = | .00 | LSW2 = | 2 |
| MINOR = | 1 | DELQ = | .00 | NITER = | 50 |
| DELTA = | 1.000 | COEFFA = | 1.00 | DL = | .0 |
| DMTIM = | 30.500 | PREDIC = | 1.00 | | |

3. Format of output file SGMP12.OUT

```
GROUNDWATER MODEL FOR MONTHLY DATA OF HARYANA
HANDLING SGMP11.INP

CALCULATION OF WATER BALANCES (RESULTS NOT PRINTED)

VALUES OF EXTERNAL SWITCHES

         LSW3 =  1
         LSW4 =  1
         LSW5 =  1
         LSW6 =  0

 FLOW ACROSS BOUNDARIES

NODE     INFLOW     OUTFLOW

    9     .0157      -.0416
   10     .0000      -.0212
   11     .0000      -.0444
   12     .0003      -.0110
   13     .0332       .0000
   16     .0000      -.0509
   20     .0076       .0000
   23     .0000      -.0256
   27     .0003      -.0074
   30     .0022      -.0063
   34     .0047      -.0054
   37     .0048      -.0050
   41     .0256      -.0006
   44     .0000      -.0121
   48     .0322      -.0001
   51     .0000      -.0170
   55     .0332       .0000
   58     .0000      -.0184
   62     .0203       .0000
   65     .0000      -.0219
   69     .0107      -.0001
   72     .0000      -.0443
   73     .0000      -.0265
   74     .0000      -.0399
   75     .0000      -.0400
   76     .0114      -.0621

 TOTAL    .2022      -.5018
```

4. Format of output file SGMP13.OUT

```
GROUNDWATER MODEL FOR MONTHLY DATA OF HARYANA
HANDLING SGMP11.INP

PRINTING OF CALCULATED WATER LEVELS AND BALANCES

 TOTAL NUMBER OF NODES IS  84

 UNIT LENGTH :          1 METRE
 UNIT AREA   : 1,000,000 SQ .METRES
 UNIT VOLUME : 1,000,000 CU. METRES

 UNIT OF TIME FOR DELTA AND BOUNDARY CONDITIONS IS MONTH

 VALUES OF EXTERNAL SWITCHES

          LSW7 =  2
          LSW8 =  2
          LSW9 =  2

 INITIAL WATER LEVEL ELEVATIONS

     T =      .0000
```

| NODE | HINIT | NODE | HINIT | NODE | HINIT |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 8.2000 | 58 | 7.4000 |
| 3 | 7.2000 | 31 | 9.1000 | 59 | 8.3000 |
| 4 | 7.2000 | 32 | 9.5000 | 60 | 9.1000 |
| 5 | 7.9000 | 33 | 9.1000 | 61 | 8.7000 |
| 6 | 8.4000 | 34 | 9.0000 | 62 | 8.5000 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.0100 | 37 | 8.6000 | 65 | 7.2000 |
| 10 | 7.0700 | 38 | 9.6000 | 66 | 7.9000 |
| 11 | 7.0000 | 39 | 10.0000 | 67 | 8.3000 |
| 12 | 7.5500 | 40 | 9.4000 | 68 | 8.2000 |
| 13 | 8.1500 | 41 | 9.1000 | 69 | 8.0500 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.6000 | 44 | 8.4000 | 72 | 6.9000 |
| 17 | 8.0000 | 45 | 9.5000 | 73 | 7.4000 |
| 18 | 7.9000 | 46 | 9.8000 | 74 | 7.7000 |
| 19 | 8.0000 | 47 | 9.4000 | 75 | 7.8000 |
| 20 | 8.3000 | 48 | 9.2000 | 76 | 7.6000 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.9500 | 51 | 8.0000 | 79 | 6.7100 |
| 24 | 8.6000 | 52 | 8.9000 | 80 | 7.0000 |
| 25 | 8.4000 | 53 | 9.6000 | 81 | 7.1000 |
| 26 | 8.5000 | 54 | 9.1000 | 82 | 7.2500 |
| 27 | 8.6100 | 55 | 8.9000 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

Contd.

T = 1.0000 NO. OF ITERATIONS = 11 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 8.1984 | 58 | 7.5644 |
| 3 | 7.2000 | 31 | 8.7799 | 59 | 8.2329 |
| 4 | 7.2000 | 32 | 9.0169 | 60 | 8.6559 |
| 5 | 7.9000 | 33 | 8.9071 | 61 | 8.5829 |
| 6 | 8.4000 | 34 | 8.7829 | 62 | 8.4902 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1580 | 37 | 8.4340 | 65 | 7.2535 |
| 10 | 7.3471 | 38 | 9.0839 | 66 | 7.7929 |
| 11 | 7.4522 | 39 | 9.3315 | 67 | 8.1120 |
| 12 | 7.8764 | 40 | 9.1336 | 68 | 8.1341 |
| 13 | 8.2927 | 41 | 8.9708 | 69 | 8.0699 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.4364 | 44 | 8.3218 | 72 | 6.9643 |
| 17 | 7.8413 | 45 | 9.0528 | 73 | 7.3713 |
| 18 | 7.9559 | 46 | 9.3143 | 74 | 7.6116 |
| 19 | 8.1458 | 47 | 9.1486 | 75 | 7.6993 |
| 20 | 8.3480 | 48 | 9.0132 | 76 | 7.6366 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.8421 | 51 | 7.9870 | 79 | 6.7100 |
| 24 | 8.3359 | 52 | 8.7058 | 80 | 7.0000 |
| 25 | 8.4597 | 53 | 9.0858 | 81 | 7.1000 |
| 26 | 8.5175 | 54 | 8.9436 | 82 | 7.2500 |
| 27 | 8.5252 | 55 | 8.8365 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | -.0015 | .0015 | .0000 | 9 |
| 10 | .0000 | -.0027 | .0027 | .0000 | 10 |
| 11 | .0000 | -.0044 | .0044 | .0000 | 11 |
| 12 | .0000 | -.0033 | .0032 | .0000 | 12 |
| 13 | .0000 | -.0014 | .0014 | .0000 | 13 |
| 16 | .0000 | .0016 | -.0016 | .0000 | 16 |
| 17 | .0000 | .0016 | -.0016 | .0000 | 17 |
| 18 | .0000 | -.0006 | .0005 | .0000 | 18 |
| 19 | .0000 | -.0015 | .0015 | .0000 | 19 |
| 20 | .0000 | -.0005 | .0005 | .0000 | 20 |
| 23 | .0000 | .0011 | -.0011 | .0000 | 23 |
| 24 | .0000 | .0026 | -.0026 | .0000 | 24 |
| 25 | .0000 | -.0006 | .0006 | .0000 | 25 |
| 26 | .0000 | -.0002 | .0002 | .0000 | 26 |
| 27 | .0000 | .0008 | -.0008 | .0000 | 27 |
| 30 | .0000 | .0000 | -.0000 | .0000 | 30 |
| 31 | .0000 | .0031 | -.0031 | .0000 | 31 |
| 32 | .0000 | .0047 | -.0047 | .0000 | 32 |
| 33 | .0000 | .0019 | -.0019 | .0000 | 33 |
| 34 | .0000 | .0021 | -.0021 | .0000 | 34 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 37 | .0000 | .0016 | -.0016 | .0000 | 37 |
| 38 | .0000 | .0050 | -.0050 | .0000 | 38 |
| 39 | .0000 | .0065 | -.0065 | .0000 | 39 |
| 40 | .0000 | .0026 | -.0026 | .0000 | 40 |
| 41 | .0000 | .0012 | -.0012 | .0000 | 41 |
| 44 | .0000 | .0008 | -.0008 | .0000 | 44 |
| 45 | .0000 | .0044 | -.0044 | .0000 | 45 |
| 46 | .0000 | .0047 | -.0048 | .0000 | 46 |
| 47 | .0000 | .0025 | -.0025 | .0000 | 47 |
| 48 | .0000 | .0018 | -.0018 | .0000 | 48 |
| 51 | .0000 | .0001 | -.0001 | .0000 | 51 |
| 52 | .0000 | .0019 | -.0019 | .0000 | 52 |
| 53 | .0000 | .0051 | -.0051 | .0000 | 53 |
| 54 | .0000 | .0016 | -.0016 | .0000 | 54 |
| 55 | .0000 | .0006 | -.0006 | .0000 | 55 |
| 58 | .0000 | -.0016 | .0016 | .0000 | 58 |
| 59 | .0000 | .0007 | -.0007 | .0000 | 59 |
| 60 | .0000 | .0044 | -.0044 | .0000 | 60 |
| 61 | .0000 | .0012 | -.0012 | .0000 | 61 |
| 62 | .0000 | .0001 | -.0001 | .0000 | 62 |
| 65 | .0000 | -.0005 | .0005 | .0000 | 65 |
| 66 | .0000 | .0010 | -.0010 | .0000 | 66 |
| 67 | .0000 | .0018 | -.0018 | .0000 | 67 |
| 68 | .0000 | .0007 | -.0007 | .0000 | 68 |
| 69 | .0000 | -.0002 | .0002 | .0000 | 69 |
| 72 | .0000 | -.0006 | .0006 | .0000 | 72 |
| 73 | .0000 | .0003 | -.0003 | .0000 | 73 |
| 74 | .0000 | .0009 | -.0009 | .0000 | 74 |
| 75 | .0000 | .0010 | -.0010 | .0000 | 75 |
| 76 | .0000 | -.0004 | .0004 | .0000 | 76 |
| TOTAL | .0000 | .0523 | -.0525 | .0000 | |

T = 2.0000 NO. OF ITERATIONS = 8 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 8.1096 | 58 | 7.5888 |
| 3 | 7.2000 | 31 | 8.5311 | 59 | 8.1156 |
| 4 | 7.2000 | 32 | 8.7376 | 60 | 8.4101 |
| 5 | 7.9000 | 33 | 8.7441 | 61 | 8.4523 |
| 6 | 8.4000 | 34 | 8.6773 | 62 | 8.4445 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1913 | 37 | 8.2963 | 65 | 7.2647 |
| 10 | 7.4253 | 38 | 8.7489 | 66 | 7.7116 |
| 11 | 7.5924 | 39 | 8.9506 | 67 | 7.9727 |
| 12 | 7.9896 | 40 | 8.9137 | 68 | 8.0521 |
| 13 | 8.3431 | 41 | 8.8579 | 69 | 8.0491 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.3723 | 44 | 8.2132 | 72 | 6.9785 |
| 17 | 7.7765 | 45 | 8.7413 | 73 | 7.3370 |
| 18 | 7.9812 | 46 | 8.9599 | 74 | 7.5450 |
| 19 | 8.1999 | 47 | 8.9331 | 75 | 7.6470 |
| 20 | 8.3662 | 48 | 8.8975 | 76 | 7.6310 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.7547 | 51 | 7.9375 | 79 | 6.7100 |
| 24 | 8.1743 | 52 | 9.5004 | 80 | 7.0000 |
| 25 | 8.3802 | 53 | 8.7682 | 81 | 7.1000 |
| 26 | 8.4738 | 54 | 8.7672 | 82 | 7.2500 |
| 27 | 8.4798 | 55 | 8.7579 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | -.0003 | .0003 | .0000 | 9 |
| 10 | .0000 | -.0008 | .0008 | .0000 | 10 |
| 11 | .0000 | -.0014 | .0014 | .0000 | 11 |
| 12 | .0000 | -.0011 | .0011 | .0000 | 12 |
| 13 | .0000 | -.0005 | .0005 | .0000 | 13 |
| 16 | .0000 | .0006 | -.0006 | .0000 | 16 |
| 17 | .0000 | .0006 | -.0006 | .0000 | 17 |
| 18 | .0000 | -.0003 | .0003 | .0000 | 18 |
| 19 | .0000 | -.0005 | .0006 | .0000 | 19 |
| 20 | .0000 | -.0002 | .0002 | .0000 | 20 |
| 23 | .0000 | .0009 | -.0009 | .0000 | 23 |
| 24 | .0000 | .0016 | -.0016 | .0000 | 24 |
| 25 | .0000 | .0008 | -.0008 | .0000 | 25 |
| 26 | .0000 | .0004 | -.0004 | .0000 | 26 |
| 27 | .0000 | .0004 | -.0004 | .0000 | 27 |
| 30 | .0000 | .0009 | -.0009 | .0000 | 30 |
| 31 | .0000 | .0024 | -.0024 | .0000 | 31 |
| 32 | .0000 | .0027 | -.0027 | .0000 | 32 |
| 33 | .0000 | .0016 | -.0016 | .0000 | 33 |
| 34 | .0000 | .0010 | -.0010 | .0000 | 34 |
| 37 | .0000 | .0013 | -.0013 | .0000 | 37 |
| 38 | .0000 | .0032 | -.0032 | .0000 | 38 |
| 39 | .0000 | .0037 | -.0037 | .0000 | 39 |
| 40 | .0000 | .0022 | -.0022 | .0000 | 40 |
| 41 | .0000 | .0011 | -.0011 | .0000 | 41 |
| 44 | .0000 | .0011 | -.0011 | .0000 | 44 |
| 45 | .0000 | .0030 | -.0030 | .0000 | 45 |
| 46 | .0000 | .0035 | -.0035 | .0000 | 46 |
| 47 | .0000 | .0022 | -.0022 | .0000 | 47 |
| 48 | .0000 | .0011 | -.0011 | .0000 | 48 |
| 51 | .0000 | .0005 | -.0005 | .0000 | 51 |
| 52 | .0000 | .0020 | -.0020 | .0000 | 52 |
| 53 | .0000 | .0031 | -.0031 | .0000 | 53 |
| 54 | .0000 | .0018 | -.0018 | .0000 | 54 |
| 55 | .0000 | .0008 | -.0008 | .0000 | 55 |
| 58 | .0000 | -.0002 | .0002 | .0000 | 58 |
| 59 | .0000 | .0012 | -.0012 | .0000 | 59 |
| 60 | .0000 | .0024 | -.0024 | .0000 | 60 |
| 61 | .0000 | .0013 | -.0013 | .0000 | 61 |
| 62 | .0000 | .0005 | -.0005 | .0000 | 62 |
| 65 | .0000 | -.0001 | .0001 | .0000 | 65 |
| 66 | .0000 | .0008 | -.0008 | .0000 | 66 |
| 67 | .0000 | .0014 | -.0014 | .0000 | 67 |
| 68 | .0000 | .0008 | -.0008 | .0000 | 68 |
| 69 | .0000 | .0002 | -.0002 | .0000 | 69 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 72 | .0000 | -.0001 | .0001 | .0000 | 72 |
| 73 | .0000 | .0003 | -.0003 | .0000 | 73 |
| 74 | .0000 | .0007 | -.0007 | .0000 | 74 |
| 75 | .0000 | .0005 | -.0005 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0493 | -.0490 | .0000 | |

T = 3.0000 NO. OF ITERATIONS = 8 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 8.0184 | 58 | 7.5630 |
| 3 | 7.2000 | 31 | 8.3485 | 59 | 8.0000 |
| 4 | 7.2000 | 32 | 8.5475 | 60 | 8.2433 |
| 5 | 7.9000 | 33 | 8.6156 | 61 | 8.3377 |
| 6 | 8.4000 | 34 | 8.6074 | 62 | 8.3931 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1930 | 37 | 8.1823 | 65 | 7.2507 |
| 10 | 7.4396 | 38 | 8.5176 | 66 | 7.6397 |
| 11 | 7.6295 | 39 | 8.7021 | 67 | 7.8689 |
| 12 | 8.0233 | 40 | 8.7462 | 68 | 7.9773 |
| 13 | 8.3582 | 41 | 8.7723 | 69 | 8.0177 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.3337 | 44 | 8.1098 | 72 | 6.9741 |
| 17 | 7.7296 | 45 | 8.5138 | 73 | 7.3034 |
| 18 | 7.9679 | 46 | 8.7088 | 74 | 7.4940 |
| 19 | 8.2031 | 47 | 8.7573 | 75 | 7.6074 |
| 20 | 8.3653 | 48 | 8.8106 | 76 | 7.6162 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.6854 | 51 | 7.8716 | 79 | 6.7100 |
| 24 | 8.0580 | 52 | 8.3244 | 80 | 7.0000 |
| 25 | 8.2866 | 53 | 8.5477 | 81 | 7.1000 |
| 26 | 8.4139 | 54 | 8.6168 | 82 | 7.2500 |
| 27 | 8.4443 | 55 | 8.6860 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | -.0000 | -.0000 | .0000 | 9 |
| 10 | .0000 | -.0001 | .0001 | .0000 | 10 |
| 11 | .0000 | -.0004 | .0004 | .0000 | 11 |
| 12 | .0000 | -.0003 | .0003 | .0000 | 12 |
| 13 | .0000 | -.0001 | .0002 | .0000 | 13 |
| 16 | .0000 | .0004 | -.0004 | .0000 | 16 |
| 17 | .0000 | .0005 | -.0005 | .0000 | 17 |
| 18 | .0000 | .0001 | -.0001 | .0000 | 18 |
| 19 | .0000 | -.0000 | .0000 | .0000 | 19 |
| 20 | .0000 | .0000 | .0000 | .0000 | 20 |
| 23 | .0000 | .0007 | -.0007 | .0000 | 23 |
| 24 | .0000 | .0012 | -.0011 | .0000 | 24 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 25 | .0000 | .0009 | -.0009 | .0000 | 25 |
| 26 | .0000 | .0006 | -.0006 | .0000 | 26 |
| 27 | .0000 | .0004 | -.0003 | .0000 | 27 |
| 30 | .0000 | .0009 | -.0009 | .0000 | 30 |
| 31 | .0000 | .0018 | -.0018 | .0000 | 31 |
| 32 | .0000 | .0019 | -.0018 | .0000 | 32 |
| 33 | .0000 | .0013 | -.0013 | .0000 | 33 |
| 34 | .0000 | .0007 | -.0007 | .0000 | 34 |
| 37 | .0000 | .0011 | -.0011 | .0000 | 37 |
| 38 | .0000 | .0022 | -.0022 | .0000 | 38 |
| 39 | .0000 | .0024 | -.0024 | .0000 | 39 |
| 40 | .0000 | .0016 | -.0016 | .0000 | 40 |
| 41 | .0000 | .0008 | -.0008 | .0000 | 41 |
| 44 | .0000 | .0010 | -.0010 | .0000 | 44 |
| 45 | .0000 | .0022 | -.0022 | .0000 | 45 |
| 46 | .0000 | .0025 | -.0024 | .0000 | 46 |
| 47 | .0000 | .0017 | -.0017 | .0000 | 47 |
| 48 | .0000 | .0008 | -.0008 | .0000 | 48 |
| 51 | .0000 | .0007 | -.0007 | .0000 | 51 |
| 52 | .0000 | .0017 | -.0017 | .0000 | 52 |
| 53 | .0000 | .0022 | -.0022 | .0000 | 53 |
| 54 | .0000 | .0015 | -.0015 | .0000 | 54 |
| 55 | .0000 | .0007 | -.0007 | .0000 | 55 |
| 58 | .0000 | .0003 | -.0003 | .0000 | 58 |
| 59 | .0000 | .0011 | -.0011 | .0000 | 59 |
| 60 | .0000 | .0017 | -.0016 | .0000 | 60 |
| 61 | .0000 | .0012 | -.0012 | .0000 | 61 |
| 62 | .0000 | .0005 | -.0005 | .0000 | 62 |
| 65 | .0000 | .0001 | -.0001 | .0000 | 65 |
| 66 | .0000 | .0007 | -.0007 | .0000 | 66 |
| 67 | .0000 | .0010 | -.0010 | .0000 | 67 |
| 68 | .0000 | .0007 | -.0007 | .0000 | 68 |
| 69 | .0000 | .0003 | -.0003 | .0000 | 69 |
| 72 | .0000 | .0000 | -.0000 | .0000 | 72 |
| 73 | .0000 | .0003 | -.0003 | .0000 | 73 |
| 74 | .0000 | .0005 | -.0005 | .0000 | 74 |
| 75 | .0000 | .0004 | -.0004 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0425 | -.0423 | .0000 | |

T = 4.0000 NO. OF ITERATIONS = 8 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.9415 | 58 | 7.5220 |
| 3 | 7.2000 | 31 | 8.2124 | 59 | 7.8989 |
| 4 | 7.2000 | 32 | 8.4077 | 60 | 8.1191 |
| 5 | 7.9000 | 33 | 8.5144 | 61 | 8.2436 |
| 6 | 8.4000 | 34 | 8.5546 | 62 | 8.3468 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1854 | 37 | 8.0903 | 65 | 7.2264 |
| 10 | 7.4323 | 38 | 8.3499 | 66 | 7.5763 |
| 11 | 7.6303 | 39 | 8.5267 | 67 | 7.7884 |
| 12 | 8.0265 | 40 | 8.6194 | 68 | 7.9144 |
| 13 | 8.3593 | 41 | 8.7071 | 69 | 7.9870 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 14 | 6.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.3030 | 44 | 8.0209 | 72 | 6.9629 |
| 17 | 7.6863 | 45 | 8.3434 | 73 | 7.2727 |
| 18 | 7.9361 | 46 | 8.5268 | 74 | 7.4537 |
| 19 | 8.1837 | 47 | 8.6244 | 75 | 7.5750 |
| 20 | 8.3547 | 48 | 8.7433 | 76 | 7.6009 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.6297 | 51 | 7.8048 | 79 | 6.7100 |
| 24 | 7.9676 | 52 | 8.1816 | 80 | 7.0000 |
| 25 | 8.2016 | 53 | 8.3855 | 81 | 7.1000 |
| 26 | 8.3539 | 54 | 8.4969 | 82 | 7.2500 |
| 27 | 8.4127 | 55 | 8.6262 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0001 | -.0001 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0000 | .0000 | .0000 | 11 |
| 12 | .0000 | -.0000 | .0000 | .0000 | 12 |
| 13 | .0000 | -.0000 | .0000 | .0000 | 13 |
| 16 | .0000 | .0003 | -.0003 | .0000 | 16 |
| 17 | .0000 | .0004 | -.0004 | .0000 | 17 |
| 18 | .0000 | .0003 | -.0003 | .0000 | 18 |
| 19 | .0000 | .0002 | -.0002 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0006 | -.0005 | .0000 | 23 |
| 24 | .0000 | .0009 | -.0009 | .0000 | 24 |
| 25 | .0000 | .0008 | -.0008 | .0000 | 25 |
| 26 | .0000 | .0006 | -.0006 | .0000 | 26 |
| 27 | .0000 | .0003 | -.0003 | .0000 | 27 |
| 30 | .0000 | .0008 | -.0008 | .0000 | 30 |
| 31 | .0000 | .0013 | -.0013 | .0000 | 31 |
| 32 | .0000 | .0014 | -.0014 | .0000 | 32 |
| 33 | .0000 | .0010 | -.0010 | .0000 | 33 |
| 34 | .0000 | .0005 | -.0005 | .0000 | 34 |
| 37 | .0000 | .0009 | -.0009 | .0000 | 37 |
| 38 | .0000 | .0016 | -.0016 | .0000 | 38 |
| 39 | .0000 | .0017 | -.0017 | .0000 | 39 |
| 40 | .0000 | .0012 | -.0012 | .0000 | 40 |
| 41 | .0000 | .0006 | -.0006 | .0000 | 41 |
| 44 | .0000 | .0009 | -.0009 | .0000 | 44 |
| 45 | .0000 | .0017 | -.0017 | .0000 | 45 |
| 46 | .0000 | .0018 | -.0018 | .0000 | 46 |
| 47 | .0000 | .0013 | -.0013 | .0000 | 47 |
| 48 | .0000 | .0007 | -.0007 | .0000 | 48 |
| 51 | .0000 | .0007 | -.0007 | .0000 | 51 |
| 52 | .0000 | .0014 | -.0014 | .0000 | 52 |
| 53 | .0000 | .0016 | -.0016 | .0000 | 53 |
| 54 | .0000 | .0012 | -.0012 | .0000 | 54 |
| 55 | .0000 | .0006 | -.0006 | .0000 | 55 |
| 58 | .0000 | .0004 | -.0004 | .0000 | 58 |
| 59 | .0000 | .0010 | -.0010 | .0000 | 59 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 60 | .0000 | .0012 | -.0012 | .0000 | 60 |
| 61 | .0000 | .0009 | -.0009 | .0000 | 61 |
| 62 | .0000 | .0005 | -.0005 | .0000 | 62 |
| 65 | .0000 | .0002 | -.0002 | .0000 | 65 |
| 66 | .0000 | .0006 | -.0006 | .0000 | 66 |
| 67 | .0000 | .0008 | -.0008 | .0000 | 67 |
| 68 | .0000 | .0006 | -.0006 | .0000 | 68 |
| 69 | .0000 | .0003 | -.0003 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0003 | -.0003 | .0000 | 73 |
| 74 | .0000 | .0004 | -.0004 | .0000 | 74 |
| 75 | .0000 | .0003 | -.0003 | .0000 | 75 |
| 76 | .0000 | .0002 | -.0002 | .0000 | 76 |
| TOTAL | .0000 | .0354 | -.0352 | .0000 | |

T = 5.0000 NO. OF ITERATIONS = 7 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.8793 | 58 | 7.4795 |
| 3 | 7.2000 | 31 | 8.1081 | 59 | 7.8140 |
| 4 | 7.2000 | 32 | 8.3004 | 60 | 8.0229 |
| 5 | 7.9000 | 33 | 8.4339 | 61 | 8.1683 |
| 6 | 8.4000 | 34 | 8.5127 | 62 | 8.3082 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1753 | 37 | 8.0169 | 65 | 7.1998 |
| 10 | 7.4182 | 38 | 8.2241 | 66 | 7.5218 |
| 11 | 7.6186 | 39 | 8.3966 | 67 | 7.7244 |
| 12 | 8.0185 | 40 | 8.5222 | 68 | 7.8631 |
| 13 | 8.3550 | 41 | 8.6566 | 69 | 7.9605 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.2764 | 44 | 7.9474 | 72 | 6.9501 |
| 17 | 7.6461 | 45 | 8.2133 | 73 | 7.2459 |
| 18 | 7.8988 | 46 | 8.3908 | 74 | 7.4212 |
| 19 | 8.1566 | 47 | 8.5223 | 75 | 7.5485 |
| 20 | 8.3406 | 48 | 8.6909 | 76 | 7.5873 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.5843 | 51 | 7.7444 | 79 | 6.7100 |
| 24 | 7.8945 | 52 | 8.0674 | 80 | 7.0000 |
| 25 | 8.1285 | 53 | 8.2624 | 81 | 7.1000 |
| 26 | 8.2996 | 54 | 8.4030 | 82 | 7.2500 |
| 27 | 8.3845 | 55 | 8.5781 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0001 | -.0001 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 13 | .0000 | .0000 | -.0000 | .0000 | 13 |
| 16 | .0000 | .0003 | -.0003 | .0000 | 16 |
| 17 | .0000 | .0004 | -.0004 | .0000 | 17 |
| 18 | .0000 | .0004 | -.0004 | .0000 | 18 |
| 19 | .0000 | .0003 | -.0003 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0005 | -.0004 | .0000 | 23 |
| 24 | .0000 | .0007 | -.0007 | .0000 | 24 |
| 25 | .0000 | .0007 | -.0007 | .0000 | 25 |
| 26 | .0000 | .0005 | -.0005 | .0000 | 26 |
| 27 | .0000 | .0003 | -.0003 | .0000 | 27 |
| 30 | .0000 | .0006 | -.0006 | .0000 | 30 |
| 31 | .0000 | .0010 | -.0010 | .0000 | 31 |
| 32 | .0000 | .0010 | -.0010 | .0000 | 32 |
| 33 | .0000 | .0008 | -.0008 | .0000 | 33 |
| 34 | .0000 | .0004 | -.0004 | .0000 | 34 |
| 37 | .0000 | .0007 | -.0007 | .0000 | 37 |
| 38 | .0000 | .0012 | -.0012 | .0000 | 38 |
| 39 | .0000 | .0013 | -.0012 | .0000 | 39 |
| 40 | .0000 | .0010 | -.0009 | .0000 | 40 |
| 41 | .0000 | .0005 | -.0005 | .0000 | 41 |
| 44 | .0000 | .0007 | -.0007 | .0000 | 44 |
| 45 | .0000 | .0013 | -.0013 | .0000 | 45 |
| 46 | .0000 | .0013 | -.0013 | .0000 | 46 |
| 47 | .0000 | .0010 | -.0010 | .0000 | 47 |
| 48 | .0000 | .0005 | -.0005 | .0000 | 48 |
| 51 | .0000 | .0006 | -.0006 | .0000 | 51 |
| 52 | .0000 | .0011 | -.0011 | .0000 | 52 |
| 53 | .0000 | .0012 | -.0012 | .0000 | 53 |
| 54 | .0000 | .0009 | -.0009 | .0000 | 54 |
| 55 | .0000 | .0005 | -.0005 | .0000 | 55 |
| 58 | .0000 | .0004 | -.0004 | .0000 | 58 |
| 59 | .0000 | .0008 | -.0008 | .0000 | 59 |
| 60 | .0000 | .0010 | -.0009 | .0000 | 60 |
| 61 | .0000 | .0008 | -.0008 | .0000 | 61 |
| 62 | .0000 | .0004 | -.0004 | .0000 | 62 |
| 65 | .0000 | .0003 | -.0003 | .0000 | 65 |
| 66 | .0000 | .0005 | -.0005 | .0000 | 66 |
| 67 | .0000 | .0006 | -.0006 | .0000 | 67 |
| 68 | .0000 | .0005 | -.0005 | .0000 | 68 |
| 69 | .0000 | .0003 | -.0003 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0003 | -.0003 | .0000 | 73 |
| 74 | .0000 | .0003 | -.0003 | .0000 | 74 |
| 75 | .0000 | .0003 | -.0003 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0291 | -.0288 | .0000 | |

T = 6.0000 NO. OF ITERATIONS = 7 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.8299 | 58 | 7.4410 |
| 3 | 7.2000 | 31 | 8.0272 | 59 | 7.7444 |
| 4 | 7.2000 | 32 | 8.2168 | 60 | 7.9474 |
| 5 | 7.9000 | 33 | 8.3700 | 61 | 8.1087 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 6 | 8.4000 | 34 | 8.4792 | 62 | 8.2771 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1655 | 37 | 7.9589 | 65 | 7.1749 |
| 10 | 7.4030 | 38 | 8.1281 | 66 | 7.4762 |
| 11 | 7.6037 | 39 | 8.2977 | 67 | 7.6734 |
| 12 | 8.0071 | 40 | 8.4471 | 68 | 7.8217 |
| 13 | 8.3490 | 41 | 8.6173 | 69 | 7.9387 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.2538 | 44 | 7.8880 | 72 | 6.9378 |
| 17 | 7.6105 | 45 | 8.1129 | 73 | 7.2230 |
| 18 | 7.8631 | 46 | 8.2874 | 74 | 7.3949 |
| 19 | 8.1291 | 47 | 8.4435 | 75 | 7.5269 |
| 20 | 8.3263 | 48 | 8.6501 | 76 | 7.5759 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.5474 | 51 | 7.6931 | 79 | 6.7100 |
| 24 | 7.8354 | 52 | 7.9768 | 80 | 7.0000 |
| 25 | 8.0676 | 53 | 8.1675 | 81 | 7.1000 |
| 26 | 8.2530 | 54 | 8.3298 | 82 | 7.2500 |
| 27 | 8.3603 | 55 | 8.5401 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0001 | -.0001 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |
| 13 | .0000 | .0001 | -.0001 | .0000 | 13 |
| 16 | .0000 | .0002 | -.0002 | .0000 | 16 |
| 17 | .0000 | .0004 | -.0003 | .0000 | 17 |
| 18 | .0000 | .0004 | -.0003 | .0000 | 18 |
| 19 | .0000 | .0003 | -.0003 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0004 | -.0004 | .0000 | 23 |
| 24 | .0000 | .0006 | -.0006 | .0000 | 24 |
| 25 | .0000 | .0006 | -.0006 | .0000 | 25 |
| 26 | .0000 | .0005 | -.0005 | .0000 | 26 |
| 27 | .0000 | .0002 | -.0002 | .0000 | 27 |
| 30 | .0000 | .0005 | -.0005 | .0000 | 30 |
| 31 | .0000 | .0008 | -.0008 | .0000 | 31 |
| 32 | .0000 | .0008 | -.0008 | .0000 | 32 |
| 33 | .0000 | .0006 | -.0006 | .0000 | 33 |
| 34 | .0000 | .0003 | -.0003 | .0000 | 34 |
| 37 | .0000 | .0006 | -.0006 | .0000 | 37 |
| 38 | .0000 | .0009 | -.0009 | .0000 | 38 |
| 39 | .0000 | .0010 | -.0009 | .0000 | 39 |
| 40 | .0000 | .0007 | -.0007 | .0000 | 40 |
| 41 | .0000 | .0004 | -.0004 | .0000 | 41 |
| 44 | .0000 | .0006 | -.0006 | .0000 | 44 |
| 45 | .0000 | .0010 | -.0010 | .0000 | 45 |
| 46 | .0000 | .0010 | -.0010 | .0000 | 46 |
| 47 | .0000 | .0008 | -.0008 | .0000 | 47 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 48 | .0000 | .0004 | -.0004 | .0000 | 48 |
| 51 | .0000 | .0005 | -.0005 | .0000 | 51 |
| 52 | .0000 | .0009 | -.0009 | .0000 | 52 |
| 53 | .0000 | .0009 | -.0009 | .0000 | 53 |
| 54 | .0000 | .0007 | -.0007 | .0000 | 54 |
| 55 | .0000 | .0004 | -.0004 | .0000 | 55 |
| 58 | .0000 | .0004 | -.0004 | .0000 | 58 |
| 59 | .0000 | .0007 | -.0007 | .0000 | 59 |
| 60 | .0000 | .0007 | -.0007 | .0000 | 60 |
| 61 | .0000 | .0006 | -.0006 | .0000 | 61 |
| 62 | .0000 | .0003 | -.0003 | .0000 | 62 |
| 65 | .0000 | .0002 | -.0002 | .0000 | 65 |
| 66 | .0000 | .0004 | -.0004 | .0000 | 66 |
| 67 | .0000 | .0005 | -.0005 | .0000 | 67 |
| 68 | .0000 | .0004 | -.0004 | .0000 | 68 |
| 69 | .0000 | .0002 | -.0002 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0002 | -.0002 | .0000 | 73 |
| 74 | .0000 | .0003 | -.0003 | .0000 | 74 |
| 75 | .0000 | .0002 | -.0002 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0235 | -.0233 | .0000 | |

T = 7.0000 NO. OF ITERATIONS = 6 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.7904 | 58 | 7.4080 |
| 3 | 7.2000 | 31 | 7.9632 | 59 | 7.6879 |
| 4 | 7.2000 | 32 | 8.1505 | 60 | 7.8876 |
| 5 | 7.9000 | 33 | 8.3187 | 61 | 8.0614 |
| 6 | 8.4000 | 34 | 8.4522 | 62 | 8.2522 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1565 | 37 | 7.9129 | 65 | 7.1530 |
| 10 | 7.3887 | 38 | 8.0531 | 66 | 7.4385 |
| 11 | 7.5890 | 39 | 8.2209 | 67 | 7.6324 |
| 12 | 7.9956 | 40 | 8.3882 | 68 | 7.7886 |
| 13 | 8.3429 | 41 | 8.5862 | 69 | 7.9211 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.2344 | 44 | 7.8402 | 72 | 6.9268 |
| 17 | 7.5796 | 45 | 8.0344 | 73 | 7.2039 |
| 18 | 7.8312 | 46 | 8.2073 | 74 | 7.3737 |
| 19 | 8.1041 | 47 | 8.3821 | 75 | 7.5096 |
| 20 | 8.3132 | 48 | 8.6180 | 76 | 7.5667 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.5173 | 51 | 7.6506 | 79 | 6.7100 |
| 24 | 7.7872 | 52 | 7.9047 | 80 | 7.0000 |
| 25 | 8.0170 | 53 | 8.0933 | 81 | 7.1000 |
| 26 | 8.2137 | 54 | 8.2724 | 82 | 7.2500 |
| 27 | 8.3338 | 55 | 8.5101 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

Contd.

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| (ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS) | | | | | |
| 9 | .0000 | .0001 | -.0001 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |
| 13 | .0000 | .0001 | -.0001 | .0000 | 13 |
| 16 | .0000 | .0002 | -.0002 | .0000 | 16 |
| 17 | .0000 | .0003 | -.0003 | .0000 | 17 |
| 18 | .0000 | .0003 | -.0003 | .0000 | 18 |
| 19 | .0000 | .0003 | -.0002 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0003 | -.0003 | .0000 | 23 |
| 24 | .0000 | .0005 | -.0005 | .0000 | 24 |
| 25 | .0000 | .0005 | -.0005 | .0000 | 25 |
| 26 | .0000 | .0004 | -.0004 | .0000 | 26 |
| 27 | .0000 | .0002 | -.0002 | .0000 | 27 |
| 30 | .0000 | .0004 | -.0004 | .0000 | 30 |
| 31 | .0000 | .0006 | -.0006 | .0000 | 31 |
| 32 | .0000 | .0006 | -.0006 | .0000 | 32 |
| 33 | .0000 | .0005 | -.0005 | .0000 | 33 |
| 34 | .0000 | .0003 | -.0003 | .0000 | 34 |
| 37 | .0000 | .0004 | -.0004 | .0000 | 37 |
| 38 | .0000 | .0007 | -.0007 | .0000 | 38 |
| 39 | .0000 | .0007 | -.0007 | .0000 | 39 |
| 40 | .0000 | .0006 | -.0006 | .0000 | 40 |
| 41 | .0000 | .0003 | -.0003 | .0000 | 41 |
| 44 | .0000 | .0005 | -.0005 | .0000 | 44 |
| 45 | .0000 | .0008 | -.0008 | .0000 | 45 |
| 46 | .0000 | .0008 | -.0008 | .0000 | 46 |
| 47 | .0000 | .0006 | -.0006 | .0000 | 47 |
| 48 | .0000 | .0003 | -.0003 | .0000 | 48 |
| 51 | .0000 | .0004 | -.0004 | .0000 | 51 |
| 52 | .0000 | .0007 | -.0007 | .0000 | 52 |
| 53 | .0000 | .0007 | -.0007 | .0000 | 53 |
| 54 | .0000 | .0006 | -.0006 | .0000 | 54 |
| 55 | .0000 | .0003 | -.0003 | .0000 | 55 |
| 58 | .0000 | .0003 | -.0003 | .0000 | 58 |
| 59 | .0000 | .0006 | -.0006 | .0000 | 59 |
| 60 | .0000 | .0006 | -.0006 | .0000 | 60 |
| 61 | .0000 | .0005 | -.0005 | .0000 | 61 |
| 62 | .0000 | .0002 | -.0002 | .0000 | 62 |
| 65 | .0000 | .0002 | -.0002 | .0000 | 65 |
| 66 | .0000 | .0004 | -.0004 | .0000 | 66 |
| 67 | .0000 | .0004 | -.0004 | .0000 | 67 |
| 68 | .0000 | .0003 | -.0003 | .0000 | 68 |
| 69 | .0000 | .0002 | -.0002 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0002 | -.0002 | .0000 | 73 |
| 74 | .0000 | .0002 | -.0002 | .0000 | 74 |
| 75 | .0000 | .0002 | -.0002 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0190 | -.0187 | .0000 | |

T = 8.0000 NO. OF ITERATIONS = 6 NO. OF SUBITERATIONS = 0

Contd.

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.7591 | 58 | 7.3807 |
| 3 | 7.2000 | 31 | 7.9128 | 59 | 7.6425 |
| 4 | 7.2000 | 32 | 8.0981 | 60 | 7.8403 |
| 5 | 7.9000 | 33 | 8.2780 | 61 | 8.0242 |
| 6 | 8.4000 | 34 | 8.4307 | 62 | 8.2326 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1488 | 37 | 7.8766 | 65 | 7.1347 |
| 10 | 7.3763 | 38 | 7.9946 | 66 | 7.4078 |
| 11 | 7.5759 | 39 | 8.1609 | 67 | 7.5998 |
| 12 | 7.9853 | 40 | 8.3420 | 68 | 7.7624 |
| 13 | 8.3374 | 41 | 8.5618 | 69 | 7.9071 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.2184 | 44 | 7.8023 | 72 | 6.9175 |
| 17 | 7.5538 | 45 | 7.9729 | 73 | 7.1883 |
| 18 | 7.8040 | 46 | 8.1449 | 74 | 7.3567 |
| 19 | 8.0825 | 47 | 8.3342 | 75 | 7.4957 |
| 20 | 8.3020 | 48 | 8.5929 | 76 | 7.5593 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.4931 | 51 | 7.6161 | 79 | 6.7100 |
| 24 | 7.7482 | 52 | 7.8476 | 80 | 7.0000 |
| 25 | 7.9760 | 53 | 8.0353 | 81 | 7.1000 |
| 26 | 8.1816 | 54 | 8.2275 | 82 | 7.2500 |
| 27 | 8.3229 | 55 | 8.4866 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0001 | -.0001 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |
| 13 | .0000 | .0001 | -.0001 | .0000 | 13 |
| 16 | .0000 | .0002 | -.0002 | .0000 | 16 |
| 17 | .0000 | .0003 | -.0002 | .0000 | 17 |
| 18 | .0000 | .0003 | -.0003 | .0000 | 18 |
| 19 | .0000 | .0002 | -.0002 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0002 | -.0002 | .0000 | 23 |
| 24 | .0000 | .0004 | -.0004 | .0000 | 24 |
| 25 | .0000 | .0004 | -.0004 | .0000 | 25 |
| 26 | .0000 | .0003 | -.0003 | .0000 | 26 |
| 27 | .0000 | .0002 | -.0002 | .0000 | 27 |
| 30 | .0000 | .0003 | -.0003 | .0000 | 30 |
| 31 | .0000 | .0005 | -.0005 | .0000 | 31 |
| 32 | .0000 | .0005 | -.0005 | .0000 | 32 |
| 33 | .0000 | .0004 | -.0004 | .0000 | 33 |
| 34 | .0000 | .0002 | -.0002 | .0000 | 34 |
| 37 | .0000 | .0004 | -.0003 | .0000 | 37 |
| 38 | .0000 | .0006 | -.0006 | .0000 | 38 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 39 | .0000 | .0006 | -.0006 | .0000 | 39 |
| 40 | .0000 | .0005 | -.0004 | .0000 | 40 |
| 41 | .0000 | .0002 | -.0002 | .0000 | 41 |
| 44 | .0000 | .0004 | -.0004 | .0000 | 44 |
| 45 | .0000 | .0006 | -.0006 | .0000 | 45 |
| 46 | .0000 | .0006 | -.0006 | .0000 | 46 |
| 47 | .0000 | .0005 | -.0005 | .0000 | 47 |
| 48 | .0000 | .0002 | -.0002 | .0000 | 48 |
| 51 | .0000 | .0003 | -.0003 | .0000 | 51 |
| 52 | .0000 | .0006 | -.0006 | .0000 | 52 |
| 53 | .0000 | .0006 | -.0006 | .0000 | 53 |
| 54 | .0000 | .0005 | -.0004 | .0000 | 54 |
| 55 | .0000 | .0002 | -.0002 | .0000 | 55 |
| 58 | .0000 | .0003 | -.0003 | .0000 | 58 |
| 59 | .0000 | .0004 | -.0004 | .0000 | 59 |
| 60 | .0000 | .0005 | -.0005 | .0000 | 60 |
| 61 | .0000 | .0004 | -.0004 | .0000 | 61 |
| 62 | .0000 | .0002 | -.0002 | .0000 | 62 |
| 65 | .0000 | .0002 | -.0002 | .0000 | 65 |
| 66 | .0000 | .0003 | -.0003 | .0000 | 66 |
| 67 | .0000 | .0003 | -.0003 | .0000 | 67 |
| 68 | .0000 | .0003 | -.0003 | .0000 | 68 |
| 69 | .0000 | .0001 | -.0001 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0002 | -.0002 | .0000 | 73 |
| 74 | .0000 | .0002 | -.0002 | .0000 | 74 |
| 75 | .0000 | .0001 | -.0001 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0152 | -.0149 | .0000 | |

T = 9.0000 NO. OF ITERATIONS = 6 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.7343 | 58 | 7.3584 |
| 3 | 7.2000 | 31 | 7.8728 | 59 | 7.6062 |
| 4 | 7.2000 | 32 | 8.0565 | 60 | 7.8029 |
| 5 | 7.9000 | 33 | 8.2456 | 61 | 7.9948 |
| 6 | 8.4000 | 34 | 8.4135 | 62 | 8.2171 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1424 | 37 | 7.8479 | 65 | 7.1195 |
| 10 | 7.3658 | 38 | 7.9486 | 66 | 7.3830 |
| 11 | 7.5648 | 39 | 8.1139 | 67 | 7.5737 |
| 12 | 7.9764 | 40 | 8.3057 | 68 | 7.7415 |
| 13 | 8.3328 | 41 | 8.5426 | 69 | 7.8960 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.2052 | 44 | 7.7722 | 72 | 6.9098 |
| 17 | 7.5326 | 45 | 7.9246 | 73 | 7.1756 |
| 18 | 7.7816 | 46 | 8.0961 | 74 | 7.3430 |
| 19 | 8.0646 | 47 | 8.2967 | 75 | 7.4846 |
| 20 | 8.2926 | 48 | 8.5732 | 76 | 7.5535 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.4736 | 51 | 7.5884 | 79 | 6.7100 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 24 | 7.7169 | 52 | 7.8024 | 80 | 7.0000 |
| 25 | 7.9428 | 53 | 7.9897 | 81 | 7.1000 |
| 26 | 8.1555 | 54 | 8.1922 | 82 | 7.2500 |
| 27 | 8.3092 | 55 | 8.4681 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0001 | -.0001 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |
| 13 | .0000 | .0000 | -.0000 | .0000 | 13 |
| 16 | .0000 | .0001 | -.0001 | .0000 | 16 |
| 17 | .0000 | .0002 | -.0002 | .0000 | 17 |
| 18 | .0000 | .0002 | -.0002 | .0000 | 18 |
| 19 | .0000 | .0002 | -.0002 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0002 | -.0002 | .0000 | 23 |
| 24 | .0000 | .0003 | -.0003 | .0000 | 24 |
| 25 | .0000 | .0003 | -.0003 | .0000 | 25 |
| 26 | .0000 | .0003 | -.0003 | .0000 | 26 |
| 27 | .0000 | .0001 | -.0001 | .0000 | 27 |
| 30 | .0000 | .0002 | -.0002 | .0000 | 30 |
| 31 | .0000 | .0004 | -.0004 | .0000 | 31 |
| 32 | .0000 | .0004 | -.0004 | .0000 | 32 |
| 33 | .0000 | .0003 | -.0003 | .0000 | 33 |
| 34 | .0000 | .0002 | -.0002 | .0000 | 34 |
| 37 | .0000 | .0003 | -.0003 | .0000 | 37 |
| 38 | .0000 | .0004 | -.0004 | .0000 | 38 |
| 39 | .0000 | .0005 | -.0004 | .0000 | 39 |
| 40 | .0000 | .0004 | -.0004 | .0000 | 40 |
| 41 | .0000 | .0002 | -.0002 | .0000 | 41 |
| 44 | .0000 | .0003 | -.0003 | .0000 | 44 |
| 45 | .0000 | .0005 | -.0005 | .0000 | 45 |
| 46 | .0000 | .0005 | -.0005 | .0000 | 46 |
| 47 | .0000 | .0004 | -.0004 | .0000 | 47 |
| 48 | .0000 | .0002 | -.0002 | .0000 | 48 |
| 51 | .0000 | .0003 | -.0003 | .0000 | 51 |
| 52 | .0000 | .0004 | -.0004 | .0000 | 52 |
| 53 | .0000 | .0005 | -.0004 | .0000 | 53 |
| 54 | .0000 | .0004 | -.0004 | .0000 | 54 |
| 55 | .0000 | .0002 | -.0002 | .0000 | 55 |
| 58 | .0000 | .0002 | -.0002 | .0000 | 58 |
| 59 | .0000 | .0004 | -.0004 | .0000 | 59 |
| 60 | .0000 | .0004 | -.0004 | .0000 | 60 |
| 61 | .0000 | .0003 | -.0003 | .0000 | 61 |
| 62 | .0000 | .0002 | -.0002 | .0000 | 62 |
| 65 | .0000 | .0001 | -.0001 | .0000 | 65 |
| 66 | .0000 | .0002 | -.0002 | .0000 | 66 |
| 67 | .0000 | .0003 | -.0003 | .0000 | 67 |
| 68 | .0000 | .0002 | -.0002 | .0000 | 68 |
| 69 | .0000 | .0001 | -.0001 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0001 | -.0001 | .0000 | 73 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 74 | .0000 | .0001 | -.0001 | .0000 | 74 |
| 75 | .0000 | .0001 | -.0001 | .0000 | 75 |
| 76 | .0000 | .0001 | -.0001 | .0000 | 76 |
| TOTAL | .0000 | .0121 | -.0119 | .0000 | |

T = 10.0000 NO. OF ITERATIONS = 5 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.7143 | 58 | 7.3403 |
| 3 | 7.2000 | 31 | 7.8407 | 59 | 7.5770 |
| 4 | 7.2000 | 32 | 8.0231 | 60 | 7.7730 |
| 5 | 7.9000 | 33 | 8.2194 | 61 | 7.9714 |
| 6 | 8.4000 | 34 | 8.3996 | 62 | 8.2048 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1370 | 37 | 7.8250 | 65 | 7.1072 |
| 10 | 7.3571 | 38 | 7.9119 | 66 | 7.3631 |
| 11 | 7.5555 | 39 | 8.0763 | 67 | 7.5529 |
| 12 | 7.9690 | 40 | 8.2766 | 68 | 7.7249 |
| 13 | 8.3288 | 41 | 8.5272 | 69 | 7.8871 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.1944 | 44 | 7.7481 | 72 | 6.9035 |
| 17 | 7.5151 | 45 | 7.8862 | 73 | 7.1653 |
| 18 | 7.7629 | 46 | 8.0572 | 74 | 7.3321 |
| 19 | 8.0498 | 47 | 8.2668 | 75 | 7.4758 |
| 20 | 8.2847 | 48 | 8.5576 | 76 | 7.5488 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.4577 | 51 | 7.5661 | 79 | 6.7100 |
| 24 | 7.6913 | 52 | 7.7664 | 80 | 7.0000 |
| 25 | 7.9158 | 53 | 7.9534 | 81 | 7.1000 |
| 26 | 8.1342 | 54 | 8.1642 | 82 | 7.2500 |
| 27 | 8.2980 | 55 | 8.4534 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0001 | -.0000 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |
| 13 | .0000 | .0000 | -.0000 | .0000 | 13 |
| 16 | .0000 | .0001 | -.0001 | .0000 | 16 |
| 17 | .0000 | .0002 | -.0002 | .0000 | 17 |
| 18 | .0000 | .0002 | -.0002 | .0000 | 18 |
| 19 | .0000 | .0002 | -.0001 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0002 | -.0002 | .0000 | 23 |
| 24 | .0000 | .0003 | -.0002 | .0000 | 24 |
| 25 | .0000 | .0003 | -.0003 | .0000 | 25 |
| 26 | .0000 | .0002 | -.0002 | .0000 | 26 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 27 | .0000 | .0001 | -.0001 | .0000 | 27 |
| 30 | .0000 | .0002 | -.0002 | .0000 | 30 |
| 31 | .0000 | .0003 | -.0003 | .0000 | 31 |
| 32 | .0000 | .0003 | -.0003 | .0000 | 32 |
| 33 | .0000 | .0003 | -.0003 | .0000 | 33 |
| 34 | .0000 | .0001 | -.0001 | .0000 | 34 |
| 37 | .0000 | .0002 | -.0002 | .0000 | 37 |
| 38 | .0000 | .0004 | -.0003 | .0000 | 38 |
| 39 | .0000 | .0004 | -.0004 | .0000 | 39 |
| 40 | .0000 | .0003 | -.0003 | .0000 | 40 |
| 41 | .0000 | .0001 | -.0001 | .0000 | 41 |
| 44 | .0000 | .0002 | -.0002 | .0000 | 44 |
| 45 | .0000 | .0004 | -.0004 | .0000 | 45 |
| 46 | .0000 | .0004 | -.0004 | .0000 | 46 |
| 47 | .0000 | .0003 | -.0003 | .0000 | 47 |
| 48 | .0000 | .0002 | -.0002 | .0000 | 48 |
| 51 | .0000 | .0002 | -.0002 | .0000 | 51 |
| 52 | .0000 | .0004 | -.0003 | .0000 | 52 |
| 53 | .0000 | .0004 | -.0004 | .0000 | 53 |
| 54 | .0000 | .0003 | -.0003 | .0000 | 54 |
| 55 | .0000 | .0001 | -.0001 | .0000 | 55 |
| 58 | .0000 | .0002 | -.0002 | .0000 | 58 |
| 59 | .0000 | .0003 | -.0003 | .0000 | 59 |
| 60 | .0000 | .0003 | -.0003 | .0000 | 60 |
| 61 | .0000 | .0002 | -.0002 | .0000 | 61 |
| 62 | .0000 | .0001 | -.0001 | .0000 | 62 |
| 65 | .0000 | .0001 | -.0001 | .0000 | 65 |
| 66 | .0000 | .0002 | -.0002 | .0000 | 66 |
| 67 | .0000 | .0002 | -.0002 | .0000 | 67 |
| 68 | .0000 | .0002 | -.0002 | .0000 | 68 |
| 69 | .0000 | .0001 | -.0001 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0001 | .0000 | 72 |
| 73 | .0000 | .0001 | -.0001 | .0000 | 73 |
| 74 | .0000 | .0001 | -.0001 | .0000 | 74 |
| 75 | .0000 | .0001 | -.0001 | .0000 | 75 |
| 76 | .0000 | .0000 | -.0000 | .0000 | 76 |
| TOTAL | .0000 | .0098 | -.0095 | .0000 | |

T = 11.0000 NO. OF ITERATIONS = 5 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3900 | 30 | 7.6984 | 58 | 7.3258 |
| 3 | 7.2000 | 31 | 7.8152 | 59 | 7.5538 |
| 4 | 7.2000 | 32 | 7.9965 | 60 | 7.7494 |
| 5 | 7.9000 | 33 | 8.1986 | 61 | 7.9530 |
| 6 | 8.4000 | 34 | 8.3886 | 62 | 8.1951 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1327 | 37 | 7.8068 | 65 | 7.0973 |
| 10 | 7.3500 | 38 | 7.8829 | 66 | 7.3471 |
| 11 | 7.5478 | 39 | 8.0466 | 67 | 7.5363 |
| 12 | 7.9629 | 40 | 8.2537 | 68 | 7.7117 |
| 13 | 8.3256 | 41 | 8.5150 | 69 | 7.8801 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 16 | 7.1857 | 44 | 7.7290 | 72 | 6.8984 |
| 17 | 7.5009 | 45 | 7.8558 | 73 | 7.1571 |
| 18 | 7.7479 | 46 | 8.0266 | 74 | 7.3233 |
| 19 | 8.0377 | 47 | 8.2433 | 75 | 7.4688 |
| 20 | 8.2784 | 48 | 8.5452 | 76 | 7.5451 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.4450 | 51 | 7.5484 | 79 | [illegible] |
| 24 | 7.6709 | 52 | 7.7378 | 80 | [illegible] |
| 25 | 7.8941 | 53 | 7.9247 | 81 | 7.1000 |
| 26 | 8.1171 | 54 | 8.1421 | 82 | 7.2500 |
| 27 | 8.2890 | 55 | 8.4419 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0000 | -.0000 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0001 | -.0001 | .0000 | 12 |
| 13 | .0000 | .0000 | -.0000 | .0000 | 13 |
| 16 | .0000 | .0001 | -.0001 | .0000 | 16 |
| 17 | .0000 | .0001 | -.0001 | .0000 | 17 |
| 18 | .0000 | .0001 | -.0001 | .0000 | 18 |
| 19 | .0000 | .0001 | -.0001 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0001 | .0000 | 20 |
| 23 | .0000 | .0001 | -.0001 | .0000 | 23 |
| 24 | .0000 | .0002 | -.0002 | .0000 | 24 |
| 25 | .0000 | .0002 | -.0002 | .0000 | 25 |
| 26 | .0000 | .0002 | -.0002 | .0000 | 26 |
| 27 | .0000 | .0001 | -.0001 | .0000 | 27 |
| 30 | .0000 | .0002 | -.0001 | .0000 | 30 |
| 31 | .0000 | .0002 | -.0002 | .0000 | 31 |
| 32 | .0000 | .0003 | -.0002 | .0000 | 32 |
| 33 | .0000 | .0002 | -.0002 | .0000 | 33 |
| 34 | .0000 | .0001 | -.0001 | .0000 | 34 |
| 37 | .0000 | .0002 | -.0002 | .0000 | 37 |
| 38 | .0000 | .0003 | -.0003 | .0000 | 38 |
| 39 | .0000 | .0003 | -.0003 | .0000 | 39 |
| 40 | .0000 | .0002 | -.0002 | .0000 | 40 |
| 41 | .0000 | .0001 | -.0001 | .0000 | 41 |
| 44 | .0000 | .0002 | -.0002 | .0000 | 44 |
| 45 | .0000 | .0003 | -.0003 | .0000 | 45 |
| 46 | .0000 | .0003 | -.0003 | .0000 | 46 |
| 47 | .0000 | .0002 | -.0002 | .0000 | 47 |
| 48 | .0000 | .0001 | -.0001 | .0000 | 48 |
| 51 | .0000 | .0002 | -.0002 | .0000 | 51 |
| 52 | .0000 | .0003 | -.0003 | .0000 | 52 |
| 53 | .0000 | .0003 | -.0003 | .0000 | 53 |
| 54 | .0000 | .0002 | -.0002 | .0000 | 54 |
| 55 | .0000 | .0001 | -.0001 | .0000 | 55 |
| 58 | .0000 | .0001 | -.0001 | .0000 | 58 |
| 59 | .0000 | .0002 | -.0002 | .0000 | 59 |
| 60 | .0000 | .0002 | -.0002 | .0000 | 60 |
| 61 | .0000 | .0002 | -.0002 | .0000 | 61 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 62 | .0000 | .0001 | -.0001 | .0000 | 62 |
| 65 | .0000 | .0001 | -.0001 | .0000 | 65 |
| 66 | .0000 | .0002 | -.0002 | .0000 | 66 |
| 67 | .0000 | .0002 | -.0002 | .0000 | 67 |
| 68 | .0000 | .0001 | -.0001 | .0000 | 68 |
| 69 | .0000 | .0001 | -.0001 | .0000 | 69 |
| 72 | .0000 | .0001 | -.0000 | .0000 | 72 |
| 73 | .0000 | .0001 | -.0001 | .0000 | 73 |
| 74 | .0000 | .0001 | -.0001 | .0000 | 74 |
| 75 | .0000 | .0001 | -.0001 | .0000 | 75 |
| 76 | .0000 | .0000 | -.0000 | .0000 | 76 |
| TOTAL | .0000 | .0078 | -.0075 | .0000 | |

T = 12.0000 NO. OF ITERATIONS = 5 NO. OF SUBITERATIONS = 0

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 7.6858 | 58 | 7.3143 |
| 3 | 7.2000 | 31 | 7.7949 | 59 | 7.5354 |
| 4 | 7.2000 | 32 | 7.9755 | 60 | 7.7307 |
| 5 | 7.9000 | 33 | 8.1822 | 61 | 7.9384 |
| 6 | 8.4000 | 34 | 8.3798 | 62 | 8.1875 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.1292 | 37 | 7.7924 | 65 | 7.0893 |
| 10 | 7.3442 | 38 | 7.8599 | 66 | 7.3344 |
| 11 | 7.5417 | 39 | 8.0232 | 67 | 7.5232 |
| 12 | 7.9580 | 40 | 8.2356 | 68 | 7.7013 |
| 13 | 8.3230 | 41 | 8.5054 | 69 | 7.8746 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.1787 | 44 | 7.7139 | 72 | 6.8944 |
| 17 | 7.4896 | 45 | 7.8318 | 73 | 7.1505 |
| 18 | 7.7358 | 46 | 8.0025 | 74 | 7.3164 |
| 19 | 8.0280 | 47 | 8.2247 | 75 | 7.4633 |
| 20 | 8.2733 | 48 | 8.5355 | 76 | 7.5421 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.4348 | 51 | 7.5343 | 79 | 6.7100 |
| 24 | 7.6547 | 52 | 7.7152 | 80 | 7.0000 |
| 25 | 7.8769 | 53 | 7.9022 | 81 | 7.1000 |
| 26 | 8.1035 | 54 | 8.1247 | 82 | 7.2500 |
| 27 | 8.2818 | 55 | 8.4328 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0000 | -.0000 | .0000 | 9 |
| 10 | .0000 | .0001 | -.0001 | .0000 | 10 |
| 11 | .0000 | .0001 | -.0001 | .0000 | 11 |
| 12 | .0000 | .0000 | -.0000 | .0000 | 12 |
| 13 | .0000 | .0000 | -.0000 | .0000 | 13 |
| 16 | .0000 | .0001 | -.0001 | .0000 | 16 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 17 | .0000 | .0001 | -.0001 | .0000 | 17 |
| 18 | .0000 | .0001 | -.0001 | .0000 | 18 |
| 19 | .0000 | .0001 | -.0001 | .0000 | 19 |
| 20 | .0000 | .0001 | -.0000 | .0000 | 20 |
| 23 | .0000 | .0001 | -.0001 | .0000 | 23 |
| 24 | .0000 | .0002 | -.0002 | .0000 | 24 |
| 25 | .0000 | .0002 | -.0002 | .0000 | 25 |
| 26 | .0000 | .0001 | -.0001 | .0000 | 26 |
| 27 | .0000 | .0001 | -.0001 | .0000 | 27 |
| 30 | .0000 | .0001 | -.0001 | .0000 | 30 |
| 31 | .0000 | .0002 | -.0002 | .0000 | 31 |
| 32 | .0000 | .0002 | -.0002 | .0000 | 32 |
| 33 | .0000 | .0002 | -.0002 | .0000 | 33 |
| 34 | .0000 | .0001 | -.0001 | .0000 | 34 |
| 37 | .0000 | .0001 | -.0001 | .0000 | 37 |
| 38 | .0000 | .0002 | -.0002 | .0000 | 38 |
| 39 | .0000 | .0002 | -.0002 | .0000 | 39 |
| 40 | .0000 | .0002 | -.0002 | .0000 | 40 |
| 41 | .0000 | .0001 | -.0001 | .0000 | 41 |
| 44 | .0000 | .0001 | -.0001 | .0000 | 44 |
| 45 | .0000 | .0002 | -.0002 | .0000 | 45 |
| 46 | .0000 | .0002 | -.0002 | .0000 | 46 |
| 47 | .0000 | .0002 | -.0002 | .0000 | 47 |
| 48 | .0000 | .0001 | -.0001 | .0000 | 48 |
| 51 | .0000 | .0001 | -.0001 | .0000 | 51 |
| 52 | .0000 | .0002 | -.0002 | .0000 | 52 |
| 53 | .0000 | .0002 | -.0002 | .0000 | 53 |
| 54 | .0000 | .0002 | -.0002 | .0000 | 54 |
| 55 | .0000 | .0001 | -.0001 | .0000 | 55 |
| 58 | .0000 | .0001 | -.0001 | .0000 | 58 |
| 59 | .0000 | .0002 | -.0002 | .0000 | 59 |
| 60 | .0000 | .0002 | -.0002 | .0000 | 60 |
| 61 | .0000 | .0001 | -.0001 | .0000 | 61 |
| 62 | .0000 | .0001 | -.0001 | .0000 | 62 |
| 65 | .0000 | .0001 | -.0001 | .0000 | 65 |
| 66 | .0000 | .0001 | -.0001 | .0000 | 66 |
| 67 | .0000 | .0001 | -.0001 | .0000 | 67 |
| 68 | .0000 | .0001 | -.0001 | .0000 | 68 |
| 69 | .0000 | .0001 | -.0001 | .0000 | 69 |
| 72 | .0000 | .0000 | -.0000 | .0000 | 72 |
| 73 | .0000 | .0001 | -.0001 | .0000 | 73 |
| 74 | .0000 | .0001 | -.0001 | .0000 | 74 |
| 75 | .0000 | .0001 | -.0001 | .0000 | 75 |
| 76 | .0000 | .0000 | -.0000 | .0000 | 76 |
| TOTAL | .0000 | .0062 | -.0060 | .0000 | |

APPENDIX C

1. Format of output files for inverse run

2. Format of output file SGMP13.OUT

GROUNDWATER MODEL FOR MONTHLY DATA OF HARYANA
HANDLING SGMP11.INP

PRINTING OF CALCULATED WATER LEVELS AND BALANCES

TOTAL NUMBER OF NODES IS 84

UNIT LENGTH : 1 METRE
UNIT AREA : 1,000,000 SQ .METRES
UNIT VOLUME : 1,000,000 CU. METRES

UNIT OF TIME FOR DELTA AND BOUNDARY CONDITIONS IS MONTH

VALUES OF EXTERNAL SWITCHES

LSW7 = 2
LSW8 = 2
LSW9 = 2

INITIAL WATER LEVEL ELEVATIONS

T = .0000

| NODE | HINIT | NODE | HINIT | NODE | HINIT |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 8.2000 | 58 | 7.4000 |
| 3 | 7.2000 | 31 | 9.1000 | 59 | 8.3000 |
| 4 | 7.2000 | 32 | 9.5000 | 60 | 9.1000 |
| 5 | 7.9000 | 33 | 9.1000 | 61 | 8.7000 |
| 6 | 8.4000 | 34 | 9.0000 | 62 | 8.5000 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.0100 | 37 | 8.6000 | 65 | 7.2000 |
| 10 | 7.0700 | 38 | 9.6000 | 66 | 7.9000 |
| 11 | 7.0000 | 39 | 10.0000 | 67 | 8.3000 |
| 12 | 7.5500 | 40 | 9.4000 | 68 | 8.2000 |
| 13 | 8.1500 | 41 | 9.1000 | 69 | 8.0500 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.6000 | 44 | 8.4000 | 72 | 6.9000 |
| 17 | 8.0000 | 45 | 9.5000 | 73 | 7.4000 |
| 18 | 7.9000 | 46 | 9.8000 | 74 | 7.7000 |
| 19 | 8.0000 | 47 | 9.4000 | 75 | 7.8000 |
| 20 | 8.3000 | 48 | 9.2000 | 76 | 7.6000 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.9500 | 51 | 8.0000 | 79 | 6.7100 |
| 24 | 8.6000 | 52 | 8.9000 | 80 | 7.0000 |
| 25 | 8.4000 | 53 | 9.6000 | 81 | 7.1000 |
| 26 | 8.5000 | 54 | 9.1000 | 82 | 7.2500 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 27 | 8.6100 | 55 | 8.9000 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

| | | | | | |
|---|---|---|---|---|---|
| T = | 1.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 50 |
| T = | 2.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 24 |
| T = | 3.0000 | NO. OF ITERATIONS = | 4 | NO. OF SUBITERATIONS = | 5 |
| T = | 4.0000 | NO. OF ITERATIONS = | 4 | NO. OF SUBITERATIONS = | 1 |
| T = | 5.0000 | NO. OF ITERATIONS = | 3 | NO. OF SUBITERATIONS = | 0 |
| T = | 6.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 0 |
| T = | 7.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 1 |
| T = | 8.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 0 |
| T = | 9.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 0 |
| T = | 10.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 0 |
| T = | 11.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 0 |

| | | | | | |
|---|---|---|---|---|---|
| T = | 12.0000 | NO. OF ITERATIONS = | 2 | NO. OF SUBITERATIONS = | 0 |

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 6.7000 | 29 | 7.8000 | 57 | 7.1000 |
| 2 | 7.3000 | 30 | 8.1985 | 58 | 7.4057 |
| 3 | 7.2000 | 31 | 9.1018 | 59 | 8.3038 |
| 4 | 7.2000 | 32 | 9.5028 | 60 | 9.0948 |
| 5 | 7.9000 | 33 | 9.0974 | 61 | 8.7087 |
| 6 | 8.4000 | 34 | 8.9944 | 62 | 8.5083 |
| 7 | 8.9000 | 35 | 8.5000 | 63 | 8.5000 |
| 8 | 6.5400 | 36 | 8.0000 | 64 | 6.8000 |
| 9 | 7.0082 | 37 | 8.5940 | 65 | 7.2004 |
| 10 | 7.0707 | 38 | 9.5919 | 66 | 7.9022 |
| 11 | 6.9984 | 39 | 9.9977 | 67 | 8.3059 |
| 12 | 7.5485 | 40 | 9.3952 | 68 | 8.2069 |
| 13 | 8.1475 | 41 | 9.1070 | 69 | 8.0543 |
| 14 | 8.6050 | 42 | 8.9000 | 70 | 8.0600 |
| 15 | 6.5000 | 43 | 7.7000 | 71 | 6.6000 |
| 16 | 7.6009 | 44 | 8.3974 | 72 | 6.9062 |
| 17 | 8.0084 | 45 | 9.4934 | 73 | 7.4050 |
| 18 | 7.9049 | 46 | 9.7968 | 74 | 7.7069 |
| 19 | 8.0023 | 47 | 9.4004 | 75 | 7.7928 |
| 20 | 8.2985 | 48 | 9.1945 | 76 | 7.6071 |
| 21 | 8.4000 | 49 | 9.0000 | 77 | 7.7000 |
| 22 | 7.1900 | 50 | 7.3900 | 78 | 6.3600 |
| 23 | 7.9595 | 51 | 7.9936 | 79 | 6.7100 |
| 24 | 8.6094 | 52 | 8.9020 | 80 | 7.0000 |
| 25 | 8.4051 | 53 | 9.5998 | 81 | 7.1000 |
| 26 | 8.5006 | 54 | 9.1057 | 82 | 7.2500 |
| 27 | 8.6167 | 55 | 8.9076 | 83 | 7.1400 |
| 28 | 8.3000 | 56 | 8.9000 | 84 | 7.2500 |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | .0000 | .0000 | .0058 | -.0058 | 9 |
| 10 | .0000 | .0000 | .0090 | -.0090 | 10 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 11 | .0000 | .0000 | .0146 | -.0146 | 11 |
| 12 | .0000 | .0000 | .0092 | -.0092 | 12 |
| 13 | .0000 | .0000 | .0040 | -.0040 | 13 |
| 16 | .0000 | .0000 | -.0058 | .0058 | 16 |
| 17 | .0000 | .0000 | -.0060 | .0060 | 17 |
| 18 | .0000 | .0000 | -.0026 | .0026 | 18 |
| 19 | .0000 | .0000 | .0022 | -.0022 | 19 |
| 20 | .0000 | .0000 | .0008 | -.0008 | 20 |
| 23 | .0000 | .0000 | -.0014 | .0014 | 23 |
| 24 | .0000 | .0000 | -.0062 | .0062 | 24 |
| 25 | .0000 | .0000 | .0086 | -.0086 | 25 |
| 26 | .0000 | .0000 | .0018 | -.0018 | 26 |
| 27 | .0000 | .0000 | -.0026 | .0026 | 27 |
| 30 | .0000 | .0000 | .0042 | -.0042 | 30 |
| 31 | .0000 | .0000 | -.0026 | .0026 | 31 |
| 32 | .0000 | .0000 | -.0116 | .0116 | 32 |
| 33 | .0000 | .0000 | -.0012 | .0012 | 33 |
| 34 | .0000 | .0000 | -.0066 | .0066 | 34 |
| 37 | .0000 | .0000 | -.0026 | .0026 | 37 |
| 38 | .0000 | .0000 | -.0082 | .0082 | 38 |
| 39 | .0000 | .0000 | -.0142 | .0142 | 39 |
| 40 | .0000 | .0000 | -.0018 | .0018 | 40 |
| 41 | .0000 | .0000 | .0002 | -.0002 | 41 |
| 44 | .0000 | .0000 | .0008 | -.0008 | 44 |
| 45 | .0000 | .0000 | -.0072 | .0072 | 45 |
| 46 | .0000 | .0000 | -.0044 | .0044 | 46 |
| 47 | .0000 | .0000 | -.0024 | .0024 | 47 |
| 48 | .0000 | .0000 | -.0048 | .0048 | 48 |
| 51 | .0000 | .0000 | .0000 | .0000 | 51 |
| 52 | .0000 | .0000 | .0000 | .0000 | 52 |
| 53 | .0000 | .0000 | -.0104 | .0104 | 53 |
| 54 | .0000 | .0000 | .0008 | -.0008 | 54 |
| 55 | .0000 | .0000 | .0002 | -.0002 | 55 |
| 58 | .0000 | .0000 | .0054 | -.0054 | 58 |
| 59 | .0000 | .0000 | .0018 | -.0018 | 59 |
| 60 | .0000 | .0000 | -.0106 | .0106 | 60 |
| 61 | .0000 | .0000 | .0000 | .0000 | 61 |
| 62 | .0000 | .0000 | .0008 | -.0008 | 62 |
| 65 | .0000 | .0000 | .0008 | -.0008 | 65 |
| 66 | .0000 | .0000 | -.0024 | .0024 | 66 |
| 67 | .0000 | .0000 | -.0018 | .0018 | 67 |
| 68 | .0000 | .0000 | .0004 | -.0004 | 68 |
| 69 | .0000 | .0000 | .0012 | -.0012 | 69 |
| 72 | .0000 | .0000 | .0020 | -.0020 | 72 |
| 73 | .0000 | .0000 | .0000 | .0000 | 73 |
| 74 | .0000 | .0000 | -.0012 | .0012 | 74 |
| 75 | .0000 | .0000 | -.0032 | .0032 | 75 |
| 76 | .0000 | .0000 | .0020 | -.0020 | 76 |
| TOTAL | .0000 | -.0001 | -.0452 | .0452 | |

APPENDIX D

1. Format of output files for drain runs

2. Water balance component of SGMP13.OUT for drain at 1.0 m

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | -.0058 | .0000 | .0058 | .0000 | 9 |
| 10 | -.0090 | .0000 | .0090 | .0000 | 10 |
| 11 | -.0146 | .0000 | .0146 | .0000 | 11 |
| 12 | -.0092 | .0000 | .0092 | .0000 | 12 |
| 13 | -.0040 | .0000 | .0040 | .0000 | 13 |
| 16 | .0058 | .0000 | -.0058 | .0000 | 16 |
| 17 | .0060 | .0000 | -.0060 | .0000 | 17 |
| 18 | .0026 | .0000 | -.0026 | .0000 | 18 |
| 19 | -.0022 | .0000 | .0022 | .0000 | 19 |
| 20 | -.0008 | .0000 | .0008 | .0000 | 20 |
| 23 | .0014 | .0000 | -.0014 | .0000 | 23 |
| 24 | .0062 | .0000 | -.0062 | .0000 | 24 |
| 25 | -.0086 | .0000 | .0086 | .0000 | 25 |
| 26 | -.0018 | .0000 | .0018 | .0000 | 26 |
| 27 | .0026 | .0000 | -.0026 | .0000 | 27 |
| 30 | -.0042 | .0000 | .0042 | .0000 | 30 |
| 31 | .0026 | .0000 | -.0026 | .0000 | 31 |
| 32 | .0116 | .0000 | -.0116 | .0000 | 32 |
| 33 | .0012 | .0000 | -.0012 | .0000 | 33 |
| 34 | .0066 | .0000 | -.0066 | .0000 | 34 |
| 37 | .0026 | .0000 | -.0026 | .0000 | 37 |
| 38 | .0082 | .0000 | -.0082 | .0000 | 38 |
| 39 | .0142 | -.0000 | -.0062 | -.0080 | 39 |
| 40 | .0018 | .0000 | -.0010 | -.0008 | 40 |
| 41 | -.0002 | .0000 | .0002 | .0000 | 41 |
| 44 | -.0008 | .0000 | .0008 | .0000 | 44 |
| 45 | .0072 | .0000 | -.0072 | .0000 | 45 |
| 46 | .0044 | .0000 | -.0044 | .0000 | 46 |
| 47 | .0024 | .0000 | .0046 | -.0070 | 47 |
| 48 | .0048 | .0000 | -.0048 | .0000 | 48 |
| 51 | .0000 | .0000 | .0000 | .0000 | 51 |
| 52 | .0000 | .0000 | .0000 | .0000 | 52 |
| 53 | .0104 | .0000 | -.0104 | .0000 | 53 |
| 54 | -.0008 | .0000 | .0008 | .0000 | 54 |
| 55 | -.0002 | .0000 | .0002 | .0000 | 55 |
| 58 | -.0054 | .0000 | .0054 | .0000 | 58 |
| 59 | -.0018 | .0000 | .0018 | .0000 | 59 |
| 60 | .0106 | .0000 | -.0106 | .0000 | 60 |
| 61 | .0000 | .0000 | .0000 | .0000 | 61 |
| 62 | -.0008 | .0000 | .0008 | .0000 | 62 |
| 65 | -.0008 | .0000 | .0008 | .0000 | 65 |
| 66 | .0024 | .0000 | -.0024 | .0000 | 66 |
| 67 | .0018 | .0000 | -.0018 | .0000 | 67 |
| 68 | -.0004 | .0000 | .0004 | .0000 | 68 |
| 69 | -.0012 | .0000 | .0012 | .0000 | 69 |
| 72 | -.0020 | .0000 | .0020 | .0000 | 72 |
| 73 | .0000 | .0000 | .0000 | .0000 | 73 |
| 74 | .0012 | .0000 | -.0012 | .0000 | 74 |
| 75 | .0032 | .0000 | -.0032 | .0000 | 75 |
| 76 | -.0020 | .0000 | .0020 | .0000 | 76 |
| TOTAL | .0452 | .0002 | -.0294 | -.0158 | |

3. Water balance component of SGMP13.OUT for drain at 1.5 m

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 9 | -.0058 | .0000 | .0058 | .0000 | 9 |
| 10 | -.0090 | .0000 | .0090 | .0000 | 10 |
| 11 | -.0146 | .0000 | .0146 | .0000 | 11 |
| 12 | -.0092 | .0000 | .0092 | .0000 | 12 |
| 13 | -.0040 | .0000 | .0040 | .0000 | 13 |
| 16 | .0058 | .0000 | -.0058 | .0000 | 16 |
| 17 | .0060 | .0000 | -.0060 | .0000 | 17 |
| 18 | .0026 | .0000 | -.0026 | .0000 | 18 |
| 19 | -.0022 | .0000 | .0022 | .0000 | 19 |
| 20 | -.0008 | .0000 | .0008 | .0000 | 20 |
| 23 | .0014 | .0000 | -.0014 | .0000 | 23 |
| 24 | .0062 | .0000 | -.0062 | .0000 | 24 |
| 25 | -.0086 | .0000 | .0086 | .0000 | 25 |
| 26 | -.0018 | .0000 | .0018 | .0000 | 26 |
| 27 | .0026 | .0000 | -.0026 | .0000 | 27 |
| 30 | -.0042 | .0000 | .0042 | .0000 | 30 |
| 31 | .0026 | .0000 | -.0026 | .0000 | 31 |
| 32 | .0116 | .0000 | -.0078 | -.0038 | 32 |
| 33 | .0012 | .0000 | -.0012 | .0000 | 33 |
| 34 | .0066 | .0000 | -.0066 | .0000 | 34 |
| 37 | .0026 | .0000 | -.0026 | .0000 | 37 |
| 38 | .0082 | .0000 | -.0082 | .0000 | 38 |
| 39 | .0142 | .0000 | -.0044 | -.0098 | 39 |
| 40 | .0018 | .0000 | .0034 | -.0052 | 40 |
| 41 | -.0002 | .0000 | .0002 | .0000 | 41 |
| 44 | -.0008 | .0000 | .0008 | .0000 | 44 |
| 45 | .0072 | .0000 | -.0064 | -.0008 | 45 |
| 46 | .0044 | .0000 | -.0036 | -.0008 | 46 |
| 47 | .0024 | .0000 | .0078 | -.0102 | 47 |
| 48 | .0048 | .0000 | -.0048 | .0000 | 48 |
| 51 | .0000 | .0000 | .0000 | .0000 | 51 |
| 52 | .0000 | .0000 | .0000 | .0000 | 52 |
| 53 | .0104 | .0000 | -.0082 | -.0022 | 53 |
| 54 | -.0008 | .0000 | .0038 | -.0030 | 54 |
| 55 | -.0002 | .0000 | .0002 | .0000 | 55 |
| 58 | -.0054 | .0000 | .0054 | .0000 | 58 |
| 59 | -.0018 | .0000 | .0018 | .0000 | 59 |
| 60 | .0106 | .0000 | -.0106 | .0000 | 60 |
| 61 | .0000 | .0000 | .0000 | .0000 | 61 |
| 62 | -.0008 | .0000 | .0008 | .0000 | 62 |
| 65 | -.0008 | .0000 | .0008 | .0000 | 65 |
| 66 | .0024 | .0000 | -.0024 | .0000 | 66 |
| 67 | .0018 | .0000 | -.0018 | .0000 | 67 |
| 68 | -.0004 | .0000 | .0004 | .0000 | 68 |
| 69 | -.0012 | .0000 | .0012 | .0000 | 69 |
| 72 | -.0020 | .0000 | .0020 | .0000 | 72 |
| 73 | .0000 | .0000 | .0000 | .0000 | 73 |
| 74 | .0012 | .0000 | -.0012 | .0000 | 74 |
| 75 | .0032 | .0000 | -.0032 | .0000 | 75 |
| 76 | -.0020 | .0000 | .0020 | .0000 | 76 |
| TOTAL | .0452 | .0003 | -.0096 | -.0358 | |

# APPENDIX E

1. Format of input files for normal run

2. Format of input file SGMP11.INP

' NUMERICAL GROUNDWATER MODELLING OF BULANDSHEHAR'

' WITH MONTHLY DATA FROM JUNE 1976 TO OCT. 1977'

| N | NSIDES |
|---|---|
| 100 | 263 |

| TMDAS | DMTIM | T | DELTA | MINOR | MAJOR | LIST | DL |
|---|---|---|---|---|---|---|---|
| 'MONTH' | 30.5 | 0 | 1 | 1 | 2 | 2 | .1 |

| SCALE | ERROR | COEFFA | PREDIC | DELQ | LSW1 | LSW2 | NITER |
|---|---|---|---|---|---|---|---|
| 253439 | 0.08 | 0.1 | 1 | .05 | 1 | 1 | 250 |

| K | NTYPE | CO(X,1) | CO(Y,1) | SL(K) | TL(K) | BL(K) | UL(K) | LL(K) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 3.5 | 29.7 | 203 | 203 | 136 | 203 | 136 |
| 2 | 1 | 5.85 | 31.25 | 210 | 210 | 142 | 210 | 142 |
| 3 | 1 | 6.6 | 31.5 | 210.1 | 210.1 | 141.6 | 210.1 | 141.6 |
| 4 | 1 | 11.2 | 32.2 | 210.3 | 210.3 | 140.3 | 210.3 | 140.3 |
| 5 | 1 | 13.65 | 28.8 | 210 | 210 | 145 | 210 | 145 |
| 6 | 1 | 16.7 | 27.7 | 208 | 208 | 145 | 208 | 145 |
| 7 | 1 | 18 | 28.6 | 208 | 208 | 144.5 | 208 | 144.5 |
| 8 | 1 | 20.5 | 30.6 | 208 | 208 | 143 | 208 | 143 |
| 9 | 1 | 23.25 | 31.35 | 208.7 | 208.7 | 142.2 | 208.7 | 142.2 |
| 10 | 1 | 25.6 | 34.35 | 209.5 | 209.5 | 134.5 | 209.5 | 134.5 |
| 11 | 1 | 28.5 | 33.35 | 206.1 | 206.1 | 136.1 | 206.1 | 136.1 |
| 12 | 1 | 31.35 | 32.2 | 204 | 204 | 141 | 204 | 141 |
| 13 | 1 | 4.35 | 26.4 | 199 | 199 | 134.5 | 199 | 134.5 |
| 14 | 3 | 7.1 | 28.5 | 205 | 205 | 139 | 205 | 139 |
| 15 | 3 | 10.85 | 27.15 | 207.8 | 207.8 | 143.3 | 207.8 | 143.3 |
| 16 | 3 | 13.45 | 26.85 | 209 | 209 | 145.5 | 209 | 145.5 |
| 17 | 3 | 15.45 | 25.3 | 207.7 | 207.7 | 149.7 | 207.7 | 149.7 |
| 18 | 3 | 18.15 | 26.3 | 206 | 206 | 148 | 206 | 148 |
| 19 | 3 | 19.6 | 27.8 | 206.2 | 206.2 | 146.2 | 206.2 | 146.2 |
| 20 | 3 | 22.2 | 29.25 | 207.3 | 207.3 | 146.8 | 207.3 | 146.8 |
| 21 | 3 | 24.2 | 28.3 | 206.2 | 206.2 | 148.7 | 206.2 | 148.7 |
| 22 | 3 | 26.1 | 31.5 | 207.8 | 207.8 | 140.3 | 207.8 | 140.3 |
| 23 | 3 | 28.65 | 31.4 | 205 | 205 | 140 | 205 | 140 |
| 24 | 3 | 30.7 | 30.45 | 203 | 203 | 143 | 203 | 143 |
| 25 | 1 | 33.75 | 29.65 | 200.5 | 200.5 | 144.5 | 200.5 | 144.5 |
| 26 | 1 | 5.7 | 23.6 | 195.8 | 195.8 | 135.8 | 195.8 | 135.8 |
| 27 | 3 | 7.8 | 24.8 | 198.1 | 198.1 | 135.1 | 198.1 | 135.1 |
| 28 | 3 | 12.05 | 24.05 | 206.5 | 206.5 | 148.5 | 206.5 | 148.5 |
| 29 | 3 | 15.1 | 23.1 | 207 | 207 | 154.5 | 207 | 154.5 |
| 30 | 3 | 17.75 | 24.2 | 205.5 | 205.5 | 151.5 | 205.5 | 151.5 |
| 31 | 3 | 20 | 25.55 | 205 | 205 | 149 | 205 | 149 |
| 32 | 3 | 22.15 | 26.8 | 205.2 | 205.2 | 149.2 | 205.2 | 149.2 |
| 33 | 3 | 25.45 | 25.55 | 204 | 204 | 153.5 | 204 | 153.5 |
| 34 | 3 | 27.05 | 29.9 | 207 | 207 | 145 | 207 | 145 |
| 35 | 3 | 27.7 | 28 | 205 | 205 | 150 | 205 | 150 |
| 36 | 3 | 29.55 | 26.2 | 203.8 | 203.8 | 147.8 | 203.8 | 147.8 |
| 37 | 3 | 29.6 | 28.95 | 205.7 | 205.7 | 148.7 | 205.7 | 148.7 |
| 38 | 3 | 31.1 | 28.65 | 202 | 202 | 146 | 202 | 146 |

Contd.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 39 | 3 | 30.55 | 25.75 | 203.2 | 203.2 | 147.7 | 203.2 | 147.7 |
| 40 | 1 | 34.5 | 27.3 | 199 | 199 | 147.5 | 199 | 147.5 |
| 41 | 1 | 7.9 | 21.5 | 198 | 198 | 143 | 198 | 143 |
| 42 | 3 | 13.05 | 21.65 | 205.8 | 205.8 | 155.8 | 205.8 | 155.8 |
| 43 | 3 | 18.75 | 21.45 | 203.5 | 203.5 | 155 | 203.5 | 155 |
| 44 | 3 | 20.15 | 23.3 | 203.6 | 203.6 | 151.1 | 203.6 | 151.1 |
| 45 | 3 | 22 | 24.15 | 203.6 | 203.6 | 151.1 | 203.6 | 151.1 |
| 46 | 3 | 24.85 | 22.9 | 202 | 202 | 153 | 202 | 153 |
| 47 | 3 | 28.75 | 23.5 | 202.3 | 202.3 | 154.3 | 202.3 | 154.3 |
| 48 | 3 | 33 | 22.8 | 201.6 | 201.6 | 154.6 | 201.6 | 154.6 |
| 49 | 1 | 36.65 | 23.4 | 196 | 196 | 152 | 196 | 152 |
| 50 | 1 | 10.15 | 15.85 | 203.5 | 203.5 | 155.5 | 203.5 | 155.5 |
| 51 | 3 | 12.35 | 17.9 | 204.3 | 204.3 | 157.8 | 204.3 | 157.8 |
| 52 | 3 | 15.8 | 19.05 | 203.3 | 203.3 | 158.3 | 203.3 | 158.3 |
| 53 | 3 | 18.55 | 16.75 | 200 | 200 | 156 | 200 | 156 |
| 54 | 3 | 21.4 | 18.35 | 200.7 | 200.7 | 151.2 | 200.7 | 151.2 |
| 55 | 3 | 22.2 | 21.25 | 201.5 | 201.5 | 150 | 201.5 | 150 |
| 56 | 3 | 24.55 | 19.5 | 200.8 | 200.8 | 149.3 | 200.8 | 149.3 |
| 57 | 3 | 26.65 | 21.2 | 201.5 | 201.5 | 153 | 201.5 | 153 |
| 58 | 3 | 26.9 | 19.15 | 200.8 | 200.8 | 148.8 | 200.8 | 148.8 |
| 59 | 3 | 29.1 | 19.95 | 201 | 201 | 152.5 | 201 | 152.5 |
| 60 | 3 | 32.3 | 20.4 | 200.8 | 200.8 | 155.8 | 200.8 | 155.8 |
| 61 | 1 | 36.25 | 20.35 | 194 | 194 | 154 | 194 | 154 |
| 62 | 1 | 12.7 | 11.55 | 198 | 198 | 155.5 | 198 | 155.5 |
| 63 | 3 | 14.5 | 14.65 | 199.2 | 199.2 | 156.7 | 199.2 | 156.7 |
| 64 | 3 | 17.85 | 13 | 197.3 | 197.3 | 163.8 | 197.3 | 163.8 |
| 65 | 3 | 21.3 | 14.55 | 197.8 | 197.8 | 150.8 | 197.8 | 150.8 |
| 66 | 3 | 24.95 | 16.4 | 199 | 199 | 146.5 | 199 | 146.5 |
| 67 | 3 | 28.65 | 16.5 | 199 | 199 | 149 | 199 | 149 |
| 68 | 3 | 30.9 | 17.3 | 199 | 199 | 156.5 | 199 | 156.5 |
| 69 | 3 | 34 | 17.4 | 197 | 197 | 159.5 | 197 | 159.5 |
| 70 | 1 | 37.55 | 16.7 | 192 | 192 | 162 | 192 | 162 |
| 71 | 1 | 13.5 | 8.15 | 195 | 195 | 157.5 | 195 | 157.5 |
| 72 | 3 | 15.5 | 10.95 | 197 | 197 | 164.5 | 197 | 164.5 |
| 73 | 3 | 18.2 | 10.5 | 196.2 | 196.2 | 162.7 | 196.2 | 162.7 |
| 74 | 3 | 21.8 | 11.4 | 195 | 195 | 155 | 195 | 155 |
| 75 | 3 | 25.65 | 12.7 | 196 | 196 | 163.5 | 196 | 163.5 |
| 76 | 3 | 28.55 | 14.45 | 197 | 197 | 159.5 | 197 | 159.5 |
| 77 | 3 | 31.25 | 14.9 | 196 | 196 | 160 | 196 | 160 |
| 78 | 3 | 35 | 12.95 | 192.2 | 192.2 | 162.2 | 192.2 | 162.2 |
| 79 | 1 | 38.7 | 14.35 | 190 | 190 | 166.5 | 190 | 166.5 |
| 80 | 1 | 14.4 | 5.5 | 193.8 | 193.8 | 158.8 | 193.8 | 158.8 |
| 81 | 3 | 16.05 | 7.85 | 195.5 | 195.5 | 162.5 | 195.5 | 162.5 |
| 82 | 3 | 24.6 | 10 | 193.8 | 193.8 | 163.8 | 193.8 | 163.8 |
| 83 | 3 | 26.7 | 10 | 193.8 | 193.8 | 168.8 | 193.8 | 168.8 |
| 84 | 3 | 28.4 | 11.45 | 194 | 194 | 171 | 194 | 171 |
| 85 | 3 | 30.8 | 12.15 | 194 | 194 | 171.5 | 194 | 171.5 |
| 86 | 3 | 33.45 | 10.25 | 191.7 | 191.7 | 165.2 | 191.7 | 165.2 |
| 87 | 3 | 35.5 | 10.25 | 191 | 191 | 168 | 191 | 168 |
| 88 | 1 | 38.2 | 11.1 | 190 | 190 | 170 | 190 | 170 |
| 89 | 3 | 26.2 | 7.3 | 192.6 | 192.6 | 167.6 | 192.6 | 167.6 |
| 90 | 3 | 29.9 | 8.95 | 192 | 192 | 170 | 192 | 170 |
| 91 | 3 | 33.6 | 8 | 190.8 | 190.8 | 168.8 | 190.8 | 168.8 |
| 92 | 3 | 36.65 | 8.35 | 190 | 190 | 170 | 190 | 170 |
| 93 | 1 | 18.25 | 4.25 | 193.5 | 193.5 | 161.5 | 193.5 | 161.5 |
| 94 | 1 | 21.05 | 6.9 | 193.5 | 193.5 | 162 | 193.5 | 162 |
| 95 | 1 | 25.1 | 4.5 | 192 | 192 | 169.5 | 192 | 169.5 |
| 96 | 1 | 29.6 | 5.25 | 191 | 191 | 170 | 191 | 170 |

Contd.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 97 | 1 | 32.25 | 2.7 | 190 | 190 | 171 | 190 | 171 |
| 98 | 1 | 36.25 | 3.95 | 189.5 | 189.5 | 172 | 189.5 | 172 |
| 99 | 1 | 38.85 | 5 | 189 | 189 | 171.5 | 189 | 171.5 |
| 100 | 1 | 41 | 8.65 | 188 | 188 | 169.5 | 188 | 169.5 |

| K | AS(K) | ASC(K) |
|---|---|---|
| 1 | 0.1145 | 0.001 |
| 2 | 0.1125 | 0.001 |
| 3 | 0.112 | 0.001 |
| 4 | 0.1065 | 0.001 |
| 5 | 0.1 | 0.001 |
| 6 | 0.1 | 0.001 |
| 7 | 0.1025 | 0.001 |
| 8 | 0.1075 | 0.001 |
| 9 | 0.112 | 0.001 |
| 10 | 0.103 | 0.001 |
| 11 | 0.097 | 0.001 |
| 12 | 0.087 | 0.001 |
| 13 | 0.1155 | 0.001 |
| 14 | 0.1105 | 0.001 |
| 15 | 0.1005 | 0.001 |
| 16 | 0.095 | 0.001 |
| 17 | 0.0925 | 0.001 |
| 18 | 0.1 | 0.001 |
| 19 | 0.105 | 0.001 |
| 20 | 0.11 | 0.001 |
| 21 | 0.111 | 0.001 |
| 22 | 0.1065 | 0.001 |
| 23 | 0.095 | 0.001 |
| 24 | 0.086 | 0.001 |
| 25 | 0.0815 | 0.001 |
| 26 | 0.1125 | 0.001 |
| 27 | 0.108 | 0.001 |
| 28 | 0.094 | 0.001 |
| 29 | 0.0925 | 0.001 |
| 30 | 0.0975 | 0.001 |
| 31 | 0.105 | 0.001 |
| 32 | 0.108 | 0.001 |
| 33 | 0.106 | 0.001 |
| 34 | 0.1025 | 0.001 |
| 35 | 0.098 | 0.001 |
| 36 | 0.093 | 0.001 |
| 37 | 0.0885 | 0.001 |
| 38 | 0.083 | 0.001 |
| 39 | 0.091 | 0.001 |
| 40 | 0.08 | 0.001 |
| 41 | 0.108 | 0.001 |
| 42 | 0.0955 | 0.001 |
| 43 | 0.098 | 0.001 |
| 44 | 0.1025 | 0.001 |
| 45 | 0.1055 | 0.001 |
| 46 | 0.1055 | 0.001 |
| 47 | 0.104 | 0.001 |
| 48 | 0.0875 | 0.001 |
| 49 | 0.0795 | 0.001 |
| 50 | 0.106 | 0.001 |
| 51 | 0.1025 | 0.001 |
| 52 | 0.0865 | 0.001 |

Contd.

| | | |
|---|---|---|
| 53 | 0.1 | 0.001 |
| 54 | 0.102 | 0.001 |
| 55 | 0.1055 | 0.001 |
| 56 | 0.1055 | 0.001 |
| 57 | 0.1055 | 0.001 |
| 58 | 0.1055 | 0.001 |
| 59 | 0.1025 | 0.001 |
| 60 | 0.0925 | 0.001 |
| 61 | 0.082 | 0.001 |
| 62 | 0.1015 | 0.001 |
| 63 | 0.099 | 0.001 |
| 64 | 0.0985 | 0.001 |
| 65 | 0.099 | 0.001 |
| 66 | 0.106 | 0.001 |
| 67 | 0.102 | 0.001 |
| 68 | 0.0975 | 0.001 |
| 69 | 0.0875 | 0.001 |
| 70 | 0.0815 | 0.001 |
| 71 | 0.1035 | 0.001 |
| 72 | 0.1015 | 0.001 |
| 73 | 0.1025 | 0.001 |
| 74 | 0.1045 | 0.001 |
| 75 | 0.1085 | 0.001 |
| 76 | 0.105 | 0.001 |
| 77 | 0.0975 | 0.001 |
| 78 | 0.0925 | 0.001 |
| 79 | 0.082 | 0.001 |
| 80 | 0.106 | 0.001 |
| 81 | 0.1045 | 0.001 |
| 82 | 0.115 | 0.001 |
| 83 | 0.1155 | 0.001 |
| 84 | 0.1125 | 0.001 |
| 85 | 0.105 | 0.001 |
| 86 | 0.1025 | 0.001 |
| 87 | 0.095 | 0.001 |
| 88 | 0.087 | 0.001 |
| 89 | 0.1165 | 0.001 |
| 90 | 0.116 | 0.001 |
| 91 | 0.103 | 0.001 |
| 92 | 0.095 | 0.001 |
| 93 | 0.1065 | 0.001 |
| 94 | 0.11 | 0.001 |
| 95 | 0.114 | 0.001 |
| 96 | 0.113 | 0.001 |
| 97 | 0.1085 | 0.001 |
| 98 | 0.101 | 0.001 |
| 99 | 0.095 | 0.001 |
| 100 | 0.086 | 0.001 |

| IB | IE | CONDU |
|---|---|---|
| 1 | 2 | 3 |
| 1 | 14 | 3 |
| 1 | 13 | 3 |
| 2 | 3 | 3 |
| 2 | 14 | 3 |
| 3 | 4 | 3 |
| 3 | 14 | 3 |
| 4 | 5 | 3 |

Contd.

| | | |
|---|---|---|
| 4 | 14 | 3 |
| 4 | 15 | 3 |
| 5 | 6 | 3 |
| 5 | 15 | 3 |
| 5 | 16 | 3 |
| 6 | 7 | 3 |
| 6 | 16 | 3 |
| 6 | 17 | 3 |
| 6 | 18 | 3 |
| 7 | 8 | 3 |
| 7 | 18 | 3 |
| 7 | 19 | 3 |
| 8 | 9 | 3 |
| 8 | 19 | 3 |
| 8 | 20 | 3 |
| 9 | 10 | 3 |
| 9 | 20 | 3 |
| 9 | 21 | 3 |
| 9 | 22 | 3 |
| 10 | 11 | 3 |
| 10 | 22 | 3 |
| 11 | 12 | 3 |
| 11 | 22 | 3 |
| 11 | 23 | 3 |
| 12 | 25 | 3 |
| 12 | 23 | 3 |
| 12 | 24 | 3 |
| 13 | 14 | 3 |
| 13 | 26 | 3 |
| 13 | 27 | 3 |
| 14 | 15 | 3 |
| 14 | 27 | 3 |
| 15 | 16 | 3 |
| 15 | 27 | 3 |
| 15 | 28 | 3 |
| 16 | 17 | 3 |
| 16 | 28 | 3 |
| 17 | 18 | 3 |
| 17 | 28 | 3 |
| 17 | 29 | 3 |
| 17 | 30 | 3 |
| 18 | 19 | 3 |
| 18 | 30 | 3 |
| 18 | 31 | 3 |
| 19 | 20 | 3 |
| 19 | 31 | 3 |
| 19 | 32 | 3 |
| 20 | 21 | 3 |
| 20 | 32 | 3 |
| 21 | 22 | 3 |
| 21 | 32 | 3 |
| 21 | 33 | 3 |
| 21 | 34 | 3 |
| 21 | 35 | 3 |
| 22 | 23 | 3 |
| 22 | 34 | 3 |
| 23 | 24 | 3 |
| 23 | 34 | 3 |

Contd.

| | | |
|---|---|---|
| 23 | 37 | 3 |
| 24 | 25 | 3 |
| 24 | 37 | 3 |
| 24 | 38 | 3 |
| 25 | 40 | 3 |
| 25 | 38 | 3 |
| 26 | 27 | 3 |
| 26 | 41 | 3 |
| 27 | 28 | 3 |
| 27 | 41 | 3 |
| 28 | 29 | 3 |
| 28 | 42 | 3 |
| 28 | 41 | 3 |
| 29 | 30 | 3 |
| 29 | 42 | 3 |
| 29 | 52 | 3 |
| 29 | 43 | 3 |
| 30 | 31 | 3 |
| 30 | 43 | 3 |
| 30 | 44 | 3 |
| 31 | 32 | 3 |
| 31 | 44 | 3 |
| 31 | 45 | 3 |
| 32 | 33 | 3 |
| 32 | 45 | 3 |
| 33 | 35 | 3 |
| 33 | 45 | 3 |
| 33 | 46 | 3 |
| 33 | 47 | 3 |
| 33 | 36 | 3 |
| 34 | 35 | 3 |
| 34 | 37 | 3 |
| 35 | 36 | 3 |
| 35 | 37 | 3 |
| 36 | 37 | 3 |
| 36 | 38 | 3 |
| 36 | 39 | 3 |
| 36 | 47 | 3 |
| 37 | 38 | 3 |
| 38 | 39 | 3 |
| 38 | 40 | 3 |
| 39 | 47 | 3 |
| 39 | 48 | 3 |
| 39 | 40 | 3 |
| 40 | 48 | 3 |
| 40 | 49 | 3 |
| 41 | 42 | 3 |
| 41 | 50 | 3 |
| 41 | 51 | 3 |
| 42 | 51 | 3 |
| 42 | 52 | 3 |
| 43 | 44 | 3 |
| 43 | 52 | 3 |
| 43 | 53 | 3 |
| 43 | 54 | 3 |
| 43 | 55 | 3 |
| 44 | 45 | 3 |
| 44 | 55 | 3 |

Contd.

| | | |
|---|---|---|
| 45 | 46 | 3 |
| 45 | 55 | 3 |
| 46 | 47 | 3 |
| 46 | 55 | 3 |
| 46 | 56 | 3 |
| 46 | 57 | 3 |
| 47 | 48 | 3 |
| 47 | 57 | 3 |
| 47 | 59 | 3 |
| 47 | 60 | 3 |
| 48 | 49 | 3 |
| 48 | 60 | 3 |
| 48 | 61 | 3 |
| 49 | 61 | 3 |
| 50 | 51 | 3 |
| 50 | 62 | 3 |
| 50 | 63 | 3 |
| 51 | 52 | 3 |
| 51 | 63 | 3 |
| 52 | 53 | 3 |
| 52 | 63 | 3 |
| 53 | 54 | 3 |
| 53 | 63 | 3 |
| 53 | 64 | 3 |
| 53 | 65 | 3 |
| 54 | 55 | 3 |
| 54 | 65 | 3 |
| 54 | 66 | 3 |
| 54 | 56 | 3 |
| 55 | 56 | 3 |
| 56 | 57 | 3 |
| 56 | 66 | 3 |
| 56 | 58 | 3 |
| 57 | 58 | 3 |
| 57 | 59 | 3 |
| 58 | 59 | 3 |
| 58 | 66 | 3 |
| 58 | 67 | 3 |
| 59 | 60 | 3 |
| 59 | 67 | 3 |
| 59 | 68 | 3 |
| 60 | 61 | 3 |
| 60 | 68 | 3 |
| 60 | 69 | 3 |
| 61 | 69 | 3 |
| 61 | 70 | 3 |
| 62 | 63 | 3 |
| 62 | 72 | 3 |
| 62 | 71 | 3 |
| 63 | 64 | 3 |
| 63 | 72 | 3 |
| 64 | 65 | 3 |
| 64 | 72 | 3 |
| 64 | 73 | 3 |
| 64 | 74 | 3 |
| 65 | 66 | 3 |
| 65 | 74 | 3 |
| 65 | 75 | 3 |

Contd.

| | | |
|---|---|---|
| 66 | 67 | 3 |
| 66 | 75 | 3 |
| 66 | 76 | 3 |
| 67 | 68 | 3 |
| 67 | 76 | 3 |
| 67 | 77 | 3 |
| 68 | 69 | 3 |
| 68 | 77 | 3 |
| 69 | 70 | 3 |
| 69 | 77 | 3 |
| 69 | 78 | 3 |
| 70 | 78 | 3 |
| 70 | 79 | 3 |
| 71 | 72 | 3 |
| 71 | 81 | 3 |
| 71 | 80 | 3 |
| 72 | 73 | 3 |
| 72 | 81 | 3 |
| 73 | 74 | 3 |
| 73 | 81 | 3 |
| 73 | 94 | 3 |
| 74 | 75 | 3 |
| 74 | 94 | 3 |
| 74 | 82 | 3 |
| 75 | 76 | 3 |
| 75 | 82 | 3 |
| 75 | 83 | 3 |
| 75 | 84 | 3 |
| 76 | 77 | 3 |
| 76 | 84 | 3 |
| 76 | 85 | 3 |
| 77 | 78 | 3 |
| 77 | 85 | 3 |
| 78 | 79 | 3 |
| 78 | 85 | 3 |
| 78 | 86 | 3 |
| 78 | 87 | 3 |
| 78 | 88 | 3 |
| 79 | 88 | 3 |
| 80 | 81 | 3 |
| 80 | 93 | 3 |
| 81 | 94 | 3 |
| 81 | 93 | 3 |
| 82 | 83 | 3 |
| 82 | 94 | 3 |
| 82 | 89 | 3 |
| 83 | 84 | 3 |
| 83 | 89 | 3 |
| 83 | 90 | 3 |
| 84 | 85 | 3 |
| 84 | 90 | 3 |
| 85 | 86 | 3 |
| 85 | 90 | 3 |
| 86 | 87 | 3 |
| 86 | 90 | 3 |
| 86 | 91 | 3 |
| 87 | 88 | 3 |
| 87 | 91 | 3 |

Contd.

| | | |
|---|---|---|
| 87 | 92 | 3 |
| 88 | 92 | 3 |
| 88 | 100 | 3 |
| 89 | 94 | 3 |
| 89 | 95 | 3 |
| 89 | 90 | 3 |
| 89 | 96 | 3 |
| 90 | 91 | 3 |
| 90 | 96 | 3 |
| 91 | 92 | 3 |
| 91 | 96 | 3 |
| 91 | 97 | 3 |
| 91 | 98 | 3 |
| 92 | 100 | 3 |
| 92 | 98 | 3 |
| 92 | 99 | 3 |
| 93 | 94 | 3 |
| 94 | 95 | 3 |
| 95 | 96 | 3 |
| 96 | 97 | 3 |
| 97 | 98 | 3 |
| 98 | 99 | 3 |
| 99 | 100 | 3 |

3. Format of input file SGKP12A.INP

| LSW3 | LSW4 | LSW5 | LSW6 |
|---|---|---|---|
| 3 | 2 | 2 | 1 |

H(K): INITIAL WATER TABLE ELEVATIONS JUNE 1976

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 199.2 | 202.5 | 203.6 | 206 | 206 | 203.5 | 203 | 201.5 | 202 | 204 |
| 199.7 | 195 | 195 | 201 | 204.2 | 205 | 203 | 201.2 | 201 | 200.5 |
| 199 | 201.8 | 199 | 195.5 | 192.5 | 192 | 195 | 202 | 201.5 | 200 |
| 199 | 198.1 | 197 | 201 | 200 | 197.8 | 199 | 195.5 | 197 | 192 |
| 193.8 | 200.5 | 198.5 | 197.8 | 196.5 | 195 | 196 | 194 | 186 | 194.4 |
| 197.5 | 198.7 | 197 | 196.5 | 196 | 193.5 | 194 | 192 | 192.6 | 192 |
| 184 | 191.5 | 195 | 194.1 | 193.2 | 190 | 189.9 | 190.2 | 187.8 | 182 |
| 188.2 | 192.7 | 192.4 | 191 | 189.5 | 189 | 188.2 | 185 | 182 | 186.5 |
| 190.1 | 189.7 | 189 | 188.3 | 187.5 | 186 | 184.5 | 183.4 | 189 | 188 |
| 186.5 | 184 | 187.8 | 189.5 | 188.6 | 188.3 | 186.8 | 185 | 183 | 180.5 |

H(K): WATER TABLE ELEVATIONS ON OCTOBER 1976

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 200.1 | 203.5 | 204.5 | 208 | 208 | 205.5 | 204.1 | 202.5 | 202.2 | 205 |
| 199.8 | 196 | 196 | 202 | 206.1 | 207 | 205 | 203 | 202.4 | 200.5 |
| 199.2 | 201.9 | 200 | 196 | 193.5 | 193.9 | 195.9 | 204 | 203.9 | 202.2 |
| 200.7 | 199 | 197.9 | 201.2 | 200.4 | 199 | 196.6 | 196.5 | 198.2 | 193 |
| 195 | 203 | 200.5 | 199.3 | 197.8 | 196.2 | 197.2 | 195 | 187.5 | 195.9 |
| 199.6 | 201 | 197.8 | 197.3 | 197.2 | 194.5 | 195.1 | 193 | 193.9 | 192.2 |
| 186 | 192.2 | 197 | 195.6 | 195 | 191 | 191 | 191.6 | 189 | 183 |
| 190.6 | 194.5 | 194.4 | 193 | 190 | 189.7 | 189.6 | 186 | 183 | 189 |
| 192.5 | 191.2 | 190.2 | 189 | 188.7 | 187.3 | 185.5 | 183.5 | 190.8 | 189 |
| 188 | 185 | 190.2 | 191.7 | 191 | 189.9 | 188.3 | 186 | 183.8 | 181.2 |

DELTA: MONSOON 1976
4

H(K): WATER TABLE ELEVATIONS JUNE 1977

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 200 | 203 | 204 | 207 | 206 | 203.1 | 202.1 | 201 | 201.2 | 203 |
| 198.8 | 195 | 195.1 | 201 | 204.2 | 205 | 203 | 200.7 | 200 | 199.5 |
| 198.5 | 201.6 | 198.6 | 194.9 | 191.5 | 192 | 194.5 | 202 | 201.5 | 200 |
| 198.7 | 198 | 197 | 201 | 200.1 | 198 | 198.6 | 195 | 197.1 | 191.2 |
| 193.2 | 200.5 | 198.2 | 197.5 | 196 | 195 | 195.8 | 194 | 186 | 194.5 |
| 197.2 | 198.2 | 196.6 | 196.1 | 195.5 | 193 | 193.5 | 191.5 | 192 | 191.7 |
| 184 | 191.5 | 195 | 194 | 194 | 189.9 | 189.4 | 189.5 | 187 | 182 |
| 188.5 | 192.5 | 192.3 | 191 | 189 | 188 | 187.6 | 184.1 | 182 | 187 |
| 190 | 189.7 | 188.7 | 188 | 186.8 | 185.5 | 184.2 | 182.1 | 189 | 187.3 |
| 186.1 | 183.8 | 188 | 189.2 | 189 | 187.5 | 186.5 | 184.3 | 182.4 | 180 |

DELTA: NONMONSOON 1976 - 77
8

H(K): WATER TABLE ELEVATIONS OCTOBER 1977

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 200.5 | 204 | 204.8 | 208.5 | 207 | 204.6 | 203.8 | 202.2 | 202.5 | 205 |
| 202 | 198.5 | 197 | 202 | 205.6 | 206.3 | 204.8 | 203 | 202.2 | 200.6 |
| 199.5 | 203.5 | 200 | 197 | 194 | 193.6 | 195.8 | 203.2 | 203.6 | 202.1 |
| 200.8 | 199 | 198.2 | 203 | 202 | 199.8 | 200.5 | 197.2 | 199 | 193 |
| 195 | 202 | 200.5 | 199.2 | 197.8 | 196.6 | 198 | 195.1 | 187 | 195.9 |
| 198.7 | 200.5 | 198.6 | 197.8 | 197.3 | 195 | 195.5 | 193.5 | 194 | 193.2 |
| 186 | 193.2 | 197 | 196.1 | 195.8 | 191.2 | 190.8 | 191.2 | 188.7 | 184 |
| 190.7 | 194.7 | 194.6 | 193.5 | 190.6 | 189.5 | 189 | 186.1 | 184 | 189.3 |
| 192.7 | 191.8 | 190.5 | 189.5 | 188.2 | 187.2 | 185.7 | 182.8 | 191.3 | 189.6 |
| 188.2 | 185.5 | 190.6 | 192.3 | 192.1 | 190.6 | 189.2 | 186.3 | 184 | 181.3 |

Contd.

DELTA: MONSOON 1977
4

H(K): WATER TABLE ELEVATIONS JUNE 1978

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 200 | 203 | 204 | 207 | 206.5 | 203.5 | 202.5 | 201 | 200.5 | 204 |
| 199 | 195.5 | 195.5 | 201 | 204.2 | 205 | 203 | 201 | 200.5 | 200 |
| 199 | 202 | 200 | 196 | 193 | 192 | 197 | 202 | 202 | 200.5 |
| 199 | 198 | 197 | 201.4 | 200.5 | 198.2 | 200 | 196 | 197.5 | 192 |
| 194.5 | 200.5 | 199 | 198 | 196 | 195.5 | 196.5 | 194 | 189 | 194.5 |
| 197 | 198.6 | 196.5 | 197 | 196.5 | 195 | 195 | 194.4 | 194 | 192 |
| 184 | 192 | 195 | 194 | 194 | 193 | 191 | 191 | 188 | 182 |
| 189 | 193 | 192.2 | 191.5 | 191.6 | 191 | 191.2 | 185.5 | 182 | 188 |
| 191 | 190.5 | 189.6 | 189.6 | 188 | 186 | 185 | 182.5 | 189 | 188.5 |
| 185.5 | 183.5 | 188.3 | 189.6 | 188.3 | 187.2 | 185.2 | 183.4 | 182.1 | 180.5 |

DELTA: NONMONSOON 1977 - 78
8

4. Format of input file SGMP12B.INP

QNET(K): NET RECHARGE OF MONSOON 1976

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

QNET(K): NET RECHARGE OF NONMONSOON 1976 - 77

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

QNET(K): NET RECHARGE OF MONSOON 1977

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Contd.

QNET(K): NET RECHARGE OF NONMONSOON 1977 - 78

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

2. Format of input file SGMP13.INP

| LSW7 | LSW8 | LSW9 |
|---|---|---|
| 2 | 2 | 2 |

APPENDIX F

1. Format of output file for inverse run

2. Format of output file SGMP13.OUT

GROUNDWATER MODEL FOR NUMERICAL GROUNDWATER MODELLING OF BULANDSHEHAR
WITH MONTHLY DATA FROM JUNE 1976 TO OCT. 1977

PRINTING OF CALCULATED WATER LEVELS AND BALANCES

TOTAL NUMBER OF NODES IS 100

UNIT LENGTH : 1 METRE
UNIT AREA : 1,000,000 SQ .METRES
UNIT VOLUME : 1,000,000 CU. METRES

UNIT OF TIME FOR DELTA AND BOUNDARY CONDITIONS IS MONTH

VALUES OF EXTERNAL SWITCHES

LSW7 = 2
LSW8 = 2
LSW9 = 2

INITIAL WATER LEVEL ELEVATIONS

T = .0000

| NODE | HINIT | NODE | HINIT | NODE | HINIT |
|---|---|---|---|---|---|
| 1 | 199.2000 | 35 | 200.0000 | 69 | 187.8000 |
| 2 | 202.5000 | 36 | 197.8000 | 70 | 182.0000 |
| 3 | 203.6000 | 37 | 199.0000 | 71 | 188.2000 |
| 4 | 206.0000 | 38 | 195.5000 | 72 | 192.7000 |
| 5 | 206.0000 | 39 | 197.0000 | 73 | 192.4000 |
| 6 | 203.5000 | 40 | 192.0000 | 74 | 191.0000 |
| 7 | 203.0000 | 41 | 193.8000 | 75 | 189.5000 |
| 8 | 201.5000 | 42 | 200.5000 | 76 | 189.0000 |
| 9 | 202.0000 | 43 | 198.5000 | 77 | 188.2000 |
| 10 | 204.0000 | 44 | 197.8000 | 78 | 185.0000 |
| 11 | 199.7000 | 45 | 196.5000 | 79 | 182.0000 |
| 12 | 195.0000 | 46 | 195.0000 | 80 | 186.5000 |
| 13 | 195.0000 | 47 | 196.0000 | 81 | 190.1000 |
| 14 | 201.0000 | 48 | 194.0000 | 82 | 189.7000 |
| 15 | 204.2000 | 49 | 186.0000 | 83 | 189.0000 |
| 16 | 205.0000 | 50 | 194.4000 | 84 | 188.3000 |
| 17 | 203.0000 | 51 | 197.5000 | 85 | 187.5000 |
| 18 | 201.2000 | 52 | 198.7000 | 86 | 186.0000 |
| 19 | 201.0000 | 53 | 197.0000 | 87 | 184.5000 |
| 20 | 200.5000 | 54 | 196.5000 | 88 | 183.4000 |
| 21 | 199.0000 | 55 | 196.0000 | 89 | 189.0000 |
| 22 | 201.8000 | 56 | 193.5000 | 90 | 188.0000 |
| 23 | 199.0000 | 57 | 194.0000 | 91 | 186.5000 |
| 24 | 195.5000 | 58 | 192.0000 | 92 | 184.0000 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 25 | 192.5000 | 59 | 192.6000 | 93 | 187.8000 |
| 26 | 192.0000 | 60 | 192.0000 | 94 | 189.5000 |
| 27 | 195.0000 | 61 | 184.0000 | 95 | 188.6000 |
| 28 | 202.0000 | 62 | 191.5000 | 96 | 188.3000 |
| 29 | 201.5000 | 63 | 195.0000 | 97 | 186.8000 |
| 30 | 200.0000 | 64 | 194.1000 | 98 | 185.0000 |
| 31 | 199.0000 | 65 | 193.2000 | 99 | 183.0000 |
| 32 | 198.1000 | 66 | 190.0000 | 100 | 180.5000 |
| 33 | 197.0000 | 67 | 189.9000 | | |
| 34 | 201.0000 | 68 | 190.2000 | | |

T = 4.0000 NO. OF ITERATIONS = 20 NO. OF SUBITERATIONS = 125

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 200.1000 | 35 | 200.4188 | 69 | 188.9657 |
| 2 | 203.5000 | 36 | 199.0144 | 70 | 183.0000 |
| 3 | 204.5000 | 37 | 196.5959 | 71 | 190.6000 |
| 4 | 208.0000 | 38 | 196.4644 | 72 | 194.4946 |
| 5 | 208.0000 | 39 | 198.2126 | 73 | 194.3653 |
| 6 | 205.5000 | 40 | 193.0000 | 74 | 192.9648 |
| 7 | 204.1000 | 41 | 195.0000 | 75 | 189.9678 |
| 8 | 202.5000 | 42 | 202.9820 | 76 | 189.7014 |
| 9 | 202.2000 | 43 | 200.4600 | 77 | 189.6171 |
| 10 | 205.0000 | 44 | 199.3046 | 78 | 185.9563 |
| 11 | 199.8000 | 45 | 197.8464 | 79 | 183.0000 |
| 12 | 196.0000 | 46 | 196.2209 | 80 | 189.0000 |
| 13 | 196.0000 | 47 | 197.1509 | 81 | 192.4977 |
| 14 | 201.9591 | 48 | 194.9788 | 82 | 191.1854 |
| 15 | 206.0526 | 49 | 187.5000 | 83 | 190.2400 |
| 16 | 206.9987 | 50 | 195.9000 | 84 | 189.0082 |
| 17 | 204.9970 | 51 | 199.5638 | 85 | 188.7013 |
| 18 | 202.9670 | 52 | 200.9597 | 86 | 187.3242 |
| 19 | 202.3999 | 53 | 197.7638 | 87 | 185.5079 |
| 20 | 200.5112 | 54 | 197.2611 | 88 | 183.5000 |
| 21 | 199.1605 | 55 | 197.1861 | 89 | 190.7544 |
| 22 | 201.8890 | 56 | 194.5264 | 90 | 188.9695 |
| 23 | 199.9857 | 57 | 195.1441 | 91 | 187.9658 |
| 24 | 196.0281 | 58 | 193.0320 | 92 | 184.9970 |
| 25 | 193.5000 | 59 | 193.9110 | 93 | 190.2000 |
| 26 | 193.3000 | 60 | 192.1755 | 94 | 191.7000 |
| 27 | 195.8503 | 61 | 186.0000 | 95 | 191.0000 |
| 28 | 203.9815 | 62 | 192.2000 | 96 | 189.9000 |
| 29 | 203.9050 | 63 | 196.9662 | 97 | 188.3000 |
| 30 | 202.1944 | 64 | 195.5648 | 98 | 186.0000 |
| 31 | 200.6858 | 65 | 194.9678 | 99 | 183.8000 |
| 32 | 199.0476 | 66 | 190.9709 | 100 | 181.2000 |
| 33 | 197.8559 | 67 | 190.9980 | | |
| 34 | 201.1606 | 68 | 191.6449 | | |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 14 | .0000 | -8.3733 | -.0274 | 8.4000 | 14 |
| 15 | .0000 | -14.4262 | -.1795 | 14.6000 | 15 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 16 | .0000 | -7.7280 | -.0725 | 7.8000 | 16 |
| 17 | .0000 | -7.3780 | -.0224 | 7.4000 | 17 |
| 18 | .0000 | -4.8075 | .0073 | 4.8000 | 18 |
| 19 | .0000 | -4.7864 | -.0138 | 4.8000 | 19 |
| 20 | .0000 | -.0414 | .0417 | .0000 | 20 |
| 21 | .0000 | -.8604 | .0608 | .8000 | 21 |
| 22 | .0000 | -.4003 | .0000 | .4000 | 22 |
| 23 | .0000 | -2.9285 | -.0717 | 3.0000 | 23 |
| 24 | .0000 | -1.2564 | .0565 | 1.2000 | 24 |
| 27 | .0000 | -6.4350 | .2345 | 6.2000 | 27 |
| 28 | .0000 | -12.7149 | -.0821 | 12.8000 | 28 |
| 29 | .0000 | -11.5490 | -.0496 | 11.6000 | 29 |
| 30 | .0000 | -8.4083 | .0075 | 8.4000 | 30 |
| 31 | .0000 | -5.4029 | .0027 | 5.4000 | 31 |
| 32 | .0000 | -4.2464 | .0467 | 4.2000 | 32 |
| 33 | .0000 | -5.6218 | .0223 | 5.6000 | 33 |
| 34 | .0000 | -.5422 | -.0579 | .6000 | 34 |
| 35 | .0000 | -1.6972 | -.1025 | 1.8000 | 35 |
| 36 | .0000 | -3.9345 | -.0657 | 4.0000 | 36 |
| 37 | .0000 | 5.6881 | .1125 | -5.8000 | 37 |
| 38 | .0000 | -2.9683 | -.0319 | 3.0000 | 38 |
| 39 | .0000 | -5.5318 | -.0689 | 5.6000 | 39 |
| 42 | .0000 | -16.8760 | -.0738 | 17.0000 | 42 |
| 43 | .0000 | -12.9685 | -.0302 | 13.0000 | 43 |
| 44 | .0000 | -5.2235 | .0232 | 5.2000 | 44 |
| 45 | .0000 | -6.0450 | .0453 | 6.0000 | 45 |
| 46 | .0000 | -6.6300 | .0304 | 6.6000 | 46 |
| 47 | .0000 | -8.1695 | -.0310 | 8.2000 | 47 |
| 48 | .0000 | -6.6671 | -.1325 | 6.8000 | 48 |
| 51 | .0000 | -18.7946 | -.0666 | 18.8000 | 51 |
| 52 | .0000 | -16.5311 | -.0538 | 16.6000 | 52 |
| 53 | .0000 | -6.1960 | -.0045 | 6.2000 | 53 |
| 54 | .0000 | -5.5421 | -.0574 | 5.6000 | 54 |
| 55 | .0000 | -6.6066 | .0070 | 6.6000 | 55 |
| 56 | .0000 | -5.4094 | .0098 | 5.4000 | 56 |
| 57 | .0000 | -4.9936 | -.0061 | 5.0000 | 57 |
| 58 | .0000 | -4.4285 | .0289 | 4.4000 | 58 |
| 59 | .0000 | -7.3762 | -.0234 | 7.4000 | 59 |
| 60 | .0000 | -1.0262 | .0266 | 1.0000 | 60 |
| 63 | .0000 | -17.5973 | -.0307 | 17.6000 | 63 |
| 64 | .0000 | -9.7963 | -.0033 | 9.8000 | 64 |
| 65 | .0000 | -13.9439 | -.0309 | 14.0000 | 65 |
| 66 | .0000 | -7.9194 | .1207 | 7.8000 | 66 |
| 67 | .0000 | -5.2115 | .0118 | 5.2000 | 67 |
| 68 | .0000 | -6.7664 | -.0333 | 6.8000 | 68 |
| 69 | .0000 | -7.7739 | -.0256 | 7.8000 | 69 |
| 72 | .0000 | -10.1615 | -.0379 | 10.2000 | 72 |
| 73 | .0000 | -13.5681 | -.0273 | 13.6000 | 73 |
| 74 | .0000 | -16.2207 | .0095 | 16.2000 | 74 |
| 75 | .0000 | -3.4401 | .0405 | 3.4000 | 75 |
| 76 | .0000 | -3.6226 | .0229 | 3.6000 | 76 |
| 77 | .0000 | -7.8000 | .0004 | 7.8000 | 77 |
| 78 | .0000 | -7.0135 | .0141 | 7.0000 | 78 |
| 81 | .0000 | -16.7168 | -.0368 | 16.8000 | 81 |
| 82 | .0000 | -10.2023 | .0032 | 10.2000 | 82 |
| 83 | .0000 | -5.7980 | -.0017 | 5.8000 | 83 |
| 84 | .0000 | -3.4150 | .0154 | 3.4000 | 84 |
| 85 | .0000 | -7.0008 | .0011 | 7.0000 | 85 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 86 | .0000 | -6.3963 | -.0034 | 6.4000 | 86 |
| 87 | .0000 | -3.6104 | .0101 | 3.6000 | 87 |
| 89 | .0000 | -14.6011 | -.0045 | 14.6000 | 89 |
| 90 | .0000 | -8.0038 | .0047 | 8.0000 | 90 |
| 91 | .0000 | -11.9812 | -.0201 | 12.0000 | 91 |
| 92 | .0000 | -6.4046 | .0050 | 6.4000 | 92 |
| TOTAL | .0000 | -480.7997 | -.5571 | 481.3997 | |

T = 12.0000 NO. OF ITERATIONS = 31 NO. OF SUBITERATIONS = 188

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 200.0000 | 35 | 200.0833 | 69 | 186.9842 |
| 2 | 203.0000 | 36 | 198.0009 | 70 | 182.0000 |
| 3 | 204.0000 | 37 | 198.5784 | 71 | 188.5000 |
| 4 | 207.0000 | 38 | 194.9758 | 72 | 192.5084 |
| 5 | 206.0000 | 39 | 197.1277 | 73 | 192.3302 |
| 6 | 203.1000 | 40 | 191.2000 | 74 | 190.9856 |
| 7 | 202.1000 | 41 | 193.2000 | 75 | 188.9952 |
| 8 | 201.0000 | 42 | 200.5145 | 76 | 188.0095 |
| 9 | 201.2000 | 43 | 198.1594 | 77 | 187.5843 |
| 10 | 203.0000 | 44 | 197.4674 | 78 | 184.1073 |
| 11 | 198.8000 | 45 | 196.0043 | 79 | 182.0000 |
| 12 | 195.0000 | 46 | 195.0476 | 80 | 187.0000 |
| 13 | 195.1000 | 47 | 195.7918 | 81 | 189.9683 |
| 14 | 200.9907 | 48 | 193.9996 | 82 | 189.7274 |
| 15 | 204.2149 | 49 | 186.0000 | 83 | 188.7015 |
| 16 | 204.9980 | 50 | 194.5000 | 84 | 188.0127 |
| 17 | 203.0262 | 51 | 197.1734 | 85 | 186.8499 |
| 18 | 200.7398 | 52 | 198.2208 | 86 | 185.5023 |
| 19 | 199.9636 | 53 | 196.5718 | 87 | 184.1696 |
| 20 | 199.4506 | 54 | 196.0879 | 88 | 182.1000 |
| 21 | 198.5078 | 55 | 195.5383 | 89 | 188.9747 |
| 22 | 201.5963 | 56 | 193.0142 | 90 | 187.2742 |
| 23 | 198.6373 | 57 | 193.4970 | 91 | 186.1026 |
| 24 | 194.9240 | 58 | 191.4595 | 92 | 183.8134 |
| 25 | 191.5000 | 59 | 191.9934 | 93 | 188.0000 |
| 26 | 192.0000 | 60 | 191.6867 | 94 | 189.2000 |
| 27 | 194.4779 | 61 | 184.0000 | 95 | 189.0000 |
| 28 | 202.0221 | 62 | 191.5000 | 96 | 187.5000 |
| 29 | 201.4757 | 63 | 194.9527 | 97 | 186.5000 |
| 30 | 200.0071 | 64 | 194.0071 | 98 | 184.3000 |
| 31 | 198.6925 | 65 | 193.9904 | 99 | 182.4000 |
| 32 | 197.9851 | 66 | 189.8692 | 100 | 180.0000 |
| 33 | 197.0080 | 67 | 189.3985 | | |
| 34 | 200.9959 | 68 | 189.5054 | | |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 14 | .0000 | 8.4547 | -.0540 | -8.4000 | 14 |
| 15 | .0000 | 14.3099 | -.3090 | -14.0000 | 15 |
| 16 | .0000 | 7.7359 | -.1356 | -7.6000 | 16 |
| 17 | .0000 | 7.2810 | -.0807 | -7.2000 | 17 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 18 | .0000 | 6.0596 | .0168 | -6.0000 | 18 |
| 19 | .0000 | 8.3300 | .0706 | -8.4000 | 19 |
| 20 | .0000 | 3.9372 | .0594 | -4.0000 | 20 |
| 21 | .0000 | 3.4985 | .1011 | -3.6000 | 21 |
| 22 | .0000 | 1.3164 | -.1167 | -1.2000 | 22 |
| 23 | .0000 | 4.0061 | -.0064 | -4.0000 | 23 |
| 24 | .0000 | 2.6269 | .1713 | -2.8000 | 24 |
| 27 | .0000 | 10.3863 | .4143 | -10.8000 | 27 |
| 28 | .0000 | 12.5733 | -.1739 | -12.4000 | 28 |
| 29 | .0000 | 11.6655 | -.0666 | -11.6000 | 29 |
| 30 | .0000 | 8.3810 | .0198 | -8.4000 | 30 |
| 31 | .0000 | 6.3885 | .0124 | -6.4000 | 31 |
| 32 | .0000 | 4.7615 | .0382 | -4.8000 | 32 |
| 33 | .0000 | 5.5691 | .0314 | -5.6000 | 33 |
| 34 | .0000 | .5560 | -.1563 | -.4000 | 34 |
| 35 | .0000 | 1.3596 | -.1604 | -1.2000 | 35 |
| 36 | .0000 | 3.2835 | -.0841 | -3.2000 | 36 |
| 37 | .0000 | -4.6907 | -.1985 | 4.8000 | 37 |
| 38 | .0000 | 4.5817 | .1076 | -4.8000 | 38 |
| 39 | .0000 | 4.9491 | -.1495 | -4.8000 | 39 |
| 42 | .0000 | 16.7776 | -.1098 | -16.8000 | 42 |
| 43 | .0000 | 15.2221 | -.0216 | -15.2000 | 43 |
| 44 | .0000 | 6.3782 | .0216 | -6.4000 | 44 |
| 45 | .0000 | 8.2704 | .1299 | -8.4000 | 45 |
| 46 | .0000 | 6.3714 | .0289 | -6.4000 | 46 |
| 47 | .0000 | 9.6473 | -.0469 | -9.6000 | 47 |
| 48 | .0000 | 6.6695 | -.2690 | -6.4000 | 48 |
| 51 | .0000 | 21.7691 | -.0831 | -21.6000 | 51 |
| 52 | .0000 | 20.0367 | -.0281 | -20.0000 | 52 |
| 53 | .0000 | 9.6692 | -.0687 | -9.6000 | 53 |
| 54 | .0000 | 8.5430 | -.1425 | -8.4000 | 54 |
| 55 | .0000 | 9.1783 | .0221 | -9.2000 | 55 |
| 56 | .0000 | 7.9700 | .0297 | -8.0000 | 56 |
| 57 | .0000 | 7.1893 | .0104 | -7.2000 | 57 |
| 58 | .0000 | 6.7481 | .0516 | -6.8000 | 58 |
| 59 | .0000 | 10.7889 | .0106 | -10.8000 | 59 |
| 60 | .0000 | 2.8581 | -.0585 | -2.8000 | 60 |
| 63 | .0000 | 18.0210 | -.0244 | -18.0000 | 63 |
| 64 | .0000 | 10.4173 | -.0169 | -10.4000 | 64 |
| 65 | .0000 | 7.7092 | -.1086 | -7.6000 | 65 |
| 66 | .0000 | 8.9864 | .2131 | -9.2000 | 66 |
| 67 | .0000 | 7.5917 | .0080 | -7.6000 | 67 |
| 68 | .0000 | 10.0188 | -.0185 | -10.0000 | 68 |
| 69 | .0000 | 13.2146 | -.0141 | -13.2000 | 69 |
| 72 | .0000 | 11.2465 | -.0462 | -11.2000 | 72 |
| 73 | .0000 | 14.0502 | -.0497 | -14.0000 | 73 |
| 74 | .0000 | 16.3395 | .0651 | -16.4000 | 74 |
| 75 | .0000 | 7.1518 | .0485 | -7.2000 | 75 |
| 76 | .0000 | 8.7385 | .0612 | -8.8000 | 76 |
| 77 | .0000 | 11.1890 | .0106 | -11.2000 | 77 |
| 78 | .0000 | 13.5605 | .0399 | -13.6000 | 78 |
| 81 | .0000 | 17.6350 | -.0338 | -17.6000 | 81 |
| 82 | .0000 | 10.0140 | -.0135 | -10.0000 | 82 |
| 83 | .0000 | 7.1936 | .0064 | -7.2000 | 83 |
| 84 | .0000 | 4.8004 | -.0007 | -4.8000 | 84 |
| 85 | .0000 | 10.7894 | .0111 | -10.8000 | 85 |
| 86 | .0000 | 8.8005 | -.0001 | -8.8000 | 86 |
| 87 | .0000 | 4.7939 | .0059 | -4.8000 | 87 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 89 | .0000 | 14.8114 | -.0120 | -14.8000 | 89 |
| 90 | .0000 | 13.9958 | .0049 | -14.0000 | 90 |
| 91 | .0000 | 15.2293 | -.0287 | -15.2000 | 91 |
| 92 | .0000 | 7.6034 | -.0030 | -7.6000 | 92 |
| TOTAL | .0000 | 585.3098 | -1.0677 | -584.3998 | |

T = 16.0000 NO. OF ITERATIONS = 23 NO. OF SUBITERATIONS = 171

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 200.5000 | 35 | 202.0330 | 69 | 188.6925 |
| 2 | 204.0000 | 36 | 199.7822 | 70 | 184.0000 |
| 3 | 204.8000 | 37 | 200.4818 | 71 | 190.7000 |
| 4 | 208.5000 | 38 | 197.1985 | 72 | 194.7283 |
| 5 | 207.0000 | 39 | 199.0375 | 73 | 194.5863 |
| 6 | 204.6000 | 40 | 193.0000 | 74 | 193.4647 |
| 7 | 203.8000 | 41 | 195.0000 | 75 | 190.5769 |
| 8 | 202.2000 | 42 | 201.9789 | 76 | 189.5252 |
| 9 | 202.5000 | 43 | 200.4810 | 77 | 189.0037 |
| 10 | 205.0000 | 44 | 199.2045 | 78 | 186.0717 |
| 11 | 202.0000 | 45 | 197.8419 | 79 | 184.0000 |
| 12 | 198.5000 | 46 | 196.5990 | 80 | 189.3000 |
| 13 | 197.0000 | 47 | 197.9820 | 81 | 192.6764 |
| 14 | 201.9521 | 48 | 195.0993 | 82 | 191.7655 |
| 15 | 205.5542 | 49 | 187.0000 | 83 | 190.5421 |
| 16 | 206.3244 | 50 | 195.9000 | 84 | 189.5070 |
| 17 | 204.8011 | 51 | 198.6640 | 85 | 188.2219 |
| 18 | 203.0118 | 52 | 200.4798 | 86 | 187.2417 |
| 19 | 202.1645 | 53 | 198.5643 | 87 | 185.7343 |
| 20 | 200.5925 | 54 | 197.7549 | 88 | 182.8000 |
| 21 | 199.5293 | 55 | 197.3003 | 89 | 191.2599 |
| 22 | 203.4936 | 56 | 194.9877 | 90 | 189.5764 |
| 23 | 200.0139 | 57 | 195.5130 | 91 | 188.1566 |
| 24 | 196.9926 | 58 | 193.5134 | 92 | 185.4630 |
| 25 | 194.0000 | 59 | 194.0189 | 93 | 190.6000 |
| 26 | 193.6000 | 60 | 193.1870 | 94 | 192.3000 |
| 27 | 195.7747 | 61 | 186.0000 | 95 | 192.1000 |
| 28 | 203.1656 | 62 | 193.2000 | 96 | 190.6000 |
| 29 | 203.6283 | 63 | 196.9640 | 97 | 189.2000 |
| 30 | 202.0973 | 64 | 196.0693 | 98 | 186.3000 |
| 31 | 200.7501 | 65 | 195.7594 | 99 | 184.0000 |
| 32 | 199.0239 | 66 | 191.1608 | 100 | 181.3000 |
| 33 | 198.2014 | 67 | 190.8347 | | |
| 34 | 202.9797 | 68 | 191.2106 | | |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 14 | .0000 | -8.3940 | -.0062 | 8.4000 | 14 |
| 15 | .0000 | -10.4291 | -.1714 | 10.6000 | 15 |
| 16 | .0000 | -5.1287 | -.0716 | 5.2000 | 16 |
| 17 | .0000 | -6.5572 | -.0430 | 6.6000 | 17 |
| 18 | .0000 | -6.1814 | -.0184 | 6.2000 | 18 |
| 19 | .0000 | -7.5939 | -.0064 | 7.6000 | 19 |
| 20 | .0000 | -4.2392 | .0390 | 4.2000 | 20 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 21 | .0000 | -5.4752 | .0756 | 5.4000 | 21 |
| 22 | .0000 | -8.5345 | -.0652 | 8.6000 | 22 |
| 23 | .0000 | -4.0898 | .0900 | 4.0000 | 23 |
| 24 | .0000 | -4.9213 | .1214 | 4.8000 | 24 |
| 27 | .0000 | -9.8141 | .2245 | 9.6000 | 27 |
| 28 | .0000 | -7.3374 | -.0621 | 7.4000 | 28 |
| 29 | .0000 | -10.3369 | -.0628 | 10.4000 | 29 |
| 30 | .0000 | -8.0090 | .0088 | 8.0000 | 30 |
| 31 | .0000 | -6.5946 | -.0057 | 6.6000 | 31 |
| 32 | .0000 | -4.6553 | .0550 | 4.6000 | 32 |
| 33 | .0000 | -7.8388 | .0392 | 7.8000 | 33 |
| 34 | .0000 | -6.6962 | -.1040 | 6.8000 | 34 |
| 35 | .0000 | -7.9004 | -.0999 | 8.0000 | 35 |
| 36 | .0000 | -5.7712 | -.0288 | 5.8000 | 36 |
| 37 | .0000 | -4.5034 | -.0968 | 4.6000 | 37 |
| 38 | .0000 | -6.8411 | .0409 | 6.8000 | 38 |
| 39 | .0000 | -8.7123 | -.0874 | 8.8000 | 39 |
| 42 | .0000 | -9.9571 | -.0425 | 10.0000 | 42 |
| 43 | .0000 | -15.3616 | -.0348 | 15.4000 | 43 |
| 44 | .0000 | -6.0306 | .0309 | 6.0000 | 44 |
| 45 | .0000 | -8.2502 | .0505 | 8.2000 | 45 |
| 46 | .0000 | -8.4247 | .0251 | 8.4000 | 46 |
| 47 | .0000 | -15.5470 | -.0519 | 15.6000 | 47 |
| 48 | .0000 | -7.4903 | -.1092 | 7.6000 | 48 |
| 51 | .0000 | -13.5754 | -.0302 | 13.6000 | 51 |
| 52 | .0000 | -16.5258 | -.0352 | 16.6000 | 52 |
| 53 | .0000 | -16.1631 | -.0376 | 16.2000 | 53 |
| 54 | .0000 | -12.1389 | -.0615 | 12.2000 | 54 |
| 55 | .0000 | -9.8148 | .0152 | 9.8000 | 55 |
| 56 | .0000 | -10.4015 | .0019 | 10.4000 | 56 |
| 57 | .0000 | -8.7998 | -.0005 | 8.8000 | 57 |
| 58 | .0000 | -8.8136 | .0133 | 8.8000 | 58 |
| 59 | .0000 | -11.3959 | -.0037 | 11.4000 | 59 |
| 60 | .0000 | -8.7722 | -.0274 | 8.8000 | 60 |
| 63 | .0000 | -18.0005 | -.0222 | 18.0000 | 63 |
| 64 | .0000 | -13.7914 | -.0082 | 13.8000 | 64 |
| 65 | .0000 | -13.9534 | -.0471 | 14.0000 | 65 |
| 66 | .0000 | -10.5357 | .1352 | 10.4000 | 66 |
| 67 | .0000 | -6.8165 | .0167 | 6.8000 | 67 |
| 68 | .0000 | -7.9847 | -.0157 | 8.0000 | 68 |
| 69 | .0000 | -11.3928 | -.0067 | 11.4000 | 69 |
| 72 | .0000 | -12.5697 | -.0299 | 12.6000 | 72 |
| 73 | .0000 | -15.5759 | -.0194 | 15.6000 | 73 |
| 74 | .0000 | -20.4661 | .0135 | 20.4000 | 74 |
| 75 | .0000 | -11.6303 | .0306 | 11.6000 | 75 |
| 76 | .0000 | -7.8285 | .0289 | 7.8000 | 76 |
| 77 | .0000 | -7.8124 | .0128 | 7.8000 | 77 |
| 78 | .0000 | -14.4062 | .0107 | 14.4000 | 78 |
| 81 | .0000 | -18.8809 | -.0339 | 19.0000 | 81 |
| 82 | .0000 | -13.9988 | -.0009 | 14.0000 | 82 |
| 83 | .0000 | -8.6063 | .0062 | 8.6000 | 83 |
| 84 | .0000 | -7.2055 | .0055 | 7.2000 | 84 |
| 85 | .0000 | -8.0128 | .0132 | 8.0000 | 85 |
| 86 | .0000 | -8.4018 | .0019 | 8.4000 | 86 |
| 87 | .0000 | -5.6050 | .0050 | 5.6000 | 87 |
| 89 | .0000 | -19.0189 | .0023 | 19.0000 | 89 |
| 90 | .0000 | -19.0060 | -.0030 | 19.0000 | 90 |
| 91 | .0000 | -16.7888 | -.0168 | 16.8000 | 91 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 92 | .0000 | -10.5965 | -.0032 | 10.6000 | 92 |
| TOTAL | .0000 | -662.9028 | -.4576 | 663.3997 | |

T = 24.0000 NO. OF ITERATIONS = 22 NO. OF SUBITERATIONS = 184

| NODE | H | NODE | H | NODE | H |
|---|---|---|---|---|---|
| 1 | 200.0000 | 35 | 200.5159 | 69 | 188.0303 |
| 2 | 203.0000 | 36 | 198.1710 | 70 | 182.0000 |
| 3 | 204.0000 | 37 | 200.0190 | 71 | 189.0000 |
| 4 | 207.0000 | 38 | 196.0434 | 72 | 193.0218 |
| 5 | 206.5000 | 39 | 197.5135 | 73 | 192.2095 |
| 6 | 203.5000 | 40 | 192.0000 | 74 | 191.4662 |
| 7 | 202.5000 | 41 | 194.5000 | 75 | 191.6083 |
| 8 | 201.0000 | 42 | 200.4977 | 76 | 190.9951 |
| 9 | 200.5000 | 43 | 199.0213 | 77 | 191.2288 |
| 10 | 204.0000 | 44 | 197.9602 | 78 | 185.4755 |
| 11 | 199.0000 | 45 | 196.0106 | 79 | 182.0000 |
| 12 | 195.5000 | 46 | 195.5056 | 80 | 188.0000 |
| 13 | 195.5000 | 47 | 196.5096 | 81 | 190.9996 |
| 14 | 200.9922 | 48 | 194.0162 | 82 | 190.5410 |
| 15 | 204.1891 | 49 | 189.0000 | 83 | 189.6050 |
| 16 | 204.9544 | 50 | 194.5000 | 84 | 189.5911 |
| 17 | 202.9536 | 51 | 196.9888 | 85 | 188.0300 |
| 18 | 200.9686 | 52 | 198.6128 | 86 | 186.0006 |
| 19 | 200.5467 | 53 | 196.4876 | 87 | 184.9516 |
| 20 | 200.0464 | 54 | 197.0207 | 88 | 182.5000 |
| 21 | 199.0178 | 55 | 196.5120 | 89 | 188.9912 |
| 22 | 201.9563 | 56 | 194.9910 | 90 | 188.5056 |
| 23 | 199.9688 | 57 | 194.9678 | 91 | 185.4639 |
| 24 | 196.0460 | 58 | 194.4290 | 92 | 183.5341 |
| 25 | 193.0000 | 59 | 194.0107 | 93 | 188.3000 |
| 26 | 192.0000 | 60 | 192.0221 | 94 | 189.6000 |
| 27 | 196.9977 | 61 | 184.0000 | 95 | 188.3000 |
| 28 | 202.0258 | 62 | 192.0000 | 96 | 187.2000 |
| 29 | 202.0207 | 63 | 194.9535 | 97 | 185.2000 |
| 30 | 200.5317 | 64 | 194.0333 | 98 | 183.4000 |
| 31 | 199.0061 | 65 | 193.9835 | 99 | 182.1000 |
| 32 | 197.9720 | 66 | 192.9843 | 100 | 180.5000 |
| 33 | 196.9959 | 67 | 191.0280 | | |
| 34 | 201.4044 | 68 | 190.9594 | | |

WATER BALANCE COMPONENTS

(ALL COMPONENTS ARE CALCULATED FOR THE LAST 1 TIME STEPS)

| NODE | NET RECHARGE | CHANGE IN STORAGE | SUBSURFACE FLOW | ARTIFICIAL FLOW | NODE |
|---|---|---|---|---|---|
| 14 | .0000 | 8.3810 | .0196 | -8.4000 | 14 |
| 15 | .0000 | 10.6305 | -.2300 | -10.4000 | 15 |
| 16 | .0000 | 5.2972 | -.0972 | -5.2000 | 16 |
| 17 | .0000 | 6.8254 | -.0257 | -6.8000 | 17 |
| 18 | .0000 | 5.5588 | .0417 | -5.6000 | 18 |
| 19 | .0000 | 5.6001 | .0266 | -5.6000 | 19 |
| 20 | .0000 | 2.0274 | -.0271 | -2.0000 | 20 |
| 21 | .0000 | 2.7418 | .0580 | -2.8000 | 21 |
| 22 | .0000 | 6.9153 | -.1156 | -6.8000 | 22 |

Contd.

| | | | | | |
|---|---|---|---|---|---|
| 23 | .0000 | .1339 | -.1335 | .0000 | 23 |
| 24 | .0000 | 2.2519 | .1593 | -2.4000 | 24 |
| 27 | .0000 | -9.2560 | .0565 | 9.2000 | 27 |
| 28 | .0000 | 7.3132 | -.1128 | -7.2000 | 28 |
| 29 | .0000 | 7.7201 | -.1202 | -7.6000 | 29 |
| 30 | .0000 | 5.9989 | .0006 | -6.0000 | 30 |
| 31 | .0000 | 5.5895 | .0102 | -5.6000 | 31 |
| 32 | .0000 | 4.7137 | .0866 | -4.8000 | 32 |
| 33 | .0000 | 7.9185 | .0811 | -8.0000 | 33 |
| 34 | .0000 | 5.3172 | -.1170 | -5.2000 | 34 |
| 35 | .0000 | 6.1475 | -.1478 | -6.0000 | 35 |
| 36 | .0000 | 5.2203 | -.0200 | -5.2000 | 36 |
| 37 | .0000 | 1.0951 | -.2932 | -.8000 | 37 |
| 38 | .0000 | 3.5551 | .1142 | -3.6000 | 38 |
| 39 | .0000 | 6.9522 | -.1515 | -6.8000 | 39 |
| 42 | .0000 | 10.0714 | -.0709 | -10.0000 | 42 |
| 43 | .0000 | 9.6587 | -.0584 | -9.6000 | 43 |
| 44 | .0000 | 4.3196 | .0230 | -4.4000 | 44 |
| 45 | .0000 | 8.2221 | .1770 | -8.4000 | 45 |
| 46 | .0000 | 5.9379 | .0617 | -6.0000 | 46 |
| 47 | .0000 | 10.4516 | -.0502 | -10.4000 | 47 |
| 48 | .0000 | 7.3775 | -.1770 | -7.2000 | 48 |
| 51 | .0000 | 15.2563 | -.0405 | -15.2000 | 51 |
| 52 | .0000 | 13.6582 | -.0516 | -13.6000 | 52 |
| 53 | .0000 | 16.8463 | -.0161 | -16.8000 | 53 |
| 54 | .0000 | 5.3465 | -.1460 | -5.2000 | 54 |
| 55 | .0000 | 4.3910 | .0085 | -4.4000 | 55 |
| 56 | .0000 | -.0172 | .0168 | .0000 | 56 |
| 57 | .0000 | 2.3798 | .0199 | -2.4000 | 57 |
| 58 | .0000 | -3.9288 | -.0715 | 4.0000 | 58 |
| 59 | .0000 | .0460 | -.0463 | .0000 | 59 |
| 60 | .0000 | 6.8110 | -.0106 | -6.8000 | 60 |
| 63 | .0000 | 17.9930 | -.0098 | -18.0000 | 63 |
| 64 | .0000 | 13.6164 | -.0150 | -13.6000 | 64 |
| 65 | .0000 | 14.0081 | -.0059 | -14.0000 | 65 |
| 66 | .0000 | -14.8732 | .0733 | 14.8000 | 66 |
| 67 | .0000 | -.9172 | .1175 | .8000 | 67 |
| 68 | .0000 | 1.1764 | .0233 | -1.2000 | 68 |
| 69 | .0000 | 4.4163 | -.0159 | -4.4000 | 69 |
| 72 | .0000 | 9.6627 | -.0631 | -9.6000 | 72 |
| 73 | .0000 | 16.4091 | -.0024 | -16.4000 | 73 |
| 74 | .0000 | 16.4987 | .0618 | -16.4000 | 74 |
| 75 | .0000 | -7.5843 | -.0160 | 7.6000 | 75 |
| 76 | .0000 | -7.5918 | -.0081 | 7.6000 | 76 |
| 77 | .0000 | -12.2470 | -.1530 | 12.4000 | 77 |
| 78 | .0000 | 4.3722 | .0281 | -4.4000 | 78 |
| 81 | .0000 | 11.6905 | -.0810 | -11.6000 | 81 |
| 82 | .0000 | 8.4103 | -.0098 | -8.4000 | 82 |
| 83 | .0000 | 4.3816 | .0186 | -4.4000 | 83 |
| 84 | .0000 | -.4054 | .0057 | .4000 | 84 |
| 85 | .0000 | 1.1354 | .0646 | -1.2000 | 85 |
| 86 | .0000 | 5.9947 | .0051 | -6.0000 | 86 |
| 87 | .0000 | 2.8039 | -.0121 | -2.8000 | 87 |
| 89 | .0000 | 18.8819 | .0009 | -18.8000 | 89 |
| 90 | .0000 | 8.8401 | -.0323 | -8.8000 | 90 |
| 91 | .0000 | 22.0094 | .0099 | -22.0000 | 91 |
| 92 | .0000 | 12.3902 | .0102 | -12.4000 | 92 |
| TOTAL | .0000 | 382.5483 | -1.3747 | -380.7998 | |