OPTIMAL CONJUNCTIVE USE-SUSTAINED YIELD PUMPING ANALYSIS

FOR EASTERN ARKANSAS

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CHAPTER I

INTRODUCTION AND SCOPE OF STUDY

1.1 Study Area

The likelihood that irrigated agricultural acreages will increase in eastern Arkansas is high. This results from favorable agricultural soils, climate, and the availability of significant water resources.

Most of the eastern Arkansas region is underlain by the Mississippi Alluvial Aquifer, a Quaternary deposit of unconsolidated sands and gravels. Numerous rivers flow through the region. The study area within Arkansas is shown as the shaded area in Figure 1.1 (Ludwig, 1988).

Hstoric use of groundwater for agriculture and other uses has overstressed the aquifer and caused significant cones of depression. Maintaining current withdrawal rates is not desirable and may be impossible over the long-term. To assure a sustained yield of groundwater, its use should decrease. However, projected water demands for agriculture are significantly greater than current use. Increased groundwater use could result in more severe depressions, locally inadequate saturated thickness, economic hardship, and litigious entanglements. State and federal agencies wish to avoid these consequences.

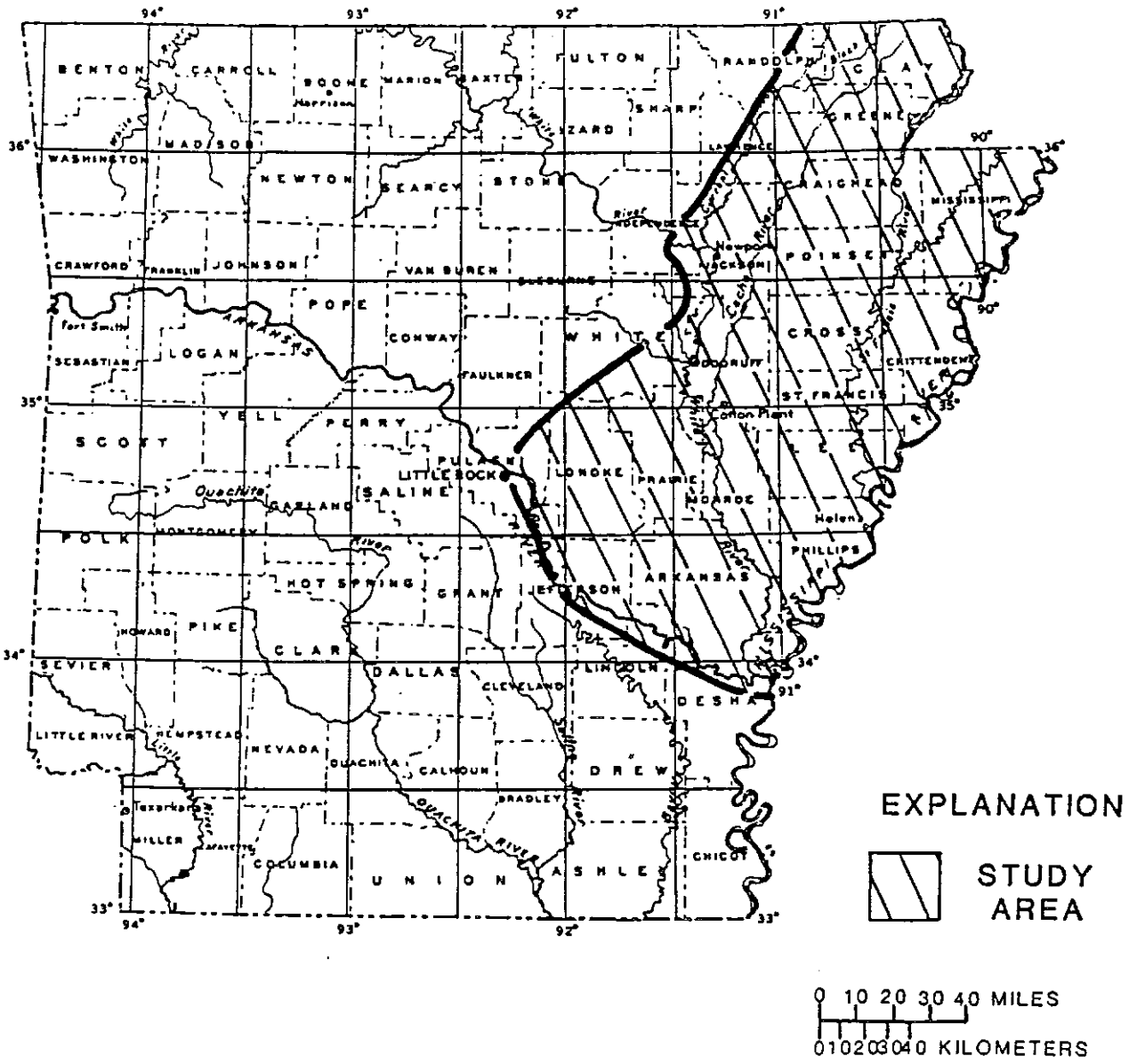


Figure 1.1 Location of the Study Area in Arkansas

The planning process can be aided by a knowledge of a) regional sustainable yield of groundwater, and b) feasible surface water use that will cause acceptable consequences. As a part of the Eastern Arkansas Regional Comprehensive Study (EARCS), this report provides such information.

1.2 Report Objectives

This report provides optimal future groundwater and surface water use strategies for the EARCS area. A "strategy" for a 1595-cell area in a single decade refers to a set of 1595 cell-by-cell volumes of groundwater plus the accompanying set of 1595 cell-by-cell volumes of surface water.

Strategies are obtained through a series of steps. First, much of the alluvial plain north of the Arkansas River is divided into 1595 cells. Each cell is three-miles by three-miles in size. Second, a finite-difference computer optimization/simulation model is developed for the study area. The model utilizes information on the physical system and anticipated future demand for water. Average climatic conditions are assumed. The model computes the water use strategy that maximizes the total combined volume of groundwater and surface water in each decade. Assuming validity of assumed hydrogeologic and climatic

conditions, the computed optimal groundwater use is sustainable forever. In addition, average annual streamflow resulting from computed groundwater and surface water use strategies should not decrease below acceptable levels.

Next, the volume of unsatisfied future water demand is computed as the difference between the projected water demand and the optimal sustainable water supply. The importation of water from other sources is required in cells that have unsatisfied demand. In the third and final step, a monthly allocation model is applied. This involves the use of monthly demand data. The allocation model determines the monthly pumping, surface water and unmet water demand.

More precisely stated, the report objectives are:

a) compute optimal annual future water use strategies for two projected water demand data sets;

b) quantify the annual future imported water requirement for agricultural, municipal, and industrial users;

and

c) describe the monthly water use and imported water requirement that are in harmony with the optimal annual strategies.

1.3 Organization of the Report

This report has six chapters and extensive appendices. Introductory materials are included in Chapter I. Chapter II presents the data sources of the physical parameters and water demands of the EARCS area. The third chapter introduces the optimization model formulation that is applicable to the study area. In Chapter IV, the computational experiments that involve alternative scenarios and analysis of the corresponding results are presented. Sensitivity analysis is also included in Chapter IV. Chapter V deals with the monthly allocation of groundwater and surface water based on the annual strategies. The last chapter, Chapter VI, provides a summary of the major conclusions drawn from the study. In addition, the final chapter also provides recommendations for planning purposes based on the project study results. The cell-by-cell values of optimal annual pumping, surface water use, and unsatisfied water demand for alternative scenarios are included as Appendices A, B, and C, respectively.

CHAPTER II

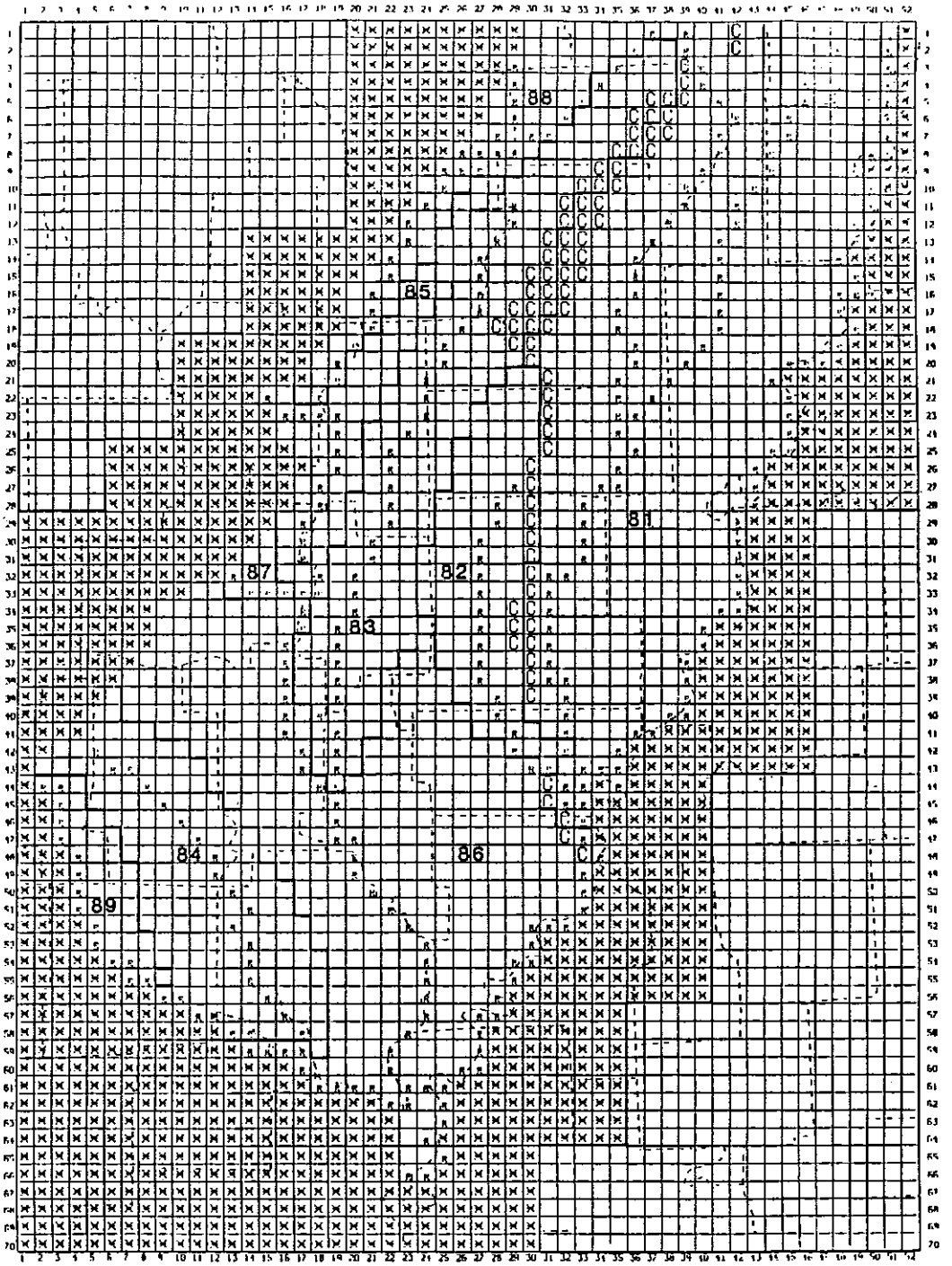
DATA SOURCES

2.1 Estimates of System Parameters and Water Demands

The data used in the computational models was obtained from a variety of sources. Detailed published data is not repeated in this report. However, the sources of the data are credited below.

The U. S. Geological Survey (U. S. G. S.) provided the EARCS area boundary definition data. Within Arkansas, the study area encompasses the part of the aquifer that is north of the Arkansas River. The study area also includes the Missouri bootheel. Figure 2.1 shows the finite-difference cell system provided by the U. S. G. S. for modeling purposes (Ludwig, 1988). The EARCS area does not include the inactive cells. Inactive cells are shown in Figure 2.1 as: a) cells with the * symbol, b) Crowley's Ridge cells designated with the C symbol, and c) cells that do not have a designated two-digit basin code number.

All physical system parameters used in the models are determined by the U. S. G. S. (Ludwig, 1988). Parameter calibration was accomplished by Ludwig (1988) through the use of a groundwater simulation model (McDonald and Harbaugh, 1984). For each cell in the EARCS area, the U. S. G. S. provided data on: a) historic (1982) water



EXPLANATION
C = CROWLEY'S RIDGE R = RIVER
+ = INACTIVE NODE

SCALE = 1: 1,250,000.

81-ST.FRANCIS RIVER BASIN
82-L'ANGUILLE RIVER BASIN
83-CACHE RIVER BASIN
84-BAYOU METO RIVER BASIN
85- UPPER WHITE RIVER BASIN
86-LOWER WHITE RIVER BASIN
87-LITTLE RED RIVER BASIN
88-BLACK RIVER BASIN
89-PLUM BAYOU BASIN

Figure 2.1 Finite-difference Cell System for the Study Area

levels, b) hydraulic conductivity, c) river conductance, d) river stage, e) ground elevation, f) aquifer bottom, and g) aquifer top. The U. S. G. S. also provided estimates of the historic recharge across the northern boundary of the study area and supplied the water demand data in the Missouri portion of the study area (personal communication: Gus Ludwig, Carmen Baxter, and John Terry).

The Soil Conservation Service (S. C. S.) provided estimates of water demand in each Arkansas cell in the EARCS area (Soil Conservation Service, 1986). Data from the S. C. S. include: a) current and projected annual total water demand, b) current and projected agricultural demand on both monthly and annual bases, c) current (1982) monthly and annual surface water demand, and d) current (1982) monthly and annual tertiary aquifer demand. Two sets of data for the projected or future water annual total demand are supplied by the S. C. S.. The first set includes the future water demand in the absence of conservation measures. The second set includes estimates of water demand assuming that conservation practices are implemented. Similarly, data on projected agricultural demands on both monthly and annual basis are provided for both the with and without conservation scenarios.

The U. S. Army Corps of Engineers (C. O. E.) provided estimates of the minimum acceptable streamflow at selected river locations in the

study area. The C. O. E. provided data on inflow to rivers, at their points of origin, from outside the area, or from overland inflow. All the data from the C. O. E. is included as Appendix M of an accompanying report (Cantiller and Peralta, 1988).

2.2 Data Bank Development

The data required as input to the management model in this report comes from different sources, and is obtained in varied units and formats. When systematically organizing the data for this modeling effort, minimal data handling and data manipulation are desirable. Accordingly, each data set is virtually left unaltered except for the addition of header records that a) identify the source of data, b) record the format code for reading purposes, c) provide the conversion factor necessary to convert the data from the its current units to the units required by the model, and d) specify the type of parameter or parameters included in the data file.

2.3 Summary

The data required to adequately represent the EARCS area in a mathematical modeling formulation comes from different agencies. A data bank that organizes the data for subsequent modeling efforts has been developed at the University of Arkansas.

CHAPTER III

CONJUNCTIVE WATER USE AND SUSTAINED GROUNDWATER YIELD OPTIMIZATION MODEL

3.1 Assumptions and Types of Cells

The EARCS area is defined by a set of 1595 finite-difference cells for modeling purposes. Each cell is classified into different categories: a) constant head or variable head cell, b) river or non-river cell, and c) confined or unconfined aquifer cell. The governing equations and bound constraints that are applicable to a particular cell are determined in accordance with its cell categories.

Each cell may be classified either as a variable head or constant head cell depending on three factors: head elevation, groundwater pumping, and recharge. (By 'recharge' is meant inflow from outside the system or by intentional injection. It does not mean recharge due to deep percolation or stream/aquifer interflow.) The upper and lower limits associated with these three factors specify the cell type. A variable head cell is any cell that has a varying head elevation. Groundwater pumping is allowed in variable head cells. However, the recharge is fixed at zero. In contrast, a constant head cell is any

cell that has unchanging head elevation. There is no groundwater pumping in this type of cell. Recharge may be either positive or negative in sign. (Negative recharge values mean that the direction of flow is into the aquifer. Positive recharge means discharge from the aquifer.) Typically, constant head cells represent cells along the periphery of the study area. In the EARCS area, however, only the cells in the northern boundary are constant head cells. Out of 1595 cells in the study area, only 21 cells are constant head cells. The rest of the cells are variable head cells.

The appropriate upper limit on surface water in any cell depends on whether or not that cell is a river cell. We assume that future use of water from reservoirs and unmodeled bayous will be the same as current usage. Thus, non-river cells provide surface water at their current rates. River cells are potential sources of additional surface water. They have the capability of supplying surface water in excess of their current rate. Some river cells are also designated as control or effluent cells. All computed strategies must result in average streamflow at control cells that is not less than prespecified minimum acceptable discharge rates.

Cells are classified as confined or unconfined to properly compute saturated thickness. The saturated thickness of a confined aquifer cell is determined in a manner different to that of an unconfined aquifer.

When the initial head elevation is lower than the top of the aquifer, unconfined aquifer conditions exist. In this case, the saturated thickness is the difference between the the initial potentiometic surface elevation and the base of the aquifer. When the initial head elevation is higher than the top of the aquifer, the cell is considered a confined aquifer cell. The saturated thickness is computed as the difference between the aquifer top and aquifer base.

Ludwig (1988) considered that vertical movement of water could occur in all cells. As is commonly done, all cells were treated as stream/aquifer cells. The degree of deep percolation that could occur in a cell is a function of vertical hydraulic conductivity and assumed 'river stage' values. Both data types were obtained from Ludwig (1988). For non-river cells, vertical conductivity is very small by comparison with river cells.

In calibrating a finite difference model for the EARCS area, Ludwig (1988) obtained best results when assuming insignificant flow between the modeled Quaternary aquifer and deeper formations. Thus, two-dimensional flow is simulated in this study.

Peralta and Cantiller (1988) compared alternative model formulations for maximizing the sustained yield of groundwater for a situation such as the one considered by this study. They compared a

simple iterative steady-state optimization model with a more realistic combination model that used both steady and unsteady flow equations. They found that if pumping was not permitted to decrease with time, the iterative steady-state approach yielded answers very similar to those from the more sophisticated model. In addition, they found that the simple model required about one third the computer memory and processing time of the more complex model. The iterative steady-state approach was used in this study. As is reported later, even the simple model required about 12 MBytes of memory and over two hours of CPU time on an IBM 4381. This significantly taxed the Univ. of Arkansas system. No alternative formulation was felt to be possible for this study area.

Another approximation technique was used in order to maximize total sustainable pumping for the study area. To achieve global optimality of an optimization problem such as this, all constraint equations must be linear. This means that transmissivity must be treated as temporally constant, although it may vary in space. However, the study area exhibits both confined and unconfined regions currently, and will probably have even more unconfined areas in the future. As transmissivity decreases, sustainable groundwater extraction rates usually decrease. Because transmissivity is a function of head and head is a function of transmissivity, currently existing transmissivities cannot be used for determining optimal pumping rates.

To avoid using the indicated nonlinear constraint equations, another iterative procedure was utilized. As explained in section 3.3, when computing optimal strategies, we use the conservative (smallest expected) transmissivities that would exist in the future if a maximum sustainable pumping strategy were implemented. In this way, global optimality is obtained for a linear surrogate of the nonlinear problem. Later, the acceptability of the modeling procedures used in this study is demonstrated through the use of unsteady simulation models. Using steady-state simulation for optimizing sustained yield planning is not uncommon (Peralta and Killian, 1985).

3.2 Management Model Formulation

The water management problem addressed in this report is the determination of optimal regional use of surface water and sustainable groundwater yield. The management goal is to maximize available water while maintaining various system variables at acceptable levels. This management problem is mathematically formulated as:

$$\text{Maximize } Z = \sum_i \sum_j \left(g_{i,j} + s_{i,j} \right) \qquad \forall\, i \epsilon I,\ j \epsilon J \quad \ldots\ldots (1)$$

subject to:

$$c^L_{m,n} \leq c_{m,n} \leq c^U_{m,n} \qquad \forall\ (m,n)\epsilon D \quad \ldots\ldots\ldots\ldots\ldots (2)$$

$$g^L_{i,j} \leq g_{i,j} \leq g^U_{i,j} \qquad \forall\ i\epsilon I, j\epsilon J \quad \ldots\ldots\ldots\ldots\ldots (3)$$

$$h^L_{i,j} \leq h_{i,j} \leq h^U_{i,j} \qquad \forall\ i\epsilon I, j\epsilon J \quad \ldots\ldots\ldots\ldots\ldots (4)$$

$$r^L_{i,j} \leq r_{i,j} \leq r^U_{i,j} \qquad \forall\ i\epsilon I, j\epsilon J \quad \ldots\ldots\ldots\ldots\ldots (5)$$

$$s^L_{i,j} \leq s_{i,j} \qquad \forall\ i\epsilon I, j\epsilon J \quad \ldots\ldots\ldots\ldots\ldots (6)$$

$$s_{i,j} \leq s^U_{i,j} \qquad \forall\ (i,j)\epsilon X \quad \ldots\ldots\ldots\ldots\ldots (7)$$

$$g_{i,j} + s_{i,j} \leq s^U_{i,j} \qquad \forall\ (i,j)\epsilon Y \quad \ldots\ldots\ldots\ldots\ldots (8)$$

$$t^i_{i,j}\, h_{i+1,j} + t^i_{i-1,j}\, h_{i-1,j} + t^j_{i,j-1}\, h_{i,j-1} + t^j_{i,j}\, h_{i,j+1} - \left(t^i_{i,j} + t^i_{i-1,j} + t^j_{i,j} + t^j_{i,j-1} + v_{i,j} \right) h_{i,j} = g_{i,j} + r_{i,j} - v_{i,j}\, w_{i,j} \qquad \forall\ i\epsilon I, j\epsilon J \quad \ldots\ldots\ldots\ldots\ldots (9)$$

$$\sum_i \sum_j \left[s_{i,j} + v_{i,j} \left(w_{i,j} - h_{i,j} \right) \right] + c_{m,n} = \sum_i \sum_j \left(p_{i,j} + o_{i,j} \right) \qquad \forall\ i\epsilon I,\ j\epsilon J,\ (i,j)\epsilon\Gamma(k),$$

and cell m,n is the most

downstream effluent cell
in river reach k ..... (10)

where:

Z = the objective function (L^3/T),

i = row index of a finite-difference cell,

j = column index of a finite-difference cell,

I = set of row indices of the cells in the study area,

J = set of column indices of the cells in the study area,

m = row index of a finite-difference effluent cell,

n = column index of a finite-difference effluent cell,

D = set of row index and column index pairs of effluent cells,

X = set of row index and column index pairs of nonriver cells,

Y = set of row index and column index pairs of river cells,

k = river reach index,

$\Gamma(k)$ = set of row index and column index pairs of cells in river reach k,

$g_{i,j}$ = the steady-state groundwater pumping in cell i,j (L^3/T),

$s_{i,j}$ = surface water in cell i,j (L^3/T),

$c^L_{m,n}$ = lower limit on effluent (discharge to next downstream river reach) in cell m,n (L^3/T),

$c_{m,n}$ = effluent in river cell m,n (L^3/T),

$c^U_{m,n}$ = upper limit on effluent in river cell m,n (L^3/T),

$g^L_{i,j}$ = lower limit on groundwater pumping in cell i,j (L^3/T),

$g^U_{i,j}$ = upper limit on groundwater pumping in cell i,j (L^3/T),

$h^L_{i,j}$ = lower limit on potentiometric head in cell i,j (L),

$h_{i,j}$ = potentiometric head in cell i,j (L),

$h^U_{i,j}$ = upper limit on potentiometric head in cell i,j (L),

$r^L_{i,j}$ = lower limit on recharge in cell i,j (L^3/T),

$r_{i,j}$ = recharge in cell i,j (L^3/T),

$r^U_{i,j}$ = upper limit on recharge in cell i,j (L^3/T),

$s^L_{i,j}$ = lower limit on surface water in cell i,j (L^3/T),

$s^U_{i,j}$ = upper limit on surface water in cell i,j (L^3/T),

$t^i_{i,j}$ = harmonic midpoint transmissivity between cell i,j and cell i+1,j (L^2/T),

$t^j_{i,j}$ = harmonic midpoint transmissivity between cell i,j and cell i,j+1 (L^2/T),

$v_{i,j}$ = river conductance in cell i,j (L^2/T),

$w_{i,j}$ = river stage in cell i,j (L),

$p_{i,j}$ = influent into river cell i,j from outside the river reach (L^3/T),

and

$o_{i,j}$ = overland inflow into the river in cell i,j (L^3/T).

The midpoint transmissivities are computed using the following:

$$t^j_{i,j} = 2\, a_{i,j} \left[\frac{b_{i,j}\, b_{i,j+1}}{b_{i,j} + b_{i,j+1}} \right] \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

$$t^i_{i,j} = 2\, a_{i,j} \left[\frac{b_{i,j}\, b_{i+1,j}}{b_{i,j} + b_{i+1,j}} \right] \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

where: $b_{i,j}$ is the initial saturated thickness (L), and

$a_{i,j}$ is the hydraulic conductivity of cell i,j (L/T).

The computation of saturated thickness has been discussed in section 3.1 of this Chapter.

The decision variables in the model are the cell effluent, pumping, surface water, recharge, and potentiometric head. Model solution is based on the assumption that all other parameters are known. In essence, the saturated thickness in each cell is assumed to be invariant throughout the decades. Although this may not be realistic, the size of the problem area has made this assumption a computational necessity.

3.2.1 Objective Function

Equation (1) is the mathematical representation of the objective function. The sum of utilized groundwater and surface water is maximized. The absence of weighting factors in the objective function implies no difference in the relative importance of groundwater and surface water. This means that the source of water to satisfy water demand is not a management issue. The goal is to utilize as much available water as possible, while satisfying prespecified constraint conditions on the decision variables.

3.2.2 Constraints and Bounds

The constraint set is included in Equations (2) through (10). The lower and upper bounds on effluent, pumping, head, and recharge are presented in Equations (2-5) respectively. Equation (2) applies only to effluent cells. In the EARCS area, there are sixteen (16) effluent cell that are constrained by Equation (2). The lower limit on stream discharge at effluent cells have been provided by the C. O. E.. The upper limits on effluent have been arbitrarily set to 100 times the minimum value. Groundwater pumping is fixed at zero for the 21 EARCS area constant head cells. Therefore, Equation (3) serves to bound the

pumping in the 1574 variable head cells only. The restriction on head, Equation (4), applies to the same cells because the constant head cells assume fixed potentiometric head elevation. In the EARCS study area, the minimum saturated thickness is included by setting the lower limit on head to be the base of the aquifer plus 20 feet in each cell. Equation (5) applies to 21 constant head cells while the recharge of all other cells are fixed at zero. No feasible strategy could be computed if recharge across each cell of the northern boundary was constrained not to exceed the current rate. This results from slight data inaccuracies. As demonstrated later, permitting up to twice as much as current recharge always yielded optimal strategies. All strategies reported in this report, except sensitivity runs A and B, permitted up to twice the observed recharge rate in each cell of the northern boundary. It should be noted that loosening this bound in this manner did not, in any other the reported scenarios, cause total recharge along the northern boundary to exceed the currently observed rate.

Equations (6) through (8) are the constraints for lower and upper limits on surface water. The lower limit on surface water is set to the current surface water use in all cells regardless of cell type. However, Equation (7) is exclusively used to specify the upper bound on non-river cells. In the EARCS area, this upper bound is also equal to the lower bound. This effectively fixes the surface water in non-river cells to the current surface use. A different set of upper

bound constraints is applied to river cells. Equation (8) specifies that in river cells the sum of groundwater pumping and surface water be bounded by a defined upper limit. For the EARCS area, this upper bound is defined as the sum of groundwater and surface water demand.

Equation (9) is the two-dimensional steady-state equation that governs each cell in the study area. The stream-aquifer interflow component of this equation appears as two separate terms, one on each side of the equation. The equation is written in this way for convenience. Equation (9) essentially ensures mass balance in each cell.

Equation (10) is the river reach mass balance equation. It assures the sum of all inputs to any river reach is equal to the volume of water that goes out of that river reach. There are sixteen (16) such equations for the EARCS area.

3.3 Iterative Procedure for the Computation of Appropriate Transmissivities

Appropriate transmissivities are needed in the solution of the model described in section 3.2 of this Chapter. An iterative procedure to obtain these transmissivities is discussed in this section.

The data for historic water levels does not necessarily define a steady-state potentiometric surface. It is therefore possible that substantial changes in saturated thickness would be observed when this data is used. To ensure the validity of steady-state assumptions, it is important to base the models on appropriate head elevations. Moreover, it is desirable to use conservative estimates of these head elevations. To accomplish this task, an iterative procedure is recommended.

The iteration is started by using the historic water levels in estimating the saturated thickness. The optimization/simulation model presented in section 3.2 is solved while using the water demand for the fifth decade as data. The optimal head from this model is taken as the initial head for the second iteration. The iteration is continued until the largest difference in the current iteration's initial head and optimal head is generally less than one foot. In all cases, the final difference is less than 10% of the minimum saturated thickness. The optimal heads from the final iteration are then used to compute transmissivities assumed for the optimization model to develop the maximum sustained yield water use strategies. As a result of using these transmissivities in developing all reported optimal strategies, pumping never had to decrease in a cell due to transmissivity decreasing with time.

3.4 Summary

This Chapter presents the mathematical formulation of the optimization/simulation model for eastern Arkansas. The objective function and the constraining equations are described in detail. The lower and upper limits on the decision variables are also discussed in relation to cell type and classification. The model is discussed in the context of its utility to the EARCS area. Chapter III also presents an iterative procedure to compute the appropriate transmissivities. The transmissivities obtained from this procedure lead to fairly 'safe' strategies--we expect them to be sustainable if other utilized data is accurate.

CHAPTER IV

OPTIMAL ANNUAL WATER USE-SUSTAINED GROUNDWATER YIELD STRATEGIES

4.1 Tested Scenarios

The management model that is formulated in Chapter III has been coded and tested at the University of Arkansas Computing Center. All runs used MINOS (Modular In-Core Nonlinear Optimization System), an optimization code that solves large and sparse problems efficiently (Murtagh and Saunders, 1987). The computer models are actually written in GAMS (General Algebraic Modeling System). GAMS is a pre-processor computer language that includes MINOS as one of its possible optimization codes. Initially a product of the World Bank (Kendrick and Meeraus, 1985), GAMS is now a propriety product of GAMS Development Corporation.

The modeling efforts for the EARCS area required extensive data from several agencies. Moreover, considerable changes in data are needed to run models for various scenarios. For these reasons, a computer package, VILMA (Virtually Interactive Large-scale Model for Arkansas), was developed. VILMA is designed to facilitate the creation

of the decade-by-decade optimization/simulation models (Cantiller and Peralta, 1988).

In this report, a "scenario" refers to a series of decade-by-decade strategies from 1990 to 2030. Two sets of scenarios each are reported for models that utilize water demand data with conservation (CMA and CON scenarios) and without conservation (SMA and SUB scenarios). Therefore, four different scenarios are presented. Each scenario is based on the management problem formulation discussed in Chapter III. However, the established lower bound on groundwater pumping in each cell differs from scenario to scenario:

a) CMA scenario - lower bound on pumping equals the M & I (municipal and industrial) demand,

b) CON scenario - lower bound on pumping is zero,

c) SMA scenario - lower bound on pumping equals the M & I demand, and

d) SUB scenario - lower bound on pumping is M & I demand in the first decade, after which, the lower limit equals the optimal pumping of the preceding decade's strategy.

The summary of results of the computer runs for the CMA, CON, SMA, and SUB scenarios are presented in Tables 4.1, 4.2, 4.3, and 4.4; respectively. The GAMS models generated by VILMA for each run involved 14,404 equations and 6,397 variables. (Because of a peculiarity of the

GAMS/MINOS interface, some bounds are described in the model as equations, resulting in more equations than one might expect.) Typically, after recent Univ. of Arkansas computer system upgrades, a run requires about 8,300 seconds of CPU (Central Processing Unit) time.

4.2 Analysis of Results

Results shown in Tables 4.1 to 4.4 are organized by water demand, sources, aquifer volume balance and river volume balance. In these tables, 'groundwater pumping' refers to extraction from the Quaternary aquifer. Extraction from the Tertiary aquifer is considered to be constant in time and is depicted only in the second row as 'deep aquifer demand'. 'Stream-aquifer interflow' refers to all vertical movement of water, except for pumping. It includes deep percolation at non-river cells and stream-aquifer interflow at river cells. 'River stream-aquifer interflow' refers to vertical movement at river cells only.

Results of the CMA, CON, and SMA scenarios are obtained from successful model runs. However, in the SUB scenario, the runs for the fourth (2020) and the fifth (2030) decades failed to provide feasible results. In these cases, the strategy of 2010 is taken as the best possible solution. The values of unmet needs are then obtained by subtraction. It should be mentioned that none of the strategies can

fully satisfy all anticipated demand in any decade.

In the CON and CMA scenarios one may note that projected municipal and industrial demand is unusually low in the 2020 decade. This demand data was provided by federal agency as was all other demand data used in this study.

The CMA scenario results show a definite increase in groundwater pumping from decade to decade. The same trend is observed in the CON scenario. The surface water also increases through the decades in the CON and CMA scenarios. Comparing the results of Tables 4.1 and 4.2, the groundwater pumping in the CMA scenario is observed to be higher. The CON scenario appears to compensate for this by providing more surface water. As a result, more imported water is needed in the CMA scenario in each decade. This is expected since the model has more freedom to spatially allocate groundwater in the CON scenario than in the CMA scenario. In this, and subsequent comparison between scenarios, note that the scenario with the more restricted bounds on variables will generally yield less total water than another scenario.

The SMA scenario results in Table 4.3 show a similar increasing trend in groundwater pumping from the first to the fifth decade. The same is indicated in the tabulated results for the first three decades of the SUB scenario. Comparing the results of the SMA and SUB

Table 4.1

Summary of Optimal Steady State Solutions for the CMA Scenario
(acre-ft per year)

EARCS AREA TOTAL VALUES	1990	2000	2010	2020	2030
Water Demand	5,581,116	5,848,938	6,177,345	6,449,296	6,760,397
Deep Aquifer Demand	59,585	59,585	59,585	59,585	59,585
Quaternary Aquifer Demand	5,521,538	5,789,354	6,117,761	6,389,712	6,700,813
DEMANDS					
Municipal and Industrial Demand	38,103	40,959	43,362	14,200	47,998
Agricultural Demand	5,543,013	5,807,979	6,133,983	6,435,096	6,712,399
SOURCES					
Groundwater Pumping	3,697,917	3,947,121	4,197,644	4,394,633	4,610,769
Surface Water	1,104,789	1,148,284	1,201,084	1,249,541	1,293,949
Imported Water	718,832	693,949	719,033	745,538	796,095
AQUIFER VOLUME BALANCE					
Groundwater Pumping	3,697,917	3,947,121	4,197,644	4,394,632	4,610,769
Stream-Aquifer Interflow	-3,643,880	-3,893,010	-4,143,480	-4,340,420	-4,556,670
Recharge	-54,041	-54,112	-54,165	-54,212	-54,097
RIVER VOLUME BALANCE					
River Influent	384,216,700	384,216,700	384,216,700	384,216,700	384,216,700
River Overland Inflow	101,250,900	101,250,900	101,250,900	101,250,900	101,250,900
River Surface Water	- 703,828	- 747,323	- 800,123	- 848,580	- 892,988
River Stream-Aquifer Interflow	-1,056,660	-1,148,940	-1,243,110	-1,316,700	-1,403,490
System Effluent	483,707,100	483,571,300	483,424,400	483,302,300	483,171,100

Table 4.2

Summary of Optimal Steady State Solutions for the CON Scenario
(acre-ft per year)

EARCS AREA TOTAL VALUES	1990	2000	2010	2020	2030
Water Demand	5,581,116	5,848,938	6,177,345	6,449,296	6,760,397
Deep Aquifer Demand	59,585	59,585	59,585	59,585	59,585
Quaternary Aquifer Demand	5,521,538	5,789,354	6,117,761	6,389,712	6,700,813
DEMANDS					
Municipal and Industrial Demand	38,103	40,959	43,362	14,200	47,998
Agricultural Demand	5,543,013	5,807,979	6,133,983	6,435,096	6,712,399
SOURCES					
Groundwater Pumping	3,693,930	3,942,953	4,193,555	4,394,518	4,608,469
Surface Water	1,111,330	1,155,402	1,208,623	1,252,551	1,302,241
Imported Water	716,279	690,999	715,583	742,643	790,102
AQUIFER VOLUME BALANCE					
Groundwater Pumping	3,693,930	3,942,953	4,193,555	4,394,518	4,608,469
Stream-Aquifer Interflow	-3,639,700	-3,888,780	-4,139,340	-4,340,260	-4,554,150
Recharge	-54,233	-54,178	-54,215	-54,259	-54,320
RIVER VOLUME BALANCE					
River Influent	384,216,700	384,216,700	384,216,700	384,216,700	384,216,700
River Overland Inflow	101,250,900	101,250,900	101,250,900	101,250,900	101,250,900
River Surface Water	-710,369	-754,441	-807,662	-851,590	-901,280
River Stream-Aquifer Interflow	-1,051,730	-1,143,510	-1,237,390	-1,314,760	-1,397,790
System Effluent	483,705,500	483,569,600	483,422,500	483,301,200	483,168,500

Table 4.3

Summary of Optimal Steady State Solutions for the SMA Scenario
(acre-ft per year)

EARCS AREA TOTAL VALUES	1990	2000	2010	2020	2030
Water Demand	6,149,504	7,038,131	7,926,252	8,813,210	9,702,367
Deep Aquifer Demand	59,585	59,585	59,585	59,585	59,585
Quaternary Aquifer Demand	6,089,920	6,978,547	7,866,668	8,753,626	9,642,783
DEMANDS					
Municipal and Industrial Demand	42,259	45,400	48,039	49,491	53,174
Agricultural Demand	6,107,245	6,992,731	7,878,213	8,763,719	9,649,193
SOURCES					
Groundwater Pumping	3,905,118	4,458,991	4,982,305	5,467,387	5,908,291
Surface Water	1,172,637	1,302,346	1,432,043	1,561,750	1,691,458
Imported Water	1,012,165	1,217,210	1,452,320	1,724,489	2,043,034
AQUIFER VOLUME BALANCE					
Groundwater Pumping	3,905,118	4,458,991	4,982,305	5,467,386	5,908,291
Stream-Aquifer Interflow	-3,851,050	-4,404,820	-4,928,140	-5,413,220	-5,854,140
Recharge	-54,071	-54,173	-54,166	-54,166	-54,149
RIVER VOLUME BALANCE					
River Influent	384,216,700	384,216,700	384,216,700	384,216,700	384,216,700
River Overland Inflow	101,250,900	101,250,900	101,250,900	101,250,900	101,250,900
River Surface Water	-771,676	-901,385	-1,031,082	-1,160,789	-1,290,497
River Stream-Aquifer Interflow	-1,072,350	-1,268,220	-1,456,590	-1,635,610	-1,805,770
System Effluent	483,623,600	483,298,000	482,979,900	482,671,200	482,371,300

Table 4.4

Summary of Optimal Steady State Solutions for the SUB Scenario
(acre-ft per year)

EARCS AREA TOTAL VALUES	1990	2000	2010	2020	2030
Water Demand	6,149,504	7,038,131	7,926,252	8,813,210	9,702,367
Deep Aquifer Demand	59,585	59,585	59,585	59,585	59,585
Quaternary Aquifer Demand	6,089,920	6,978,547	7,866,668	8,753,626	9,642,783
DEMANDS					
Municipal and Industrial Demand	42,259	45,400	48,039	49,491	53,174
Agricultural Demand	6,107,245	6,992,731	7,878,213	8,763,719	9,649,193
SOURCES					
Groundwater Pumping	3,905,118	3,919,134	3,930,132	3,930,132	3,930,132
Surface Water	1,172,637	1,302,986	1,433,134	1,433,134	1,433,134
Imported Water	1,012,165	1,756,427	2,503,402	3,390,360	4,279,517
AQUIFER VOLUME BALANCE					
Groundwater Pumping	3,905,118	3,919,314	3,930,132	3,930,132	3,930,132
Stream-Aquifer Interflow	-3,851,050	-3,865,030	-3,875,990	-3,875,990	-3,875,990
Recharge	-54,071	-54,108	-54,146	-54,146	-54,146
RIVER VOLUME BALANCE					
River Influent	384,216,700	384,216,700	384,216,700	384,216,700	384,216,700
River Overland Inflow	101,250,900	101,250,900	101,250,900	101,250,900	101,250,900
River Surface Water	-771,676	-902,025	-1,032,173	-1,032,173	-1,032,173
River Stream-Aquifer Interflow	-1,072,350	-1,081,010	-1,088,040	-1,088,040	-1,088,040
System Effluent	483,623,600	483,484,600	483,347,400	483,347,400	483,347,400

scenarios, the groundwater pumping in the SMA scenario is significantly higher in each decade. Moreover, the imported water needs of the SMA scenario are lower than the unmet needs of the SUB scenario. These results indicate that the strategies of the SMA scenario utilize more available water than those of the SUB scenario.

The G-ratio, T-ratio, and the area's average final saturated thickness are presented in Tables 4.5, 4.6, and 4.7; respectively, for comparison purposes. The G-ratio is defined as the ratio of the area's total optimal pumping to its total groundwater demand. On the other hand, the T-ratio refers to the ratio of the total provided water to the total water demand.

Table 4.5 shows that in the CMA and CON scenarios, there is an increase in the G-ratio from the first to the third decade. The trend is reversed during the fourth and fifth decades. A decade-by-decade comparison of G-ratios reveals higher values in the CMA scenario. Table 4.6 shows that the T-ratios of the CON scenario are slightly higher in all decades. Therefore, the CON scenario provides more total water than the CMA scenario, even though the CMA scenario provides more groundwater.

Finally, the average final saturated thickness are comparable in the CMA and CON scenarios. Note that the reported saturated thicknesses are those of the final steady-state potentiometric surface that would

Table 4.5

G-Ratio for Alternative Scenarios

DECADE	SCENARIO			
	CMA	CON	SMA	SUB
1990	0.7288	0.7280	0.6921	0.6921
2000	0.7389	0.7382	0.6828	0.6001
2010	0.7403	0.7396	0.6716	0.5297
2020	0.7396	0.7396	0.6583	0.4732
2030	0.7374	0.7370	0.6426	0.4274

where:
G-Ratio = total optimal pumping / total groundwater demand

Table 4.6

T-Ratio for Alternative Scenarios

DECADE	SCENARIO			
	CMA	CON	SMA	SUB
1990	0.8698	0.8703	0.8338	0.8338
2000	0.8801	0.8806	0.8256	0.7483
2010	0.8825	0.8830	0.8154	0.6818
2020	0.8833	0.8838	0.8030	0.6127
2030	0.8812	0.8821	0.7881	0.5562

where:
T-Ratio = total optimal pumping plus surface water / total water demand

Table 4.7

Average Final Saturated Thickness for Alternative Scenarios (ft)

DECADE	SCENARIO			
	CMA	CON	SMA	SUB
1990	78	78	76	76
2000	77	76	72	76
2010	75	75	69	75
2020	74	74	67	75
2030	73	73	65	75

ultimately evolve if the pumping strategy of a particular decade were continued for a long period of time. These are not the saturated thicknesses that would exist during the particular decade.

Both scenarios that use projected water demands in the absence of conservation measures show decreasing values of T-ratio and G-ratio with time. Based on these ratios, the SMA scenario provided significantly more water than the SUB scenario. Analysis of the resulting final saturated thickness (Table 4.7) indicates that the SUB scenario maintained higher values of final saturated thickness. This is so because the SUB scenario assumes the same pumping strategy for each of the last three decades. Once again, the reported saturated thicknesses and heads are those that would ultimately evolve, and may not exist by a particular decade.

Comparing total groundwater pumping values in Tables 4.1-4.4 with final saturated thickness in Table 4.7 illustrates that as total pumping increases, final saturated thickness decreases.

The analysis of results was based on the study area's total values. A cell-by-cell comparison of strategies is not attempted. However, the cell-by-cell GAMSOP (General Algebraic Modeling System Output Processor) listing of the strategies are included in Appendices A, B, and C. GAMSOP and instructions for its use are available at the University of Arkansas Computing Center (1988).

Table 4.8

Description of Sensitivity Runs

SENSITIVITY RUN	PARAMETER VARIED	VARIATION FROM MODEL CON2010	COMMENT
A	recharge factor	100% decrease	infeasible
B	recharge factor	100% increase	optimal
C	hydraulic conductivity	20% increase	infeasible
D	hydraulic conductivity	20% decrease	optimal
E	river conductance	20% increase	optimal
F	river conductance	20% decrease	optimal
G	river influent	20% increase	optimal
H	river influent	20% decrease	optimal
I	overland inflow	20% increase	optimal
J	overland inflow	20% decrease	optimal
K	river cell effluent	20% increase	optimal
L	river cell effluent	20% decrease	optimal

Table 4.9

Summary of Optimal Steady State Solutions for Feasible Sensitivity Runs (acre-ft per year)

EARCS AREA TOTAL VALUES	B	D	E	F	G
Water Demand	6,177,345	6,177,345	6,177,345	6,177,345	6,177,345
Deep Aquifer Demand	59,585	59,585	59,585	59,585	59,585
Quaternary Aquifer Demand	6,117,761	6,117,761	6,117,761	6,117,761	6,117,761
DEMANDS					
Municipal and Industrial Demand	43,362	43,362	43,362	43,362	43,362
Agricultural Demand	6,133,983	6,133,983	6,133,983	6,133,983	6,133,983
SOURCES					
Groundwater Pumping	4,290,151	4,211,602	4,302,437	4,019,952	4,193,555
Surface Water	1,207,950	1,198,717	1,208,623	1,208,593	1,208,623
Imported Water	619,660	707,441	606,700	889,216	715,583
AQUIFER VOLUME BALANCE					
Groundwater Pumping	4,290,151	4,211,602	4,302,437	4,019,952	4,193,555
Stream-Aquifer Interflow	-4,213,590	-4,157,890	-4,247,850	-3,966,200	-4,139,340
Recharge	-76,560	-53,708	-54,584	-53,750	-54,215
RIVER VOLUME BALANCE					
River Influent	384,216,700	384,216,700	384,216,700	384,216,700	461,060,000
River Overland Inflow	101,250,900	101,250,900	101,250,900	101,250,900	101,250,900
River Surface Water	806,990	797,757	807,662	807,632	807,662
River Stream-Aquifer Interflow	-1,246,840	-1,152,600	-1,172,410	-1,304,020	-1,237,390
System Effluent	483,413,800	483,517,200	483,487,500	483,355,900	560,265,900

EARCS AREA TOTAL VALUES	H	I	J	K	L
Water Demand	6,177,345	6,177,345	6,177,345	6,177,345	6,177,345
Deep Aquifer Demand	59,585	59,585	59,585	59,585	59,585
Quaternary Aquifer Demand	6,117,761	6,117,761	6,117,761	6,117,761	6,117,761
DEMANDS					
Municipal and Industrial Demand	43,362	43,362	43,362	43,362	43,362
Agricultural Demand	6,133,983	6,133,983	6,133,983	6,133,983	6,133,983
SOURCES					
Groundwater Pumping	4,193,555	4,193,555	4,193,555	4,193,555	4,193,555
Surface Water	1,208,623	1,208,623	1,208,623	1,208,623	1,208,623
Imported Water	715,583	715,583	715,583	715,583	715,583
AQUIFER VOLUME BALANCE					
Groundwater Pumping	4,193,555	4,193,555	4,193,555	4,193,555	4,193,555
Stream-Aquifer Interflow	-4,139,340	-4,139,340	-4,139,340	-4,139,340	-4,139,340
Recharge	-54,215	-54,215	-54,215	-54,215	-54,215
RIVER VOLUME BALANCE					
River Influent	307,373,300	384,216,700	384,216,700	384,216,700	384,216,700
River Overland Inflow	101,250,900	121,501,100	81,000,740	101,250,900	101,250,900
River Surface Water	807,662	807,662	807,662	807,662	807,662
River Stream-Aquifer Interflow	-1,237,390	-1,237,390	-1,237,390	-1,237,390	-1,237,390
System Effluent	406,579,200	503,672,700	463,172,400	483,422,500	483,422,500

4.3 Sensitivity Analysis

This section presents the results of sensitivity runs made on model CON2010. Table 4.8 provides a list of the parameters that were systematically varied. Table 4.8 also shows the degree of variation that was implemented in each run. The results of the feasible sensitivity runs are presented in Table 4.9.

The experimental results show that when the recharge factor is reduced to 1, the model fails to converge into a feasible strategy. The same effect is observed when a 20% increase in hydraulic conductivity is in effect. Sensitivity run B shows that the system can provide about 2 percent more water (compared with run CON2010) when the permitted recharge at constant head cells is increased (when recharge at each cell can be up to 3 times as much as observed in 1982). Surprisingly, Run D indicates that a decrease in hydraulic conductivity increases groundwater use slightly (0.4 percent). However, surface water use decreases and, as expected, total water use decreases. surface water and lower unmet water demand. Higher river conductance values (Run E) result in increased flow from stream to aquifer and enhanced total system performance. On the other hand (Run F), a decrease in this parameter adversely affects the the total available water from the area. Results show that the EARCS area is completely insensitive to tested variations in river influent, overland inflow, and lower limit on effluent.

4.4 Summary

In this chapter, a tabulated summary of results is presented for each one of four alternative scenarios. Results show that the groundwater pumping values increase with decade in all scenarios. A comparison of demand and total optimal conjunctive water use yields the following.

Total demand of SMA and SUB is greater than that of CMA and CON, ie. demand is greater if conservation measures are not implemented:

$$SMA = SUB > CMA = CON \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Total provided water is greatest for the SMA scenario and is from 5 to 28 percent greater (first to fifth decade respectively) greater for the SMA than for the CMA scenario. CON and CMA scenarios provide about the same volume of water. In fact, total provided water in the CON scenario is never more than 0.2 percent greater than that of the CMA scenario. Furthermore, total provided water ranges from being equal in SMA and SUB strategies in the first decade, to being 20 percent greater for SMA than for SUB in the third decade, to being 42 percent greater for SMA than for SUB in the fifth decade.

$$SMA > CON \sim CMA > SUB \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Consideration of the ratios of total provided water to total water

demand (T-ratio) shows that the ratios for CON and CMA are very similar. These scenarios have better T-ratios than the SMA scenario, which in turn is better than the SUB scenario.

$$CON \sim CMA > SMA > SUB \qquad \text{.....(15)}$$

If no conservation measures can be implemented, the SMA strategies are preferred to the SUB strategies, because numerical infeasibility prevented SUB strategies from being developed for all decades. If conservation measures can be implemented, CMA strategies are preferable to those from the CON scenario, because they assure that municipal and industrial demand can be satisfied in all decades. Equation (15) shows that if conservation measures can be implemented, CMA strategies are preferred to SMA strategies.

Results of the sensitivity runs indicate that the model is sensitive to changes in the aquifer parameters. However, no significant effect is observed to result from varying streamflow values.

CHAPTER V

CONJUNCTIVE ALLOCATION OF WATER RESOURCES

5.1 Monthly Allocation Model

The solution of the optimization model described in Chapter III results in the optimal annual volumes of groundwater and surface water to be used in each cell. The sum of optimal groundwater and surface water is the optimal amount of available water. The annual unsatisfied demand is the difference of the total water demand and optimal available water. The annual unsatisfied demand is met by importing water from other sources. A better knowledge of the distribution in time of the unsatisfied demand is needed for system diversion design purposes.

The monthly allocation model serves as a post-processor to the management model described in Chapter III. Thus, the optimal annual groundwater and surface water use in a particular decade is assumed to be known. Furthermore, the cell-by-cell annual unsatisfied demand is computed prior to allocation.

In this report, municipal and industrial use is given the highest

priority. This means that in each cell, the available water is allocated to M & I use to the extent possible before considering other types of water demand. More specifically, in each cell, optimal groundwater is first alloted to M & I use. If the optimal groundwater volume is insufficient to fully supply the M & I demand, the remaining unmet M & I demand is obtained from surface water. Any final remaining unmet demand is reported as the annual M & I unsatisfied demand. We assume that any unsatisfied M & I demand will be provided by import from other sources.

In each cell, the optimal groundwater volume less the amount allotted to M & I use is available for agricultural use. The optimal surface water volume less the amount allocated for M & I purposes is likewise available for agriculture. Allocation of the water resources to agriculture is accomplished by alloting as much of the available groundwater at the end of the irrigation season as possible. This allocation proceeds backward in time from September to April. Subsequently, available surface water is allocated beginning with April and proceeding to September. In the event that agricultural demand is not met, the unsatisfied demand will need to be provided from imported water.

The distribution in time of available water and unmet water needs may be accomplished in two ways. The option to implement the monthly allocation model in VILMA (written in GAMS) may be chosen. This

option is applicable if available groundwater is sufficient to satisfy M & I demand. Alternatively, one may use the FORTRAN computer program, ALLOCATE, shown in Appendix D. All monthly results in this study are obtained using ALLOCATE. Data input format for ALLOCATE is found in Appendix E. Sample output from ALLOCATE is shown in Appendix F.

5.2 Analysis of Results

Results of the allocation of water resources for the CMA, CON, SMA, and SUB scenarios are presented in Tables 5.1, 5.2, 5.3, and 5.4; respectively. The tabulated results for the CMA and CON scenarios show a definite trend of increasing agricultural groundwater use in each month from the first decade to the fifth decade. The trend of increasing use through the decades is also observed in the monthly surface water use. The monthly groundwater use in the CMA scenario is generally lower than that for the CON scenario in all decades. However, the monthly agricultural surface water allocation in the CMA scenario is generally higher. In spite of this, the monthly unsatisfied demand remains higher in the CMA than in the CON scenario.

The CMA scenario guarantees enough groundwater supply for M & I. This is confirmed in results shown in Table 5.1. There is no surface water component in the reported M & I use in this table. Similarly,

Table 5.1

Summary of Conjunctive Water Allocations for the CMA Scenario
(annual values in acre-ft per year, monthly values in acre-ft per month)

EARCS AREA TOTAL VALUES		1990	2000	2010	2020	2030
TOTAL MONTHLY AGRICULTURAL GROUNDWATER USE	APRIL	1,793	3,669	5,451	7,202	8,920
	MAY	267,802	304,659	339,261	367,104	390,895
	JUNE	681,773	743,049	796,506	848,915	883,008
	JULY	1,270,281	1,343,675	1,417,122	1,478,512	1,533,719
	AUGUST	1,246,669	1,310,196	1,383,271	1,454,487	1,512,045
	SEPTEMBER	191,495	200,914	212,672	224,213	234,183
ANNUAL AGRICULTURAL GROUNDWATER USE		3,659,814	3,906,162	4,154,282	4,380,433	4,562,771
ANNUAL M & I GROUNDWATER USE		38,103	40,959	43,362	14,200	47,998
TOTAL GROUNDWATER USE		3,697,917	3,947,121	4,197,644	4,394,633	4,610,769
TOTAL MONTHLY AGRICULTURAL SURFACE WATER USE	APRIL	26,797	27,610	28,486	29,254	29,987
	MAY	287,084	290,515	295,398	299,412	302,810
	JUNE	230,426	236,461	246,831	256,720	265,872
	JULY	300,216	324,732	347,725	368,722	387,890
	AUGUST	223,876	232,284	244,498	255,875	266,511
	SEPTEMBER	36,390	36,682	38,147	39,557	40,879
ANNUAL AGRICULTURAL SURFACE WATER USE		1,104,789	1,148,284	1,201,084	1,249,541	1,293,949
ANNUAL M & I SURFACE WATER USE		0	0	0	0	0
TOTAL SURFACE WATER USE		1,104,789	1,148,284	1,201,084	1,249,541	1,293,949
TOTAL MONTHLY UNSATISFIED AGRICULTURAL DEMAND	APRIL	98	111	152	219	285
	MAY	70,112	72,701	80,502	91,587	103,490
	JUNE	163,151	167,572	183,774	194,230	217,152
	JULY	255,993	238,360	242,807	253,580	265,180
	AUGUST	208,924	196,496	193,786	188,716	192,674
	SEPTEMBER	20,554	18,709	18,013	17,206	17,314
ANNUAL AGRICULTURAL UNSATISFIED DEMAND		718,832	693,949	719,033	745,538	796,095
ANNUAL M & I UNSATISFIED DEMAND		0	0	0	0	0
TOTAL UNSATISFIED DEMAND		718,832	693,949	719,033	745,538	796,095

Table 5.2

Summary of Conjunctive Water Allocations for the CON Scenario
(annual values in acre-ft per year, monthly values in acre-ft per month)

EARCS AREA TOTAL VALUES		1990	2000	2010	2020	2030
TOTAL MONTHLY AGRICULTURAL GROUNDWATER USE	APRIL	1,794	3,669	5,451	7,202	8,920
	MAY	268,466	304,711	340,596	367,044	392,096
	JUNE	681,582	743,618	797,976	849,107	884,868
	JULY	1,271,811	1,346,490	1,418,200	1,480,920	1,535,658
	AUGUST	1,248,815	1,311,968	1,384,534	1,455,604	1,515,258
	SEPTEMBER	191,891	200,838	213,270	224,301	234,687
ANNUAL AGRICULTURAL GROUNDWATER USE		3,664,358	3,911,294	4,160,026	4,384,178	4,571,487
ANNUAL M & I GROUNDWATER USE		29,572	31,659	33,529	10,340	36,982
TOTAL GROUNDWATER USE		3,693,930	3,942,953	4,193,555	4,394,518	4,608,469
TOTAL MONTHLY AGRICULTURAL SURFACE WATER USE	APRIL	26,652	27,456	28,333	29,244	29,834
	MAY	286,142	289,442	294,334	299,029	301,485
	JUNE	230,165	236,221	246,631	256,490	265,632
	JULY	300,076	324,612	347,484	368,502	387,660
	AUGUST	223,876	232,284	244,498	255,875	266,511
	SEPTEMBER	36,390	36,682	38,147	39,557	40,879
ANNUAL AGRICULTURAL SURFACE WATER USE		1,103,302	1,146,697	1,199,426	1,248,698	1,292,002
ANNUAL M & I SURFACE WATER USE		8,028	8,705	9,197	3,853	10,239
TOTAL SURFACE WATER USE		1,111,330	1,155,402	1,208,623	1,252,551	1,302,241
TOTAL MONTHLY UNSATISFIED AGRICULTURAL DEMAND	APRIL	243	265	305	229	438
	MAY	70,391	73,723	80,230	92,029	103,614
	JUNE	163,602	167,242	182,503	194,264	215,532
	JULY	254,603	235,665	241,971	251,392	263,472
	AUGUST	206,779	194,724	192,524	187,600	189,461
	SEPTEMBER	20,157	18,786	17,415	17,118	16,809
ANNUAL AGRICULTURAL UNSATISFIED DEMAND		715,776	690,404	714,947	742,636	789,326
ANNUAL M & I UNSATISFIED DEMAND		503	595	636	7	777
TOTAL UNSATISFIED DEMAND		716,279	690,999	715,583	742,643	790,103

Table 5.3

Summary of Conjunctive Water Allocations for the SMA Scenario
(annual values in acre-ft per year, monthly values in acre-ft per month)

EARCS AREA TOTAL VALUES		1990	2000	2010	2020	2030
TOTAL MONTHLY AGRICULTURAL GROUNDWATER USE	APRIL	2,176	4,438	6,869	9,084	11,179
	MAY	278,211	337,602	382,607	425,646	456,380
	JUNE	695,119	787,084	881,838	957,856	1,017,099
	JULY	1,332,696	1,510,754	1,673,045	1,828,101	1,967,691
	AUGUST	1,346,060	1,535,228	1,719,690	1,896,546	2,071,535
	SEPTEMBER	208,596	238,484	270,218	300,662	331,234
ANNUAL AGRICULTURAL GROUNDWATER USE		3,862,859	4,413,591	4,934,266	5,417,896	5,855,117
ANNUAL M & I GROUNDWATER USE		42,259	45,400	48,039	49,491	53,174
TOTAL GROUNDWATER USE		3,905,118	4,458,991	4,982,305	5,467,387	5,908,291
TOTAL MONTHLY AGRICULTURAL SURFACE WATER USE	APRIL	28,159	30,504	32,626	34,591	36,370
	MAY	302,993	322,230	340,140	357,383	374,412
	JUNE	247,579	273,537	300,863	328,812	356,998
	JULY	307,275	348,002	388,902	429,995	471,268
	AUGUST	246,720	282,942	319,167	355,392	391,620
	SEPTEMBER	39,910	45,130	50,345	55,577	60,791
ANNUAL AGRICULTURAL SURFACE WATER USE		1,172,637	1,302,346	1,432,043	1,561,750	1,691,458
ANNUAL M & I SURFACE WATER USE		0	0	0	0	0
TOTAL SURFACE WATER USE		1,172,637	1,302,346	1,432,043	1,561,750	1,691,458
TOTAL MONTHLY UNSATISFIED AGRICULTURAL DEMAND	APRIL	98	119	221	684	1,447
	MAY	103,653	135,458	182,996	233,193	295,868
	JUNE	273,605	309,366	376,976	462,714	564,993
	JULY	376,416	445,425	529,978	621,577	728,429
	AUGUST	266,669	295,979	329,976	371,546	415,048
	SEPTEMBER	27,723	30,862	32,174	34,775	37,249
ANNUAL AGRICULTURAL UNSATISFIED DEMAND		1,012,165	1,217,210	1,452,320	1,724,490	2,043,034
ANNUAL M & I UNSATISFIED DEMAND		0	0	0	0	0
TOTAL UNSATISFIED DEMAND		1,012,165	1,217,210	1,452,320	1,724,490	2,043,034

Table 5.4

Summary of Conjunctive Water Allocations for the SUB Scenario
(annual values in acre-ft per year, monthly values in acre-ft per month)

EARCS AREA TOTAL VALUES		1990	2000	2010	2020	2030
TOTAL MONTHLY AGRICULTURAL GROUNDWATER USE	APRIL	2,176	139	106		
	MAY	278,211	69,219	31,011		
	JUNE	695,119	576,361	436,922		
	JULY	1,332,696	1,452,587	1,441,636		
	AUGUST	1,346,060	1,535,874	1,701,910		
	SEPTEMBER	208,596	240,443	272,293		
ANNUAL AGRICULTURAL GROUNDWATER USE		3,862,859	3,874,623	3,883,877		
ANNUAL M & I GROUNDWATER USE		42,259	44,511	46,255		
TOTAL GROUNDWATER USE		3,905,118	3,919,134	3,930,132		
TOTAL MONTHLY AGRICULTURAL SURFACE WATER USE	APRIL	28,159	30,492	32,603		
	MAY	302,993	322,074	339,940		
	JUNE	247,579	273,538	300,852		
	JULY	307,275	348,005	388,697		
	AUGUST	246,720	282,942	319,167		
	SEPTEMBER	39,910	45,116	50,328		
ANNUAL AGRICULTURAL SURFACE WATER USE		1,172,637	1,302,167	1,431,587		
ANNUAL M & I SURFACE WATER USE		0	819	1,547		
TOTAL SURFACE WATER USE		1,172,637	1,302,986	1,433,134		
TOTAL MONTHLY UNSATISFIED AGRICULTURAL DEMAND	APRIL	98	4,430	7,007		
	MAY	103,653	403,997	534,792		
	JUNE	237,606	520,089	821,903		
	JULY	376,416	503,590	761,592		
	AUGUST	266,669	295,334	347,755		
	SEPTEMBER	27,723	28,918	30,116		
ANNUAL AGRICULTURAL UNSATISFIED DEMAND		1,012,165	1,756,357	2,503,165		
ANNUAL M & I UNSATISFIED DEMAND		0	70	237		
TOTAL UNSATISFIED DEMAND		1,012,165	1,756,427	2,503,402		

there is no annual M & I unsatisfied demand in any decade. However, as seen from the optimal annual strategies, guaranteeing M & I needs results in an increase in the overall volume of needed imported water.

Results of the SMA and SUB scenarios support the conclusions made in Chapter IV. The system performance in the SUB scenario is inferior to that of the SMA scenario. It should be noted that no allocations are reported for the last two decades of the SUB Scenario. As discussed in Chapter IV, the optimal annual available water in the fourth and fifth decades of this scenario is assumed to be the same as that of the third decade. Therefore, the monthly allocation of groundwater and surface water in the fourth decade is based on the optimal amounts of available water in 2010 as applied to the water demands of 2020. Similarly, the monthly allocation for 2030 is based on the amounts of available water in the third decade.

Tables 5.1 through 5.4 present summaries in terms of area totals of the monthly allocation in the EARCS area. The detailed cell-by-cell allocations are not included here to keep this report within manageable size. They are included on attendant magnetic tapes.

5.3 Summary

The results of the monthly allocation of available water provide information that is important for planning long-term conjunctive water use systems. Specificially, monthly water resource allocation is performed such that the allocation is in harmony with the annual volumes of available water. The use of the methodology discussed in this Chapter is recommended for coarse planning of conjunctive allocation of water resources. Because only annual and monthly average data is used in this effort, more detailed verification of the daily streamflow that may result from strategy implementation is desirable for actual system design.

CHAPTER VI

SUMMARY AND CONCLUSIONS

6.1 Report Summary

A mathematical optimization/simulation model of the Quaternary Mississippi Plain Alluvial Aquifer in eastern Arkansas is presented. The model maximizes the total annual allocation of surface water resources and sustained groundwater yield for this 13,000 square mile area. Through an iterative steady-state approach, the model appropriately considers the development of unconfined conditions while simultaneously assuring the sustainability of any computed optimal groundwater extraction strategy. The model develops optimal strategies for anticipated time-varying demands of the five decades between 1990 and 2030. Resulting unsatisfied future water demands are also reported.

Four tested scenarios include two which assume the implementation of on-farm water conservation measures (CMA and CON) and two which do not anticipate increased conservation practice (SMA and SUB). The CMA and SMA scenarios assure that M & I demand will be satisfied in all decades. CON and SUB scenarios do not.

Optimal future groundwater and surface use strategies are presented and the results are analyzed. The allocation of monthly groundwater pumping and surface water use is also reported. The allocation model ensures that the sum of monthly values are in harmony with the annual optimal strategies.

6.2 Conclusions and Recommendations

In general, since water demand increases with time, optimal groundwater and surface water use increases with time also. However, physically available water is insufficient to fully satisfy the water demand in any scenario.

Review of results indicates that strategies from the CMA scenario provide greater groundwater pumping than those from the CON scenario. However, CON strategies provide slightly more total water (up to 0.2 percent more). If conservation measures will be implemented by water users, the CMA scenario is preferred between the two scenarios because it satisfies M & I demand in all decades.

Strategies from the SMA scenario provide significantly more water than those from the SUB scenario. Since SMA strategies also satisfy M & I demand in all decades, the SMA scenario is preferred to the SUB scenario.

By the year 2030, CMA strategies satisfy 88 percent of demand, while SMA strategies provide 78 percent of their greater demand. If avoiding or minimizing the need for physical diversion systems is a goal, the CMA scenario is preferred over the SMA scenario. Whether it is a realistic option depends in part on the ability of the state to influence on-farm water use.

Implementing a presented pumping strategy will probably not induce more total groundwater flow across the Missouri-Arkansas border than is currently occuring. Strategy implementation will result in the eventual evolution of a steady-state potentiometric surface. Each such surface will provide at least 20 feet of saturated thickness in each cell. Figure 6.3 demonstrates the dynamic evolution of heads from current to ultimate steady-state heads if the SMA scenario is implemented. This figure is created by comparing heads simulated using an unsteady simulation model (McDonald and Harbaugh, 1984) for the partially unconfined aquifer system. The 'target' heads are those computed by the optimization model. 'Simulated heads' describe unsteady response to pumping at the appropriate optimal rates for the first four decades, followed by pumping at the optimal fifth decade rate for the last sixteen decades.

Assuming average hydrologic conditions and accurate aquifer parameters, implementing a presented strategy should assure that average annual streamflow at critical control cells does not drop below prespecified levels. Estimates of flow from the rivers to the aquifer based on the optimal steady-state potentiometric surface are greater

than will occur when the actual surface is higher than the ultimate steady surface to which it is evolving. Actual streamflow increases as flow to the aquifer decreases. Thus average streamflow based on optimal steady-state interflow is conservative. Actual average streamflow will probably be greater than the computed value during the next fifty years.

Building conveyance systems for the time-varying diversion of surface water from rivers within the area should be preceeded by more detailed modeling of flow in those rivers. Currently available data is inadequate for this task. Once such data is available, a model that optimizes allocation of a dynamic stream-aquifer system can be utilized (Peralta and others, 1987).

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APPENDIX A

Optimal Annual Sustainable Groundwater Use Strategies for Alternative Scenarios in Five Decades (parts a, b, and c in each strategy)

MATRIX GGP CMA1990 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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19																		
20																		1078
21																		1740
22															20	1138	2158	10
23																101	20	10
24															1948	3051	8826	
25																1884	8237	
26																	2611	
27																488	10	
28																2515	20	
29															1491	20	2068	
30															1778	2901	20	2109
31														1788	2518	2481	20	2424
32													40	6828	1437	1731	20	10
33												1587	2558	3281	40	40	40	20	10
34									40	1388	2740	3348	3232	1801	2293	3123	10	2417
35								1870	3822	3487	3527	2888	884	4888	2884	10	1883	
36								1771	2388	3074	2981	588	2734	5352	10	3130	2858	
37							2587	1845	1988	3842	2112	1888	5233	2878	10	1834	2843	
38							1080	1941	1544	1880	4387	3080	2798	2147	171	3888	5801	
39							148	448	1848	1923	4830	1030	2347	4246	10	882	2558	
40							511	551	1648	2358	4252	2097	5823	8858	10	1523	0	
41							5700	6051	5074	3518	2238	1858	1528	10	10	1778	1302	
42			1508	2081	40	3488	8582	6225	3287	3934	4810	10	10	3840	1013	435	31	2312
43		0	10	783	5708	10	40	5335	5821	2012	877	0	0	182	0	5338	10	838
44		1843	10	388	5860	2728	7532	40	7324	4743	40	0	0	0	0	4370	4063	0
45			10	1180	4828	5917	6000	13188	40	8788	4688	40	0	0	0	0	3437	1888
46			10	844	4412	8888	5914	8832	12388	40	7181	4187	40	0	0	0	2878	1718
47			10	2378	2240	5237	7487	8488	8582	4807	31	8328	40	40	40	0	1388	4287
48				10	3788	4708	5783	8788	8128	5503	8477	40	5141	0	0	20	1897	3797
49				10	4238	5148	4577	8820	8078	5888	8008	0	2873	1327	10	0	0	4848
50				10	8038	3828	7787	8285	8412	3878	8232	5588	0	3448	10	10	0	951
51				10	4711	3878	2881	7478	8127	5453	4322	4187	4505	0	10	10	0	0
52					10	2488	7898	7384	8878	4388	3782	3388	0	4527	10	10	0	0
53					10	8772	7898	7883	7443	7388	8808	1422	2858	0	808	10	10	0
54						10	10	3188	5785	8518	7278	822	830	0	4484	10	10	0
55							10	10	3743	12034	1833	1043	0	0	3478	10	10	0
56								0	0	8432	7284	8708	481	10	4488	2000	732	
57									10	10	7121	5887	4487	10	3808	4213		
58										10	10	8543	5985	10	4850			
59													0	0	0	0	5248	
60																0	3305	
61																	0	
62																		
63																		
64																		
65																		
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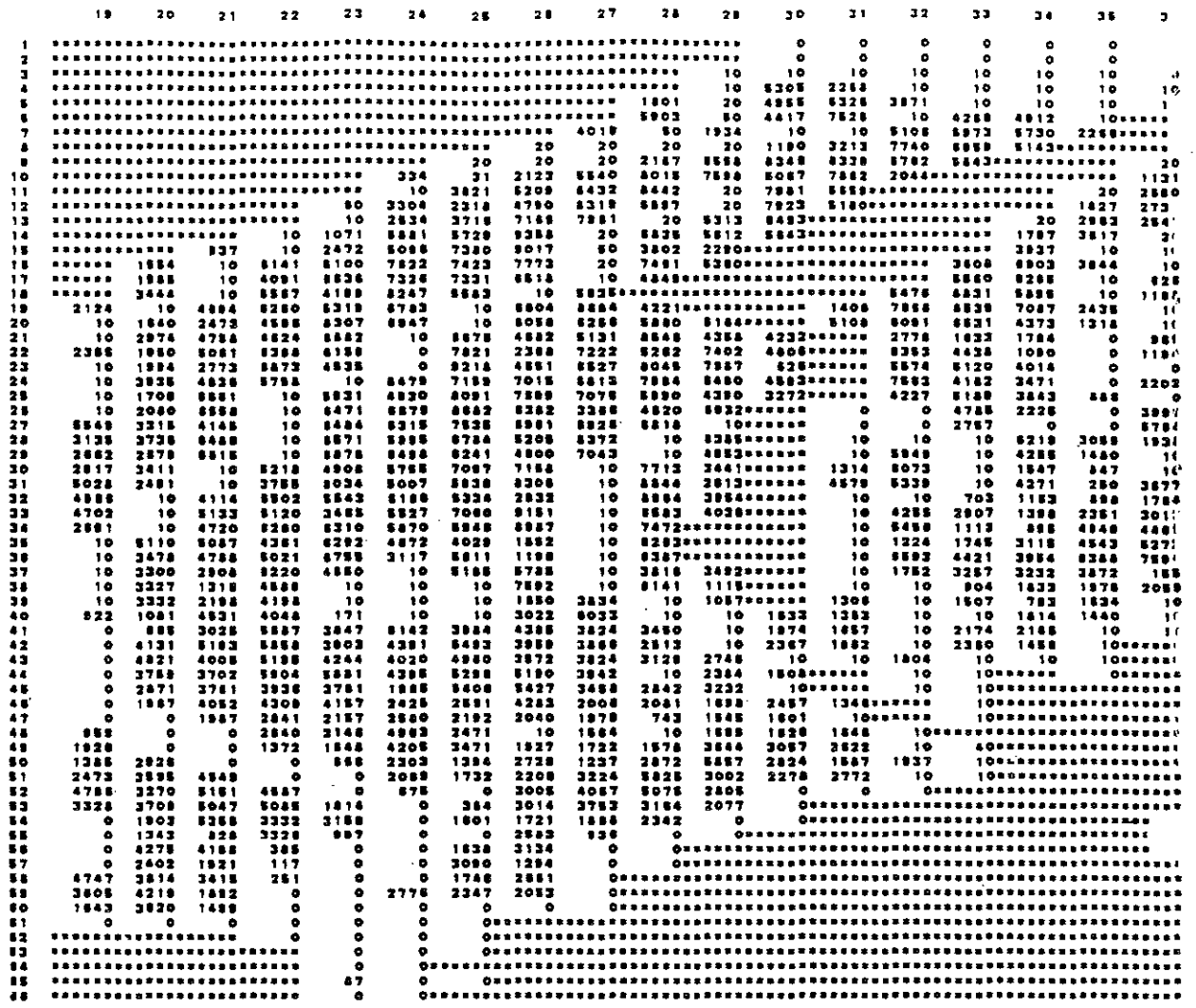

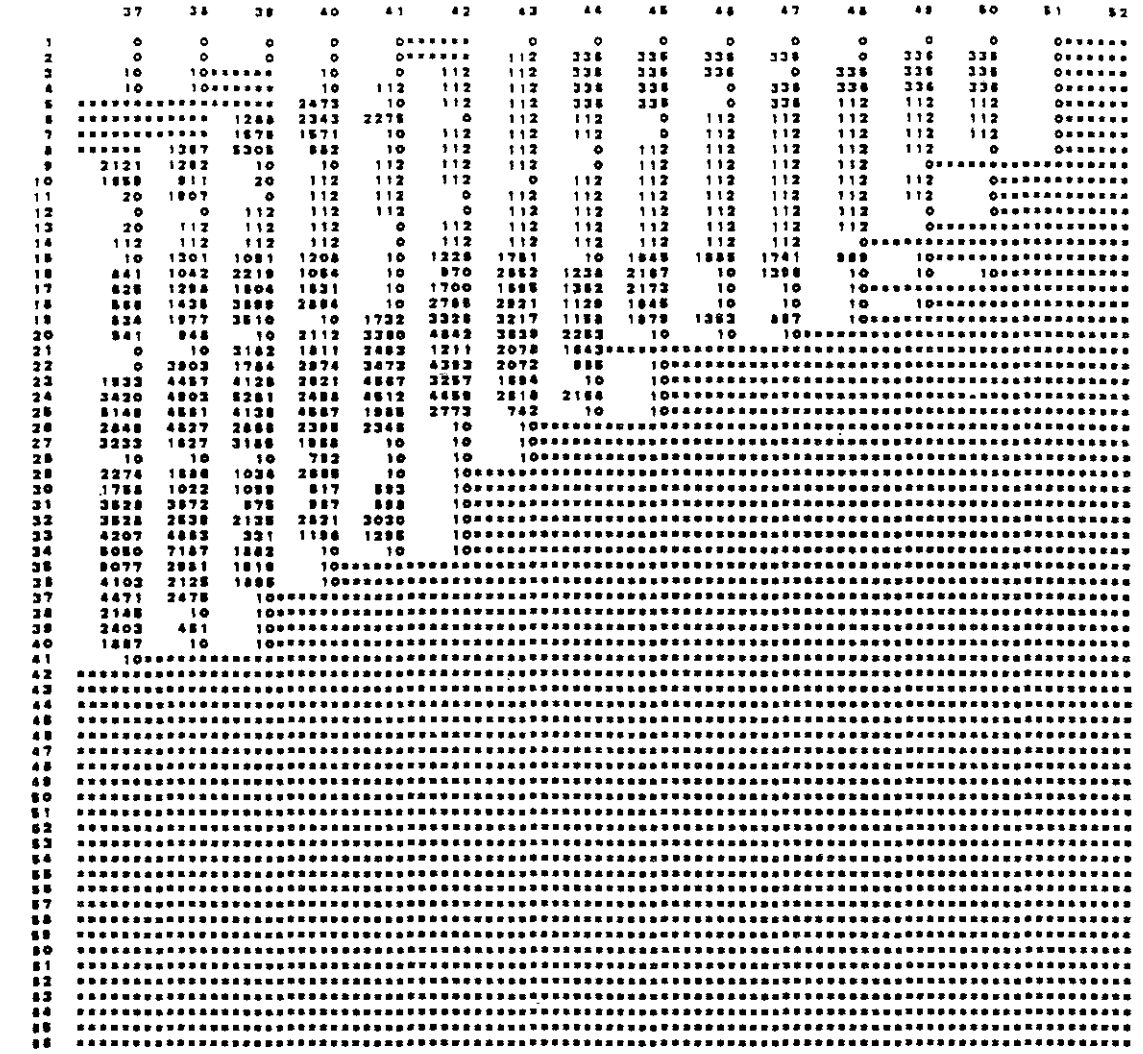

SCALAR TOTGW CMA1980 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3697917

MATRIX GGP CMA2000 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
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19																		
20																		141
21																		2826
22															20	1797	2847	10
23															101	20		10
24															1858	2708		67
25																2412		814
26																		328
27																780		1
28																3041		20
29															1828			20 3808
30														3204	3002			20 2892
31													2222	3208	3288			20 306
32												40	8137	2708	2588			20
33										2378	3017	3048	40	40	40			20
34								40	1842	3085	3958	2923	1753	2208	3173			10 287
35								2884	4845	3907	4213	2300	554	6834	3072			10 2482
36								2802	3288	3709	3488	208	2753	4821		10	3381	3481
37							3027	2383	2714	4018	1031	2433	5788	3372		10	2852	3479
38							1118	1710	2888	2819	4708	2587	2841	2872		182	3824	568
39							248	480	3848	2885	5248	828	1945	4828		10	785	327
40							887	884	1881	2813	3884	1582	6015	5311		10	2237	
41							5887	8837	8770	3828	2820	1828	2085	10		10	2278	220
42		1947	2144		10	3508	8242	8218	3345	4548	1117	10	10	4744	1108		547	31 2400
43	0	10	508	5878	10	40	8484	8448	2382	1058	0	0	202	0	8482		10	884
44	1804	10	543	5742	2720	7524	40	8883	8002	40	0	0	0	0	4083		4128	0
45		10	1348	4832	5781	7810	13422	40	8470	4982	40	0	0	0	0		3848	193
46		10	1145	4381	6334	5727	5714	12408	40	8722	4217	40	0	0	0		2324	198
47		10	2832	2276	5888	7320	5255	8218	4710	31	8017	40	40	40	0		1141	484
48		10	2888	4586	5822	5635	5854	5281	8175	40	4976	0	0	20	1928			326
49		10	4277	5018	4388	8404	5828	5787	8005	0	2892	1488	10	0		0		3988
50		10	7138	3871	8908	8088	8827	3853	7248	4881	0	3675	10	10		0		1723
51		10	4138	4844	2283	8737	8794	8453	4708	3773	3883	0	10	10		0		0
52		10	2294	8582	8834	7888	4802	3831	2858	0	3618	10	10	0				
53		10	8270	8812	7072	8588	8897	8288	1300	2283	0	1181	10	10				
54		10	10	2903	5145	7817	8390	775	709	0	3636	10	10					
55		10	10	3348	10812	1337	872	0	0	3062	1828	10						
56			0	0	8724	8382	8823	803	10	4084	1828	1548						
57			10	10	8271	8232	3908	10	3081	3888								
58			10	10	8737	8281	10	3885										
59			0	0	0	0	442											
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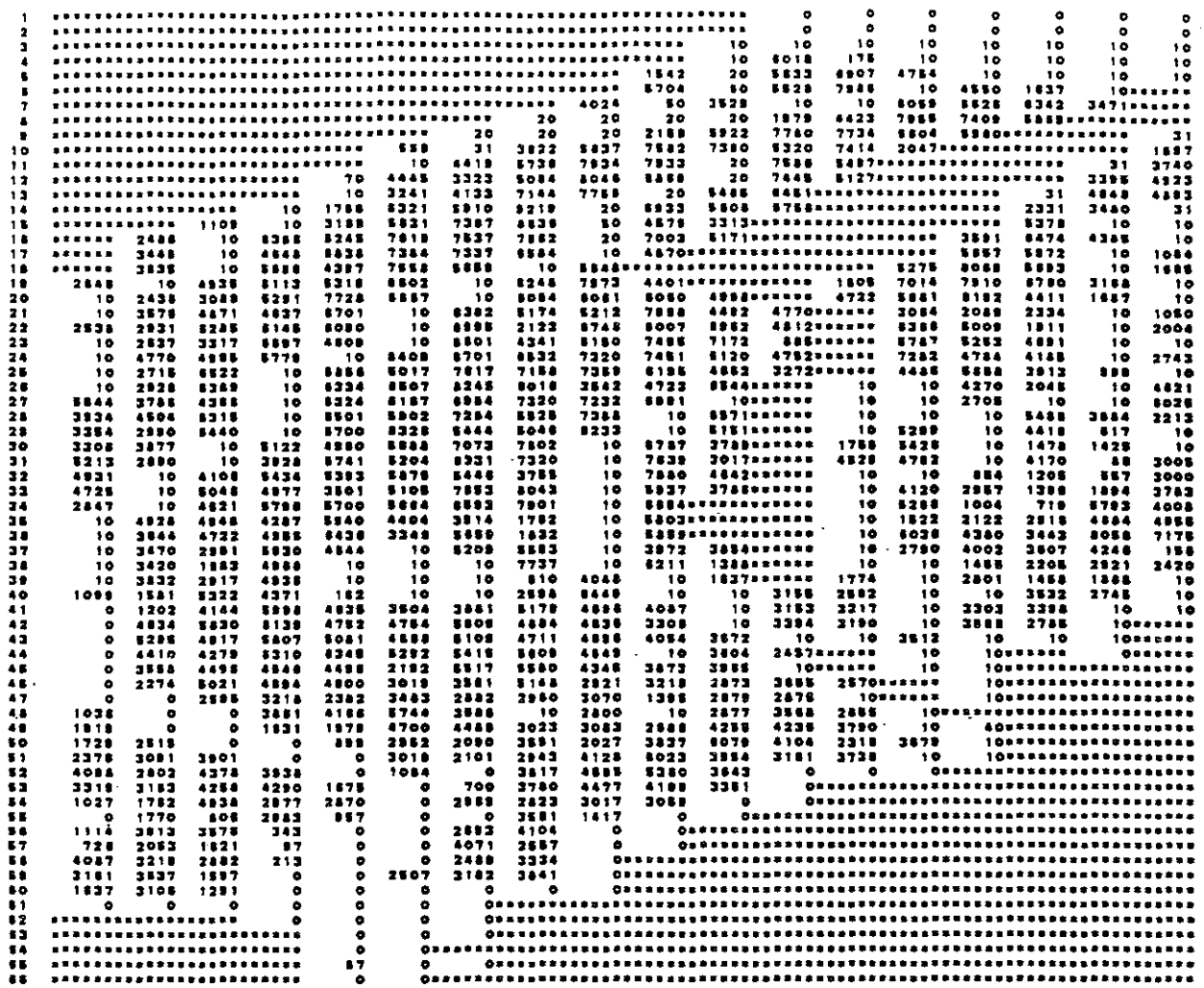

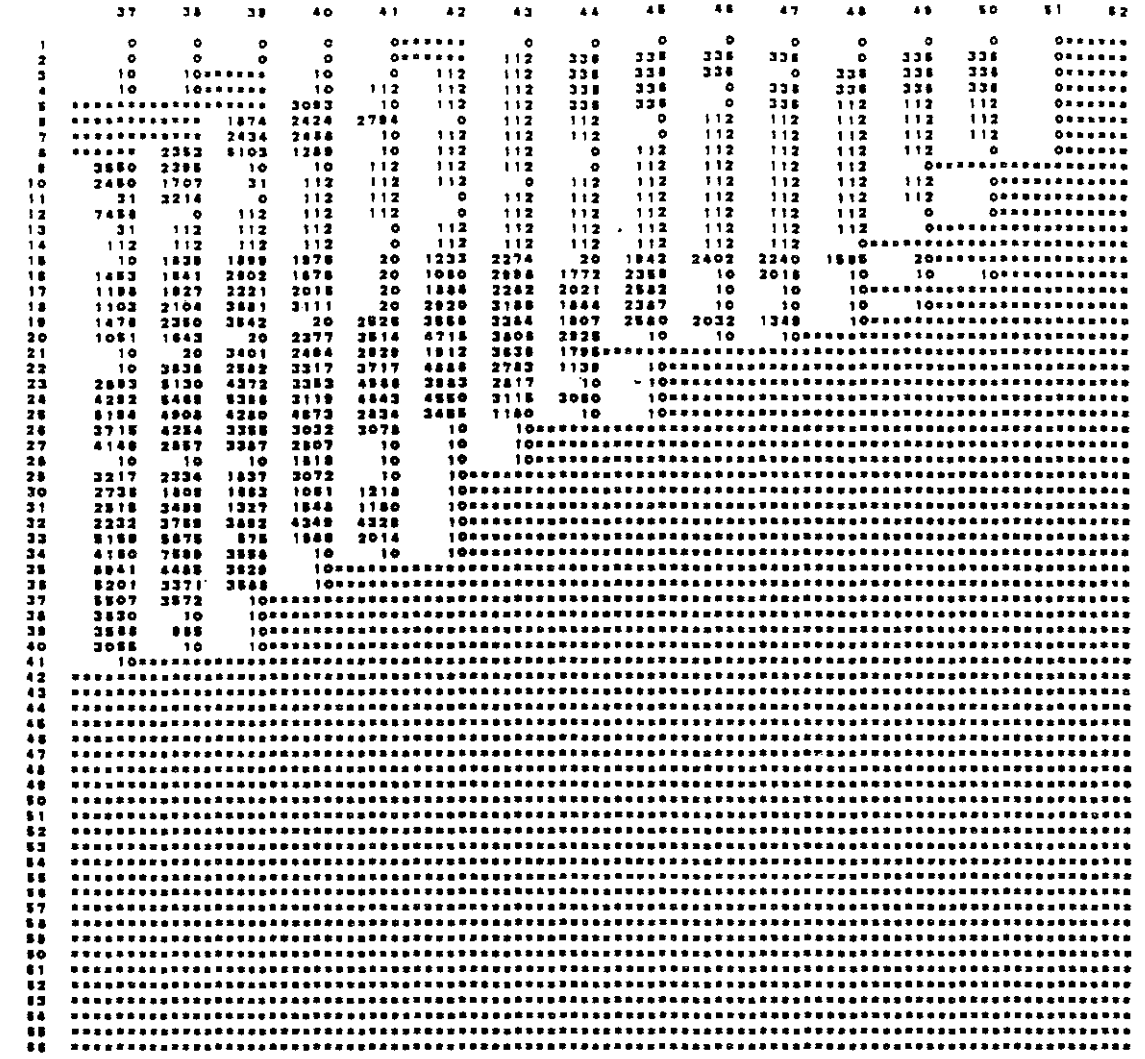

SCALAR TOTGW CMA2000 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3947121

MATRIX GCP CMA2010 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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20																		1726
21																		3871
22															20	2332	2948	10
23																111	20	10
24																1772	2887	6700
25																	2387	6153
26																		3980
27																	1086	10
28																	3480	20
29																2137	20	5086
30															2573	4214	20	3872
31														2617	3801	3978	20	3772
32													40	5713	3455	3327	20	10
33												2887	3414	2853	40	40	20	10
34									40	2444	3382	4488	2875	1710	2134	3218	10	3401
35								3328	5388	4272	4808	2048	884	4715	3433	10	10	3088
36								3328	4088	4268	2918	208	2808	4374	10	3781	4181	
37							3627	3108	3388	4342	647	2483	5404	3784	10	3288	4180	
38							1147	1780	4031	3800	4238	2588	2788	3503	102	3848	5885	
39							344	830	5446	3184	5319	378	1732	4987	10	488	3888	
40							1223	1314	2238	2834	3503	1488	5205	5881	10	2880	0	
41							5886	5808	5585	2834	2521	1888	2585	10	10	2728	2892	
42		2321	2178	40	3526	7848	8207	3284	3724	4831	10	10	2340	1181	845	40	2480	
43	0	10	1035	5488	10	40	8583	8308	2090	1058	0	0	212	0	8588	10	1384	
44	1878	10	708	5628	2718	7530	40	8885	5088	40	0	0	0	0	3813	4173	0	
45	10	1514	4638	5823	7851	13811	40	8193	5001	40	0	0	0	0	3653	2143		
46	10	1421	4352	5038	5581	5610	12440	40	5348	4877	40	0	0	0	2128	2181		
47	10	2881	2313	5735	7183	5088	5818	4823	31	5748	40	40	40	0	888	5348		
48	10	4188	4480	5510	5328	5507	5104	5804	40	4838	0	10	31	1885	2848			
49	10	4218	4903	4231	6041	5800	5591	8007	0	2705	1484	10	10	10	3544			
50	10	5384	3478	5158	7120	7325	4232	5418	4588	0	3438	10	10	10	1308			
51	10	3855	5858	2032	6108	5582	5808	4970	3518	3480	0	2012	10	10	10			
52	10	2144	6188	5988	5847	5440	4028	2827	0	3370	10	10	10	10				
53	10	5840	6072	6305	5884	5288	5887	1248	2877	0	1007	10	10	10				
54	10	10	2858	4821	5877	5852	884	834	0	3437	10	10	10					
55	10	10	3008	8422	1174	947	0	0	2403	1813	10	10						
56	0	0	5140	5843	5287	832	10	3837	2233	1880								
57	10	10	5567	4822	3437	10	2722	3204										
58	10	10	8085	4632	10	3478												
59	0	0	0	0	3833													
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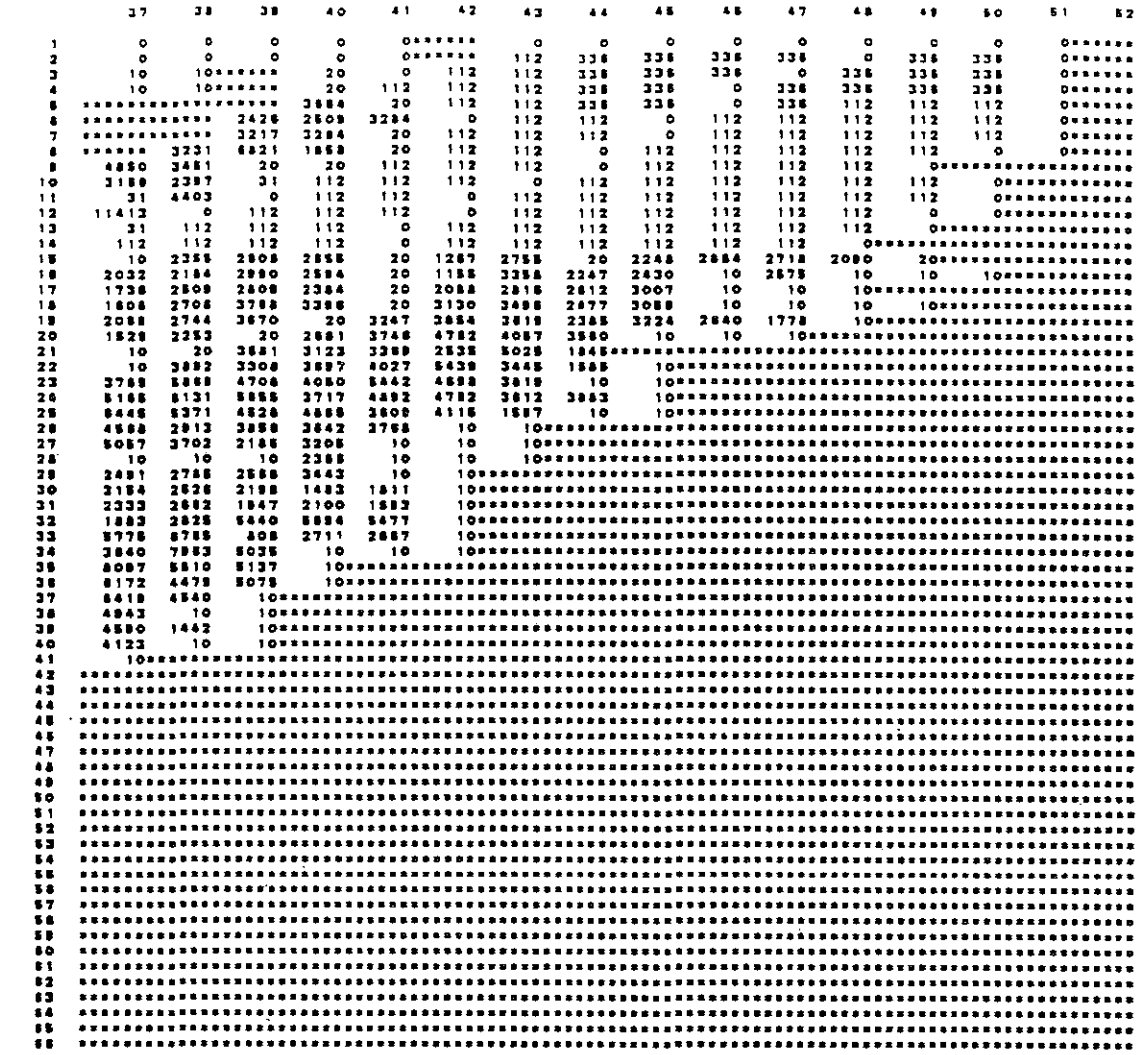

SCALAR TOTGW CMA2010 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4187644

MATRIX GCP CMA2020 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	2033
21																	4857
22														10	2473	3350	10
23														10	10	10	10
24															1784	2641	5892
25																2336	8162
26																	4555
27																1308	10
28																3886	10
29															2418	10	5331
30															2863	4760	10	4862
31														2834	4280	4586	10	3917
32													10	5384	4075	3885	10	10
33											3488	3728	2710	10	10	10	10	10
34									10	2858	3812	4824	2474	1892	2040	3258	10	3878
35									3901	5058	4583	5302	1843	554	4831	3717	10	3885
36									3928	4752	4713	2487	208	2857	3892	10	4046	4782
37								3778	3736	3827	4004	540	2528	5071	4159	10	3978	4811
38								1174	1856	5084	4853	3800	2588	2648	4080	10	4071	5511
39								442	589	7248	3784	3487	378	1527	5288	10	1000	4427
40								1528	1822	2477	3031	3305	1405	6287	7005	10	3417	10
41								5557	5884	5442	2349	2520	1837	2958	10	10	3151	3506
42			1630	1187	10	3520	7888	5359	3291	3837	4827	10	10	1524	1284	730	10	2562
43		0	10	1153	5388	10	10	5085	5185	2248	10	10	10	10	10	5572	10	1789
44		10	10	857	5532	2709	7544	10	5394	4767	2585	10	10	10	10	3907	4227	10
45			10	1888	4540	5502	7518	13883	10	5919	4528	10	10	10	10	10	3788	2331
46			10	1675	4328	5772	5411	5524	12488	10	5981	5010	10	10	10	10	1907	2383
47			10	3058	2348	5531	7028	4698	5853	4847	10	5493	58	10	10	10	887	5908
48				10	4316	4384	4847	5138	5387	4914	5588	10	4883	10	10	10	2014	2888
49				10	4357	4798	4082	5723	5386	5412	5945	10	2736	1861	10	10	10	3174
50				10	5742	3856	5522	5298	5518	4826	5718	4230	10	3298	10	10	10	715
51				10	3252	5208	1816	5588	7842	5344	5267	3300	3118	10	2133	10	10	1337
52					10	2011	5815	5455	6138	5720	4308	2248	10	2988	10	10	10	
53					10	5471	5442	5555	5248	5843	5797	1210	1828	10	1341	10	10	
54						10	10	2447	4188	5963	5039	614	579	10	3088	10	10	
55							10	10	2711	5414	1045	835	10	10	2560	2080	10	10
56								10	10	4842	5028	4722	852	10	3248	2503	1808	
57									10	10	4552	4107	3043	10	2628	2867		
58										10	10	4488	4110	10	3118			
59											10	10	10	10	3501			
60														10	2518			
61															10			
62																		
63																		
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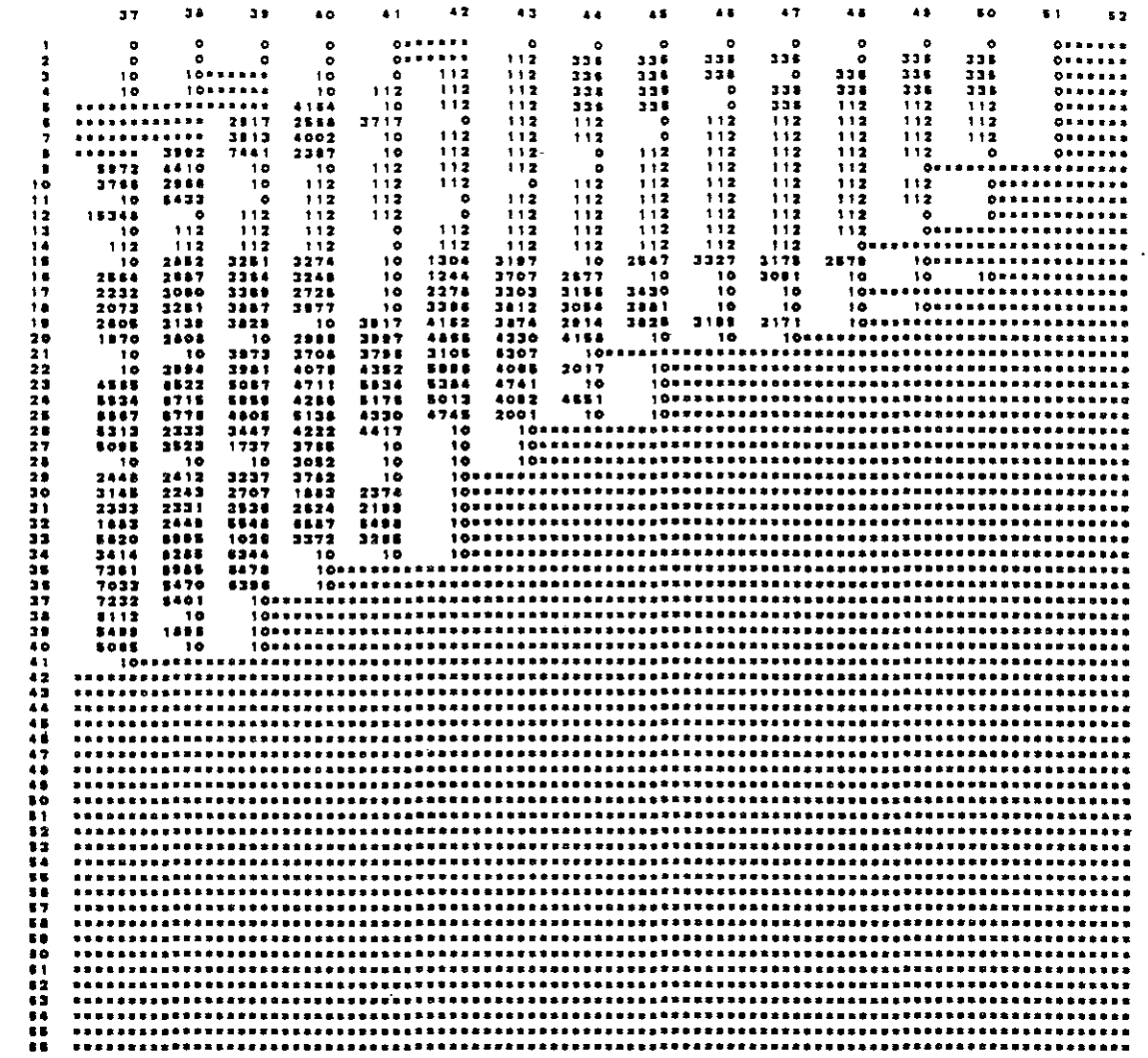

SCALAR TOTGW CMA2020 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4394633

MATRIX GCP CMA2030 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
2	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
3	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
4	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
5	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
6	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
7	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
8	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
9	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
10	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
11	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
12	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
13	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
14	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
15	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
16	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
17	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
18	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
19	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
20	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	2308
21	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	5838
22	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	20	2313	3730	10
23	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	111	20	10
24	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	1722	2443	8867
25	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	2292	8170
26	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	5082
27	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	1625	10
28	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	4213	20
29	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	2704	20	7488
30	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	3185	5226	20	5373
31	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	3281	4789	5115	20	4808
32	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	80	5003	4662	4647	20	10
33	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	4021	4072	2621	80	80	80	20	10
34	**********	**********	**********	**********	**********	**********	**********	**********	80	3283	3861	5378	2264	1832	2022	3281	10	4311
35	**********	**********	**********	**********	**********	**********	**********	**********	4588	5736	4868	5808	1638	554	4507	4032	10	4162
36	**********	**********	**********	**********	**********	**********	**********	**********	4524	5819	4884	2163	208	2881	3582	10	4377	5285
37	**********	**********	**********	**********	**********	**********	**********	4087	4282	4443	3825	540	2584	4778	4477	10	4508	5357
38	**********	**********	**********	**********	**********	**********	**********	1188	1918	5847	4007	3785	2588	2838	4582	212	4188	5426
39	**********	**********	**********	**********	**********	**********	**********	541	808	5048	4378	5188	378	1412	5841	10	1074	4901
40	**********	**********	**********	**********	**********	**********	**********	1803	1888	2881	3207	3148	1408	6188	7348	10	3892	0
41	**********	**********	**********	**********	**********	**********	**********	5725	5600	5310	2118	2508	1818	3318	10	10	3618	4016
42	**********	2485	2274	50	3890	7488	8171	3188	3580	4508	10	10	10	1327	807	40	2820	
43	******	0	20	1271	5292	20	50	8888	8084	1931	1200	0	0	232	0	5833	10	2087
44	******	2027	20	1008	5481	2715	7578	50	8202	4838	3222	0	0	0	0	3781	4284	10
45	**********		20	1817	4854	5403	7422	13902	50	5742	4830	50	0	0	0	0	3838	2488
46	**********		20	1820	4318	5542	8280	8458	12580	50	5741	4434	50	0	0	0	1741	2554
47	**********		20	3288	2387	5380	8818	4750	5428	4481	31	5308	188	50	50	0	784	8187
48	**********		20	4470	4307	8318	4978	5198	4782	5484	50	4818	0	10	40	2048	2420	
49	**********		10	4388	4707	3850	5441	5214	5281	6008	0	2738	1907	10	10	10	2847	
50	**********		10	5288	3871	5049	5581	5914	5378	5188	3814	0	2821	10	10	10	139	
51	**********		10	2845	8888	1655	5178	7321	4828	4907	3084	2787	0	2335	10	10	2488	
52	**********		10	1921	5118	5057	5808	5438	4861	1878	0	2832	10	10	10	188		
53	**********		10	5210	4974	5173	4790	5178	5230	1158	1778	0	1733	10	10	10		
54	**********		10	10	2284	3828	5430	4585	532	512	0	2780	10	10	10			
55	**********		10	10	2481	7883	943	817	0	0	2377	2317	10	10				
56	**********		10	10	4284	4858	4313	573	10	2888	2821	2011						
57	**********		10	10	4489	3723	2748	10	2184	2588								
58	**********		10	10	4075	3721	10	2800										
59	**********		0	0	0	0	3088											
60	**********		0	2328														
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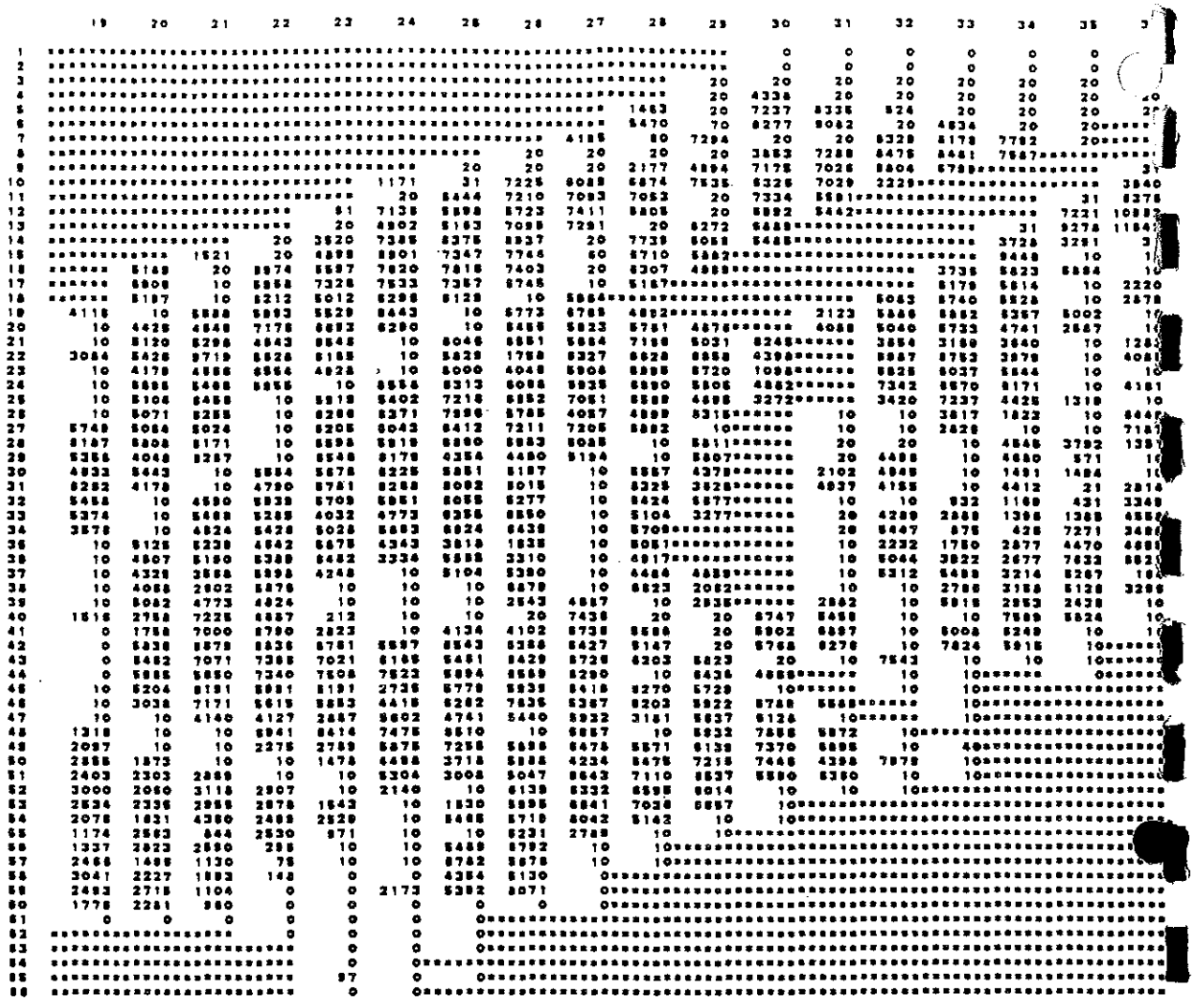
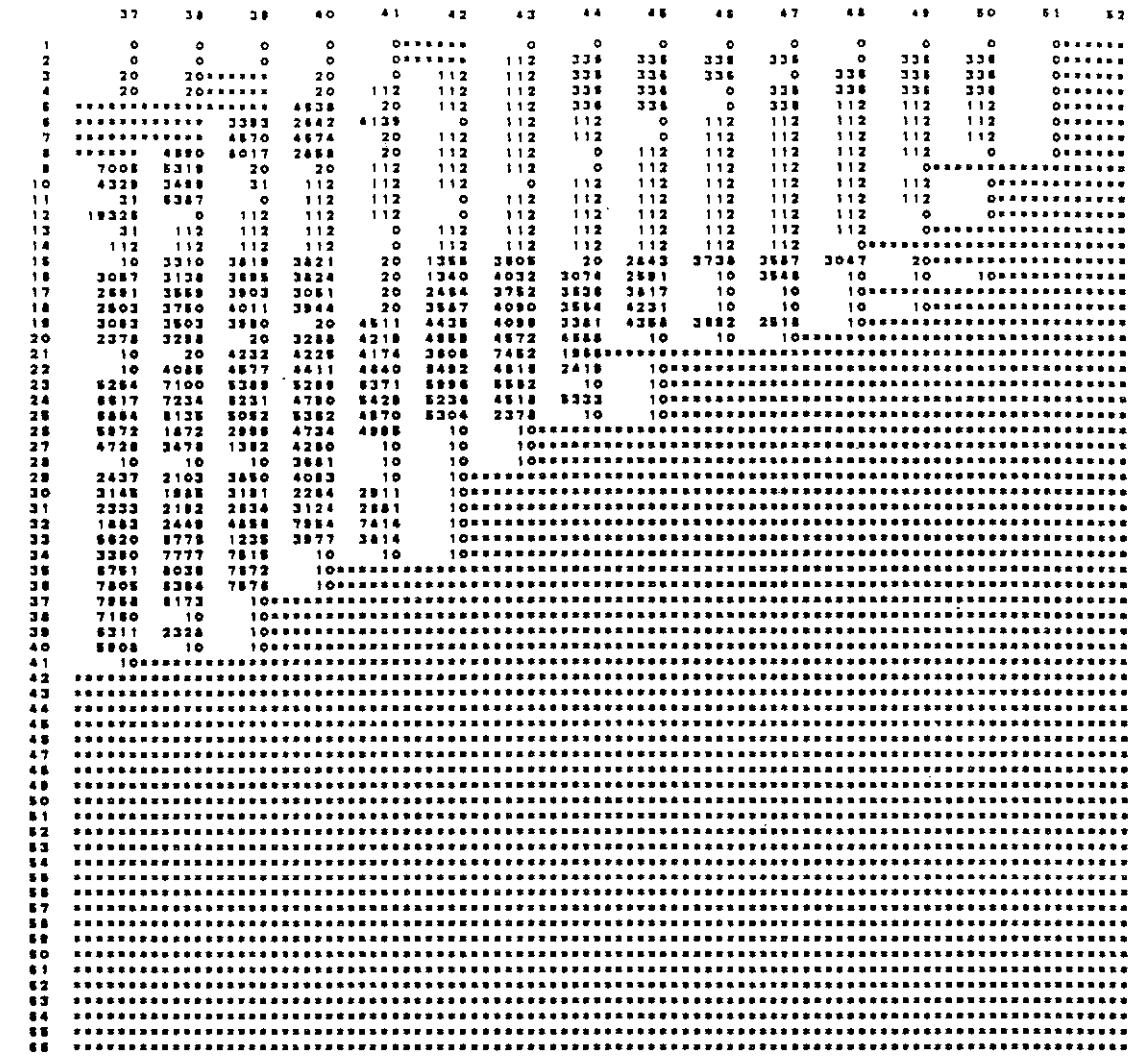
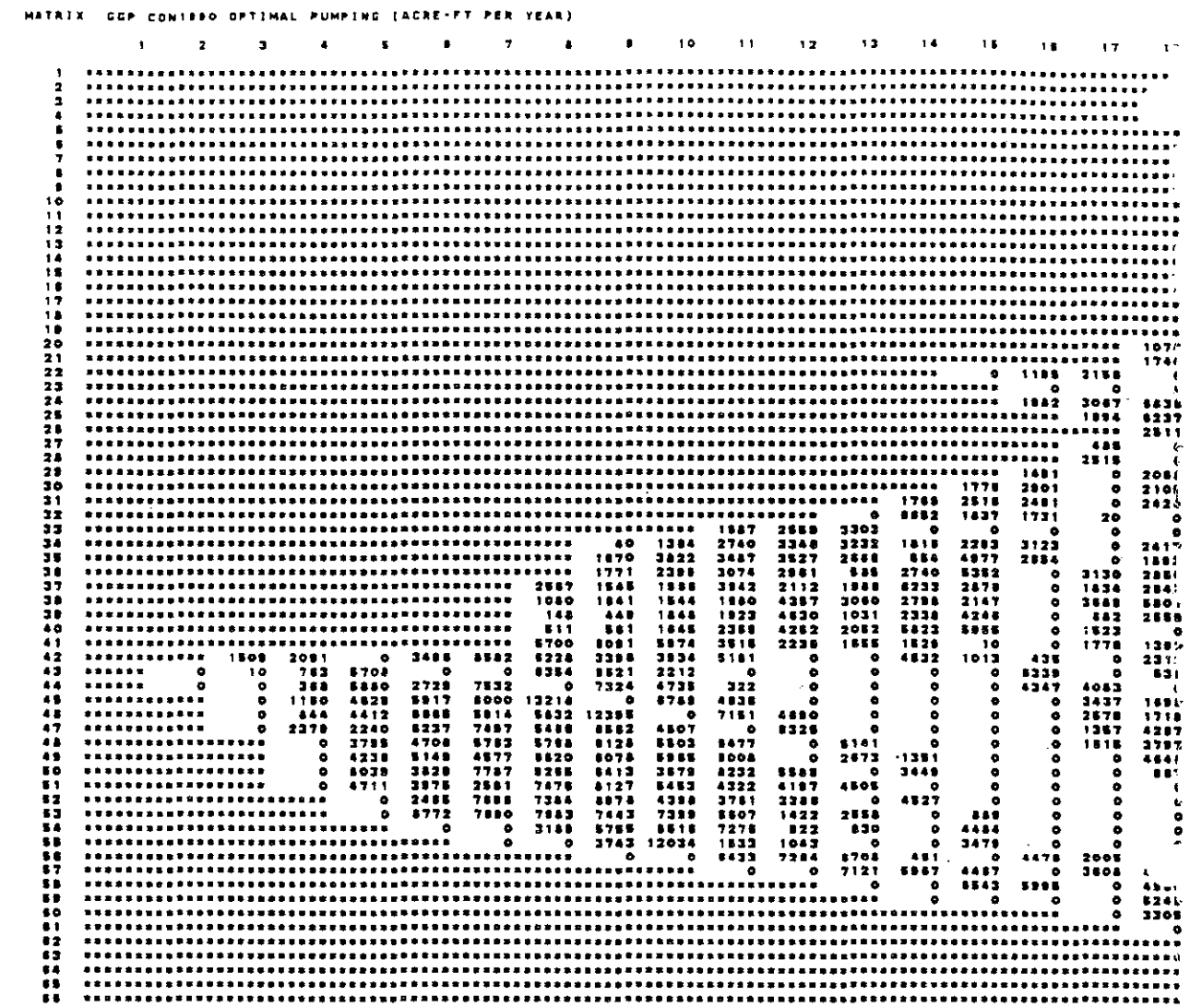
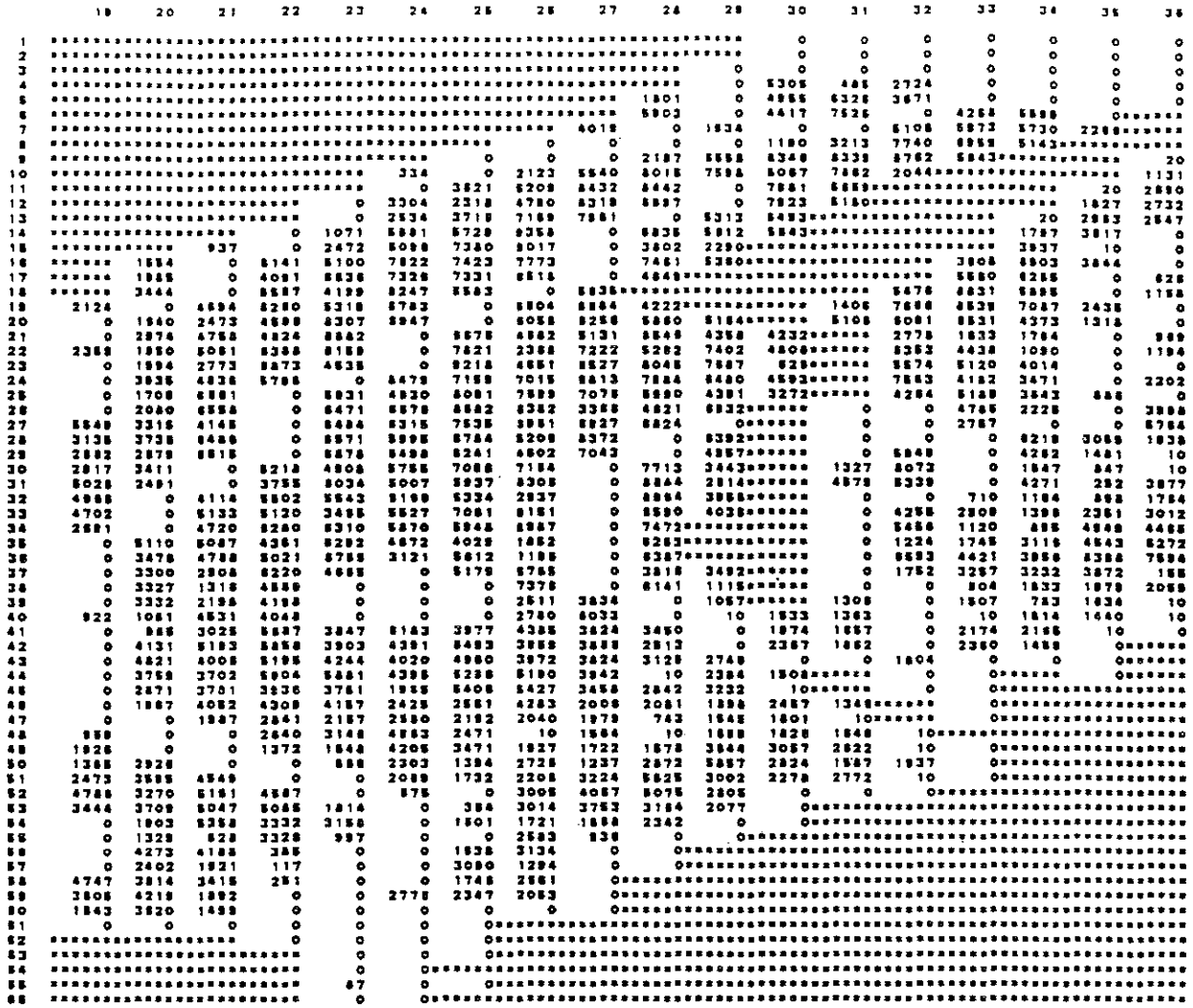
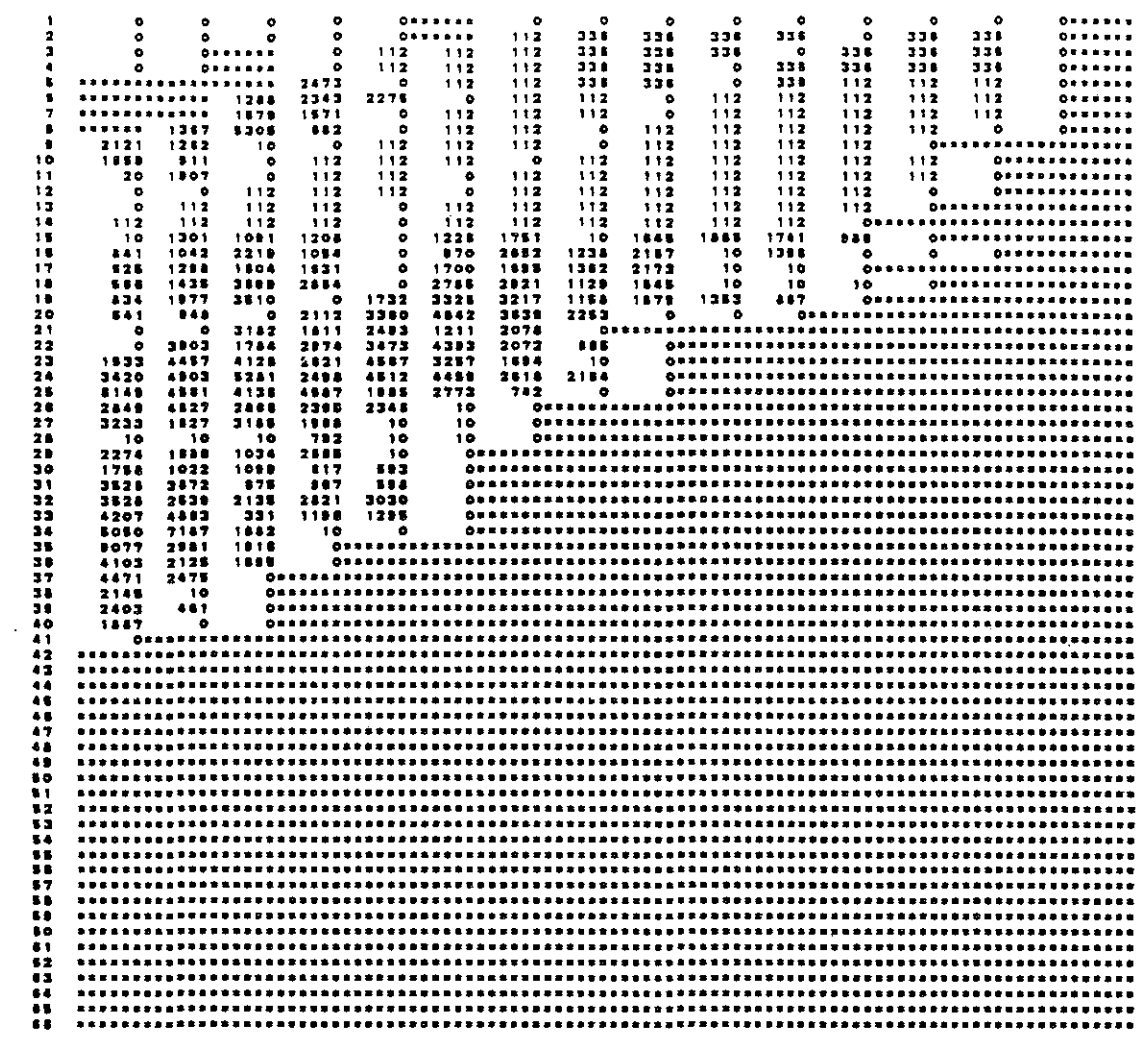




SCALAR TOTGW CMA2030 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4810760


MATRIX GGP CON1880 OPTIMAL PUMPING (ACRE-FT PER YEAR)





SCALAR TOTGW CON1990 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3893930

MATRIX GGP CON2000 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		1411
21																		2925
22																0	1787	2547	0
23																	0	0	0
24																	1882	2725	5711
25																		2413	5148
26																			3281
27																		790	0
28																		3041	0
29																	1825	0	3809
30															2204	3502	0	2892	
31														2222	3205	3285	0	3048	
32													0	8183	2708	2568	20	0	
33											2378	3017	3071	0	0	0	0	0	
34									40	1942	3085	3868	2823	1787	2208	3173	0	2877	
35								2884	4845	3807	4213	2300	884	4845	3072	0	3482		
36								2802	3268	3709	3468	208	2788	4821	0	3381	3481		
37							3027	2383	2714	4018	1031	2436	5788	3372	0	2852	3475		
38							1118	1710	2868	2818	4705	2867	2691	2492	0	3824	5884		
39							248	490	3848	2588	5348	828	1853	4828	0	738	3273		
40							887	884	1881	2813	3884	1548	5015	5311	0	2237	0		
41							5887	5937	5770	3442	2678	1408	2085	10	0.	2278	3200		
42			1947	2144	0	3505	6242	8222	3348	4178	3341	0	0	4744	1108	547	0	2400	
43		0	10	808	5578	0	0	6472	8448	2438	0	0	0	0	0	6452	0	884	
44		0	0	842	5742	2720	7524	0	8882	5032	0	0	0	0	0	4107	4128	0	
45		0	1348	4832	5761	7810	13441	0	6470	4883	0	0	0	0	0	3548	1937		
46		0	1148	4381	5334	5727	5714	12408	0	5723	4824	0	0	0	0	2337	1982		
47		0	2832	2278	5388	7320	5258	8218	4710	0	5017	0	0	0	0	1151	4640		
48		0	3588	4588	5822	5835	5884	5281	6178	0	4978	0	0	0	1548	3282			
49		0	4277	5018	4385	6404	5828	5787	9008	0	2892	1410	0	0	0	3886			
50		0	7138	3871	5805	6098	5928	3881	7248	4881	0	3302	0	0	0	1101			
51		0	4138	4944	2283	6737	5794	5483	4883	3773	3883	0	2007	0	0	0			
52		0	2284	5852	5834	7588	4802	3823	2858	0	3818	0	0	0	0				
53		0	8270	5812	7072	5888	5887	5284	1300	2253	0	555	0	0	0				
54		0	0	2903	5148	7517	5390	775	709	0	3835	0	0	0	0				
55		0	0	0	3348	10813	1337	872	0	0	3052	1555	0	0	0				
56		0	0	5734	5362	5923	503	0	4064	1840	1556								
57		0	0	6271	5233	3808	0	3051	3588										
58		0	5737	5251	0	3885													
59		0	0	0	0	4437													
60		0	2819																
61		0																	
62																			
63																			
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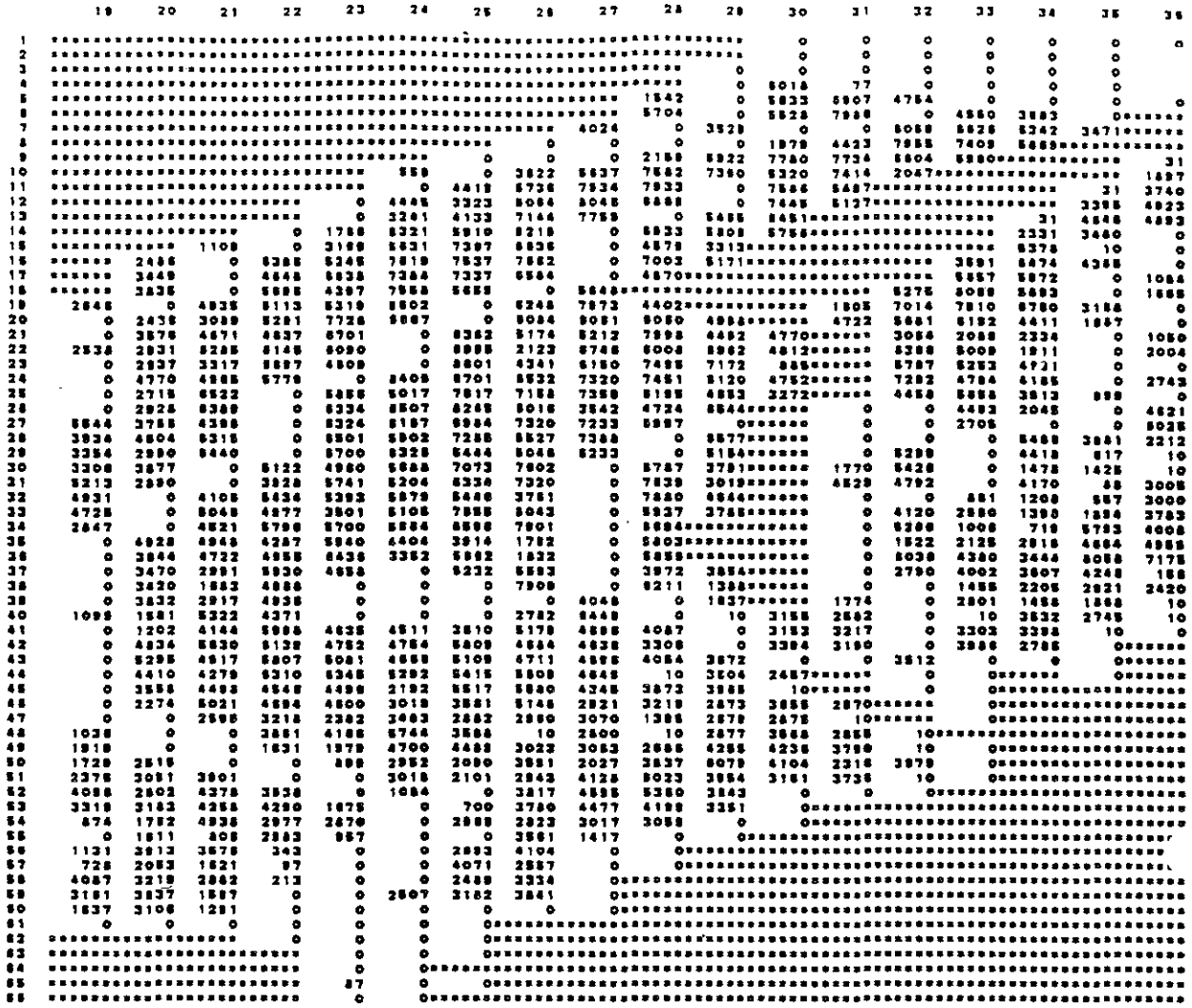
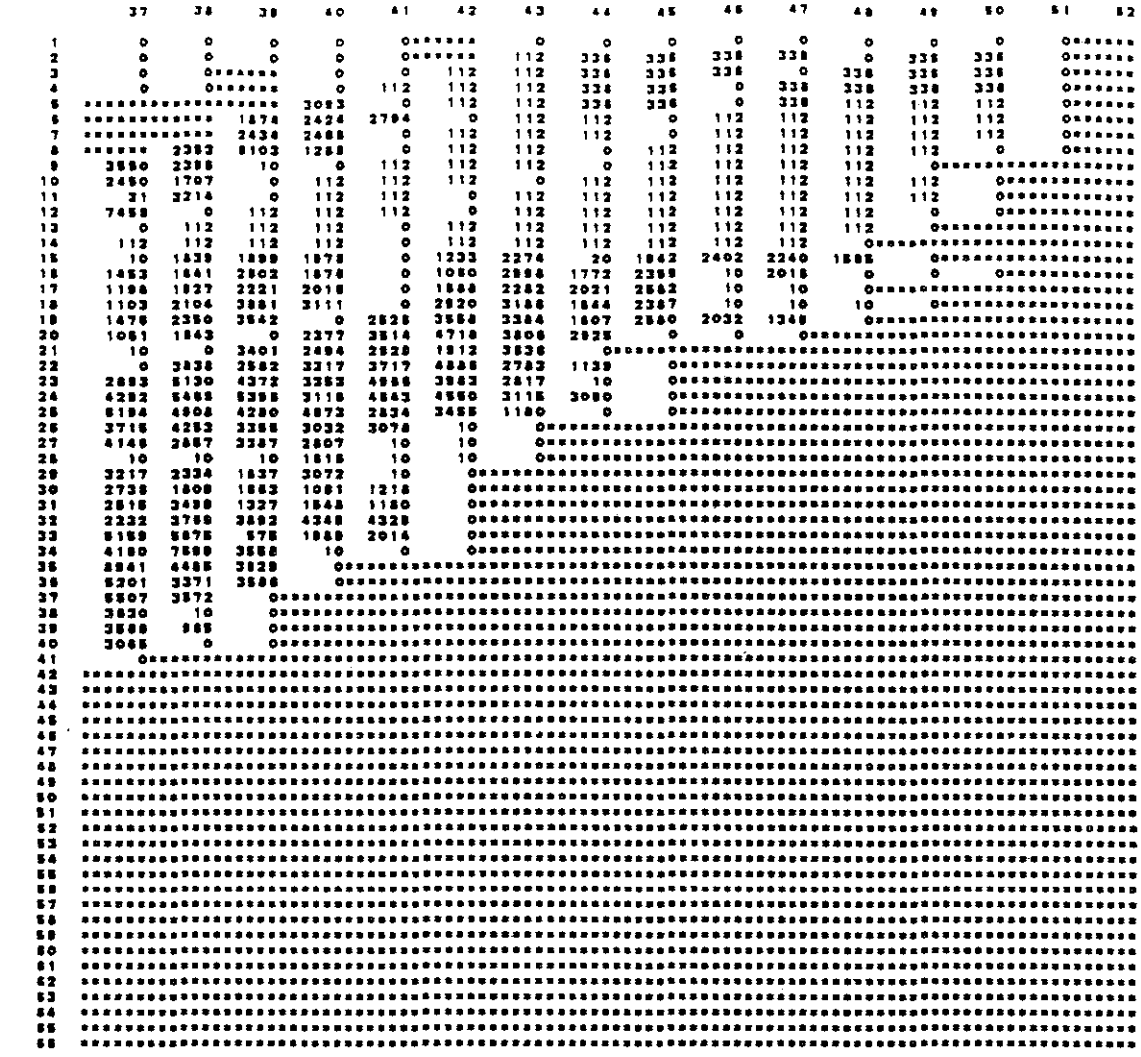
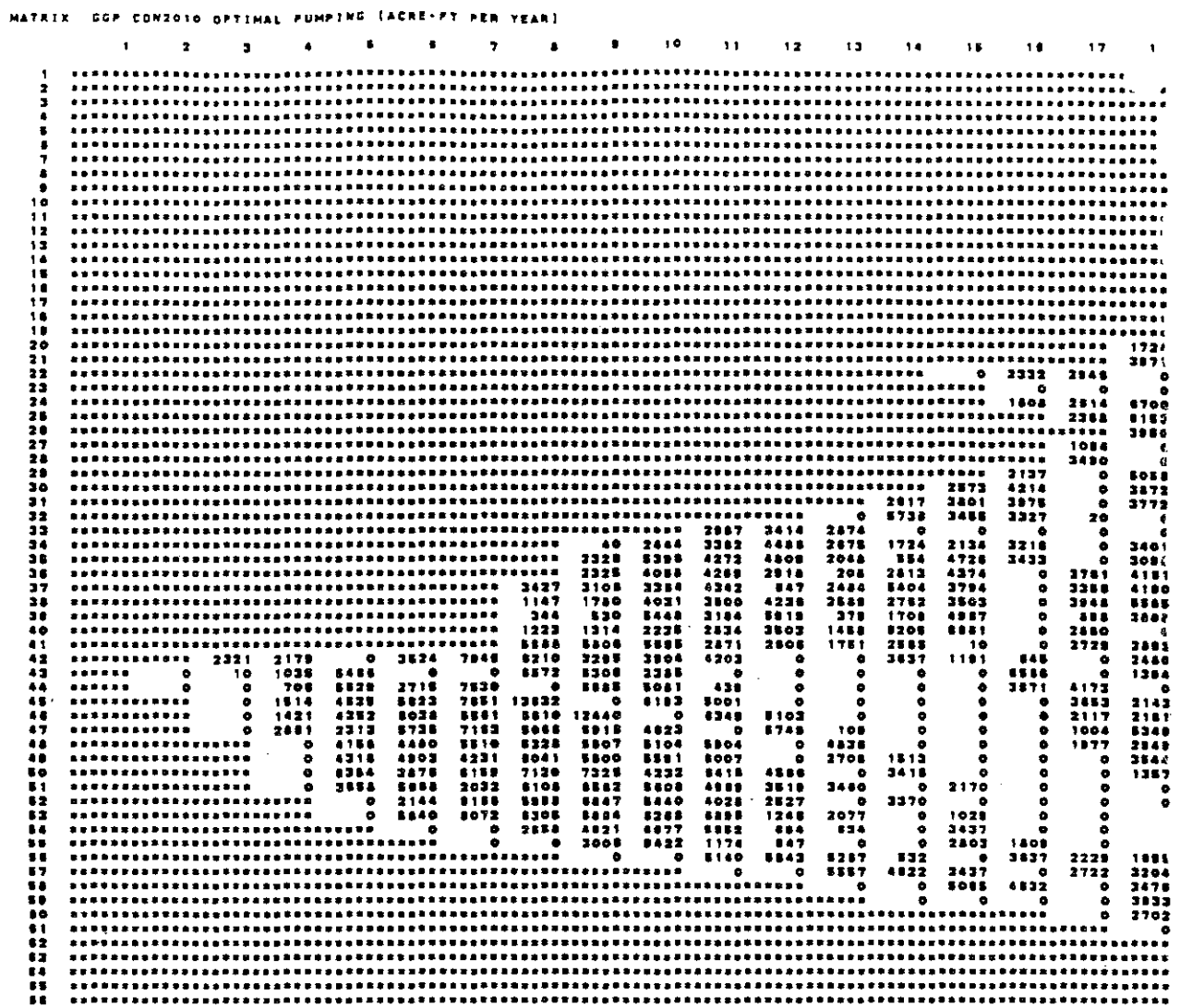
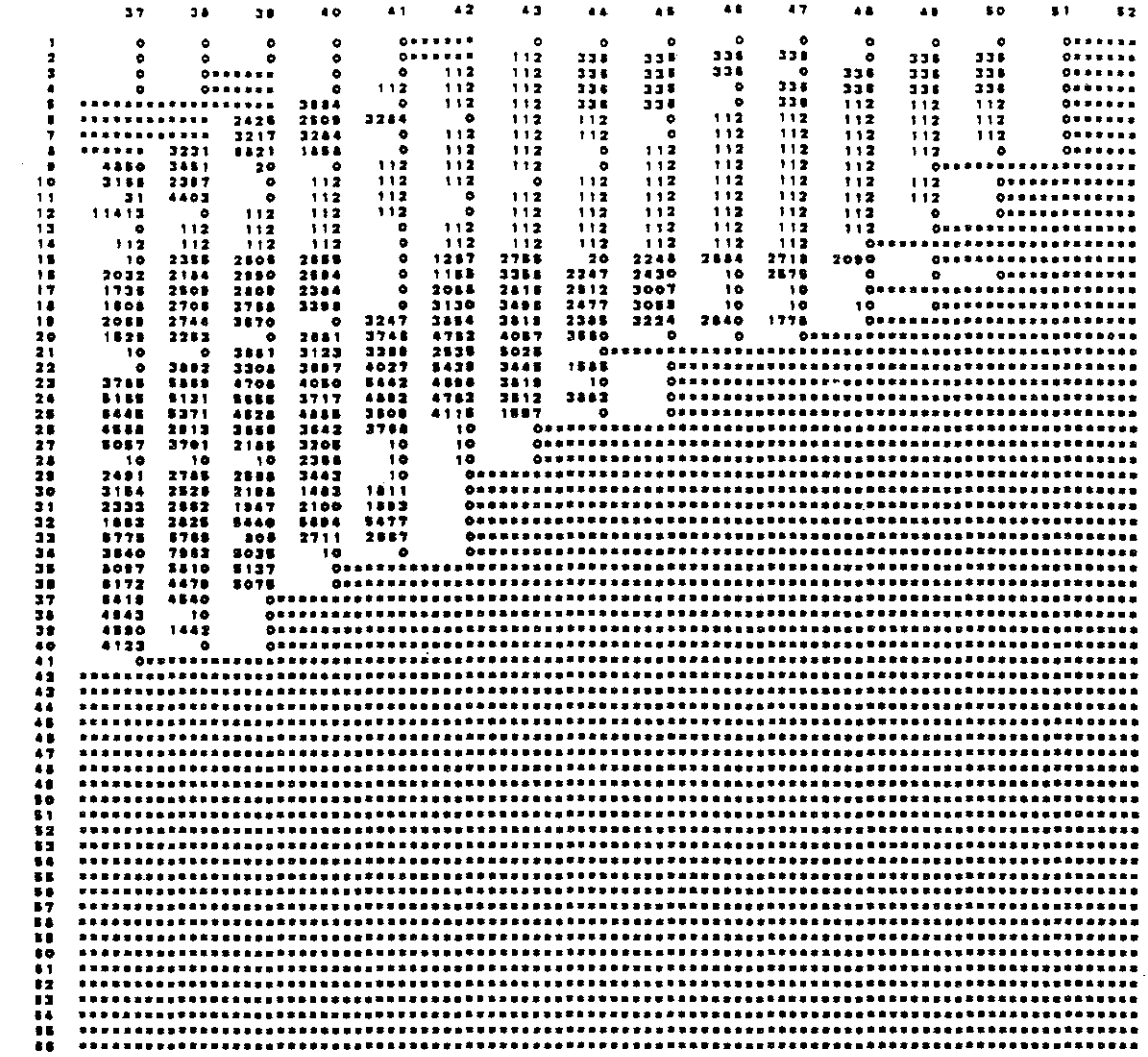
66																			





SCALAR TOTGW CON2000 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3942853

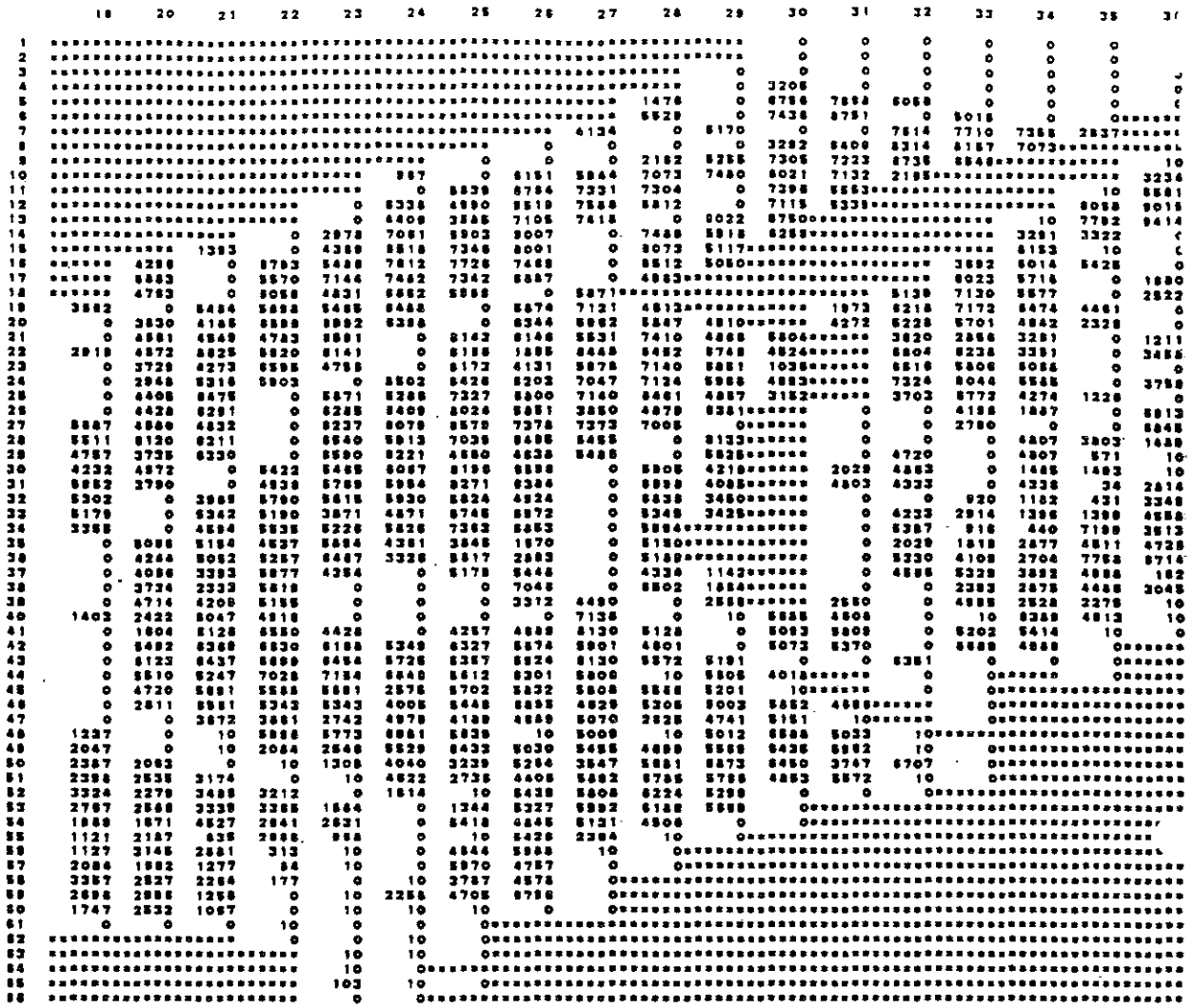

MATRIX GGP CON2010 OPTIMAL PUMPING (ACRE-FT PER YEAR)

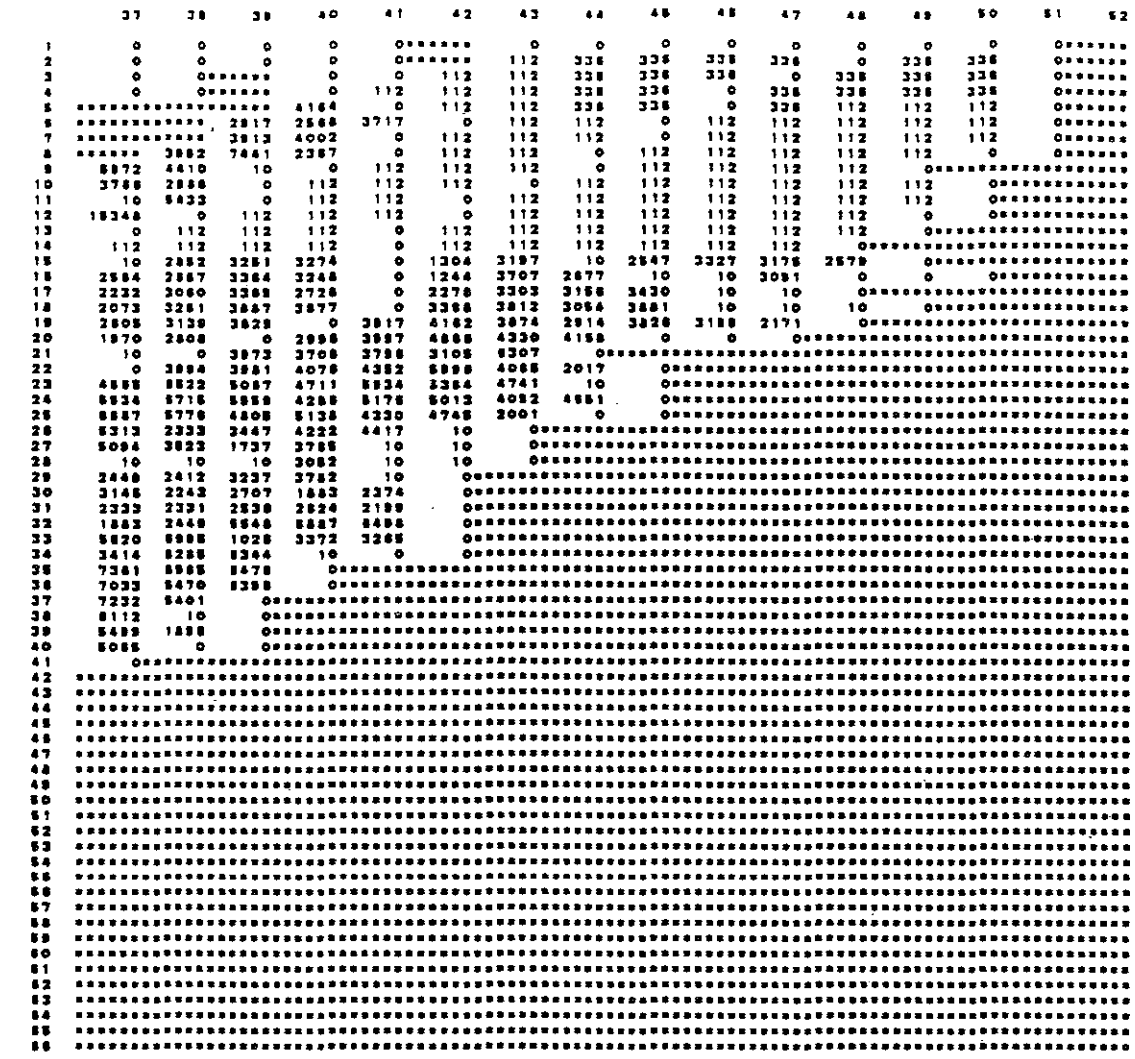


SCALAR TOTGW CDM2010 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4183585

MATRIX CGP CON2020 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		2033
21																		4957
22															0	2484	3350	0
23																0	0	0
24																1767	2546	5882
25																	2337	5162
26																		4588
27																	1308	0
28																	3866	0
29																2419	0	5321
30															2883	4740	0	4862
31														2834	4280	4868	0	3817
32													0	5381	4078	3865	10	0
33												3488	3728	2718	0	0	0	0
34									10	2858	3612	4824	2474	1885	2040	3258	0	3878
35								3901	6058	4583	5303	1843	854	4835	3717	0	0	3855
36								3925	4782	4713	2497	208	2859	3882	0	4088	4762	
37							3778	3735	3937	4004	840	2528	5071	4188	0	3878	4511	
38							1174	1850	5084	4683	3800	2588	2850	4058	0	4071	5511	
39							442	888	7248	3784	5487	378	1638	5288	0	1000	4427	
40							1528	1822	2477	3031	2305	1405	6258	7008	0	3417	0	
41							5857	5884	5442	2348	2518	1438	2868	10	0	3151	3500	
42			1830	1187	0	3820	7888	5351	3282	3837	4901	0	0	1848	1284	738	0	2583
43		0	10	1183	5368	0	0	5088	6185	2230	0	0	0	0	0	4578	0	1788
44		0	0	857	5532	2708	7544	0	6384	4888	2823	0	0	0	0	3927	4227	0
45		0	1888	4846	5502	7819	13888	0	5918	4555	0	0	0	0	0	0	3758	2331
46		0	1678	4328	5772	5411	8524	12488	0	5891	5010	0	0	0	0	0	1820	2383
47		0	3088	2348	5531	7028	4898	5853	4547	0	5493	324	0	0	0	0	878	5808
48			0	4318	4384	4847	5138	5387	4914	5898	0	4583	0	0	0	0	2028	2888
49			0	4387	4788	4082	5723	5398	5412	5988	0	2734	1584	0	0	0	0	3176
50			0	5742	3858	5523	6258	5518	4824	5718	4230	0	3298	0	0	0	0	557
51			0	3282	5208	1818	5588	7842	5344	5287	3300	3118	0	2228	0	0	0	1888
52				0	2011	5515	5488	5138	5728	4308	2248	0	2848	0	0	0	0	0
53				0	5471	5442	5858	5248	5643	5787	1218	1928	0	1417	0	0	0	0
54					0	0	2447	4158	5983	5038	814	578	0	3088	0	0	0	0
55						0	0	2711	5414	1048	838	10	0	2598	2078	0	0	0
56								0	0	4842	5028	4723	552	0	3248	2508	1813	
57										0	0	4852	4107	3043	0	2428	2887	
58											0	0	4488	4118	0	0	3118	
59												0	0	0	0	0	3501	
60																0	2518	
61																	0	
62																		
63																		
64																		
65																		
66																		

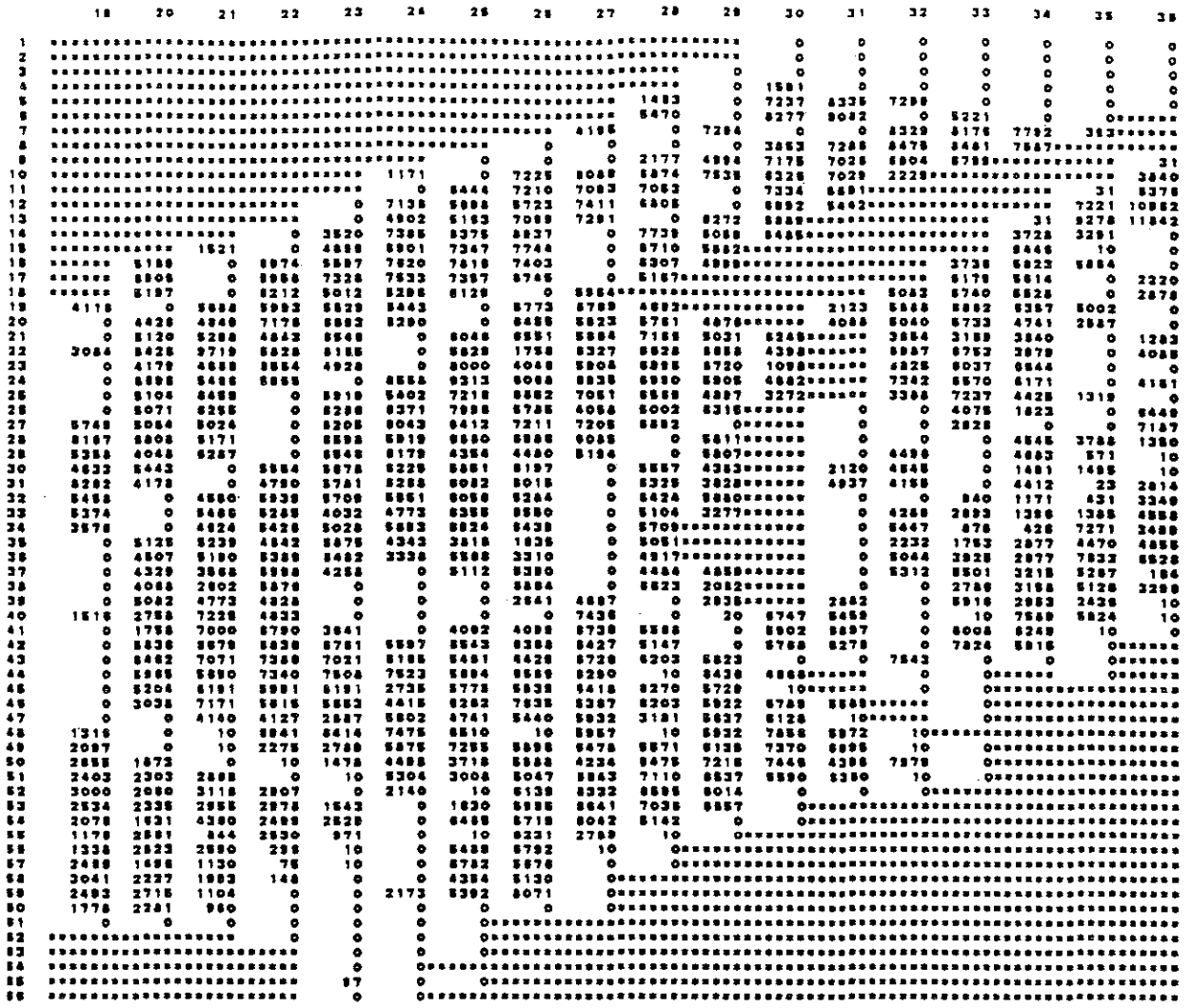


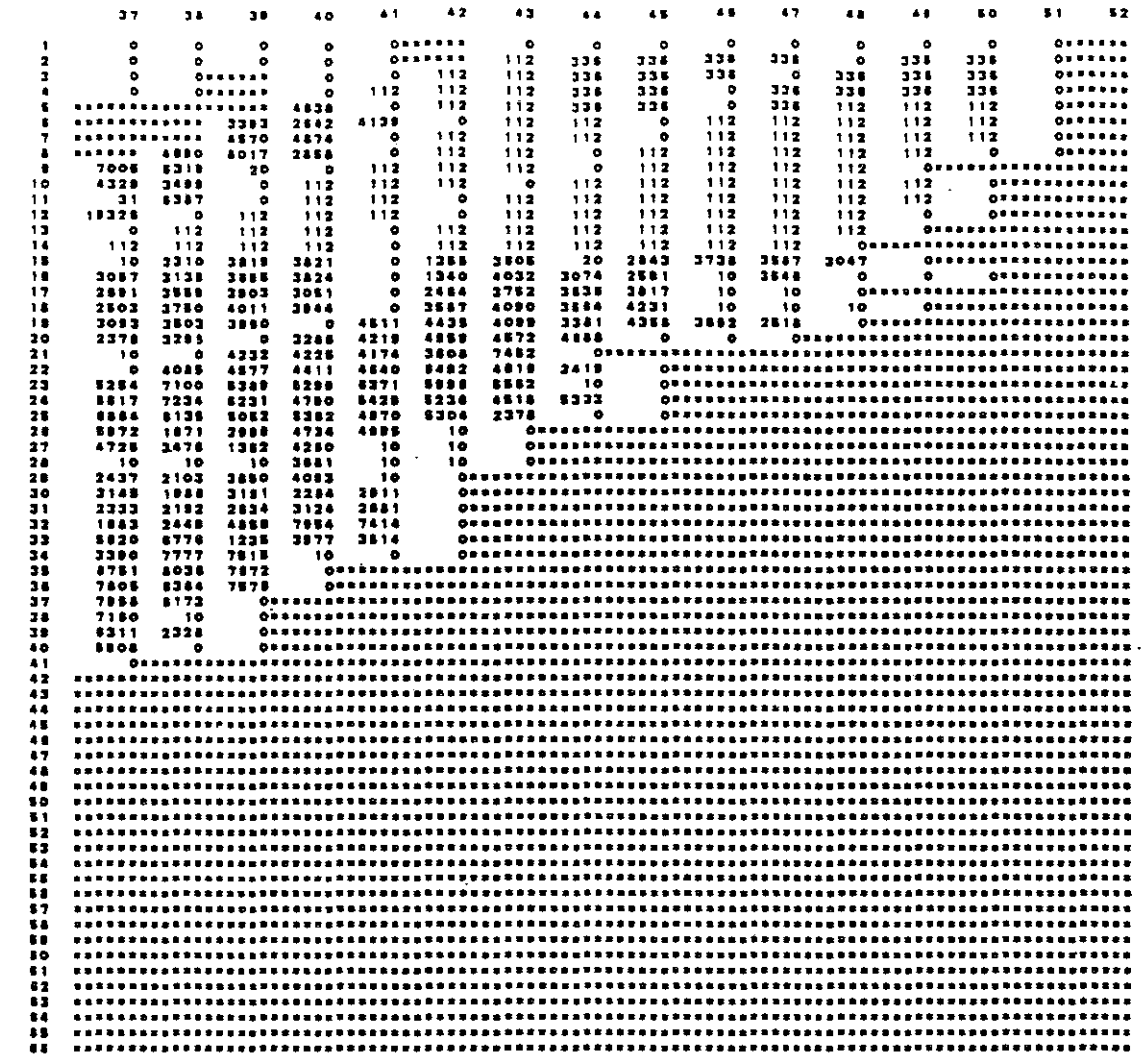


SCALAR TOTGW CON2020 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4394518

MATRIX GGP CON2030 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		2308
21																		5835
22																0	2380	3730	0
23																	0	0	0
24																	1783	2457	5887
25																		2283	5170
26																			5082
27																		1525	0
28																		4213	0
29																	2704	0	7488
30																3185	5225	0	5373
31															3281	4788	5115	0	4905
32													0	5035	4882	4847	20	0	
33												4021	4072	2548	0	0	0	0	0
34									80	3293	3881	5379	2284	1650	2022	3281	0	4311	
35									4589	5738	4848	5808	1838	884	4830	4032	0	4182	
36									4524	5818	4888	2153	268	2887	3882	0	4377	5295	
37								4087	4292	4443	3825	840	2868	4779	4477	0	4568	5357	
38								1188	1818	5887	4007	3786	2889	2648	4852	0	4186	5428	
39								541	808	3048	4370	5188	378	1416	5841	0	1074	4901	
40								1803	1888	2881	3207	3148	1408	8156	7348	0	3882	0	
41								5725	5800	5310	2118	2514	1678	3108	10	0	3518	4014	
42			2508	2274	0	3890	7488	5178	3200	3560	4787	0	0	484	1327	807	0	2820	
43		0	20	1271	5282	0	0	5723	5084	2148	0	0	0	0	0	5833	0	2087	
44		0	0	1006	5481	2715	7578	0	5202	4524	4075	0	0	0	0	3778	4284	0	
45		0	1817	4884	5403	7422	13928	0	5742	4412	0	0	0	0	0	3838	2488		
46		0	1920	4318	5542	5280	5488	12580	0	5741	4834	0	0	0	0	1747	2854		
47		0	3266	2387	5380	5918	4750	5428	4491	0	5308	500	0	0	0	786	5187		
48		0	4470	4307	5318	4978	5188	4782	5484	0	4818	0	0	0	2068	2420			
49		0	4386	4707	3950	5441	5214	5281	5008	0	2738	1810	0	0	0	2847			
50		0	5288	3871	5048	5981	5814	5377	5188	3814	0	2921	0	0	0	188			
51		0	2846	5588	1858	5178	7321	4825	4807	3064	2787	0	2424	0	0	2488			
52		0	1821	5118	5057	5808	5438	4858	1975	0	2832	0	0	0	320				
53		0	5210	4874	5172	4780	5179	5230	1158	1778	0	1774	0	0					
54		0	0	2284	3428	5430	4588	532	512	0	2780	0	0						
55		0	0	2491	7883	843	817	0	0	2377	2228	0							
56		0	4284	4888	4313	873	0	2888	2921	2017									
57		0	0	4899	3723	2748	0	2154	3589										
58		0	0	4075	3721	0	2800												
59		0	0	0	0	3088													
60		0	2328																
61		0																	
62																			
63																			
64																			
65																			





SCALAR TOTGW CON2030 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4606469

MATRIX CGP SMA1990 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		1240
21																		1871
22																22	1352	2490	11
23																	112	22	11
24																	1907	2351	7883
25																	1913	7014	
26																			2818
27																	841	11	
28																	2777	22	
29																	1884	22	2310
30																1951	3189	22	2347
31															1028	2757	2720	22	2712
32													45	8284	2016	1888	22	11	
33											1828	2812	3188	45	45	45	22	11	
34								45	1488	3012	3853	2988	1500	2506	3432	11	2878	
35								1825	4084	3611	3884	2002	884	2818	2818	11	2099	
36								1832	2850	3383	3188	233	2249	8032	11	3513	3184	
37							2807	1648	2142	4058	1233	2188	5848	3212	11	2027	2830	
38							1182	1892	1874	1848	4810	2788	2228	2382	190	3891	6483	
39							148	488	1848	1887	4886	803	1282	4880	11	737	2838	
40							841	801	1788	2530	4313	1448	5884	8314	11	1871	0	
41							8027	8484	5378	3807	2480	1827	1887	11	11	1814	1841	
42			1888	2308	45	3852	8018	5810	2778	4133	388	11	11	4884	1123	478	34	2501	
43		0	11	828	8882	11	45	8487	8887	2381	1088	0	0	202	0	8748	11	885	
44		1828	11	383	8232	2834	7744	45	7878	4383	45	0	0	0	0	4878	4448	0	
45			11	1287	4882	8208	8388	12407	45	7282	4401	45	0	0	0	0	3787	1880	
46			11	811	4882	7080	8213	8873	12474	45	7881	1234	45	0	0	0	1884	1823	
47			11	2808	2443	8828	7810	8822	7027	8085	34	8788	45	45	45	0	758	4780	
48				11	4182	4972	8107	8082	8484	8818	8883	45	8488	0	0	22	0	4874	
49				11	4837	8441	4833	7312	8800	8312	8433	0	2948	115	11	0	0	3888	
50				11	8142	4380	8777	8821	8108	3315	8282	8402	0	3055	11	11	0	184	
51				11	8328	4811	2801	8478	8181	8313	3882	4782	8348	0	11	11	0	0	
52					11	2782	8887	8358	8282	4112	3548	4088	0	8448	11	11	0	0	
53					11	7483	8887	8054	8407	8480	4774	1708	2884	0	11	11	11	0	
54						11	11	3803	8408	8271	7144	1108	888	0	3525	11	11	0	
55						11	11	4187	13678	1743	1282	0	0	4083	11	11	0		
56							0	0	7230	8228	7851	523	11	3787	11	0			
57								11	11	8058	8787	5084	11	4348	11				
58									11	11	7438	8832	11	8482					
59									0	0	0	0	0	8310					
60														0	3877				
61															0				
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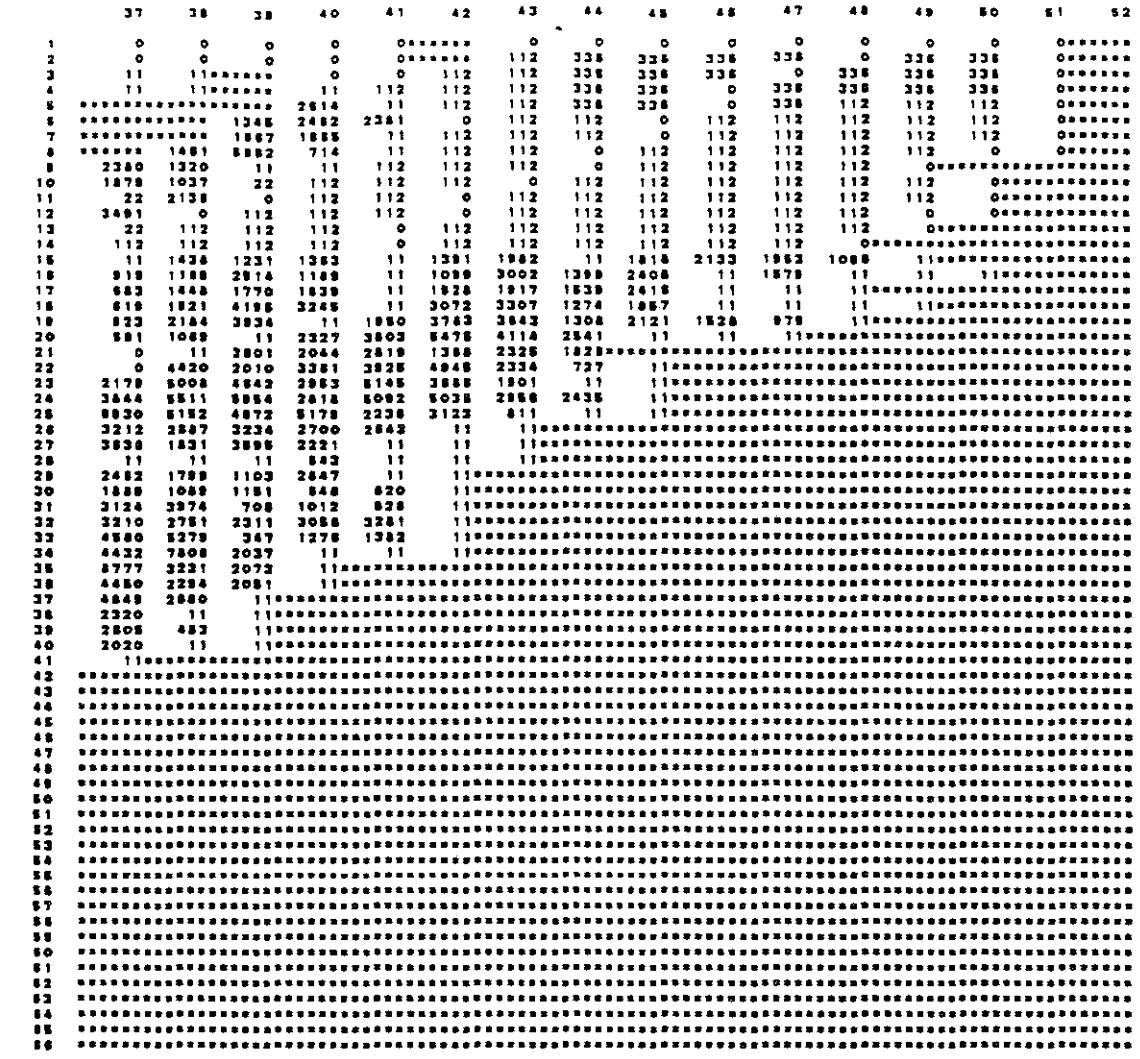

SCALAR TOTGW SMA1990 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3905118

MATRIX GCP SHA2000 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		1880
21																		3733
22															22	2250	3374	11
23																112	22	11
24																1754	2010	8218
25																	1828	7872
26																		3883
27																	854	11
28																	3859	22
29																2041	22	4828
30															2928	4252	22	3726
31														2613	3804	3874	22	3636
32													45	5807	3222	3045	22	11
33													45	45	45	45	22	11
34								45	2278	3888	4890	2852	1367	2613	3803	11	3859	
35								3023	5277	4818	4971	1582	554	3325	3878	11	3088	
36								3082	3858	4388	2252	208	2132	5083	11	4301	4407	
37							3552	2818	3187	4532	540	2275	5492	4132	11	3181	4188	
38							1287	1822	2318	3388	4341	2589	1880	3411	202	4402	5881	
39							247	535	3048	2715	5825	389	956	5535	11	811	3928	
40							887	1108	2288	3021	3445	1408	5592	7020	11	2844	0	
41							5384	5729	5615	1889	2521	1902	2447	11	11	2588	2848	
42			2225	2485	45	3832	8098	5401	2513	3033	4603	11	11	1774	1338	850	24	2784
43		0	11	1041	5178	11	45	5423	5897	2013	1178	0	0	224	0	7220	11	1150
44		2005	11	803	5467	2843	7971	45	7545	4182	45	0	0	0	0	3033	4835	0
45			11	1884	5181	5375	8820	12288	45	7515	3987	45	0	0	0	0	4248	2383
46			11	1287	4915	7152	5382	8218	12327	45	7515	2317	45	0	0	0	1381	2357
47			11	3081	2848	8808	7878	5607	7153	5261	34	5885	45	45	45	0	0	5832
48				11	4867	5151	5304	8211	5593	5952	7033	45	5027	0	0	22	0	4858
49				11	5021	5535	4828	7422	5354	5485	6932	0	3274	0	11	0	0	3430
50				11	9303	5020	5826	5865	5108	3244	9282	5402	0	3074	11	11	0	0
51				11	5328	5385	2901	5712	5101	5312	3871	4782	5360	0	11	11	0	0
52					11	2837	5811	5577	5218	4112	3538	4088	0	5445	11	11	0	
53					11	7577	5751	5158	5482	5432	4748	1827	3018	0	11	11	11	
54						11	11	3725	5408	5243	7113	1108	1011	0	3752	11	11	
55							11	11	4167	13807	1743	1380	0	0	4113	11	11	
56								0	0	7284	5247	7787	649	11	3758	11	0	
57									11	11	5078	5841	5085	11	4379	11		
58										11	11	7472	5872	11	5510			
59											0	0	0	0	5327			
60														0	3928			
61															0			
62																		
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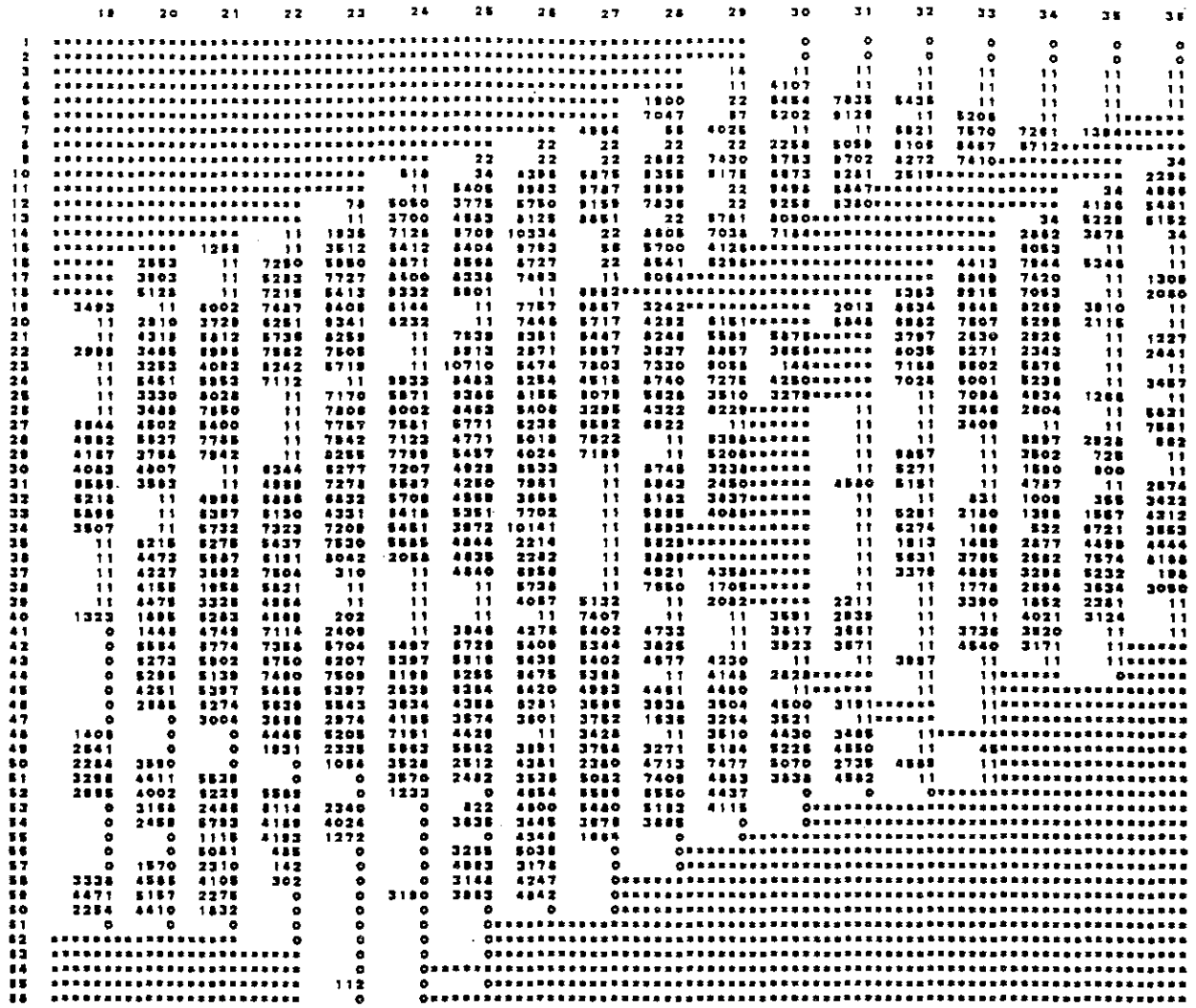
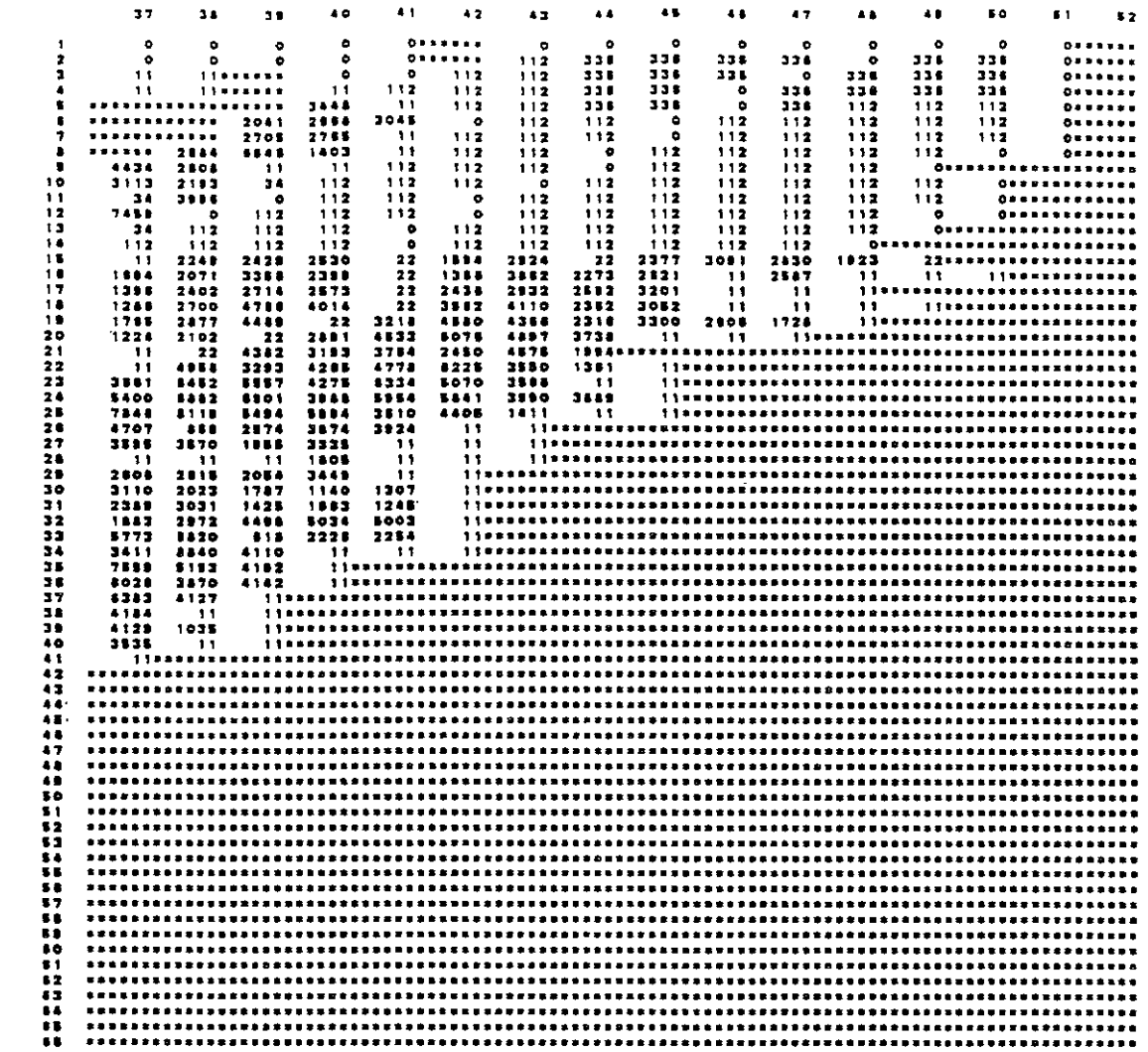
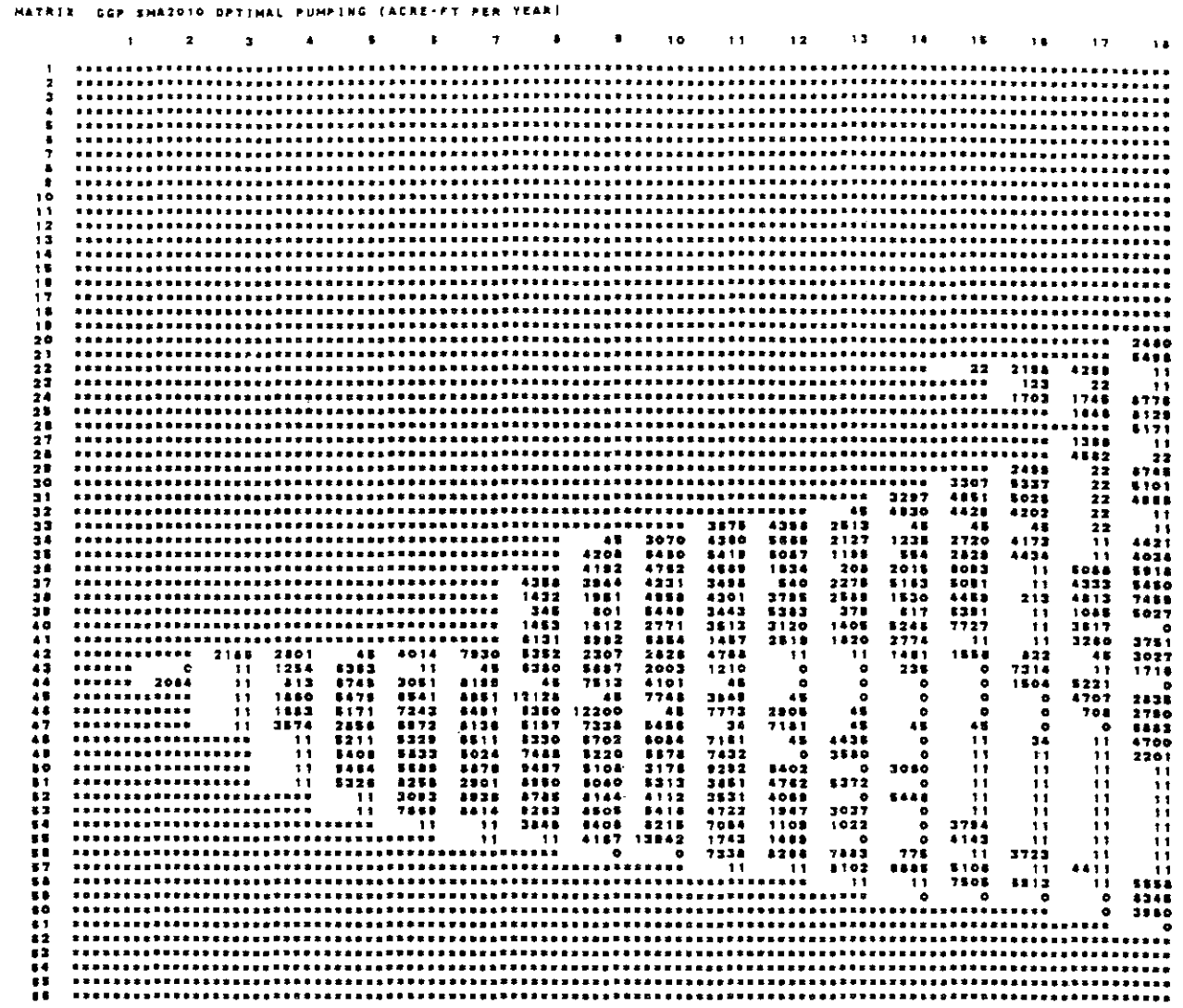
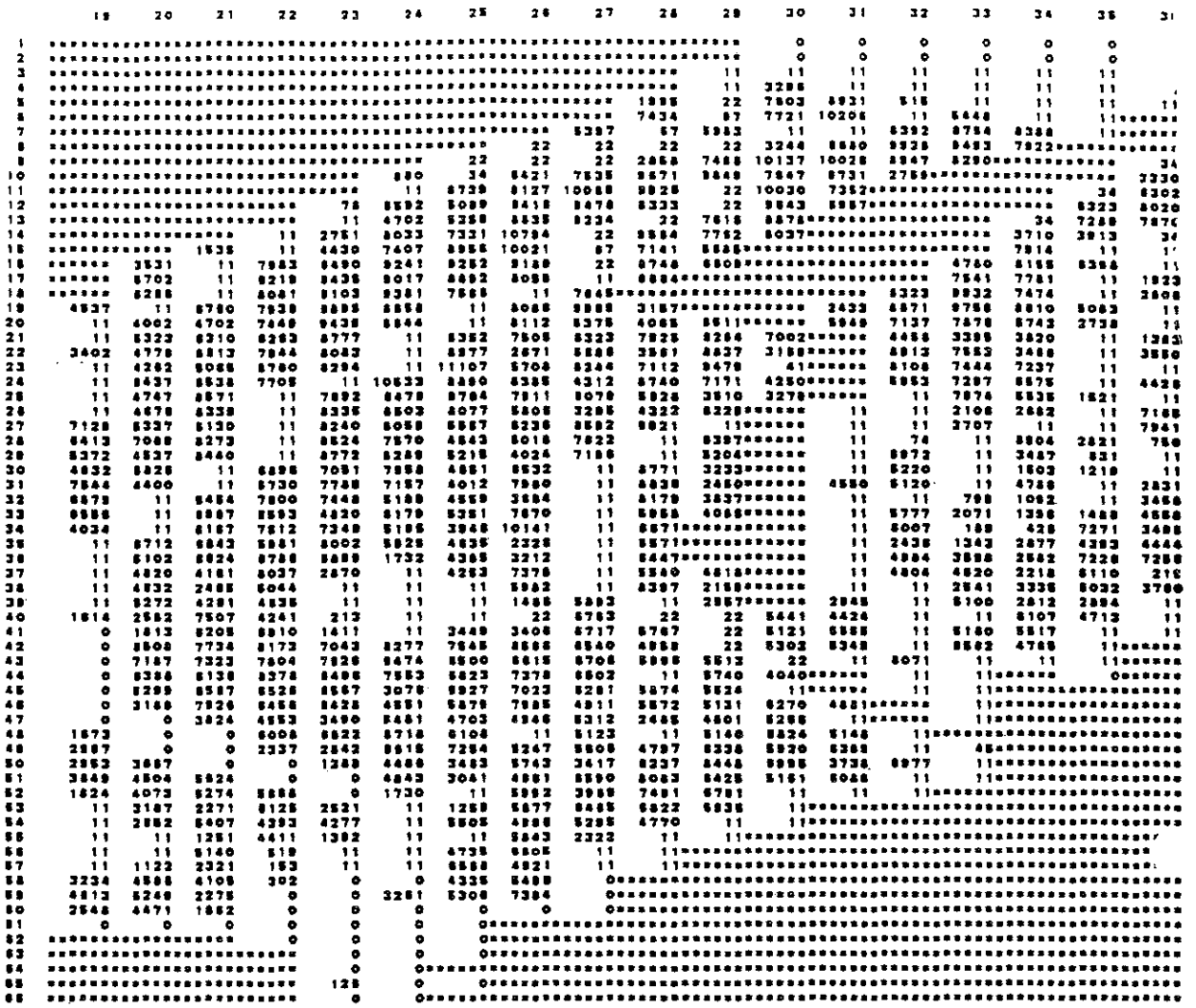
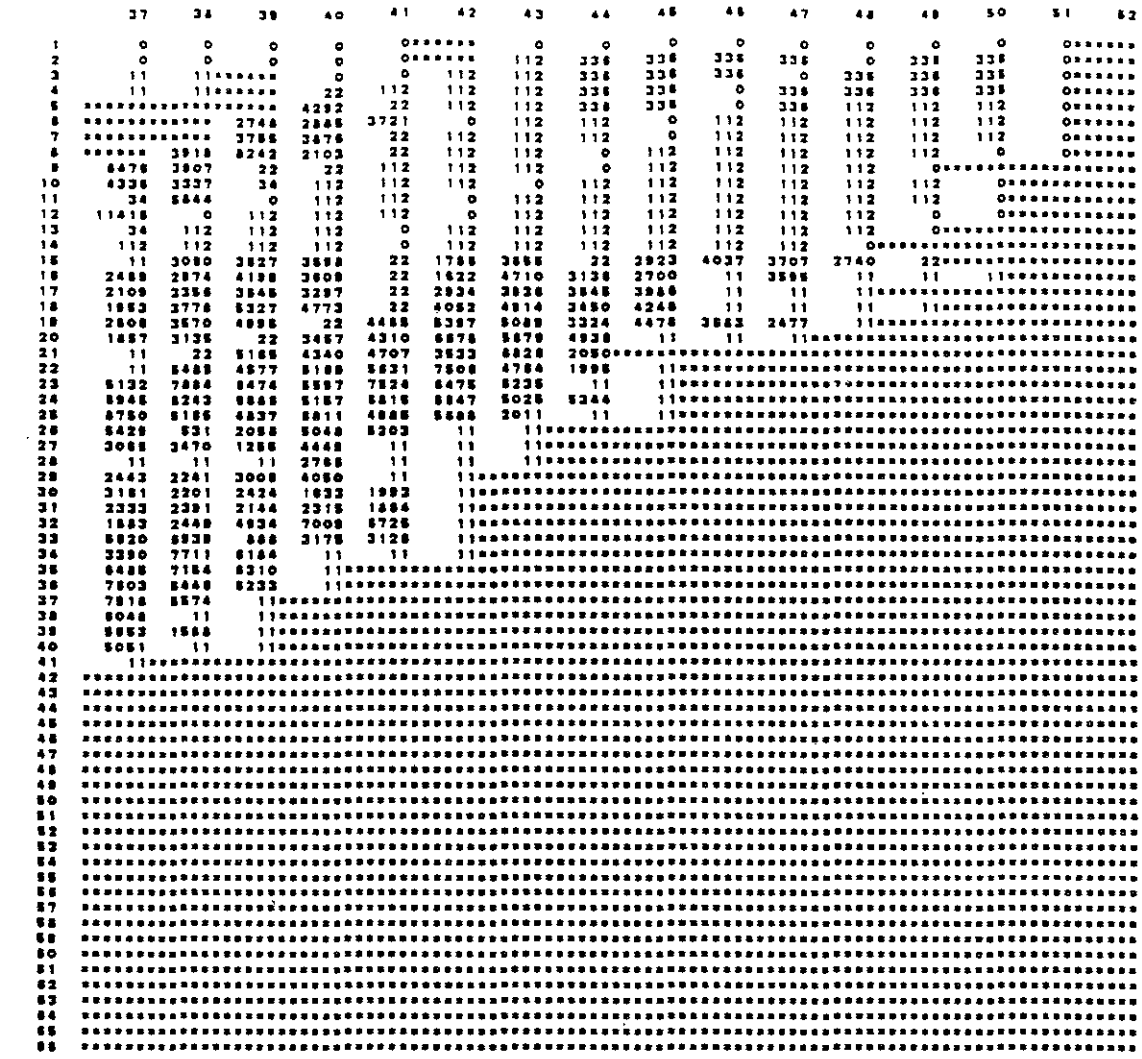




SCALAR TOTGW SMA2000 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4468881


MATRIX GGP SMA2010 OPTIMAL PUMPING (ACRE-FT PER YEAR)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
2480
5488
22 2188 4288 11
11 123 22 11
1703 1746 6778
1648 6128
5171
1388 11
4582 22
2498 22 6748
3307 8337 22 5101
3297 4861 5028 22 4888
45 4830 4428 4202 22 11
3675 4388 2813 45 45 45 22 11
45 3070 4380 5888 2127 1238 2720 4172 11 4421
4208 5450 5418 5067 1188 554 2828 4434 11 4026
4182 4762 4689 1834 208 2016 8083 11 5088 5918
4388 3944 4231 3498 540 2278 5163 5081 11 4332 5450
1432 1951 4858 4301 3785 2588 1530 4458 213 4813 7488
345 801 5448 3443 5383 378 617 5381 11 1088 5027
1453 1612 2771 3513 2120 1405 5245 7727 11 3817 0
8131 8982 8854 1487 2818 1820 2774 11 11 3260 3751
2168 2801 45 4014 7930 5352 2307 2828 4768 11 11 1481 1858 822 45 3027
C 11 1254 6383 11 45 6380 5887 2003 1210 0 0 235 0 7314 11 1718
2064 11 813 8748 3051 8188 45 7513 4101 45 0 0 0 0 1504 5221 0
11 1880 8478 8541 8851 12128 45 7748 3848 45 0 0 0 0 4707 2838
11 1883 8171 7243 8481 8380 12200 45 7773 2805 45 0 0 0 708 2780
11 3874 2858 8872 8138 8187 7328 5486 34 7181 45 45 45 0 0 8882
11 8211 8329 8511 8330 8702 8084 7181 45 4435 0 11 34 11 4700
11 8408 8833 8024 7488 8220 8878 7432 0 3580 0 11 11 11 2201
11 8484 8588 8878 8487 8108 3178 8282 8402 0 3080 11 11 11 11
11 8328 8258 2901 8880 8060 8313 3851 4782 8372 0 11 11 11 11
11 3083 8838 8785 8144 4112 3531 4088 0 8448 11 11 11 11
11 7888 8814 8283 8505 8418 4722 1847 3037 0 11 11 11 11
11 11 3848 8408 8215 7084 1108 1022 0 3784 11 11 11
11 11 4187 13842 1742 1488 0 0 4143 11 11 11
0 0 7338 8288 7883 775 11 3723 11 11
11 11 8102 8885 5108 11 4411 11
0 0 0 0 8348
0 3980
0

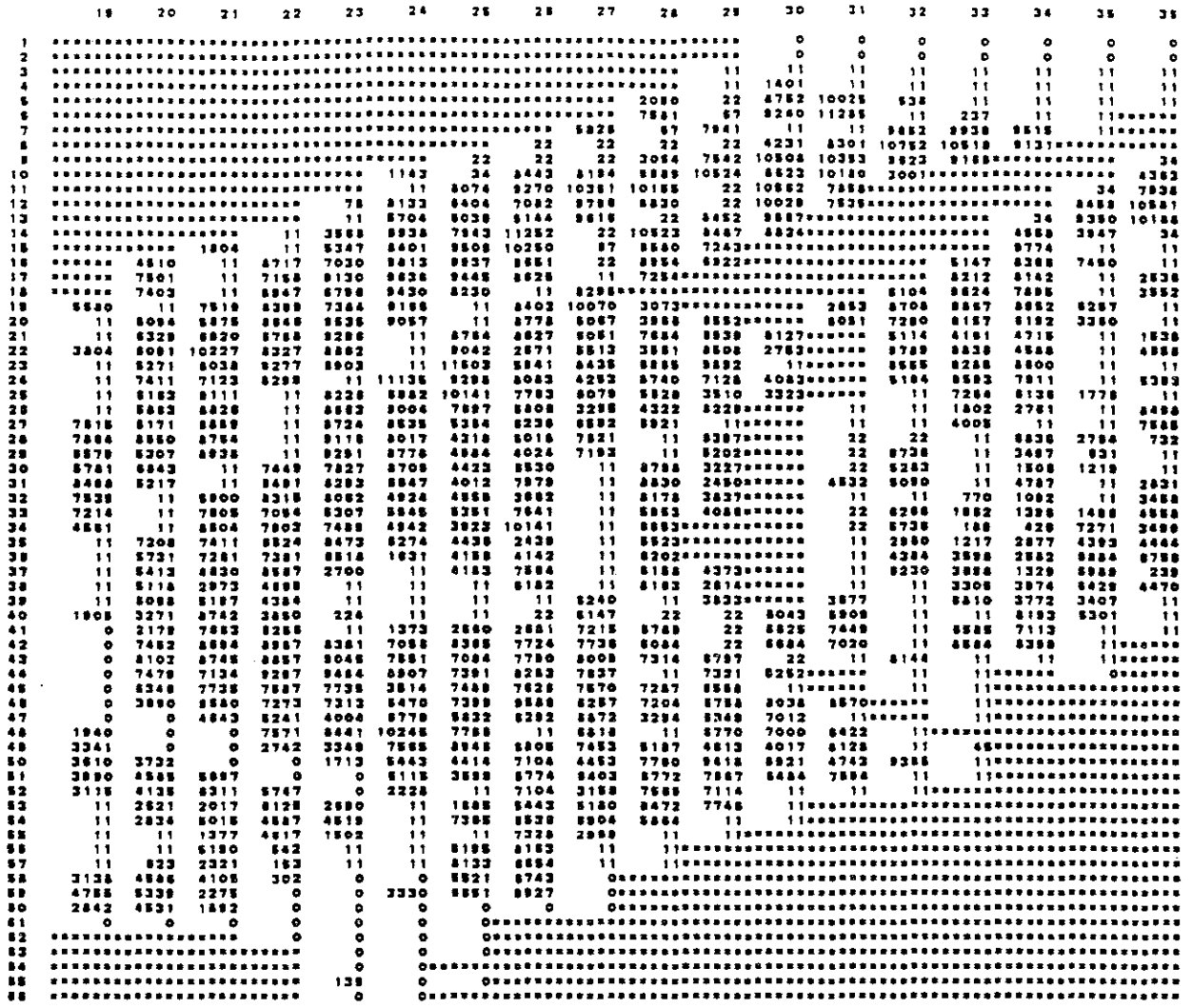


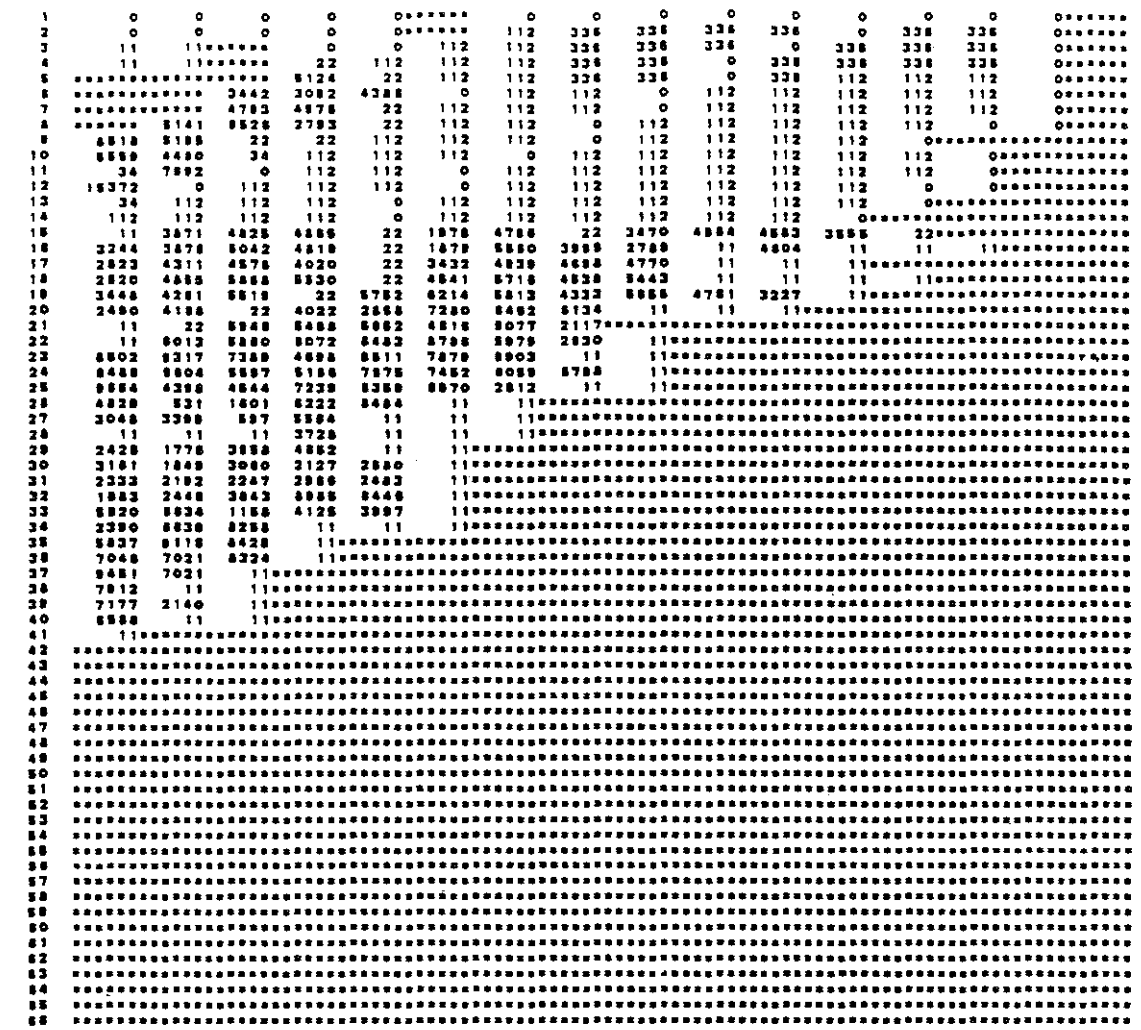


SCALAR TOTGW SHA2010 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 4982306

MATRIX DGP SMA2020 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		3076
21																		7288
22															22	1552	5144	11
23															123	22	11	
24															1675	1480	8332	
25																1485	8888	
26																	8348	
27																1779	11	
28																8455	22	
29															2988	22	8983	
30															3983	8422	22	8478
31														3858	5889	8178	22	8087
32													45	4354	8425	5388	22	11
33													45	45	45	45	22	11
34								45	3851	5034	8878	1714	1103	2828	4544	11	6295	
35								5384	7844	8222	7122	838	554	2347	5181	11	8001	
36								5322	5867	3804	1271	208	1858	8124	11	5878	8828	
37							8133	5071	5278	3114	840	2278	4858	5873	11	5468	8710	
38							1585	2081	8600	3377	3785	2588	1251	5507	224	5225	7858	
39							443	858	7248	4188	4888	378	604	5828	11	1258	8128	
40							1008	2118	3274	3882	2882	1405	5105	8248	11	4588	0	
41							5812	6778	7008	1055	2815	1423	2701	11	11	3833	4857	
42		2118	2883	45	4185	7855	5352	2243	2582	4784	11	11	1308	1772	884	45	2288	
43	0	11	1445	8548	11	45	5338	5887	1887	1288	0	0	245	0	7485	11	2281	
44	2152	11	1022	7001	3180	8428	45	7482	4038	45	0	0	0	0	0	5508	0	
45	11	11	2157	6777	8708	8082	11880	45	7974	3726	45	0	0	0	0	4733	3308	
46	11	11	2088	8428	7335	8828	8808	12082	45	7488	3778	45	0	0	0	0	3224	
47	11	11	4068	3082	7141	8300	4893	7483	5848	34	7378	45	45	45	0	0	7487	
48	11	11	5738	5507	8708	8448	8811	8217	7287	45	4084	0	11	45	11	4700		
49	11	11	5788	8028	8118	7384	5118	5882	7830	0	3885	0	11	11	11	410		
50	11	11	8824	8388	8827	8371	5108	3108	8282	8402	0	3034	11	11	11	11		
51	11	11	5328	10132	2801	8187	5880	5213	3630	4782	8383	0	11	11	11	11		
52	11	11	3248	8050	8884	8088	4112	3528	4088	0	8448	11	11	11				
53	11	11	8082	8877	8388	8883	5388	4701	2087	3060	0	11	11	11				
54	11	11	11	3872	8408	8188	7082	1108	1034	0	3058	11	11					
55	11	11	4187	14078	1743	1578	0	0	6173	11	11	11						
56	0	0	7384	8288	7888	800	11	3708	11	11								
57	11	11	8124	8830	8118	11	4442	11										
58	11	11	7540	8883	11	5808												
59	0	0	0	0	5382													
60	0	4032																
61	0																	
62																		
63																		
64																		
65																		
66																		

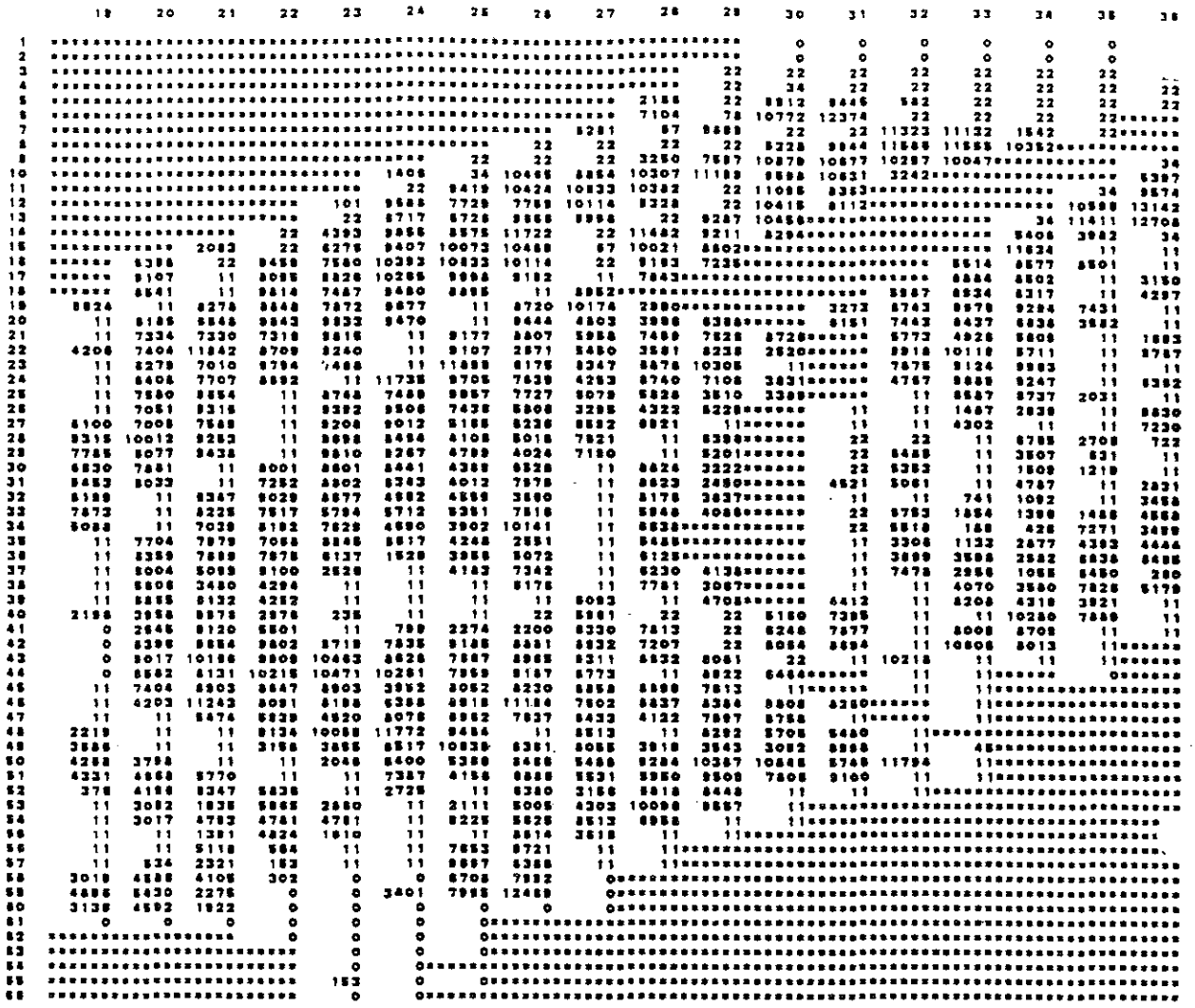


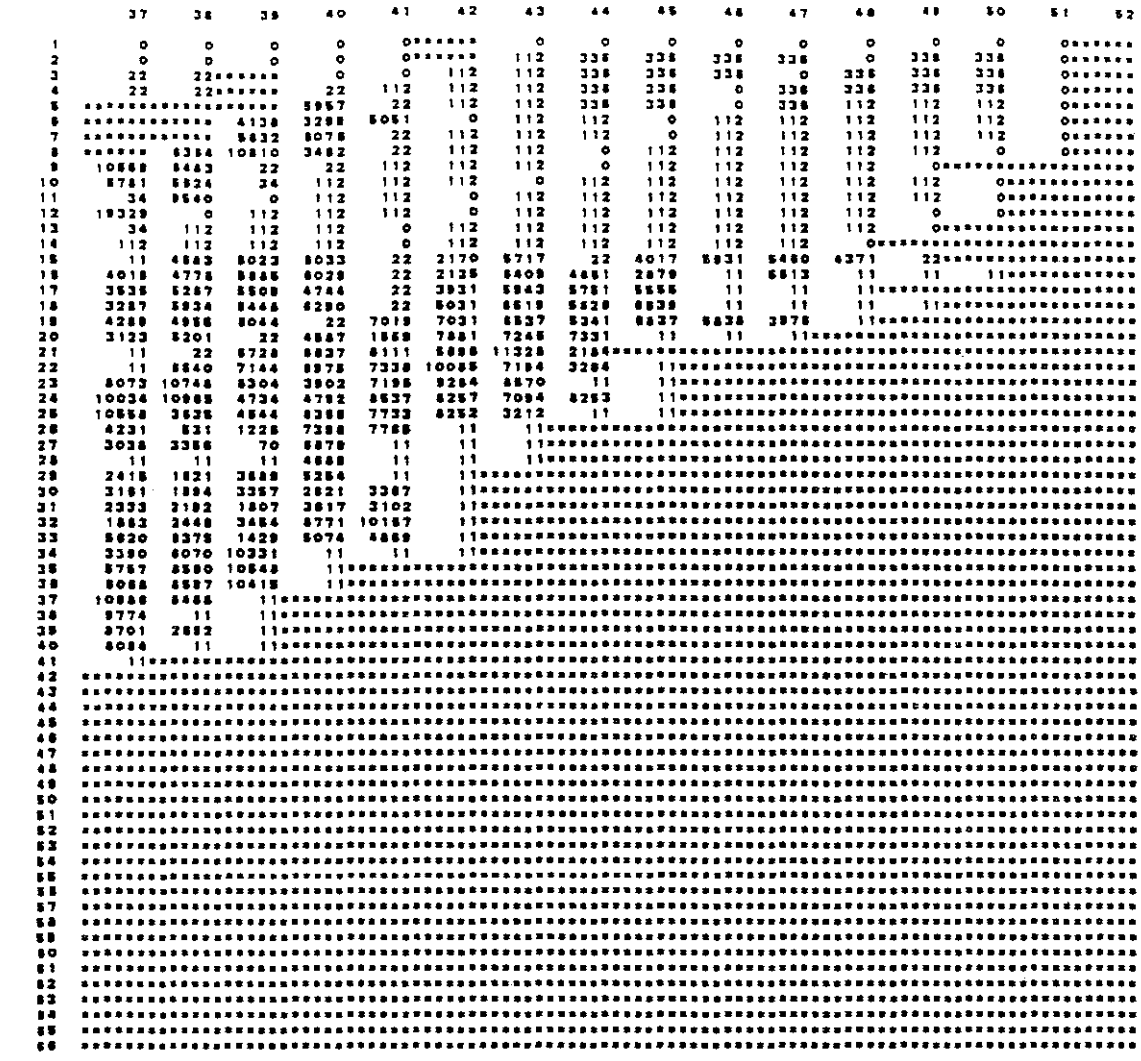


SCALAR TOTGW SMA2020 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 9467387

MATRIX GCP SMA2030 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		3540
21																		9022
22																22	1723	5951	11
23																	122	22	11
24																	1848	1238	9887
25																		1288	8244
26																			7826
27																		2192	11
28																		8347	22
29																	3414	22	11181
30																3817	7505	22	7884
31														3848	5424	7331	22	7208	
32													58	4080	5852	6516	22	11	
33													58	58	58	58	22	11	
34									58	4584	5720	7886	1443	1018	2774	4915	11	5184	
35								5673	8837	7038	5851	838	586	1833	5980	11	5988	
36								5858	5883	3218	1271	208	1721	5154	11	5863	6038	
37							5308	5188	5522	2903	540	2278	4505	5883	11	5840	7871	
38							1703	2208	7868	2884	3795	2588	1135	5772	235	5838	6484	
39							542	734	8049	4348	4718	378	804	5727	11	1433	7228	
40							2385	2824	3777	3358	2882	1405	5105	6115	11	5582	0	
41							5575	5483	5883	1055	2518	1834	2705	11	11	4807	5951	
42		2100	2594	58	4387	7777	5382	2243	2682	4748	11	11	575	1890	1185	48	3551	
43	0	22	1880	5744	22	58	5291	5887	1972	1333	0	0	258	0	7224	11	2847	
44	2252	22	1244	7288	3281	5883	58	7445	3878	58	0	0	0	0	0	5884	11	
45		22	2484	5086	5861	5324	11839	58	5211	3882	58	0	0	0	0	4304	3781	
46		22	2487	5880	7436	5778	5859	11897	58	7448	3871	58	0	0	0	0	3688	
47		22	4881	3278	7318	5473	4779	7858	5858	34	7874	58	58	58	0	0	5788	
48		22	5272	5895	5914	5880	5931	5348	7415	58	3431	0	11	48	11	4480		
49		11	5173	5224	5213	7287	5013	7045	5431	0	4180	0	11	11	11	526		
50		11	5784	7028	5875	5245	5105	3038	5292	5402	0	3038	11	11	11	11		
51		11	5328	12005	2801	5425	5815	5313	3511	4782	5385	0	11	11	11	11		
52		11	3403	5184	5203	7885	4112	3515	4068	0	5448	11	11	11	11			
53		11	5254	5840	5473	4502	5382	4571	2188	3081	0	11	11	11	11			
54		11	11	4084	5408	5158	7023	1108	1045	0	3748	11	11	11				
55		11	11	4187	14204	1754	1897	0	0	4203	11	11	11					
56		11	11	7458	5317	5127	1028	11	3652	11	11							
57		11	11	5147	5874	5130	11	4474	11									
58		11	11	7874	5994	11	5852											
59		0	0	0	0	5381												
60		0	4085															
61			0															
62																		
63																		
64																		
65																		
66																		





SCALAR TOTGW SMA2030 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 5806281

MATRIX GGF SUB1980 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	1260
21																	1871
22														22	1352	2490	11
23															112	22	11
24															1807	2361	7863
25															1813	7016	
26																2818	
27															841	11	
28															2777	22	
29														1584	22	2310	
30														1951	3189	22	2347
31													1929	2787	2720	22	2713
32													45	6284	2018	1888	22	11
33												1828	2812	2155	45	45	22	11
34									45	1488	3012	3853	2948	1500	2808	3432	11	2878
35								1825	4084	3811	3864	2003	554	3818	2818	11	2088
36								1832	2850	3383	3188	233	2348	6032	11	3813	3198
37							2807	1888	2142	4058	1233	2188	6845	3212	11	2027	2830
38							1182	1892	1874	1848	4810	2795	2228	2382	180	3881	6483
39							148	488	1848	1887	4895	803	1292	4880	11	737	2830
40							541	801	1785	2530	4312	1448	5854	6314	11	1871	0
41							8027	8484	8375	3807	2480	1627	1587	11	11	1814	1841
42			1888	2308	45	3882	8096	5610	2778	4133	255	11	11	4844	1123	478	34	2501
43		0	11	828	5882	11	48	8487	5857	2381	1088	0	0	202	0	8748	11	888
44		1828	11	383	6232	2834	7744	48	7878	4383	48	0	0	0	0	4878	4448	0
45			11	1287	4882	8208	8388	12407	48	7282	4401	48	0	0	0	0	3787	1880
46			11	811	4882	7088	8213	8073	12474	48	7881	1234	48	0	0	0	1894	1823
47			11	2808	2443	8838	7810	5823	7027	5088	34	8788	48	48	48	0	788	4780
48				11	4182	4872	5107	5082	8484	5818	8883	48	5488	0	0	22	0	4874
49				11	4837	5441	4833	7312	5500	8312	8433	0	2888	118	11	0	0	3838
50				11	8142	4358	8777	8821	5108	3318	8282	8402	0	3058	11	11	0	184
51				11	5328	4511	2801	8478	8181	5313	3882	4782	8348	0	11	11	0	0
52					11	2782	8887	8388	8282	4112	3548	4088	0	8448	11	11	0	
53					11	7483	8887	8854	8407	5458	4774	1708	2884	0	11	11	11	
54						11	11	3883	8488	8271	7144	1108	888	0	3828	11	11	
55							11	11	4187	13878	1743	1282	0	0	4083	11	11	0
56								0	0	7238	8228	7851	823	11	3787	11	0	
57									11	11	8058	8737	8856	11	4348	11		
58										11	11	7438	8832	11	8482			
59											0	0	0	0	8310			
60														0	3877			
61															0			
62																		
63																		
64																		
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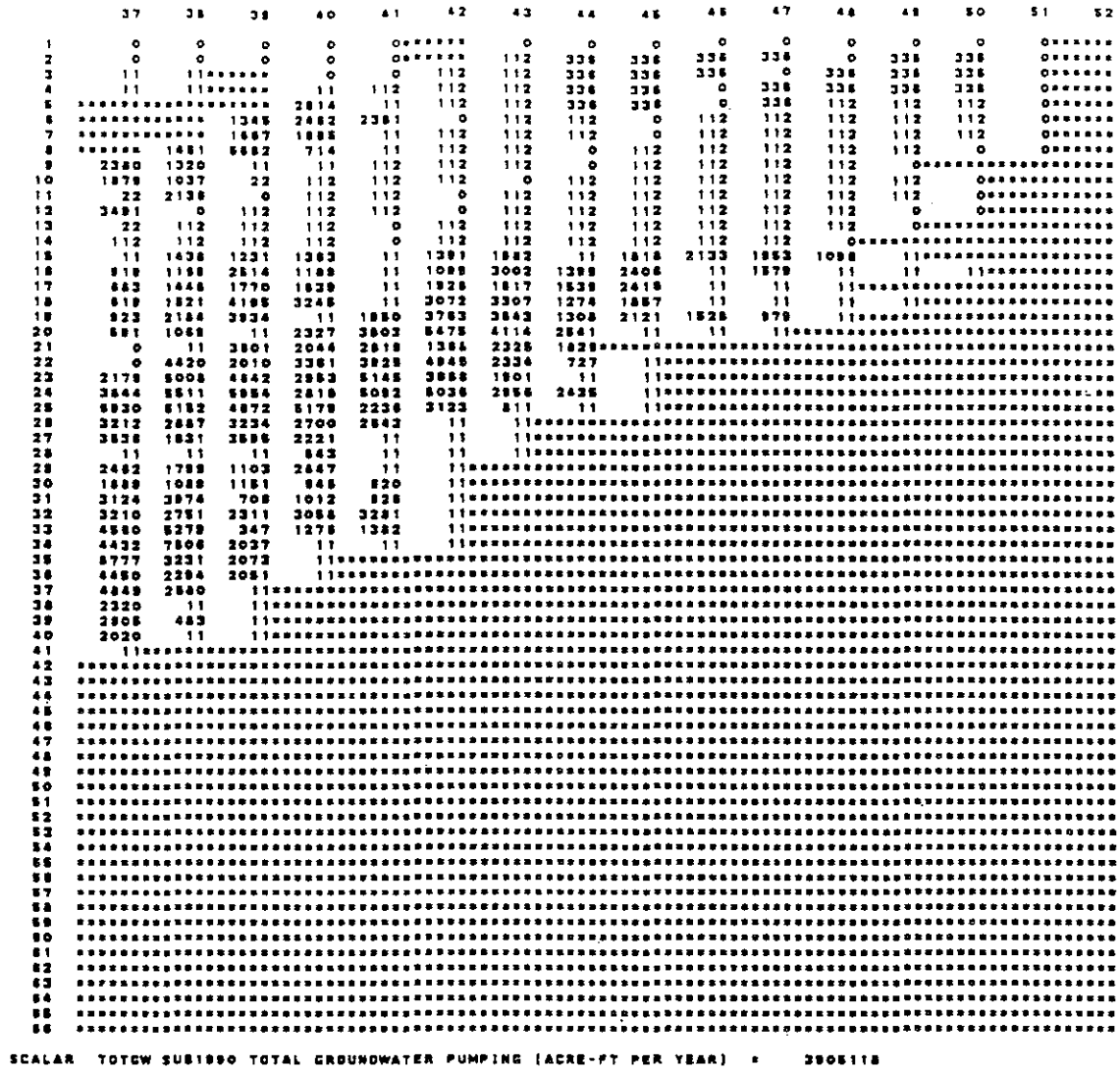

SCALAR TOTGW SUB1990 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3905118

MATRIX GCP SUB2000 OPTIMAL PUMPING (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		1240
21																		1971
22															22	1352	2490	11
23																112	22	11
24																1907	2381	7883
25																	1913	7014
26																		2818
27																	841	11
28																	2777	22
29																1584	22	2310
30															1851	2188	22	2347
31														1829	2757	2720	22	2713
32													45	8284	2018	1889	22	11
33													45	45	45	45	22	11
34									45	1488	3012	3853	2988	1500	2508	3432	11	2578
35									1825	4084	3811	3854	2003	954	3619	2918	11	2089
36									1932	2550	3363	3188	233	2348	8032	11	3813	3188
37								2807	1888	2142	4058	1233	2188	5845	3212	11	2027	2930
38								1182	1892	1874	1848	4810	2798	2228	2382	190	3981	8453
39								148	488	1848	1987	4858	803	1282	4880	11	727	2830
40								841	801	1788	2530	4312	1445	5854	8316	11	1871	0
41							8027	8464	8378	3807	2480	1827	1887	11	11	1914	1541	
42			1888	2308	45	3852	8098	5810	2778	4133	358	11	11	4884	1123	478	34	2501
43		0	11	828	5882	11	45	8467	5887	2381	1088	0	0	202	0	8748	11	586
44		1828	11	383	8232	2834	7744	45	7878	4383	45	0	0	0	0	4878	4448	0
45			11	1287	4882	8208	8388	12407	45	7282	4401	45	0	0	0	0	3787	1880
46			11	911	4882	7080	8213	8073	12474	45	7881	1234	45	0	0	0	1884	1823
47			11	2608	2443	8838	7810	5823	7027	5088	34	8788	45	45	45	0	788	4780
48				11	4182	4872	8107	8082	8484	5818	8883	45	5488	0	0	22	0	4874
49				11	4837	8441	4833	7312	8800	8312	8433	0	2888	118	11	0	0	3888
50				11	8142	4380	8777	8821	8108	3315	8282	8402	0	3088	11	11	0	184
51				11	8328	4811	2801	8478	8181	8313	3882	4782	8348	0	11	11	0	0
52					11	2782	8887	8388	8282	4712	2848	4088	0	8448	11	11	0	0
53					11	7483	8687	8084	8407	8480	4774	1708	2884	0	11	11	0	0
54						11	11	2803	8408	8271	7144	1108	888	0	3828	11	11	0
55							11	11	8187	13878	1743	1282	0	0	4082	11	11	0
56								0	0	7230	8228	7881	823	11	3787	11	0	
57									11	11	8088	8787	8084	11	4348	11		
58											11	11	7438	8832	11	8482		
59												0	0	0	0	8310		
60																0	3877	
61																	0	
62																		
63																		
64																		
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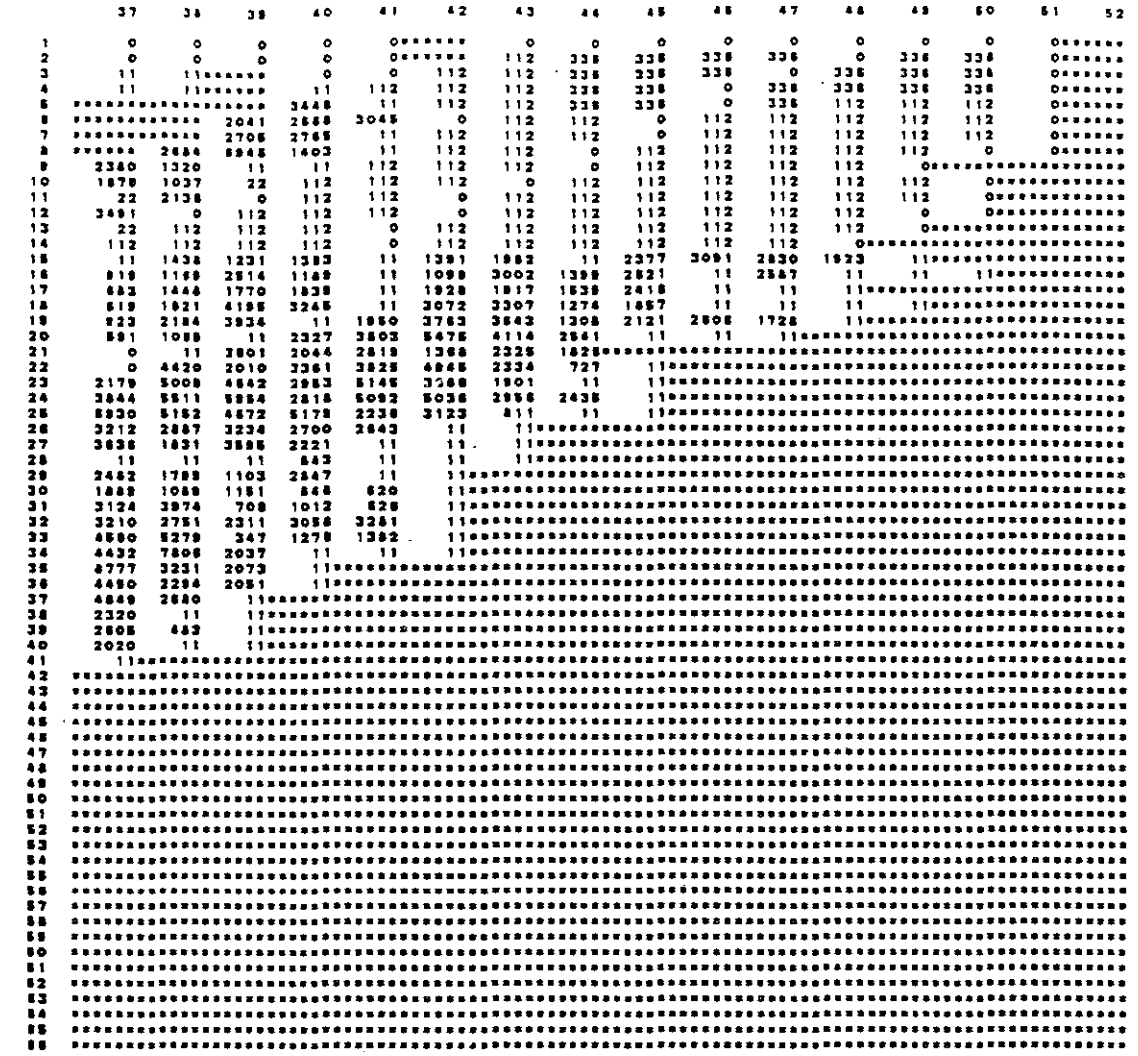
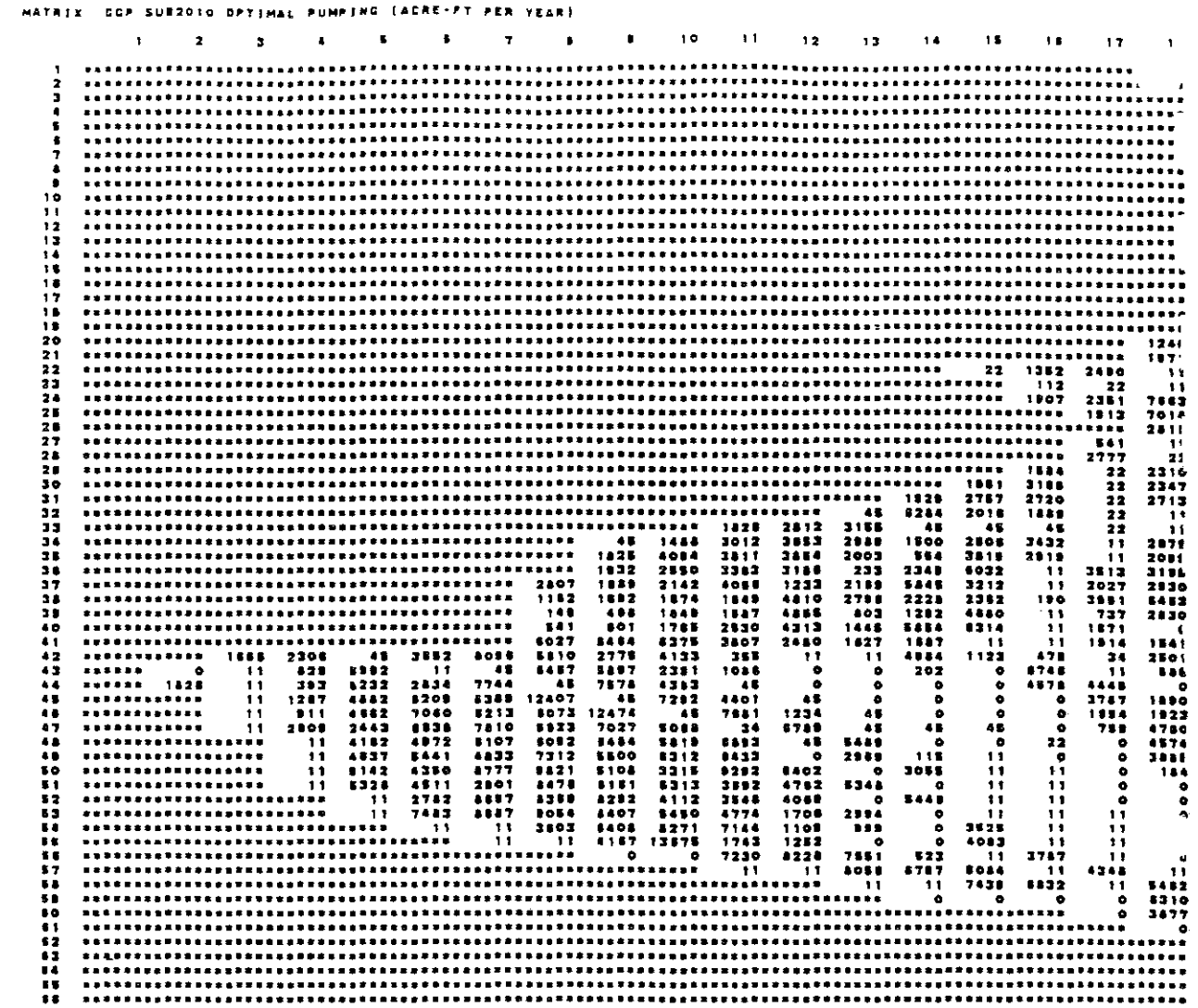
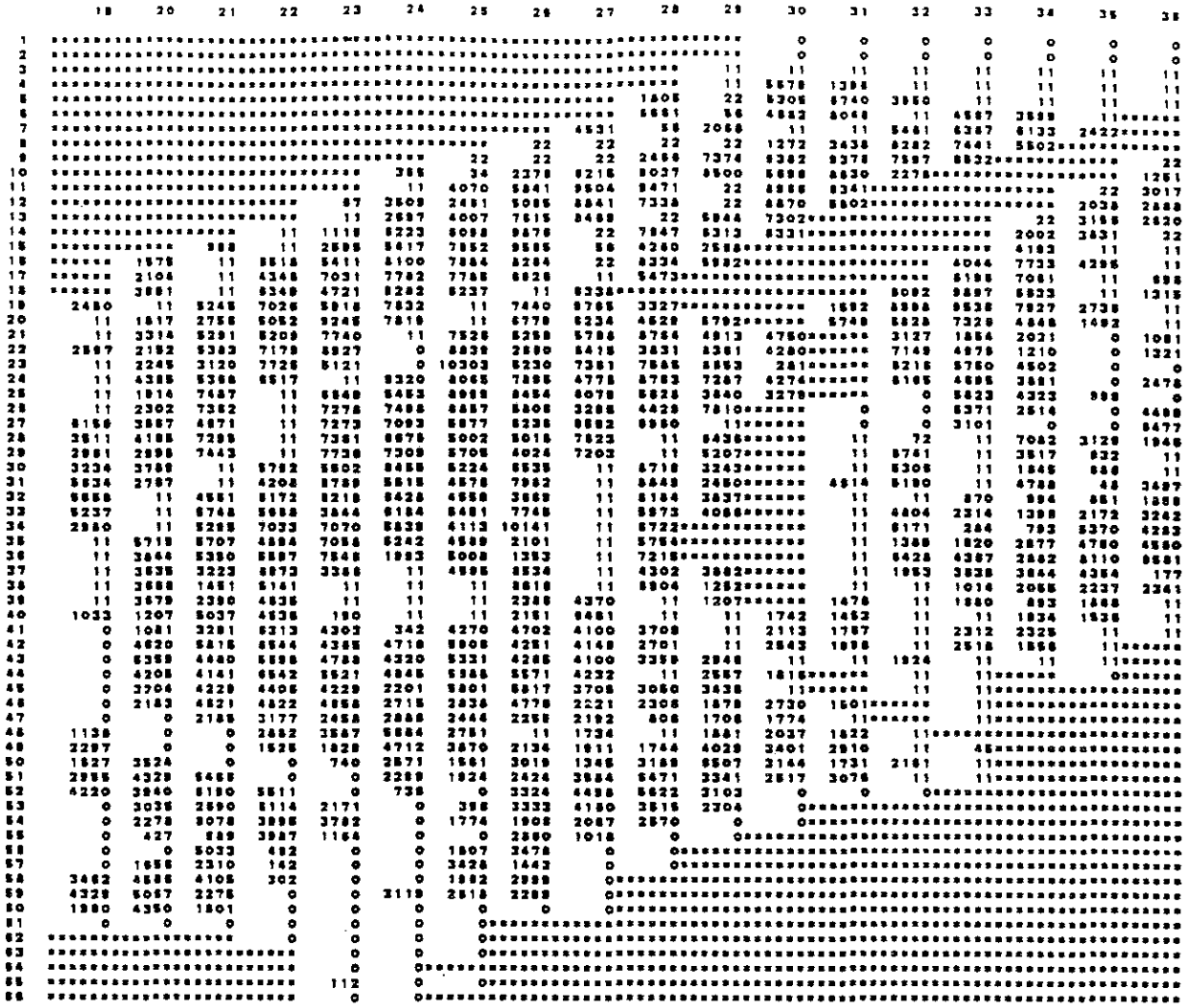
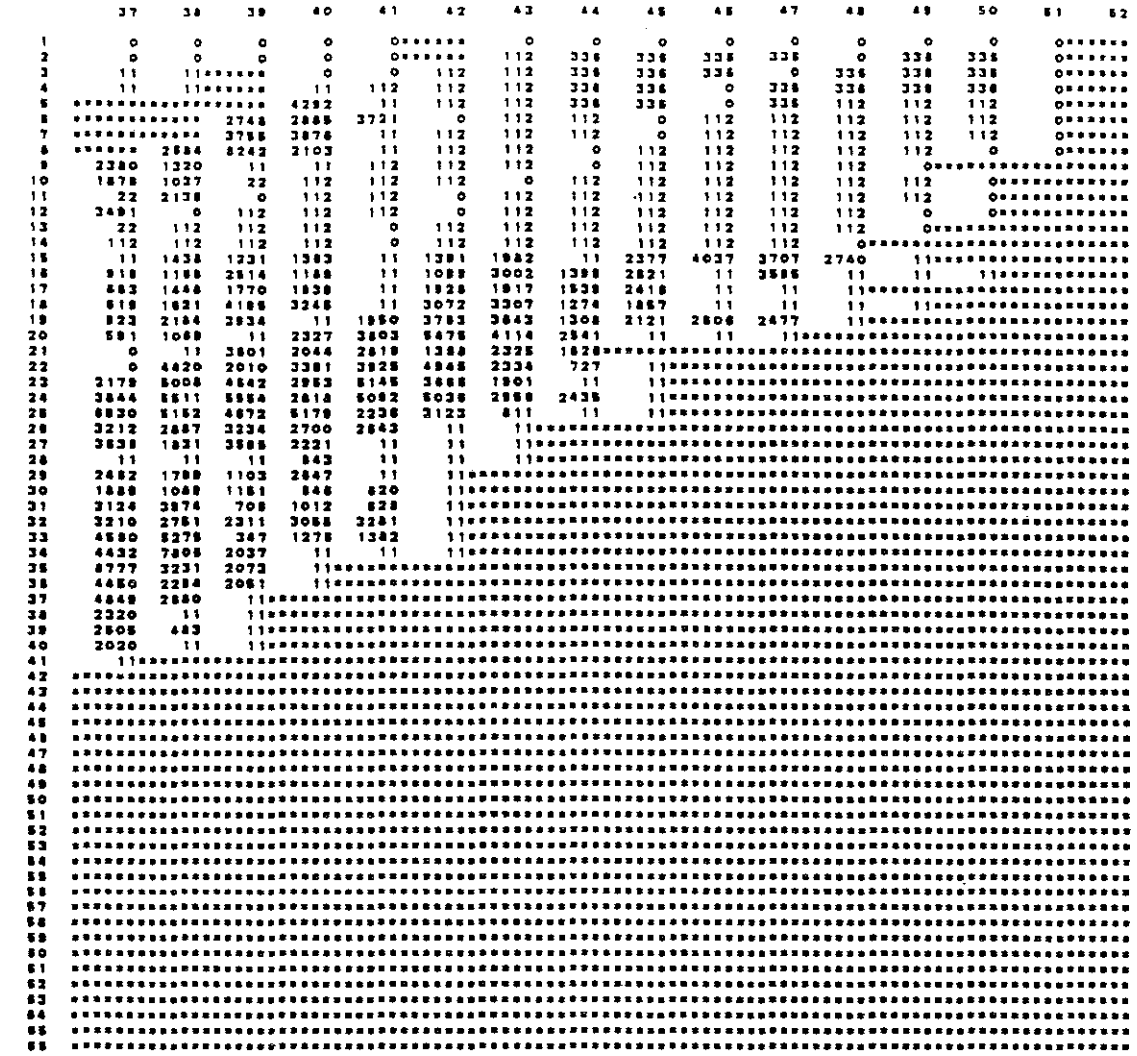
66																		



SCALAR TOTGW SUB2000 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3818134


MATRIX DCP SUB2010 OPTIMAL PUMPING (ACRE-FT PER YEAR)





SCALAR TOTGW SUB2010 TOTAL GROUNDWATER PUMPING (ACRE-FT PER YEAR) = 3830132

APPENDIX B

Optimal Annual Available Surface Water Use Strategies
for Alternative Scenarios in Five Decades
(parts a, b, c, and d in each strategy)

MATRIX SSSW CMA1990 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																0
20																
21																
22															342	8
23																1307
24																450
25																
26																
27																
28																
29																0
30															204	341
31														200	280	285
32													2012	1280	150	141
33											185	318	817	5027	2394	0
34									0	121	383	418	515	351	388	7
35									115	483	487	436	741	524	883	6
36									147	242	373	370	871	527	1158	2 4
37								325	115	194	849	529	197	1313	475	782
38								104	158	57	122	797	481	474	282	1715
39								5	40	77	289	754	881	885	788	2232
40								17	19	135	212	720	582	1111	1108	2 5
41								570	824	617	588	294	208	200	0	1 1
42		102	408	8078	348	888	861	782	781	885	1853	833	855	181		4
43	0	0	208	883	5321	10647	844	878	703	833	1441	833	575	583	1	4
44	0	0	58	802	274	788	8482	782	770	677	787	882	852	1237		881
45		0	328	483	807	772	841	11082	707	561	1345	471	915	882		843
46		0	189	448	888	809	842	873	5791	783	818	1298	1732	1048		811
47		898	708	728	848	883	888	888	480	8448	880	877	1481	1233	1	1
48		1143	1194	482	853	889	838	888	871	8484	827	2834	2788	2	1	
49		2888	1382	827	475	721	831	813	800	8327	825	2877	1012	2	1	
50		838	878	288	857	781	788	1088	888	2887	1204	2778	1787	1	1	
51		1278	400	228	218	823	882	818	888	1981	2502	7800	2918	2888		
52		7888	188	844	818	733	880	820	1907	8248	2882	2331	2834			
53		841	881	848	874	828	880	788	754	1388	4408	2423	2878			
54		3188	7888	283	482	721	820	820	484	3132	2488	8				
55		818	8338	313	1020	131	848	0	3084	1903	8					
56				4818	4372	841	818	888	31	8783	1					
57								8888	8826	804	808	381	7	2		
58										3088	8488	887	811			
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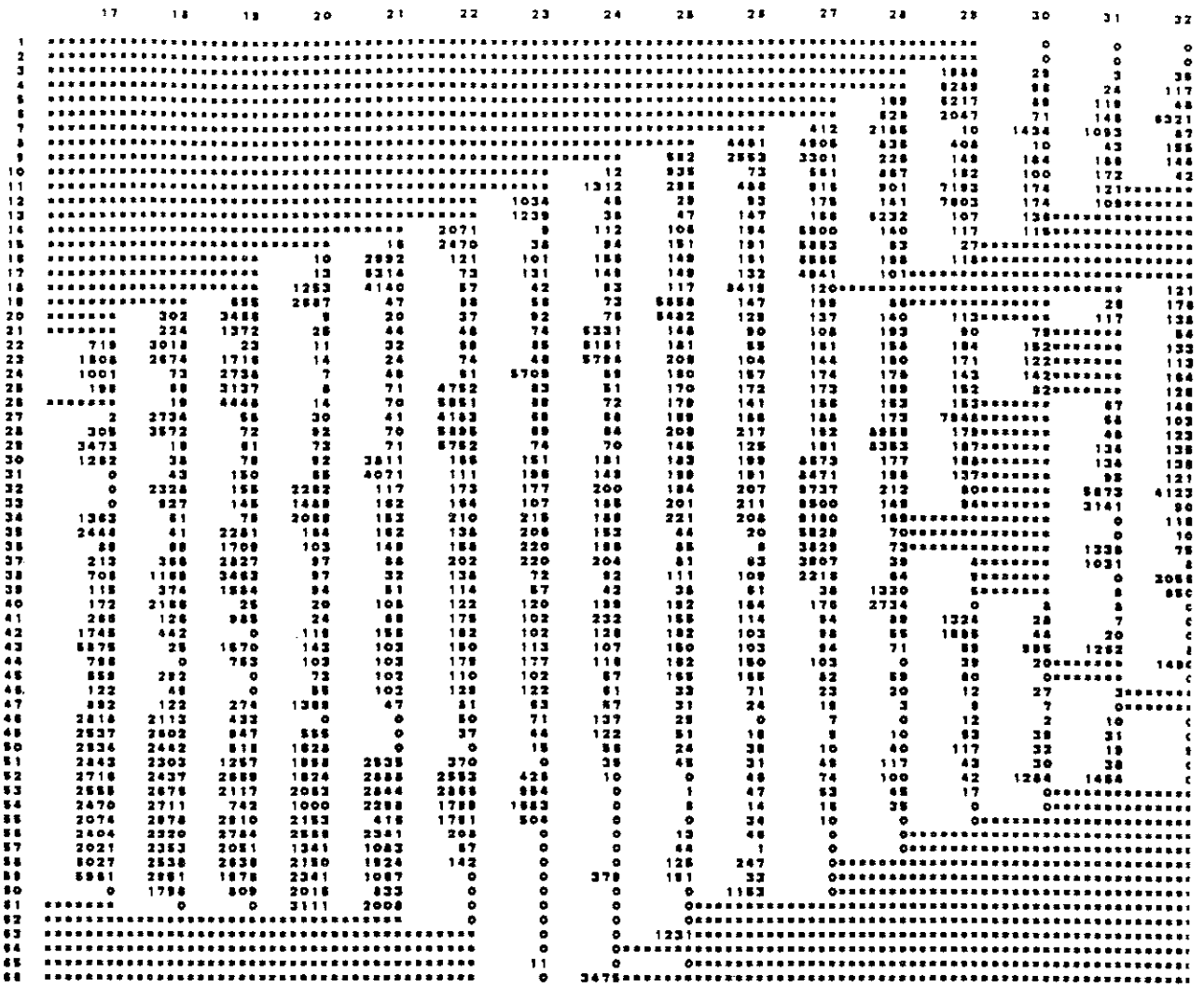

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4													8289	98	24	117
5												189	8217	88	119	48
6												828	2047	71	148	8321
7											412	2185	10	1434	1093	87
8									4481	4905	838	408	10	43	188	146
9								582	2853	3301	228	148	184	188	146	
10							12	935	73	581	887	182	100	172	42	
11							1312	288	488	818	901	7193	174	121		
12						1034	48	28	93	178	141	7803	174	108		
13						1239	38	47	147	188	8232	107	138			
14					2071	8	112	108	194	8800	140	117	118			
15				18	2478	38	84	181	191	8883	83	27				
16			10	2892	121	101	188	148	181	8888	188	118				
17			13	8314	73	131	148	148	132	4841	101					
18		1283	4140	87	42	83	117	8418	120							121
19	888	2887	47	88	88	73	8858	147	188	88				28		178
20	302	3488	8	20	37	92	78	8482	128	137	140	113		117		138
21	224	1372	28	44	48	74	8331	148	90	108	193	90	78			84
22	3018	23	11	32	88	85	8181	181	88	181	188	184	182			133
23	2674	1718	14	24	74	48	5784	208	104	144	180	171	122			113
24	73	2738	7	48	81	8708	88	180	187	174	178	143	142			184
25	88	3137	8	71	4782	83	81	178	172	173	189	182	82			128
26	18	4448	14	78	8881	88	72	178	141	188	183	183		87		148
27	2738	88	38	41	4183	88	88	188	188	188	173	7848		88		183
28	3872	72	82	78	8895	88	84	208	217	182	8888	178		48		123
29	18	81	73	71	8782	74	78	148	128	181	8383	187		134		138
30	38	78	82	3811	188	181	181	183	188	8873	177	188		134		138
31	43	138	88	4871	111	188	148	188	181	8471	188	137		88		121
32	2328	188	2282	117	173	177	288	184	287	8737	212	88		8873		4123
33	827	148	1488	182	184	187	188	281	211	8588	148	84		3141		88
34	81	78	2088	183	218	218	188	221	288	8188	188			8		118
35	41	2281	184	182	138	288	182	44	28	8828	78			8		18
36	88	1788	183	148	188	228	188	88	8	3828	73			1338		78
37	388	2827	87	88	282	228	284	81	83	2887	38	4		1831		8
38	1188	3483	87	32	138	72	82	111	188	2218	84	8		8		2888
39	374	1884	84	81	114	87	42	38	81	38	1338	5		8		858
40	2188	28	28	188	122	128	138	182	184	178	2734	8		8		8
41	128	888	24	88	178	182	182	232	188	114	84	88	1324	28	7	8
42	442	8	118	188	182	182	182	128	182	183	88	88	1888	44	28	8
43	28	1878	142	183	188	113	187	188	183	84	71	88	888	1282	8	
44	8	783	183	183	178	177	118	182	188	183	8	38	28			1488
45	282	8	72	182	118	182	87	188	188	82	88	88	8			8
46	48	8	88	182	128	122	81	33	71	23	28	12	27		3	
47	122	274	1388	47	81	83	87	31	24	18	3	8	7		8	
48	2113	432	8	8	88	71	137	28	8	7	8	12	2	18	8	
49	2882	847	888	8	37	44	122	81	18	8	18	83	38	31	8	
58	2442	818	1828	8	8	18	88	24	38	18	48	117	32	18	8	
51	2383	1287	1888	2838	378	8	38	48	31	48	117	43	38	38	8	
52	2437	2888	1824	2888	2882	428	18	8	48	74	188	42	1284	1488	8	
53	2878	2117	2882	2844	2888	884	8	1	47	82	88	17	8			
54	2711	742	1888	2288	1788	1883	8	8	14	18	38	8	8			
55	2878	2818	2153	418	1781	584	8	8	34	18	8	8				
56	2328	2784	2888	2341	288	8	8	18	48	8	8					
57	2353	2881	1341	1883	87	8	8	88	1	8	8					
58	2538	2838	2158	1824	142	8	8	128	247	8						
88	2881	1878	2341	1887	8	8	8	378	181	32	8					
88	1788	888	2818	833	8	8	8	8	8	1183	8					
81	8	8	3111	2888	8	8	8	8	8							
82					8	8	8	8	8							
83						8	8	8	1231							
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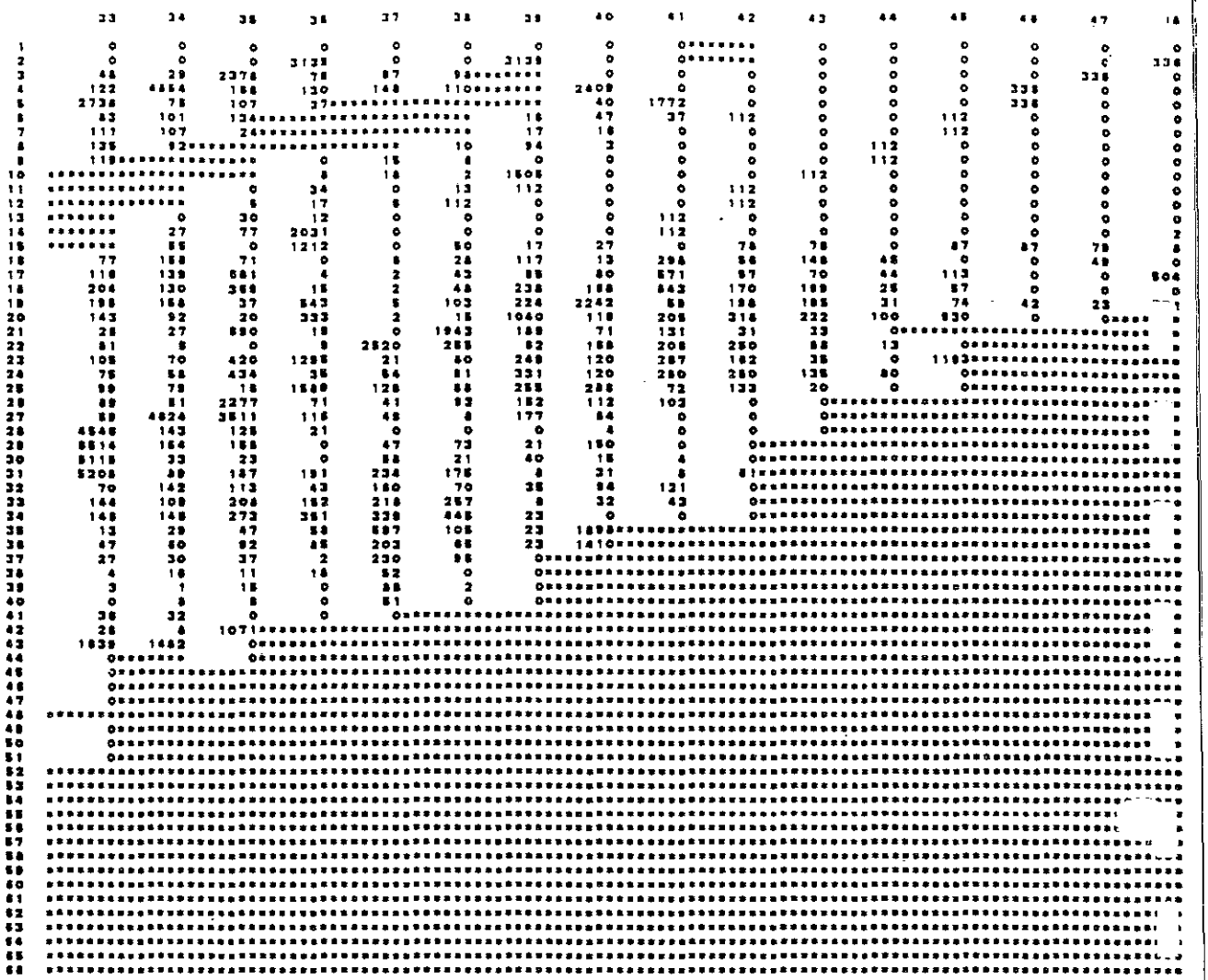
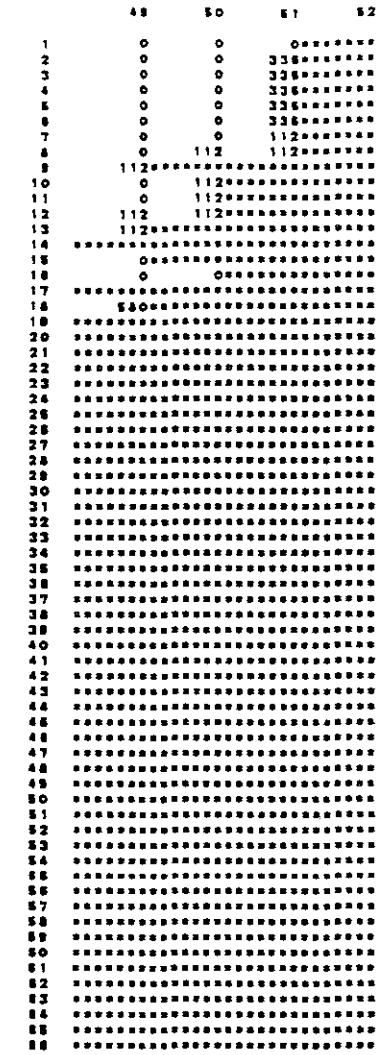
88							8	3475								





SCALAR TOTSW CMA1990 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1104788

MATRIX SSSW CMA2000 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
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17																
18																0
19																
20																
21																
22															527	148
23																2102
24																450
25																
26																
27																
28																
29																179
30															204	343
31														200	288	286
32													2343	1260	150	1
33											188	318	817	6272	3404	6
34									0	121	363	418	515	351	358	7
35									118	483	467	438	741	824	883	8
36									147	242	373	370	471	827	1158	3104
37								325	118	194	548	529	187	1313	478	833
38								104	158	87	122	787	481	474	282	2977
39								8	40	77	288	784	881	885	786	2 0
40								17	18	135	212	720	582	1111	1108	2 4
41								570	826	817	589	294	208	200	0	2 6
42			102	408	5743	348	888	881	782	781	895	1853	433	888	181	4
43		0	0	208	883	5518	10608	844	878	703	533	1441	933	575	582	1208
44		0	0	88	802	274	788	8242	782	770	877	787	882	883	1287	898
45			0	328	483	807	772	841	11028	707	981	1345	471	818	893	843
46			0	188	446	888	808	842	873	8882	783	816	1288	1732	1048	1
47			981	708	725	848	883	586	889	490	5188	880	877	1481	1233	1 3
48			1272	1184	482	883	888	838	586	871	5287	927	2834	2788	2 2	
49			2888	1382	527	475	721	831	813	800	5072	528	2877	1012	2 8	
50			1383	878	288	857	781	788	1088	888	2887	1084	2778	1787	2887	
51			1132	400	228	218	823	882	818	888	1981	2802	7058	2818	2888	
52				8777	188	844	818	788	880	820	1907	4802	2853	2331	2834	
53				483	851	848	874	828	880	788	754	1388	4083	2423		8
54					2880	8888	283	482	721	820	820	484	2880	2488		1
55						482	4718	313	1020	131	848	0	2884	1903		5
56								4388	3812	841	818	888	31	5117	2	1
57											8348	8320	804	808	381	8483
58													2713	4448	857	811
59														8824	3240	2888
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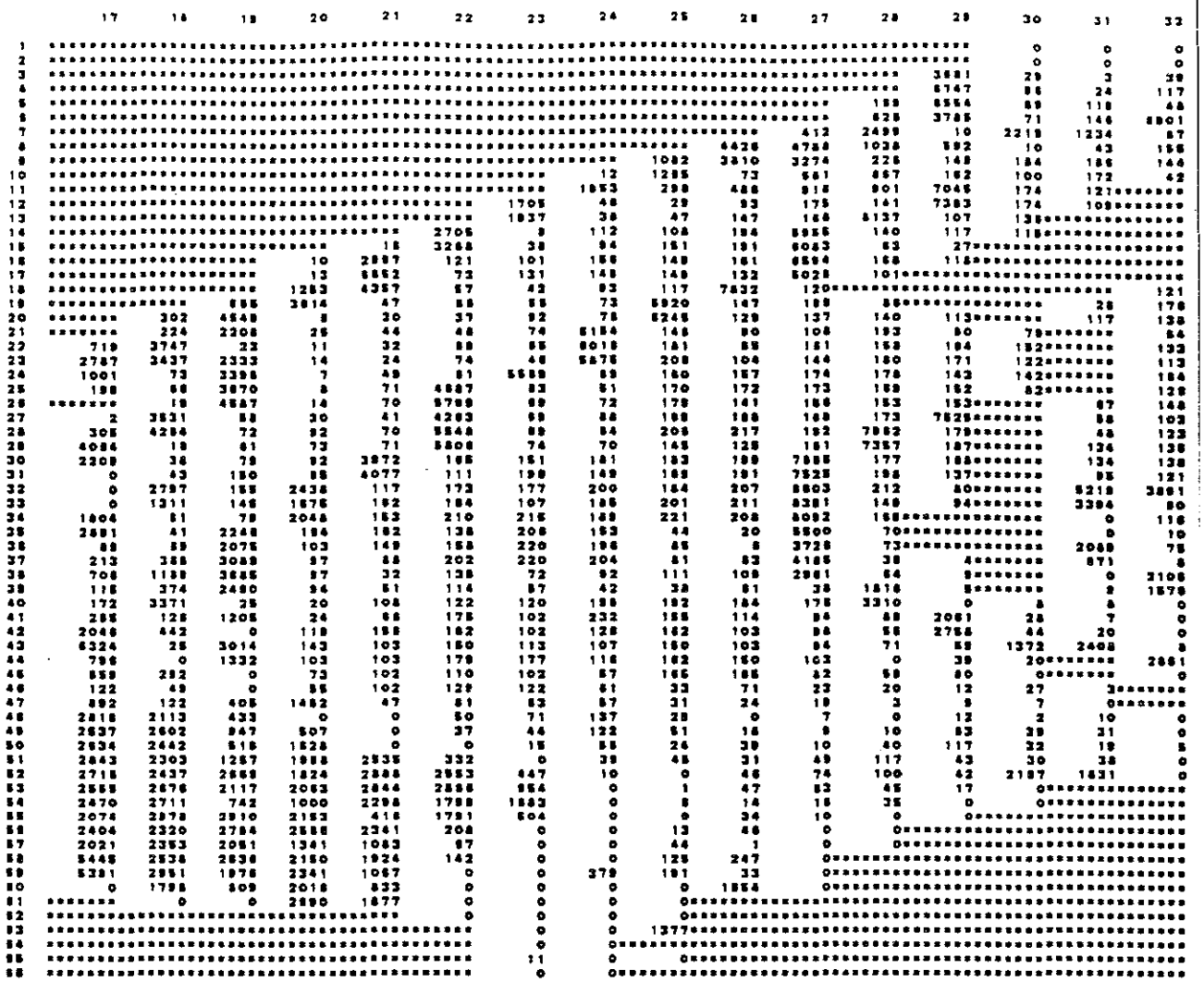

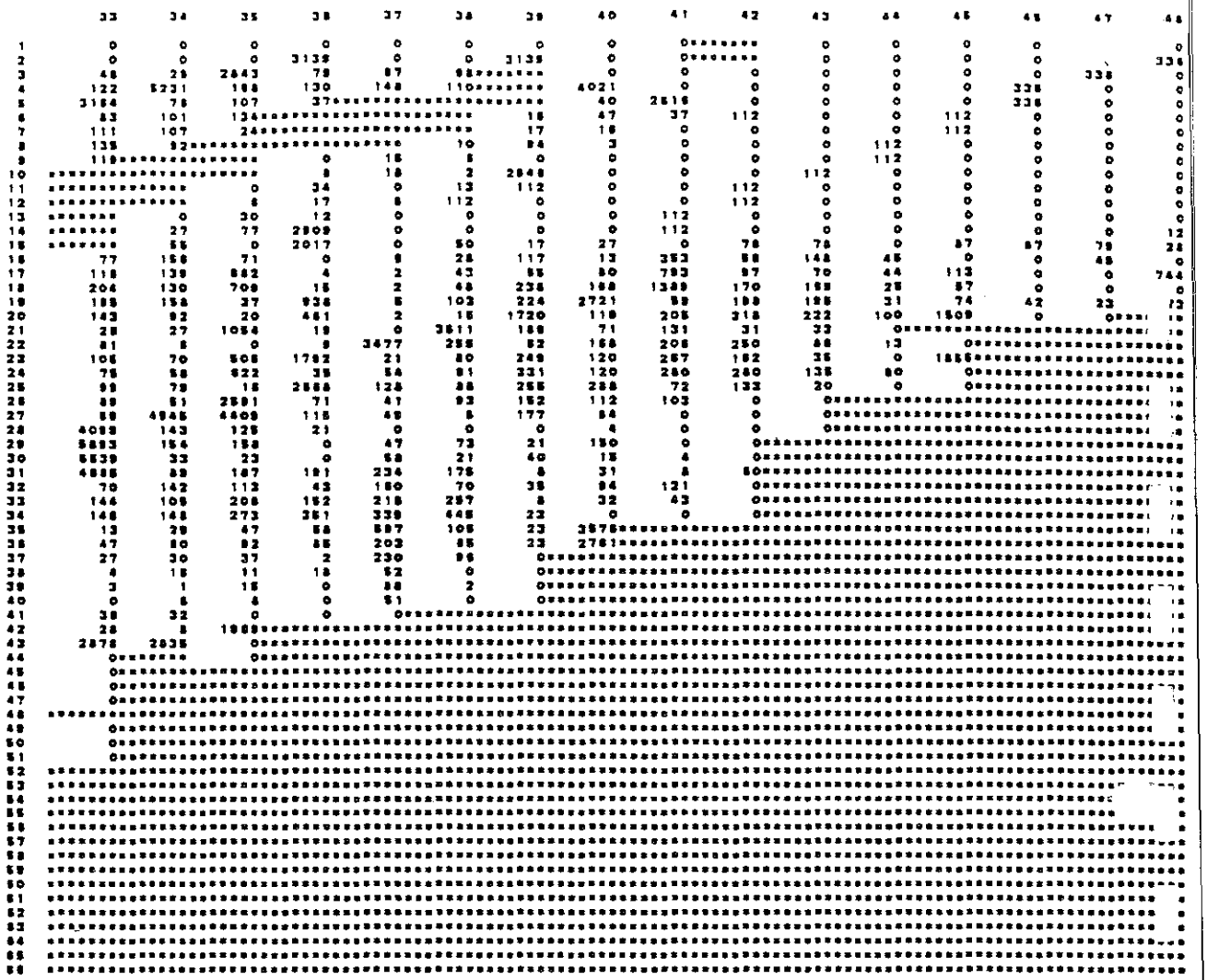

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5	0	0	336	
6	0	0	336	
7	0	0	112	
8	0	112	112	
9	112			
10	0	112		
11	0	112		
12	112	112		
13	112			
14				
15	0			
16	0	0		
17				
18	756			
19				
20				
21				
22				
23				
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SCALAR TOTSW CMA2000 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1148284

MATRIX SSSW CMA2010 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
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11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															880	140
23																2813
24																
25																
26																
27																
28																
29																178
30															204	341
31														200	280	
32													2838	1280	150	
33											158	318	817	8487	4252	
34																
35									118	483	487	438	741	824	883	339
36									147	242	373	370	671	827	1158	3826
37								325	118	194	548	828	187	1313	475	882
38								104	188	87	122	787	491	474	282	
39								8	40	77	288	784	881	885	788	
40								17	18	138	212	720	882	1111	1108	
41								570	826	817	588	284	208	200	0	
42		102	408	6482	348	888	981	782	781	885	1883	833	855	181		
43	0	0	208	883	8703	10887	844	878	703	533	1441	933	575	583	1205	
44	0	0	88	802	274	788	8041	782	770	877	787	942	883	1287	898	
45		0	328	483	807	772	841	11011	707	881	1345	471	818	883		
46		0	188	448	888	808	842	873	5530	783	818	1296	1732	1048		1
47	1280	708	728	848	883	888	888	490	5906	860	877	1481	1233		1	3
48	1388	1184	482	883	888	839	888	871	5118	827	2834	2788			2	2
49	2784	1382	827	478	721	831	813	800	4480	825	2877	1012			2	2365
50	1885	878	288	887	791	788	1088	888	2857	1008	2778	1787			2887	
51	1012	488	228	218	823	852	818	885	1881	2502	8887	2818			2888	
52	8088	188	844	818	733	880	820	1807	4728	2853	2231					
53	433	881	848	874	828	880	788	784	1388	3800	2423				8	
54	2888	8018	283	482	721	820	820	484	2884	2488						
55	488	4203	313	1028	131	848	0	2751	1903							
58	3880	3824	841	818	588	31	4883									
57	4885	4888	884	508	381											
58	2428	4331	887													
59	8858	2818														
60																
61																
62																
63																
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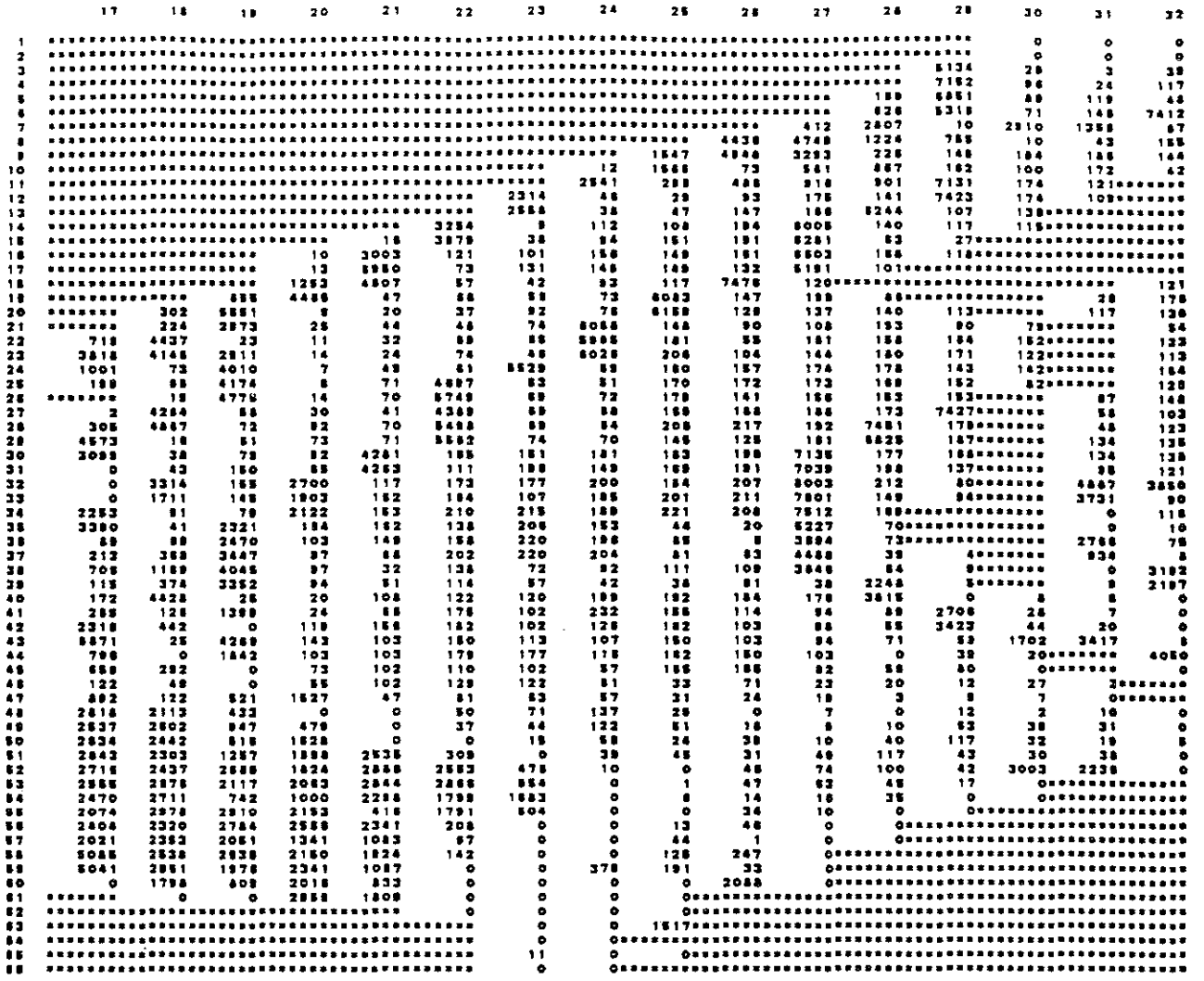
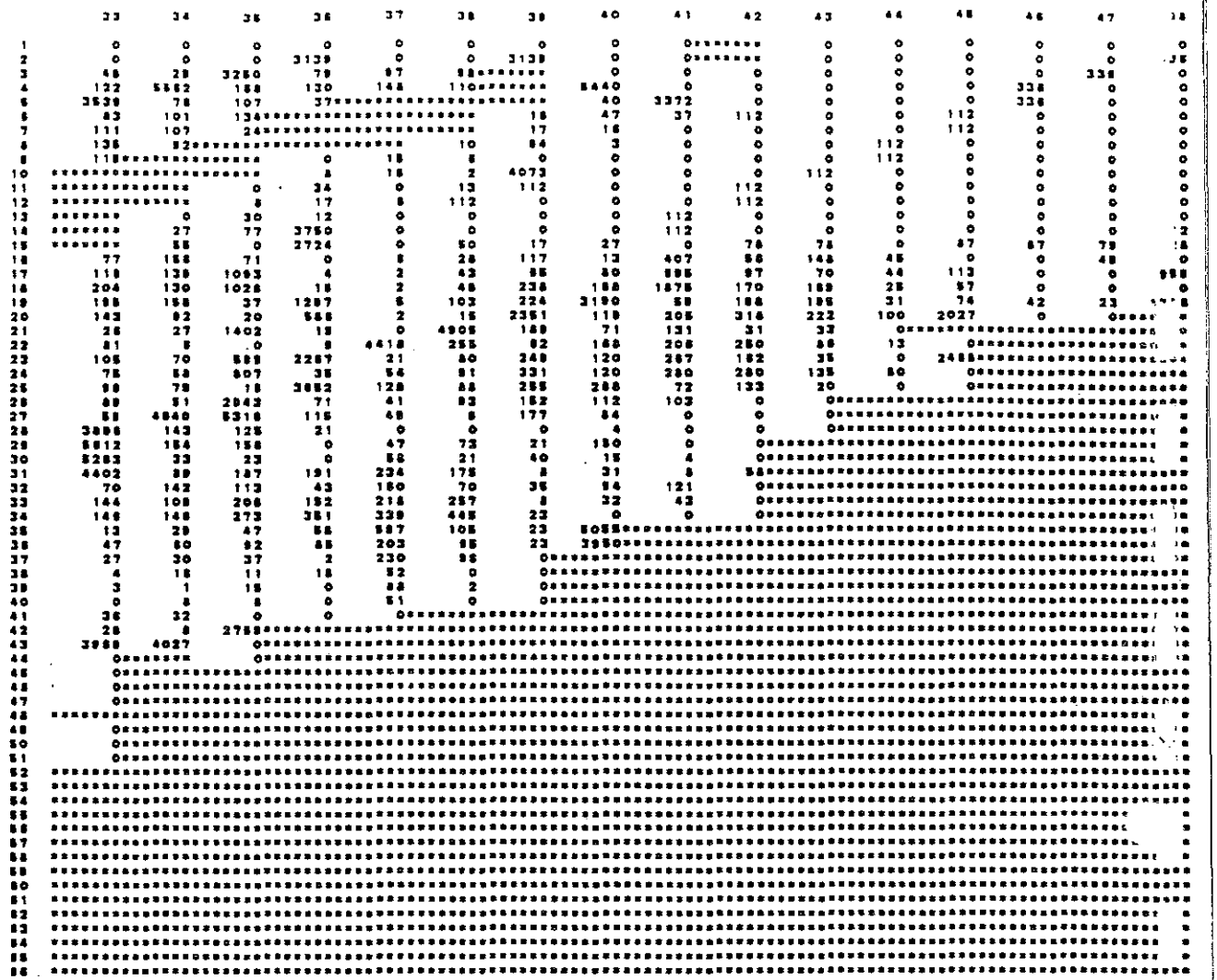
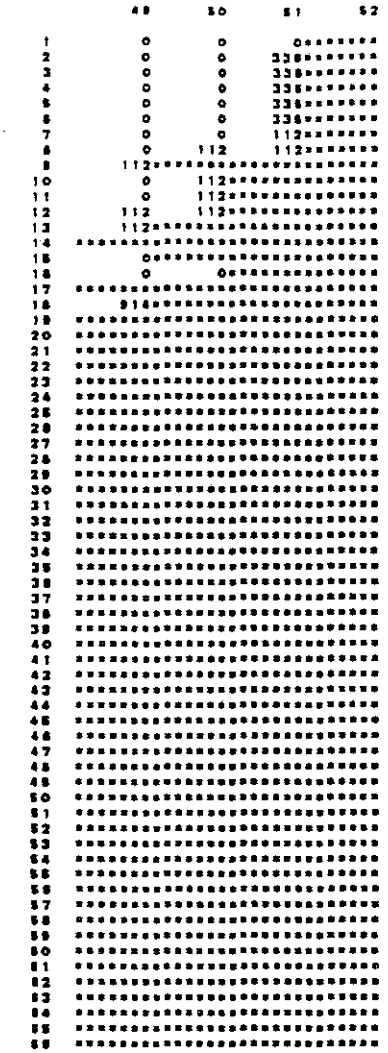
65																
66																







SCALAR TOTSW CMA2010 TOTAL SURFACE WATER [ACRE-FT PER YEAR] = 1201084

MATRIX SSSW CMA2020 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															1148	
23																
24																
25																
26																
27																
28																
29																
30															204	
31														200	280	
32													2906	1280	150	
33											155	319	817	6678	5061	
34									0	121	383	418	816	351	355	
35								118	482	487	438	741	824	883		
36								147	242	373	370	671	827	1158		
37							325	118	194	849	829	197	1313	475		
38							104	158	87	122	797	491	474	282		
39							5	40	77	288	784	581	686	788		
40							17	19	136	212	720	582	1111	1108		
41							570	624	617	598	284	208	200	0		
42		102	408	5198	348	388	881	792	781	695	1663	833	888	181		
43	0	0	208	883	5888	10648	844	676	703	533	1441	933	875	893		
44	0	0	65	802	274	788	7870	782	770	877	787	882	863	1287		
45	0	328	483	807	772	841	11011	707	561	1348	471	818	883			
46	0	188	448	898	808	842	873	5421	783	815	1288	1732	1048			
47	1568	708	728	848	883	588	888	498	5886	880	877	1481	1233			
48	1486	1184	482	883	898	838	886	871	4887	827	2834	2788				
49	2870	1382	827	478	721	831	813	800	4888	828	2877	1012				
50	1928	878	288	857	781	788	1098	898	2857	842	2778	1787				
51	810	400	228	218	823	882	818	888	1881	2802	8188	2818				
52	5828	188	844	818	733	880	820	1807	4884	2883	2231					
53	382	881	848	874	828	880	788	784	1388	3734	2427					
54	2382	8437	283	482	721	820	820	484	2787	248						
55	388	3770	313	1020	131	848	0	2857	188							
56	3888	3183	841	818	888	31	4088									
57	4348	4374	804	808	381											
58	2183	3894	887													
59	8282	2848														
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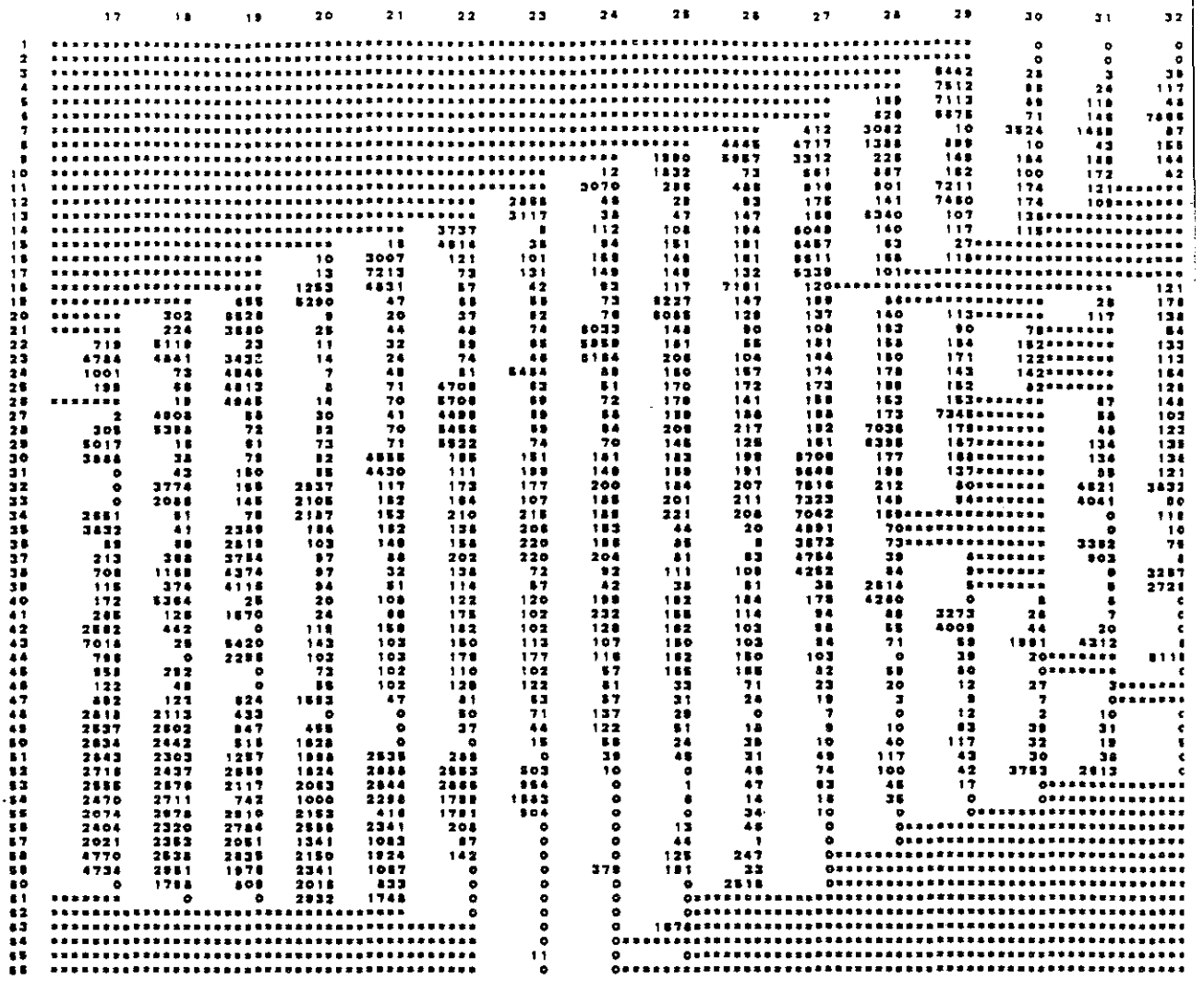
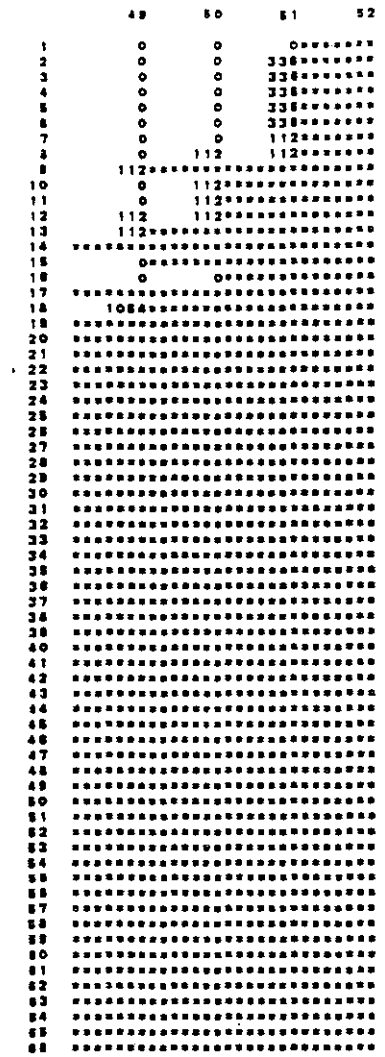
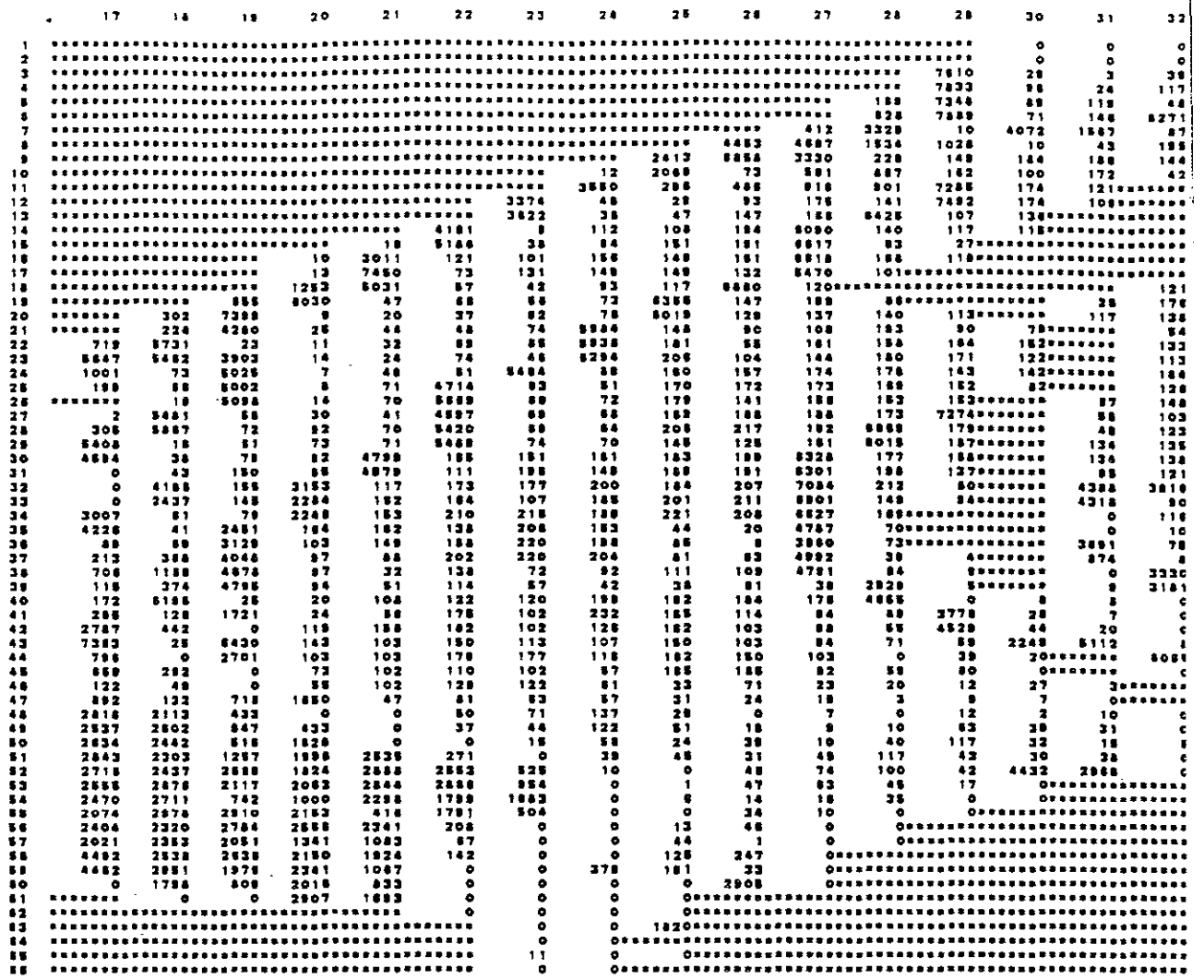


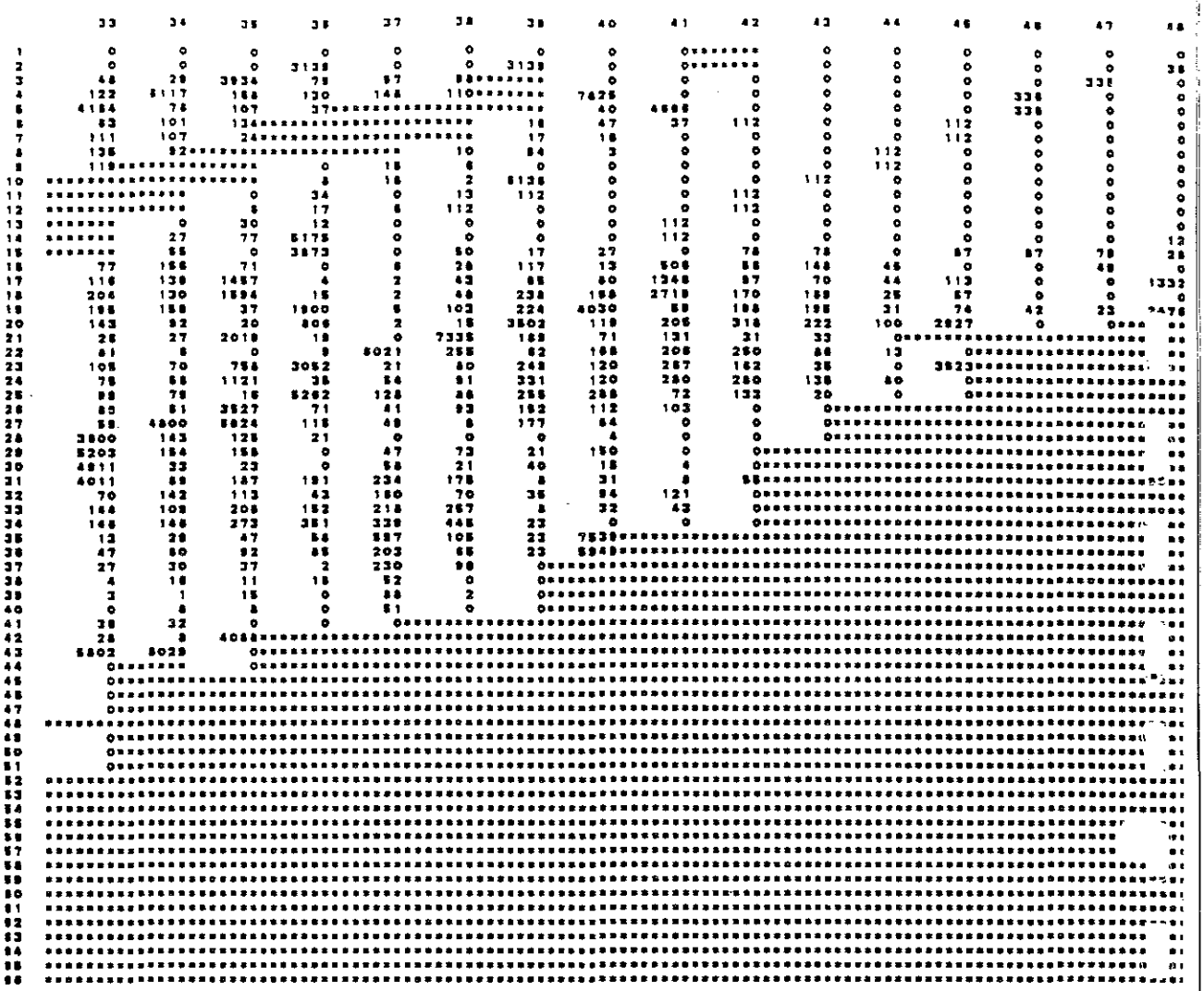


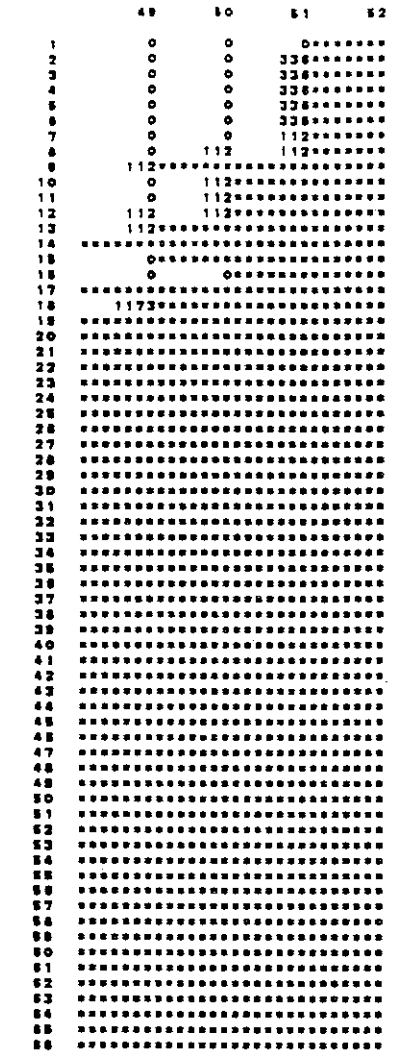
SCALAR TOTSW CMA2020 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1249541

MATRIX SSSW CMA2030 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															1388	146
23																4097
24																456
25																
26																
27																
28																
29																178
30															204	341
31														200	280	788
32													3147	1280	150	141
33											185	319	817	5848	5748	6
34									0	121	383	418	518	351	388	161
35									116	483	487	438	741	824	863	231
36									147	242	273	370	671	827	1186	5031
37								325	118	194	548	528	187	1313	478	891
38								104	188	67	122	787	491	474	282	5971
39								8	40	77	288	784	981	898	788	134
40								17	18	138	212	720	582	1111	1108	101
41								570	824	617	588	284	208	200	0	171
42			102	408	4870	348	888	881	782	781	885	1883	833	888	181	84
43		0	0	208	883	5084	10808	846	878	703	832	1441	933	878	883	1201
44		0	0	84	802	274	788	7728	782	770	877	787	882	883	1287	881
45			0	328	483	807	772	841	11025	707	881	1345	471	918	883	845
46			0	188	448	888	808	842	873	8324	783	818	1298	1732	1048	811
47		1881		708	728	848	883	888	889	480	8488	880	877	1481	1232	801
48		1681		1184	482	883	888	839	888	871	4824	827	2824	2788		882
49		2586		1382	827	478	721	831	813	800	4483	828	2877	1012		881
50		2138		878	288	857	781	788	1088	889	2887	883	2778	1787		2881
51		834		400	228	218	822	882	818	888	1981	2502	5840	2318		2881
52			5088		188	844	818	733	880	820	1807	4404	2883	2331		2834
53			380		881	848	874	828	880	788	784	1385	3888	2422		78
54				2180	5007	283	482	721	820	820	484	2718	2481			84
55						324	3448	313	1020	131	548	0	2872	1902		818
56								3312	2948	841	818	888	31	3758		81
57											4002	4081	804	808	381	8386
58													2002	3887	857	811
59														4888	2444	1338
60																81
61																84
62																888
63																888
64																
65																







SCALAR TOTSW CMA2030 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1293148

MATRIX SSSW CON1990 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
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18																
19																
20																
21																
22															352	148
23																1408
24																480
25																
26																
27																
28																
29																578
30															204	341
31														200	280	388
32													2053	1280	150	41
33											158	319	817	8057	2436	40
34									0	121	383	816	515	351	388	67
35								118	463	467	438	741	824	882		28
36								147	242	373	370	871	827	1188	2294	
37							325	118	184	848	828	197	1313	478	773	
38							104	188	87	122	787	491	474	282	1888	
39							8	40	77	288	784	881	898	788		42
40							17	18	138	212	720	562	1111	1108		88
41							570	824	817	888	284	208	200	0		71
42		102	408	5118	348	888	851	782	761	686	1883	833	886	181		84
43	0	0	208	883	8331	10887	844	878	703	533	1441	833	878	883		1201
44	1843	10	88	802	274	788	8822	782	770	877	787	882	883	1287		891
45	10	328	483	807	772	841	11102	787	881	1348	471	818	883	845		845
46	10	188	445	888	808	842	873	8831	783	818	1288	1732	1048			1
47	808	708	728	845	883	888	888	488	6477	880	877	1481	1233			08
48	1153	1184	482	883	888	838	888	488	671	8824	827	2834	2788			81
49	2888	1382	827	478	721	831	813	800	8327	828	2877	1012				81
50	848	878	288	887	781	788	1088	838	2887	1284	2778	1747	288			
51	1288	488	228	218	823	882	818	888	1881	2582	7888	2818	288			
52	7888	188	844	818	733	888	828	1887	8248	2883	2321	283				
53	881	881	848	874	828	888	788	784	1388	4488	2423	78				
54	3188	7818	283	482	721	828	828	488	3132	2488	84					
55	828	8348	313	1828	131	848	8	3884	1883	18						
56	4818	4372	841	818	888	31	8782	81								
57	8888	8838	884	888	381	7181										
58	3888	8478	887	818												
59	7312	3824	3888													
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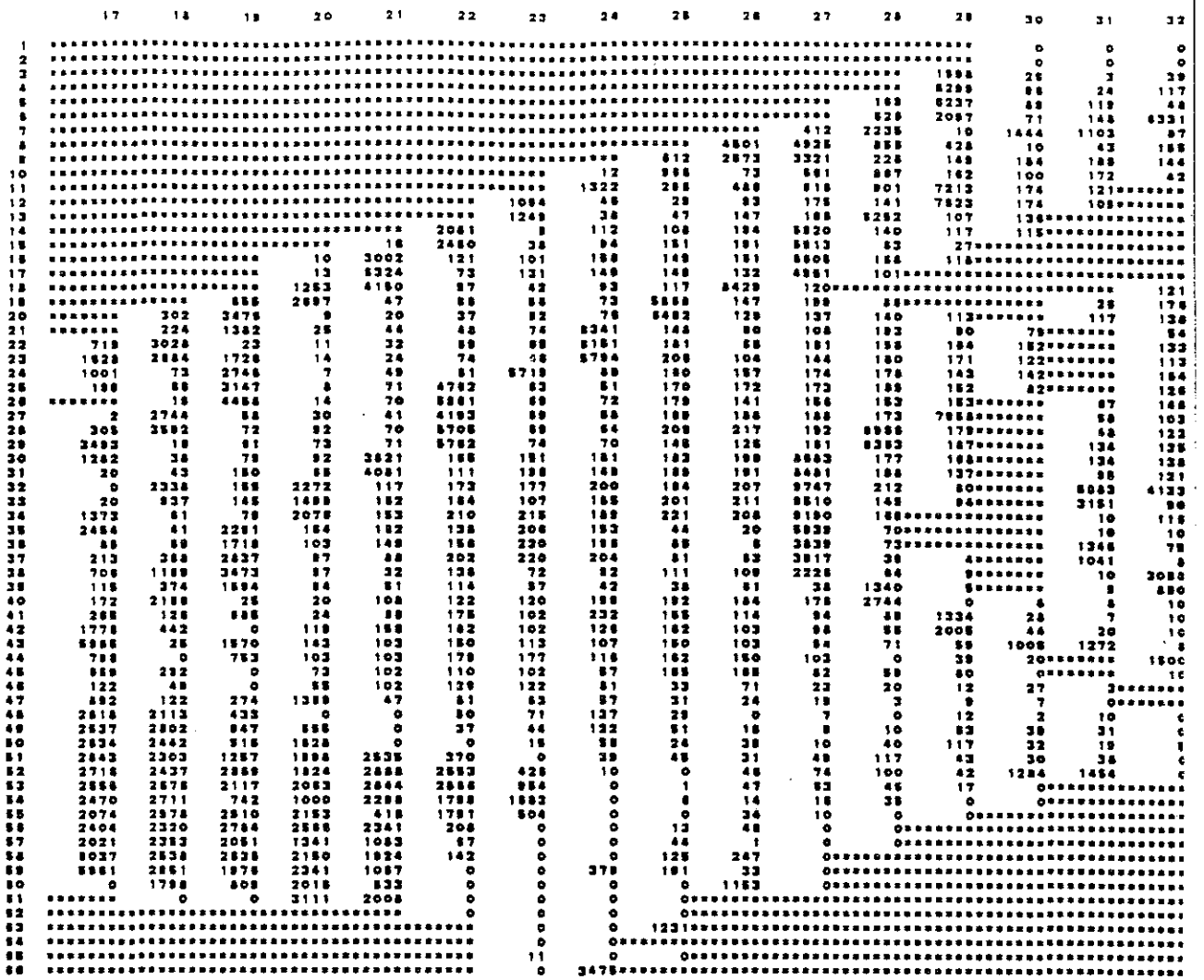

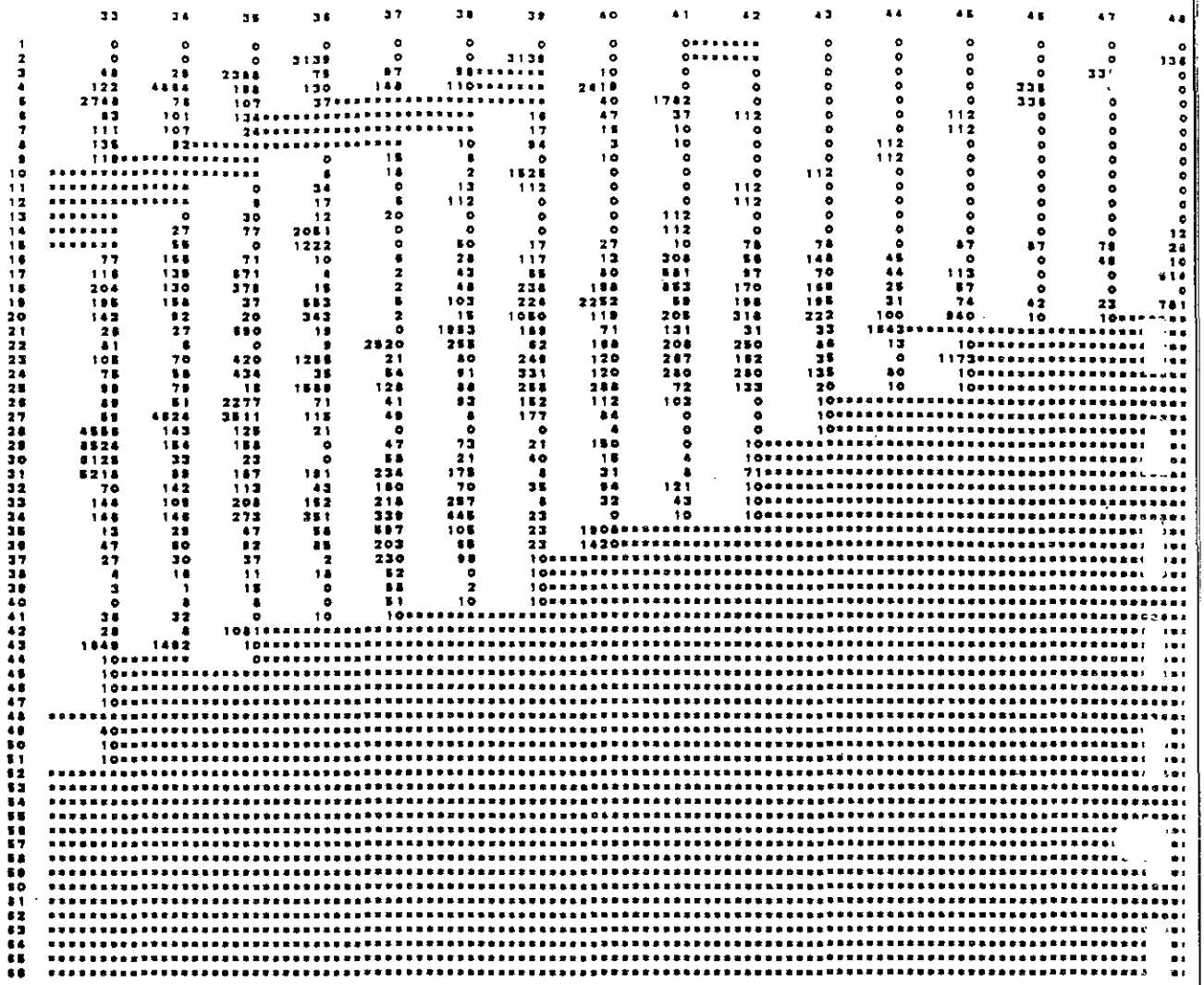

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3	0	0	336	
4	0	0	336	
5	0	0	336	
6	0	0	336	
7	0	0	112	
8	0	112	112	
9	112			
10	0	112		
11	0	112		
12	112	112		
13	112			
14				
15	10			
16	10	10		
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18	590			
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SCALAR TOTSW CON1990 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1111330

MATRIX SSSW CON2000 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
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11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															847	148
23																2206
24																450
25																
26																
27																
28																
29																179
30															204	341
31														200	280	265
32													2383	1280	180	
33												156	318	817	5312	3444
34										0	121	383	416	815	351	386
35									118	462	467	436	741	824	883	
36									147	242	373	370	871	827	1188	
37								325	118	186	848	429	197	1313	475	843
38								104	188	87	122	787	481	474	282	3188
39								8	40	77	268	784	981	886	788	
40								17	18	135	212	720	582	1111	1108	
41								570	824	817	889	284	208	200	0	
42		102	408	5783	348	835	881	782	781	885	1883	833	856	181		
43	0	0	205	883	5828	10845	844	878	703	833	1441	933	378	893		
44	1804	10	88	802	274	785	8282	782	770	877	787	882	863	1287		
45		10	328	483	807	772	841	11088	707	881	1348	471	818	893		
46		10	188	445	898	808	842	873	5892	783	818	1298	1732	1044		
47	871	708	728	849	893	888	889	490	8188	860	877	1481	1233			
48	1282	1184	482	853	889	838	886	871	5327	827	2834	2788				
49	2878	1382	827	478	721	831	813	800	5072	828	2877	1012				
50	1373	878	288	887	781	788	1088	888	2887	1084	2778	1787				
51	1142	400	228	218	823	882	818	888	1981	2802	7058	2818				
52	8787	188	844	818	733	880	820	1907	4902	2853	2331					
53	483	881	849	874	828	880	788	784	1388	4083	2423					
54	2870	8708	283	482	721	820	820	484	2950	2488						
55	482	4728	313	1020	131	848	0	2884	1803							
56																
57																
58								4388	3812	841	818	888	31	8127		
59											8388	8330	804	808	381	
60													2723	4858	887	811
61														8824	3240	2888
62																
63																
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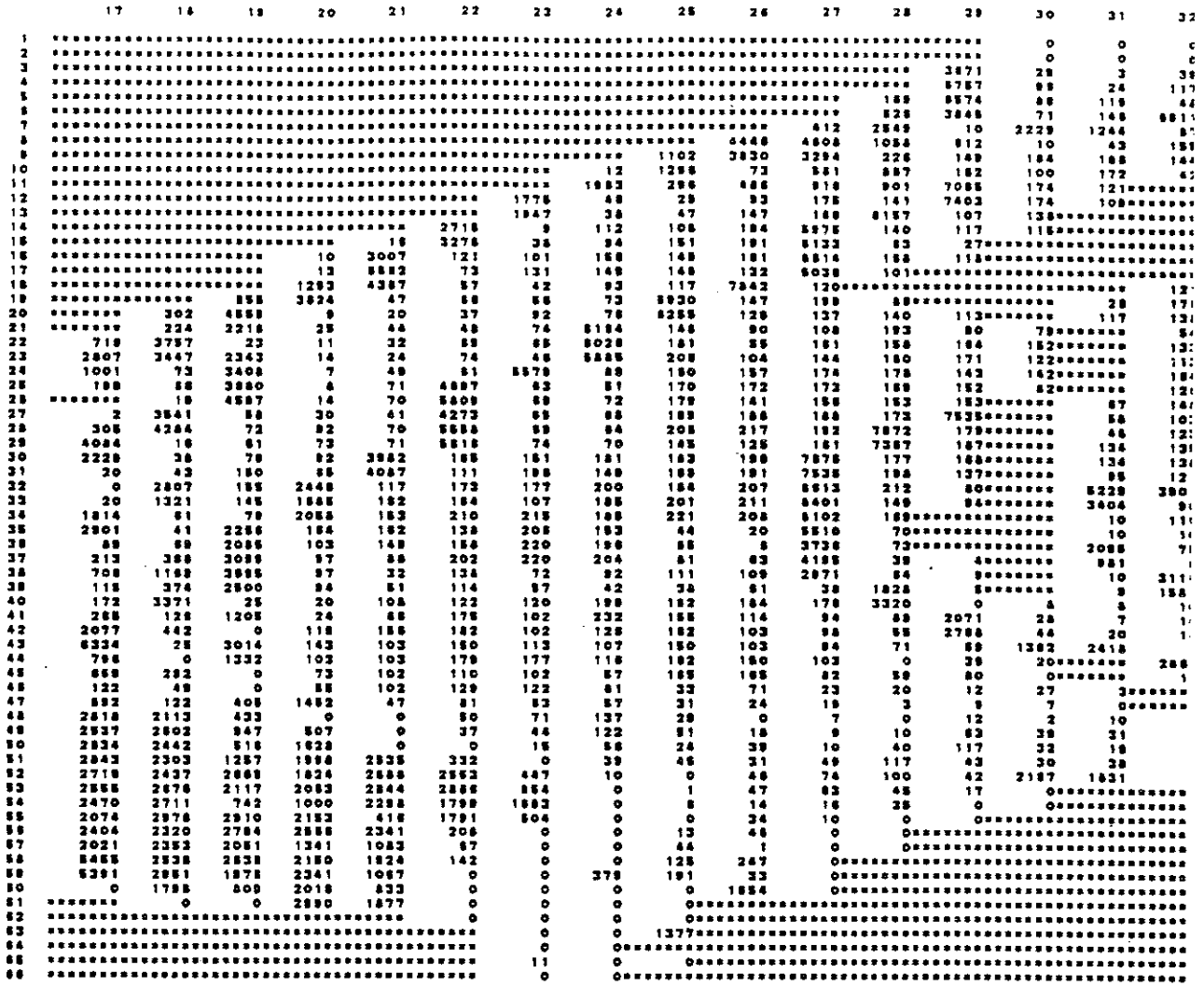

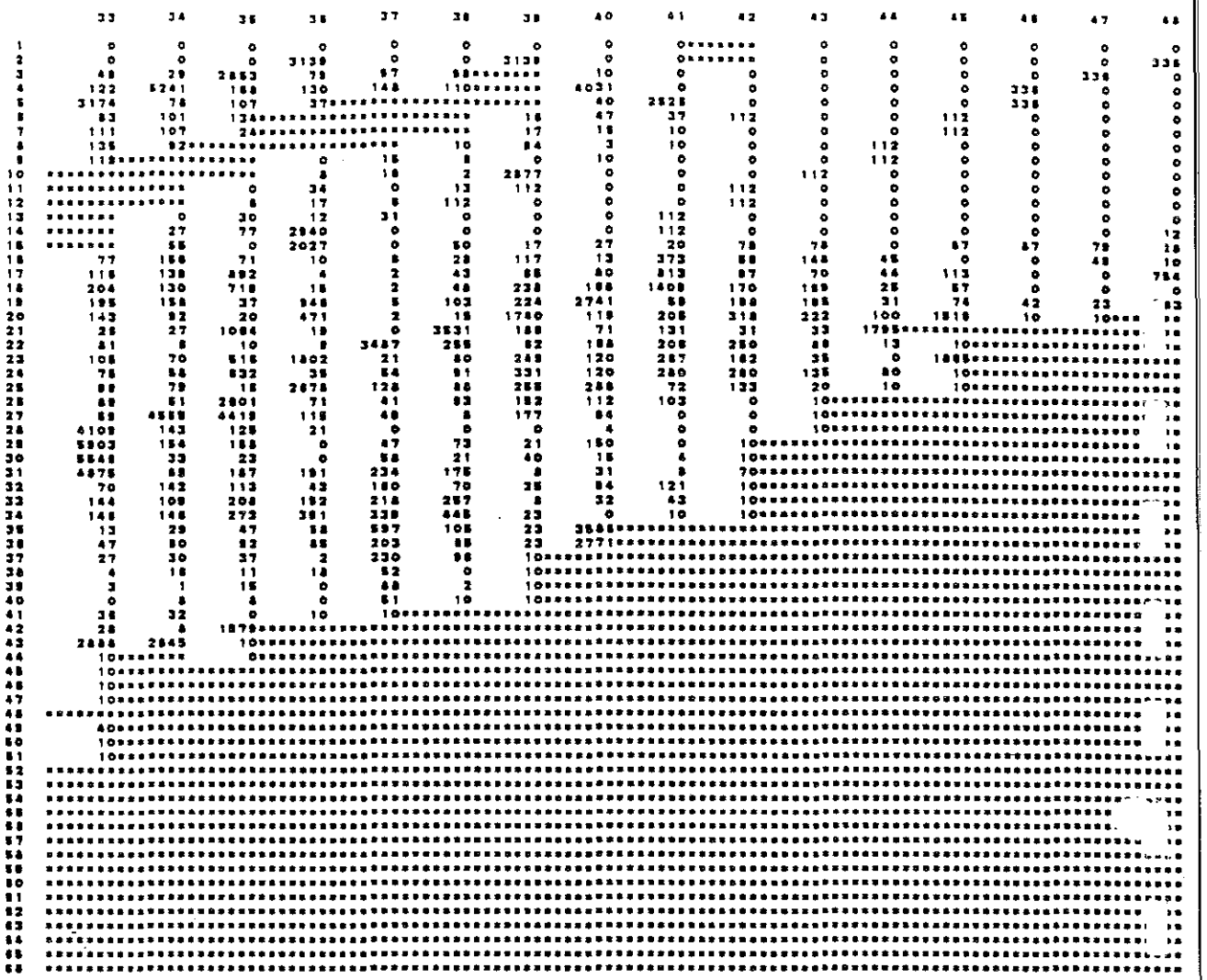

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4	0	0	336	
5	0	0	336	
6	0	0	336	
7	0	0	112	
8	0	112	112	
9	112			
10	0	112		
11	0	112		
12	112	112		
13	112			
14				
15	20			
16	10	10		
17				
18	758			
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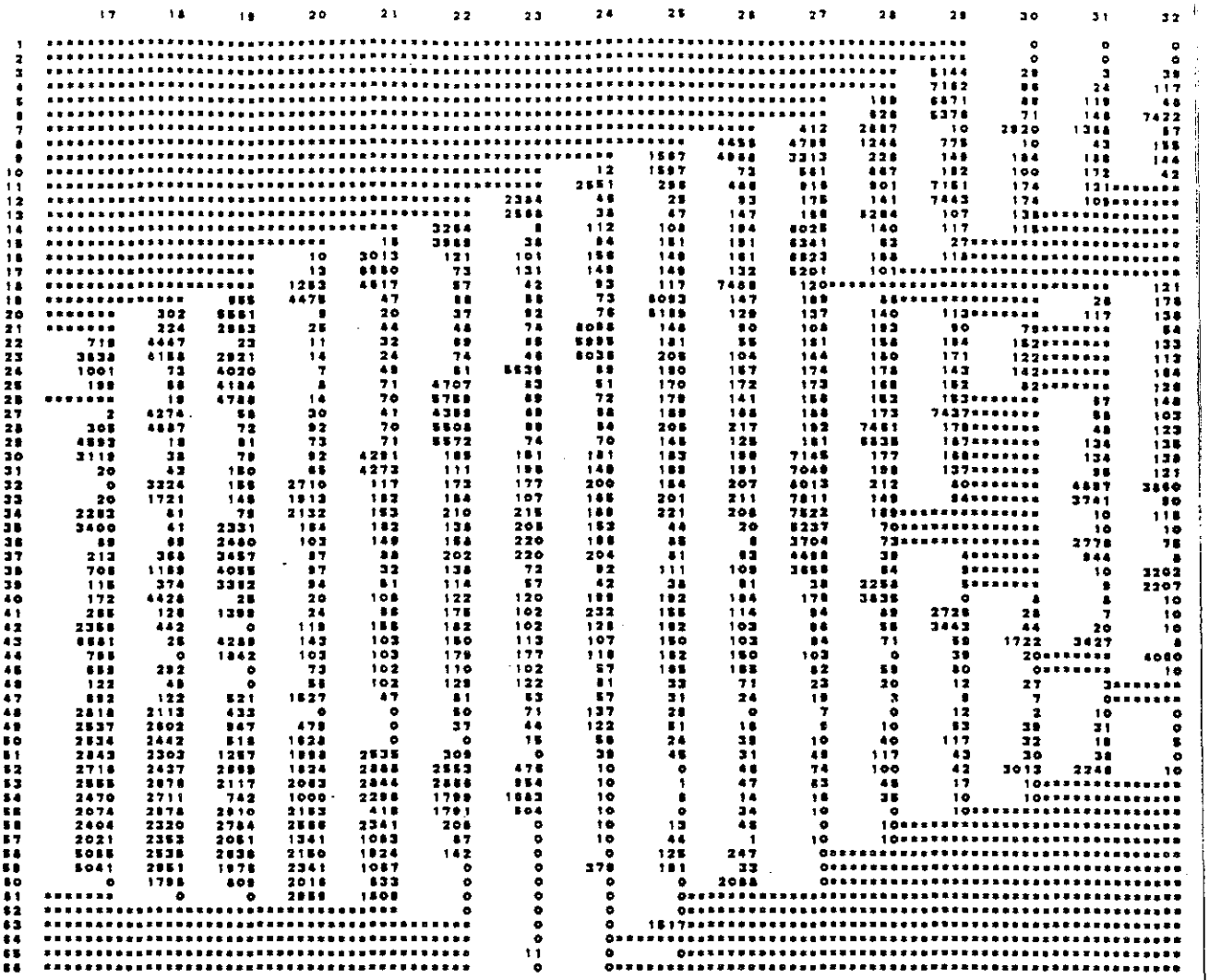
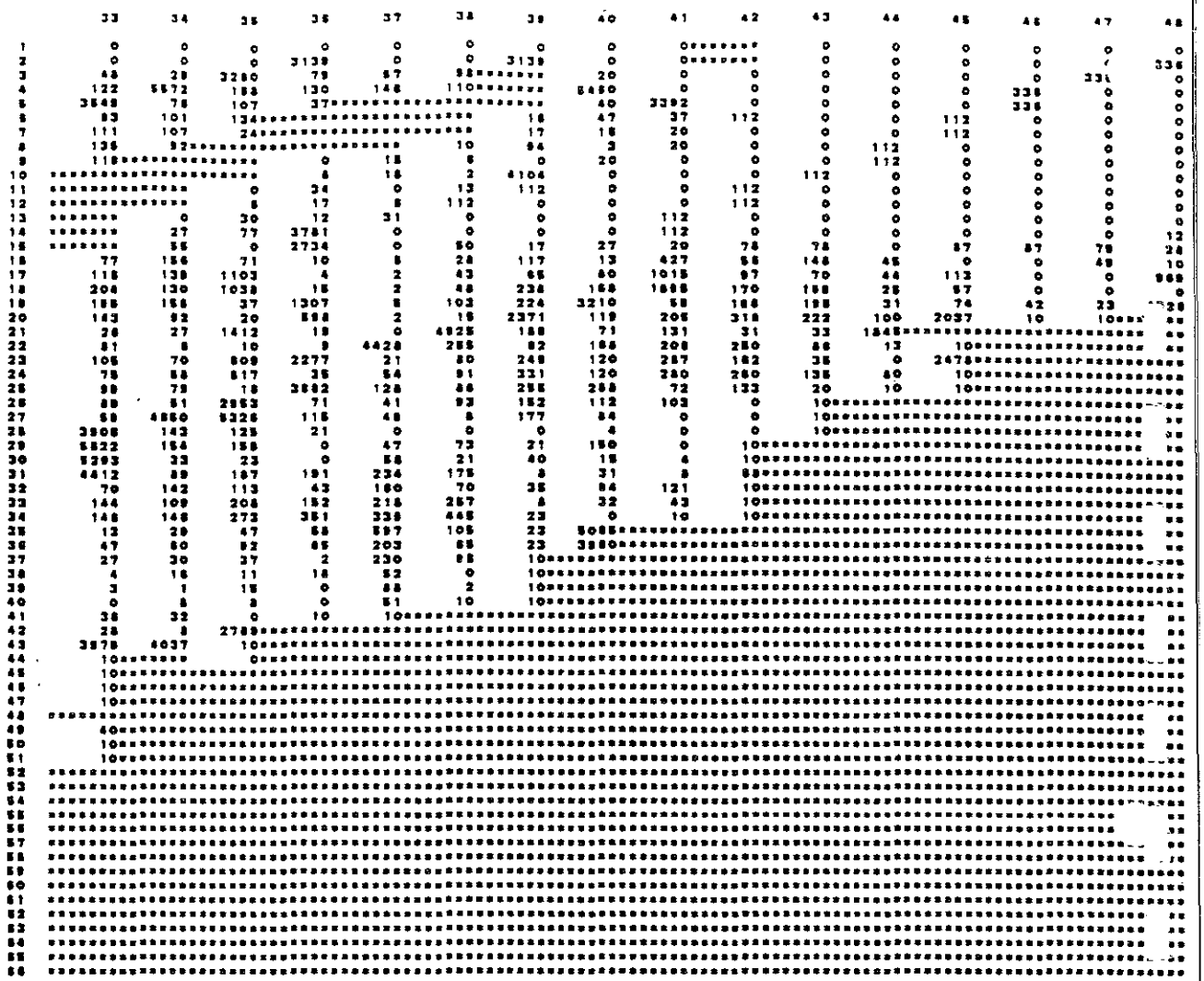
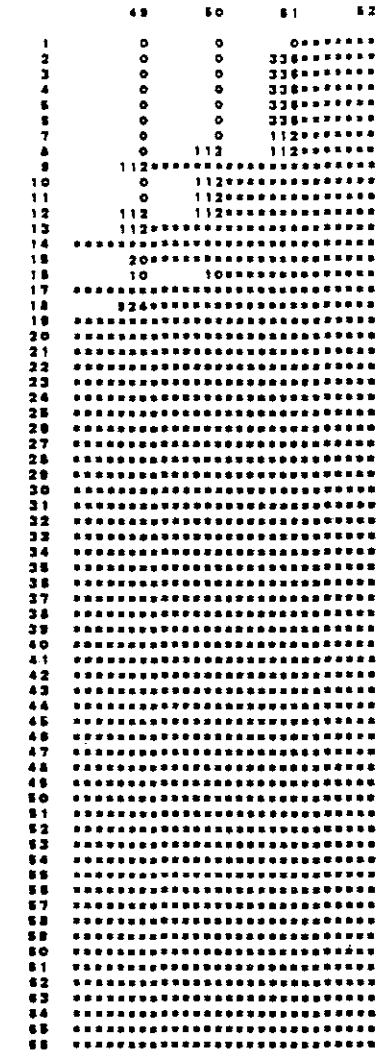
SCALAR TOTSW CON2000 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1155402

MATRIX SSSW CON2010 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															810	
23																2824
24																480
25																
26																
27																
28																
29																
30															206	341
31														200	280	285
32													2679	1286	150	141
33											155	319	817	8527	4333	40
34									0	121	363	418	815	381	385	187
35								118	483	467	438	741	624	482	138	
36								147	262	372	370	871	827	1186		
37							325	118	194	849	829	187	1313	478	902	
38							104	158	87	122	797	491	474	282	4288	
39							5	40	77	269	784	951	885	784	3204	
40							17	18	135	212	720	582	1111	1106	73	
41							570	824	817	599	284	208	200	0	178	
42		102	409	5482	348	588	881	782	781	885	1883	833	856	181	86	
43	0	0	208	583	5713	10827	644	578	702	533	1441	933	878	592	205	
44	1878	10	86	802	274	788	8061	782	770	877	787	842	853	1267	488	
45		10	328	483	807	772	841	11051	707	881	1348	471	918	883	843	
46		10	188	445	886	809	842	873	5870	783	816	1286	1732	1048	811	
47		1300	708	728	848	893	886	888	480	5837	880	877	1481	1233	93	
48		1388	1184	482	853	588	838	588	871	5158	527	2834	2788	82		
49		2774	1382	527	475	721	831	813	800	4850	525	2877	1012	85		
50		1895	878	288	857	781	788	1088	888	2857	1008	2778	1787	87		
51		1022	400	226	218	823	862	819	585	1981	2502	8587	2818	2888		
52			8108	188	844	818	733	580	820	1807	4720	2583	2331	2834		
53			443	851	849	874	828	880	788	784	1395	3900	2423	2878		
54				2586	8024	283	482	721	820	820	484	2884	2487	88		
55				410	4213	313	1020	131	548	0	2781	1901	18			
56								3980	3826	841	818	588	31	4673	81	
57											4815	4819	804	808	381	77
58													2435	4341	587	811
59														5859	2818	2382
60																
61																
62																
63																
64																
65																
66																







SCALAR TOTSW CON2010 TOTAL SURFACE WATER [ACRE-FT PER YEAR] = 1206823

MATRIX SSSW CON2020 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1
1																
2																
3																
4																
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8																
9																
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11																
12																
13																
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16																
17																
18																
19																
20																
21																
22															1154	14
23																349
24																45
25																
26																
27																
28																
29																17
30															204	34
31														200	260	26
32													2815	1280	150	14
33											155	319	817	5868	5091	1
34									0	121	363	418	515	361	355	46
35								118	483	467	438	741	824	862	33	
36								147	242	373	370	871	827	1160	447	
37							325	118	184	848	829	187	1313	478	95	
38							104	158	87	122	787	491	474	292	509	
39							8	40	77	268	784	861	895	788	180	
40							17	19	138	213	720	562	1111	1108	137	
41							570	824	817	588	284	208	200	0	163	
42		102	408	5208	348	888	861	782	781	585	1853	833	855	161	0	
43	0	0	208	583	5488	10558	844	878	703	833	1441	833	575	593	120	
44	10	10	88	802	274	755	7880	762	770	677	767	982	883	1287	89	
45		10	328	463	807	772	841	11021	707	861	1265	471	315	583	84	
46		10	188	448	898	808	842	673	8431	782	818	1298	1732	1048	81	
47		1588	708	725	848	893	588	659	490	5585	880	877	1481	1232	120	
48		1504	1184	482	863	898	838	886	671	4877	527	2834	2788	238		
49		2880	1382	527	475	721	831	813	800	4885	528	2677	1012	135		
50		1838	878	288	857	791	798	1088	888	2887	852	2778	1787	288		
51		820	400	228	218	823	882	818	588	1881	2502	8208	2818	288		
52		5535	188	844	818	733	880	820	1807	4884	2883	2331	283			
53		402	881	848	874	828	880	788	764	1388	3744	247	287			
54		2382	5447	283	482	721	820	820	484	2787	24	188				
55		388	3780	313	1020	131	848	0	2887	191	101					
56		3588	3202	841	818	588	31	4108	88							
57		4385	4384	804	808	361	870									
58		2183	3884	887	81											
59		5382	2888	213												
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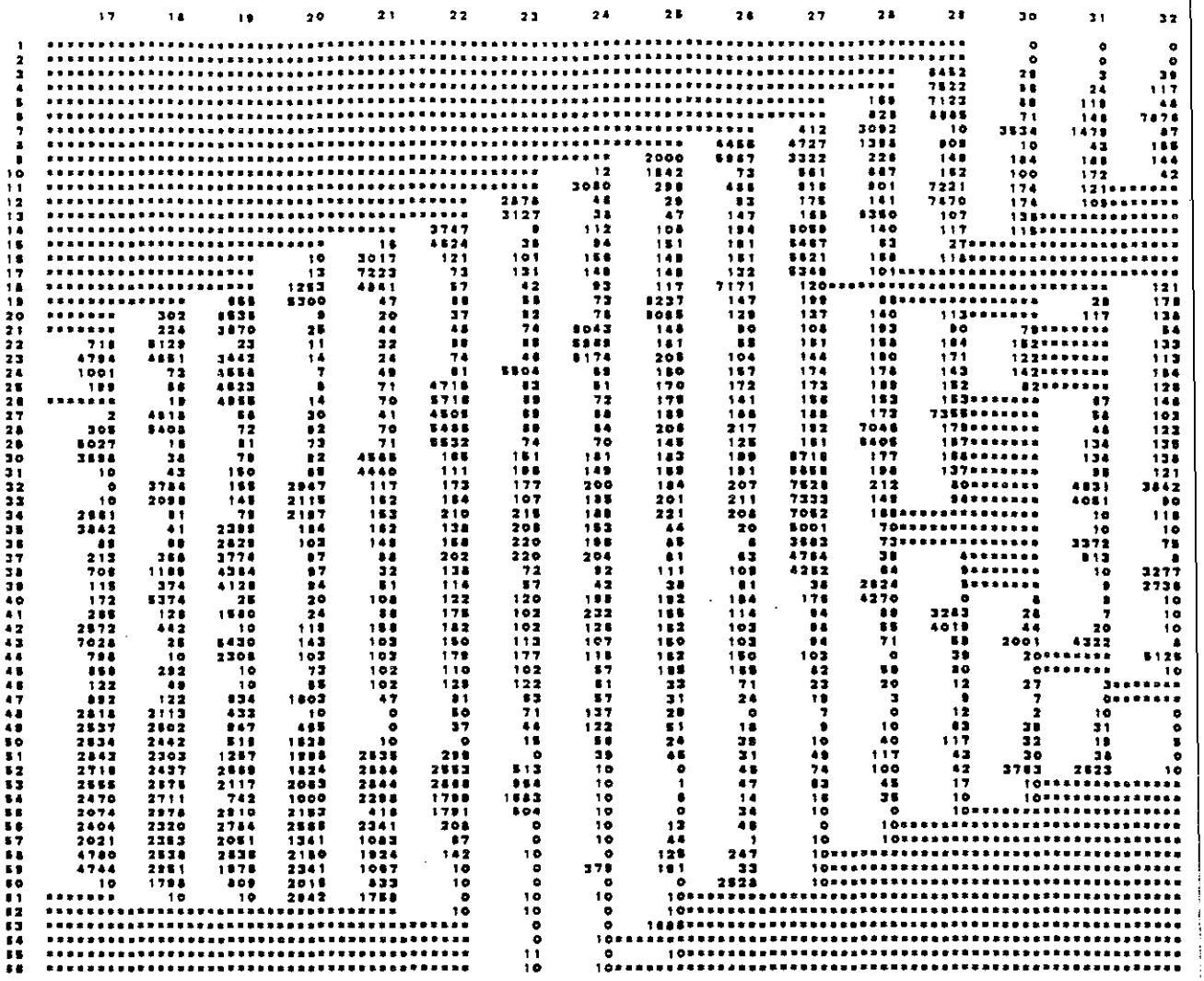

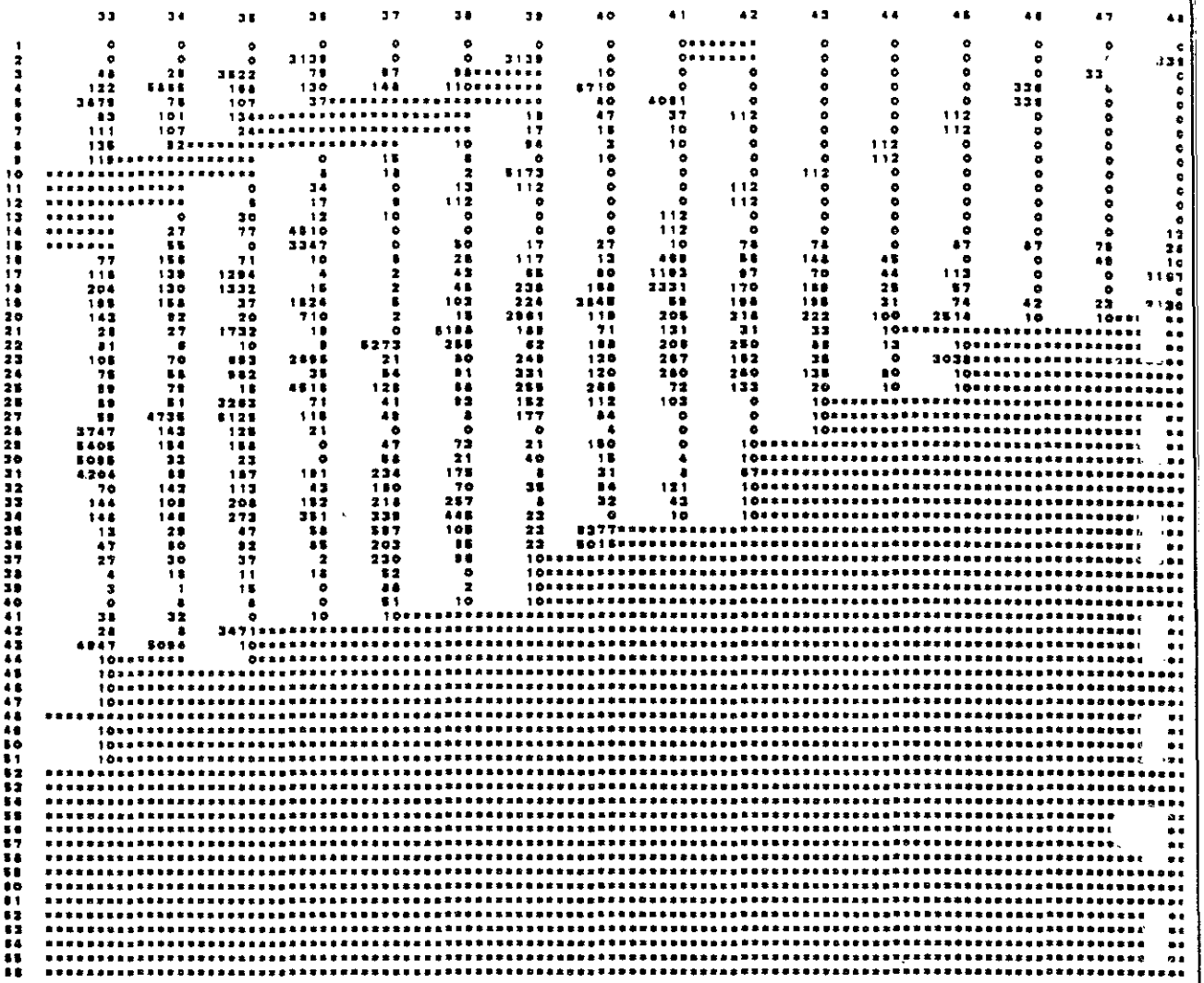

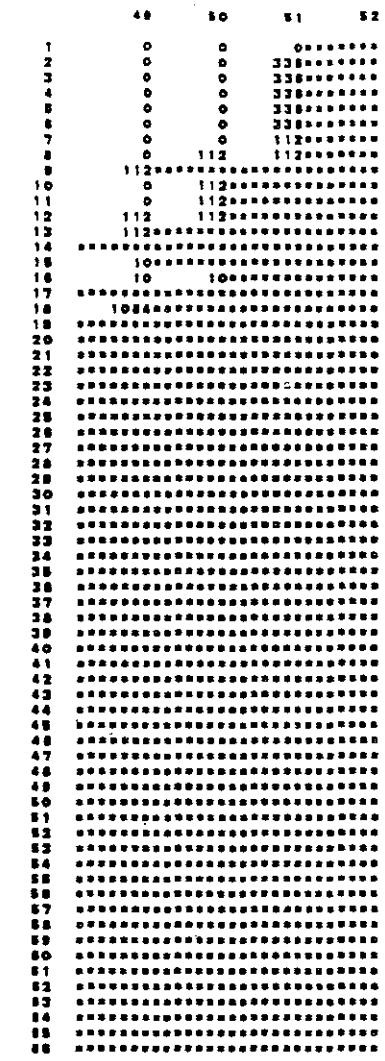

SCALAR TOTSW CON2020 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1252551

MATRIX SSSW CON2030 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
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18																
19																
20																
21																
22															1406	148
23																4205
24																450
25																
26																
27																
28																
29																170
30															204	341
31														200	230	285
32													3197	1280	150	141
33											155	318	817	5885	5828	80
34											383	518	351	358		467
35									118	482	487	438	741	824	883	338
36									147	242	373	370	871	827	1158	5049
37								328	118	184	848	828	187	1312	478	1001
38								104	158	87	122	787	491	474	282	5187
39								8	40	77	288	786	861	885	758	3848
40								17	19	138	212	720	582	1111	1106	4818
41								570	824	817	896	294	208	200	0	5488
42			102	408	5030	346	888	981	782	781	695	1853	833	855	181	84
43		0	0	208	583	6064	10555	844	878	703	833	1441	332	575	592	1205
44		2027	20	88	802	274	755	7778	782	770	877	757	882	953	1287	884
45			20	328	483	807	772	841	11078	707	881	1348	471	815	883	843
46			20	138	448	888	808	842	872	5374	753	816	1298	1722	1048	811
47		1881	708	728	848	892	888	889	480	5821	880	877	1481	1233		1202
48		1811	1184	482	883	898	838	888	871	4886	827	2834	2788			2387
49		2888	1382	827	478	721	831	813	800	4483	828	2977	1012			235
50		2148	878	288	857	781	788	1088	888	2857	883	2778	1787			288
51		844	400	228	218	823	882	818	888	1881	2502	5840	2918			258
52		5108	188	844	818	733	880	820	1907	4404	2883	2231				283
53		270	881	848	874	828	880	788	784	1388	3588	2422				2878
54		2180	5017	283	482	721	820	820	484	2718	2488					2888
55		234	3488	312	1020	131	848	0	2872	1803						
56		3322	2888	841	818	888	31	3788								
57		4012	4081	804	808	381										
58		2012	3877	887	81											
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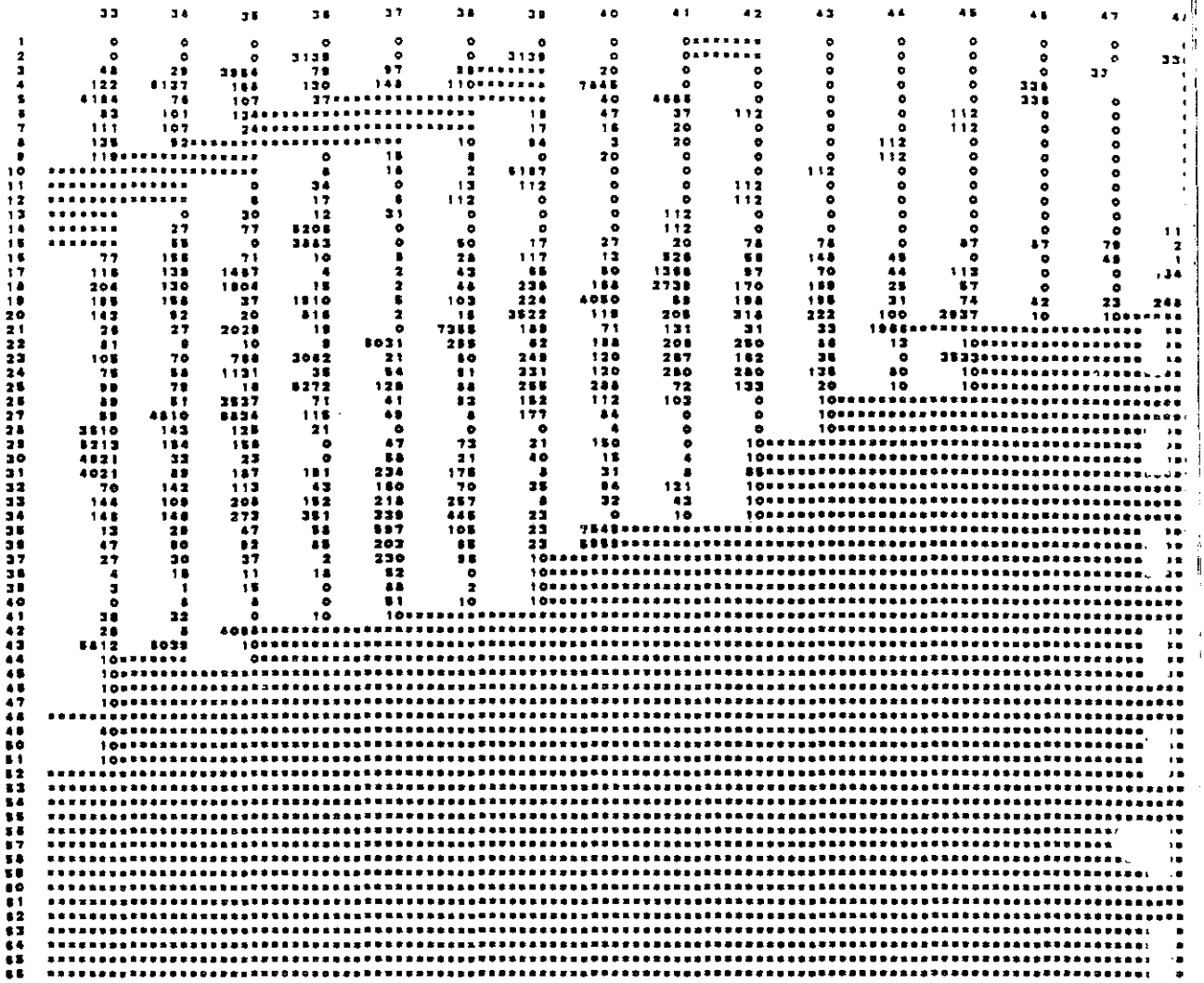

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2	0	0	338	
3	0	0	338	
4	0	0	338	
5	0	0	338	
6	0	0	338	
7	0	0	112	
8	0	112	112	
9	112			
10	0	112		
11	0	112		
12	112	112		
13	112			
14				
15	20			
16	10	10		
17				
18	1183			
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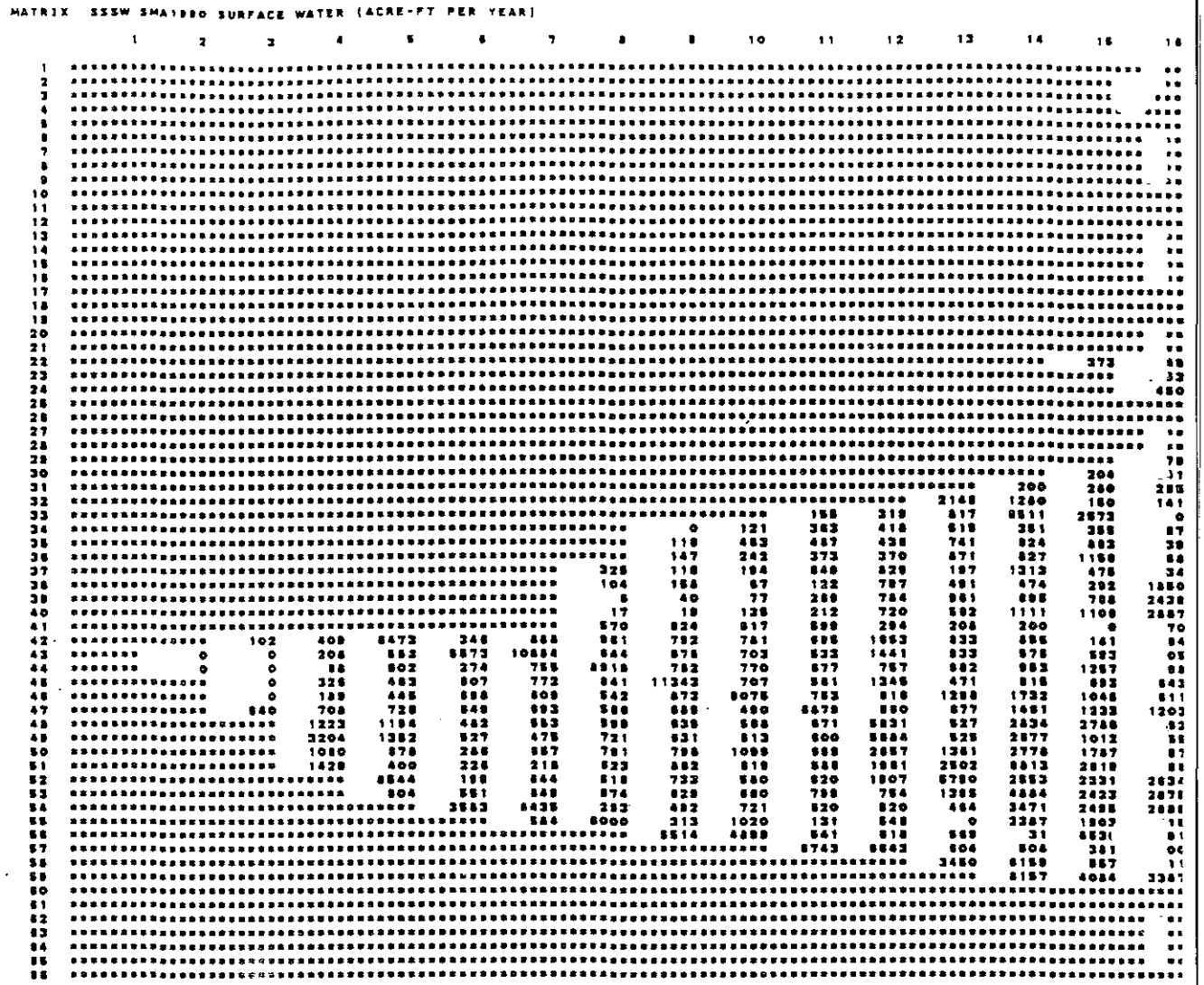
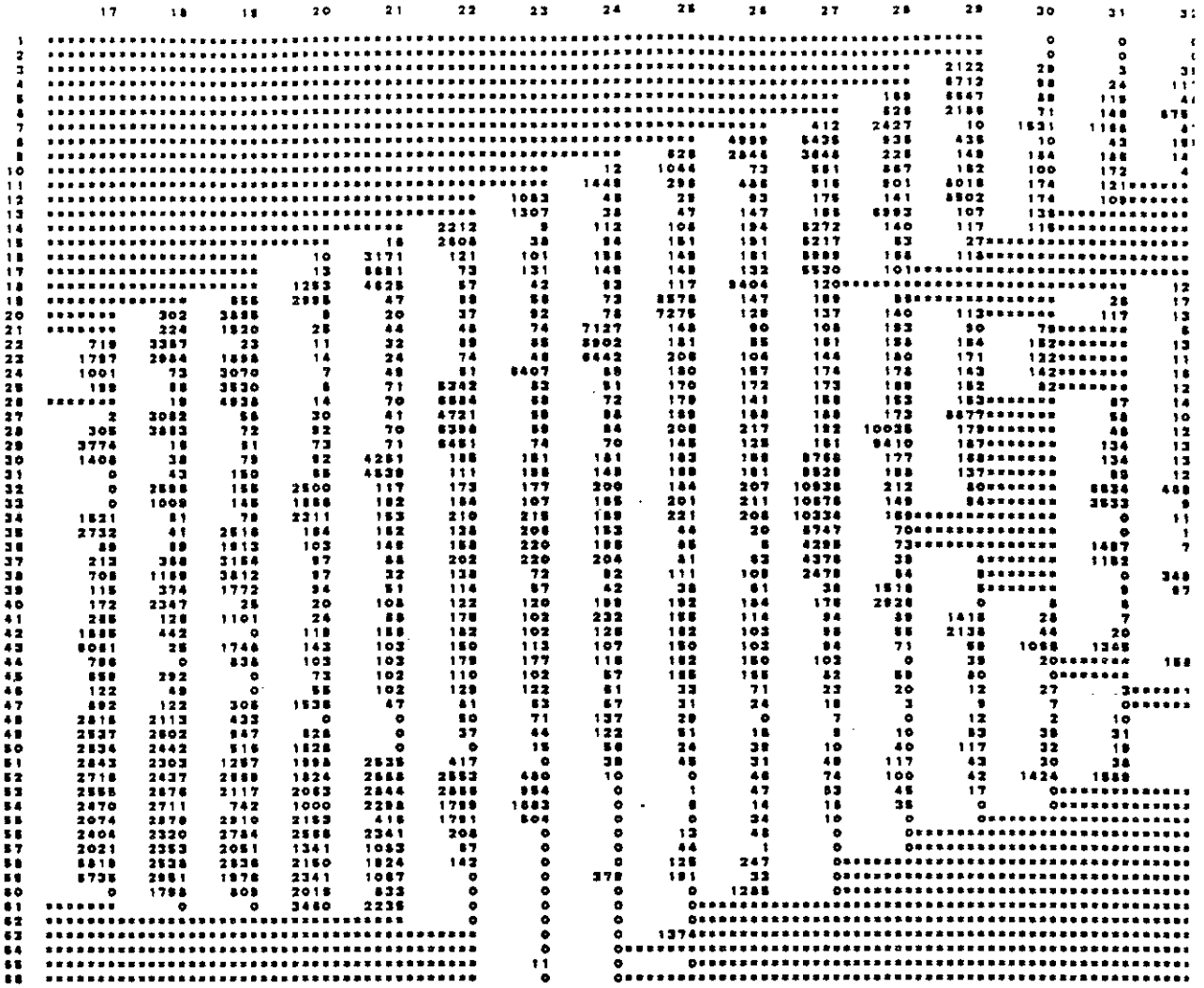
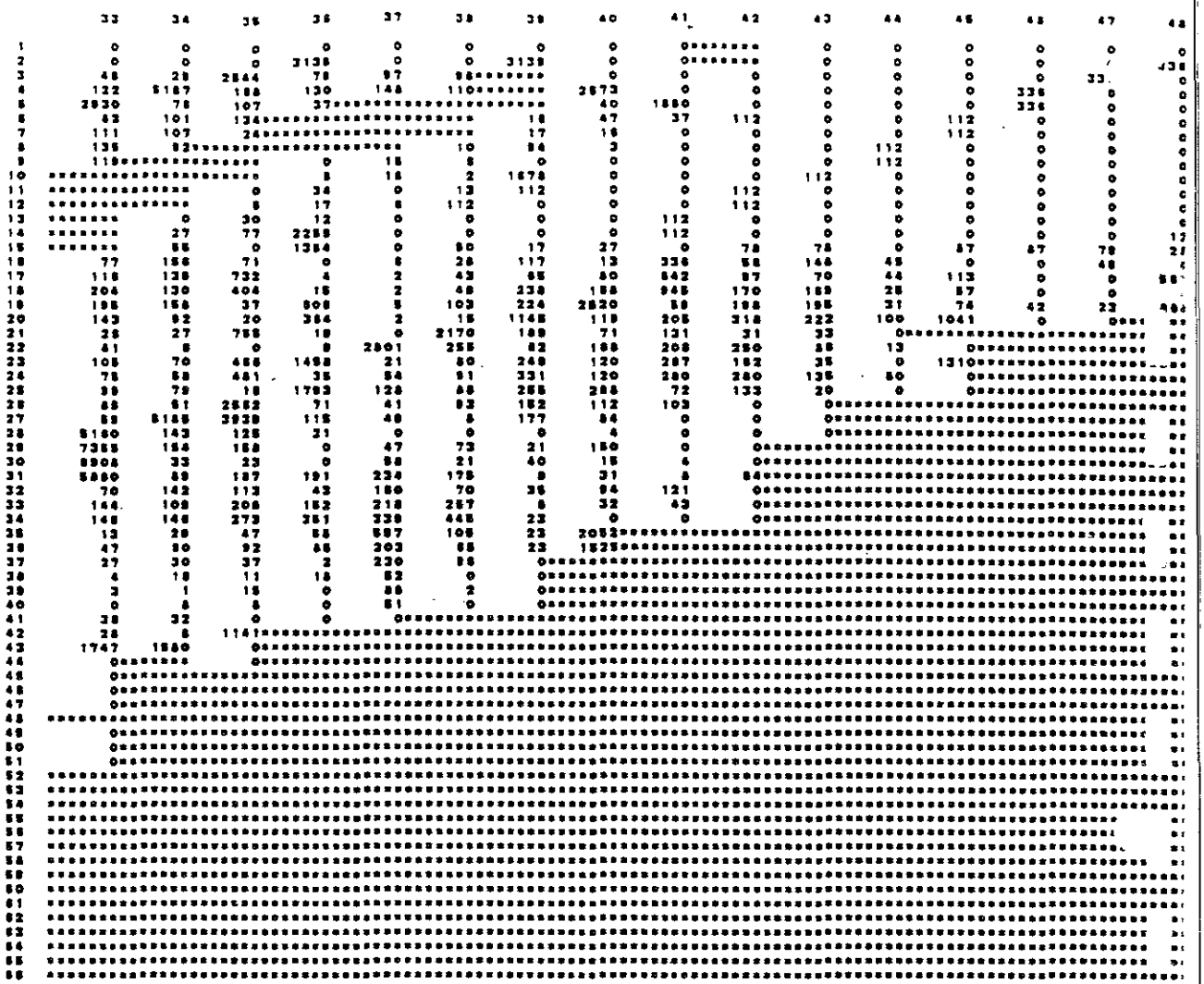
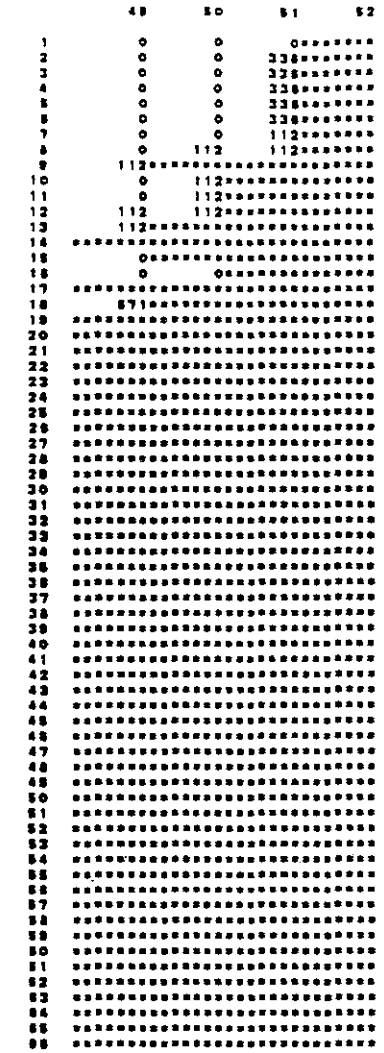
SCALAR TOTSW CON2030 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1302241


MATRIX SSSW SMA1990 SURFACE WATER (ACRE-FT PER YEAR)







SCALAR TOTSW SMA1990 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1172837

MATRIX SSSW SMA2000 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22														748	14	
23															281	
24															48	
25															88	
26															88	
27															88	
28																
29															17	
30														204	34	
31													200	280	28	
32												2642	1280	150	14	
33										155	318	617	7274	3808		
34								0	121	382	418	515	351	385	46	
35								118	483	487	438	741	824	482	33	
36								147	282	373	370	471	827	1188	388	
37							328	118	184	648	528	187	1313	478	38	
38							104	188	87	122	787	481	474	282	342	
39							8	40	77	288	784	881	885	788	28	
40							17	18	138	212	720	582	1111	1108	78	
41							570	824	817	588	284	208	200	0	88	
42		102	408	8580	348	588	981	782	741	685	1852	833	855	181	8	
43	0	0	208	583	8078	11088	844	678	703	533	1441	833	575	583	120	
44	0	0	88	802	274	788	8157	782	778	877	787	982	883	1287	88	
45	0	328	483	887	772	841	11817	787	581	1348	471	815	883	84		
46	0	188	445	888	808	842	873	8251	783	818	1288	1732	1048	81		
47	1087	788	725	845	883	588	888	488	7088	880	877	1481	1233	78		
48	1432	1184	482	883	588	838	888	871	8017	827	2834	2788	38			
49	3284	1382	827	475	721	831	813	888	5818	825	2877	1812	38			
50	1788	878	288	887	781	788	1088	888	2887	1381	2778	1787	283			
51	1428	488	228	218	823	882	818	888	1881	2882	8880	2818	288			
52	8858	188	844	815	788	588	828	1887	8882	2882	2231	283				
53	884	881	848	874	828	888	788	784	1388	4822	342	37				
54	3838	8488	283	482	721	828	528	484	3884	248	38					
55	884	8000	313	1828	131	548	8	3444	1885	81						
56	8887	4833	841	818	888	81	8588	89								
57	8787	8728	884	888	381	812										
58	3475	8148	887	81												
59	8187	4148	334													
60																
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63																
64																
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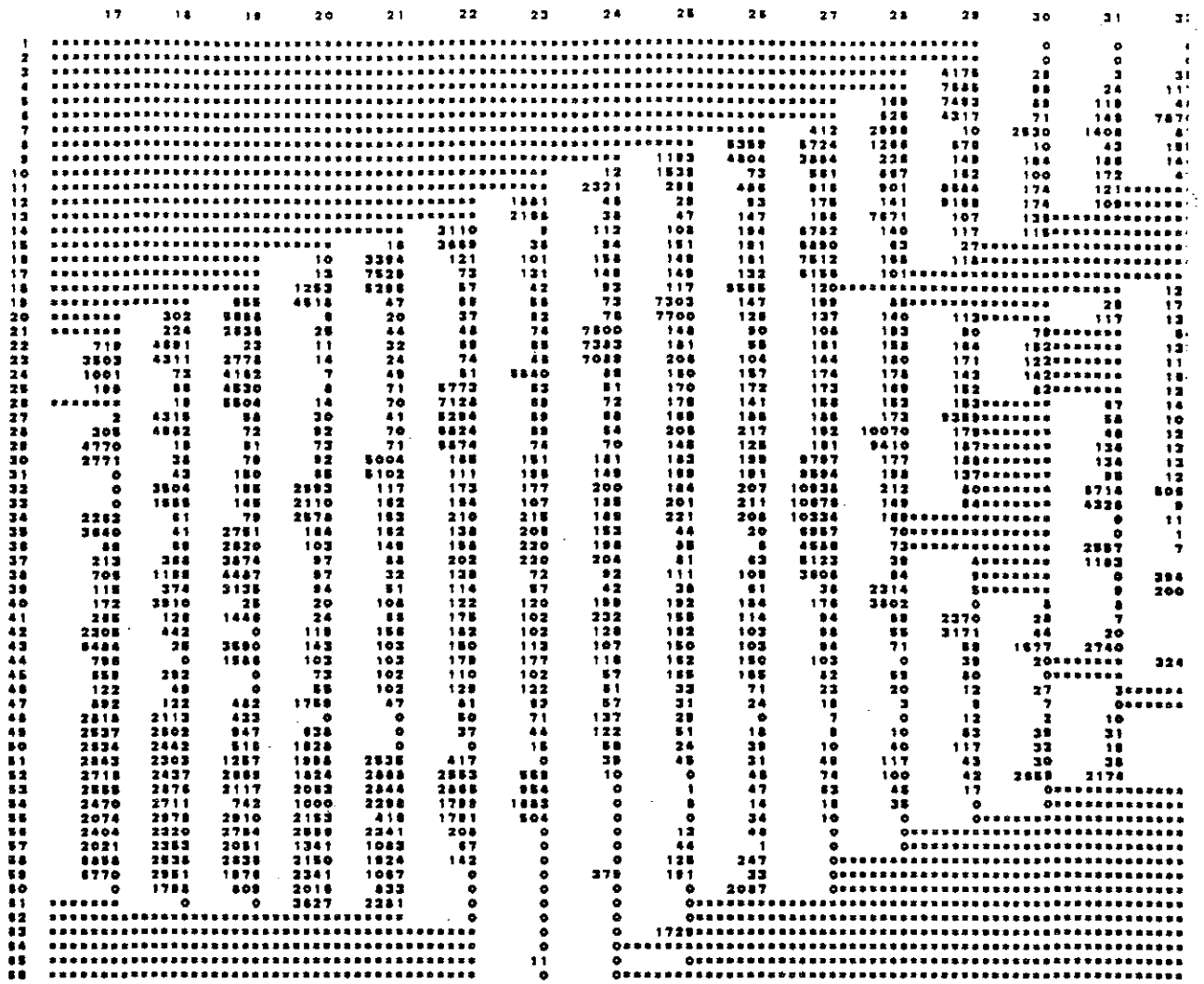

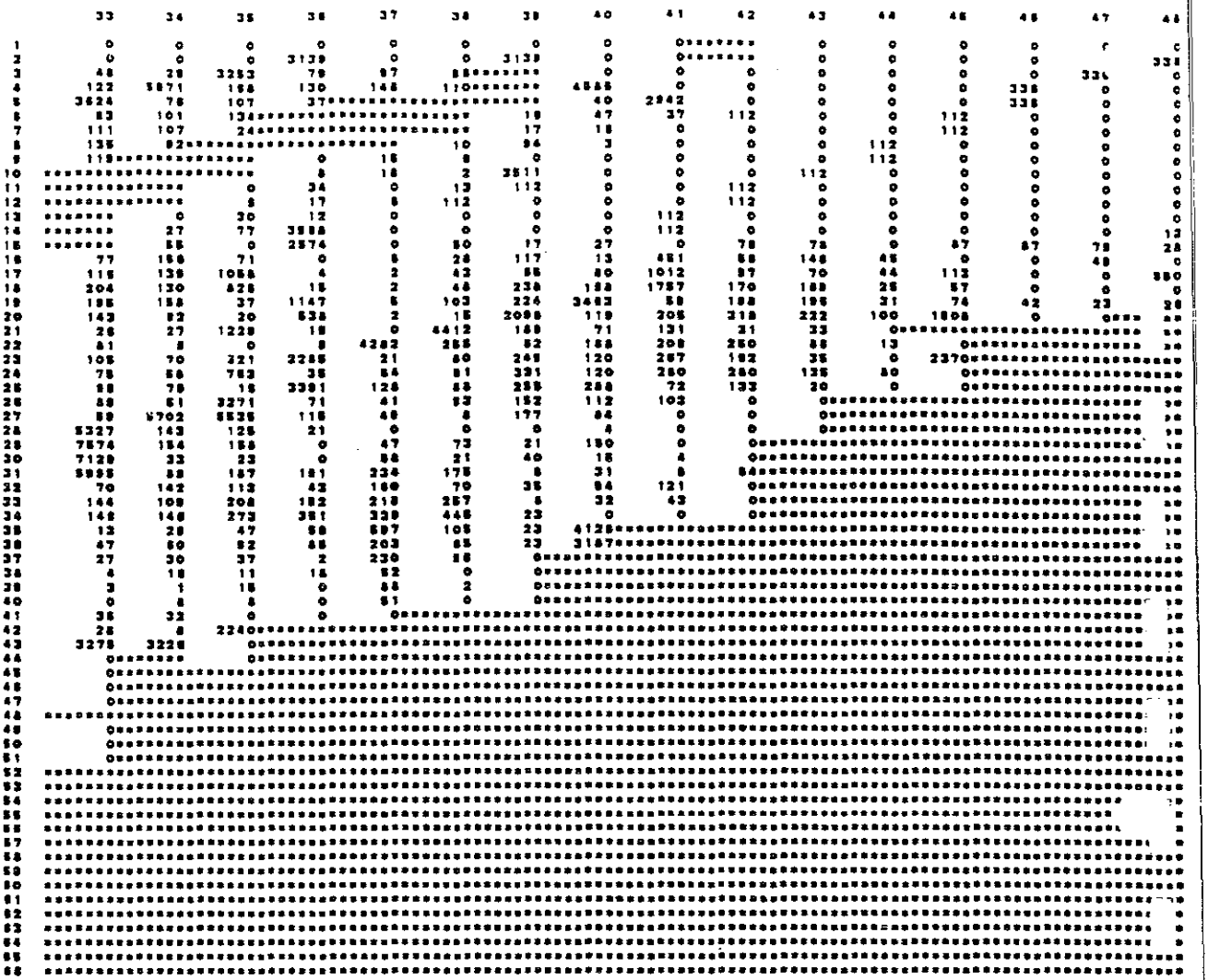

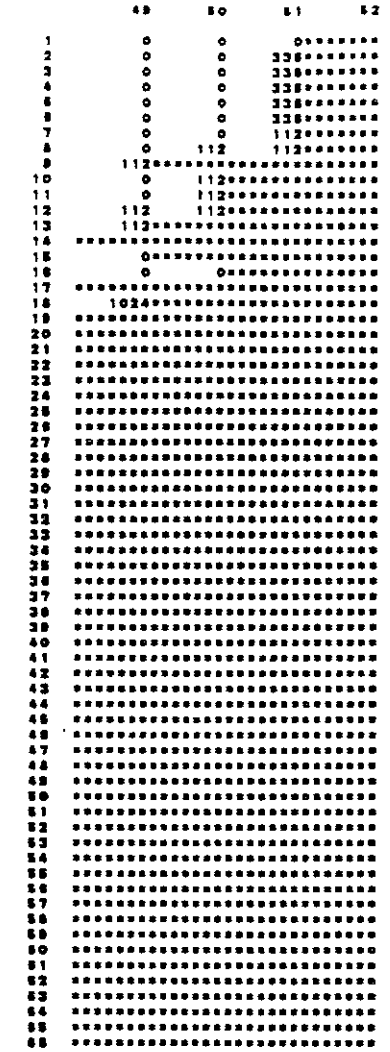

SCALAR TOTSW SMA2000 TOTAL SURFACE WATER [ACRE-FT PER YEAR] = 1302348

MATRIX SSSW SMA2010 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															1118	148
23																3783
24																480
25																
26																
27																
28																
29																179
30															204	341
31														200	280	288
32													3139	1280	150	11
33											188	318	817	4038	5237	0
34								0	121	383	418	518	381	388		17
35								118	483	487	438	741	824	883		18
36								147	242	372	370	871	827	1188	4988	
37							325	118	194	948	828	187	1313	475	1137	
38							104	158	67	122	787	481	474	282	5061	
39							6	40	77	288	784	881	888	768		11
40							17	13	138	212	720	862	1111	1108		11
41							570	824	817	888	284	208	200	0		18
42		102	408	8847	348	888	961	782	781	888	1882	833	888	181		14
43	0	0	208	823	8578	11315	844	878	783	833	1441	833	875	882	1208	
44	0	0	88	802	274	788	8387	782	778	877	787	882	883	1287	888	
45	0	328	483	807	772	841	11883	787	881	1348	471	818	883		643	
46	0	188	448	888	888	842	873	8428	783	818	1288	1732	1048		111	
47	1836	788	728	848	883	886	888	488	7248	880	877	1481	1231		13	
48	1842	1194	482	883	888	838	888	871	8284	827	2834	2788			2	
49	3384	1382	827	478	721	831	813	888	8848	828	2877	1812			18	
50	2488	874	288	887	781	788	1888	888	2887	1381	2778	1787			2887	
51	1428	488	228	218	823	882	818	888	1881	2582	4888	2818			2888	
52	8784	188	844	818	733	848	828	1887	8838	2883	2331				2834	
53	884	881	888	874	828	888	788	784	1388	4881	2428				78	
54	3884	8888	283	482	721	828	828	488	3837	2488					18	
55	884	8888	8888	313	1828	138	848	8	3881	1883					18	
58			8888	4888	841	818	888	31	8884						1	
57							8882	8787	884	888	381	8784				
58											3488	8213	887	811		
59												8187	4188	3387		
60																
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63																
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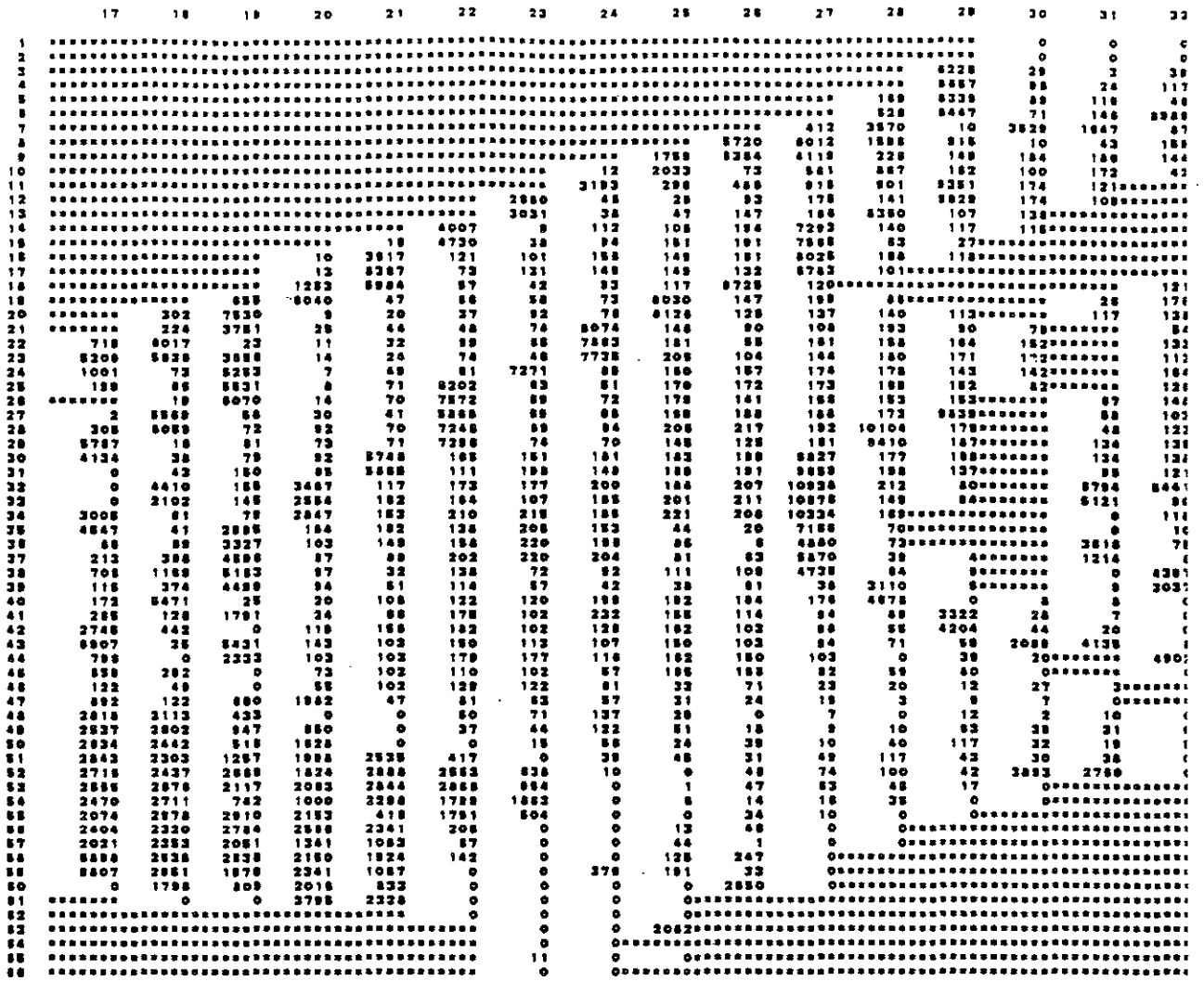
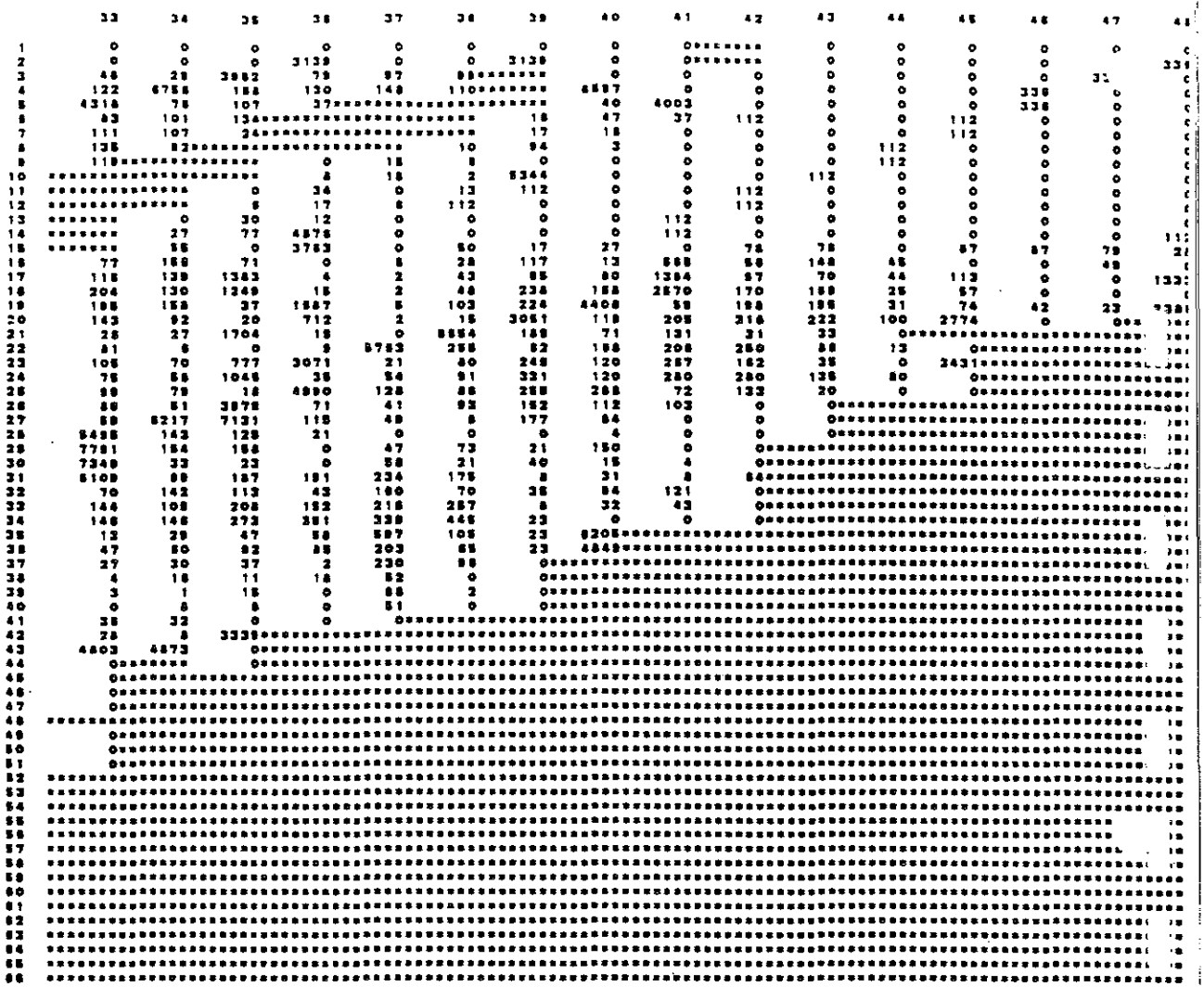
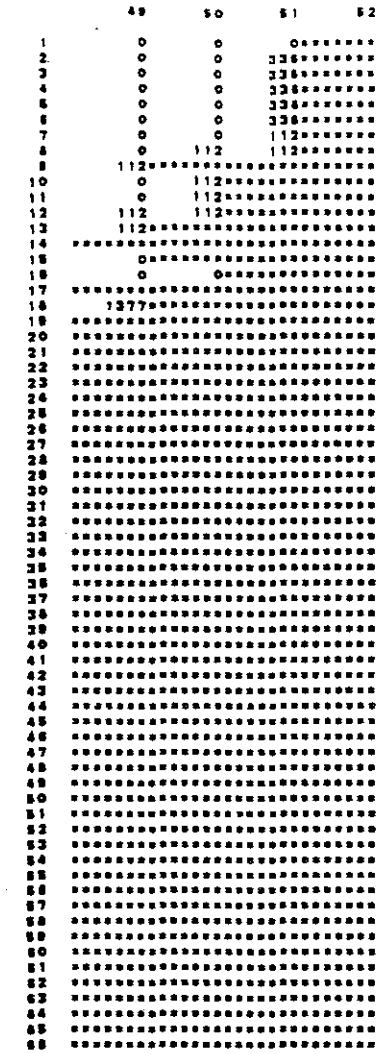
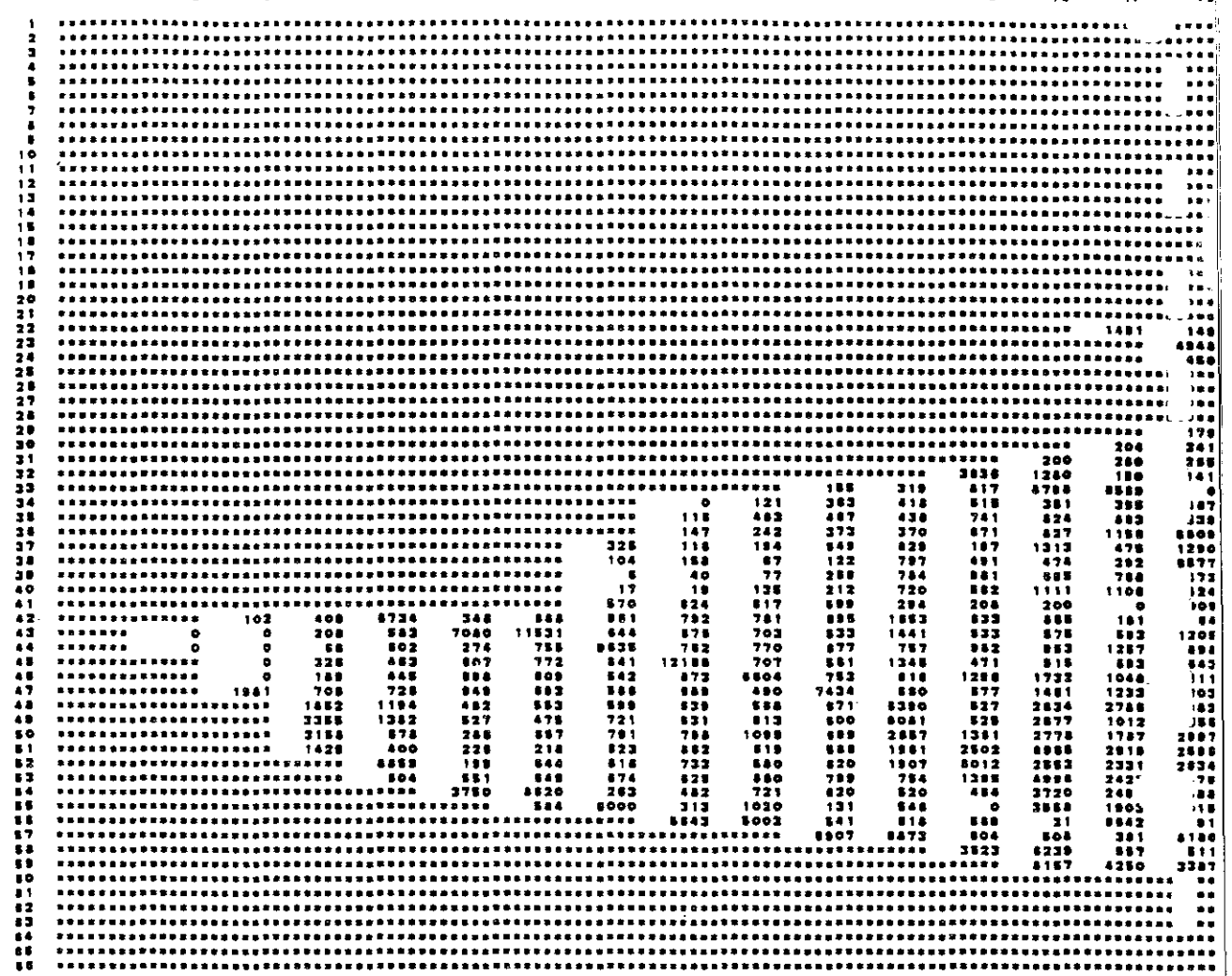


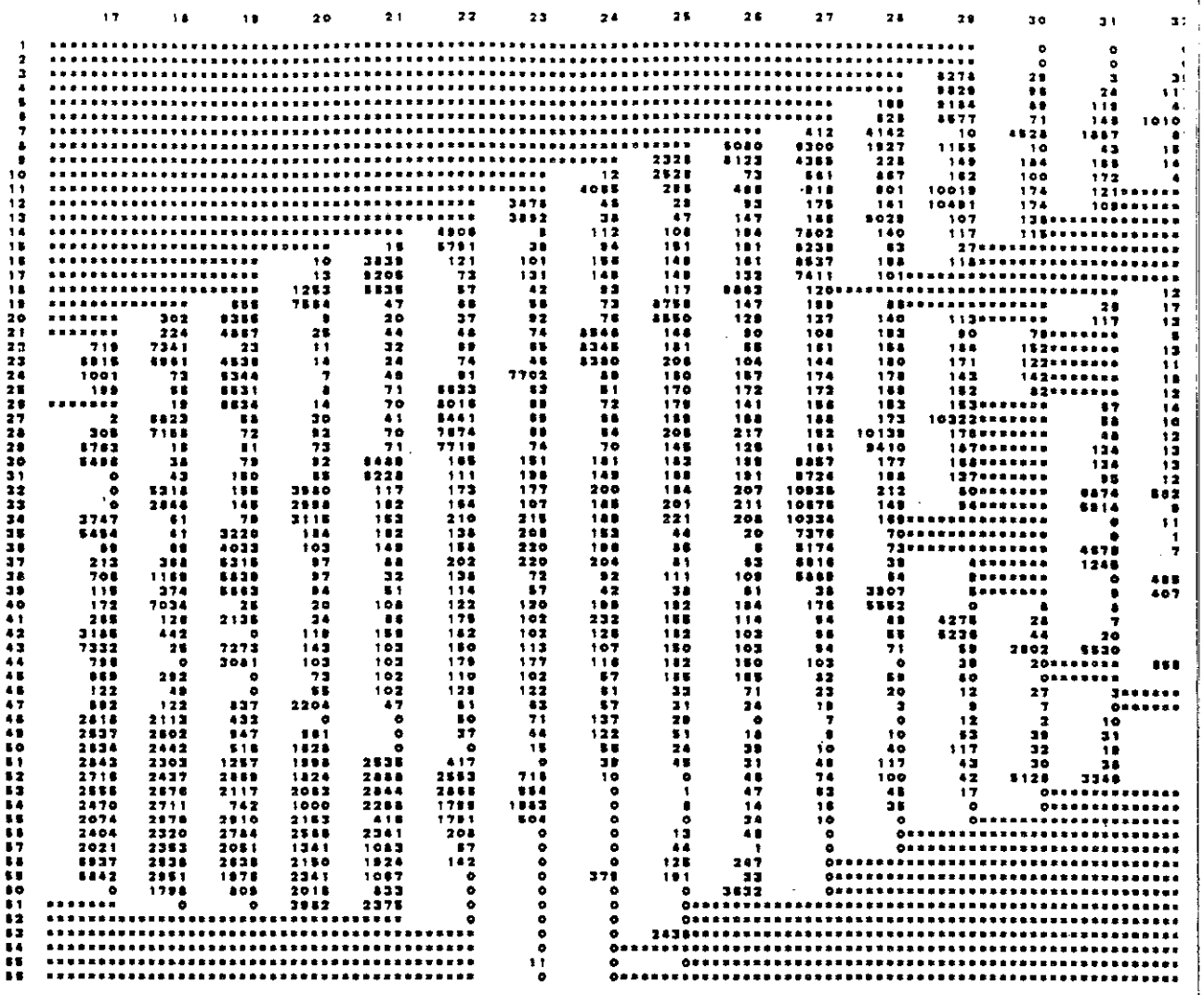


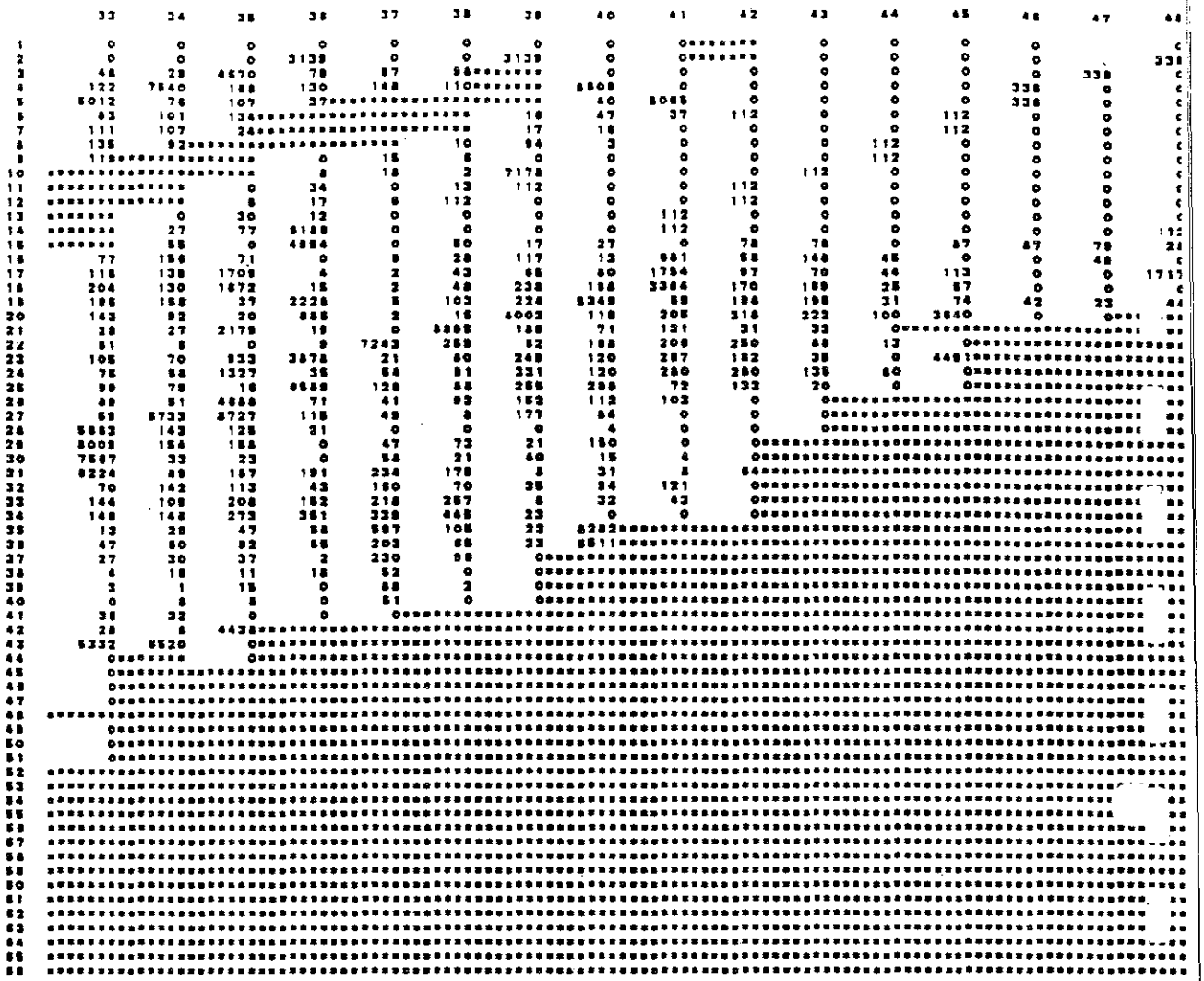


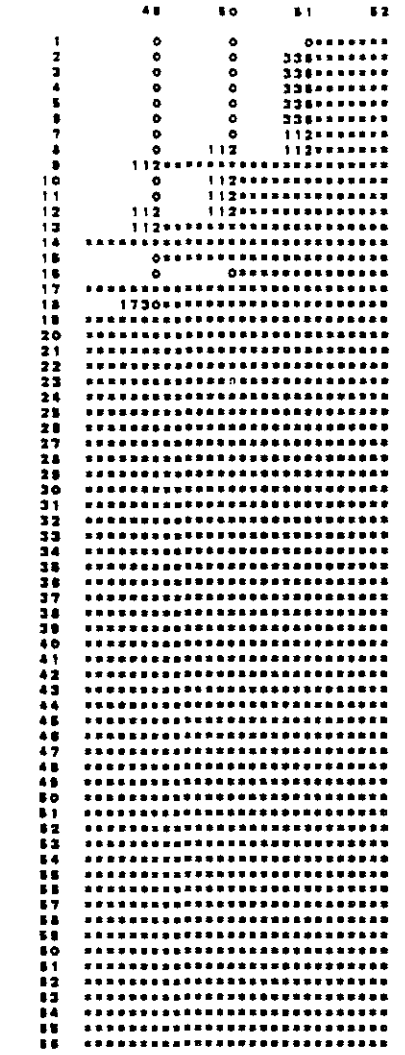
SCALAR TOTSW SMA2010 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1432043

MATRIX SSSW SMA2020 SURFACE WATER (ACRE-FT PER YEAR)









SCALAR TOTSW SMA2020 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1581760

MATRIX SSSW SMA2030 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
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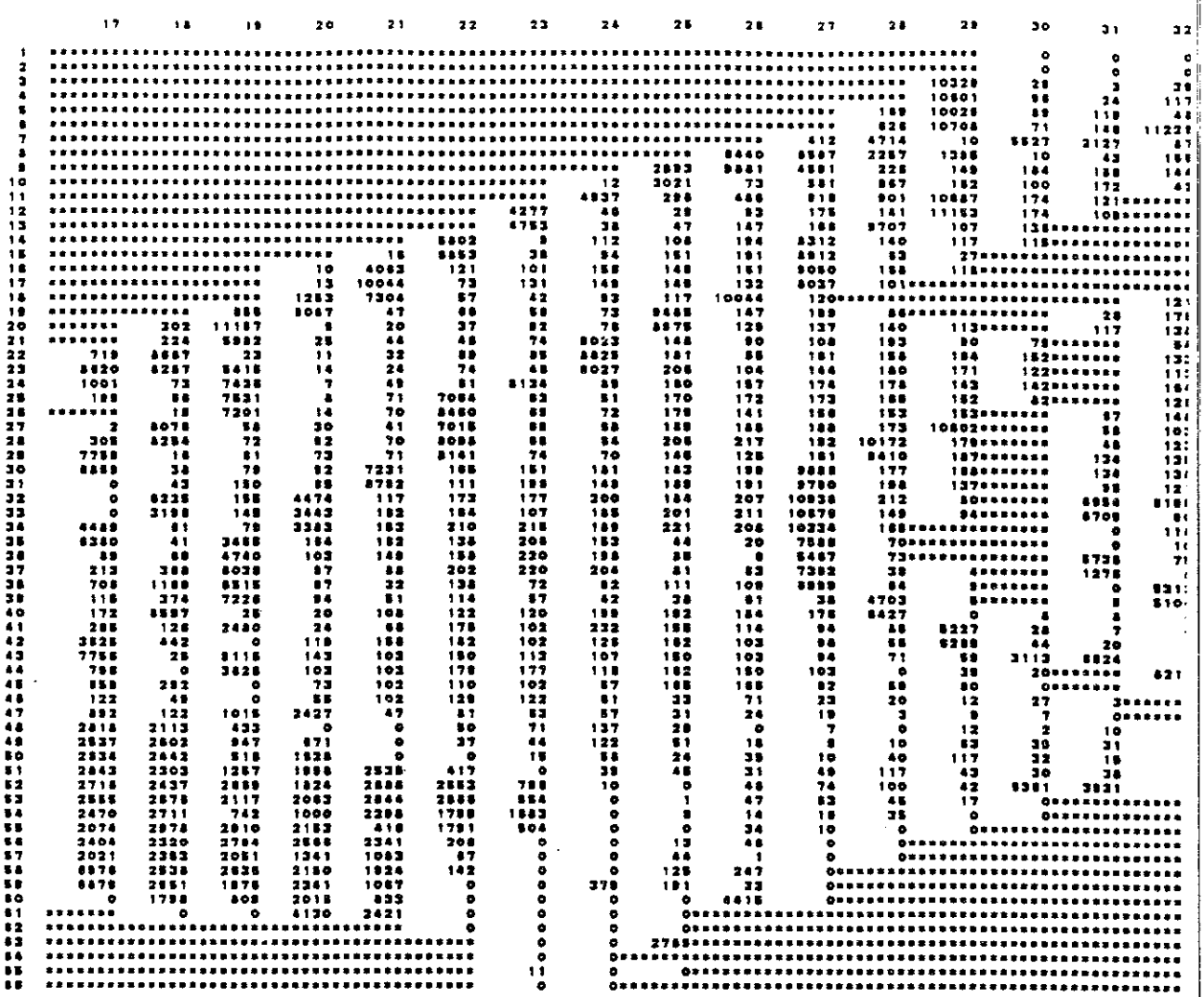
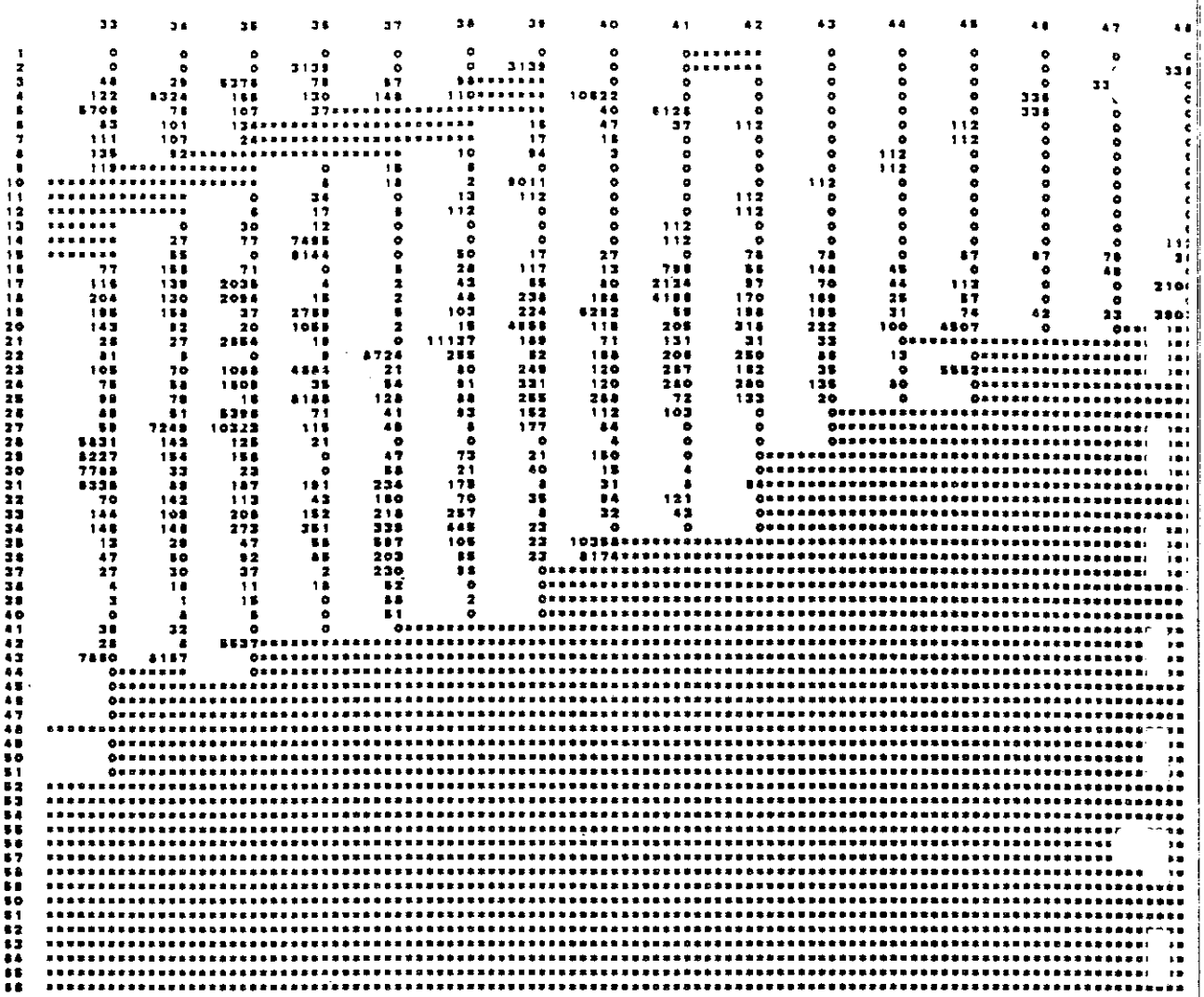
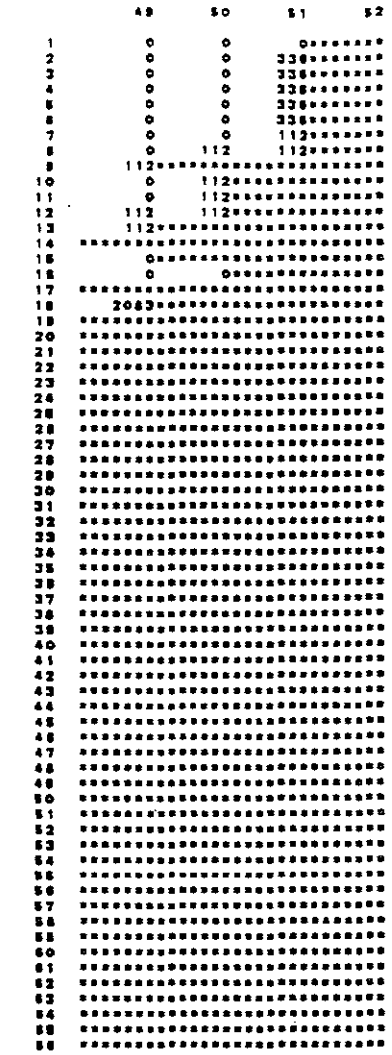
18																
19																
20																
21																
22															1883	
23																8112
24																450
25																
26																
27																
28																
29																
30															204	341
31														200	258	288
32													6133	1280	150	141
33											155	318	817	9582	7901	0
34								0	121	383	418	515	381	386	17	
35								116	483	467	435	741	526	883	18	
36								147	242	273	370	871	827	1158	13	
37							325	115	184	548	828	187	1213	475	1441	
38							104	158	87	122	787	481	474	282	8153	
39							0	40	77	288	784	861	895	788	5844	
40							17	18	138	212	720	862	1111	1108	17	
41							570	824	817	588	294	208	300	0	12	
42		102	609	8821	348	888	961	782	781	695	1853	833	655	181	14	
43	0	0	208	583	7583	11745	844	878	703	633	1441	933	575	883	8	
44	0	0	88	802	274	755	8673	782	770	877	787	982	883	1287	838	
45	0	328	483	807	772	841	12444	707	581	1345	471	815	893	843		
46	0	188	448	898	808	842	873	8781	783	818	1288	1732	1048	811		
47	2428	708	728	848	883	888	888	880	7618	880	877	1481	1233	12		
48	2082	1184	482	883	888	838	888	871	8878	827	2836	2788	2			
49	3408	1382	827	478	721	831	813	800	8214	828	2877	1812	2	8		
50	3858	878	288	887	781	788	1088	888	2867	1381	2778	1787	2	7		
51	1428	400	228	218	823	862	818	885	1881	2802	8003	2818	2898			
52	8884	188	844	818	733	880	820	1907	8084	2883	2331	2834				
53	804	881	848	874	828	880	788	754	1388	5038	2423	2878				
54	3808	8881	283	482	721	820	520	484	3803	2488	8					
55	844	8000	312	1020	131	548	0	3814	1903	8						
56	8888	8038	841	818	588	31	8878	1								
57	8881	8881	804	808	381	7										
58	3848	8287	887	811												
59	8187	4308	3387													
60																
61																
62																
63																
64																
65																
66																

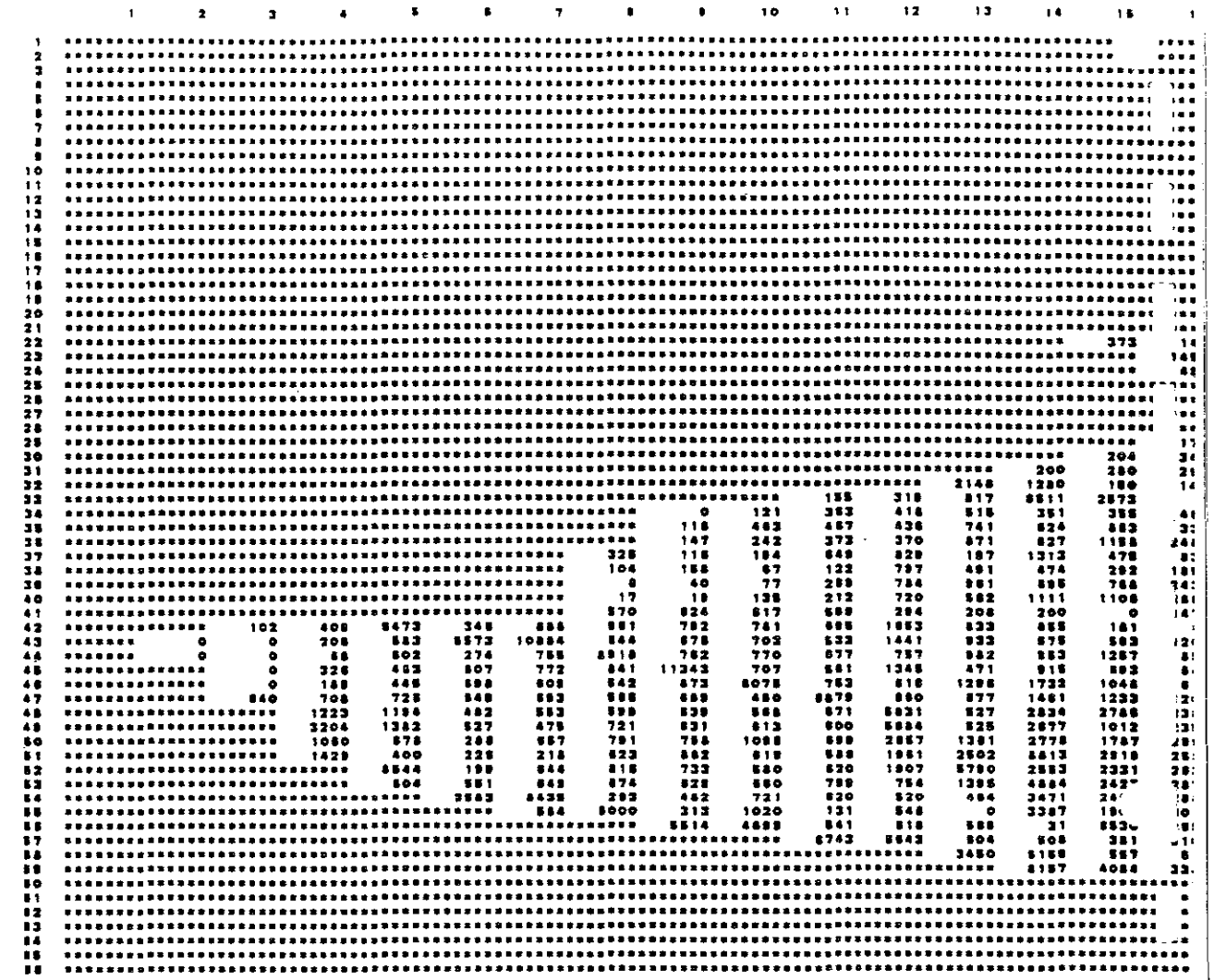


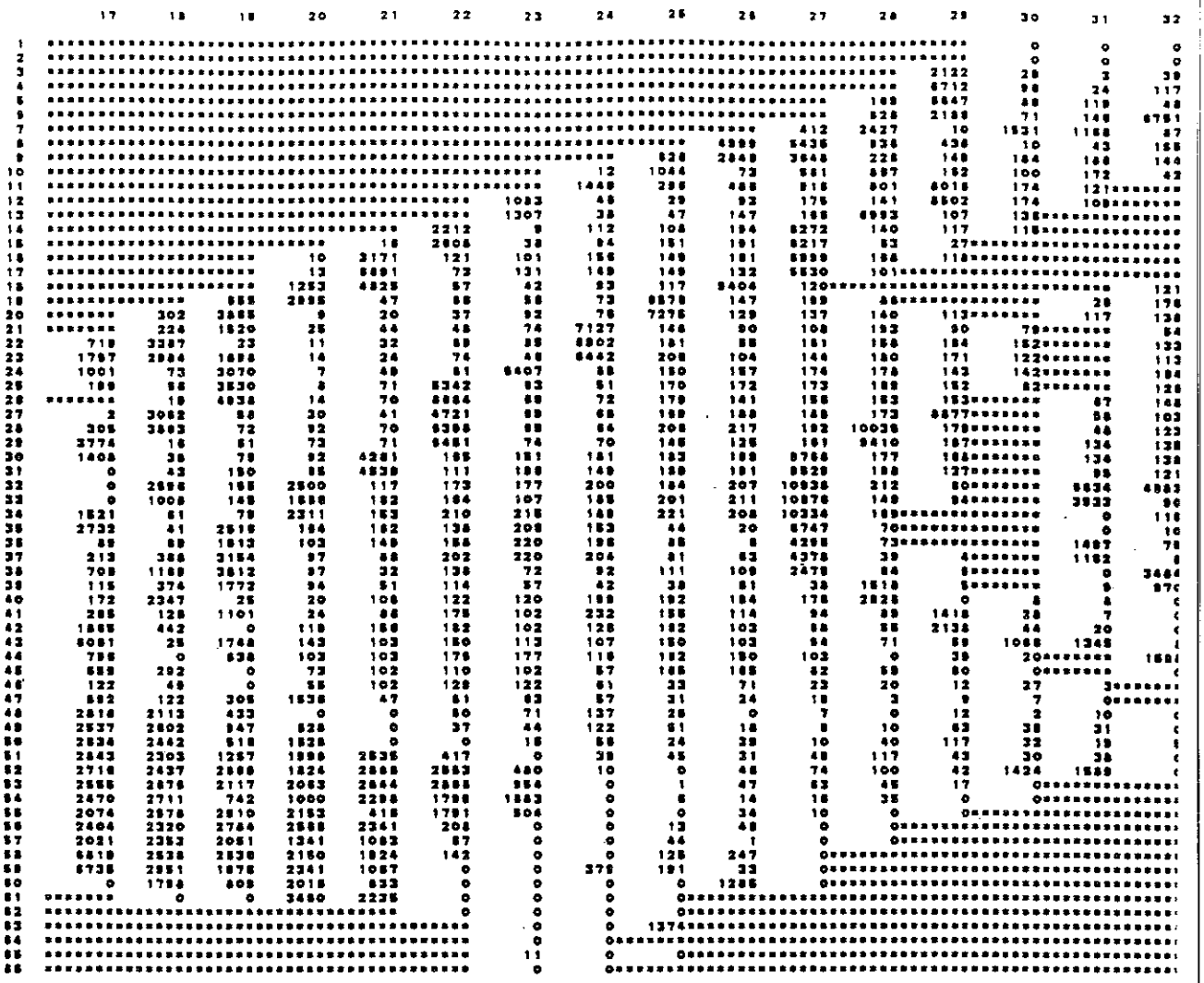


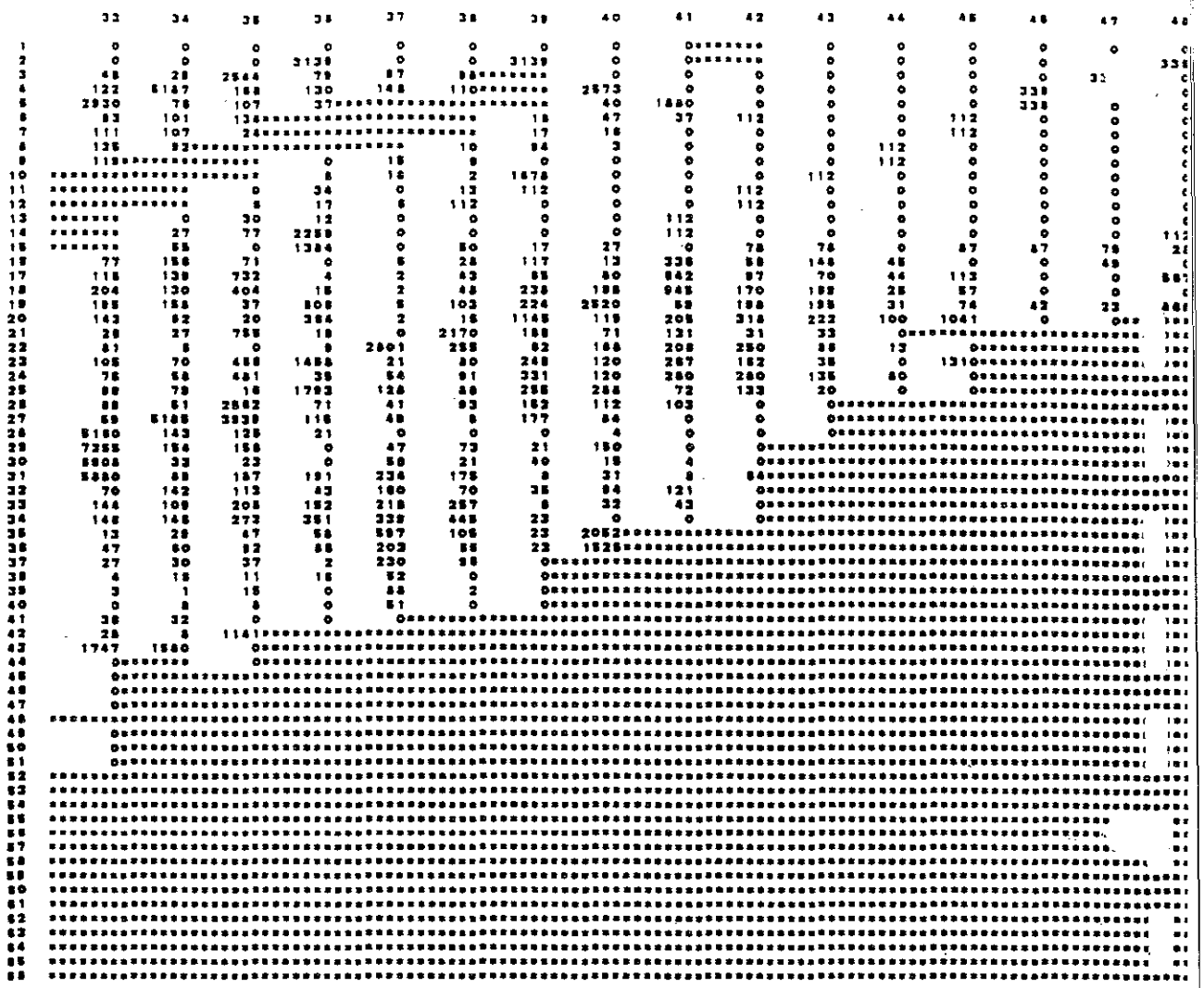


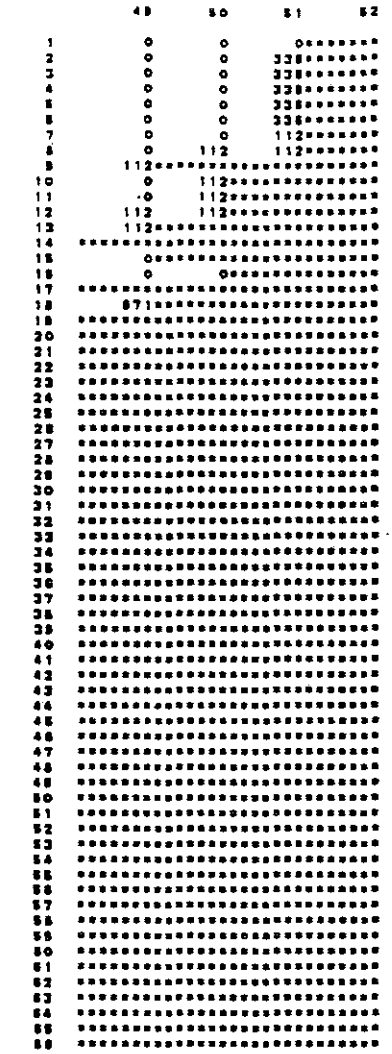
SCALAR TOTSW SMA2030 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1991458

MATRIX SSSW SUB1880 SURFACE WATER (ACRE-FT PER YEAR)



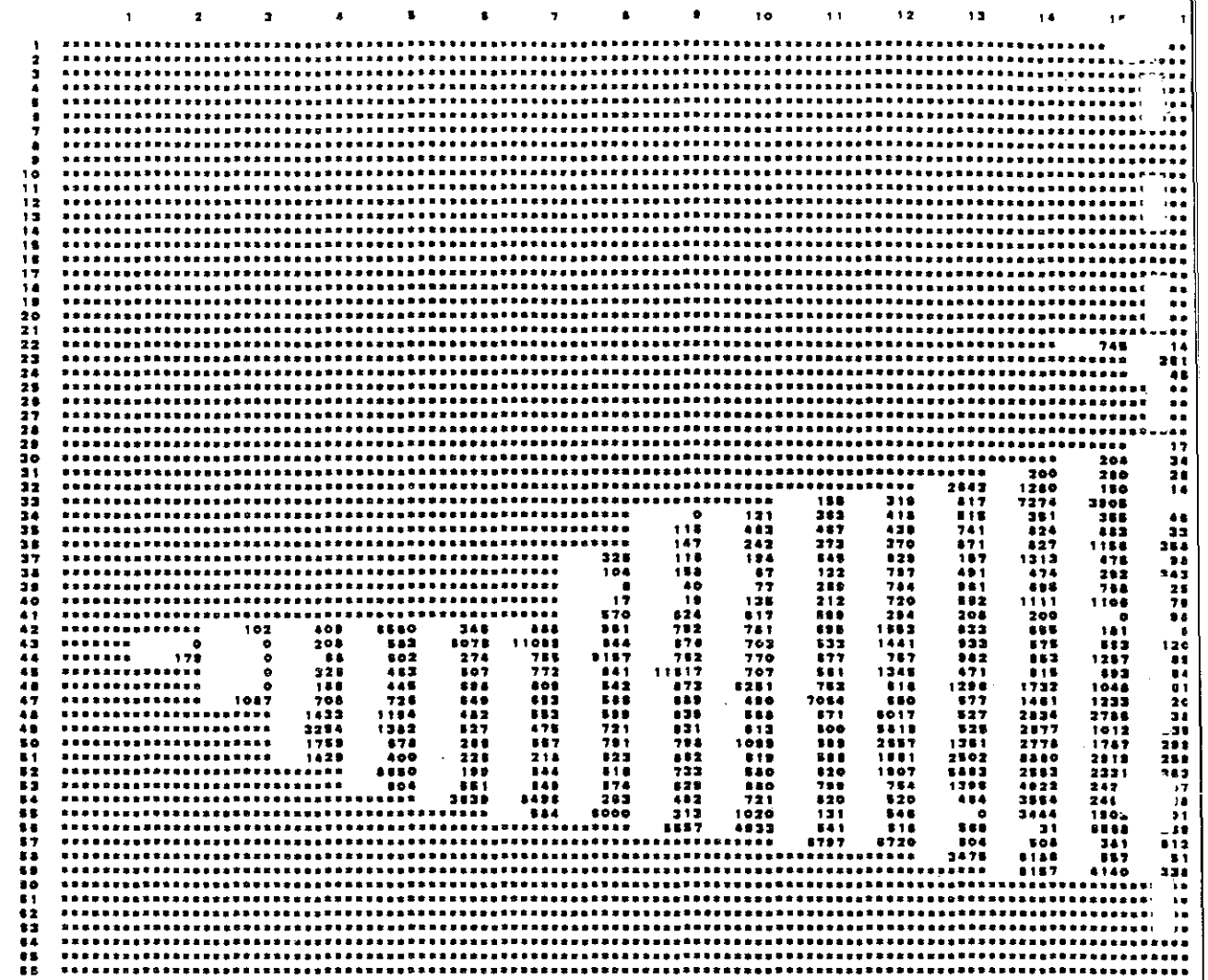


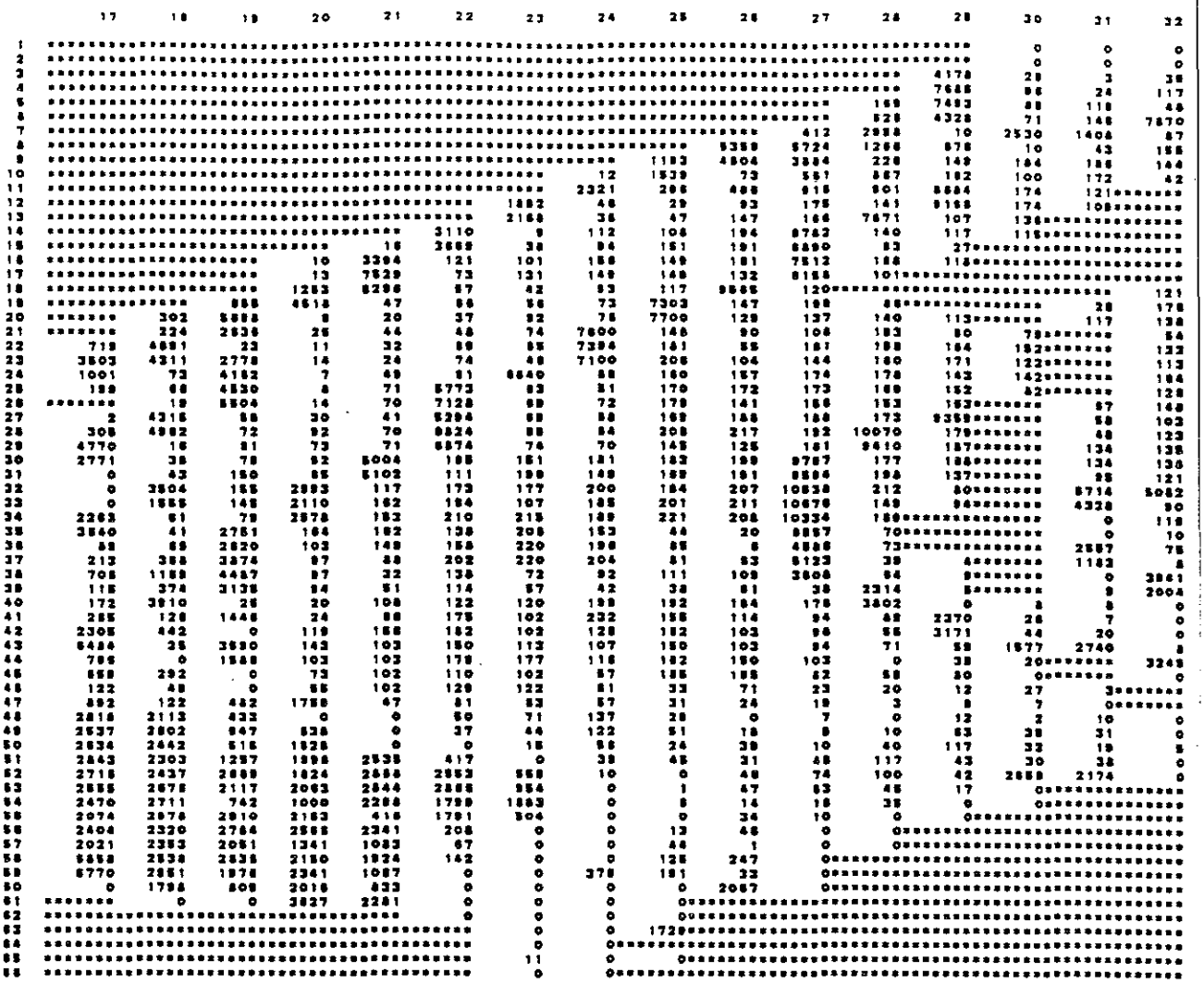




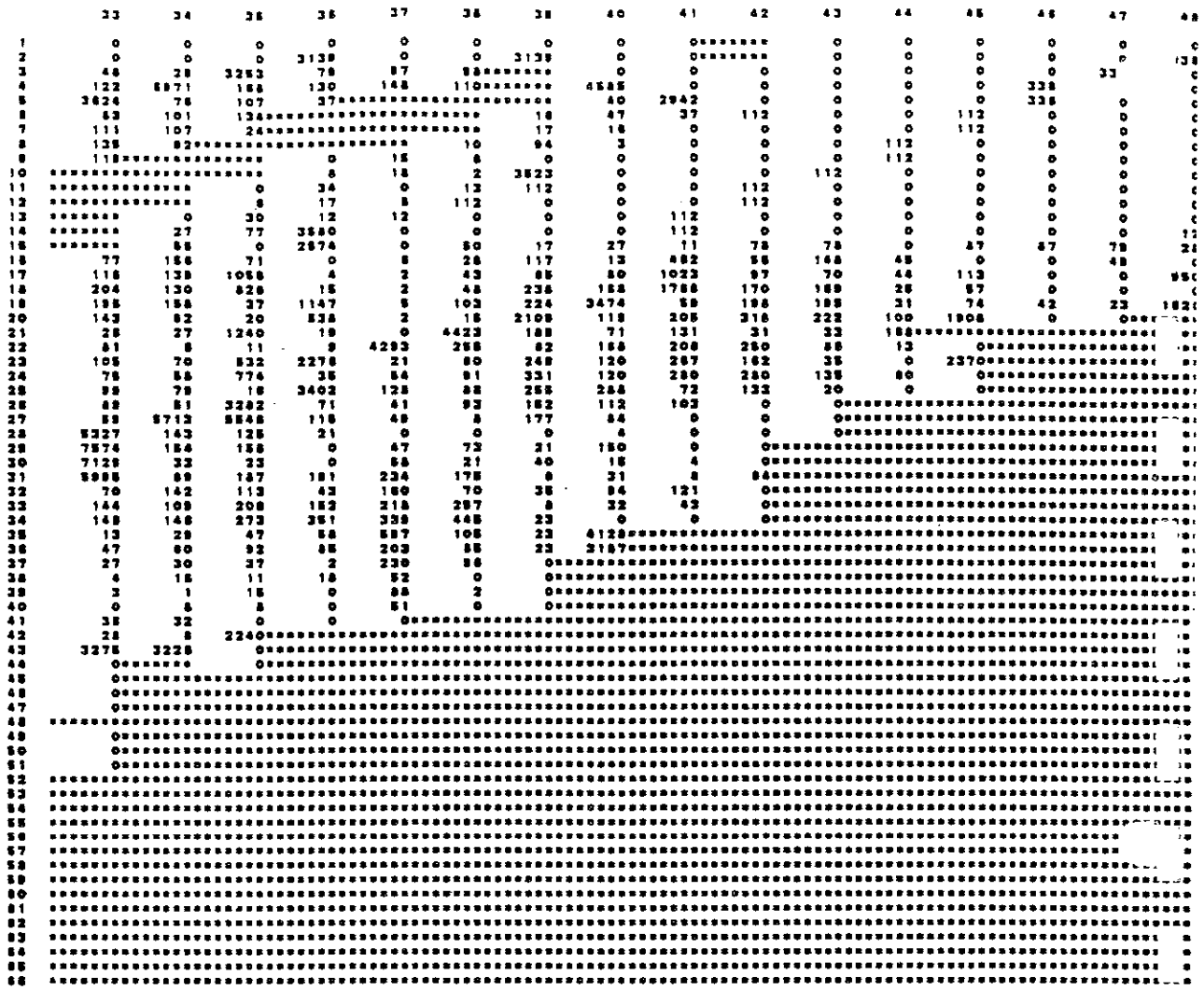
SCALAR TOTSW SUB1990 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1172537

MATRIX SSSW SUB2000 SURFACE WATER (ACRE-FT PER YEAR)





	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1														0	0	0
2														0	0	0
3													4178	29	3	38
4													7685	96	24	117
5												169	7483	88	118	46
6												828	4328	71	148	7870
7											412	2988	10	2530	1406	87
8									5358	5724	1266	878	10	10	43	155
9								1183	4804	3884	228	149	184	184	188	144
10							12	1539	73	561	867	182	100	100	172	42
11							2321	288	488	818	901	8884	174	174	121	
12						1883	48	29	93	178	141	9188	174	174	108	
13						2168	38	47	147	188	7871	107	136			
14					3110	9	112	108	194	8762	140	117	118			
15					3888	38	84	151	191	8890	83	27				
16				10	3394	121	101	158	148	181	7812	188	118			
17				13	7529	73	131	148	148	132	8188	101				
18				1283	8298	87	42	83	117	9888	120					121
19			888	4618	47	88	58	73	7303	147	188	88			28	178
20		302	5888	8	20	37	82	78	7700	128	137	140	113		117	138
21		224	2838	25	44	48	74	7800	148	90	108	183	80	78		84
22	718	4881	23	11	32	88	85	7384	141	55	181	188	184	182		122
23	3503	4311	2778	14	26	74	48	7100	208	104	144	180	171	122		113
24	1001	73	4182	7	48	81	8640	88	180	157	178	178	142	142		184
25	188	88	4530	8	71	5773	83	81	170	172	173	188	152	82		128
26		18	5504	14	70	7128	88	72	178	141	188	183	182		87	148
27	2	4318	88	30	41	5284	88	88	188	188	188	173	9358		88	103
28	308	4982	72	92	70	8824	88	84	208	217	192	10070	178		48	123
29	4778	18	81	73	71	8874	74	70	148	128	181	8418	187		134	138
30	2771	38	78	82	5004	188	181	181	182	198	8787	177	188		134	138
31	0	43	158	88	5102	111	188	148	188	181	8884	198	137		88	121
32	0	3884	188	2883	117	173	177	200	184	207	10838	212	80		8714	5082
33	0	1888	148	2118	182	184	187	188	201	211	10878	148	88		4328	88
34	2283	81	78	2878	182	218	218	188	221	208	10334	188			8	118
35	3848	41	2781	184	182	138	208	183	44	28	8887	78			8	18
36	88	88	2828	183	148	158	228	198	88	8	4888	73			2887	78
37	213	388	3874	87	88	282	228	284	81	83	8123	38	4		1183	8
38	788	1188	4487	87	22	138	72	92	111	188	3888	84	8		8	3841
39	118	374	3138	84	81	114	87	42	38	81	38	2314	8		8	2884
40	172	3818	28	28	188	122	128	188	182	184	178	3882	8	8	8	8
41	288	128	1448	24	88	178	182	232	188	114	84	88	2278	28	7	8
42	2388	442	8	118	188	182	182	128	182	188	88	88	3171	44	28	8
43	8488	28	3838	148	188	188	118	187	188	188	84	71	88	1877	2748	8
44	788	8	1888	188	188	178	177	118	182	188	188	8	38	28		3248
45	888	282	8	78	182	118	182	87	188	188	82	88	88	8		8
48	122	48	8	88	182	128	122	81	33	71	23	28	12	27	3	
47	882	122	482	1788	47	81	83	87	31	24	18	3	8	7	8	
48	2818	2118	488	8	8	88	71	137	28	8	7	8	12	2	18	8
48	2837	2882	847	838	8	37	44	122	81	18	8	18	83	38	31	8
58	2834	2442	818	1828	8	8	18	88	24	38	18	48	117	33	18	8
51	2843	2383	1287	1888	2538	417	8	38	48	31	48	117	43	38	38	8
52	2718	2437	2888	1824	2888	2883	888	18	8	48	74	188	42	2888	2174	8
53	2888	2878	2117	2883	2844	2888	884	8	1	47	83	48	17	8		
54	2478	2711	742	1888	2288	1788	1883	8	8	14	18	38	8	8		
58	2874	2878	2818	2183	418	1781	884	8	8	34	18	8	8			
58	2484	2328	2784	2888	2341	288	8	8	8	13	48	8	8			
57	2821	2383	2881	1341	1883	87	8	8	8	48	1	8	8			
58	8858	2838	2838	2188	1824	142	8	8	8	128	247	8				
58	8778	2881	1878	2341	1887	8	8	8	378	181	32	8				
88	8	1788	888	2818	833	8	8	8	8	8	2887	8				
81		8	8	3827	2281	8	8	8	8	8	8	8				
82						8	8	8	8	8	8	8				
83						8	8	8	8	172	8	8				
84						8	8	8	8	8	8	8				
85						11	8	8	8	8	8	8				
88						8	8	8	8	8	8	8				



	49	50	51	52
1	0	0	0	
2	0	0	336	
3	0	0	336	
4	0	0	336	
5	0	0	336	
6	0	0	336	
7	0	0	112	
8	0	112	112	
9	112			
10	0	112		
11	0	112		
12	112	112		
13	112			
14				
15	11			
16	0	0		
17				
18	1024			
19				
20				
21				
22				
23				
24				
25				
26				
27				
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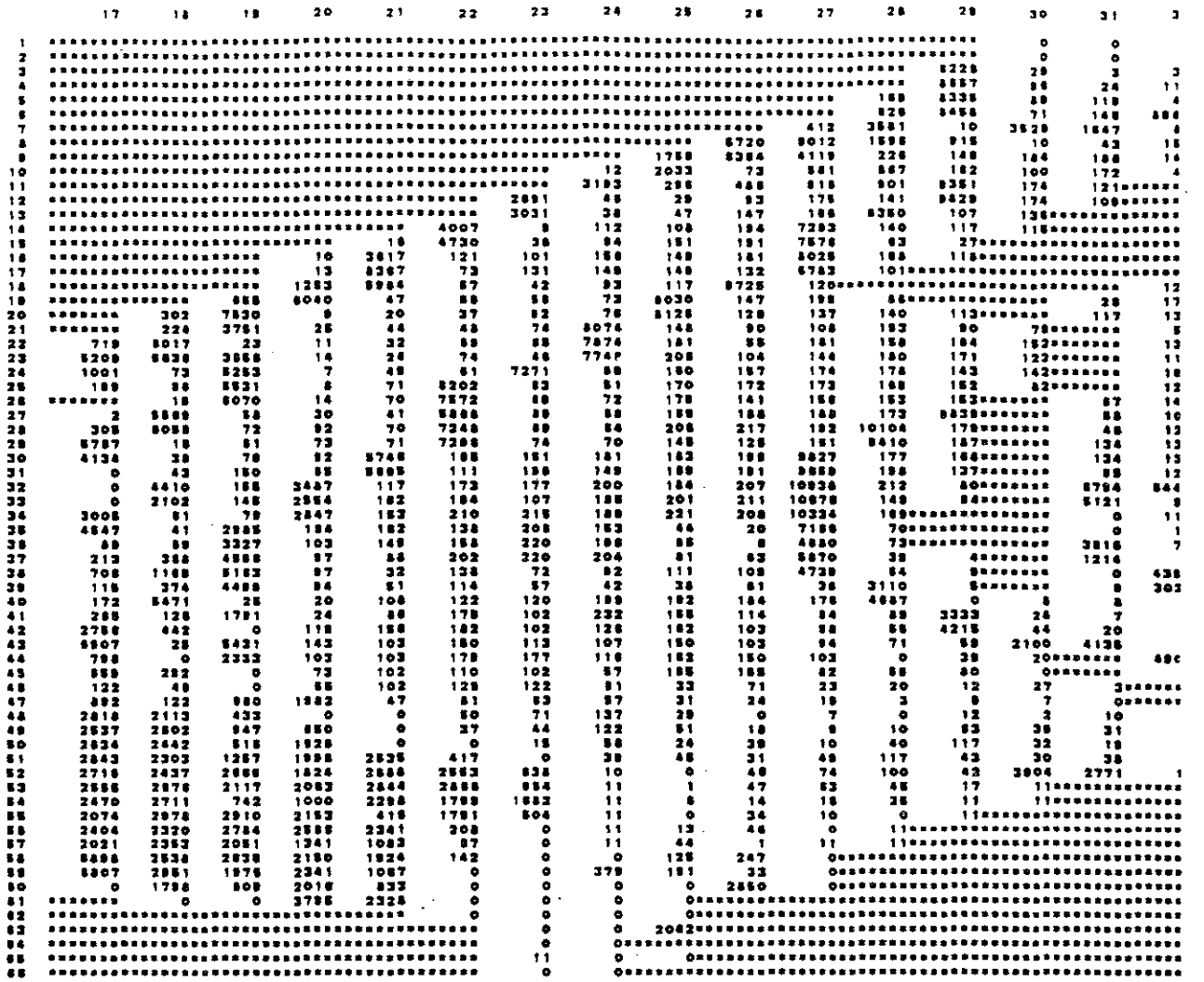
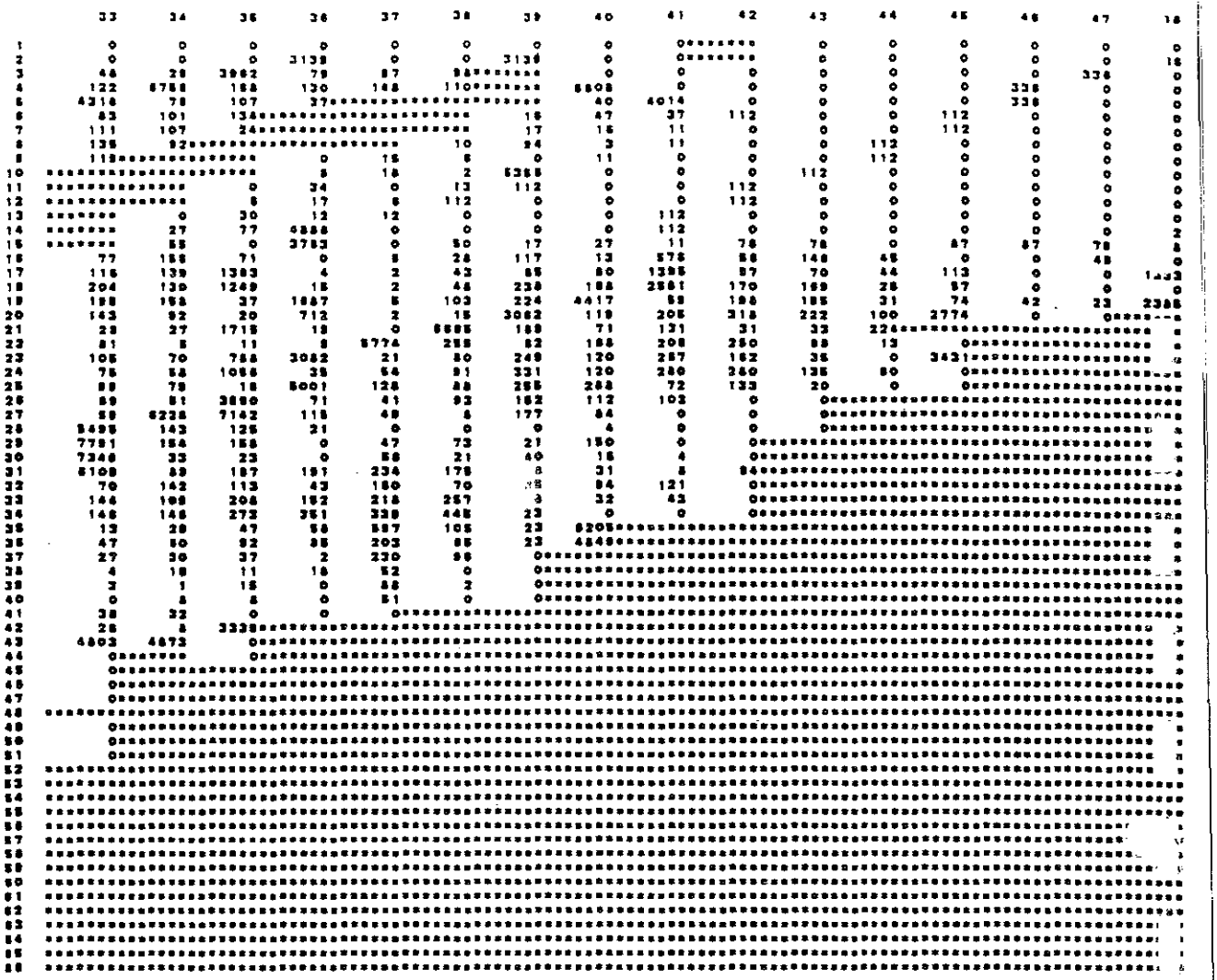
66				

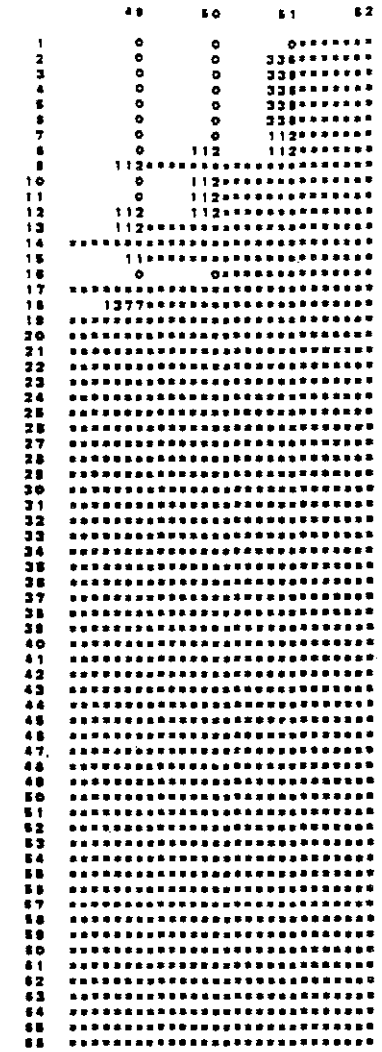
SCALAR TOTSW SUB2000 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1302336

MATRIX SSSW SUB2010 SURFACE WATER (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22															1116	148
23																3784
24																486
25																
26																
27																
28																
29																171
30															204	341
31														200	280	281
32													3138	1280	150	141
33											185	318	817	8035	5237	0
34									0	121	382	418	516	351	358	187
35									118	482	467	438	741	824	883	438
36									147	242	373	370	871	827	1156	4886
37								325	118	194	849	829	197	1313	475	1137
38								104	158	87	122	787	491	474	292	5024
39								8	40	77	288	784	881	895	788	181
40								17	18	138	212	720	882	1111	1108	111
41								570	828	817	588	284	208	200	0	181
42			102	408	8647	348	888	881	782	781	885	1882	832	889	181	84
43		0	0	208	583	8878	11315	844	878	703	532	1441	833	878	883	1208
44	288	0	0	88	802	274	788	9387	782	778	877	787	882	983	1287	884
45			0	328	483	807	772	841	11883	707	881	1348	471	918	893	843
46			0	188	448	888	809	842	873	8428	783	818	1288	1732	1048	811
47			1834	708	728	848	883	868	888	480	7248	888	877	1481	1232	483
48			1842	1184	482	883	888	838	888	871	8284	827	2834	2788	182	
49			3384	1382	827	478	721	831	813	888	8848	825	2877	1813	888	
50			2459	878	288	857	791	788	1888	888	2887	1381	2778	1787	2881	
51			1428	488	228	218	823	882	818	848	1981	2582	8888	2818	2884	
52				8784	188	844	818	732	888	828	1887	8838	2883	2331	2834	
53				884	881	848	874	828	888	788	784	1388	4881	2427	78	
54					3884	8858	283	482	721	828	838	484	3837	2481	88	
55						884	8888	313	1828	131	848	0	3881	1883	-18	
56							8888	8888	841	818	888	21	8884	81		
57								8888	8888	8852	8787	884	888	381	8184	
58												3488	8213	887	811	
59													8187	4188	3387	
60																
61																
62																
63																
64																
65																
66																







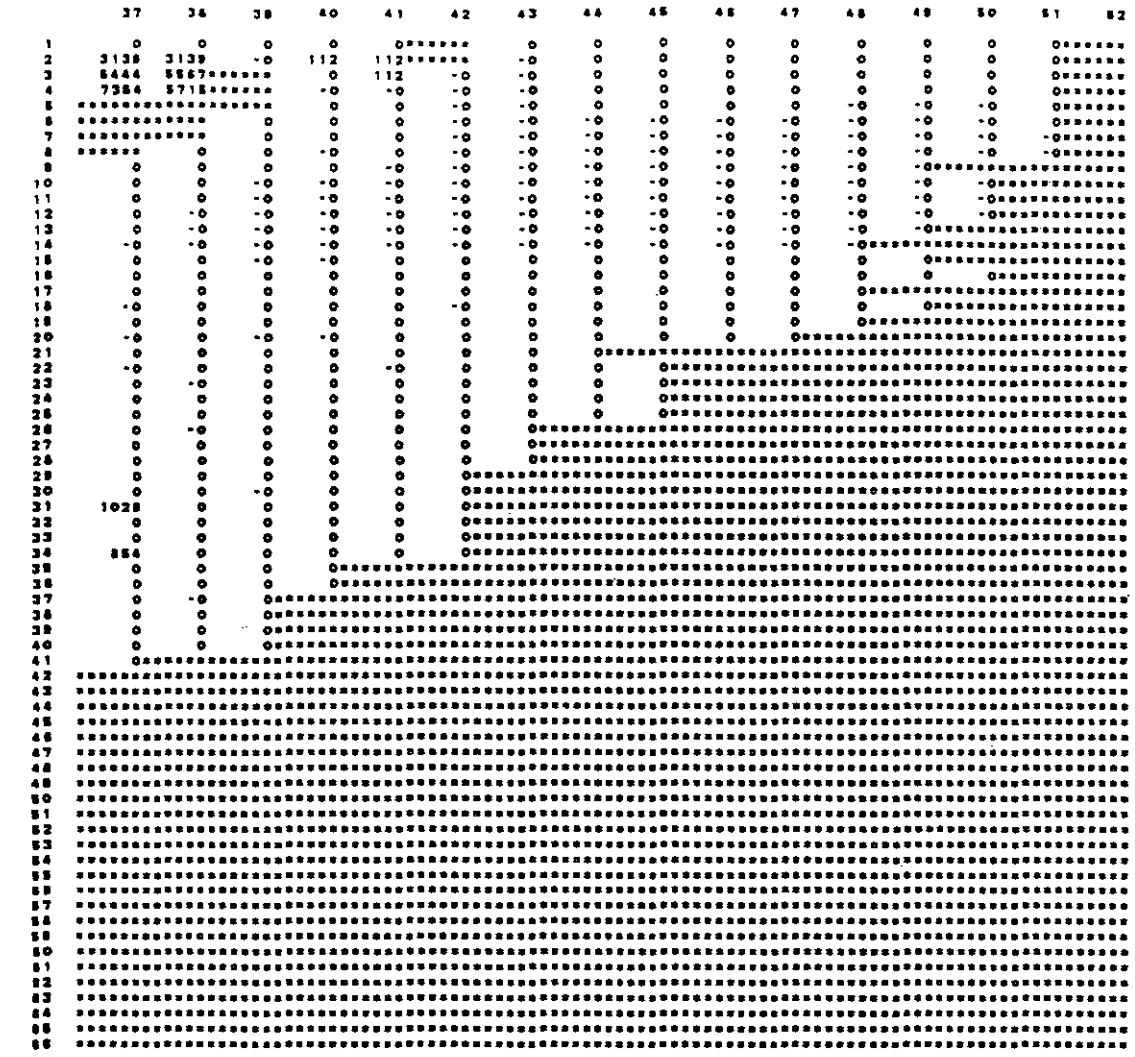
SCALAR TOTSW SUB2010 TOTAL SURFACE WATER (ACRE-FT PER YEAR) = 1433134

APPENDIX C

Unsatisfied Annual Demand (Additional Water Needed)
of Agricultural, Municipal and Industrial Users
for Alternative Scenarios in Five Decades
(parts a, b, and c in each strategy)

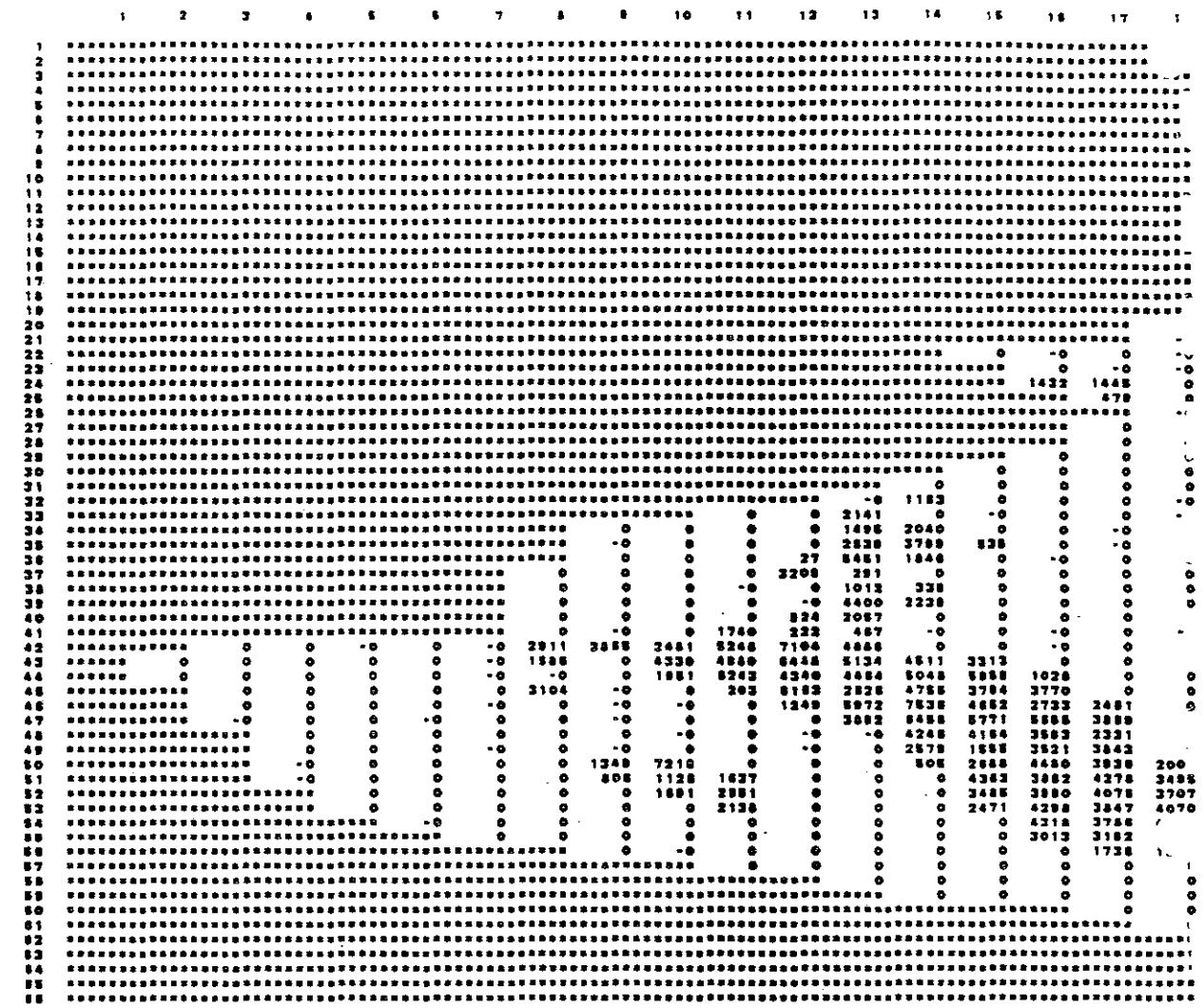
MATRIX ZUT CMA1990 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

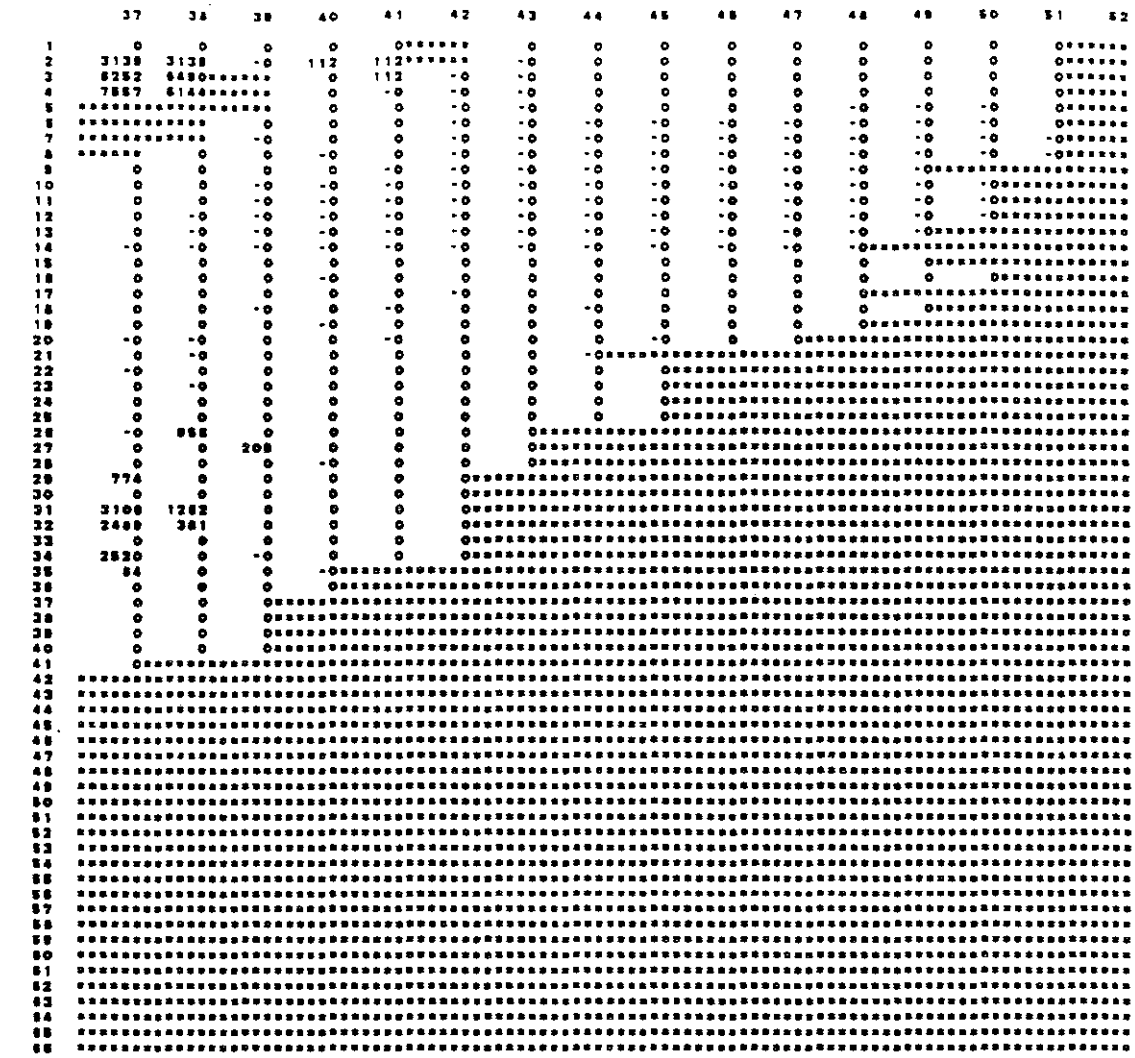
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22															0	0	0	0
23																0	0	0
24																253	251	0
25																	0	0
26																		0
27																	0	-0
28																	0	-0
29																-0	0	0
30															0	0	-0	0
31														-0	0	0	0	0
32													-0	1273	0	0	0	-0
33											0	0	2020	0	-0	0	0	0
34									0	0	0	0	888	1253	0	0	-0	0
35									0	0	0	0	2258	3688	578	0	-0	-0
36									0	0	0	0	5127	1654	0	0	0	0
37								0	0	0	0	2108	0	0	0	0	0	0
38								0	0	-0	-0	0	0	0	0	0	0	0
39								0	0	0	0	-0	2823	1483	0	-0	0	0
40								0	0	0	0	0	1131	0	0	-0	-0	0
41								0	-0	0	2314	0	0	0	0	-0	0	0
42			0	0	-0	-0	-0	3187	4182	3810	1751	7754	4537	882	0	-0	0	0
43		0	0	0	0	0	-0	1788	0	4883	5153	8883	4917	3941	3150	0	0	0
44		0	0	0	0	0	-0	-0	0	2809	5806	4072	4724	4928	5184	448	0	0
45			0	0	0	0	0	3084	-0	0	736	5458	2488	4868	3842	3500	0	0
46			0	0	0	0	-0	0	0	-0	-0	1881	6273	8172	4847	2918	1667	0
47			0	0	0	0	0	0	-0	0	0	0	3546	8941	6012	5878	3388	0
48				-0	0	0	0	0	0	-0	0	-0	-0	5029	4940	4241	3421	0
49				-0	0	0	-0	0	-0	0	-0	-0	0	3451	1818	4177	4523	-0
50				0	0	0	0	0	2990	8158	0	0	-0	1800	3177	5314	4872	3417
51				-0	0	0	0	0	2285	1920	2717	-0	0	0	5178	4804	5055	4110
52					0	0	0	0	0	2727	3817	0	0	0	4134	4887	4824	4382
53					0	0	0	0	0	457	3868	0	0	0	3800	5098	4548	4780
54						-0	0	0	0	0	0	0	0	0	0	5122	4428	4851
55							0	0	0	0	0	-0	0	0	0	5288	3723	5293
56								0	0	0	0	0	0	0	0	338	2302	3414
57											0	0	0	0	0	0	0	-0
58													-0	0	0	0	0	0
59														0	0	0	0	-0
60																	0	0
61																		0
62																		
63																		
64																		
65																		
66																		



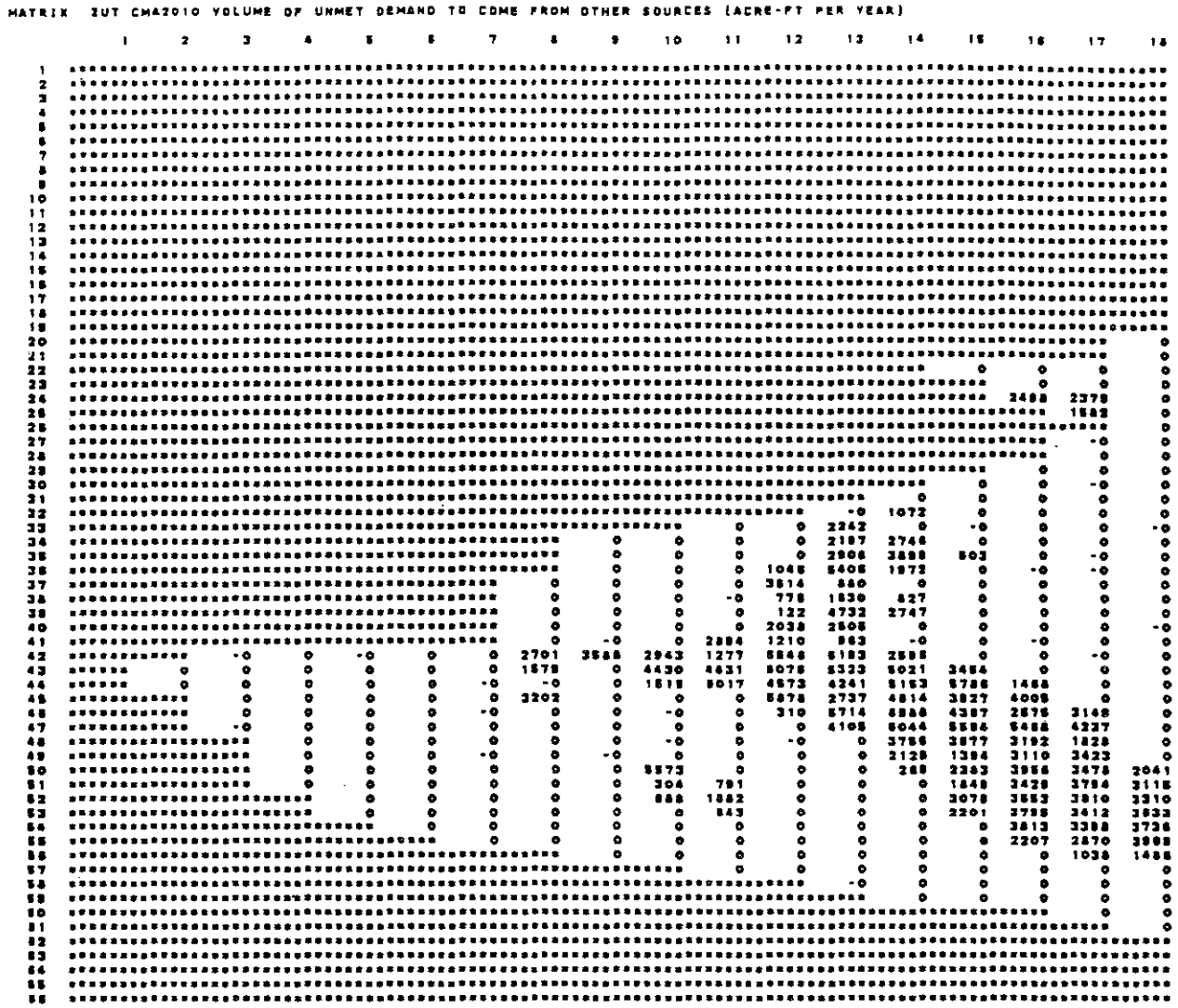
SCALAR ZUTT CMA1990 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACAE-FT PER YEAR) = 718832

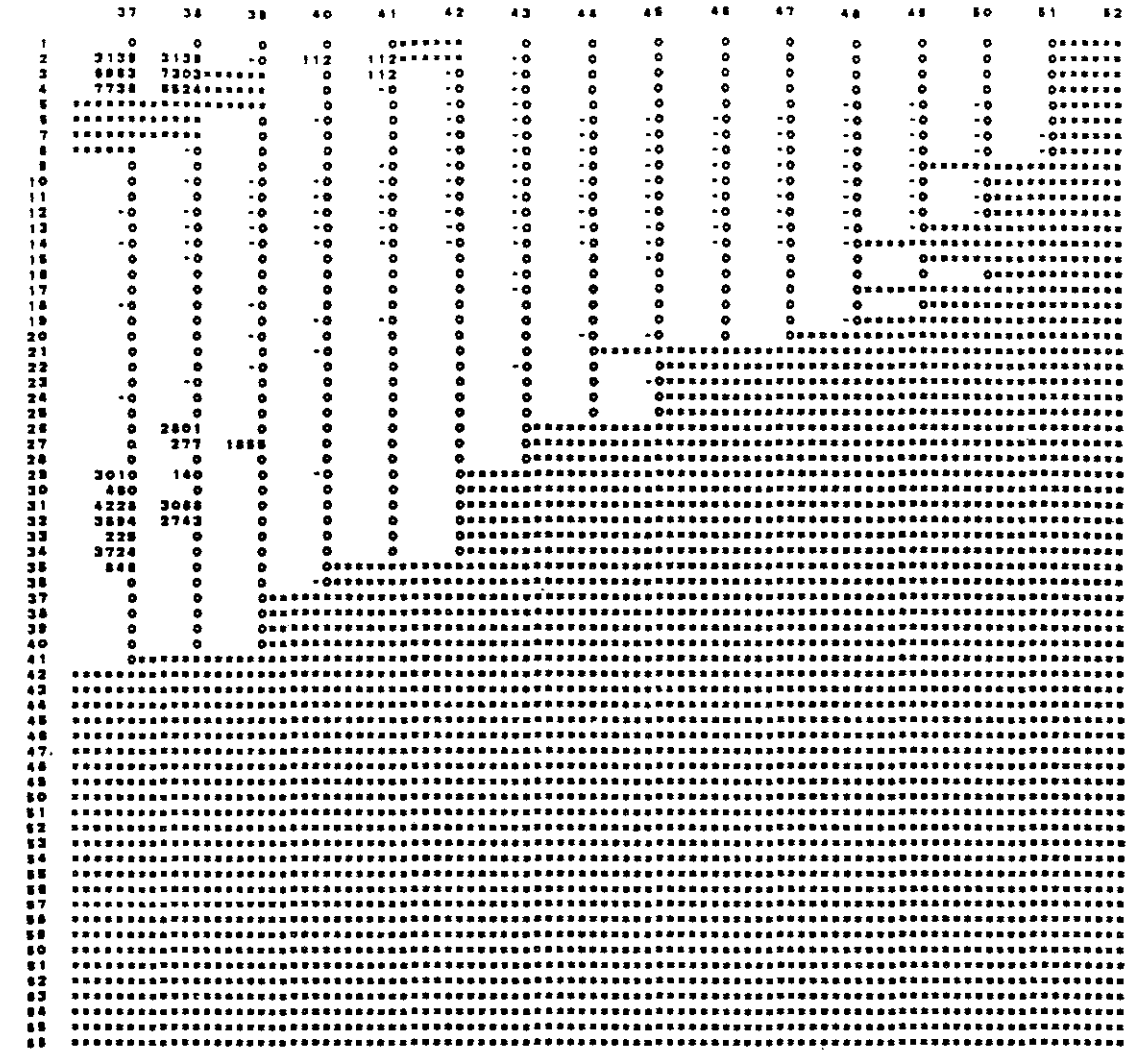
MATRIX IUT CMA3000 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)





SCALAR ZUTT CMA2000 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 893848

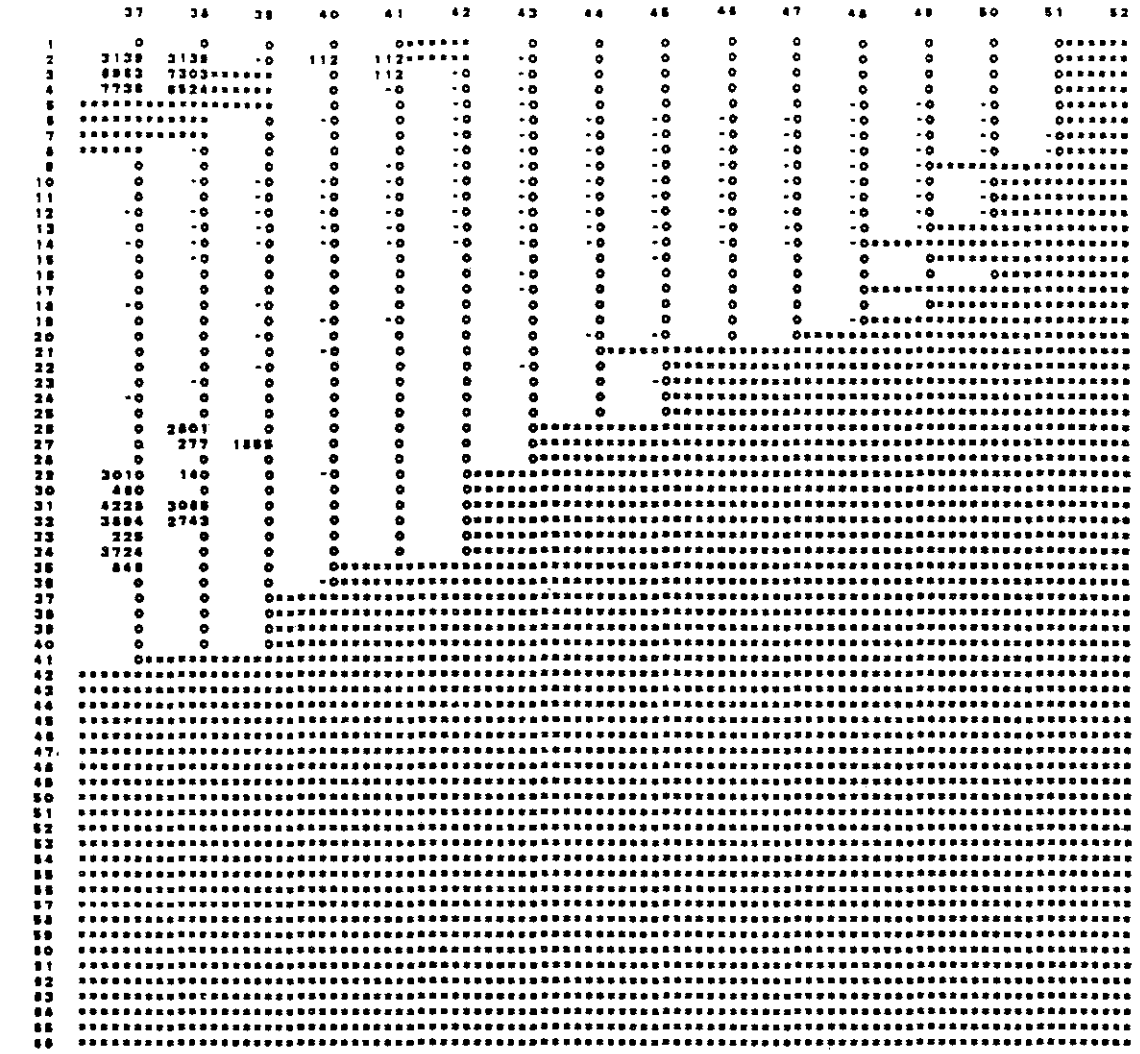

MATRIX 2UT CMA2010 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18



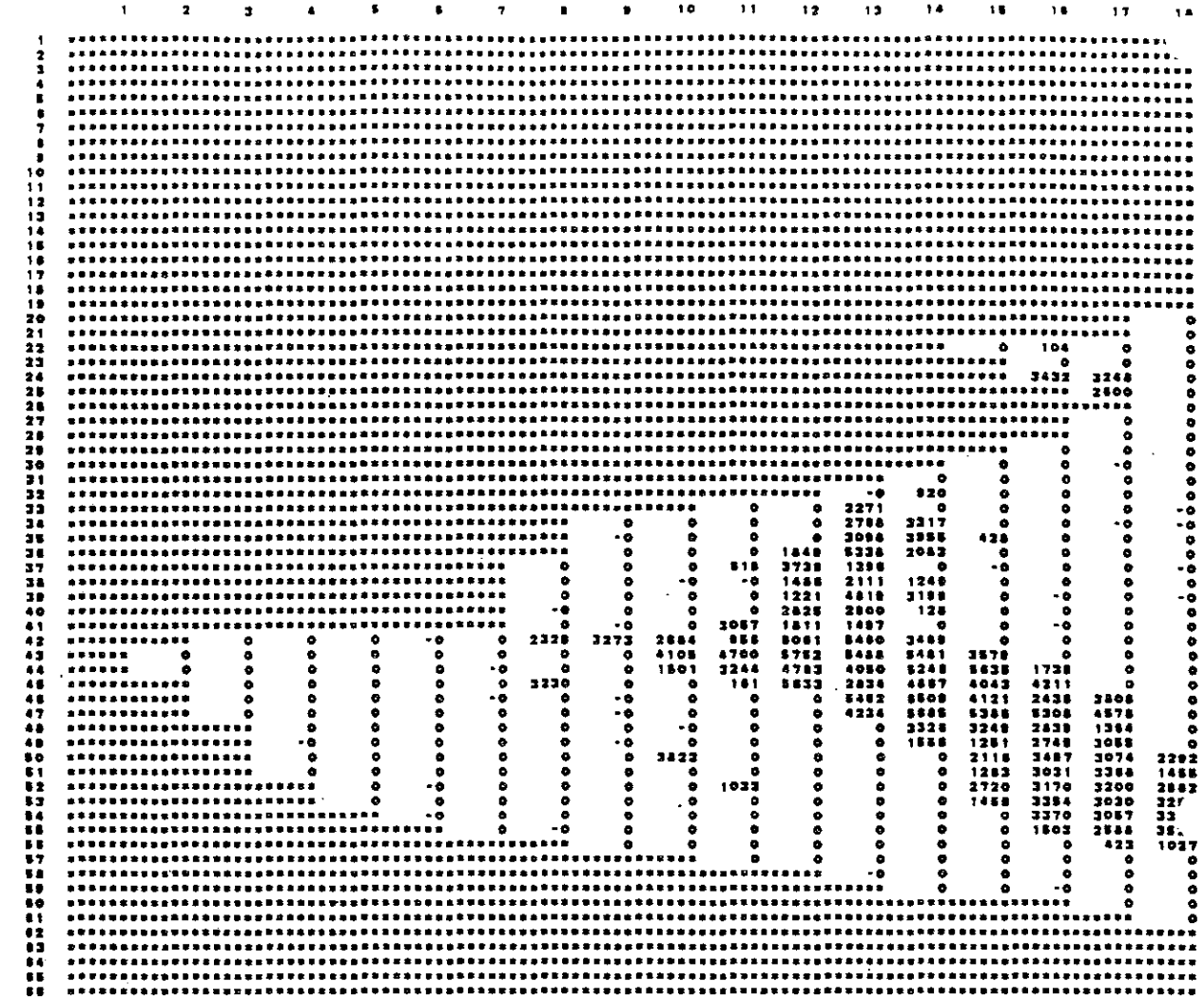
SCALAR ZUTT CMA2010 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 719033

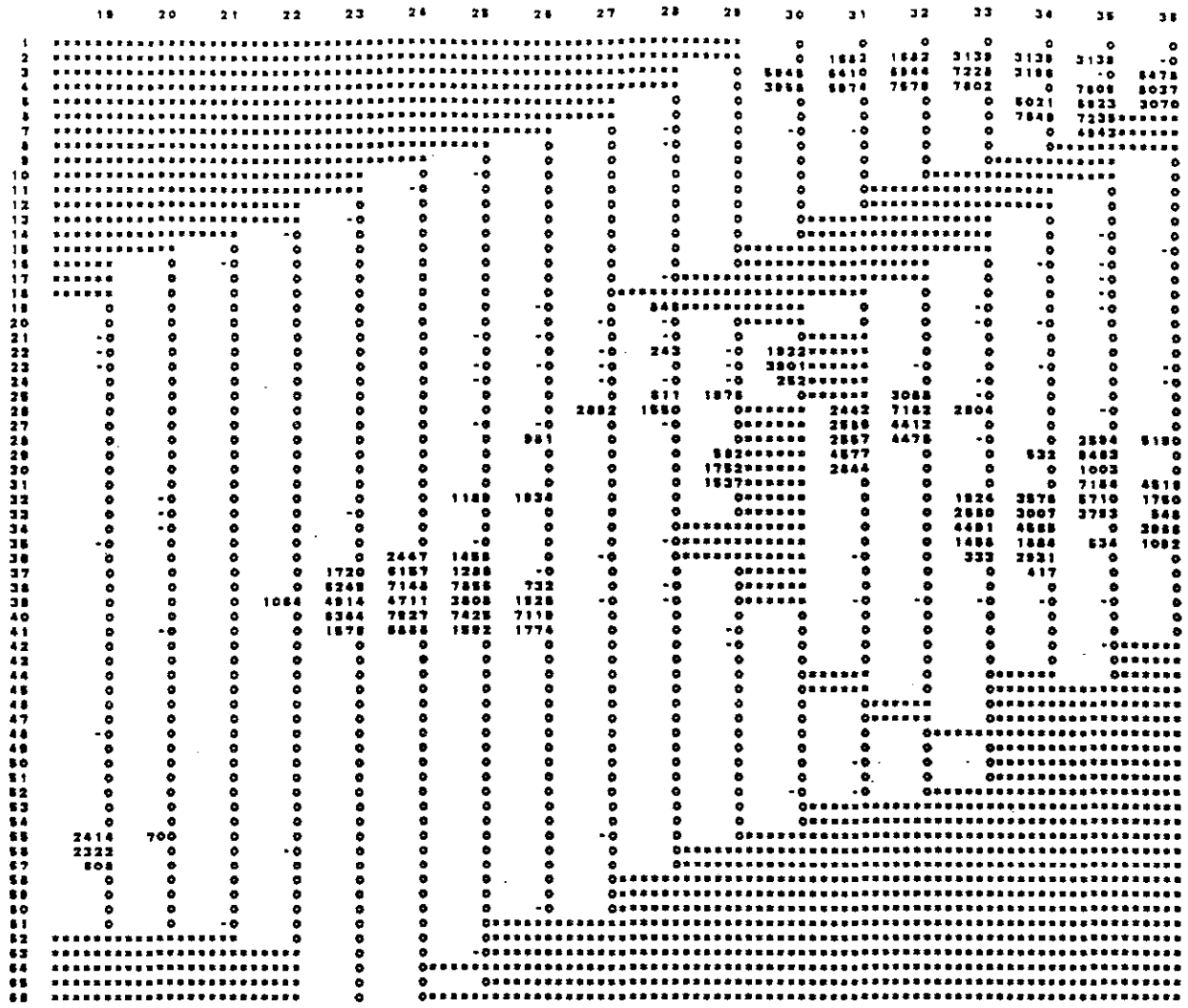
MATRIX ZUT CMA2020 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

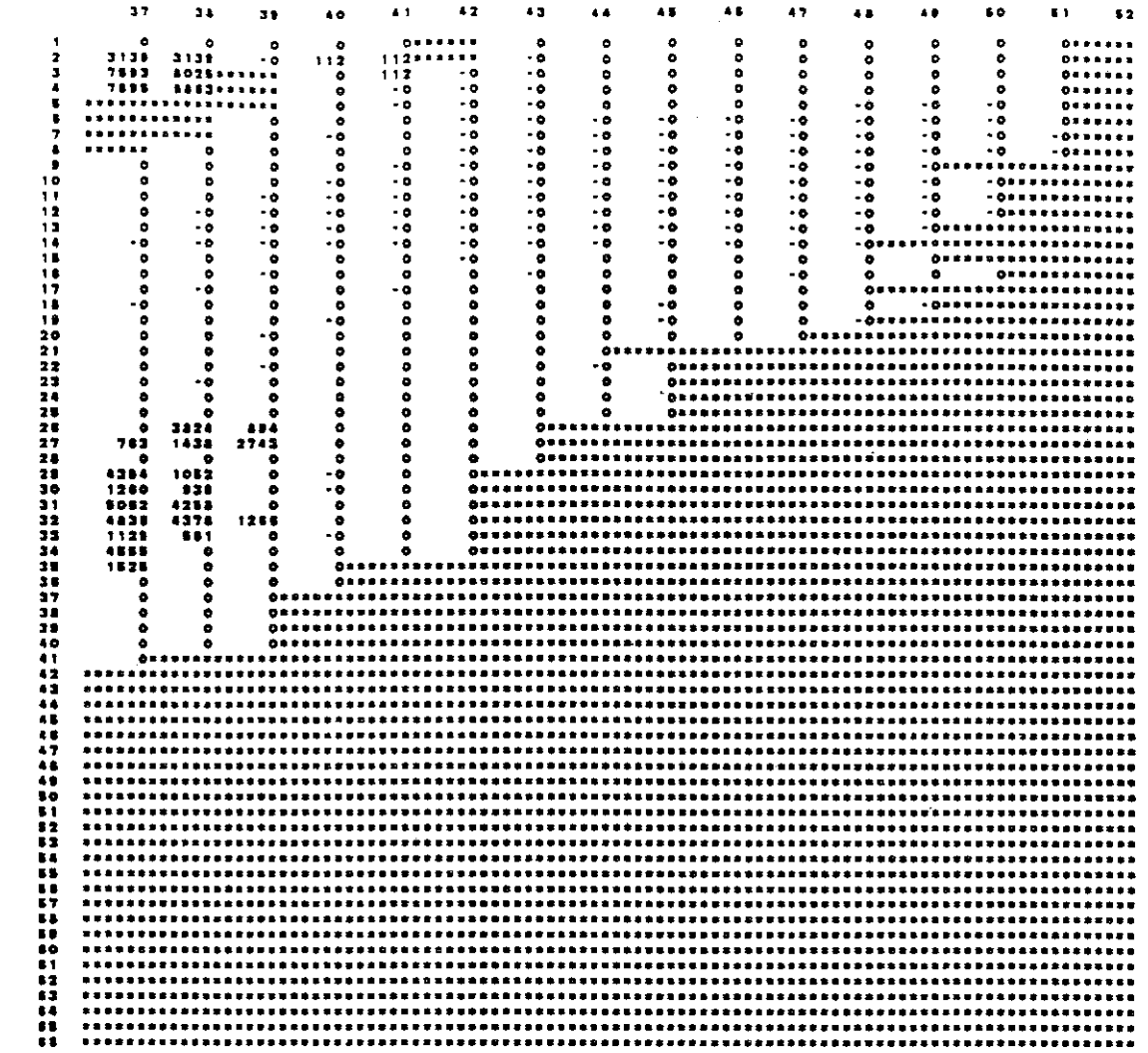
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22															0	104	0	0
23																0	0	0
24																3432	3248	0
25																	2800	0
26																		0
27																	0	0
28																	0	0
29																0	0	0
30															0	0	-0	0
31														0	0	0	0	0
32													-0	820	0	0	0	0
33										0	0	2271	0	0	0	0	0	-0
34								0	0	0	0	2788	3317	0	0	0	-0	-0
35								-0	0	0	0	3088	3885	428	0	0	0	0
36								0	0	0	1848	5338	2083	0	0	0	0	0
37							0	0	0	818	3738	1388	0	-0	0	0	0	-0
38							0	0	-0	-0	1486	2111	1248	0	0	0	0	0
39							0	0	0	0	1221	4818	3188	0	-0	0	0	-0
40							-0	0	0	0	2825	2800	128	0	0	0	0	0
41							0	-0	0	3057	1811	1497	0	0	-0	0	0	0
42		0	0	0	-0	0	2328	3273	2884	856	8081	5480	3485	0	0	0	0	0
43	0	0	0	0	0	0	0	0	4105	4700	5752	5488	5481	3578	0	0	0	0
44	0	0	0	0	0	-0	0	0	1501	3244	4783	4050	5246	5838	1738	0	0	0
45		0	0	0	0	0	3230	0	0	181	5833	2826	4857	4043	4211	0	0	0
46		0	0	0	0	-0	0	-0	0	0	0	5492	5508	4121	2436	3808	0	0
47		0	0	0	0	0	0	-0	0	0	0	4234	5888	5388	5308	4578	0	0
48		0	0	0	0	0	0	0	-0	0	0	0	3328	3248	2838	1384	0	0
49		-0	0	0	0	0	0	-0	0	0	0	0	1858	1251	2748	3058	0	0
50		0	0	0	0	0	0	3823	0	0	0	0	0	2118	3487	3078	2282	0
51		0	0	0	0	0	0	0	0	0	0	0	0	1283	3031	3368	1456	0
52		0	-0	0	0	0	0	0	1032	0	0	0	0	2720	3170	3200	2982	0
53		0	0	0	0	0	0	.0	0	0	0	0	1458	3384	3030	327	0	0
54		-0	0	0	0	0	0	0	0	0	0	0	0	0	3370	3057	33	0
55		0	-0	0	0	0	0	0	0	0	0	0	0	0	1502	2586	35	0
56		0	0	0	0	0	0	0	0	0	0	0	0	0	0	423	1027	0
57		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58		0	0	0	0	0	0	0	0	0	0	0	-0	0	0	0	0	0
59		0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	0	0
60		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



SCALAR ZUTT CMA2010 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 719033


MATRIX ZUT CMA2020 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

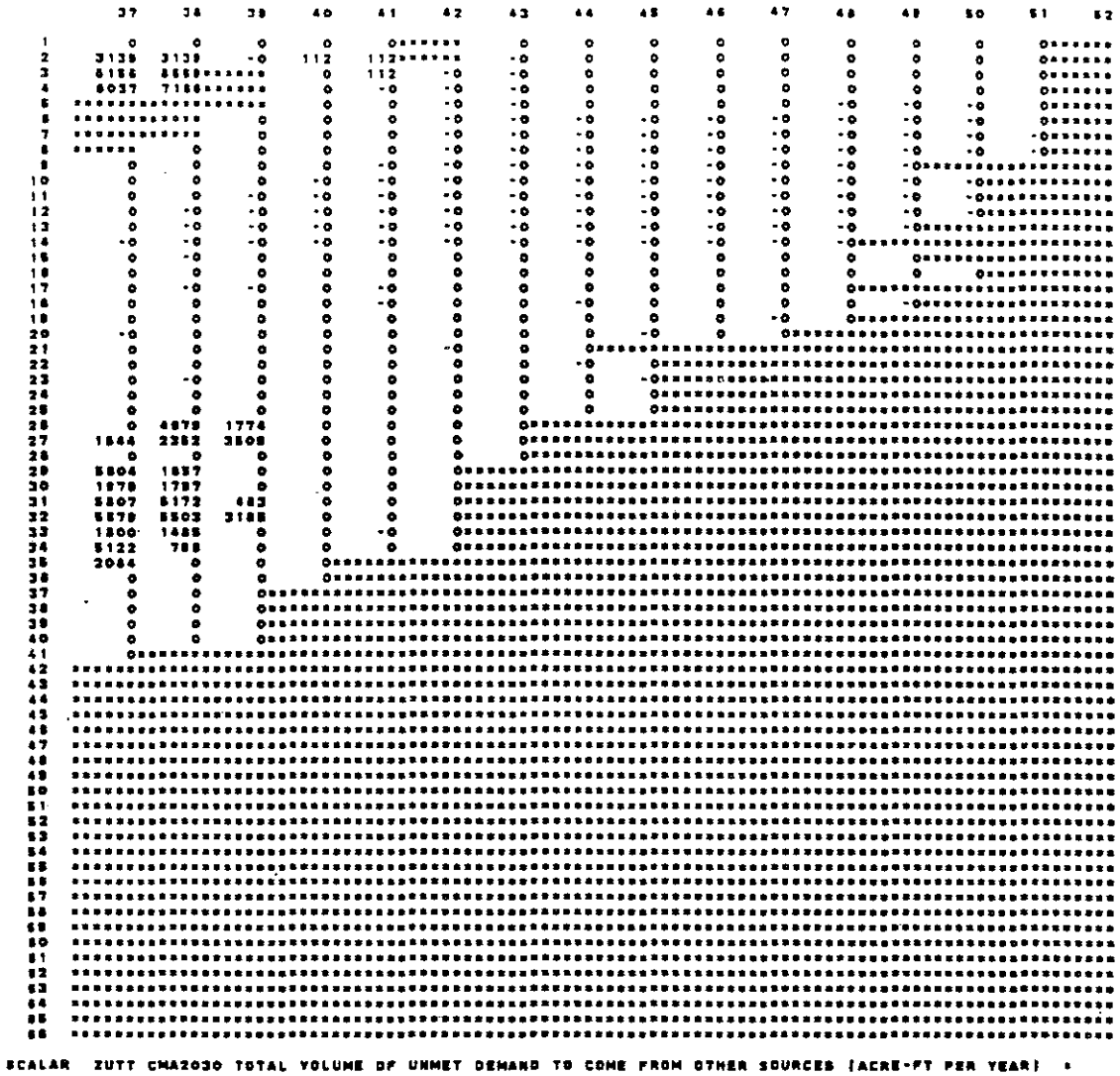




SCALAR ZUTT CMA2020 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 745536

MATRIX IUT CMA2030 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

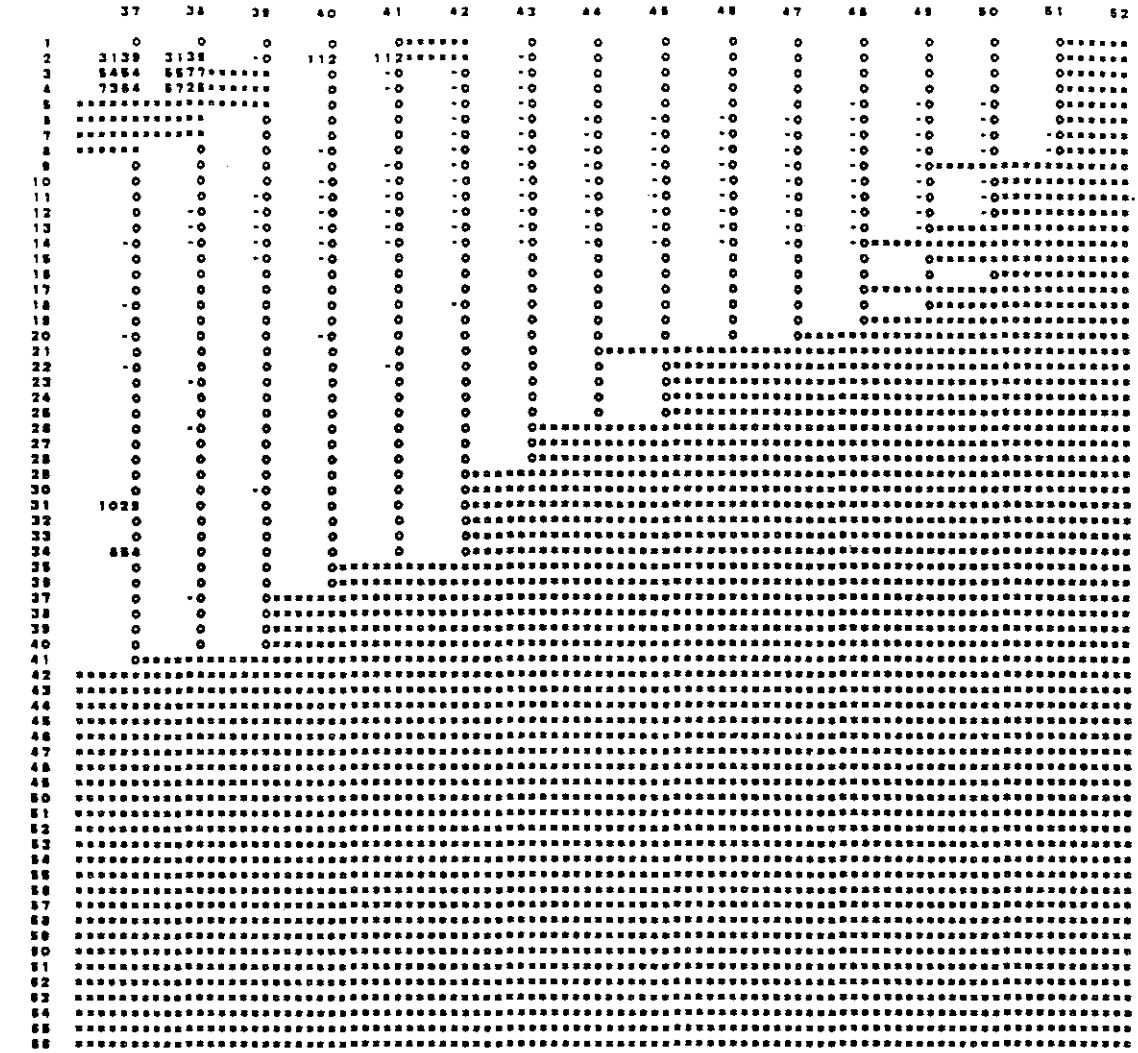
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
2	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
3	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
4	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
5	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
6	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
7	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
8	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
9	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
10	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
11	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
12	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
13	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
14	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
15	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
16	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
17	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
18	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
19	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
20	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
21	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
22	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	886	0	0
23	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0
24	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	4320	4091	0
25	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	3848	0
26	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
27	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
28	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
29	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0
30	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0
31	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	0
32	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	-0	844	0	0	0	0
33	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	2427	0	0	0	0	0
34	**********	**********	**********	**********	**********	**********	**********	**********	0	-0	0	0	3371	3838	0	0	-0	0
35	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	3350	4070	477	0	0	0
36	**********	**********	**********	**********	**********	**********	**********	**********	0	0	282	2897	5343	2187	0	0	0	0
37	**********	**********	**********	**********	**********	**********	**********	0	0	0	1245	3784	1852	0	-0	0	0	-0
38	**********	**********	**********	**********	**********	**********	**********	0	0	-0	1395	1738	2544	1838	0	0	0	0
39	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	2174	4811	3848	0	-0	-0	-0
40	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	3844	3174	422	0	0	-0	-0
41	**********	**********	**********	**********	**********	**********	**********	0	-0	0	3185	2351	1844	38	0	0	0	0
42	**********	481	0	0	0	0	2385	3183	2821	1177	6835	5885	5268	0	0	-0	0	
43	0	0	0	0	0	-0	1509	0	4348	4563	5468	6835	5803	3838	0	0	-0	
44	0	0	0	0	0	0	0	0	1388	2478	4871	3884	5328	5504	2081	0	0	
45	**********	0	-0	0	0	0	3518	0	0	188	5421	2921	4816	4148	4391	0	0	
46	**********	0	0	0	0	-0	0	0	0	0	0	5287	6088	3908	2318	4345	0	
47	**********	-0	0	0	0	-0	0	-0	0	0	0	4318	5370	5228	5186	4858	0	
48	**********	0	0	0	0	0	0	0	-0	0	0	0	2847	2671	2528	983	0	
49	**********	0	0	0	0	0	0	-0	0	-0	0	0	888	1123	2428	2728	0	
50	**********	0	0	0	0	0	0	0	2404	0	0	0	0	1880	3088	2718	2887	
51	**********	0	0	0	0	0	0	0	0	0	0	0	0	883	2880	2883	0	
52	**********	**********	0	0	0	0	0	0	0	80	0	0	0	2404	2831	2838	2670	
53	**********	**********	0	0	0	0	0	0	0	0	0	0	0	778	2885	2882	2912	
54	**********	**********	**********	0	0	0	0	0	0	0	0	0	0	0	2878	2756	3032	
55	**********	**********	**********	**********	0	0	0	0	0	0	0	0	0	0	843	2338	3127	
56	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	0	0	0	0	536	
57	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	-0	0	0	0	0	0	0	
58	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	-0	-0	0	0	0	
59	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	-0	0	0	
60	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	
61	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
62	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
63	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
64	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
65	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
66	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********



SCALAR ZUTT CMA2030 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) . 786085

MATRIX IUT CON1990 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

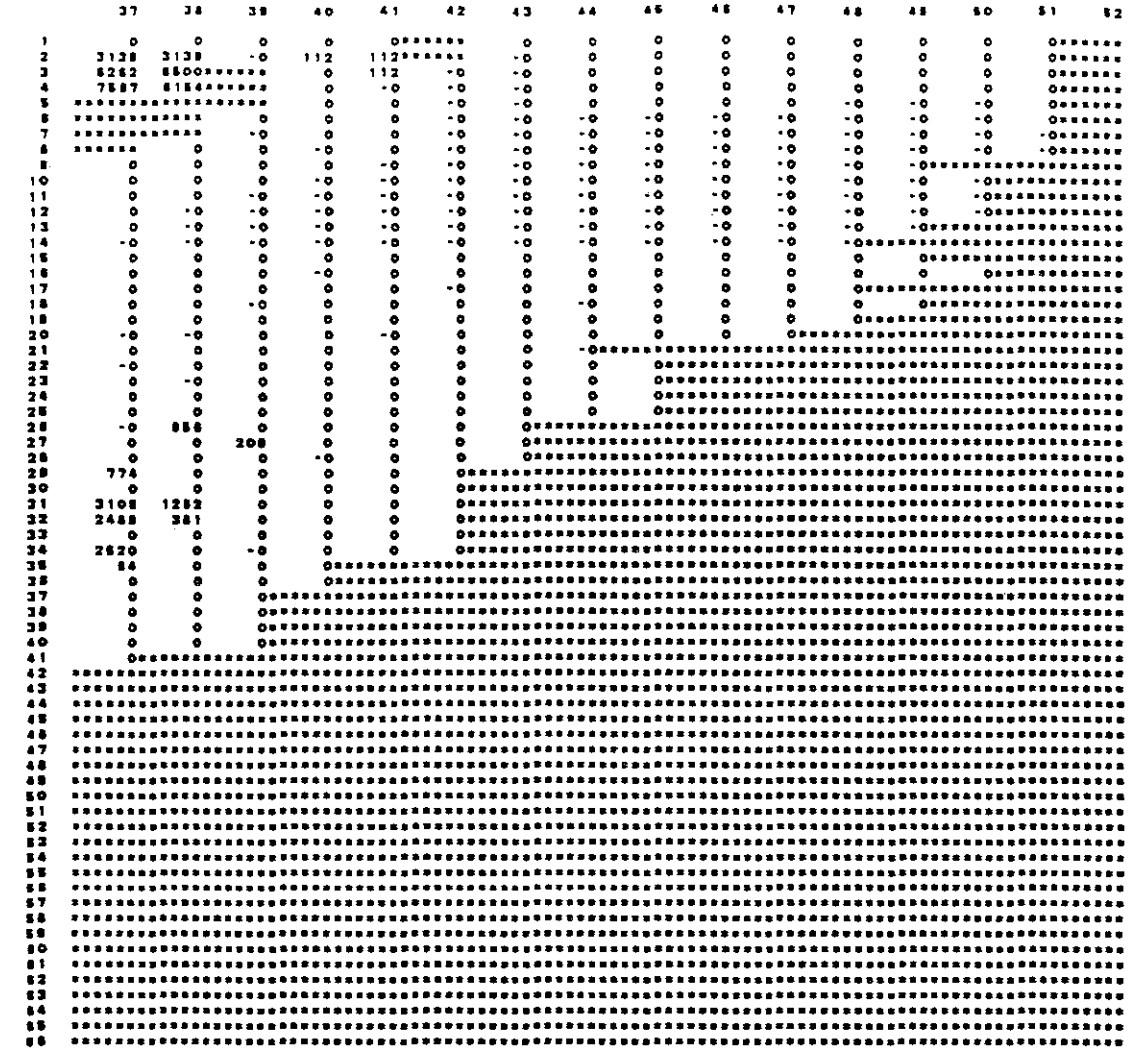
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22															0	0	0	0
23																0	0	0
24																220	238	0
25																	0	0
26																		0
27																	0	-0
28																	0	0
29																-0	0	0
30															0	0	0	0
31														-0	0	0	0	0
32												0	1248	0	0	0	0	0
33										0	0	1899	0	-0	0	0	0	0
34									0	0	0	688	1218	0	0	0	-0	0
35									0	0	0	2254	3888	868	0	0	-0	0
36									0	0	0	8127	1648	0	-0	0	0	0
37								0	0	0	0	2108	0	0	0	0	0	0
38								0	0	-0	-0	0	0	0	0	0	0	0
39								0	0	0	0	-0	3823	1802	0	0	0	0
40								0	0	0	0	0	1178	0	0	0	-0	0
41								0	-0	0	2317	0	0	0	0	0	0	0
42			0	0	-0	-0	-0	3184	4191	3610	1480	7784	4547	0	0	-0	0	0
43		0	0	0	0	-0	0	1748	0	4892	5130	8483	4917	4123	3150	0	-0	0
44		0	0	0	0	0	-0	-0	0	2817	5223	4072	4724	4828	4184	488	0	0
45			0	0	0	0	0	3038	0	0	788	6536	2498	4588	3642	3500	0	0
46			0	0	0	0	-0	0	0	-0	-0	1187	5313	5172	4887	2818	1884	0
47			-0	0	0	0	0	0	-0	0	0	0	3988	5981	5052	5878	2383	0
48				-0	0	0	0	0	0	-0	0	-0	-0	5028	4840	4261	3402	0
49				0	0	0	-0	0	-0	0	-0	-0	0	3427	1828	4177	4523	-0
50				0	0	0	0	0	2980	9186	0	0	-0	1490	3187	6326	4872	3401
51				0	0	0	0	0	2268	1820	2717	-0	0	0	5188	4614	5085	4110
52					0	0	0	0	0	2727	3817	0	0	0	4144	4707	4824	4382
53					0	0	0	0	0	457	3689	0	0	0	3417	5108	4858	477
54						-0	0	0	0	0	0	0	0	0	0	5132	4435	46
55						0	0	0	0	0	0	-0	0	0	0	5388	3733	52
56								0	0	0	0	0	0	0	0	331	2297	3418
57										0	0	0	0	0	0	0	0	-0
58												0	0	0	0	0	0	0
59													0	0	0	0	0	-0
60																	0	0
61																		0
62																		
63																		
64																		
65																		
66																		



SCALAR ZUTT CON1980 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 718278

MATRIX 2UT CON2000 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		-0
22															0	-0	0	-0
23																0	-0	-0
24																1388	1428	0
25																	478	0
26																		-0
27																	0	0
28																	0	0
29																0	0	0
30															0	0	0	0
31														0	0	0	0	0
32												0	1138	0	0	0	0	-0
33										0	0	2120	0	0	0	0	0	0
34								0	0	0	0	1488	2028	0	0	0	-0	0
35								-0	0	0	0	2838	3788	524	0	0	0	0
36								0	0	0	27	5481	1840	0	0	0	0	0
37							0	0	0	0	3208	288	0	0	0	0	0	0
38							0	0	0	-0	0	1012	328	0	0	-0	0	0
39							0	0	0	0	-0	4400	2232	0	0	0	0	0
40							0	0	0	0	824	2084	0	0	0	0	0	0
41							0	-0	0	2226	383	481	-0	0	0	0	0	-0
42			0	0	-0	0	-0	2206	3884	2880	3024	7114	4884	0	0	-0	0	0
43		0	0	0	0	-0	0	1888	0	4244	5028	6448	5134	4713	3313	0	-0	0
44		0	0	0	0	0	-0	-0	0	1821	6263	4340	4484	5048	5988	1004	0	0
45			0	0	0	0	0	3048	-0	0	233	6203	2826	4755	3784	2770	0	0
46			0	0	0	0	-0	0	-0	-0	0	841	6012	7838	4852	2733	2483	0
47			0	0	0	-0	0	0	-0	0	0	0	3932	8488	5811	5885	3858	0
48				0	0	0	0	0	0	-0	0	-0	-0	4248	4184	3813	2311	0
49				0	0	0	-0	0	-0	0	0	-0	0	2883	1588	3821	3843	0
50				0	0	0	0	0	1348	7218	0	0	0	877	2898	4480	3938	2827
51				0	0	0	0	0	808	1128	1850	0	0	0	2388	3882	4278	3488
52					0	0	0	0	0	1881	2888	0	0	0	3488	4000	4078	3707
53					0	0	0	0	0	0	2142	0	0	0	3077	4308	3857	4070
54						-0	0	0	0	0	0	0	0	0	0	4228	3798	4180
55						0	0	0	0	0	0	0	0	0	0	2883	3202	4477
56								0	-0	0	0	0	0	0	0	0	1724	1877
57										0	0	0	0	0	0	0	0	0
58												0	0	0	0	0	0	0
59													0	0	0	0	0	0
60																	0	0
61																		0
62																		
63																		
64																		
65																		
66																		



SCALAR IUTT CON2000 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 890999

MATRIX ZUT CDW2010 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
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10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22															0	0	0	0
23																0	0	0
24																2462	2383	0
25																	1841	0
26																		0
27																	-0	0
28																		0
29																0		0
30															0	0	0	0
31														0	0	0	0	0
32												0	1048	0	0	0	0	0
33										0	0	2220	0	0	0	0	0	0
34								0	0	0	0	2197	2731	0	0	0	0	0
35								0	0	0	0	2508	3886	402	0	0	0	0
36								0	0	0	1048	5406	1987	0	0	0	-0	0
37							0	0	0	0	3614	878	0	0	0	0	0	0
38							0	0	0	-0	778	1830	820	0	0	0	0	0
39							0	0	0	0	122	4732	2771	0	0	0	0	0
40							0	0	0	0	2038	2836	0	0	0	0	0	-0
41							0	-0	0	2858	1128	1100	0	0	0	-0	0	0
42		-0	0	-0	0	0	2888	3588	2783	1905	6858	5203	1298	0	0	0	0	0
43	0	0	0	0	-0	0	1580	0	4138	5820	6078	5323	5233	3454	0	0	-0	0
44	0	0	0	0	0	-0	-0	0	1824	5818	4873	4241	5183	5788	1411	0	0	0
45	0	0	0	0	0	0	3181	0	0	0	5918	2737	4814	3827	4005	0	0	0
46	0	0	0	0	0	-0	0	0	-0	0	184	5754	6988	4387	2675	2138	0	0
47	-0	0	0	0	0	0	0	0	0	0	0	4038	8084	5604	5468	4232	0	0
48		-0	0	0	0	0	0	0	-0	0	-0	0	3758	3887	3223	1818	0	0
49		0	0	0	0	-0	0	-0	0	0	0	0	2110	1404	3120	3432	0	0
50		0	0	0	0	0	0	0	5572	0	0	0	285	2393	3868	3488	1982	
51		0	0	0	0	0	0	0	304	782	0	0	0	1892	3438	3804	3128	
52		0	0	0	0	0	0	0	588	1883	0	0	0	3088	3582	3820	3320	
53		0	0	0	0	0	0	0	0	546	0	0	0	2178	3808	3422	3842	
54		0	0	0	0	0	0	0	0	0	0	0	0	0	3423	3408	37	
55						0	0	0	0	0	0	0	0	0	2211	2880	3	
56							0	0	0	0	0	0	0	0	0	1042	16	
57										0	0	0	0	0	0	0	0	0
58												0	0	0	0	0	0	0
59													0	0	0	0	0	0
60																	0	0
61																		0
62																		
63																		
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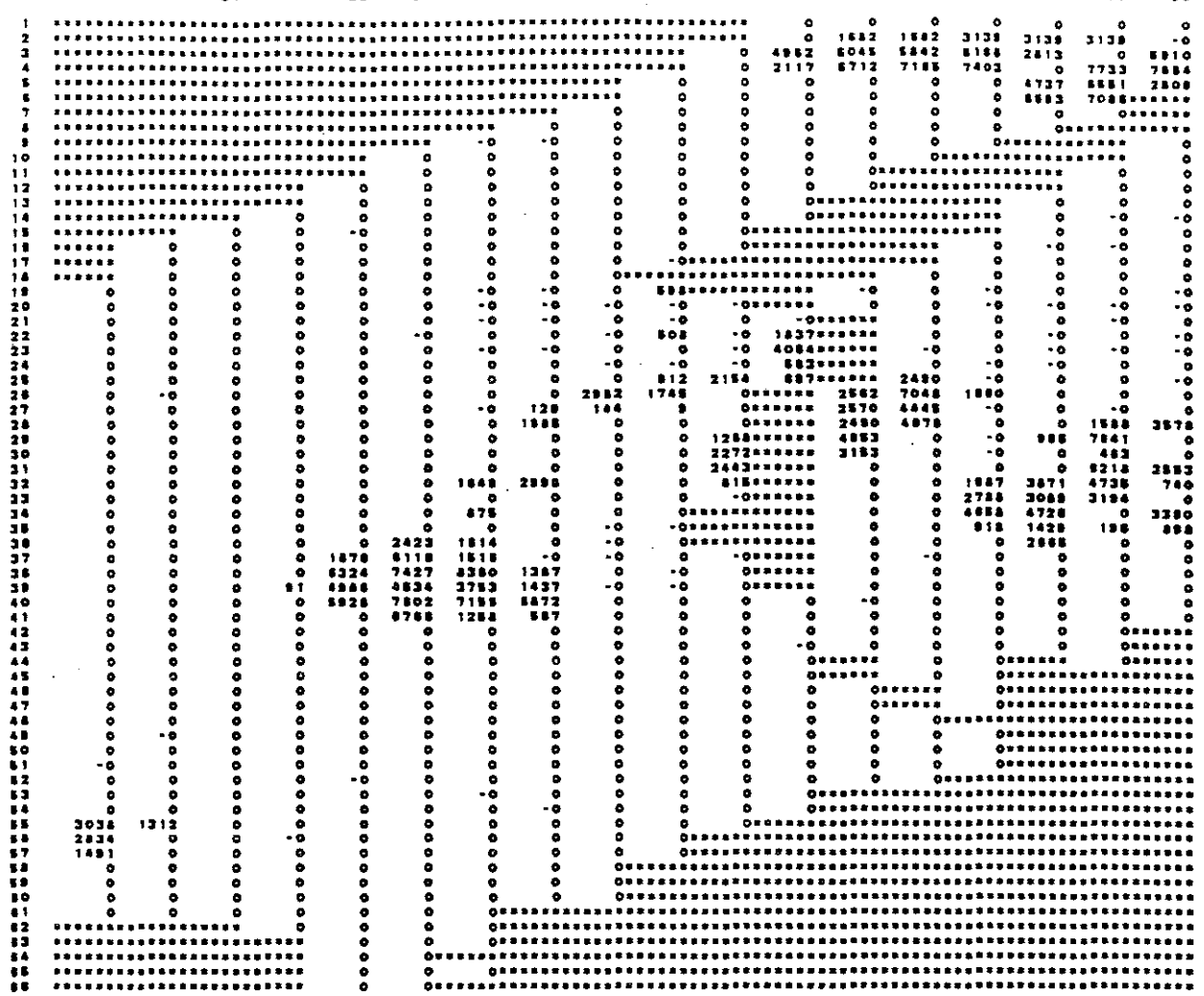
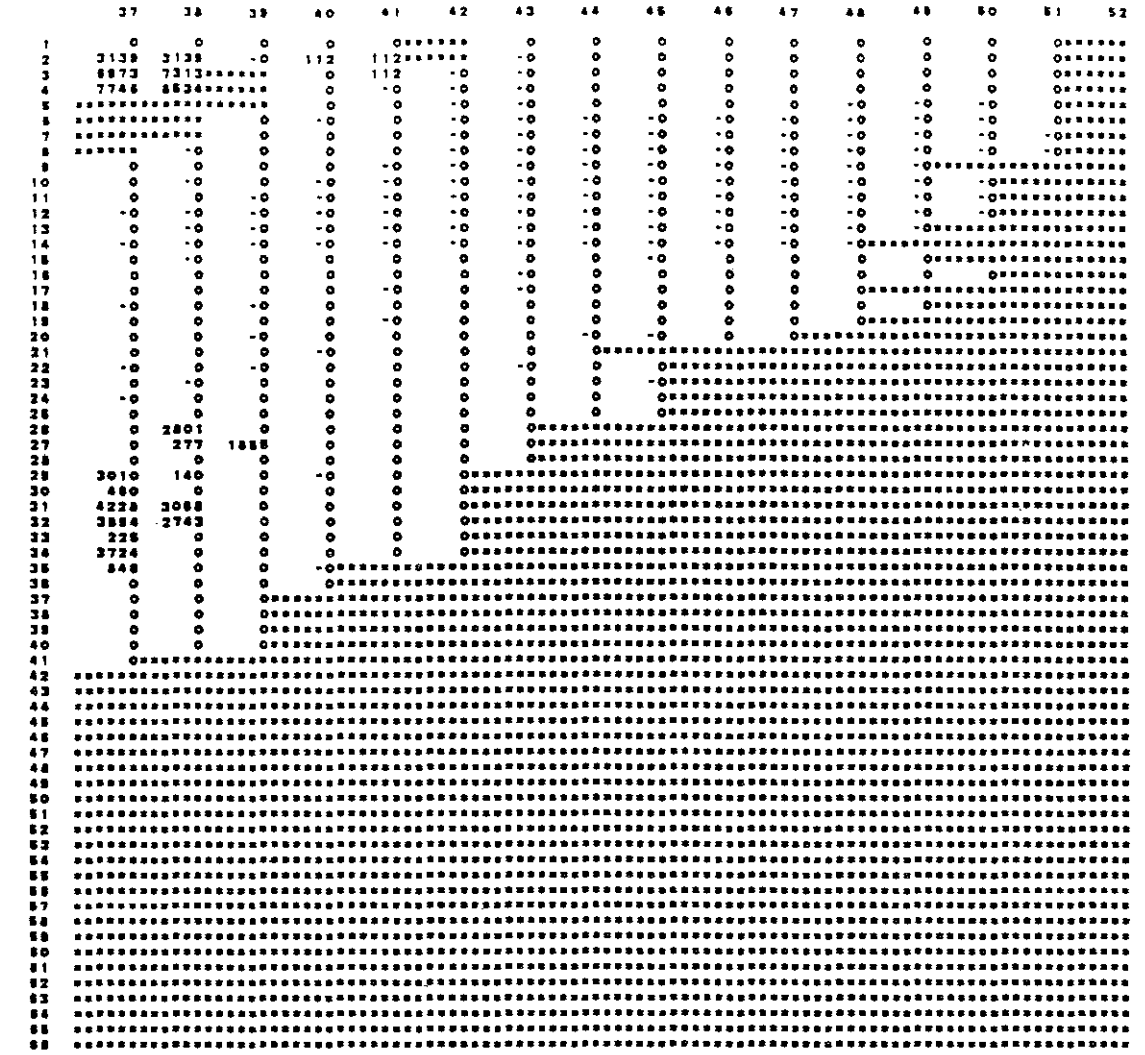
66																		

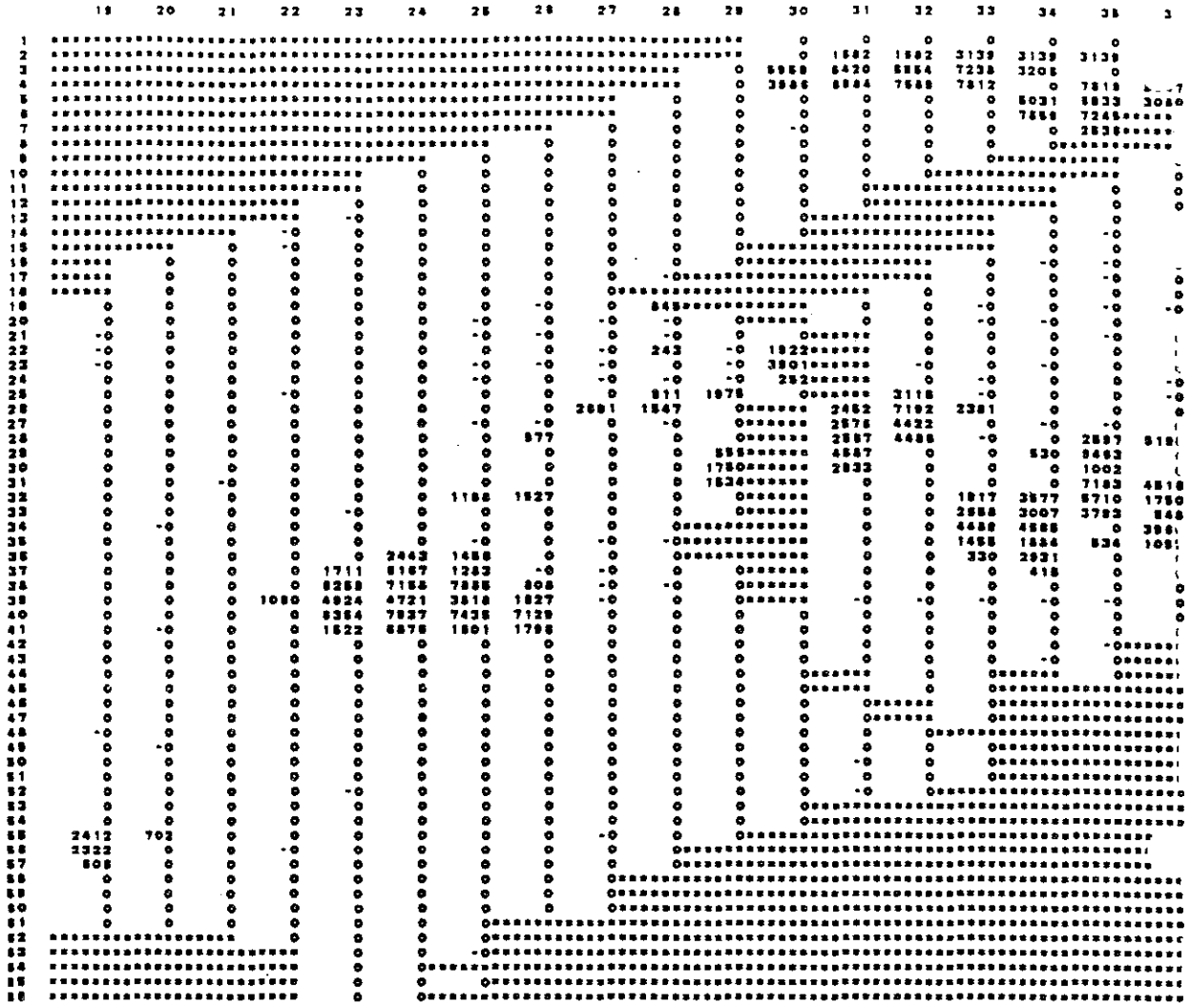


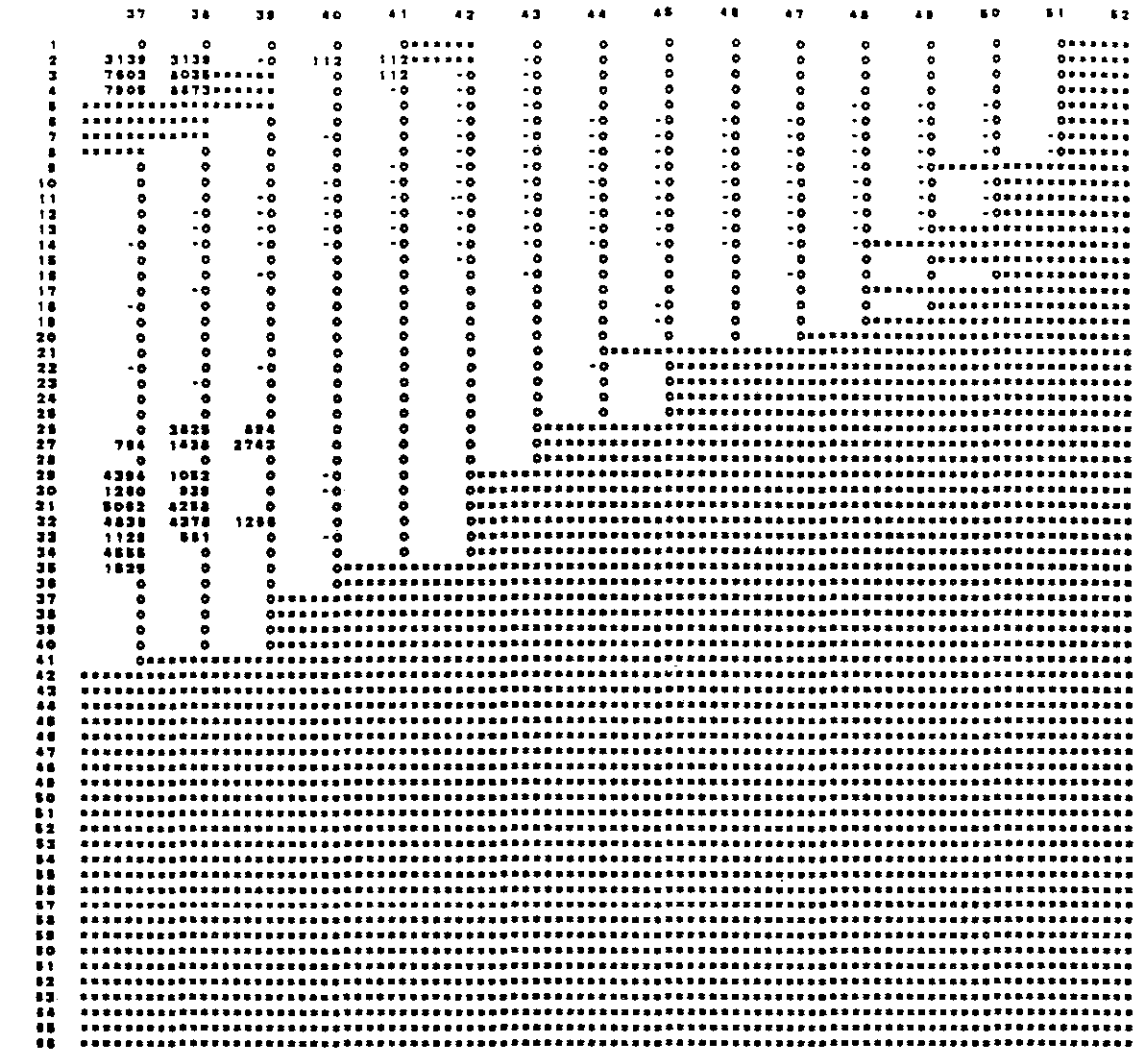


SCALAR IUTT CON2010 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 715563

MATRIX ZUT CON2020 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

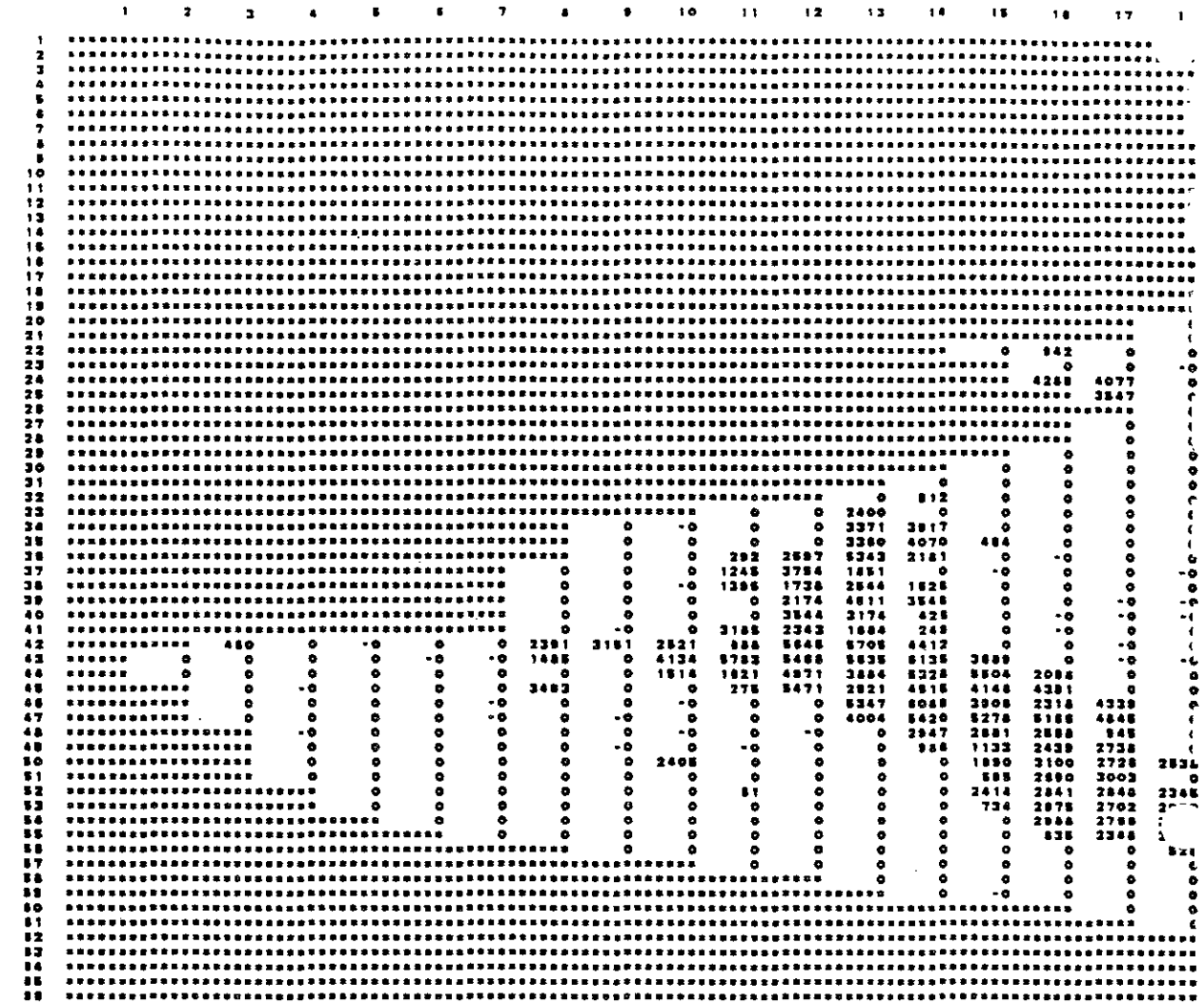
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
2	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
3	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
4	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
5	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
6	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
7	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
8	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
9	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
10	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
11	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
12	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
13	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
14	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
15	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
16	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
17	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
18	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
19	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
20	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
21	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
22	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	93	0	0
23	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	-0	0
24	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	3429	3244	0
25	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	2698	0
26	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
27	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
28	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
29	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0
30	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0
31	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	0
32	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	913	0	0	0	0
33	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	2288	0	0	0	0	0
34	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	2768	3213	0	0	0	-0
35	**********	**********	**********	**********	**********	**********	**********	**********	-0	0	0	0	3088	3856	424	0	0	0
36	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	1848	5338	2081	0	-0	0	0
37	**********	**********	**********	**********	**********	**********	0	0	0	0	818	3738	1386	0	-0	0	0	-0
38	**********	**********	**********	**********	**********	**********	0	0	0	-0	-0	1488	2111	1248	0	0	0	0
39	**********	**********	**********	**********	**********	**********	0	0	0	0	0	1221	4818	3187	0	-0	0	-0
40	**********	**********	**********	**********	**********	**********	-0	0	0	0	0	2828	2800	127	0	0	0	-0
41	**********	**********	**********	**********	**********	**********	0	-0	0	3057	1812	1488	0	0	0	-0	0	0
42	**********	0	0	-0	-0	0	2327	3273	2884	882	6071	5470	3487	0	0	0	-0	0
43	*******	0	0	0	-0	0	0	0	4124	4710	6782	5488	5491	3589	0	0	-0	0
44	*******	0	0	0	0	-0	-0	0	1572	2906	4783	4080	5256	5845	1718	0	0	0
45	**********	0	0	0	0	0	3228	0	0	244	5843	2844	4877	4063	4221	0	0	0
46	**********	0	0	0	0	-0	0	-0	-0	0	0	6502	6518	4131	2448	3785	0	0
47	**********	0	0	0	0	0	0	-0	0	0	0	3977	5895	5286	5216	4588	0	0
48	**********	-0	0	0	0	0	0	0	-0	0	-0	0	3328	3258	2848	1351	0	0
49	**********	-0	0	0	0	0	0	-0	0	0	-0	0	1882	1281	2758	3086	0	0
50	**********	0	0	0	0	0	0	0	3825	0	0	0	0	2128	3507	3044	2480	0
51	**********	0	0	0	0	0	0	0	0	0	0	0	0	1188	3041	3378	1127	0
52	**********	**********	-0	-0	0	0	0	0	0	1033	0	0	0	2730	3180	3210	2872	0
53	**********	**********	0	0	0	0	0	0	0	0	0	0	0	1420	3384	3040	3260	0
54	**********	**********	**********	0	0	0	0	0	0	0	0	0	0	0	3360	3087	3272	0
55	**********	**********	**********	**********	0	0	0	0	0	0	0	0	0	0	1484	2598	3832	0
56	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	418	1023
57	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	0	0	0	0
58	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	0
59	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	0
60	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
61	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
62	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
63	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
64	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
65	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
66	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********

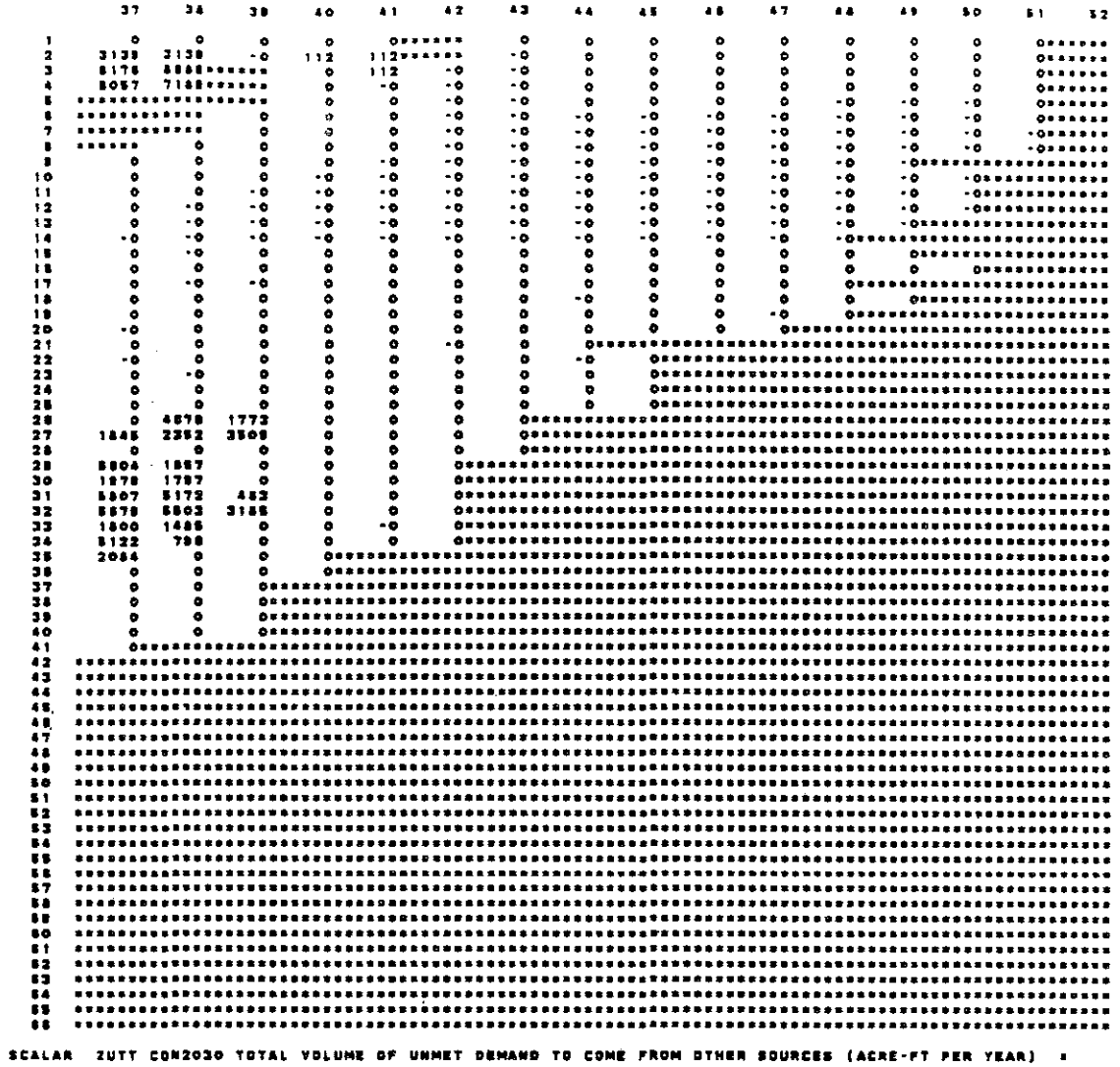




SCALAR ZUTT CON2020 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 742843

MATRIX ZUT CON2030 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

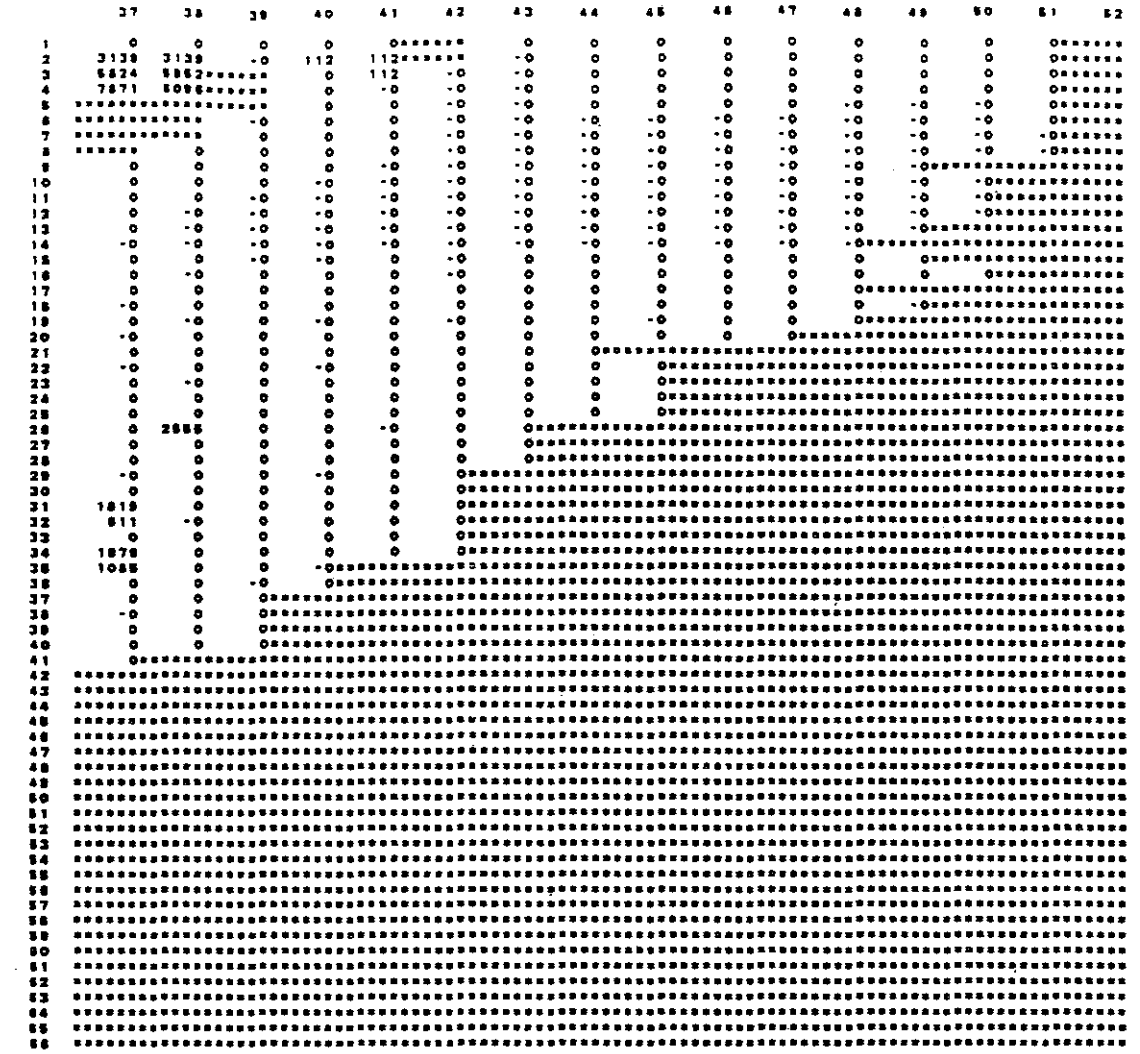




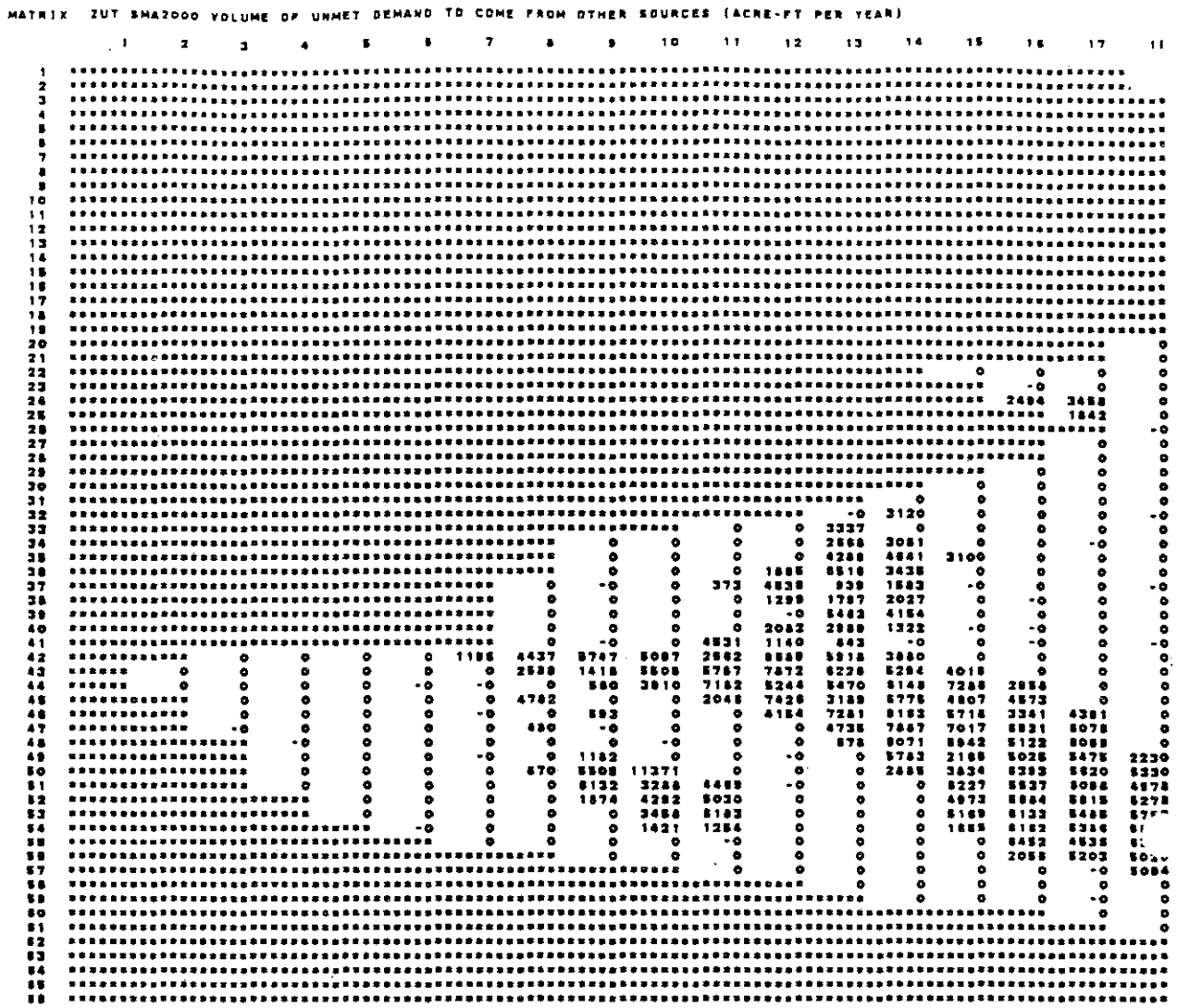
SCALAR ZUTT CON2030 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 780102

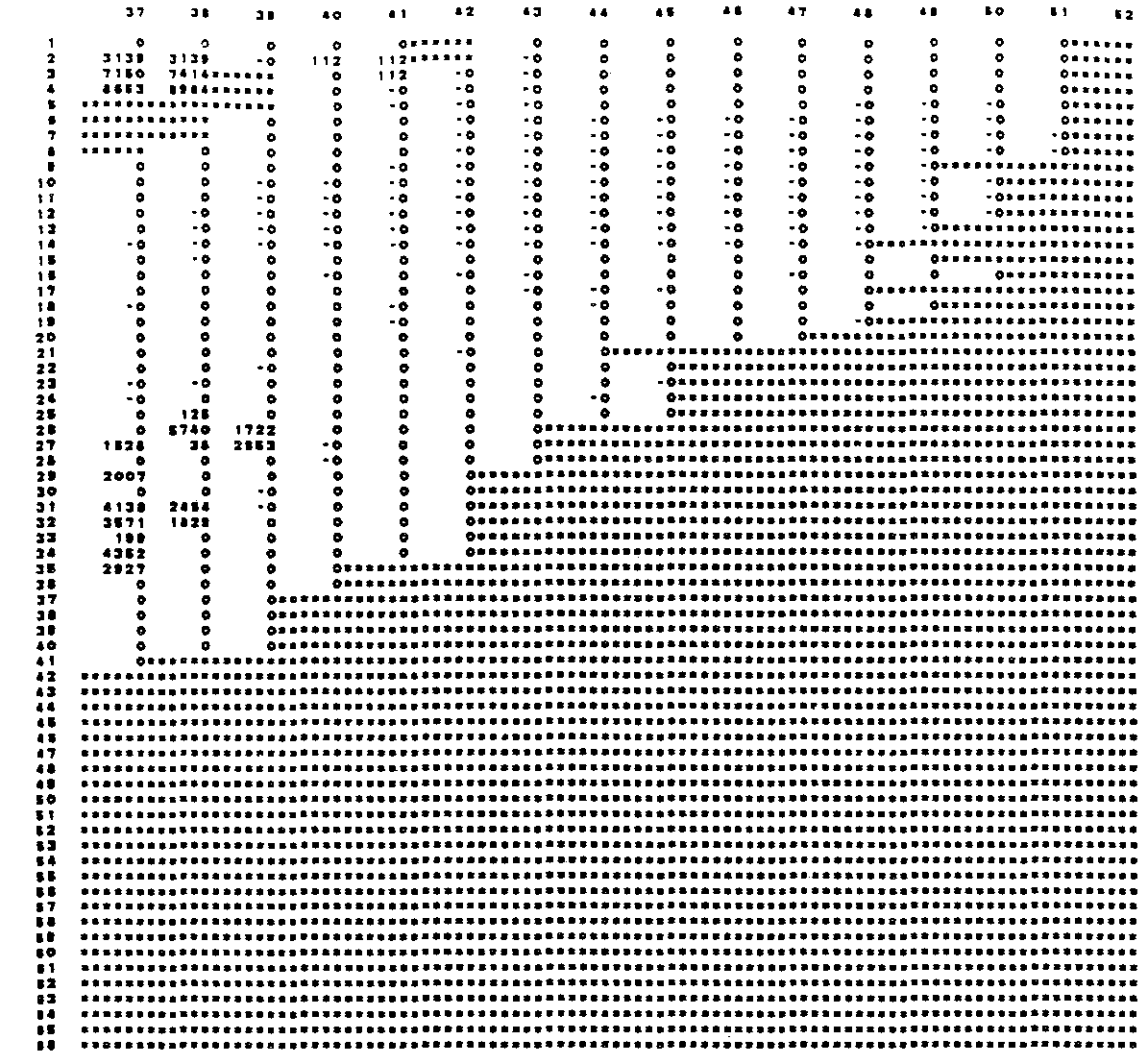
MATRIX ZUT SMA1990 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22															0	0	0	0
23																0	0	0
24																508	1483	0
25																	0	0
26																		0
27																	0	0
28																0	0	0
29																	0	0
30															0	0	-0	0
31													0	0	0	0	0	0
32												0	2380	0	-0	0	0	0
33										-0	0	2848	0	0	0	0	0	0
34								0	0	0	0	1270	1808	0	0	0	0	0
35								0	0	0	0	3388	4101	2288	0	0	0	0
36								0	0	0	45	5018	2537	0	0	0	0	0
37							0	0	0	0	3483	0	1088	0	0	0	0	0
38							0	0	0	0	0	574	880	0	-0	0	0	0
39							0	0	0	0	-0	4677	2888	0	0	0	0	0
40							0	0	0	-0	224	2133	427	0	0	-0	-0	-0
41							0	-0	0	2418	0	0	0	0	-0	0	0	0
42		0	0	0	0	552	4127	5323	3844	6784	6625	5032	0	0	-0	0	0	0
43	0	0	0	0	0	0	2145	1134	4885	5532	7852	5456	4302	3495	0	0	0	0
44	0	0	0	0	0	-0	0	283	3529	6882	4512	5281	5478	6882	872	0	0	0
45	0	0	0	0	0	0	4082	0	0	1420	7178	2774	5204	4044	3884	0	0	0
46	0	0	0	0	0	-0	0	168	0	0	5000	6871	9085	6581	3247	3058	0	0
47	0	0	0	0	-0	0	148	-0	-0	0	0	4054	7718	6872	6842	4512	0	0
48	0	-0	0	-0	0	0	0	0	-0	0	0	0	8058	6842	5100	3038	0	0
49	-0	-0	0	0	-0	0	918	0	0	0	-0	0	5828	2183	5026	5438	1718	0
50	0	0	0	0	0	703	5508	11300	0	0	0	0	2847	3821	5393	5620	5078	0
51	0	0	0	0	0	0	5842	3085	4257	-0	0	0	0	5227	5837	5078	4941	0
52	0	0	0	0	0	0	1522	3911	4841	0	0	0	4973	5649	5802	5233	0	0
53	0	0	0	0	0	0	0	3379	5881	0	0	0	5188	6133	5487	5746	0	0
54	-0	0	0	0	0	0	0	1354	1148	0	0	0	1840	5182	5320	5843	0	0
55	0	0	0	0	0	0	0	0	0	-0	0	0	0	6441	4478	5368	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	1582	5181	4984	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	5082	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



SCALAR ZUTT SMA1990 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 1012186


MATRIX ZUT SMA2000 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)



SCALAR ZUTT SMA2000 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 1217210

MATRIX ZUT SMA2010 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22															0	170	0	0
23															0	0	0	0
24																4280	6385	0
25																	3777	0
26																		0
27																	0	0
28																	0	0
29																0	0	0
30															0	0	0	0
31														0	0	0	0	0
32													0	3881	0	0	0	0
33											0	0	4021	0	0	0	0	0
34									0	-0	0	0	4053	4367	0	0	0	0
35									0	0	0	0	5188	5182	3932	0	0	0
36									0	0	816	3370	6827	4331	0	0	0	0
37								0	0	0	2253	5114	1884	2052	-0	0	0	-0
38								0	0	-0	550	2675	2411	3178	0	0	0	0
39								0	0	0	0	1411	5862	5330	0	-0	0	-0
40								0	0	-0	-0	3398	3804	2302	0	0	0	-0
41								811	-0	0	5318	2224	1842	516	0	0	0	0
42		574	0	0	0	1428	4545	8117	5458	2805	6781	8404	4863	-0	0	0	-0	0
43	0	0	0	0	0	0	2853	1886	5763	8043	8090	8898	8288	4538	388	0	0	0
44	0	0	0	0	0	0	0	838	4151	7405	5977	5878	5815	7711	5226	0	0	0
45	0	0	0	0	0	0	5488	0	0	2395	7677	3808	5348	5170	5291	0	0	0
46	0	0	0	0	0	-0	0	1003	0	178	3714	7891	8282	5675	3436	8083	0	0
47	-0	0	0	-0	0	505	-0	0	0	0	0	5416	8058	7380	7300	8681	0	0
48	0	0	0	0	0	0	0	-0	0	0	0	1468	8084	8842	8144	8085	49	0
49	0	0	0	0	-0	43	1434	0	0	-0	0	5823	2174	5026	8511	3821	0	0
50	0	0	0	0	0	1025	5508	11439	0	0	0	2817	2648	6393	5620	5387	0	0
51	0	0	0	0	0	0	5822	3489	4572	-0	-0	0	6227	5837	6114	6013	0	0
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53	0	0	0	0	0	0	0	3838	8384	0	0	0	5188	6133	5802	5838	0	0
54	0	0	0	0	-0	0	0	1448	1357	0	0	-0	1888	6182	8451	5890	0	0
55	0	0	0	0	0	0	0	0	0	-0	0	0	0	0	6482	4588	6402	0
56	0	0	0	0	0	0	0	0	0	-0	0	0	0	0	2128	6244	6073	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	6138	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	-0	0
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63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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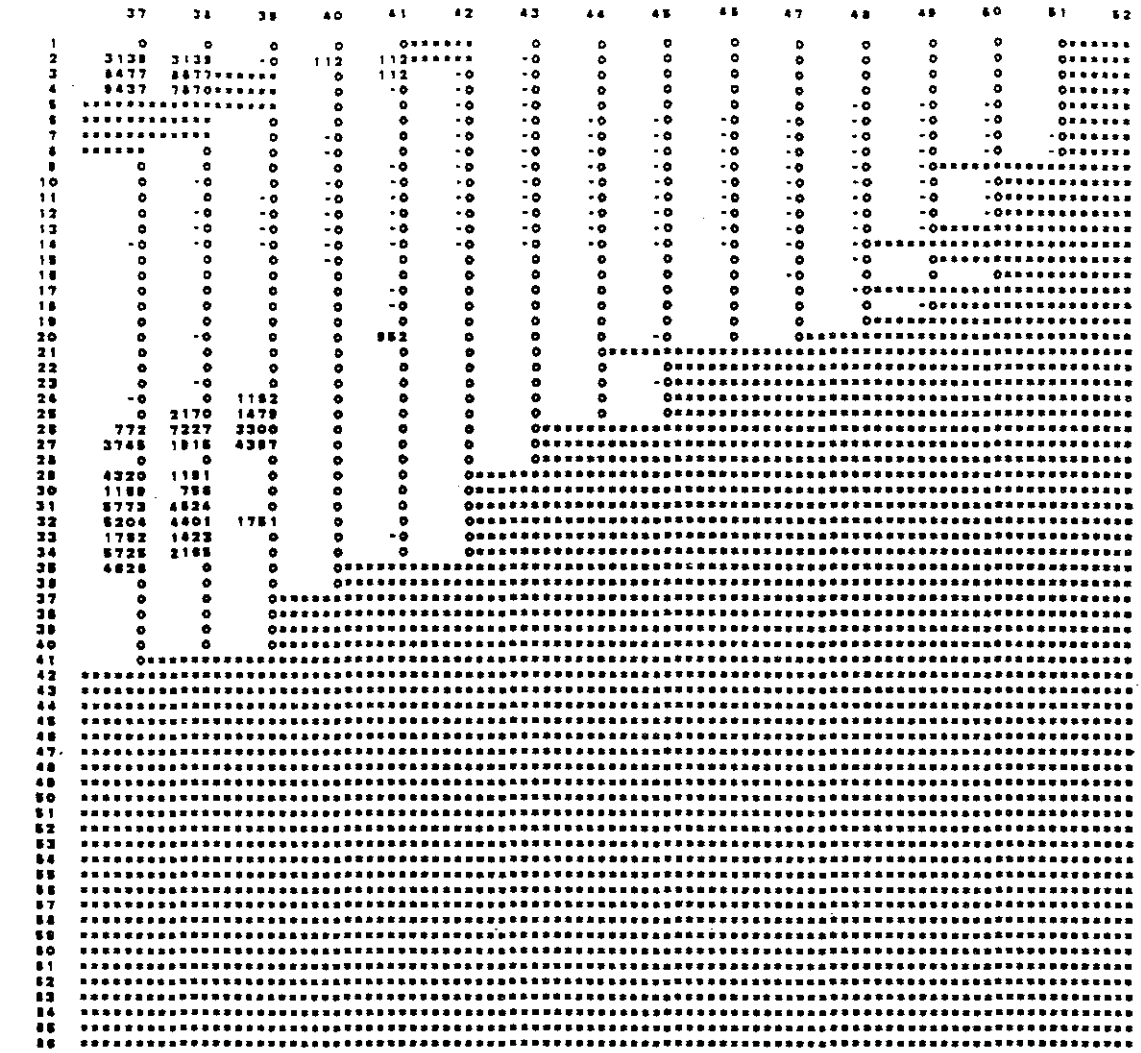
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



SCALAR ZUTT SMA2010 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 1452320

MATRIX ZUT SMA2020 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	**
1	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
2	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
3	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
4	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
5	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
6	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
7	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
8	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
9	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
10	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
11	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
12	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
13	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
14	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
15	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
16	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
17	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
18	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
19	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
20	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
21	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
22	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	2138	0	0
23	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0
24	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	8042	7308	0
25	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	6713	0
26	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0
27	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
28	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0
29	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0
30	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0
31	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	324	0	0	0	0
32	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	-0	4501	0	0	0	0
33	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	4703	0	0	0	0	-0
34	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	5427	5830	0	0	0	0
35	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	82	6021	5722	4750	0	0	0
36	**********	**********	**********	**********	**********	**********	**********	**********	0	0	2825	4818	7458	5217	0	0	0	0
37	**********	**********	**********	**********	**********	**********	**********	0	0	0	3488	5593	3028	2497	-0	0	0	-0
38	**********	**********	**********	**********	**********	**********	**********	0	0	-0	2980	3508	3826	4261	0	0	0	0
39	**********	**********	**********	**********	**********	**********	**********	0	0	0	0	2787	8443	8175	1320	0	-0	0
40	**********	**********	**********	**********	**********	**********	**********	-0	0	0	23	4845	4620	3077	188	0	-0	-0
41	**********	**********	**********	**********	**********	**********	**********	1288	478	84	5987	3508	2758	1387	0	0	0	-0
42	**********	1168	84	0	0	1857	4685	5342	5751	3055	8815	7880	5688	0	0	-0	0	
43	*******	0	0	0	0	0	0	3325	1878	5024	8287	8310	7788	7277	5058	858	0	0
44	*******	0	0	0	0	0	-0	0	1110	4384	7838	8710	5885	7484	8137	7458	0	0
45	**********	0	0	0	0	0	6188	-0	0	2731	7826	4020	5818	5724	5980	433	0	
46	**********	0	-0	0	0	-0	0	1404	0	567	2968	7802	8380	8021	3831	7808	0	
47	**********	0	0	0	0	0	1131	-0	0	0	0	8688	8230	7703	7879	7884	477	
48	**********	-0	0	0	0	0	0	0	-0	0	0	2052	8089	8842	8188	8124	131	
49	**********	0	0	0	-0	247	1884	0	0	-0	0	8864	2180	5025	8548	8381		
50	**********	0	0	0	0	1184	8508	11508	0	0	0	2960	3887	8393	8820	8464		
51	**********	0	0	0	0	0	7112	3891	4880	-0	0	0	8227	8837	8137	8048		
52	**********	0	0	0	0	0	1878	8084	8407	0	-0	0	4873	8788	8838	8387		
53	**********	0	0	0	0	0	0	3813	8578	0	0	0	8188	8132	8820	88		
54	**********	0	0	0	0	0	0	1888	1483	0	0	0	2434	8182	8818	8(		
55	**********	0	0	0	-0	-0	0	0	8473	8881	84							
56	**********	0	0	0	0	0	0	0	2178	8288	8118							
57	**********	0	0	0	0	0	0	-0	8177									
58	**********	-0	0	0	0	0												
59	**********	0	0	0	-0	-0												
60	**********	0	0															
61	**********	0																
62	**********																	
63	**********																	
64	**********																	
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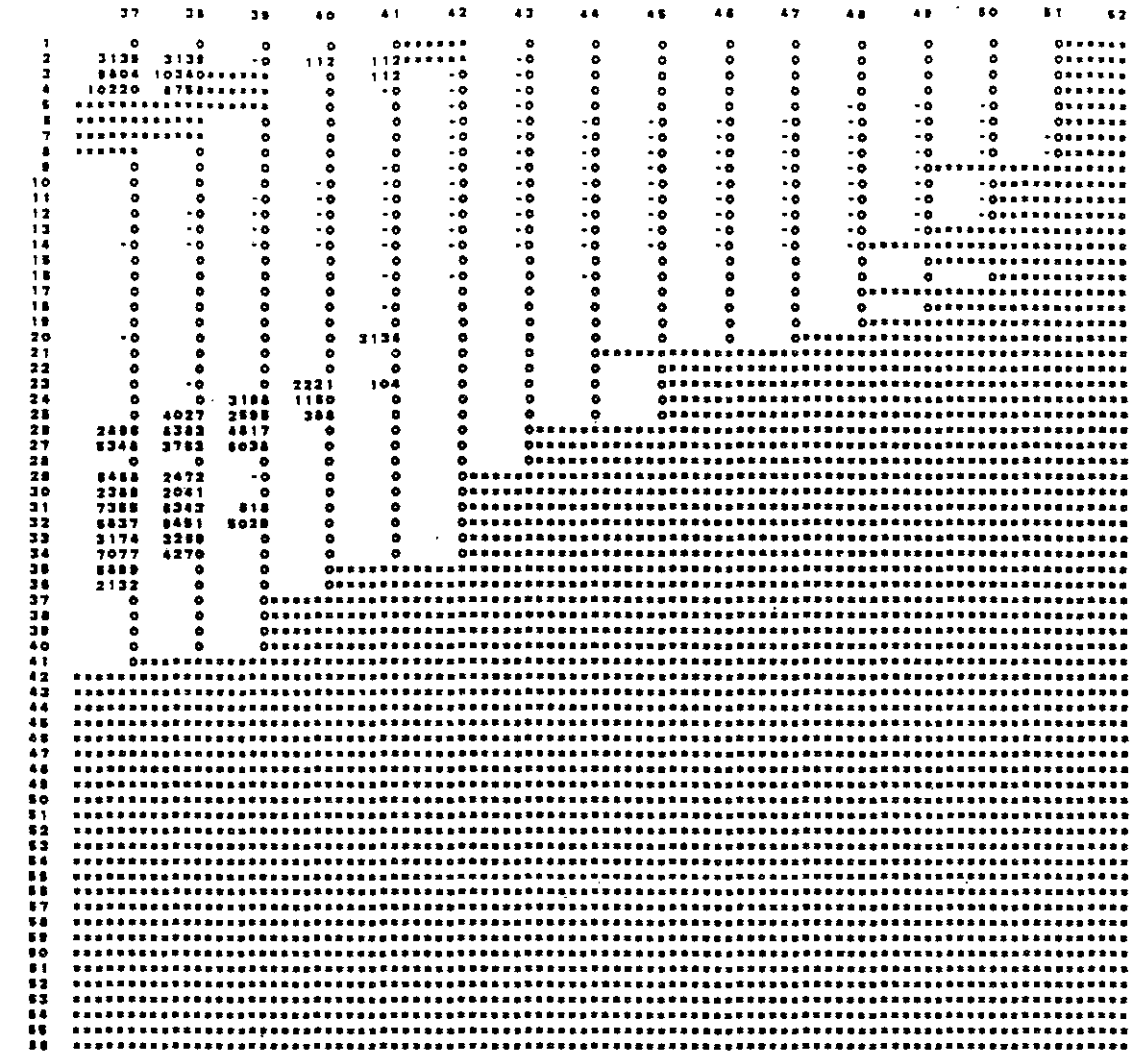
66	**********																	



SCALAR ZUTT SMA2020 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 1724489

MATRIX ZUT SMA2030 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2																		
3																		
4																		
5																		
6																		
7																		
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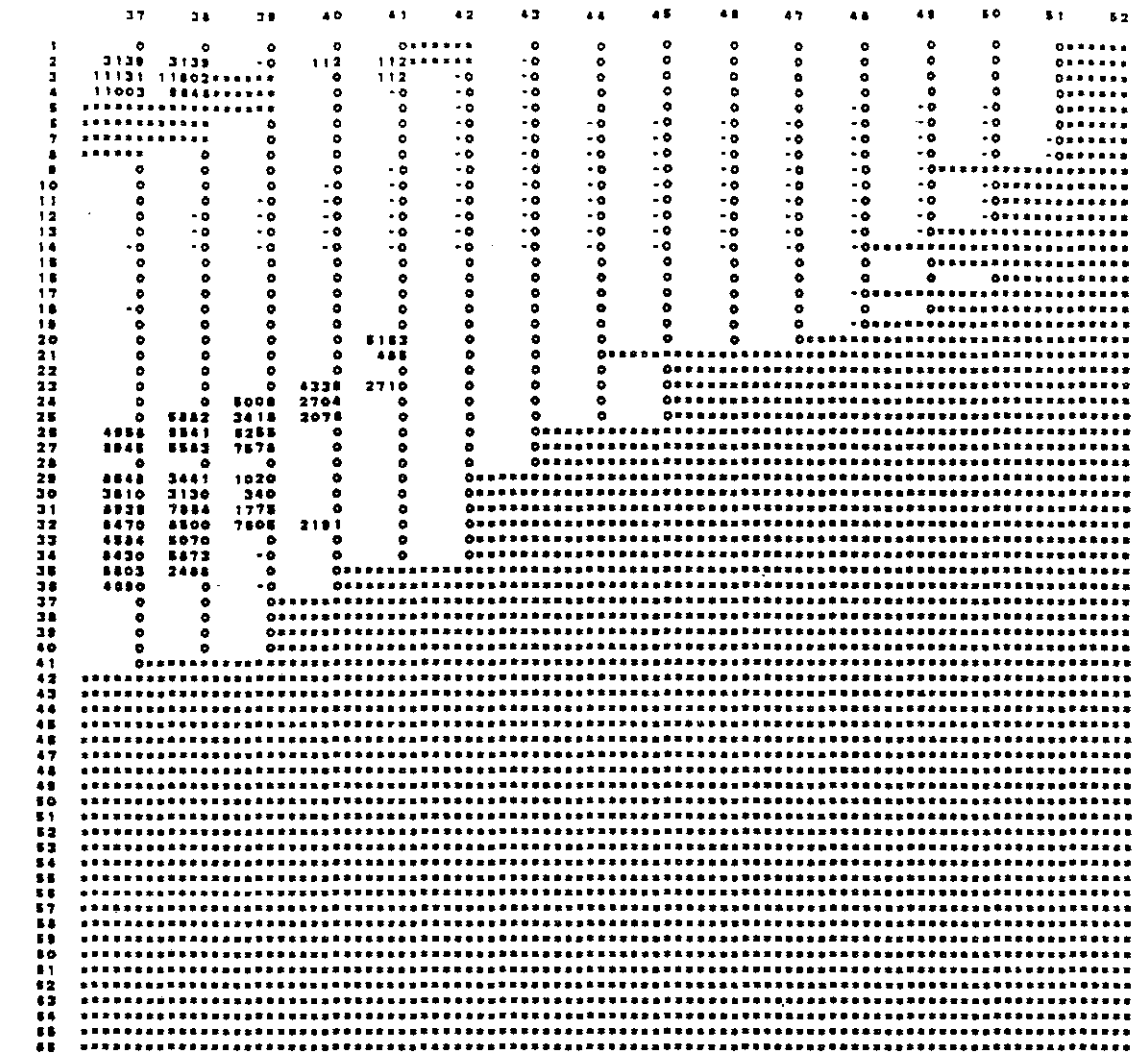
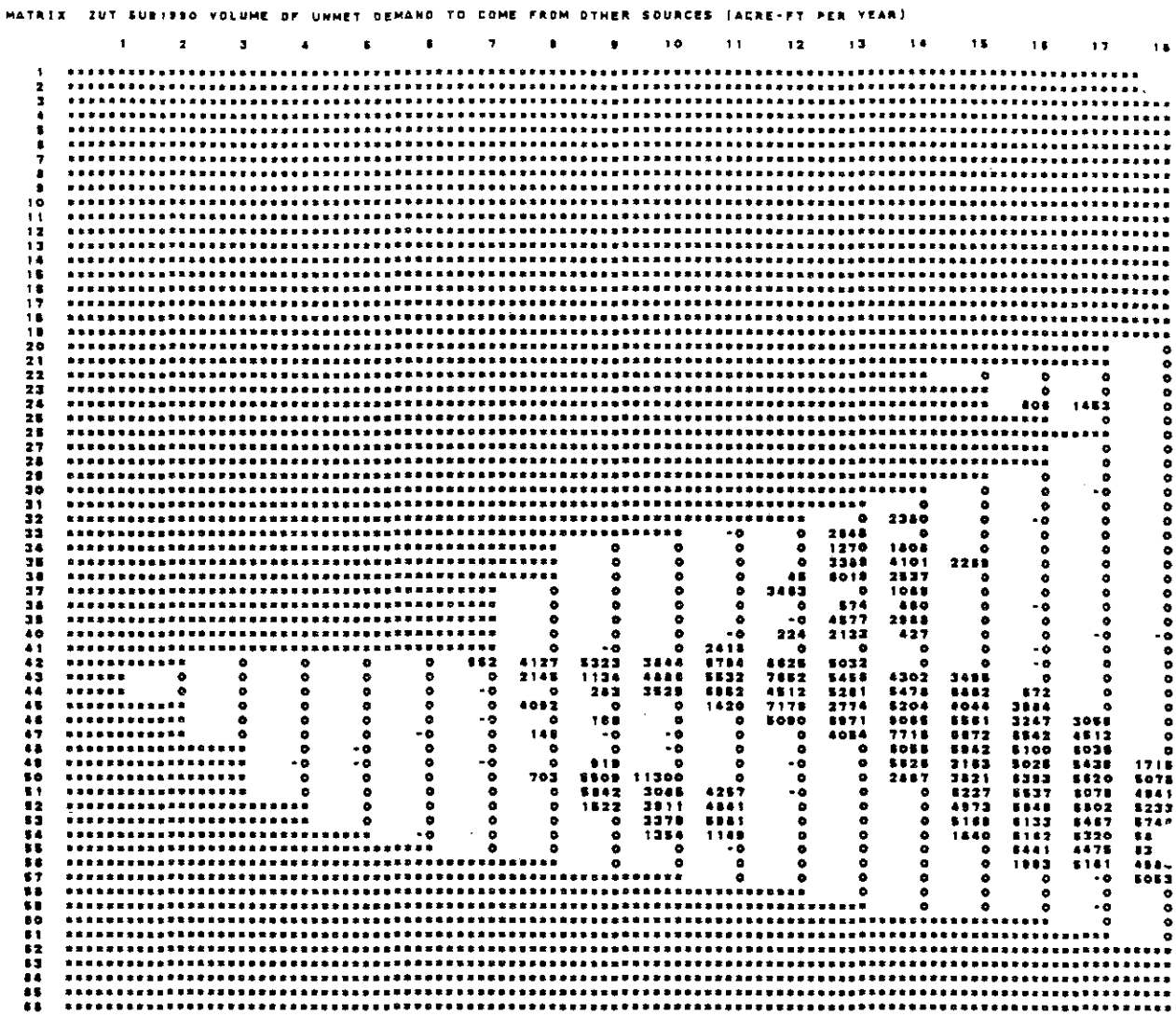
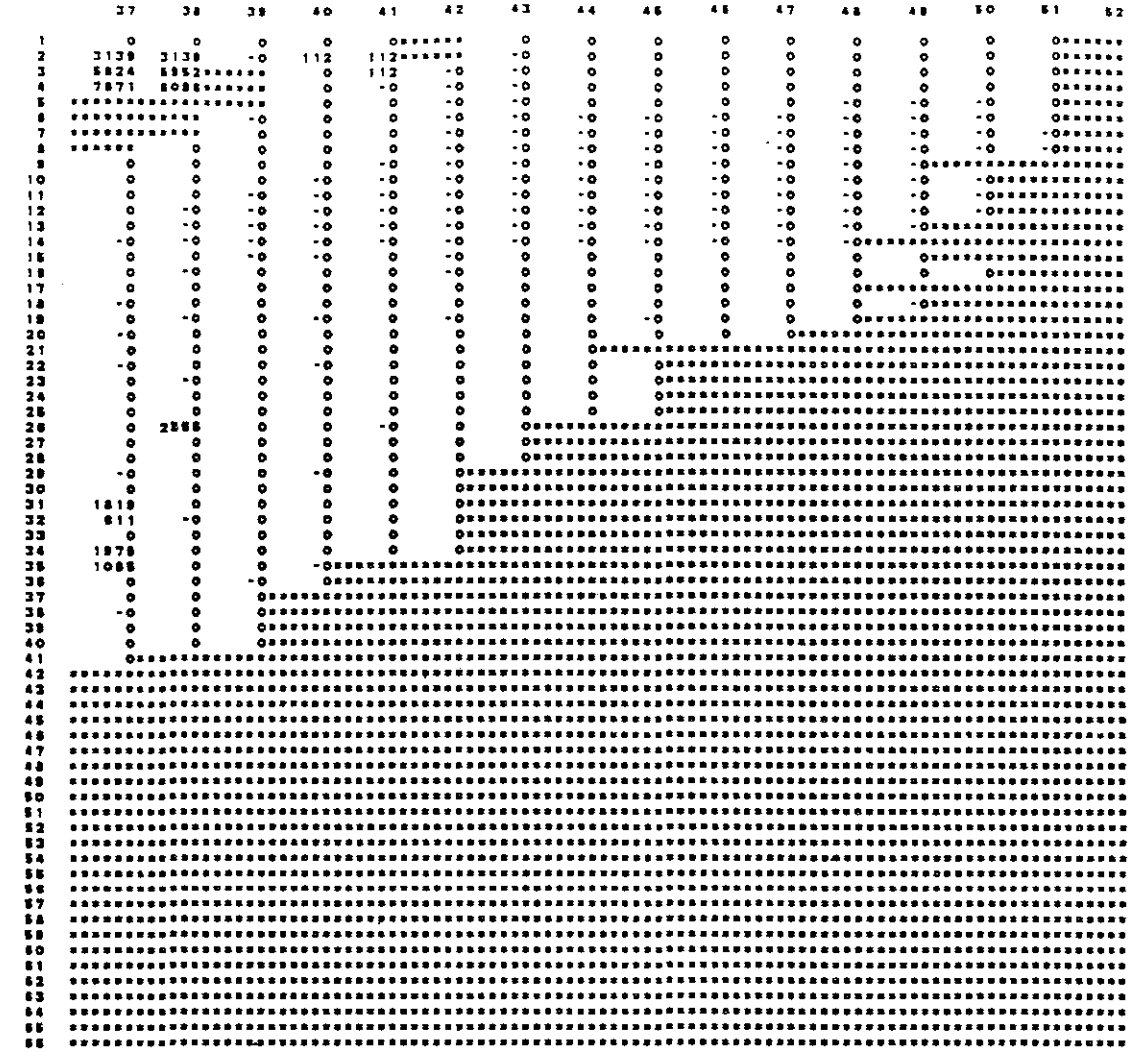
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		0
21																		0
22																0	3272	77	0
23																	0	0	0
24																	7404	8218	0
25																		7849	0
26																			0
27																		0	0
28																		0	0
29																	-0	0	0
30																854	0	0	0
31															1027	1532	0	0	0
32														0	4871	0	0	0	0
33													0	868	5190	0	0	0	-0
34									0	0	0	0	6889	6888	172	0	0	0	0
35								830	0	0	1762	6821	6274	6512	0	0	0	0	0
36								868	0	4248	6816	7840	8063	0	0	0	0	0	0
37							0	0	798	4544	6073	4074	2881	-0	0	0	0	0	-0
38							-0	0	264	5210	4340	4841	5188	782	0	0	0	0	0
39							0	0	0	50	4017	6923	7006	2378	-0	-0	-0	-0	-0
40							0	-0	0	1138	5634	5436	3709	1026	0	0	0	0	-0
41							1892	1037	886	6272	4688	3884	2163	0	0	0	0	0	-0
42			1752	301	0	0	1902	4787	6518	5814	3301	4878	6576	6888	0	0	-0	0	0
43		0	0	0	0	0	-0	3726	2271	6286	6552	6828	6538	6270	5877	1388	0	0	-0
44		0	0	0	0	0	-0	0	1401	4647	7867	7443	6083	6152	6582	6208	0	0	0
45			0	0	0	0	0	6887	0	0	3017	6177	4434	7487	6287	6637	1323	0	0
46			0	0	0	0	0	0	1824	0	786	3263	6212	6458	6187	3825	6828	0	0
47			0	0	0	0	0	1472	-0	0	0	0	6778	6402	6048	6062	6488	2230	
48				0	0	0	0	0	0	-0	0	0	2933	6113	6842	6188	6186	484	
49				0	0	0	-0	458	1874	0	0	-0	-0	6804	2786	6026	6681	5326	
50				0	0	0	0	1286	6508	11676	0	0	0	2976	3889	6363	6820	6830	
51				0	0	0	0	0	7602	3894	6100	-0	-0	0	6227	6637	6188	6064	
52				0	0	0	0	2120	6428	6809	0	-0	0	4873	6790	6860	6410		
53				0	0	0	0	0	3892	6788	0	0	0	6188	6132	6838	6828		
54						-0	0	0	0	1623	1888	0	0	0	1786	6162	6681	6138	
55							0	0	0	0	0	-0	0	0	0	6462	4722	6437	
56								0	0	0	0	0	0	0	0	2260	6326	6181	
57											0	0	0	0	0	0	-0	6218	
58												0	0	0	0	0	0	0	
59													0	0	0	0	-0	0	
60																	0	0	
61																		0	
62																			
63																			
64																			
65																			
66																			



SCALAR ZUTT $MA2030 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 2043034


MATRIX ZUT SUB:1990 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)



SCALAR ZUTT SUB1890 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 1012185

MATRIX IUT SUB2000 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
2	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
3	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
4	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
5	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
6	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
7	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
8	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
9	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
10	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
11	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
12	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
13	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
14	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
15	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
16	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
17	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
18	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
19	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
20	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	510
21	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	1782
22	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	908	864	0
23	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	-0	0	0	0
24	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	2341	3118	858	
25	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	1755	858		
26	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	1177		
27	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	413	0		
28	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	892	0		
29	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	457	0	2218		
30	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	877	1084	0	1377	
31	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	884	1047	1154	0	1121	
32	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	2443	1208	1158	0	-0	
33	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	924	793	3014	0	0	0	0	0
34	**********	**********	**********	**********	**********	**********	**********	**********	0	781	874	1007	2231	2848	107	371	0	871
35	**********	**********	**********	**********	**********	**********	**********	1188	1183	804	1117	3877	4841	2808	757	0	887	
36	**********	**********	**********	**********	**********	**********	**********	1130	1108	1022	931	5491	3256	31	0	788	1209	
37	**********	**********	**********	**********	**********	**********	**********	778	1127	1045	848	3842	1045	1230	820	0	1154	1259
38	**********	**********	**********	**********	**********	**********	**********	135	130	1842	1508	830	1590	1878	1048	0	411	488
39	**********	**********	**********	**********	**********	**********	**********	88	87	1200	728	970	5058	3820	858	0	174	1099
40	**********	**********	**********	**********	**********	**********	**********	458	505	503	481	1214	2948	1050	706	0	873	0
41	**********	**********	**********	**********	**********	**********	**********	357	285	240	2883	1161	818	800	0	0	874	1105
42	**********	**********	558	189	0	190	1107	4228	5485	3887	7010	8588	8818	870	218	171	0	263
43	**********	0	0	212	186	0	0	2844	1418	5131	8877	7872	8226	5318	4018	474	0	588
44	**********	0	0	210	285	109	227	0	527	3709	7182	5244	5470	8148	7288	1412	388	0
45	**********	0	287	288	188	231	4541	0	227	1832	7428	3188	5778	4807	4873	488	473	
46	**********	0	388	254	82	128	148	448	0	134	8237	7281	8183	8718	3341	4078	434	
47	**********	0	482	208	188	188	284	158	183	0	188	4738	7887	7017	8821	5317	1052	
48	**********	**********	0	525	178	187	118	108	133	140	0	218	8071	5942	5122	8088	82	
49	**********	**********	0	384	195	88	110	1038	183	488	-0	305	8888	2188	5028	8478	1778	
50	**********	**********	0	181	870	48	702	5308	11300	0	0	0	2904	3834	8393	8520	8148	
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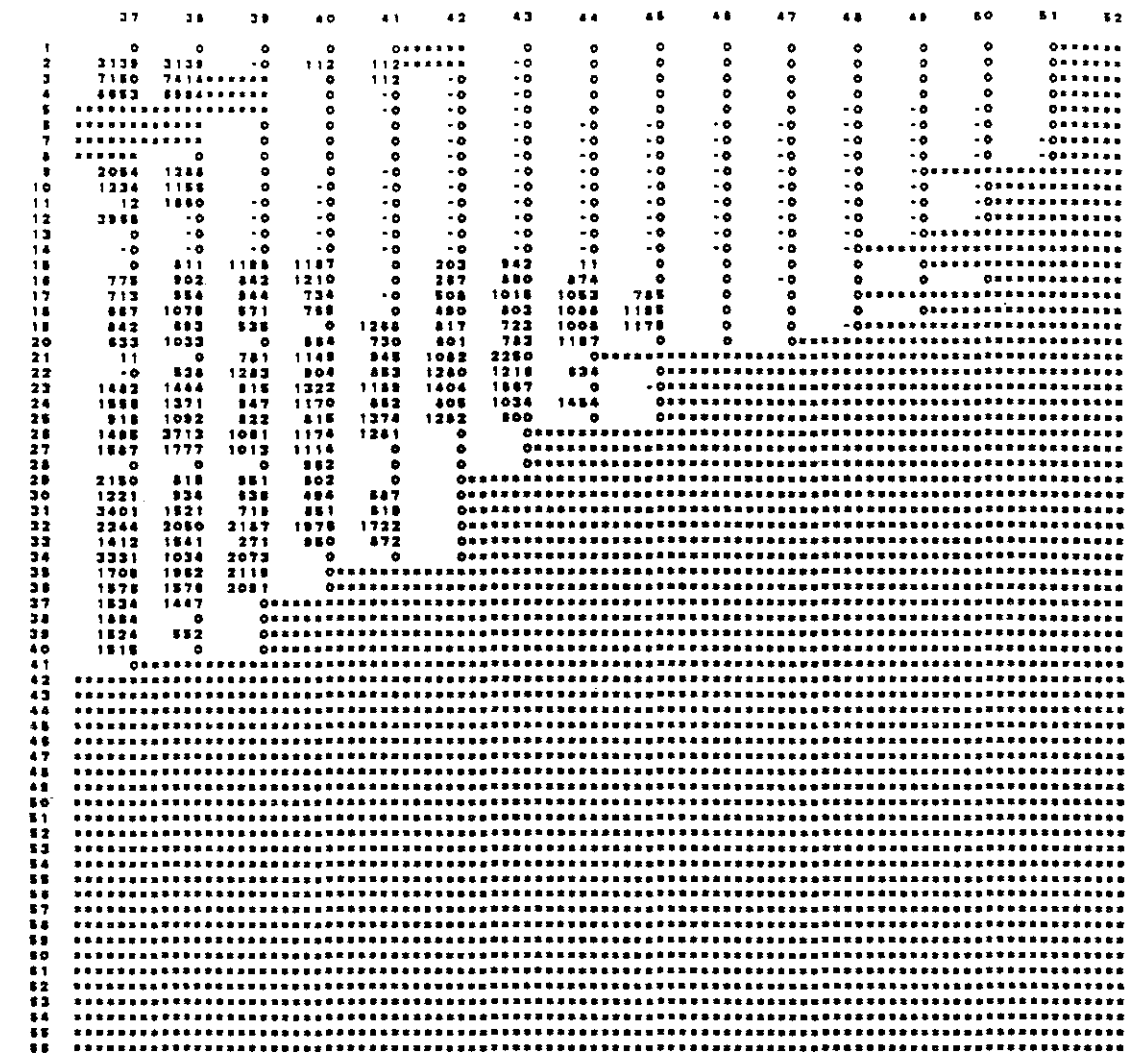
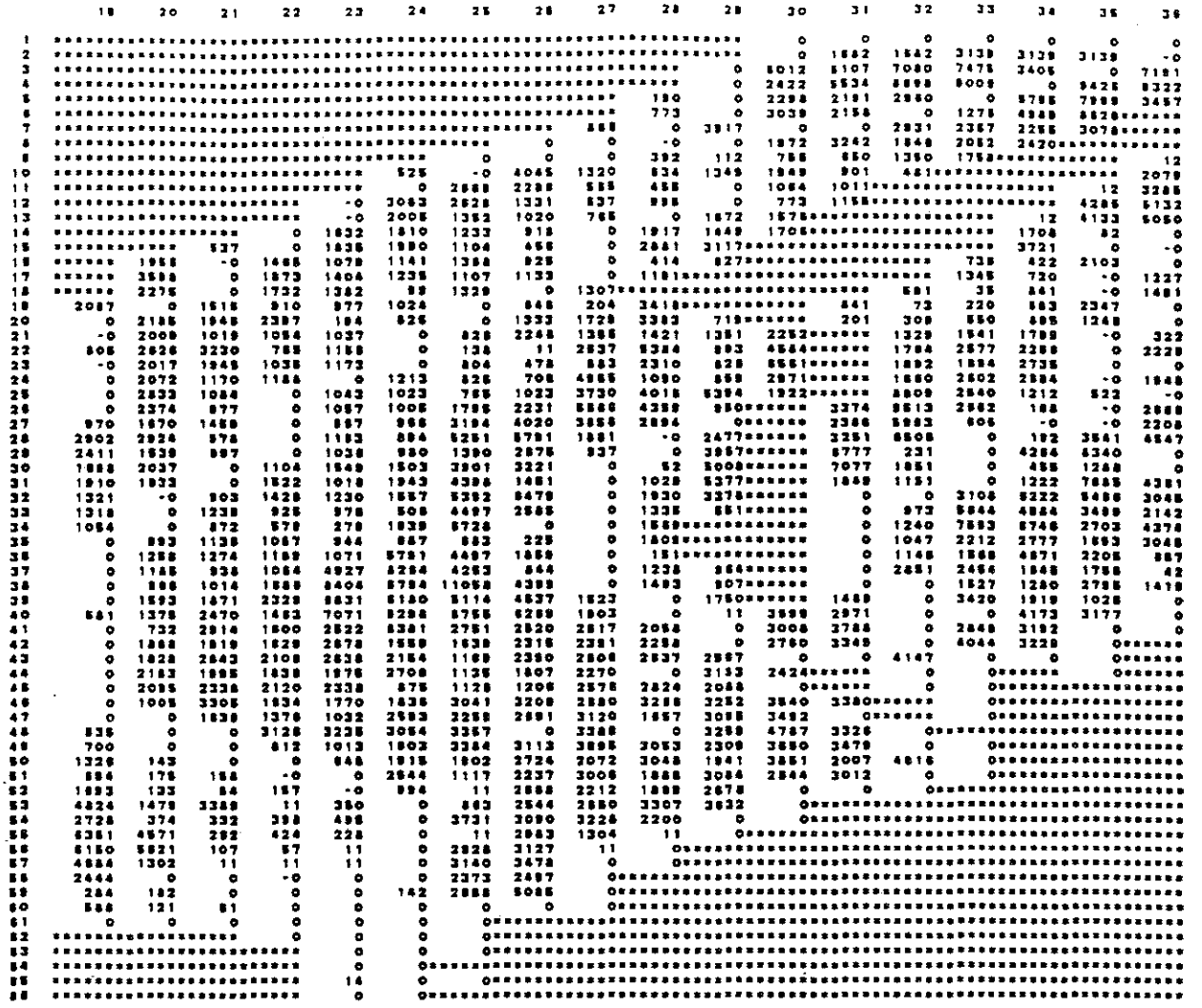
52	**********	**********	**********	0	188	114	208	1800	4282	8022	0	0	0	4873	8884	8818	8278	
53	**********	**********	**********	0	194	84	104	48	3441	8187	121	21	0	8188	8133	8488	8782	
54	**********	**********	**********	**********	0	0	122	0	1383	1223	0	12	0	1482	8182	8388	8817	
55	**********	**********	**********	**********	**********	0	0	0	122	-0	108	0	0	30	8482	4838	8388	
56	**********	**********	**********	**********	**********	**********	**********	0	0	84	18	118	128	0	2028	8203	8028	
57	**********	**********	**********	**********	**********	**********	**********	**********	0	0	22	44	11	0	31	8084		
58	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	33	40	0	48	
59	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	0	0	-0	17	
60	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	52	
61	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	0	
62	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
63	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
64	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
65	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
66	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********

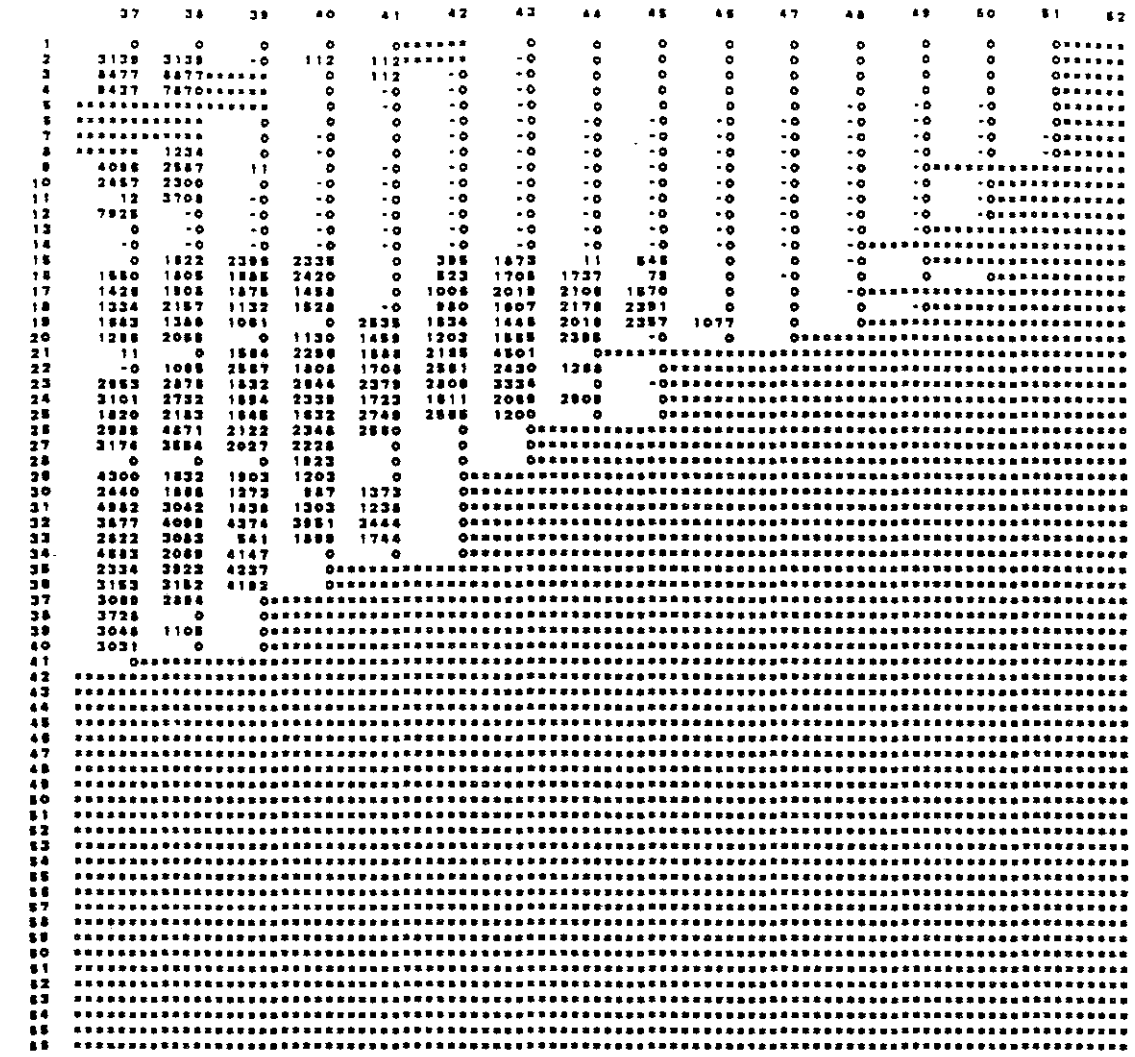


SCALAR ZUTT SUB2000 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 1768427

MATRIX ZUT SUB2010 VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		122
21																		352
22																0	1815	1768
23																	-0	0
24																	4075	4780
25																		3510
26																		235
27																	825	
28																	1785	
29																	815	0
30																1388	2188	0
31															1388	2054	2308	0
32													0	2507	2413	2313	0	
33											1849	1586	3378	0	0	0	0	
34									0	1582	1348	2018	3181	4092	214	741	0	174
35								2383	2386	1508	2232	4365	5182	2942	1515	0	0	182
36								2280	2212	2044	1818	5882	3897	81	0	1575		242
37							1551	2255	2088	1595	4420	2090	1370	1639	0	2308		2820
38							270	258	3284	3012	1851	2804	2475	2097	0	822		988
39							188	133	2800	1458	1838	5539	4864	1711	0	248		2197
40							812	1011	1008	983	2203	3784	1894	1413	0	1948		
41							715	828	478	2958	2382	1838	1801	0	0	1348		221
42			1084	288	0	382	1280	4327	5648	4148	7238	8781	6804	1238	433	343	0	82
43		0	0	428	371	0	0	2888	1898	5375	8167	8050	8386	5318	4638	838	0	112
44		0	0	420	513	217	455	0	771	3888	7408	8977	5678	6815	7711	2180	772	0
45			0	583	897	332	462	5189	0	484	1844	7877	3805	8348	8170	5281	820	948
46			0	772	808	183	278	287	730	0	288	5388	7881	8282	5875	3438	5088	867
47			0	886	412	336	328	382	311	388	0	382	8418	8088	7380	7300	8122	210
48				0	1048	357	404	238	218	285	288	0	432	8084	8853	5188	8108	17
49				0	788	382	181	220	1152	388	988	0	811	5708	2174	5038	5822	184
50				0	322	1338	88	702	5809	11300	0	0	0	2822	3845	5383	5831	822
51				0	0	3747	0	474	8501	3488	4838	-0	24	0	8227	6527	8128	5024
52					0	311	238	418	1878	4873	5204	0	-0	0	4873	5720	5837	5333
53					0	388	127	209	88	3502	8332	241	43	0	5188	8133	5502	
54						0	0	248	0	1433	1287	0	23	-0	1924	6162	8451	
55							0	0	0	287	-0	217	0	0	80	8482	4588	
56								0	0	108	38	232	252	0	2088	8244	50	
57									0	0	48	88	22	0	82	513		
58											0	0	88	81	0	88		
59												0	0	0	-0	38		
60															0	103		
61																		
62																		
63																		
64																		
65																		
66																		





SCALAR ZUTY SUB2010 TOTAL VOLUME OF UNMET DEMAND TO COME FROM OTHER SOURCES (ACRE-FT PER YEAR) = 2503402

APPENDIX D

ALLOCATE Program Listing

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C     ********************************************************        ALL00010
C     **                                                    **        ALL00020
C     **                    "ALLOCATE"                      **        ALL00030
C     **                                                    **        ALL00040
C     **                                                    **        ALL00050
C     **       CONJUNCTIVE WATER ALLOCATION PROGRAM         **        ALL00060
C     **                                                    **        ALL00070
C     **                       BY                           **        ALL00080
C     **                                                    **        ALL00090
C     **                  HOSSEIN AZARMNIA                  **        ALL00100
C     **                                                    **        ALL00110
C     **                                                    **        ALL00120
C     **            UNDER THE SUPERVISION OF                **        ALL00130
C     **                                                    **        ALL00140
C     **                DR. R. C. PERALTA                   **        ALL00150
C     **                                                    **        ALL00160
C     **                                                    **        ALL00170
C     **             UNIVERSITY OF ARKANSAS                 **        ALL00180
C     **                  JUNE  1988                        **        ALL00190
C     **                                                    **        ALL00200
C     **                                                    **        ALL00210
C     ********************************************************        ALL00220
C                                                                     ALL00230
C                                                                     ALL00240
C     THIS PROGRAM ALLOCATES AVAILABLE GROUND-WATER FROM SEPTEMBER BACK ALL00250
C     TO APRIL TO SATISFY MONTHLY WATER DEMANDS. IF AVAILABLE GROUND-   ALL00260
C     WATER IS NOT ENOUGH TO SATISFY THE DEMANDS,THEN CALCULATES MONTHLYALL00270
C     TOTAL SURFACE-WATER-NEED FOR EACH CELL. THEN ALLOCATES SURFACE-   ALL00280
C     WATER TO SATISFY CBC MONTHLY SURFACE-WATER-NEED FROM APRIL TO     ALL00290
C     SEPTEMBER.                                                        ALL00300
C     IF AVALABLE GROUND-WATER AND SURFACE-WATER IS NOT ENOUGH TO       ALL00310
C     SATISFY WATER DEMAND, CALCULATES CBC MONTHLY UNSATISFIED DEMANDS  ALL00320
C     TO BE IMPORTED FROM OTHER SOURCES AND COMPARES THEM WITH ' ZUT '. ALL00330
C                                                                       ALL00340
C          THE RESULTS OF CONJUNCTIVE ALLOCATION PROGRAM ARE TABLES FOR ALL00350
C          CELL BY CELL MONTHLY AND ANNUAL GROUND-WATER, SURFACE-WATER, ALL00360
C          M & I, AND IMPORTED-WATER-NEED. ALSO A SUMMARY TABLE OF THE  ALL00370
C          FINAL RESULTS.                                               ALL00380
C                                                                       ALL00390
C                                                                       ALL00400
      DIMENSION HEADNG(30),NAME(2)                                      ALL00410
      REAL * 8 SWA(66,52),GP(66,52),ZUT(66,52),                         ALL00420
     *  APRWN(66,52),AMAYW(66,52),AJUNW(66,52),                         ALL00430
     *  AJULW(66,52),AUGWN(66,52),SEPWN(66,52),                         ALL00440
     *  RGP8(66,52),RGP5(66,52),RGP4(66,52),                            ALL00450
     *  RGP3(66,52),RGP2(66,52),RGP1(66,52),                            ALL00460
     *  GP8(66,52),GP5(66,52),GP4(66,52),                               ALL00470
     *  GP3(66,52),GP2(66,52),GP1(66,52),                               ALL00480
     *  SURF8(66,52),SURF5(66,52),SURF4(66,52),                         ALL00490
     *  SURF3(66,52),SURF2(66,52),SURF1(66,52),                         ALL00500
     *  RSWA8(66,52),RSWA5(66,52),RSWA4(66,52),                         ALL00510
     *  RSWA3(66,52),RSWA2(66,52),RSWA1(66,52),                         ALL00520
     *  ESWN8(66,52),ESWN5(66,52),ESWN4(66,52),                         ALL00530
     *  ESWN3(66,52),ESWN2(66,52),ESWN1(66,52),                         ALL00540
     *  SWA8(66,52),SWA5(66,52),SWA4(66,52),                            ALL00550
     *  SWA3(66,52),SWA2(66,52),SWA1(66,52),TCMAI(66,52),               ALL00560
     *  TOT8(66,52),TOT5(66,52),TOT4(66,52),                            ALL00570
     *  TOT3(66,52),TOT2(66,52),TOT1(66,52),ACBCI(66,52),               ALL00580
     *  TOTAG(66,52),GPMAI(66,52),SWMAI(66,52),RMAI3(66,52),TWAD(66,52),ALL00590
     *  TAGGP(66,52),TAGSW(66,52),TAGIMP(66,52),TCNEED(66,52)           ALL00600
      REAL * 8                                                          ALL00610
     *  TCBCGP(66,52),TCBCSW(66,52),TCBCIM(66,52),CBCTT(66,52),TAMAI.   ALL00620
     *  TG1,TG2, TG3, TG4, TG5, TG8, TSRF1, TSRF2, TSRF3, TSRF4,        ALL00630
     *  TSRF5, TSRF8, TSWAY1, TSWAY2, TSWAY3, TSWAY4, TSWAY5, TSWAY8,   ALL00640
     *  TESW1, TESW2, TESW3, TESW4, TESW5, TESW8, TGP, TSWAY, TISW ,    ALL00650
     *  TSW  , TAPRN, TMAYN, TJUNN, TJULN, TAUGN, TSEPN, TNID, TALC,    ALL00660
     *  TALC1, TALC2, TALC3, TALC4, TALC5, TALC8,TANEED,TOTGWA,         ALL00670
     *  TS1,TS2, TS3, TS4, TS5, TS8,TSMAI,TOTSWA,TOTSWU,TGMAI,TOTGWU,   ALL00680
     *  TIMP1,TIMP2,TIMP3,TIMP4,TIMP5,TIMP8,TRMAI,DWAD,TOTIMA,TOTIMU,   ALL00690
     *  TAWAD,THANDI,TOTAL,OYTOT,DSUM,2DIF,                             ALL00700
     *  AN1,AN2,AN3,AN4,AN5,AN6,AN7,AN8,AN9                             ALL00710
C                                                                       ALL00720
C                                                                       ALL00730
C       *****   DEFINITION OF VARIABLES  *****                        ALL00740
C                                                                       ALL00750
C     RGP1 TO RGP8 REMINING MONTHLY GP AFTER SATISFYING DEMAND IN AC-FT ALL00760
C     GP1 TO GP8    MONTHLY GROUND-WATER IN AC-FT                       ALL00770
C     SWA1 TO SWA8 MONTHLY SURFACE-WATER IN AC-FT                       ALL00780
C     ESWN1 TO 8    MONTHLY UNSATISFIED DEMAND IN AC-FT                 ALL00790
C     SURF1 TO 8    MONTHLY SURFACE-WATER-NEED IN AC-FT                 ALL00800
C     TG1 TO TG8    ANNUAL MONTHLY GROUND-WATER ALLOCATED IN AC-FT/YR   ALL00810
C     TS1 TO TS8    ANNUAL MONTHLY SURFACE-WATER ALLOCATED IN AC-FT/YR  ALL00820
C     TIMP1 TO 8    ANNUAL MONTHLY IMPORTED-WATER-NEED IN AC-FT/YR      ALL00830
C     AN1 TO AN8    ANNUAL MONTHLY TOTAL WATER ALLOCATED IN AC-FT/YR    ALL00840
C                                                                       ALL00850
C                                                                       ALL00860
      WRITE(8,10)                                                       ALL00870
   10 FORMAT(//80('*')////28X,'CONJUNCTIVE WATER ALLOCATION')            ALL00880
      WRITE(8,20)                                                       ALL00890
   20 FORMAT(////39X,'BY'////32X,'HOSSEIN AZARMNIA')                     ALL00900
      WRITE(8,30)                                                       ALL00910
   30 FORMAT(//28X,'UNDER THE SUPERVISION OF'//32X,'DR. R. C. PERALTA') ALL00920
      WRITE(8,40)                                                       ALL00930
   40 FORMAT(////28X,'UNIVERSITY OF ARKANSAS'/////35X,'JUNE  1988'///)  ALL00940
C                                                                       ALL00950
C     ***** READ AND PRINT HEADING *****                                ALL00960
C                                                                       ALL00970
      READ(5,50) NAME,HEADNG                                            ALL00980
   50 FORMAT(2X,2A4,30A4)                                               ALL00990
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      WRITE(6,80) HEADNG                                                ALL01000
   80 FORMAT(/30A4////130('*')/)                                        ALL01010
C                                                                       ALL01020
C                                                                       ALL01030
                     CALL MANDI(GP,SWA,APRWN,AMAYW,AJUNW,AJULW,AUGWN,   ALL01040
     *                        SEPWN,TOTAG,CPMAI,SWMAI,RMAI3,TWAD,CSCTT)  ALL01050
C                                                                       ALL01060
C                                                                       ALL01070
      TAMAI = 0                                                         ALL01080
      TANEED = 0                                                        ALL01090
C                                                                       ALL01100
C     ************  READ ZUT TABLE FROM GAMSOP OUTPUT  ***********      ALL01110
C                                                                       ALL01120
      DO 70 I=1,55                                                      ALL01130
   70    READ(7,*) I,(ZUT(I,J), J=1,12)                                 ALL01140
      DO 80 I=1,55                                                      ALL01150
   80    READ(7,*) I,(ZUT(I,J), J=13,24)                                ALL01160
      DO 90 I=1,55                                                      ALL01170
   90    READ(7,*) I,(ZUT(I,J), J=25,36)                                ALL01180
      DO 100 I=1,55                                                     ALL01190
  100    READ(7,*) I,(ZUT(I,J), J=37,48)                                ALL01200
      DO 110 I=1,55                                                     ALL01210
  110    READ(7,*) I,(ZUT(I,J), J=49,52)                                ALL01220
C                                                                       ALL01230
C                                                                       ALL01240
C                                                                       ALL01250
C                                                                       ALL01260
C     ***** ALLOCATE MONTHLY GROUND-WATER FOR EACH CELL *****           ALL01270
C                                                                       ALL01280
      DO 200 I=1,55                                                     ALL01290
      DO 200 J=1,52                                                     ALL01300
         RGP5(I,J)=GP(I,J) - SEPWN(I,J)                                 ALL01310
         IF(RGP5(I,J) .LE. 0.0) GO TO 130                               ALL01320
         GP5(I,J)=SEPWN(I,J)                                            ALL01330
C                                                                       ALL01340
         RGP5(I,J)=RGP5(I,J) - AUGWN(I,J)                               ALL01350
         IF(RGP5(I,J) .LE. 0.0) GO TO 140                               ALL01360
         GP5(I,J)=AUGWN(I,J)                                            ALL01370
C                                                                       ALL01380
         RGP4(I,J)=RGP5(I,J) - AJULW(I,J)                               ALL01390
         IF(RGP4(I,J) .LE. 0.0) GO TO 150                               ALL01400
         GP4(I,J)=AJULW(I,J)                                            ALL01410
C                                                                       ALL01420
         RGP3(I,J)=RGP4(I,J) - AJUNW(I,J)                               ALL01430
         IF(RGP3(I,J) .LE. 0.0) GO TO 160                               ALL01440
         GP3(I,J)=AJUNW(I,J)                                            ALL01450
C                                                                       ALL01460
         RGP2(I,J)=RGP3(I,J) - AMAYW(I,J)                               ALL01470
         IF(RGP2(I,J) .LE. 0.0) GO TO 170                               ALL01480
         GP2(I,J)=AMAYW(I,J)                                            ALL01490
C                                                                       ALL01500
         RGP1(I,J)=RGP2(I,J) - APRWN(I,J)                               ALL01510
         IF(RGP1(I,J) .LE. 0.0) GO TO 180                               ALL01520
         IF(RGP1(I,J) .GT. 10.) WRITE(6,120) I,J,RGP1(I,J)              ALL01530
  120    FORMAT(/20X,'**** WARNING: AVAILABLE GROUND-WATER IS MORE THAN  ALL01540
     *   NEED',2I5,F10.2)                                               ALL01550
         GP1(I,J)=APRWN(I,J)                                            ALL01560
         GO TO 200                                                      ALL01570
C                                                                       ALL01580
  130    GP5(I,J)  =GP(I,J)                                             ALL01590
         SURF5(I,J)=-RGP5(I,J)                                          ALL01600
         SURF5(I,J)=AUGWN(I,J)                                          ALL01610
         SURF4(I,J)=AJULW(I,J)                                          ALL01620
         SURF3(I,J)=AJUNW(I,J)                                          ALL01630
         SURF2(I,J)=AMAYW(I,J)                                          ALL01640
         SURF1(I,J)=APRWN(I,J)                                          ALL01650
         GO TO 200                                                      ALL01660
C                                                                       ALL01670
  140    GP5(I,J)  =RGP5(I,J)                                           ALL01680
         SURF5(I,J)=-RGP5(I,J)                                          ALL01690
         SURF4(I,J)=AJULW(I,J)                                          ALL01700
         SURF3(I,J)=AJUNW(I,J)                                          ALL01710
         SURF2(I,J)=AMAYW(I,J)                                          ALL01720
         SURF1(I,J)=APRWN(I,J)                                          ALL01730
         GO TO 200                                                      ALL01740
C                                                                       ALL01750
  150    GP4(I,J)  =RGP5(I,J)                                           ALL01760
         SURF4(I,J)=-RGP4(I,J)                                          ALL01770
         SURF3(I,J)=AJUNW(I,J)                                          ALL01780
         SURF2(I,J)=AMAYW(I,J)                                          ALL01790
         SURF1(I,J)=APRWN(I,J)                                          ALL01800
         GO TO 200                                                      ALL01810
C                                                                       ALL01820
  160    GP3(I,J)  =RGP4(I,J)                                           ALL01830
         SURF3(I,J)=-RGP3(I,J)                                          ALL01840
         SURF2(I,J)=AMAYW(I,J)                                          ALL01850
         SURF1(I,J)=APRWN(I,J)                                          ALL01860
         GO TO 200                                                      ALL01870
C                                                                       ALL01880
  170    GP2(I,J)  =RGP3(I,J)                                           ALL01890
         SURF2(I,J)=-RGP2(I,J)                                          ALL01900
         SURF1(I,J)=APRWN(I,J)                                          ALL01910
         GO TO 200                                                      ALL01920
C                                                                       ALL01930
  180    GP1(I,J)  =RGP2(I,J)                                           ALL01940
         SURF1(I,J)=-RGP1(I,J)                                          ALL01950
  200 CONTINUE                                                          ALL01960
C                                                                       ALL01870
C     *******   MONTHLY SURFACE-WATER ALLOCATED   *******               ALL01880
C                                                                       ALL01890
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      DO  300 I=1,66                                                    ALL02000
      DO  300 J=1,52                                                    ALL02010
         RSWA1(I,J)=SWA(I,J) - SURF1(I,J)                               ALL02020
         IF(RSWA1(I,J) .LE. 0.0) GO TO 220                              ALL02030
         SWA1(I,J)=SURF1(I,J)                                           ALL02040
C                                                                       ALL02050
         RSWA2(I,J)=RSWA1(I,J) - SURF2(I,J)                             ALL02060
         IF(RSWA2(I,J) .LE. 0.0) GO TO 240                              ALL02070
         SWA2(I,J)=SURF2(I,J)                                           ALL02080
C                                                                       ALL02090
         RSWA3(I,J)=RSWA2(I,J) - SURF3(I,J)                             ALL02100
         IF(RSWA3(I,J) .LE. 0.0) GO TO 260                              ALL02110
         SWA3(I,J)=SURF3(I,J)                                           ALL02120
C                                                                       ALL02130
         RSWA4(I,J)=RSWA3(I,J) - SURF4(I,J)                             ALL02140
         IF(RSWA4(I,J) .LE. 0.0) GO TO 280                              ALL02150
         SWA4(I,J)=SURF4(I,J)                                           ALL02160
C                                                                       ALL02170
         RSWA5(I,J)=RSWA4(I,J) - SURF5(I,J)                             ALL02180
         IF(RSWA5(I,J) .LE. 0.0) GO TO 270                              ALL02190
         SWA5(I,J)=SURF5(I,J)                                           ALL02200
C                                                                       ALL02210
         RSWA6(I,J)=RSWA5(I,J) - SURF6(I,J)                             ALL02220
         IF(RSWA6(I,J) .LE. 0.0) GO TO 280                              ALL02230
         IF(RSWA6(I,J) .GT. 5.0) WRITE(6,210) I,J,RSWA6(I,J)            ALL02240
 210     FORMAT(/20X,'**** WARNING: AVAILABLE SURFACE-WATER IS MORE THANALL02250
     *   NEED',2I5,F10.2)                                               ALL02260
         SWA6(I,J)=SURF6(I,J) + RSWA6(I,J)                              ALL02270
         GO TO 300                                                      ALL02280
C                                                                       ALL02290
 220     SWA1(I,J) =SWA(I,J)                                            ALL02300
         ESWN1(I,J)=-RSWA1(I,J)                                         ALL02310
         ESWN2(I,J)=SURF2(I,J)                                          ALL02320
         ESWN3(I,J)=SURF3(I,J)                                          ALL02330
         ESWN4(I,J)=SURF4(I,J)                                          ALL02340
         ESWN5(I,J)=SURF5(I,J)                                          ALL02350
         ESWN6(I,J)=SURF6(I,J)                                          ALL02360
         DSUM = ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)+ESWN4(I,J)             ALL02370
     *        +ESWN5(I,J)+ESWN6(I,J) + RMAI3(I,J)                       ALL02380
         ZDIF = ZUT(I,J) - DSUM                                         ALL02390
            IF(ZDIF .GT. 5.0) WRITE(6,230) I,J,ZDIF                     ALL02400
 230        FORMAT(/8X,'ZUT - UNSAT. FOR CELL  ',I2,3X,I2,' = ',F4.1/)  ALL02410
            IF(ZDIF .NE. 0) ESWN6(I,J) = ESWN6(I,J) + ZDIF              ALL02420
         GO TO 300                                                      ALL02430
C                                                                       ALL02440
 240     SWA2(I,J) =RSWA1(I,J)                                          ALL02450
         ESWN2(I,J)=-RSWA2(I,J)                                         ALL02460
         ESWN3(I,J)=SURF3(I,J)                                          ALL02470
         ESWN4(I,J)=SURF4(I,J)                                          ALL02480
         ESWN5(I,J)=SURF5(I,J)                                          ALL02490
         ESWN6(I,J)=SURF6(I,J)                                          ALL02500
         DSUM = ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)+ESWN4(I,J)             ALL02510
     *        +ESWN5(I,J)+ESWN6(I,J) + RMAI3(I,J)                       ALL02520
         ZDIF = ZUT(I,J) - DSUM                                         ALL02530
            IF(ZDIF .GT. 5.0) WRITE(6,230) I,J,ZDIF                     ALL02540
            IF(ZDIF .NE. 0) ESWN6(I,J) = ESWN6(I,J) + ZDIF              ALL02550
         GO TO 300                                                      ALL02560
C                                                                       ALL02570
 260     SWA3(I,J) =RSWA2(I,J)                                          ALL02580
         ESWN3(I,J)=-RSWA3(I,J)                                         ALL02590
         ESWN4(I,J)=SURF4(I,J)                                          ALL02600
         ESWN5(I,J)=SURF5(I,J)                                          ALL02610
         ESWN6(I,J)=SURF6(I,J)                                          ALL02620
         DSUM = ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)+ESWN4(I,J)             ALL02630
     *        +ESWN5(I,J)+ESWN6(I,J) + RMAI3(I,J)                       ALL02640
         ZDIF = ZUT(I,J) - DSUM                                         ALL02650
            IF(ZDIF .GT. 5.0) WRITE(6,230) I,J,ZDIF                     ALL02660
            IF(ZDIF .NE. 0) ESWN6(I,J) = ESWN6(I,J) + ZDIF              ALL02670
         GO TO 300                                                      ALL02680
C                                                                       ALL02690
 280     SWA4(I,J) =RSWA3(I,J)                                          ALL02700
         ESWN4(I,J)=-RSWA4(I,J)                                         ALL02710
         ESWN5(I,J)=SURF5(I,J)                                          ALL02720
         ESWN6(I,J)=SURF6(I,J)                                          ALL02730
         DSUM = ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)+ESWN4(I,J)             ALL02740
     *        +ESWN5(I,J)+ESWN6(I,J) + RMAI3(I,J)                       ALL02750
         ZDIF = ZUT(I,J) - DSUM                                         ALL02760
            IF(ZDIF .GT. 5.0) WRITE(6,230)I,J,ZDIF                      ALL02770
            IF(ZDIF .NE. 0) ESWN6(I,J) = ESWN6(I,J) + ZDIF              ALL02780
         GO TO 300                                                      ALL02790
C                                                                       ALL02800
 270     SWA5(I,J) =RSWA4(I,J)                                          ALL02810
         ESWN5(I,J)=-RSWA5(I,J)                                         ALL02820
         ESWN6(I,J)=SURF6(I,J)                                          ALL02830
         DSUM = ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)+ESWN4(I,J)             ALL02840
     *        +ESWN5(I,J)+ESWN6(I,J) + RMAI3(I,J)                       ALL02850
         ZDIF = ZUT(I,J) - DSUM                                         ALL02860
            IF(ZDIF .GT. 5.0) WRITE(6,230) I,J,ZDIF                     ALL02870
            IF(ZDIF .NE. 0) ESWN6(I,J) = ESWN6(I,J) + ZDIF              ALL02880
         GO TO 300                                                      ALL02890
C                                                                       ALL02900
 280     SWA6(I,J) =RSWA5(I,J)                                          ALL02910
         ESWN6(I,J)=-RSWA6(I,J)                                         ALL02920
         DSUM = ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)+ESWN4(I,J)             ALL02930
     *        +ESWN5(I,J)+ESWN6(I,J) + RMAI3(I,J)                       ALL02940
         ZDIF = ZUT(I,J) - DSUM                                         ALL02950
            IF(ZDIF .GT. 5.0) WRITE(6,230) I,J,ZDIF                     ALL02960
            IF(ZDIF .NE. 0) ESWN6(I,J) = ESWN6(I,J) + ZDIF              ALL02970
C                                                                       ALL02980
 300     CONTINUE                                                       ALL02990
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      TG1 = 0                                                                ALL03000
      TG2 = 0                                                                ALL03010
      TG3 = 0                                                                ALL03020
      TG4 = 0                                                                ALL03030
      TG5 = 0                                                                ALL03040
      TG6 = 0                                                                ALL03050
      TS1 = 0                                                                ALL03060
      TS2 = 0                                                                ALL03070
      TS3 = 0                                                                ALL03080
      TS4 = 0                                                                ALL03090
      TS5 = 0                                                                ALL03100
      TS6 = 0                                                                ALL03110
      TIMP1 = 0                                                              ALL03120
      TIMP2 = 0                                                              ALL03130
      TIMP3 = 0                                                              ALL03140
      TIMP4 = 0                                                              ALL03150
      TIMP5 = 0                                                              ALL03160
      TIMP6 = 0                                                              ALL03170
      TRMAI = 0                                                              ALL03180
      DWAD = 0                                                               ALL03190
      DO  400 I=1,65                                                         ALL03200
      DO  400 J=1,52                                                         ALL03210
     TAGGP(I,J)=GP1(I,J)+GP2(I,J)+GP3(I,J)+GP4(I,J)+GP5(I,J)+GP6(I,J)        ALL03220
     TAGSW(I,J)=SWA1(I,J)+SWA2(I,J)+SWA3(I,J)+SWA4(I,J)                      ALL03230
     *          +SWA5(I,J)+SWA6(I,J)                                        ALL03240
     TAGIMP(I,J)=ESWN1(I,J)+ESWN2(I,J)+ESWN3(I,J)                           ALL03250
     *          +ESWN4(I,J)+ESWN5(I,J)+ESWN6(I,J)                           ALL03260
     TCBCGP(I,J)= TAGGP(I,J)+GPMAI(I,J)                                     ALL03270
     TCBCSW(I,J)= TAGSW(I,J)+SWMAI(I,J)                                     ALL03280
     TCBCIM(I,J)= TAGIMP(I,J)+RMAI3(I,J)                                    ALL03290
C         TOTGW = TOTGW + TAGGP(I,J)                                        ALL03300
C         TOTSW = TOTSW + TAGSW(I,J)                                        ALL03310
C           ZUT =  ZUT + TAGIMP(I,J)                                        ALL03320
C         TAWAD = TAWAD + TOTAG(I,J)                                        ALL03330
C       TIMPMAI= TIMPMAI+ RMAI3(I,J)                                        ALL03340
C         TOTWAD = TOTWAD+ TWAD(I,J)                                        ALL03350
      TG1 = TG1 + GP1(I,J)                                                   ALL03360
      TG2 = TG2 + GP2(I,J)                                                   ALL03370
      TG3 = TG3 + GP3(I,J)                                                   ALL03380
      TG4 = TG4 + GP4(I,J)                                                   ALL03390
      TG5 = TG5 + GP5(I,J)                                                   ALL03400
      TG6 = TG6 + GP6(I,J)                                                   ALL03410
        TGMAI = TGMAI + GPMAI(I,J)                                           ALL03420
      TS1 = TS1 + SWA1(I,J)                                                  ALL03430
      TS2 = TS2 + SWA2(I,J)                                                  ALL03440
      TS3 = TS3 + SWA3(I,J)                                                  ALL03450
      TS4 = TS4 + SWA4(I,J)                                                  ALL03460
      TS5 = TS5 + SWA5(I,J)                                                  ALL03470
      TS6 = TS6 + SWA6(I,J)                                                  ALL03480
        TSMAI = TSMAI + SWMAI(I,J)                                           ALL03490
      TIMP1 = TIMP1 + ESWN1(I,J)                                             ALL03500
      TIMP2 = TIMP2 + ESWN2(I,J)                                             ALL03510
      TIMP3 = TIMP3 + ESWN3(I,J)                                             ALL03520
      TIMP4 = TIMP4 + ESWN4(I,J)                                             ALL03530
      TIMP5 = TIMP5 + ESWN5(I,J)                                             ALL03540
      TIMP6 = TIMP6 + ESWN6(I,J)                                             ALL03550
        TRMAI = TRMAI + RMAI3(I,J)                                           ALL03560
        DWAD  = DWAD  + CBCTT(I,J)                                           ALL03570
  400   CONTINUE                                                             ALL03580
      TOTGWA=TG1+TG2+TG3+TG4+TG5+TG6                                         ALL03590
      TOTGWU=TG1+TG2+TG3+TG4+TG5+TG6+TGMAI                                   ALL03600
      TOTSWA=TS1+TS2+TS3+TS4+TS5+TS6                                         ALL03610
      TOTSWU=TS1+TS2+TS3+TS4+TS5+TS6+TSMAI                                   ALL03620
      TOTIMA=TIMP1+TIMP2+TIMP3+TIMP4+TIMP5+TIMP6                             ALL03630
      TOTIMU=TIMP1+TIMP2+TIMP3+TIMP4+TIMP5+TIMP6+TRMAI                       ALL03640
                                      TAWAD=TOTGWA+TOTSWA+TOTIMA             ALL03650
                                      TMANDI=TGMAI+TSMAI+TRMAI               ALL03660
                                      TOTAL=TOTGWU+TOTSWU+TOTIMU             ALL03670
                              GVTOT = TOTAL + DWAD                           ALL03680
      WRITE(6,500)                                                           ALL03690
  500 FORMAT(//25X,'******  SURFACE-WATER REPORT  *******'/132('_')//         ALL03700
     *  3X,'I',3X,'J',8X,'APR',7X,'MAY',7X,'JUN',7X,'JUL',7X,'AUG',7X,       ALL03710
     *  'SEP',5X,'TAGSW',5X,'SWMAI',5X,'TOTSW'/132('_')/)                    ALL03720
      DO 510  I=1,65                                                         ALL03730
      DO 510  J=1,52                                                         ALL03740
      WRITE(6,55) I,J,                                                       ALL03750
     * SWA1(I,J),SWA2(I,J),SWA3(I,J),SWA4(I,J),SWA5(I,J),SWA6(I,J)           ALL03760
     * ,TAGSW(I,J),SWMAI(I,J),TCBCSW(I,J)                                    ALL03770
   55   FORMAT(2X,I2,2X,I2,2X,12F10.2)                                       ALL03780
  510 CONTINUE                                                               ALL03790
      WRITE(6,520)  TS1,TS2,TS3,TS4,TS5,TS6,TOTSWA,TSMAI,TOTSWU              ALL03800
  520 FORMAT(132('_')/3X,'ANNUAL',10F10.1)                                   ALL03810
      WRITE(6,600)                                                           ALL03820
  600 FORMAT(//25X,'******  GROUND-WATER REPORT  *******'/132('_')//         ALL03830
     *  3X,'I',3X,'J',8X,'APR',7X,'MAY',7X,'JUN',7X,'JUL',7X,'AUG',7X,       ALL03840
     *  'SEP',5X,'TAGGW',5X,'GWMAI',5X,'TOTGW'/132('_')/)                    ALL03850
      DO 610  I=1,65                                                         ALL03860
      DO 610  J=1,52                                                         ALL03870
      WRITE(6,55) I,J,                                                       ALL03880
     * GP1(I,J),GP2(I,J),GP3(I,J),GP4(I,J),GP5(I,J),GP6(I,J)                ALL03890
     * ,TAGGP(I,J),GPMAI(I,J),TCBCGP(I,J)                                   ALL03900
  610 CONTINUE                                                               ALL03910
      WRITE(6,620)  TG1,TG2,TG3,TG4,TG5,TG6,TOTGWA,TGMAI,TOTGWU             ALL03920
  620 FORMAT(132('_')/3X,'ANNUAL',10F10.1)                                   ALL03930
      WRITE(6,700)                                                           ALL03940
  700 FORMAT(//25X,'******  UNSATISFIED-WATER REPORT *******'/132('_')//ALL03950
     *  3X,'I',3X,'J',8X,'APR',7X,'MAY',7X,'JUN',7X,'JUL',7X,'AUG',7X,       ALL03960
     *  'SEP',5X,'TAGIM',5X,' RMAI',5X,'TOTIM'/132('_')/)                    ALL03970
      DO 710  I=1,65                                                         ALL03980
      DO 710  J=1,52                                                         ALL03990
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      WRITE(8,58) I,J,                                                  ALL04000
     * ESWN1(I,J),ESWN2(I,J),ESWN3(I,J),ESWN4(I,J),ESWN5(I,J),ESWN6(I,J)ALL04010
     * ,TAGIMP(I,J),RMAI3(I,J),TCBCIM(I,J)                              ALL04020
  710 CONTINUE                                                          ALL04030
      WRITE(6,720) TIMP1,TIMP2,TIMP3,TIMP4,TIMP5,                       ALL04040
     *          TIMP6,TOTIMA,TRMAI,TOTIMU                              ALL04050
  720 FORMAT(132('_')/3X,'ANNUAL',10F10.1)                              ALL04060
      WRITE(6,800)                                                      ALL04070
  800 FORMAT('1'//132('*')//35X,'&&&&&&&&&&          ANNUAL REPORT      ALL04080
     * &&&&&&&&&&'//132('_')/)                                          ALL04090
      WRITE(6,810) DWAD                                                 ALL04100
  810 FORMAT(/5X,'TOTAL TERTIARY =',F8.1)                               ALL04110
      WRITE(6,820) TOTGWA,TGMAI,TOTGWU                                  ALL04120
  820 FORMAT(/5X,'TOTGWA =',F10.0,5X,'TGMAI =' ALL04130
     *          ,F10.0,5X,'TOTGWU =',F10.0)                            ALL04140
      WRITE(6,830) TOTSWA,TSMAI,TOTSWU                                  ALL04150
  830 FORMAT(/5X,'TOTSWA =',F10.0,5X,'TSMAI =' ALL04160
     *          ,F10.0,5X,'TOTSWU =',F10.0)                            ALL04170
      WRITE(6,840)  TOTIMA,TRMAI,TOTIMU                                 ALL04180
  840 FORMAT(/5X,'TOTIMA =',F10.0,5X,'TRMAI =' ALL04190
     *          ,F10.0,5X,'TOTIMU =',F10.0)                            ALL04200
      WRITE(6,850)  TAWAD,TMANDI,TOTAL,OVTOT                            ALL04210
  850 FORMAT(/5X,'TAWAD  =',F10.0,4X,'TMANDI =' ALL04220
     *          ,F10.0,5X,'TOTAL  =',F10.0,5X,'OVERAL TOTAL =',F11.0   ALL04230
     * /2X/130('='))                                                  ALL04240
      WRITE(8,900) NAME                                                 ALL04250
  900          FORMAT(///5X,'SUMMARY OF QUTERNARY GROUND-WATER, SURFAC-ALL04260
     *WATER AND UNSATISFIED DEMAND (AC-FT) FOR SCENARIO ',2A4//132('_'))ALL04270
          WRITE(8,910)                                                  ALL04280
  910 FORMAT(/14X,'APR',7X,'MAY',7X,'JUN',7X,'JUL',7X,'AUG',7X,         ALL04290
     *  'SEP',5X,'TOTAG',5X,'M & I',5X,'TOTAL'/132('_')/)              ALL04300
        WRITE(8,920) TG1,TG2,TG3,TG4,TG5,TG6,TOTGWA,TGMAI,TOTGWU        ALL04310
  920 FORMAT(/5X,'G',4X,10F10.0)                                        ALL04320
        WRITE(8,930) TS1,TS2,TS3,TS4,TS5,TS6,TOTSWA,TSMAI,TOTSWU        ALL04330
  930 FORMAT(/5X,'S',4X,10F10.0)                                        ALL04340
      WRITE(8,940)TIMP1,TIMP2,TIMP3,TIMP4,TIMP5,TIMP6,                  ALL04350
     *          TOTIMA,TRMAI,TOTIMU                                    ALL04360
  940 FORMAT(/5X,'U',4X,10F10.0)                                        ALL04370
          AN1 = TG1 + TS1 + TIMP1                                       ALL04380
          AN2 = TG2 + TS2 + TIMP2                                       ALL04390
          AN3 = TG3 + TS3 + TIMP3                                       ALL04400
          AN4 = TG4 + TS4 + TIMP4                                       ALL04410
          AN5 = TG5 + TS5 + TIMP5                                       ALL04420
          AN6 = TG6 + TS6 + TIMP6                                       ALL04430
          AN7 = TOTGWA + TOTSWA + TOTIMA                                ALL04440
          AN8 = TGMAI + TSMAI + TRMAI                                   ALL04450
          AN9 = TOTGWU + TOTSWU + TOTIMU                                ALL04460
      WRITE(8,950)AN1,AN2,AN3,AN4,AN5,AN6,AN7,AN8,AN9                   ALL04470
  950  FORMAT(/3X,'TOTAL',2X,9F10.0//2X,130('='))                       ALL04480
      STOP                                                              ALL04490
      END                                                               ALL04500
        SUBROUTINE MANDI(GP,SWA,APRWN,AMAYW,AJUNW,AJULW,AUGWN,          ALL04510
     *                   SEPWN,TOTAG,GPMAI,SWMAI,RMAI3,TWAD,CBCTY)     ALL04520
C                                                                       ALL04530
C                    *************   M & I PROGRAM  *************       ALL04540
C                                                                       ALL04550
C                                                                       ALL04560
C     ------------------------------------------------------------      ALL04570
C                                                                       ALL04580
C       A FORTRAN PROGRAM TO READ TOTAL G,S, AND M&I, TOTAL MONTHLY     ALL04590
C       WATER DEMAND FOR EACH CELL.THEN COMPUTING TOTAL GROUND-WATER,   ALL04600
C       SURFACE-WATER AVAILABLE AND IMPORTED-WATER NEED FOR EACH CELL.  ALL04610
C                                                                       ALL04620
C     ------------------------------------------------------------      ALL04630
C                                                                       ALL04640
      REAL * 8  SWA(66,52),GP(66,52),                                   ALL04650
     *  APRWN(66,52),AMAYW(66,52),AJUNW(66,52),                         ALL04660
     *  AJULW(66,52),AUGWN(66,52),SEPWN(66,52),                         ALL04670
     *  MAI1(66,52),RMAI2(66,52),RMAI3(66,52),RGP(66,52),RSW(66,52),    ALL04680
     *  TOTAG(66,52),TWAD(66,52),GPMAI(66,52),SWMAI(66,52),             ALL04690
     *  CBCAG(66,52),CBCTY(66,52),TOT2(66,52),TOT3(66,52)               ALL04700
C                                                                       ALL04710
C       *****  DEFINITION OF VARIABLES  ******                          ALL04720
C                                                                       ALL04730
C     SWA           AVAILABLE SURFACE WATER IN AC-FT/YR                 ALL04740
C     GP            AVAILABLE GROUND WATER IN AC-FT/YR                  ALL04750
C     APRWN                                                             ALL04760
C     AMAYW                                                             ALL04770
C     AJUNW         MONTHLY AGRIC. WATER DEMAND EXCLUDING TERT. IN AC-FT ALL04780
C     AJULW                                                             ALL04790
C     AUGWN                                                             ALL04800
C     SEPWN                                                             ALL04810
C     MAI1          ANNUAL M & I WATER DEMAND IN AC-FT/YR               ALL04820
C     RMAI2         M & I WHICH CANNOT BE SUPPLIED BY GP  IN AC-FT/YR   ALL04830
C     RMAI3         M & I WHICH CANNOT BE SUPPLIED BY SW AND SHOULD BE  ALL04840
C                   IMPORTED FROM OTHER SOURCES IN AC-FT/YR             ALL04850
C     RGP           REMINING GP AFTER SATISFYING M & I IN AC-FT/YR      ALL04860
C     RSW           REMINING SW AFTER SATISFYING M & I IN AC-FT/YR      ALL04870
C     GPMAI         M & I WATER SUPPLIED BY GP IN AC-FT/YR              ALL04880
C     SWMAI         M & I WATER SUPPLIED BY SW IN AC-FT/YR              ALL04890
C     TWAD          TOTAL ANNUAL WATER DEMAND IN AC-FT                  ALL04900
C                                                                       ALL04910
      DO 3 I=1,66                                                       ALL04920
      DO 3 J=1,52                                                       ALL04930
            SWA(I,J) = 0                                                ALL04940
             GP(I,J) = 0                                                ALL04950
          APRWN(I,J) = 0                                                ALL04960
          AMAYW(I,J) = 0                                                ALL04970
          AJUNW(I,J) = 0                                                ALL04980
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            AJULW(I,J) = 0                                                  ALL05000
            AUGWN(I,J) = 0                                                  ALL05010
            SEPWN(I,J) = 0                                                  ALL05020
             MAI1(I,J) = 0                                                  ALL05030
            RMAI2(I,J) = 0                                                  ALL05040
            RMAI3(I,J) = 0                                                  ALL05050
              RGP(I,J) = 0                                                  ALL05060
              RSW(I,J) = 0                                                  ALL05070
            TOTAG(I,J) = 0                                                  ALL05080
             TWAD(I,J) = 0                                                  ALL05090
            GPMAI(I,J) = 0                                                  ALL05100
            SWMAI(I,J) = 0                                                  ALL05110
  3      CONTINUE                                                           ALL05120
         TERT = 0                                                           ALL05130
C                                                                           ALL05140
C     **** CALL MONTHLY TOTAL WATER NEED FOR EACH CELL ****                 ALL05150
C                                                                           ALL05160
C                                                                           ALL05170
                CALL PREMAI(APRWN,AMAYW,AJUNW,AJULW,AUGWN,SEPWN,            ALL05180
     *                      CBCAG,CBCTY,MAI1,TOT2,TOT3)                     ALL05190
C                                                                           ALL05200
C                                                                           ALL05210
C     **** READ TOTAL GROUND-WATER AVAILABLE FOR EACH CELL ****             ALL05220
C                                                                           ALL05230
      DO 4 I=1,65                                                           ALL05240
  4         READ(7,*) I,(GP(I,J), J=1,12)                                   ALL05250
      DO 5 I=1,65                                                           ALL05260
  5         READ(7,*) I,(GP(I,J), J=13,24)                                  ALL05270
      DO 6 I=1,65                                                           ALL05280
  6         READ(7,*) I,(GP(I,J), J=25,38)                                  ALL05290
      DO 7 I=1,65                                                           ALL05300
  7         READ(7,*) I,(GP(I,J), J=37,48)                                  ALL05310
      DO 8  I=1,65                                                          ALL05320
  8         READ(7,*) I,(GP(I,J), J=49,52)                                  ALL05330
C                                                                           ALL05340
C     **** READ TOTAL SURFACE-WATER AVAILABLE FOR EACH CELL ****            ALL05350
C                                                                           ALL05360
      DO 9 I=1,65                                                           ALL05370
  9         READ(7,*) I,(SWA(I,J), J=1,11)                                  ALL05380
      DO 10 I=1,65                                                          ALL05390
 10         READ(7,*) I,(SWA(I,J), J=12,22)                                 ALL05400
      DO 11 I=1,65                                                          ALL05410
 11         READ(7,*) I,(SWA(I,J), J=23,33)                                 ALL05420
      DO 12 I=1,65                                                          ALL05430
 12         READ(7,*) I,(SWA(I,J), J=34,44)                                 ALL05440
      DO 13 I=1,65                                                          ALL05450
 13         READ(7,*) I,(SWA(I,J), J=45,52)                                 ALL05460
C                                                                           ALL05470
      DO 20 I=1,65                                                          ALL05480
      DO 20 J=1,52                                                          ALL05490
         TAPR = TAPR + APRWN(I,J)                                           ALL05500
         TMAY = TMAY + AMAYW(I,J)                                           ALL05510
         TJUN = TJUN + AJUNW(I,J)                                           ALL05520
         TJUL = TJUL + AJULW(I,J)                                           ALL05530
         TAUG = TAUG + AUGWN(I,J)                                           ALL05540
         TSEP = TSEP + SEPWN(I,J)                                           ALL05550
         TERT = TERT + CBCTT(I,J)                                           ALL05560
 20   CONTINUE                                                              ALL05570
 58      FORMAT(3X,I2,3X,I2,5X,11F10.2)                                     ALL05580
C                                                                           ALL05590
C                                                                           ALL05600
C                                                                           ALL05610
C                                                                           ALL05620
C     ****  ALLOCATING GP & SW FOR M & I DEMAND  *****                      ALL05630
C                                                                           ALL05640
      DO 50  I=1,65                                                         ALL05650
      DO 50  J=1,52                                                         ALL05660
         RGP(I,J)=GP(I,J) - MAI1(I,J)                                       ALL05670
         IF(RGP(I,J) .LE. 0) GO TO 30                                       ALL05680
         GPMAI(I,J) = MAI1(I,J)                                             ALL05690
         GP(I,J)=RGP(I,J)                                                   ALL05700
         SWMAI(I,J) = 0.0                                                   ALL05710
         RMAI2(I,J) = 0.0                                                   ALL05720
         RMAI3(I,J)=0.0                                                     ALL05730
         GO TO 50                                                           ALL05740
C                                                                           ALL05750
 30      GPMAI(I,J)= GP(I,J)                                                ALL05760
         GP(I,J) = 0.0                                                      ALL05770
         RMAI2(I,J)= -RGP(I,J)                                              ALL05780
         RSW(I,J)=SWA(I,J) - RMAI2(I,J)                                     ALL05790
         IF(RSW(I,J) .LE. 0) GO TO 40                                       ALL05800
         SWMAI(I,J) = RMAI2(I,J)                                            ALL05810
         SWA(I,J)=RSW(I,J)                                                  ALL05820
         RMAI3(I,J)=0.0                                                     ALL05830
         GO TO 50                                                           ALL05840
C                                                                           ALL05850
 40      SWMAI(I,J)= SWA(I,J)                                               ALL05860
         SWA(I,J) = 0.0                                                     ALL05870
         RMAI3(I,J)= -RSW(I,J)                                              ALL05880
 50   CONTINUE                                                              ALL05890
C                                                                           ALL05900
C                                                                           ALL05910
C                                                                           ALL05920
      AWAD = 0.0                                                            ALL05930
      TGPMAI = 0.0                                                          ALL05940
      TSWMAI = 0.0                                                          ALL05950
      TRMAI = 0.0                                                           ALL05960
      TOTWAD = 0.0                                                          ALL05970
      DO  70 I=1,65                                                         ALL05980
      DO  70 J=1,52                                                         ALL05990
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      TOTAG(I,J) =APRWN(I,J)+AMAYW(I,J)+AJUNW(I,J)+AJULW(I,J)+AUGWN(I,J)ALL05000
     *      +SEPWN(I,J)                                                 ALL05010
      TWAD(I,J) = TOTAG(I,J) +GPMAI(I,J)+SWMAI(I,J)+RMAI3(I,J)          ALL05020
      TGPMAI = TGPMAI + GPMAI(I,J)                                      ALL05040
      TSWMAI = TSWMAI + SWMAI(I,J)                                      ALL05050
      TRMAI  = TRMAI  + RMAI3(I,J)                                      ALL05060
   70 CONTINUE                                                          ALL05070
      AWAD = TAPR+TMAY+TJUN+TJUL+TAUG+TSEP                              ALL05080
      TOTWAD = AWAD + TGPMAI + TSWMAI + TRMAI                           ALL05090
      RETURN                                                            ALL05100
      END                                                               ALL05110
C                                                                       ALL05120
C                                                                       ALL05130
      SUBROUTINE PREMAI(C1,C2,C3,C4,C5,C6,CBCAG,CBCTT,CMAI,TOT2,TOT3)   ALL05140
C                                                                       ALL05150
C           *********     PREMAI PROGRAM   *********                    ALL05160
C                                                                       ALL05170
C     ------------------------------------------------------------------ALL05180
C                                                                       ALL05190
C     ****  A FORTRAN PROGRAM TO READ  TOTAL NEED AND SUBTRACT DEEP GP  ALL05200
C     AND TO CALCULATE M & I NEED.                                      ALL05210
C                                                                       ALL05220
C     ------------------------------------------------------------------ALL05230
C                                                                       ALL05240
      REAL * 8 TNEW(66,52),DT(66,52),DTN(66,52),TOT2(66,52),            ALL05250
     1  A1(66,52),A2(66,52),A3(66,52),A4(66,52),A5(66,52),A6(66,52),    ALL05260
     2  B1(66,52),B2(66,52),B3(66,52),B4(66,52),B5(66,52),B6(66,52),    ALL05270
     3  C1(66,52),C2(66,52),C3(66,52),C4(66,52),C5(66,52),C6(66,52),    ALL05280
     4  P1(66,52),P2(66,52),P3(66,52),P4(66,52),P5(66,52),P6(66,52),    ALL05290
     5  A7(66,52),A8(66,52),CMAI(66,52),CBCAG(66,52),CBCTT(66,52),      ALL05300
     6  IBOUND(66,52),TOT3(66,52),                                     ALL05310
     *   TMAI,TC1,TC2,TC3,TC4,TC5,TC6,TDEEPG,TB1,TB2,TB3,TB4,TB5,TB6,   ALL05320
     *   TAGNID,TC1,TC2,TC3,TC4,TC5,TC6                                 ALL05330
C                                                                       ALL05340
      DATA F1,F2,F3,F4,F5,F6/0.005018,0.113190,0.195618,0.333070,       ALL05350
     *                       0.307388,0.045730/                         ALL05360
C                                                                       ALL05370
C     ******  DEFENITION OF VARIABLES ********                          ALL05380
C                                                                       ALL05390
C     A1 TO A8       MONTHLY AGRIC. WATER DEMAND IN AC-FT               ALL05400
C     A7             ORIGINAL TOTAL AGRIC. WATER DEMAND IN AC-FT        ALL05410
C     A8             ORIGINAL TOTAL WATER DEMAND IN AC-FT               ALL05420
C     B1 TO B6       MONTHLY TERTIARY WATER DEMAND IN AC-FT             ALL05430
C     P1 TO P6       MONTHLY PROPORTION IF SUM OF 6 MONTH AND TOTAL     ALL05440
C                    AGRIC. DEMAND(A7) ARE DIFFERENT IN AC-FT           ALL05450
C     C1 TO C6       ADJUSTED MONTHLY AGRIC. DEMAND IN AC-FT            ALL05460
C     IBOUND         CELL INDICATOR                                     ALL05470
C     TC1 TO TC6     ANNUAL MONTHLY AGRIC. DEMAND IN AC-FT/YR           ALL05480
C     TB1 TO TB6     ANNUAL MONTHLY TERTIARY DEMAND IN AC-FT/YR         ALL05490
C     TMAI           TOTAL M & I WATER DEMAND IN AC-FT/YR               ALL05500
C     TAGNID         TOTAL AGRIC. WATER DEMAND IN AC-FT/YR              ALL05510
C     TDEEPG         TOTAL TERTIARY WATER DEMAND IN AC-FT/YR            ALL05520
C     CBCAG          CELL BY CELL AGRIC. WATER DEMAND IN AC-FT/YR       ALL05530
C     CBCTT          CELL BY CELL TERT. WATER DEMAND IN AC-FT/YR        ALL05540
C     CMAI           CELL BY CELL M & I WATER DEMAND IN AC-FT/YR        ALL05550
C     TNEW           NEW TOTAL WATER DEMAND IN AC-FT/YR                 ALL05560
C     TOT2           SUM OF M & I PLUS AGRIC. WATER DEMAND EXCLUDING TERT.ALL05570
C     TOT3           SUM OF M & I PLUS AGRIC. WATER DEMAND INCLUDING TERT.ALL05580
C     DTN            DIFFERENCE BETWEEN NEW TOTAL AND ORIGINAL TOTAL    ALL05590
C                                                                       ALL05600
      DO 10 I=1,66                                                      ALL05610
      DO 10 J=1,52                                                      ALL05620
        IBOUND(I,J) = 0                                                 ALL05630
        A1(I,J) = 0                                                     ALL05640
        A2(I,J) = 0                                                     ALL05650
        A3(I,J) = 0                                                     ALL05660
        A4(I,J) = 0                                                     ALL05670
        A5(I,J) = 0                                                     ALL05680
        A6(I,J) = 0                                                     ALL05690
        B1(I,J) = 0                                                     ALL05700
        B2(I,J) = 0                                                     ALL05710
        B3(I,J) = 0                                                     ALL05720
        B4(I,J) = 0                                                     ALL05730
        B5(I,J) = 0                                                     ALL05740
        B6(I,J) = 0                                                     ALL05750
        P1(I,J) = 0                                                     ALL05760
        P2(I,J) = 0                                                     ALL05770
        P3(I,J) = 0                                                     ALL05780
        P4(I,J) = 0                                                     ALL05790
        P5(I,J) = 0                                                     ALL05800
        P6(I,J) = 0                                                     ALL05810
        A7(I,J) = 0                                                     ALL05820
        A8(I,J) = 0                                                     ALL05830
        CBCAG(I,J) = 0                                                  ALL05840
        CBCTT(I,J) = 0                                                  ALL05850
        CMAI(I,J) = 0                                                   ALL05860
        TNEW(I,J) = 0                                                   ALL05870
        TOT2(I,J) = 0                                                   ALL05880
        TOT3(I,J) = 0                                                   ALL05890
        DT(I,J) = 0                                                     ALL05900
        DTN(I,J) = 0                                                    ALL05910
   10   CONTINUE                                                        ALL05920
C                                                                       ALL05930
C     *****  READ IBOUND INDICATOR ******                               ALL05940
C                                                                       ALL05950
        DO  20 I=1,66                                                   ALL05960
   20   READ(7,*) I,(IBOUND(I,J) , J=1,28)                             ALL05970
        DO  30 I=1,66                                                   ALL05980
   30   READ(7,*) I,(IBOUND(I,J) , J=29,52)                            ALL05990
C       DO 40  I=1,66                                                   ALL07000
```

```
C        DO 40  J=1,52                                                          ALL07010
C 40    WRITE(8,*) (I,J,IBOUND(I,J)                                             ALL07020
C                                                                               ALL07030
C      ******  READ ORIGINAL AGRICULTURAL DEMAND INCLUDING TERTIARY  *****      ALL07040
C                                                                               ALL07050
C                                                                               ALL07060
 100  READ (8,1) I,J,A1(I,J),A2(I,J),A3(I,J),A4(I,J),A5(I,J),A6(I,J)           ALL07070
     * ,A7(I,J),A8(I,J)                                                        ALL07080
                      IF(IBOUND(I,J) .GT. 0) GO TO 110                          ALL07090
                          A1(I,J) = 0                                           ALL07100
                          A2(I,J) = 0                                           ALL07110
                          A3(I,J) = 0                                           ALL07120
                          A4(I,J) = 0                                           ALL07130
                          A5(I,J) = 0                                           ALL07140
                          A6(I,J) = 0                                           ALL07150
                          A7(I,J) = 0                                           ALL07160
                          A8(I,J) = 0                                           ALL07170
 110        IF(I .EQ. 66 .AND. J .EQ. 24) GO TO 888                            ALL07180
      GO TO 100                                                                 ALL07190
 1    FORMAT(I2,I6,24X,F8.0,5(F8.0),2(F8.0))                                    ALL07200
C                                                                               ALL07210
C                                                                               ALL07220
C       *****  READ TERTIARY WATER DEMAND FROM CELLDIST.RPT FILE  *****         ALL07230
C                                                                               ALL07240
C                                                                               ALL07250
 888  READ(8,2,END=888)I,J,B1(I,J),B2(I,J),B3(I,J),B4(I,J),                     ALL07260
     * B5(I,J),B6(I,J)                                                         ALL07270
                      IF(IBOUND(I,J) .GT. 0) GO TO 140                          ALL07280
                          B1(I,J) = 0                                           ALL07290
                          B2(I,J) = 0                                           ALL07300
                          B3(I,J) = 0                                           ALL07310
                          B4(I,J) = 0                                           ALL07320
                          B5(I,J) = 0                                           ALL07330
                          B6(I,J) = 0                                           ALL07340
 140      CBCTT(I,J)=B1(I,J)+B2 (I,J)+B3(I,J)+B4(I,J)+B5(I,J)+B6(I,J)           ALL07350
      GO TO 888                                                                 ALL07360
 2    FORMAT(//,I2,6X,I2,28X,6(F8.2))                                           ALL07370
 888  TDT = 0                                                                   ALL07380
      DO 300 I=1,66                                                             ALL07390
      DO 300 J=1,52                                                             ALL07400
      DT(I,J)=A7(I,J)-(A1(I,J)+A2(I,J)+A3(I,J)+A4(I,J)+A5(I,J)+A6(I,J))         ALL07410
         P1(I,J) = F1 * DT(I,J)                                                 ALL07420
         P2(I,J) = F2 * DT(I,J)                                                 ALL07430
         P3(I,J) = F3 * DT(I,J)                                                 ALL07440
         P4(I,J) = F4 * DT(I,J)                                                 ALL07450
         P5(I,J) = F5 * DT(I,J)                                                 ALL07460
         P6(I,J) = F6 * DT(I,J)                                                 ALL07470
            IF(A1(I,J) .EQ. 0) GO TO 401                                        ALL07480
         A1(I,J) = A1(I,J) + P1(I,J)                                            ALL07490
 401        IF(A2(I,J) .EQ. 0) GO TO 402                                        ALL07500
         A2(I,J) = A2(I,J) + P2(I,J)                                            ALL07510
 402        IF(A3(I,J) .EQ. 0) GO TO 403                                        ALL07520
         A3(I,J) = A3(I,J) + P3(I,J)                                            ALL07530
 403        IF(A4(I,J) .EQ. 0) GO TO 404                                        ALL07540
         A4(I,J) = A4(I,J) + P4(I,J)                                            ALL07550
 404        IF(A5(I,J) .EQ. 0) GO TO 405                                        ALL07560
         A5(I,J) = A5(I,J) + P5(I,J)                                            ALL07570
 405        IF(A6(I,J) .EQ. 0) GO TO 406                                        ALL07580
         A6(I,J) = A6(I,J) + P6(I,J)                                            ALL07590
 406     TNEW(I,J) = A1(I,J)+A2(I,J)+A3(I,J)+A4(I,J)+A5(I,J)+A6(I,J)            ALL07600
      DTN(I,J)=A7(I,J)-TNEW(I,J)                                                ALL07610
         TDT = TDT + DTN(I,J)                                                   ALL07620
 300  CONTINUE                                                                  ALL07630
      TB1 = 0                                                                   ALL07640
      TB2 = 0                                                                   ALL07650
      TB3 = 0                                                                   ALL07660
      TB4 = 0                                                                   ALL07670
      TB5 = 0                                                                   ALL07680
      TB6 = 0                                                                   ALL07690
      TC1 = 0                                                                   ALL07700
      TC2 = 0                                                                   ALL07710
      TC3 = 0                                                                   ALL07720
      TC4 = 0                                                                   ALL07730
      TC5 = 0                                                                   ALL07740
      TC6 = 0                                                                   ALL07750
      TMAI = 0                                                                  ALL07760
      TWAD = 0                                                                  ALL07770
      TDEEPG = 0                                                                ALL07780
      DO 200 I=1,66                                                             ALL07790
      DO 200 J=1,52                                                             ALL07800
         TB1 = TB1 + B1(I,J)                                                    ALL07810
         TB2 = TB2 + B2(I,J)                                                    ALL07820
         TB3 = TB3 + B3(I,J)                                                    ALL07830
         TB4 = TB4 + B4(I,J)                                                    ALL07840
         TB5 = TB5 + B5(I,J)                                                    ALL07850
         TB6 = TB6 + B6(I,J)                                                    ALL07860
         TDEEPG = TDEEPG + CBCTT(I,J)                                           ALL07870
 200  CONTINUE                                                                  ALL07880
C                                                                               ALL07890
         DO 50 I= 1,66                                                          ALL07900
         DO 50 J= 1,52                                                          ALL07910
              C1(I,J) = A1(I,J) - B1(I,J)                                       ALL07920
              C2(I,J) = A2(I,J) - B2(I,J)                                       ALL07930
              C3(I,J) = A3(I,J) - B3(I,J)                                       ALL07940
              C4(I,J) = A4(I,J) - B4(I,J)                                       ALL07950
              C5(I,J) = A5(I,J) - B5(I,J)                                       ALL07960
              C6(I,J) = A6(I,J) - B6(I,J)                                       ALL07970
               CMAI(I,J) = A6(I,J) - A7(I,J)                                    ALL07980
               TMAI = TMAI + CMAI(I,J)                                          ALL07990
        CBCAG(I,J) = C1(I,J)+C2(I,J)+C3(I,J)+C4(I,J)+C5(I,J)+C6(I,J)            ALL08000
```

```
          TC1 = TC1 + C1(I,J)                                                   ALL08010
          TC2 = TC2 + C2(I,J)                                                   ALL08020
          TC3 = TC3 + C3(I,J)                                                   ALL08030
          TC4 = TC4 + C4(I,J)                                                   ALL08040
          TC5 = TC5 + C5(I,J)                                                   ALL08050
          TC6 = TC6 + C6(I,J)                                                   ALL08060
        TOT2(I,J)=CMAI(I,J)+C1(I,J)+C2(I,J)+                                    ALL08070
     *           C3(I,J)+C4(I,J)+C5(I,J)+C6(I,J)                                ALL08080
          TOT3(I,J) = CMAI(I,J)                                                 ALL08090
     *              +C1(I,J)+C2(I,J)+C3(I,J)+C4(I,J)+C5(I,J)+C6(I,J)           ALL08100
     *              +B1(I,J)+B2 (I,J)+B3(I,J)+B4(I,J)+B5(I,J)+B6(I,J)          ALL08110
 50   CONTINUE                                                                  ALL08120
                    READ(5,*) N1                                                ALL08130
C                                                                               ALL08140
C       **** PRINT CBC ADJUSTED MONTHLY DEMAND IF SIGNAL IS + ****              ALL08150
C                                                                               ALL08160
                  IF(N1 .LE. 0) GO TO 52                                        ALL08170
C                                                                               ALL08180
      WRITE(6,210)                                                              ALL08190
 210    FORMAT(/'AGRICULTURAL DEM',3X,'APRIL',8X,'MAY',8X,'JUNE',8X             ALL08200
     *          ,'JULY',4X,'AUGUST',3X,'SEPTEMBER',3X,'TOTAGD',3X,             ALL08210
     * 'TERTIARY',6X,'M & I',2X,'TOTALOCATED',4X,'TOTAL'/132('_'))              ALL08220
        DO 51 I=1,66                                                            ALL08230
        DO 51 J=1,62                                                            ALL08240
        WRITE(6,3) I,J,C1(I,J),C2(I,J),C3(I,J),C4(I,J),C5(I,J),C6(I,J),         ALL08250
     * CBCAG(I,J),CBCTT(I,J),CMAI(I,J),TOT2(I,J),TOT3(I,J)                     ALL08260
 3          FORMAT(3X,I2,3X,I2,8X,11(F10.2))                                    ALL08270
 51     CONTINUE                                                                ALL08280
 52       TAGNID = TC1+TC2+TC3+TC4+TC5+TC6                                       ALL08290
          TWAD = TAGNID + TMAI                                                  ALL08300
          TOTAL= TWAD + TDEEPG                                                  ALL08310
                  IF(N1 .LE. 0) GO TO 222                                       ALL08320
      WRITE(6,210)                                                              ALL08330
      WRITE(6,220) TC1,TC2,TC3,TC4,TC5,TC6,TAGNID,TDEEPG,TMAI,TWAD,TOTAL       ALL08340
      WRITE(6,221) TB1,TB2,TB3,TB4,TB5,TB6,TDEEPG,TDT                           ALL08350
 220    FORMAT(/15X,11F10.0)                                                    ALL08360
 221    FORMAT(/132('_')/1X,'MONTHLY TERTIARY',7F10.1,                          ALL08370
     *         5X,'LEFTOVER =',F5.1/)                                          ALL08380
 222  RETURN                                                                    ALL08390
      END                                                                       ALL08400
```

APPENDIX E

Data Input Format for Program ALLOCATE

These are the definitions and FORMATS for input data to the conjunctive Water Allocation program "ALLOCATE", required by different computing device units.

UNIT 5

This unit reads NAME and HEADING of the OUTPUTS. It also reads cell by cell monthly and annual total agricultural water and total water demand including M & I, from nnSUB.TXT or nnCON.TXT files.

Card 1: FORMAT (2X, 2A4, 30A4)

Field 1-2 : NAME, name of each run.

Field 3-34 : HEADING, 120 character information about each run.

Card 2 - (N9+1) where N9 is the number of card images describing water demand in the cells: FORMAT (I2, I6, 24X, F6.0, 5F8.0, 2F9.0)

Field 1 : I, row number.

Field 2 : J, column number.

Field 3 : A1, April agricultural water demand including tertiary water in ac-ft/yr.

Field 4 : A2, May agricultural water demand including tertiary water in ac-ft/yr.

Field 5 : A3, June agricultural water demand including tertiary water in ac-ft/yr.

Field 6 : A4, July agricultural water demand including tertiary water in ac-ft/yr.

Field 7 : A5, August agricultural water demand including tertiary water in ac-ft/yr.

Field 8 : A6, September agricultural water demand including tertiary water in ac-ft/yr.

Field 9 : A7, Total agricultural water demand including tertiary water in ac-ft/yr.

Field 10 : A8, Total water demand including tertiary and M & I.

Last Card : FORMAT (freeformat *)

Field 1 : N1, signal for printing cell by cell adjusted monthly water demand as follow;

-if N1< 0, print is not needed.

-if N1≥ 0, print is needed.

Unit 7

This unit is used for GAMSOP OUTPUT* files which are being used by the ALLOCATE program.

Card 1-66 : FORMAT (freeformat *)

Field 1 : I, row number.

Field 2-29 : IBOUND, cell indicator to identify cell type as follows;

- positive integer for active cells,

- negative or zero for nonactive cells.

Card 67-132 : FORMAT (freeformat *)

Field 1 : I, row number.

Field 2-25 : IBOUND, same as above.

Card 133-462 : FORMAT (freeformat *)

Field 1 : I, row number.

Field 2-13 : GP, available ground-water in ac-ft/yr.

Card 463-792 : FORMAT (freeformat *)

Field 1 : I, row number.

Field 2-12 : SWA, available surface-water in ac-ft/yr.

Card 793-1122 : FORMAT (freeformat *)

Field 1 : I, row number.

Field 2-13 : ZUT, unsatisfied water demand in ac-ft/yr.

Unit 8

This unit is used for CELLDIST.RPT file which contains cell by cell monthly tertiary water demands.

Card 1 to the end of stack: FORMAT (//, I2, 6X, I2, 29X, 6F8.2)

Field 1 : I, row number.

Field 2 : J, column number.

Field 3 : B1, April tertiary water demand in ac-ft/yr.

Field 4 : B2, May tertiary water demand in ac-ft/yr.

Field 5 : B3, June tertiary water demand in ac-ft/yr.

Field 6 : B4, July tertiary water demand in ac-ft/yr.

Field 7 : B5, August tertiary water demand in ac-ft/yr.

Field 8 : B6, September tertiary water demand in ac-ft/yr.

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*. NOTE: GAMSOP OUTPUT contains many tables, of which ALLOCATE uses four files, namely BOUND, GP, SSW, and ZUT. Each table contains row and column numbers, and asterisk for nonactive cells. Column numbers and blank lines should be removed and asterisks changed to zero, prior to inputing the tables into ALLOCATE.

APPENDIX F

Sample Output From Program ALLOCATE

****** SURFACE-WATER REPORT *******

I	J	APR	MAY	JUN	JUL	AUG	SEP	TAGSW	SWMAI	TOTSW
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
56	10	14.99	172.89	420.80	2210.67	1973.69	174.95	4968.00	0.0	4968.00
56	11	28.00	329.00	183.96	0.0	0.0	0.0	540.96	0.0	540.96
56	12	63.99	554.11	0.0	0.0	0.0	0.0	618.10	0.0	618.10
56	13	73.01	495.81	0.0	0.0	0.0	0.0	568.82	0.0	568.82
56	14	14.01	17.00	0.0	0.0	0.0	0.0	31.01	0.0	31.01
56	15	61.01	717.11	1024.20	2374.33	2203.31	224.05	6604.00	0.0	6604.00
56	16	47.00	826.86	1180.54	636.60	0.0	0.0	2691.00	0.0	2691.00
56	17	42.36	740.44	1058.46	562.94	0.0	0.0	2404.20	0.0	2404.20
56	18	40.43	716.17	1023.00	529.31	0.0	0.0	2308.90	11.00	2319.90
56	19	48.95	863.29	1232.28	628.79	0.0	0.0	2773.30	11.00	2784.30
56	20	48.95	858.29	1225.28	422.39	0.0	0.0	2554.90	11.00	2565.90
56	21	44.18	781.04	1116.04	399.64	0.0	0.0	2340.90	0.0	2340.90
56	22	3.81	60.41	85.82	58.15	0.0	0.0	208.20	0.0	208.20
56	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
57	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	11	12.01	144.11	206.20	3105.33	3077.31	307.05	6852.00	0.0	6852.00
57	12	12.00	135.00	420.00	3014.00	2930.00	286.00	6797.00	0.0	6797.00
57	13	50.01	554.09	0.0	0.0	0.0	0.0	604.10	0.0	604.10
57	14	25.00	287.00	196.06	0.0	0.0	0.0	508.06	0.0	508.06
57	15	57.99	323.09	0.0	0.0	0.0	0.0	381.08	0.0	381.08
57	16	49.85	787.88	1131.65	2927.02	2924.92	332.97	8154.30	0.0	8154.30
57	17	25.38	449.68	642.56	903.78	0.0	0.0	2021.40	0.0	2021.40
57	18	41.42	726.40	1036.84	548.54	0.0	0.0	2353.20	0.0	2353.20
57	19	36.73	650.45	929.50	423.73	0.0	0.0	2040.40	11.00	2051.40
57	20	25.39	447.15	639.24	229.23	0.0	0.0	1341.00	0.0	1341.00
57	21	19.74	350.62	501.02	211.62	0.0	0.0	1083.00	0.0	1083.00
57	22	0.0	0.0	0.0	66.60	0.0	0.0	66.60	0.0	66.60
57	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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ANNUAL		32602.7	339939.7	300852.5	388696.7	319167.4	50328.0	1431586.9	1547.0	1433133.9

NOTE: In this and two subsequent tables, units are ac-ft. For each cell I, J, we see monthly agricultural surface water allotment, total annual agricultural surface water allotment, annual surface water allotment to M & I, and total annual surface water allotment. Subsequent two tables are analogous for groundwater and unsatisfied water demand (need for imported water).

****** GROUND-WATER REPORT *******

I	J	APR	MAY	JUN	JUL	AUG	SEP	TAGGW	GWMAI	TOTGW
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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56	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	11	0.0	0.0	178.04	3955.00	2991.00	106.00	7230.04	0.0	7230.04
56	12	0.0	153.66	1064.61	3735.33	3089.39	204.91	8227.90	0.0	8227.90
56	13	0.0	124.30	1217.20	3073.33	2926.31	310.05	7651.18	0.0	7651.18
56	14	0.0	0.0	131.35	244.33	136.31	0.0	511.99	11.00	522.99
56	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
56	16	0.0	0.0	0.0	372.82	3087.50	335.82	3776.14	11.00	3787.14
56	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
56	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	21	0.0	0.0	0.0	2160.32	2587.76	273.84	5021.92	11.00	5032.92
56	22	0.0	0.0	0.0	147.21	272.79	31.15	451.16	11.00	462.16
56	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.	.	.	.	.	.	.	.	.	.	.
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57	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
57	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
57	13	0.0	0.0	826.21	3831.33	3179.31	208.05	8044.90	11.00	8055.90
57	14	0.0	0.0	125.94	3071.00	3220.00	369.00	6785.94	11.00	6796.94
57	15	0.0	336.68	973.61	1985.33	1646.39	130.91	5072.92	11.00	5083.92
57	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
57	17	0.0	0.0	0.0	1421.80	2602.20	313.32	4337.32	11.00	4348.32
57	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
57	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	20	0.0	0.0	0.0	0.67	1487.25	157.21	1645.12	11.00	1656.12
57	21	0.0	0.0	0.0	990.92	1182.52	125.96	2299.40	11.00	2310.40
57	22	0.0	0.0	0.0	6.65	109.35	15.09	131.08	11.00	142.08
57	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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ANNUAL		106.2	31011.0	436921.5	1441635.8	1701909.7	272292.6	3883876.7	46255.0	3930131.7

See NOTE on page F-2.

****** UNSATISFIED-WATER REPORT *******

I	J	APR	MAY	JUN	JUL	AUG	SEP	TAGIM	RMAI	TOTIM
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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56	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	11	0.0	0.0	108.00	0.0	0.0	-0.00	108.00	0.0	108.00
56	12	0.0	38.00	0.0	0.0	0.0	-0.00	38.00	0.0	38.00
56	13	0.0	232.00	0.0	0.0	0.0	0.00	232.00	0.0	232.00
56	14	0.0	148.11	103.85	0.0	0.0	0.05	252.00	0.0	252.00
56	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	16	0.0	0.0	0.0	2064.66	0.0	0.00	2064.66	0.0	2064.66
56	17	0.0	0.0	0.0	2192.84	2750.14	300.98	5243.96	0.0	5243.96
56	18	0.0	0.0	0.0	2134.81	2658.51	290.81	5084.12	0.0	5084.12
56	19	0.0	0.0	0.0	2587.85	3209.97	352.03	6149.84	0.0	6149.84
56	20	0.0	0.0	0.0	2495.83	2826.83	298.27	5620.92	0.0	5620.92
56	21	0.0	0.0	0.0	106.88	0.0	0.12	107.00	0.0	107.00
56	22	0.0	0.0	0.0	57.06	0.0	-0.06	57.00	0.0	57.00
56	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
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57	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	13	0.0	33.02	12.98	0.0	0.0	0.00	46.00	0.0	46.00
57	14	0.0	0.0	88.00	0.0	0.0	-0.00	88.00	0.0	88.00
57	15	0.0	22.00	0.0	0.0	0.0	-0.00	22.00	0.0	22.00
57	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	17	0.0	0.0	0.0	63.06	0.0	-0.06	63.00	0.0	63.00
57	18	0.0	0.0	0.0	2150.90	2690.86	294.40	5136.16	0.0	5136.16
57	19	0.0	0.0	0.0	1999.71	2419.71	264.91	4684.32	0.0	4684.32
57	20	0.0	0.0	0.0	1301.62	0.0	0.06	1301.68	0.0	1301.68
57	21	0.0	0.0	0.0	11.00	0.0	0.00	11.00	0.0	11.00
57	22	0.0	0.0	0.0	10.75	0.0	0.25	11.00	0.0	11.00
57	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.00	11.00
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ANNUAL		7006.7	534791.9	821903.4	761592.2	347755.2	30115.8	2503165.2	237.0	2503402.2

See NOTE on page F-2.

&&&&&&&&&& ANNUAL REPORT &&&&&&&&&&

TOTAL TERTIARY = 59560.6

TOTGWA =	3883877.	TGMAI =	46255.	TOTGWU =	3930132.		
TOTSWA =	1431587.	TSMAI =	1547.	TOTSWU =	1433134.		
TOTIMA =	2503165.	TRMAI =	237.	TOTIMU =	2503402.		
TAWAD =	7818629.	TMANDI =	48039.	TOTAL =	7866668.	OVERALLTOTAL =	7926228.

SUMMARY OF QUATERNARY GROUND-WATER, SURFACE-WATER AND UNSATISFIED DEMAND (AC-FT) FOR SCENARIO GSUB2010

	APR	MAY	JUN	JUL	AUG	SEP	TOTAG	M & I	TOTAL
G	106.	31011.	436922.	1441636.	1701910.	272293.	3883877.	46255.	3930132.
S	32603.	339940.	300852.	388697.	319167.	50328.	1431587.	1547.	1433134.
U	7007.	534792.	821903.	761592.	347755.	30116.	2503165.	237.	2503402.
TOTAL	39716.	905743.	1559677.	2591925.	2368832.	352736.	7818629.	48039.	7866668.

NOTE: All units are ac-ft. Total Tertiary groundwater use is the first column. TOTGWA, TGMAI and TOTGWU are annual regional allotment of Quaternary groundwater to agriculture, M & I and the sum of the two. The next two rows have analogous information for available surface water and imported water, respectively. The final row in the top table contains sums of the preceeding rows. "Overall total" includes Tertiary and Quaternary groundwater, surface water and imported water. Overall total reported in such outputs may be slightly different than the value in the first row of tables 4.1-4.4. This results from data flaws. The sum of monthly tertiary use in CELLDIST.RPT did not always equal the annual tertiary use in the same file.