HYDROGEOLOGY OF WELL-FIELD AREAS NEAR TAMPA, FLORIDA, PHASE 2-- DEVELOPMENT AND DOCUMENTATION OF A QUASI-THREE-DIMENSIONAL FINITE-DIFFERENCE MODEL FOR SIMULATION OF STEADY-STATE GROUND-WATER FLOW

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ABSTRACT

A quasi-three-dimensional finite-difference model was developed for simulation of steady-state ground-water flow in two aquifers throughout a 932-square-mile area that contains 10 municipal well fields. In the model, the surficial aquifer is unconfined and is hydraulically connected to the underlying Floridan aquifer by a leakage term that represents flow through a confining layer separating the two aquifers. Utilization of the head-controlled flux condition allows head and flow in the Floridan aquifer to vary at model-grid boundaries. The water table is held constant at model-grid lateral boundaries and at large surface-water bodies, but is allowed to fluctuate elsewhere in response to changes in evapotranspiration, recharge, and leakage.

Procedures are described to calibrate the model, test its sensitivity to input-parameter errors, and validate its accuracy for predictive purposes. Also included are attachments that describe operation of the model. Example model-interrogation runs simulate water-level and water-balance changes that can be expected as a result of pumping all 10 well fields simultaneously at annual average permitted rates totaling 186.9 million gallons per day from the Floridan aquifer with recharge varying 20 percent more and less than the long-term average rate. Maps are also presented that estimate the extent and depth of cones of depression in the water table and potentiometric surface around well fields as they are pumped individually.

Maximum drawdown in the Floridan aquifer simulated by the quasi-three-dimensional model is greater in every well field and averages about 4 feet more than maximum drawdown simulated by the two-dimensional model previously developed for the area. Under average recharge conditions, about 75 percent of the pumped water is derived by increasing downward leakage. The remaining 25 percent is gained by reducing natural upward leakage in swamp and marsh areas and by slightly reducing outflow along the model boundary. Ultimately, more than 95 percent of the pumped water is derived by reducing evapotranspiration and surface discharge from the water table.

When well fields are pumped individually, drawdown in the potentiometric surface is less than when all 10 well fields are pumped simultaneously. Drawdown is much greater in the center of the modeled area where well fields are in close proximity to one another, thus increasing interference effects. Interference effects range from about 0.1 foot of additional drawdown at Morris Bridge well field to 6.1 feet of additional drawdown at Northwest well field.

INTRODUCTION

Ten municipal well fields have been established or are planned for a 932-mi^2 area north of Tampa, Fla. (fig. 1). Permits have been granted or are being considered for a combined average withdrawal rate of 186.9 Mgal/d (Southwest Florida Water Management District, written commun., 1982). In addition, several well fields for large housing subdivisions are being developed or are planned for development. Ground-water withdrawals from the Floridan aquifer in this area may eventually total several hundred million gallons per day.

A ground-water flow model that encompasses the well-field areas is needed to gain an understanding of the hydrology and to facilitate planning for the efficient utilization of water resources while conserving the environment. The model may be interrogated under various water-management alternatives to simulate water-level changes in the Floridan and surficial aquifers. The simulation runs may be used to assess adverse impacts of pumping, such as excessive drawdown, potential for saltwater encroachment, or destruction of wetlands.

The objective of this investigation is to evaluate the hydrogeology of an area encompassing the major well fields north of Tampa through development of a finite-difference digital ground-water flow model. The investigation includes two phases:

1. Develop and document a steady-state model with two-dimensional flow in one active layer.

2. Develop and document a steady-state quasi-three-dimensional model with two-dimensional flow in two active layers using the phase 1 model as a working base.

The phase 1 two-dimensional model is described by Hutchinson and others (1981). That model assisted in providing data for ground-water resource management decisions during development of the phase 2 model. Certain descriptions of the study area and modeling approach in this report are identical to or supercede those in the phase 1 report.

This report describes development of the phase 2 model and is intended as a guide for using the quasi-three-dimensional model. The aquifer system north of Tampa is conceptualized and formulated in the hydrologic model. The computer program and its application to a typical field problem in west-central Florida are described. The applicability of the model to the field problem is demonstrated through three interrogation runs.

The documentation assumes that the reader is familiar with the physics of ground-water flow, numerical methods of solving partial-differential equations, and the FORTRAN IV computer language. The report was prepared as part of a hydrogeologic investigation made by the U.S. Geological Survey in cooperation with the Southwest Florida Water Management District.

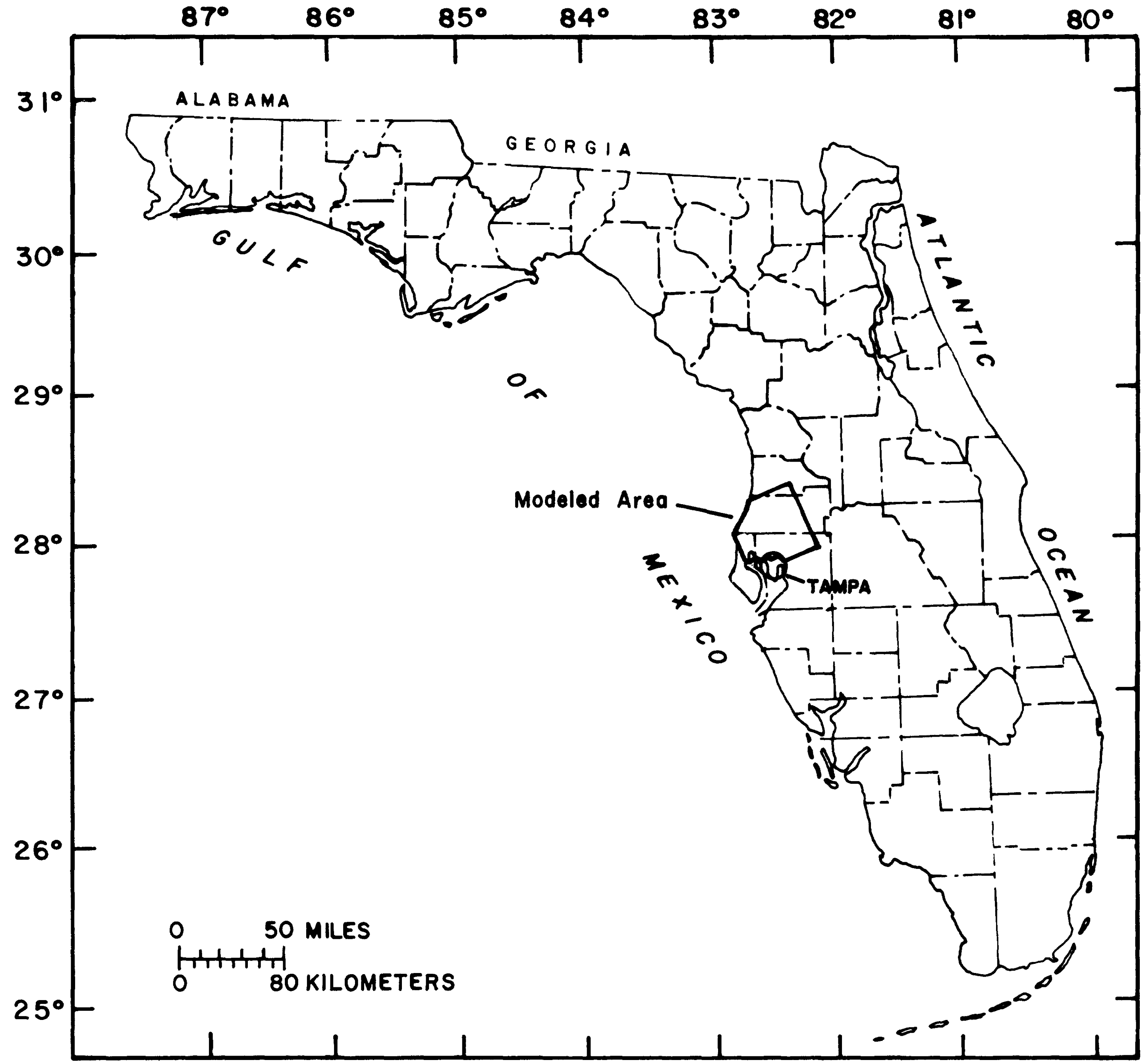


Figure 1.--Location of the modeled area near Tampa, Florida.

PREVIOUS INVESTIGATIONS

Numerous ground-water flow models of the Floridan aquifer have been or are being constructed that include all or some of the well-field areas north of Tampa (fig. 2). Cherry and others (1970) developed a conceptual model of the ground-water flow regime in the middle Gulf area. Robertson and Mallory (1977) constructed a regional model for an 875-mi^2 area that included eight major well fields. Individual well-field models have been constructed for the Cypress Creek (Seaburn and Robertson, Inc., 1977; Ryder, 1978), Morris Bridge (Ryder and others, 1980), and Cross Bar Ranch (Leggette, Brashears, and Graham, Inc., 1979) well fields. A well-field model is being constructed by the U.S. Geological Survey for the Cross Bar Ranch well field. A regional model, with relatively large grid-spacing (4-mile centers), covering an area of about 10,000 mi^2 and including the study area, has been constructed by the U.S. Geological Survey (Ryder, 1982). A companion report to this one (Hutchinson and others, 1981) describes a two-dimensional flow model of the Floridan aquifer in the well-field areas near Tampa. All the above modeling reports give detailed information concerning the hydrogeology of the area.

The model documented herein expands the Robertson and Mallory (1977) model area, includes subsequent aquifer-test results, and incorporates information from the individual well-field models. The model grid is alined with Ryder's (1982) coarsely gridded regional model so that they may be interfaced.

HYDROLOGIC MODEL

Description

The modeled area and its relation to the 10 municipal well fields are shown in figure 2. The model grid comprises an orthogonal array of 34 horizontal rows and 36 vertical columns; each grid block is 1 mile square. At the center of each grid block is a node through which data are input to or output from the model. Along the Gulf of Mexico and Tampa Bay coasts, the grid generally follows the shoreline.

The hydrologic setting is one of a coastal, karstic environment. The hydrologic system is represented by an unconfined surficial aquifer separated from the underlying Floridan aquifer by a relatively impermeable confining bed. The landscape is dotted with sinkhole depressions and the water table is near land surface. The general direction of ground-water movement is west toward the Gulf of Mexico and south toward Tampa Bay. The regional flow regime is modified by pumping from the well-field areas and by ground water discharging to streams.

Hydrologic Cycle

The elements of the hydrologic cycle in west-central Florida are rainfall, surface and subsurface runoff, evapotranspiration (ET), leakage to or from the Floridan aquifer, pumpage, and changes in amounts of water in storage in the

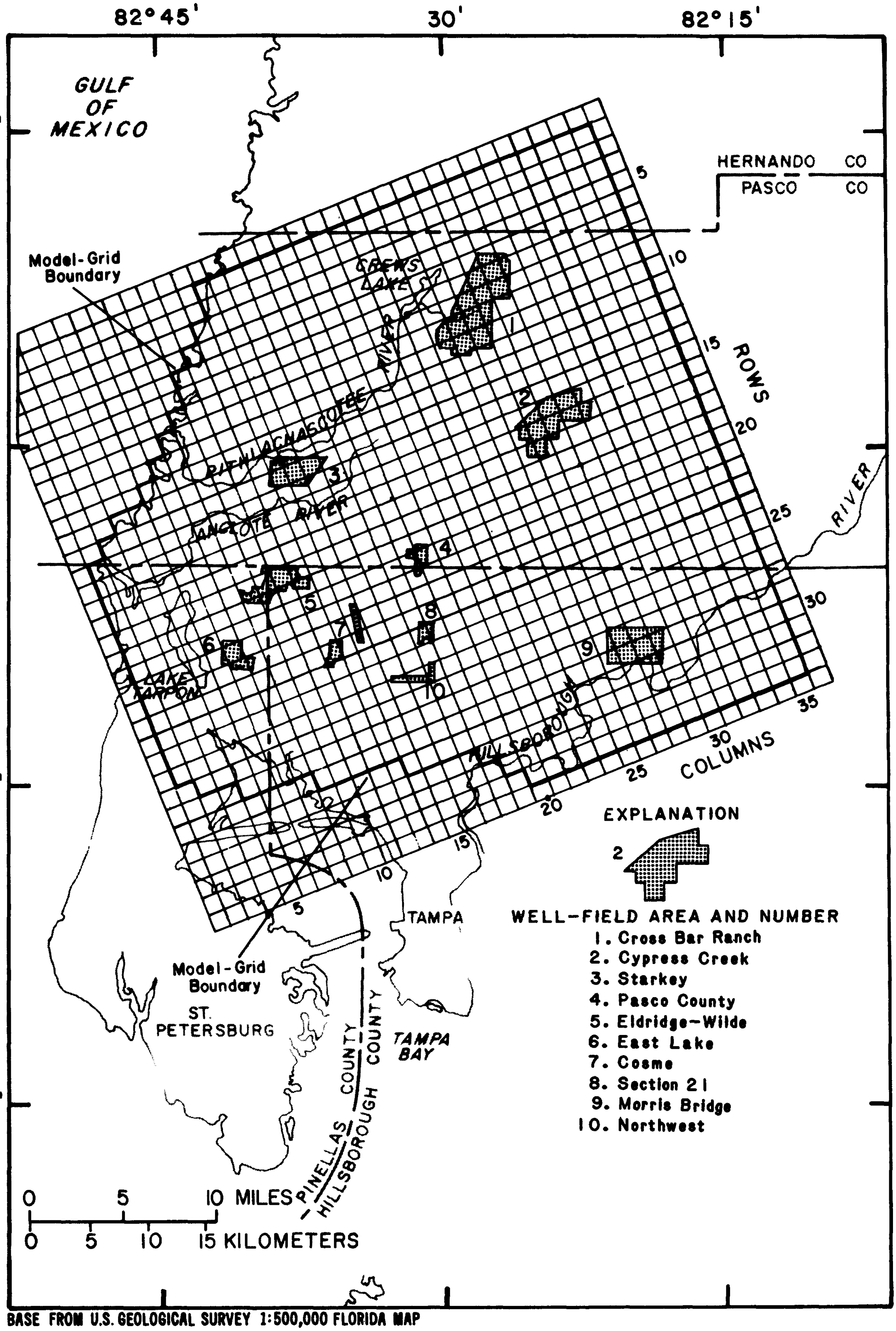


Figure 2.--Model grid and well-field areas.

surficial and Floridan aquifers. In this study, all time-dependent hydrologic parameters including ground-water levels are considered to be long-term averages, therefore, short-term fluctuations in amounts of water in storage in the surficial and Floridan aquifers are neglected. Pumpage from the surficial aquifer is so small that it is neglected.

In west-central Florida, mean annual rainfall is about 55 inches and is distributed unevenly as 7 inches in winter, 10 inches in spring, 25 inches in summer, and 13 inches in autumn (Hughes and others, 1971). At St. Leo, in east-central Pasco County, the extreme low rainfall of 36.61 inches fell in 1961, and the extreme high rainfall of 81.93 inches was recorded in 1945 (National Oceanic and Atmospheric Administration, 1958-81; and U.S. Department of Commerce, 1964).

Annual runoff ranges from near zero in internally drained areas to about 14 inches in the Anclote River basin and, in general, is directly proportional to rainfall. Under normal rainfall conditions, with no pumping, runoff from the modeled area probably averages about 10 inches per year. Five inches can be considered as overland runoff and 5 inches as contribution to base streamflow. Cherry and others (1970) indicate that up to 20 percent of the runoff from watersheds in the modeled area is derived from upward leakage from the Floridan aquifer. Parker (1975) estimated that average runoff from the Brooker Creek watershed, just east of Lake Tarpon, had declined substantially (possibly 50 percent) since the Eldridge-Wilde, Cosme, and Section 21 well fields were installed.

Evapotranspiration is a major item in the hydrologic cycle. It occurs in essentially three modes: (1) from plant surfaces and bare ground, (2) from the unsaturated zone (above the water table but beneath land surface), and (3) directly from the water table. The maximum potential evapotranspiration from a free water surface in west-central Florida is about 46 to 50 inches per year (Koehler and others, 1959; Dohrenwend, 1977). However, potential evapotranspiration is not maximum over all of west-central Florida because in much of the area the water table is below land surface and, in some areas, below plant root zones. In areas where the water table is far below land surface, water in the surficial aquifer is less subject to uptake by plants (transpiration) or direct evaporation from the water table than where the water table is at land surface and acts as a free water surface.

No matter how far below land surface the water table stands, there most likely is some minimum or base rate of evapotranspiration. This base rate is determined by evaporation and transpiration that takes place before any water can percolate to the water table. Estimates of this base rate of evapotranspiration range from 25 to 35 inches per year (Tibbals, 1978).

The actual evapotranspiration rate depends upon depth to water table, soil type, type of plant community, humidity, the amount of incoming energy (sunlight and wind), and the availability of water subject to evapotranspiration. On an areal and long-term annual basis, humidity, incoming energy, and available water can be regarded as fairly constant and uniformly distributed in west-central Florida. Soil types and plant communities are not uniformly distributed. For modeling purposes, these differences are not considered major factors in determining variability of actual evapotranspiration because depth to water table helps determine the plant community and the soil type. Therefore, depth to water table is used as the indicator of the actual rate of evapotranspiration.

The Floridan aquifer is recharged about 6 inches annually by downward leakage from the surficial aquifer. In swampy areas, about 1 inch of water discharges from the Floridan aquifer by leaking upward to the surficial aquifer. The net leakage is downward and is estimated to be roughly 5 inches per year under nonpumping conditions, based on a digital model of predevelopment flow developed by Ryder (1982). Pumping lowers the potentiometric surface, thereby inducing additional leakage from the surficial aquifer. For the calibration period, pumping 133 Mgal/d was estimated to have increased leakage to about 9 inches per year.

Conceptual Model

A generalized conceptual model of the hydrologic system is shown schematically in figure 3. The Floridan aquifer is the principal source of ground-water supply. It is confined above and below and is overlain by the unconfined surficial aquifer.

Gross water budgets for each aquifer were conceptualized as a basis for modeling the hydrologic system. Inflows and outflows from each aquifer under steady-state conditions are equated as follows:

	INFLOW		OUTFLOW	
SURFICIAL:	R + UL	=	ETRO + DL	(1)
FLORIDAN:	DL + BI	=	UL + BO + P	(2)

where R = recharge by seepage of rainfall;
UL = upward leakage through the upper confining bed;
ETRO = evapotranspiration plus runoff from the water table;
DL = downward leakage through the upper confining bed;
BI = boundary inflow;
BO = boundary outflow; and
P = pumpage.

Under normal climatological conditions, with no pumping, total inflow to the surficial aquifer averages about 26 inches per year. About 1 inch leaks upward from the Floridan aquifer, and about 25 inches is recharge computed as the residual of rainfall (55 inches) minus overland runoff (5 inches) and minimum evapotranspiration (25 inches from plant surfaces, bare land, and the unsaturated zone). About 6 inches leaks downward from the surficial aquifer to the Floridan aquifer and 5 inches seeps to streams. The remaining 15 inches of inflow is lost from the aquifer as evapotranspiration from the water table.

The Floridan aquifer receives inflow by downward leakage and across the boundary from outside the model grid. Under nonpumping conditions, downward leakage averages about 6 inches per year and boundary inflow about 1 inch per year. This water is lost through upward leakage at a rate of about 1 inch per year and boundary outflow of about 6 inches per year.

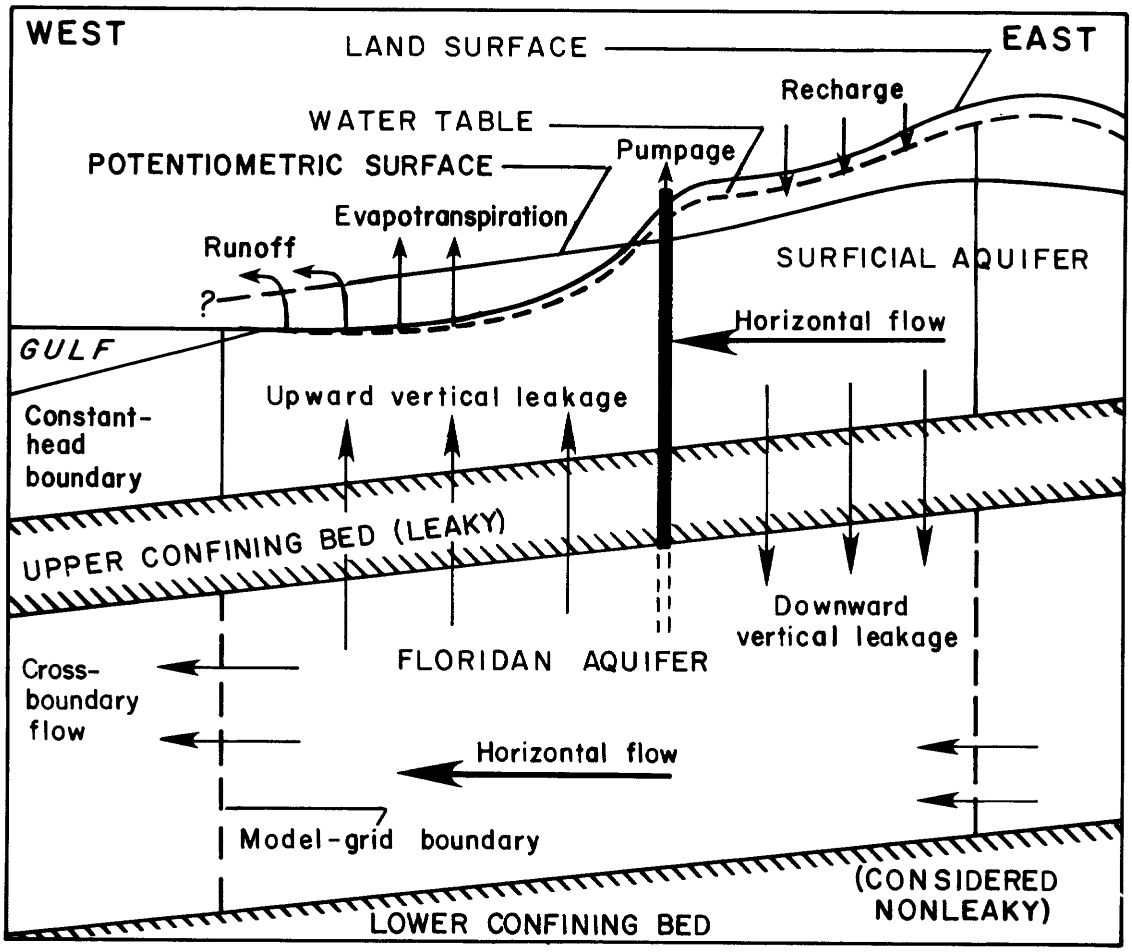


Figure 3.--Generalized conceptual model of the hydrogeologic system (modified from Wilson and Gerhart, 1980).

The water balance within the surficial aquifer may be altered significantly by pumping. Recharge may be increased, while surface-water runoff, ET, and ground-water discharge from the surficial aquifer (referred to hereafter as ET-runoff) are reduced. The mechanism in the model for handling these changes is the ET-runoff capture rate that relates the rate of capture to water-table depth. Based on the model conceptualization, all ET from the water table (15 inches) plus approximately half the runoff (6 inches) could be salvaged by lowering the water table from its average depth of about 4.5 feet to 10 feet. From a management standpoint, this may not be practical because widespread lowering of water levels could dry up lakes, alter the natural vegetation, cause pump failure in shallow wells, and induce sinkhole development. Although the ET-runoff capture rate has not been documented by field studies, results of this investigation indicate that for each foot of water-table decline about 3.8 inches of water may be salvaged.

The ET-runoff capture rate and depth probably vary within the modeled area, but for lack of validation, they were held constant. Instead, the model calibration was based on varying recharge to the surficial aquifer. Because ET-runoff capture is based on reducing water-table ET and runoff as the water table declines, recharge should approach maximum potential rates. In internally drained areas, recharge should not exceed rainfall (55 inches per year) minus minimum ET from plant surfaces and the unsaturated zone (25 inches per year), or about 30 inches per year.

The model apportions recharge to leakage and ET-runoff using the ET-runoff capture function, which is the quotient of the maximum capture rate divided by maximum capture depth. For example, if recharge is 20 inches per year and downward leakage is 5 inches per year under nonpumping conditions, the model will allocate 15 inches per year as ET-runoff. If pumping increases leakage from 5 inches per year to 12.6 inches per year, then the water table will drop 2 feet to capture the 7.6-inch-per-year leakage increase, and ET-runoff will be reduced from 15 inches per year to 7.4 inches per year. Should pumping capture all the 15-inch-per-year ET-runoff reserve, then the total recharge of 20 inches per year will leak down to the Floridan aquifer. Further pumping increases will not capture additional ET or runoff, with the result being accelerated water-table declines.

Six physiographic units were delineated (fig. 4) to conceptualize recharge to, evapotranspiration and leakage from, and transmissivity of the surficial aquifer:

Physiographic unit	Area (mi^2)	Recharge	Evapotranspiration	Leakage	Transmissivity
1. Coastal marsh	46	Low	High	Low	Low
2. Coastal sand ridge	19	Moderate	Low	High	High
3. Lowlands plain	561	Moderate	Moderate	Moderate	Moderate
4. Lakes terrace	156	High	Moderate	High	Moderate
5. Central swamp	84	Low	High	Low	Low
6. Brooksville ridge	66	Moderate	Low	High	High

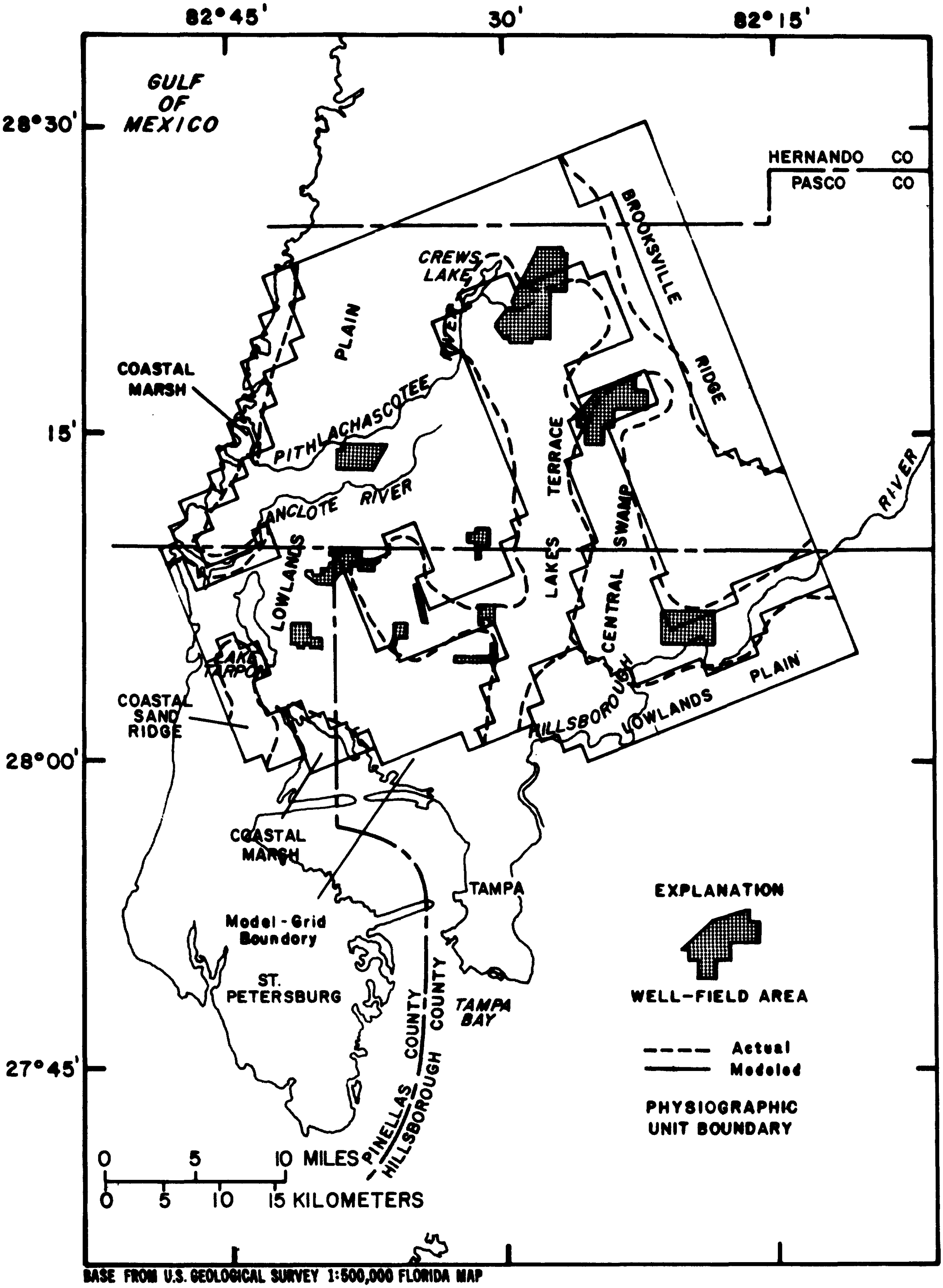


Figure 4.--Physiography of the modeled area.

Recharge to the surficial aquifer was considered to be low in marsh and swamp areas where the high water table is maintained by upward leakage from the Floridan aquifer; moderate in the moderately drained lowlands plain and the well-drained ridge areas; and high in the internally drained lakes terrace where hundreds of sinkhole lakes perforate the upper confining bed. Evapotranspiration from the water table was considered to be low along ridge areas where the water table is deep; moderate in the lowlands plain and lakes terrace where the water table is shallow; and high in marshy and swampy areas where the water table is at or near land surface. Leakage to the Floridan aquifer was considered to be low in the marsh and swamp areas where the water table generally lies below the potentiometric surface; moderate in the lowlands plain where the water table lies a few feet above the potentiometric surface; moderate in the ridge areas where the head difference between the water table and potentiometric surface is high, but the upper confining bed is relatively thick; and high in the lakes terrace where sinkholes increase the leakage rate. Transmissivity of the surficial aquifer is very low relative to transmissivity of the Floridan aquifer, but was considered to be lowest in the marsh and swamp areas where the sand is thin; moderate in the lowland plain and lakes terrace where the sand is moderately thick; and highest in the ridges where the saturated thickness is greatest.

Modeling Procedure

Modeling procedures consisted of selecting representative input parameters, adjusting them within a reasonable range of values during calibration, testing the model's sensitivity to errors in the input parameters, and running the calibrated model under a separate set of pumping and climatological conditions to validate its accuracy. Prior to implementation of these modeling procedures, the adequacy of a steady-state model was evaluated and a time period was selected for the calibration.

Aquifer tests at the major well fields indicate that water levels in the Floridan aquifer rapidly stabilize. All the water pumped from the Floridan aquifer is soon accounted for by an increase in downward leakage from or a reduction in upward leakage to the surficial aquifer. Stewart (1968, p. 171 and 187) confirms that the potentiometric surface at the Section 21 and Eldridge-Wilde well fields approaches steady-state in less than 100 days of pumping.

Because the aquifer system approaches a steady-state condition shortly after pumping begins, a transient-state model of short-term water-level changes was deemed unnecessary. For a large region containing several well fields, a steady-state model representing long-term average conditions should adequately and simply portray the effects of pumping.

The time period selected for the steady-state calibration was May 1976-April 1977. For this period, average stream discharge of eight watersheds in the modeled area was 4.3 inches per year, or 70 percent of long-term average. Rainfall recorded by the National Oceanic and Atmospheric Administration at four sites (Tampa, Tarpon Springs, Cosme well field, and St. Leo) averaged 48.64 inches, or about 88 percent of the 55-inch long-term average. Average water levels in the Floridan and surficial aquifers were considered to be slightly below normal, based upon streamflow and climatological conditions.

Recharge to the surficial aquifer was considered to be directly proportional to rainfall. For the calibration period, recharge was assumed to be 91 percent of normal. The modeling procedure for subsequent predictive runs, representative of long-term average climatological conditions, included increasing recharge by 10 percent above that determined through calibration.

The hydrologic model assumes that:

1. Ground-water movement in the surficial and Floridan aquifers is horizontal.
2. Water moves vertically into and out of the Floridan aquifer through the upper confining bed.
3. The upper confining bed has negligible storage.
4. Changes in ground-water storage in the surficial and Floridan aquifers occur instantaneously with changes in hydraulic head.
5. Transmissivity of the Floridan aquifer and leakance coefficient of the upper confining bed do not change with time.
6. Head changes in the surficial and Floridan aquifers caused by an imposed stress will eventually stabilize; that is, a condition of steady state will be reached.
7. Constant-head conditions accurately represent the hydrologic conditions of the surficial aquifer at the model-grid boundary and Lake Tarpon.
8. Head-controlled flux (HCF) conditions accurately represent the hydrologic conditions of the Floridan aquifer near the model-grid boundary.
9. Recharge to and evapotranspiration from the surficial aquifer occur instantaneously.
10. Movement of the saltwater-freshwater interface has little or no effect on computed heads.

Input Parameters

The steady-state model requires input parameters for each grid block including:

1. Altitude of the observed potentiometric surface of the Floridan aquifer;
2. Altitude of the observed water table in the surficial aquifer;
3. Storage coefficient of the Floridan aquifer (defined as zero);
4. Storage coefficient (defined as zero) and constant-head nodes of the surficial aquifer;
5. Transmissivity of the Floridan aquifer;
6. Leakance coefficient of the upper confining bed;
7. Hydraulic conductivity of the surficial aquifer;
8. Altitude of the bottom of the surficial aquifer;
9. Recharge rate to the surficial aquifer;

10. HCF condition leakage factor for the Floridan aquifer;
11. Maximum evapotranspiration-runoff capture rate from the water table divided by maximum depth at which evapotranspiration-runoff capture occurs;
12. HCF condition head factor for the Floridan aquifer;
13. Altitude of the bottom of the zone in which evapotranspiration occurs;
14. Altitude of land surface;
15. Model-grid spacing; and
16. Pumping rate from the Floridan aquifer.

The model utilizes many input parameters directly in ground-water flow equations. Others are used indirectly to compute parameters that vary with head, such as transmissivity of the surficial aquifer, evapotranspiration rate, or boundary flux. Ranges for the model parameters are presented in table 1.

Since 1971, the U.S. Geological Survey has prepared maps showing the potentiometric surface of the well-field areas for each May and September that represent seasonal low and high water-level periods, respectively. Water-levels shown on these maps may be considered to represent levels of the potentiometric surface at the trough and peak of an annual water-level hydrograph. Of the available maps, those for September 1976 and May 1977 (Ryder and Mills, 1977a; 1977b) were considered to best represent high and low water-level conditions, respectively. The average potentiometric surface, derived from the two maps for input to the model, was considered to represent the average steady-state potentiometric surface for the calibration period.

The water table in the surficial aquifer was mapped using field measurements of wells and estimates from topographic maps. It was estimated to be at or a few feet below land surface in swampy areas and the lakes terrace and at depths greater than about 5 feet below land surface for the lowlands plain and ridge areas. The water table is lower than the potentiometric surface over a 177-mi^2 area (20 percent of the modeled area). In this primarily swampy area, upward flow occurs from the Floridan aquifer to the surficial aquifer and streams. Within the ridge areas, the water table is 20 to 100 feet higher than the potentiometric surface.

The storage coefficient for each aquifer was set at zero. Because the model represents steady-state, or stabilized aquifer conditions, inflows and outflows balance and there is no change in ground-water storage. Setting the storage coefficient matrices to zero in the model is for computational efficiency so that steady state can be reached in one time step.

The storage coefficient matrix is also used to assign constant-head values to nodes, such as at the model boundary, where water levels are not expected to change. Because the model will allow heads to change at the model-grid boundary in the Floridan aquifer (by means of the HCF condition), constant-head nodes are not designated in this modeled layer. Pumping from the Floridan aquifer is expected to have little impact on the water table in the surficial aquifer at the edges of the model; therefore, constant-head boundary conditions were assigned in the surficial aquifer. Even if head changes in grid blocks adjacent to the boundary are large, changes in lateral boundary flow would be negligible due to an aquifer transmissivity of only about 300 ft^2/d. For example, if a 10-foot

Table 1.--Values for hydrologic parameters of the calibrated steady-state model

Parameter	Value	Source of data
Potentiometric-surface altitude.	1-87 ft	Ryder and Mills (1977a; 1977b).
Water-table altitude.	0-160 ft	Ryder and Mills (1977a; 1977b).
Storage coefficient, both aquifers.	0	----
Transmissivity of Floridan aquifer.	25,900-475,000 ft^2/d	Published aquifer-test results.
Transmissivity of surficial aquifer.	74-359 ft^2/d	Model computed, based on hydraulic conductivity measurements of Sinclair (1974).
Leakance coefficient of upper confining bed.	0.00015-0.0008 (ft/d)/ft	Published aquifer-test results.
Hydraulic conductivity of surficial aquifer.	10 ft/d	Sinclair (1974).
Altitude of the bottom of the surficial aquifer.	-10-(+130) ft	Wolansky and others (1979).
Saturated thickness of surficial aquifer.	7.4-35.9 ft	Model computed, based on difference between water table and estimated bottom of aquifer.
Recharge rate to surficial aquifer.	9-28 in/yr	Estimated by summing leakage and ET-runoff from water table.
Floridan aquifer boundary flux.		Model computed.
ET-runoff rate from water table.	0-38 in/yr	Model computed.
Altitude of land surface.	0-200 ft	USGS topographic maps.
Pumping rate from Floridan aquifer at individual nodes.	0-7,920,000 gal/d	SWFWMD water-use permits, pumping reports, and irrigation requirements.
Total pumping rate from Floridan aquifer.	133,400,000 gal/d	----

head change were to occur, by Darcy's formula, boundary flow would change by only 15 gal/min along the 1-mile-long face of the grid block adjacent to the boundary (ΔQ = 300 ft^2/d x 10 ft/mi x 1 mi = 3,000 ft^3/d = 15 gal/min). The storage coefficient matrix for the surficial aquifer designates 118 constant-head nodes, 111 along the model-grid boundary, 5 at Lake Tarpon, and 2 at Tampa Bay. Crews Lake, the other large lake in the modeled area, fluctuates with the water table; therefore, constant-head nodes were not assigned there.

Transmissivity of the Floridan aquifer and leakance coefficient of the upper confining bed were based on analyses of aquifer tests (table 2) and on preliminary values derived from the phase 1 two-dimensional model calibration (Hutchinson and others, 1981). Transmissivity is high north of the Cross Bar Ranch well field and in the area of the Hillsborough River. Transmissivity is lowest beneath the lakes terrace physiographic unit (fig. 5).

Leakance coefficient of the upper confining bed is model-derived in areas outside the well fields (fig. 6). Leakance coefficient is lowest in the ridge areas and is based on a relatively large head difference between the water table and potentiometric surface. Leakance coefficient is highest in the lakes terrace, coastal marsh, and along the Hillsborough River where the confining bed has been thinned by erosion or breached by sinkholes. Figure 7 depicts leakage rates in each physiographic unit as derived in the calibrated model. Leakage is upward in the coastal marsh and central swamp physiographic units; elsewhere leakage is downward.

Hydraulic conductivity of the surficial aquifer was estimated at a uniform 10 ft/d. This estimate is based on laboratory measurements for surficial materials in northwest Hillsborough County (Sinclair, 1974). The model computes transmissivity of the surficial aquifer by multiplying hydraulic conductivity by saturated thickness, determined as the difference between the simulated water table and the bottom of the aquifer. A map showing distribution of transmissivity of the surficial aquifer is presented in figure 8.

The bottom of the surficial aquifer was mapped by subtracting the thickness of surficial deposits defined by Wolansky and others (1979) from land surface. The saturated thickness was then mapped. It was found to be 10 feet or less in the coastal marsh and central swamp and 15 to 30 feet elsewhere. Figure 9 shows the bottom configuration as input to the model and the saturated thickness simulated in the steady-state calibration.

Recharge to the surficial aquifer, considered to be derived from rainfall, irrigation return, and lake augmentation, was initially computed at each node as the sum of the phase 1 two-dimensional model-computed leakage rate (Hutchinson and others, 1981) and the estimated ET-runoff capture rate from the water table. The regional pattern of recharge was then modified to conform to controls assumed by the six physiographic units (fig. 10). For the calibration period, it was estimated that average recharge varies from a minimum of 15 inches per year in the central swamp to a maximum of 28 inches per year in the lakes terrace.

Table 2.--Aquifer-test results

Well field	Transmissivity from aquifer test (ft^2/d)	Transmissivity in model (ft^2/d)	Leakance coefficient from aquifer test [(ft/d)/ft]	Leakance coefficient in model [(ft/d)/ft]	Source of information
Cross Bar Ranch	47,500-115,000	25,900-194,400	0.0005-0.0027	0.0004-0.0008	Leggette, Brashears and Graham, Inc. (1978)
Cypress Creek	31,500-53,600 1/	25,900-41,500	.00003-.0009 1/	.00015-.0008	Ryder (1978)
Starkey	40,000 2/	57,000	.003	.0003	Robertson and Mallory (1977)
Pasco County	53,000	51,800-57,000	.0003	.0003-.0004	Robertson and Mallory (1977)
Eldridge-Wilde	33,000 2/	57,000	.0003	.0004-.0005	Robertson and Mallory (1977)
East Lake	40,000 2/	57,000	.001	.0003	Robertson and Mallory (1977)
Cosme	----	57,000	----	.0003	----
Section 21	29,400-86,900	51,800	.0002-.0015	.0004	Stewart (1968)
Morris Bridge	53,500-130,000 1/	41,500-237,600	.0006-.001	.0003-.0006	Ryder and others (1980)
Northwest	----	25,900-51,800	----	.0003-.0004	----

1/ Range includes values from aquifer tests near the well field.
2/ Pumped well did not top the full thickness of the Floridan aquifer (partially penetrating).

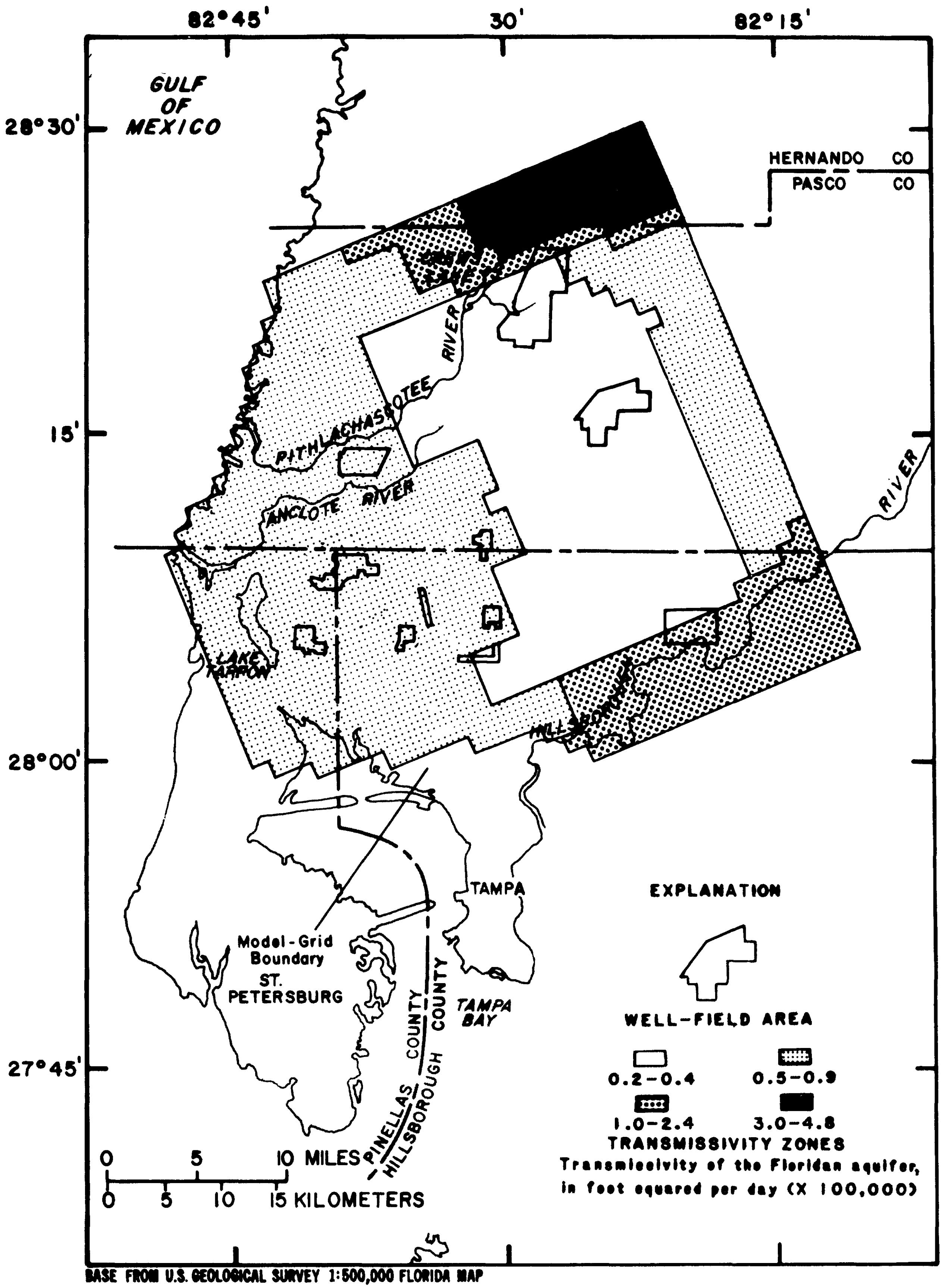


Figure 5.--Transmissivity of the Floridan aquifer.

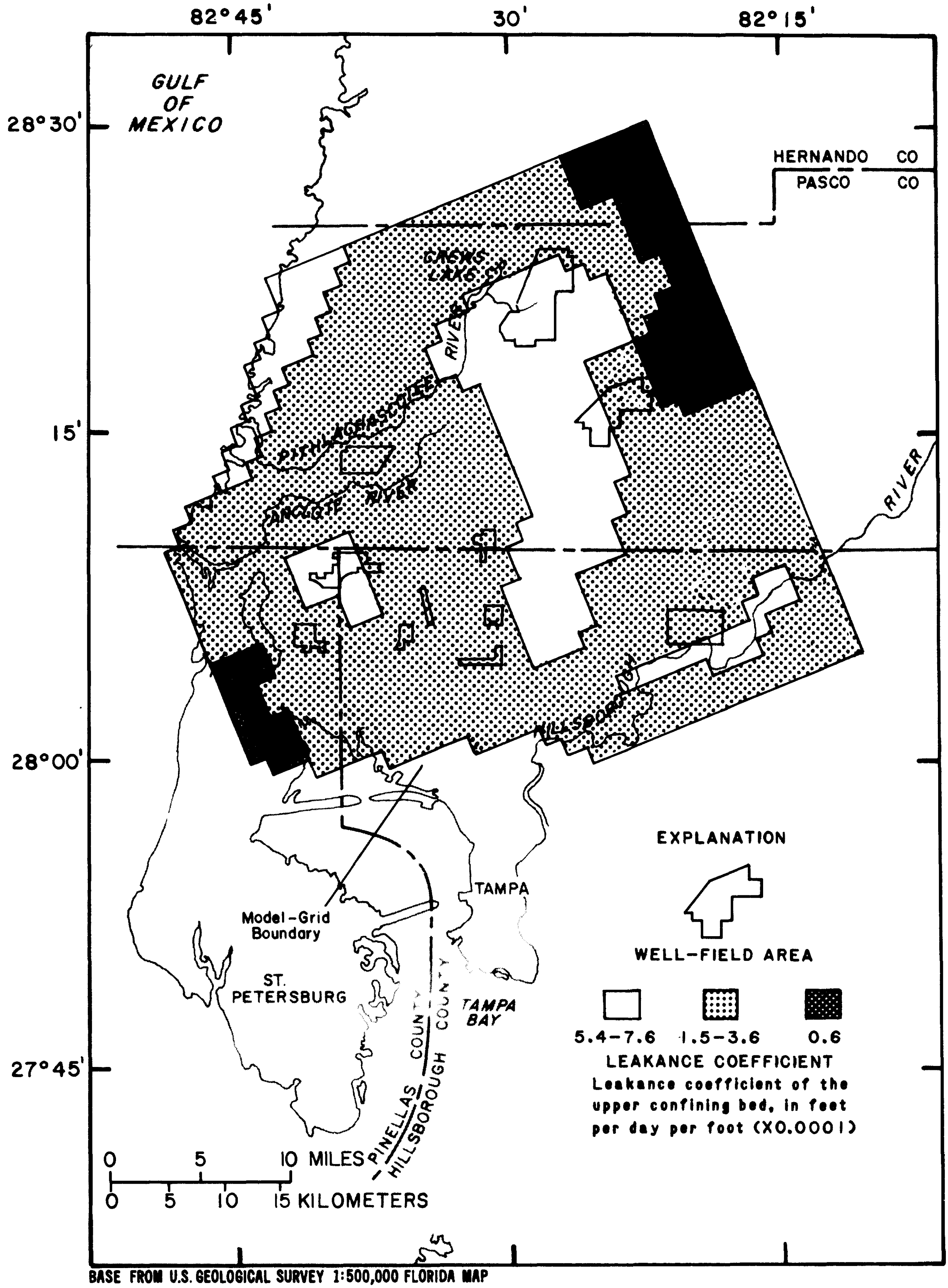


Figure 6.--Leakance coefficient of the upper confining bed.

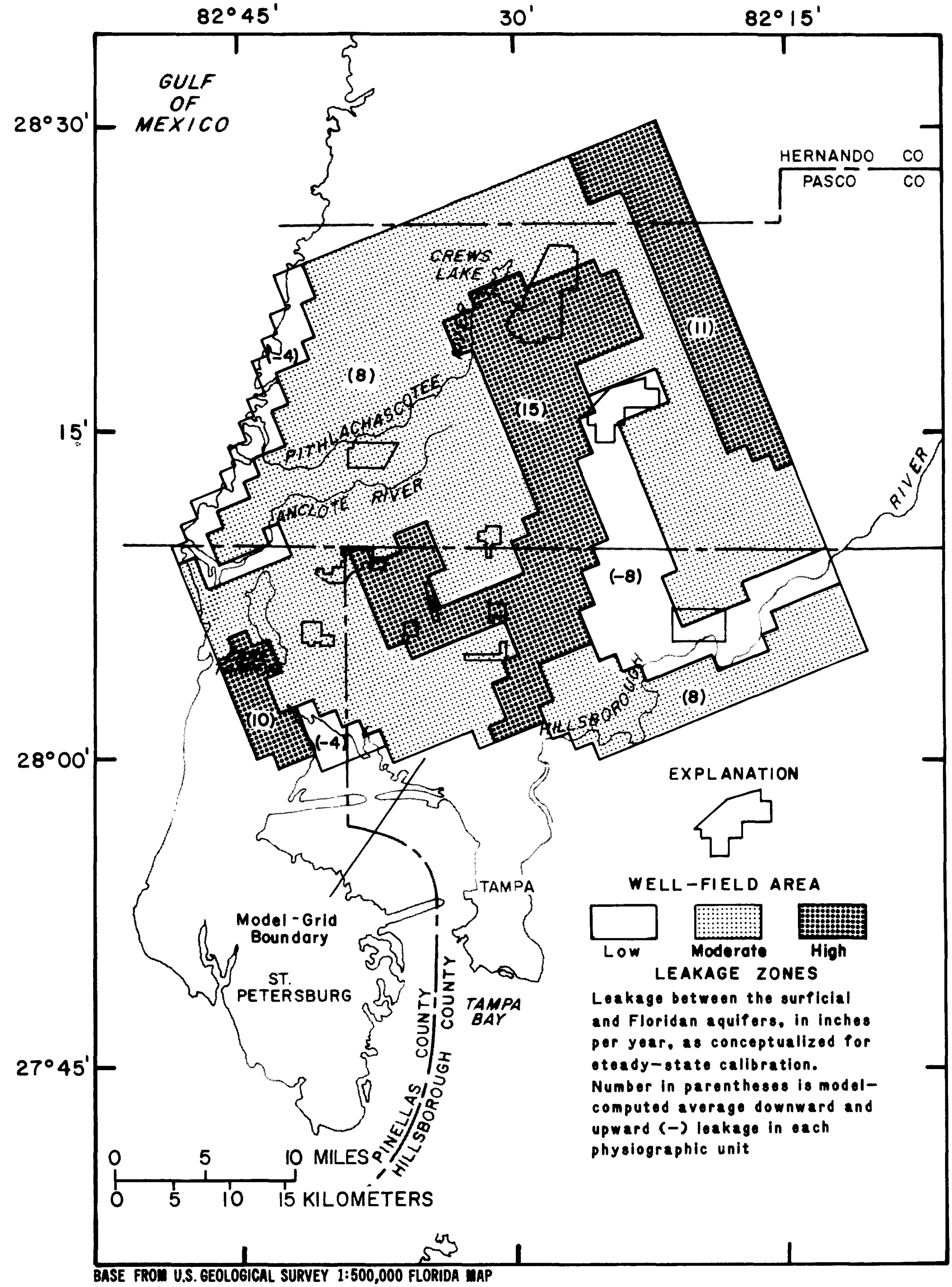
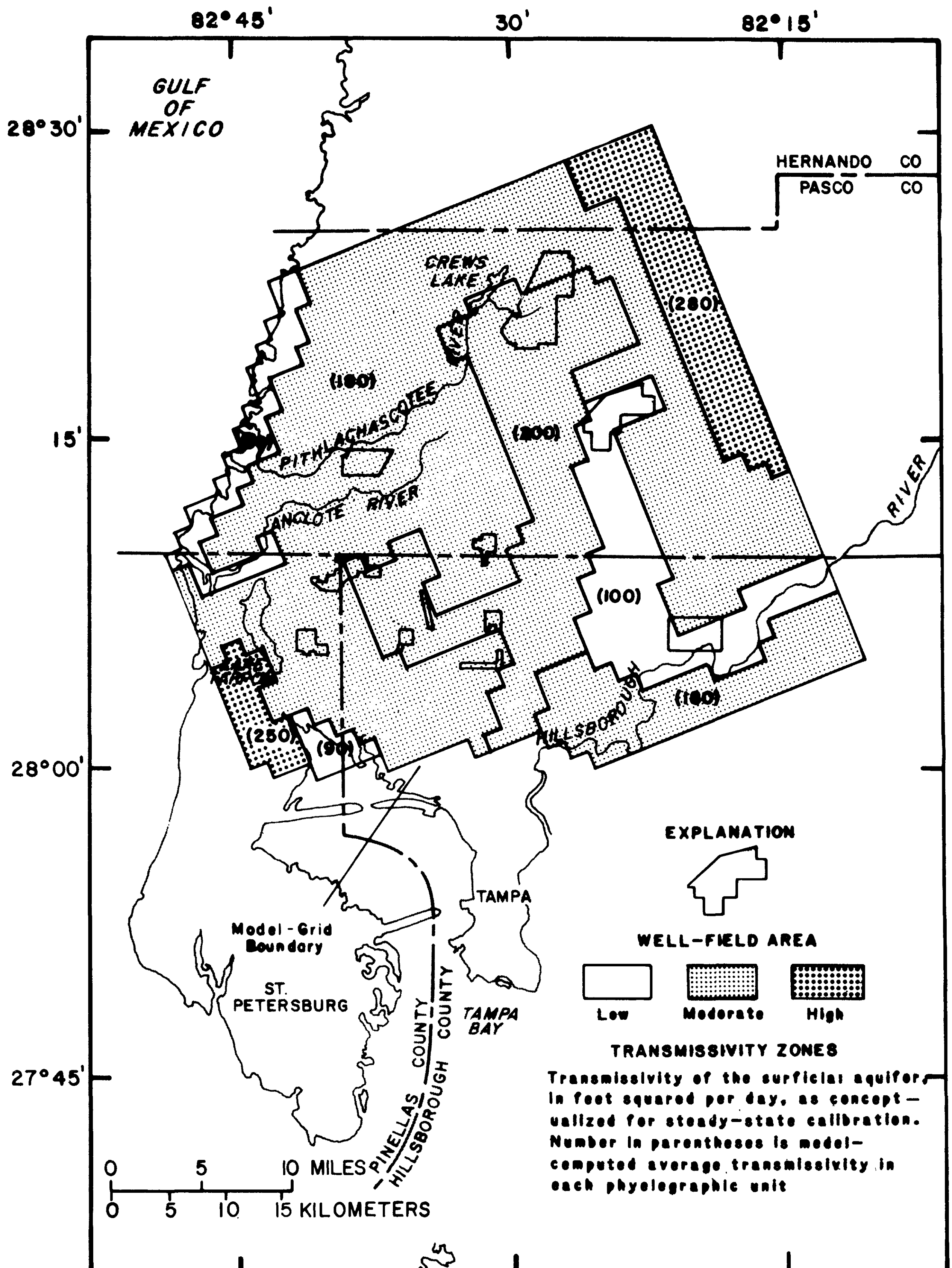


Figure 7.--Leakage rates through the upper confining bed, as computed in the steady-state model calibration.



BASE FROM U.S. GEOLOGICAL SURVEY 1:500,000 FLORIDA MAP

Figure 8.--Transmissivity of the surficial aquifer.

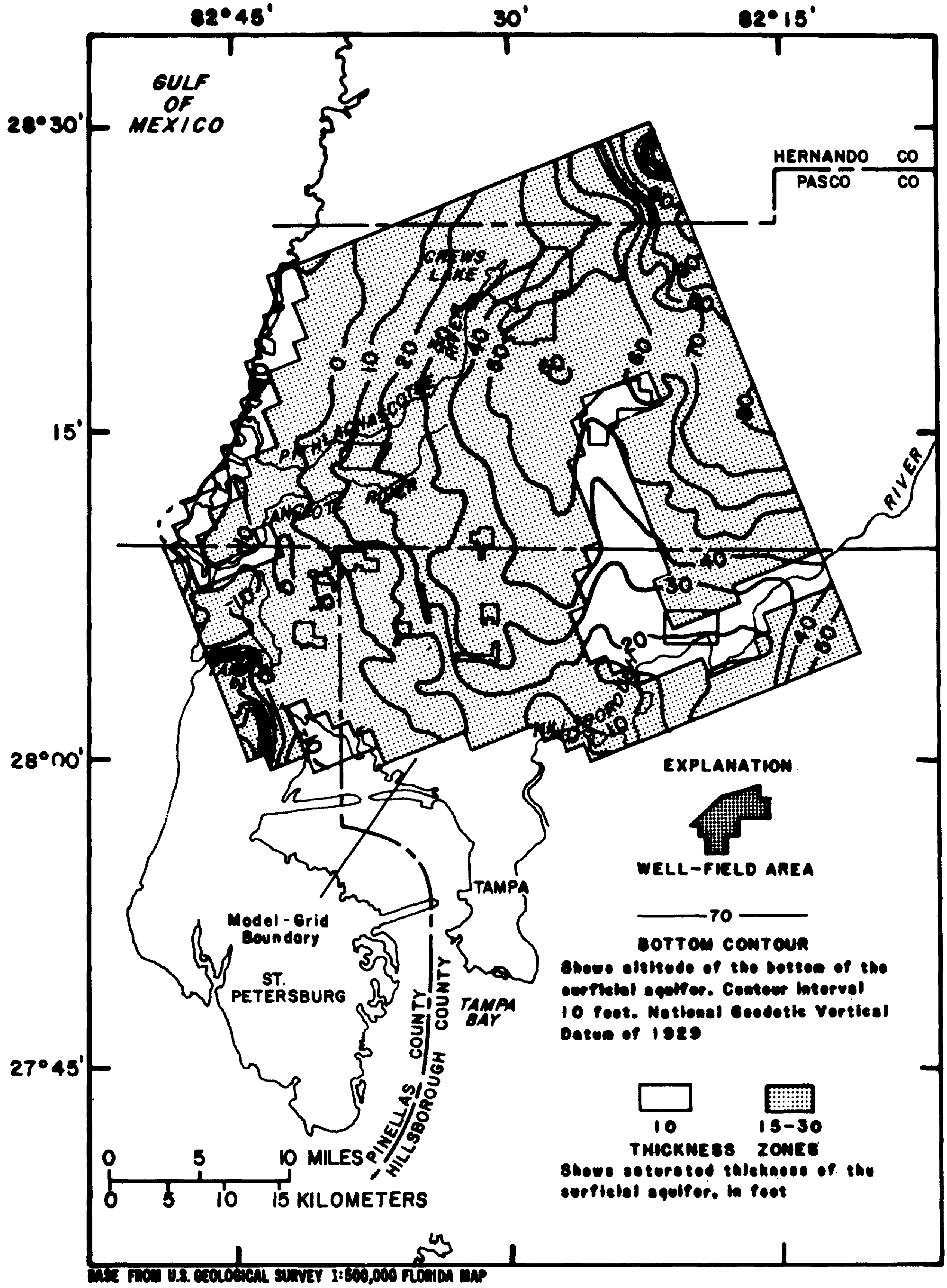


Figure 9.--Bottom configuration and saturated thickness of the surficial aquifer.

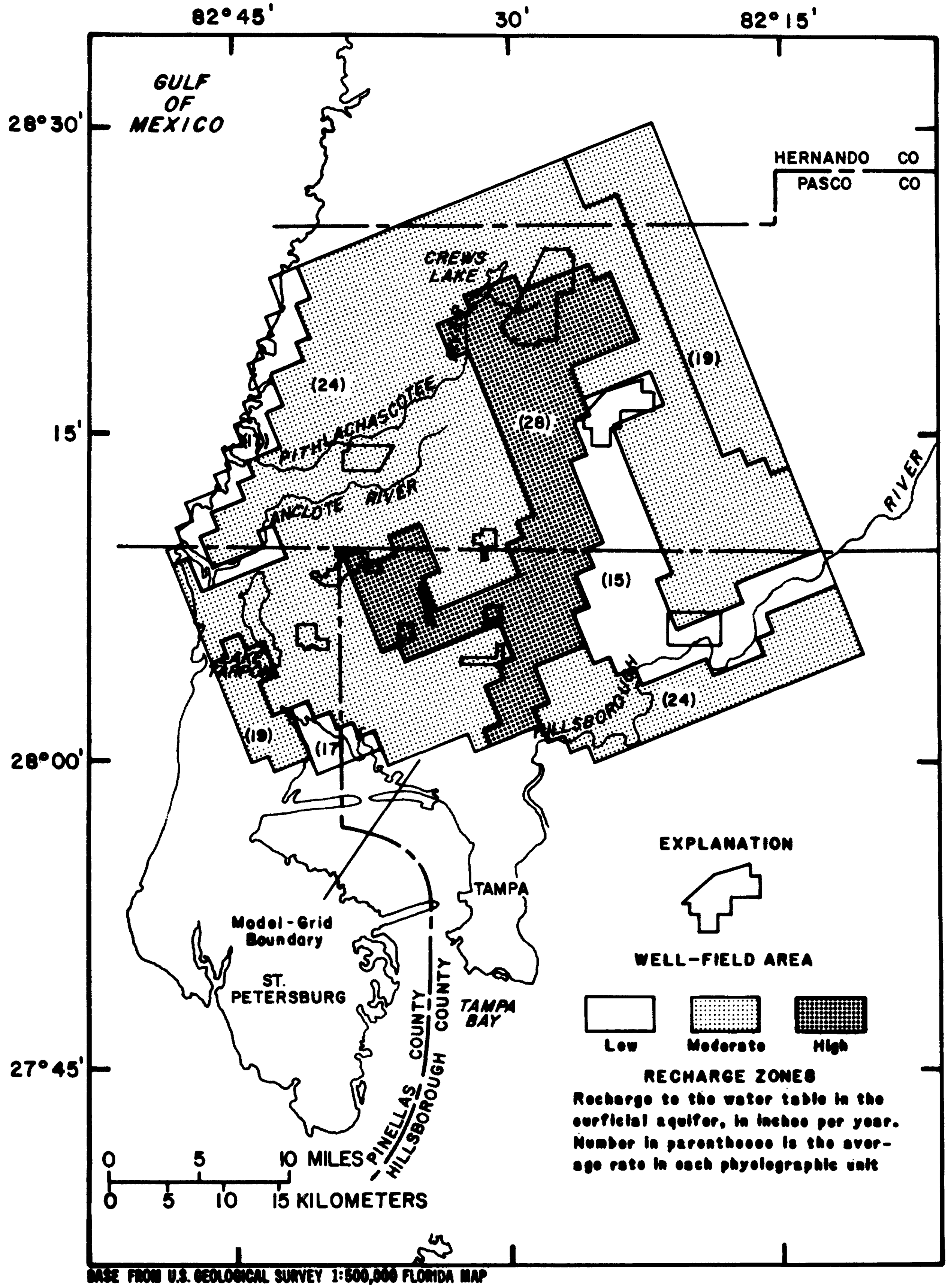


Figure 10.--Recharge to the water table in the surficial aquifer, as input for the steady-state calibration.

The HCF condition leakage factor for steady-state flow is computed analytically (using variable names that appear in the model code) by the equation:

$$CSS = \frac{T\sqrt{\lambda}}{\Delta X_i} \cdot \frac{(1-e^{-2\lambda L\sqrt{\lambda}})}{(1+e^{-2\lambda L\sqrt{\lambda}})}, \quad i = 1, 2 \qquad (3)$$

where CSS = HCF condition leakage factor (feet per second per foot);
T = transmissivity of the Floridan aquifer (feet squared per second);
λ = TK/T; TK is the leakance coefficient of the upper confining bed (feet per second per foot); k/b, where k is the hydraulic conductivity, and b is the thickness of the bed;
L = distance from model-grid boundary to constant-head point beyond (feet); and
ΔX_i = model-grid length parallel to boundary flow (feet), either DELX or DELY grid spacings.

The equation, formulated by S. P. Larson and J. V. Tracy (written commun., 1979) and derived later in this report, solves for the factor CSS. When CSS is multiplied by the difference between the head factor and potentiometric surface, flux at the model-grid boundary is computed.

The head factor in the HCF condition is the effective head in the surficial aquifer at an arbitrary distance of 15 miles from the model-grid boundary necessary to yield boundary flux calculated by the phase 1 two-dimensional model. A distance of 15 miles was selected as being beyond the effects of any stress that could be applied in the modeled area. For input to the quasi-three-dimensional model, the factor was computed using a form of Darcy's law:

$$HSS = \frac{XHCF}{CSS} + PHI \qquad (4)$$

where HSS = HCF condition head factor for the surficial aquifer (feet);
XHCF = boundary flux from two-dimensional model calibration (feet cubed per second per foot squared, or feet per second);
CSS = HCF condition leakage factor (feet per second per foot), computed from equation 1; and
PHI = head in Floridan aquifer at the model-grid boundary (feet).

The equation, rearranged to compute XHCF, is essentially that contained in the model for computing flux at the model-grid boundary (statement 11690 in computer program listing of Attachment A). Because this flux had already been computed in the phase 1 two-dimensional calibration, it was used to compute the head factor, which normally would be estimated.

Capture of evapotranspiration (ET) from the water table and runoff may be considered to be the variable source from which pumped water is derived since recharge is held constant in the model. Under normal climatological conditions, pumping will lower the water table, thereby creating the potential for extra recharge during the wet season and, subsequently, less runoff. Thus, the modeled ET-runoff capture parameter not only represents ET from the water table, but also changes in recharge and runoff.

Capture of ET from the water table and runoff was assumed to occur in the zone between land surface and a depth of 10 feet. The ET-runoff capture rate derived in the conceptual model is that for each foot of water-table decline, 3.8 inches per year of water can be captured. The maximum potential ET-runoff rate from the water table is 38 inches per year in areas where the water table is at land surface and zero where the water table is 10 feet or more below land surface. Regional patterns of ET-runoff were adjusted to conform to controls of the six physiographic units (fig. 11). It should be emphasized that ET is from the water table in the surficial aquifer and, thus, is only a component of the total ET found in standard hydrologic budget analyses (for example, Cherry and others, 1970). ET from land surface and the unsaturated zone and flood runoff are not represented in the model.

The average altitude of land surface in each grid block was obtained from U.S. Geological Survey 1:24,000 topographic maps. Topographic highs usually correspond to the ridge and terrace physiographic units, and closed basins or lows correspond to swamps and coastal marsh units.

Average withdrawals from the Floridan aquifer for the period September 1976 to May 1977 were estimated from records of the Southwest Florida Water Management District and from estimates of water requirements for citrus (University of Florida, 1977). These included withdrawals for municipal supply, miscellaneous municipal supply and treatment, citrus irrigation, and miscellaneous crop, pasture, and lake augmentation (table 3). Water pumped from private domestic wells was assumed to be small and was not considered for input to the model. The distribution of pumpage as input to the model is shown in figure 12. Pumping is distributed mainly along the Gulf Coast and in the southern part of the modeled area. The largest withdrawals occur in the well-field areas.

Calibration

The model was calibrated by systematically adjusting input parameters until simulated heads in the Floridan and surficial aquifers matched long-term average steady-state levels. Leakance coefficient of the upper confining bed and transmissivity of the Floridan aquifer had been calibrated previously in the phase 1 two-dimensional model, and these parameters were readjusted during calibration of the quasi-three-dimensional model. Error limits for the steady-state quasi-three-dimensional model calibration were set at ±5 feet of head in each aquifer. Statistics of the model calibration are listed in table 4.

The comparison of observed long-term average water levels with model-simulated values in both aquifers was good statistically, thus the model was considered to be adequately calibrated. Residuals were nearly within the ±5-foot limit and were normally distributed about means near zero. The standard deviation about the mean of the residuals for the water table was 1.3 feet. That is, the model-simulated water table matched the estimated long-term average levels within a range of 0.9 foot above to 1.7 feet below at about 68 percent of the nodes. Similarly, the model-simulated potentiometric surface matched the September 1976 to May 1977 average levels at 68 percent of the nodes within a range of 1.9 feet above to 2.3 feet below, based on a standard deviation of

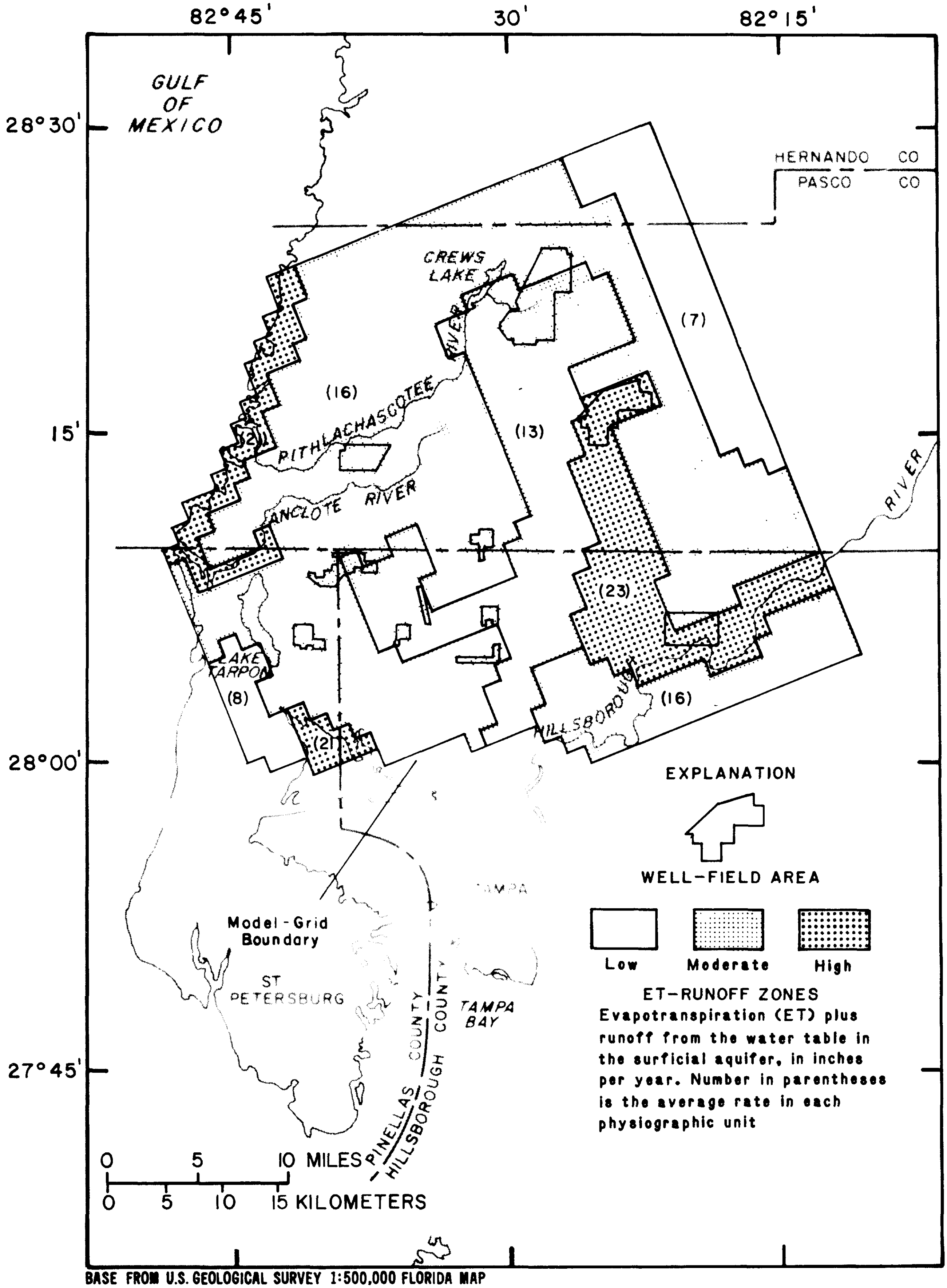


Figure 11.--Evapotranspiration plus runoff from the water table in the surficial aquifer, as computed in the steady-state calibration.

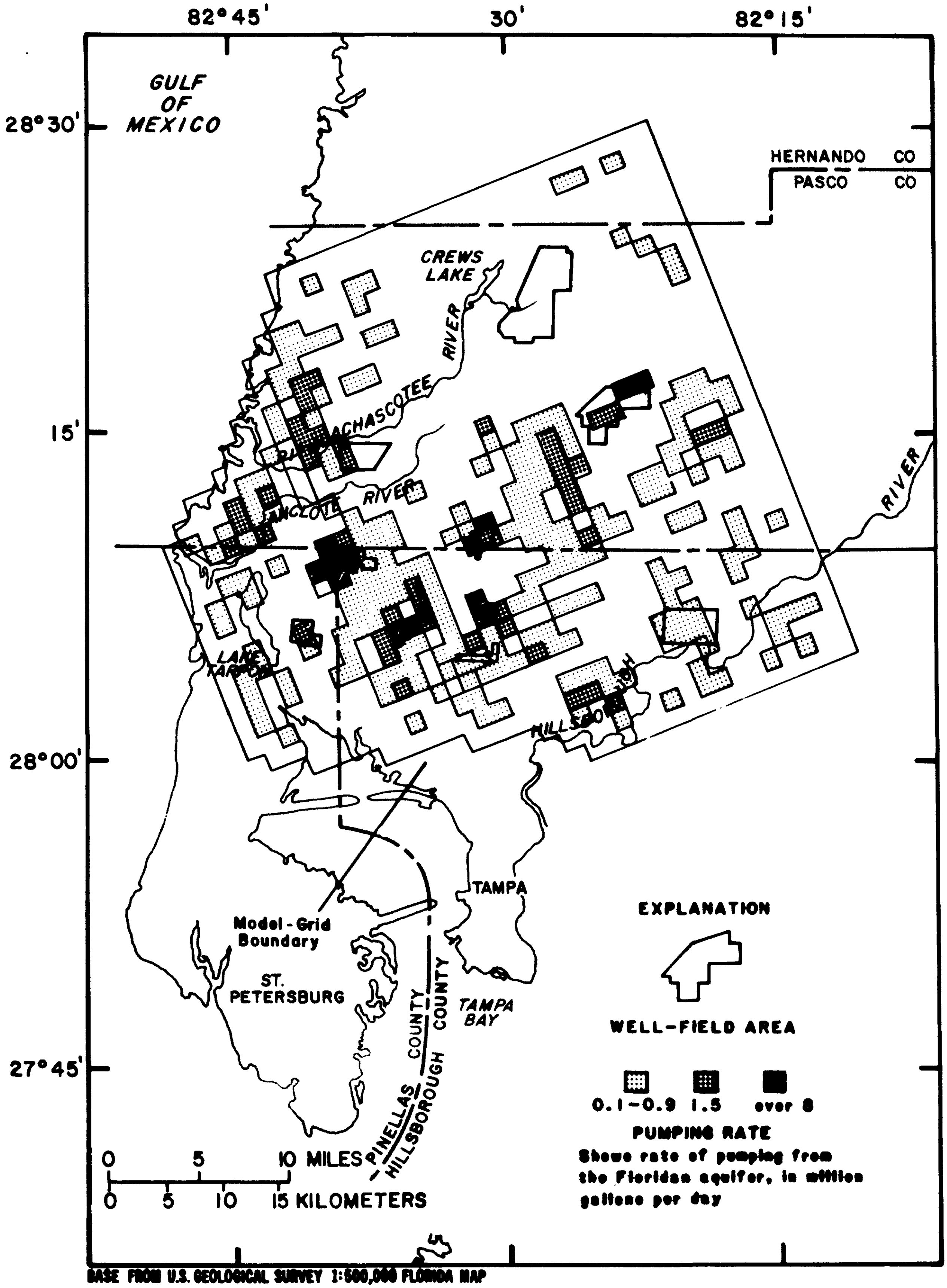


Figure 12.--Distribution of average pumpage in the modeled area, September 1976 to May 1977.

Table 3.--Average pumpage from the Floridan aquifer, September 1976 to May 1977

Use	Mgal/d	ft^3/s
Municipal[1/]	87	134
Miscellaneous municipal and treatment[2/]	11	18
Citrus irrigation[3/]	24	37
Miscellaneous crop, pasture, and lake augmentation[4/]	11	17
Total	133	206

1/ Obtained from pumping records on file at Southwest Florida Water Management District.

2/ Computed as 75 percent of the daily pumpage permitted by Southwest Florida Water Management District.

3/ Computed by the method outlined by University of Florida (1977) using a 75-percent seepage efficiency.

4/ Computed as 50 percent of the daily pumpage permitted by Southwest Florida Water Management District.

2.1 feet about a residual mean of 0.2 foot below the average level. The correlation coefficients were near 1.000, indicating near-perfect association between the long-term average and model-simulated water levels in both aquifers. Comparisons between the long-term average and model-simulated water table and potentiometric surface are shown in figures 13 and 14, respectively. Water levels simulated by the steady-state calibration run were used as starting water levels for subsequent model-sensitivity runs.

Sensitivity Analysis

Sensitivity analysis tests model sensitivity to changes in input parameters. Separate model simulations are made with individual parameters varied in turn over a reasonable range of values within which they should occur. The model was not recalibrated each time parameter values were changed since this would be impractical in terms of time and cost. Exact values of head changes from sensitivity analyses should be viewed critically, but relative changes can provide insight as to the degree to which a change in any parameter may affect results of model simulation.

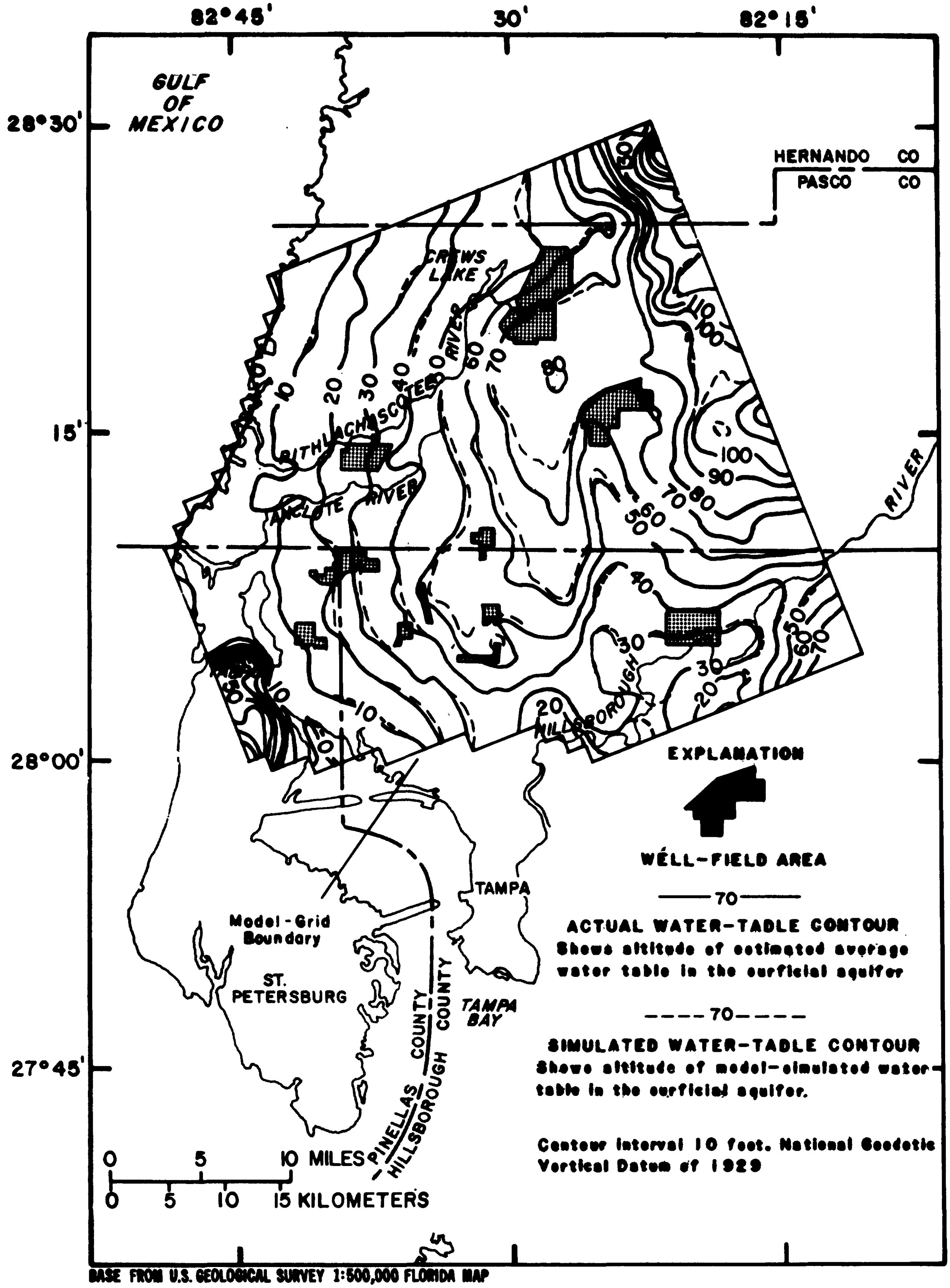


Figure 13.--Comparison of September 1976 to May 1977 estimated average and model-simulated water tables, representing steady-state calibration.

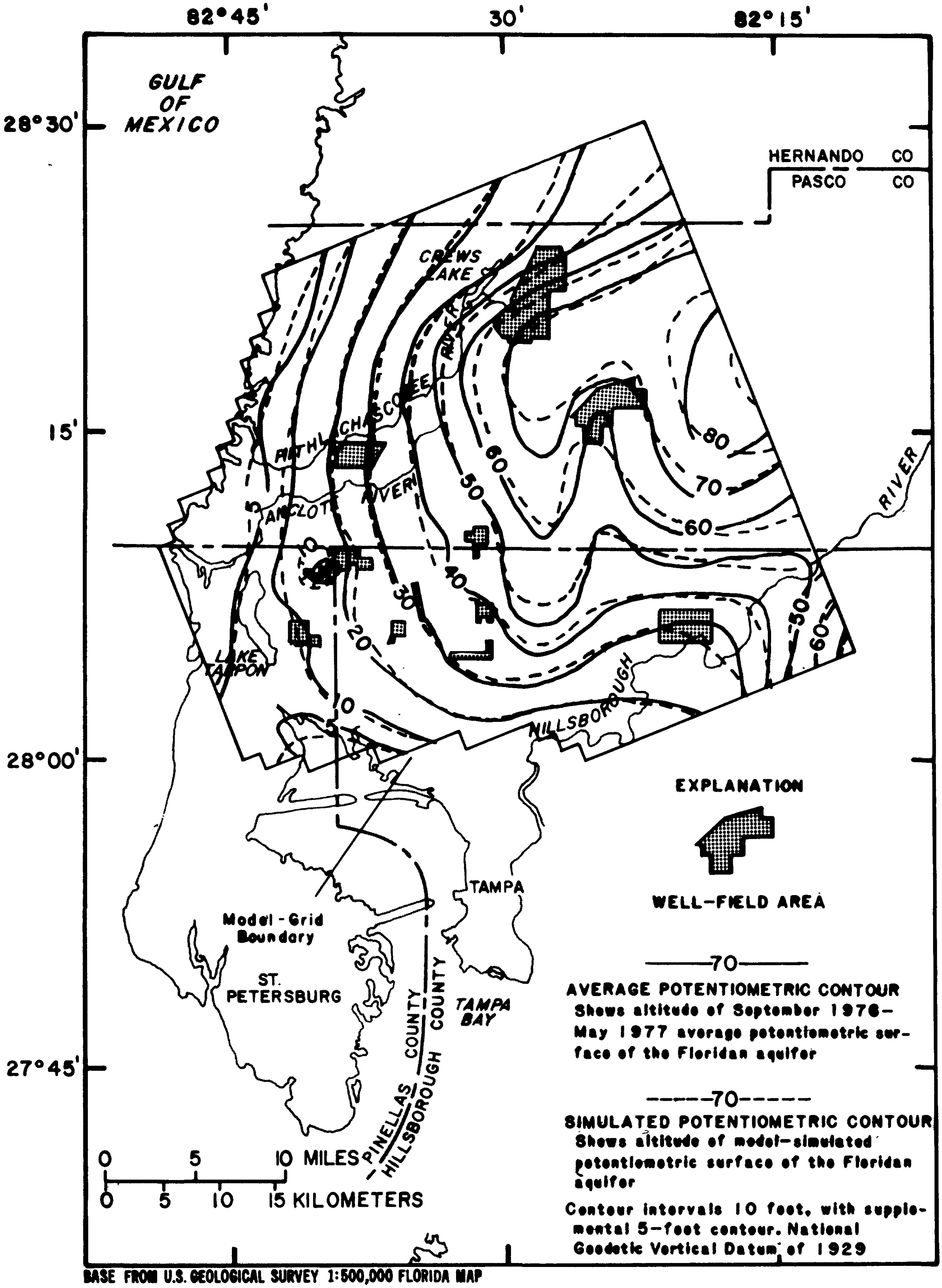


Figure 14.--Comparison of September 1976 to May 1977 average and model-simulated potentiometric surfaces, representing steady-state calibration.

Table 4.--Statistics of model calibration

Statistic	Long-term average versus model-simulated	
	Water table	Potentiometric surface
Number of active nodes	814	932
Maximum range in residuals[1] (feet)	4.4 to (-5.0)	5.3 to (-4.9)
Mode of residuals (feet)	.1	.2
Median residual (feet)	.4	.3
Mean residual (feet)	.4	.2
Mean of absolute value of residuals (feet)	1.0	1.7
Standard deviation of residuals (feet)	1.3	2.1
Correlation coefficient	.9987	.9961

1/ Residuals were computed by subtracting model-simulated water levels from the long-term average potentiometric surface and water table. A negative residual indicates that the model-simulated water level is higher than the long-term average water level, and the reverse is indicated by a positive residual.

Model sensitivity was tested by varying ET-runoff and recharge parameters and hydraulic parameters of the surficial and Floridan aquifers and the confining bed. Figure 15 shows deviations from the steady-state calibration water table and potentiometric surface by varying maximum ET-runoff capture depth (ETD) by ±5 feet, recharge rate (QRE) by ±20 percent, and maximum potential ET-runoff capture rate (ETR) by ±20 percent. Figure 16 shows deviations due to varying hydraulic conductivity (PERM) of the surficial aquifer by a factor of 3, transmissivity (T) of the Floridan aquifer by factors of 2 and 0.5, and leakance coefficient (TK) of the upper confining bed by factors of 2 and 0.5. The cross sections in both figures depict model-simulated heads along row 20 of the model. This row, through the center of the model, intersects five of the six physiographic units. The two cross sections exemplify and were used in conjunction with maps that supply areal perspective to the sensitivity analysis.

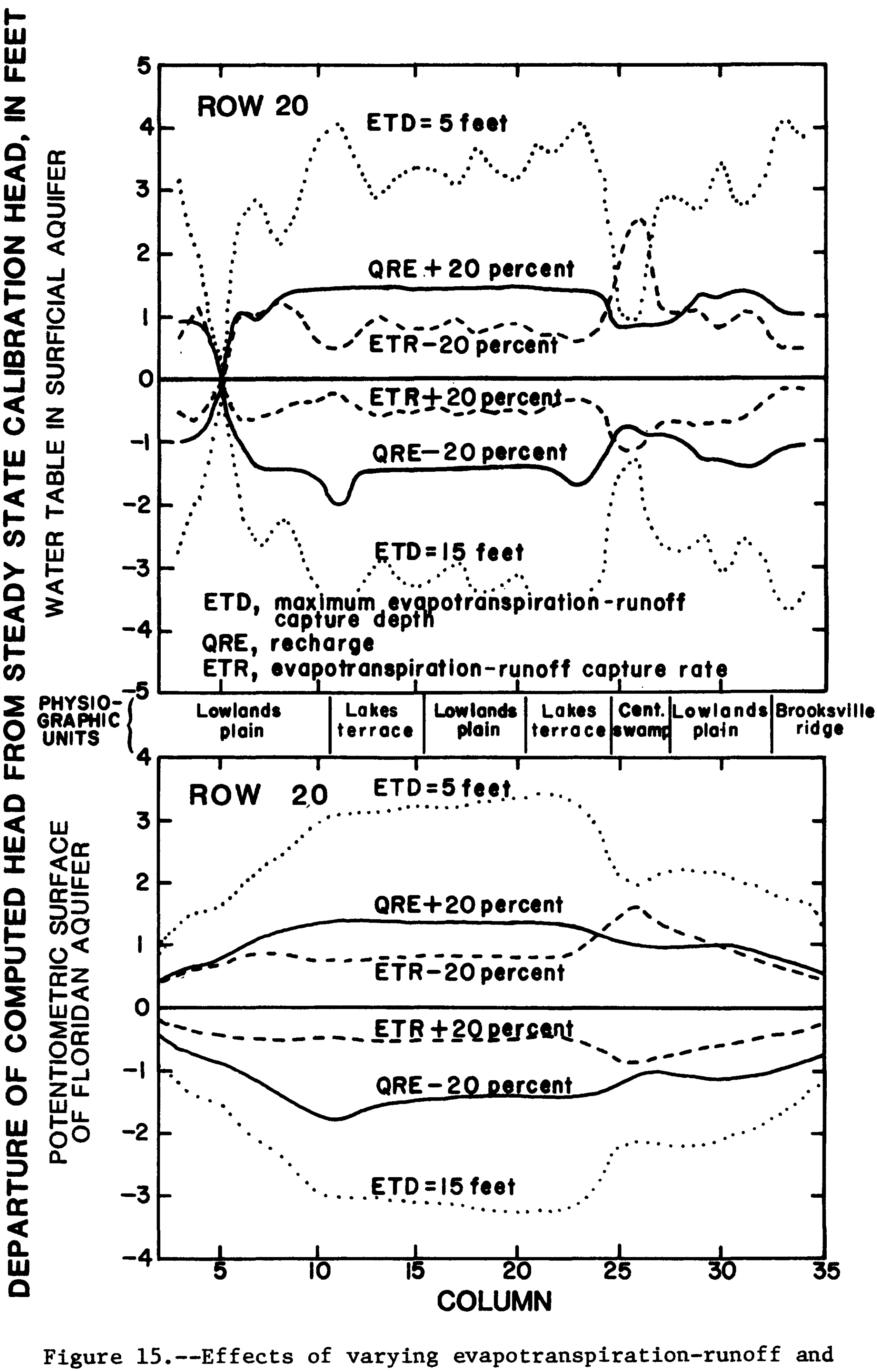


Figure 15.--Effects of varying evapotranspiration-runoff and recharge parameters on the steady-state calibration.

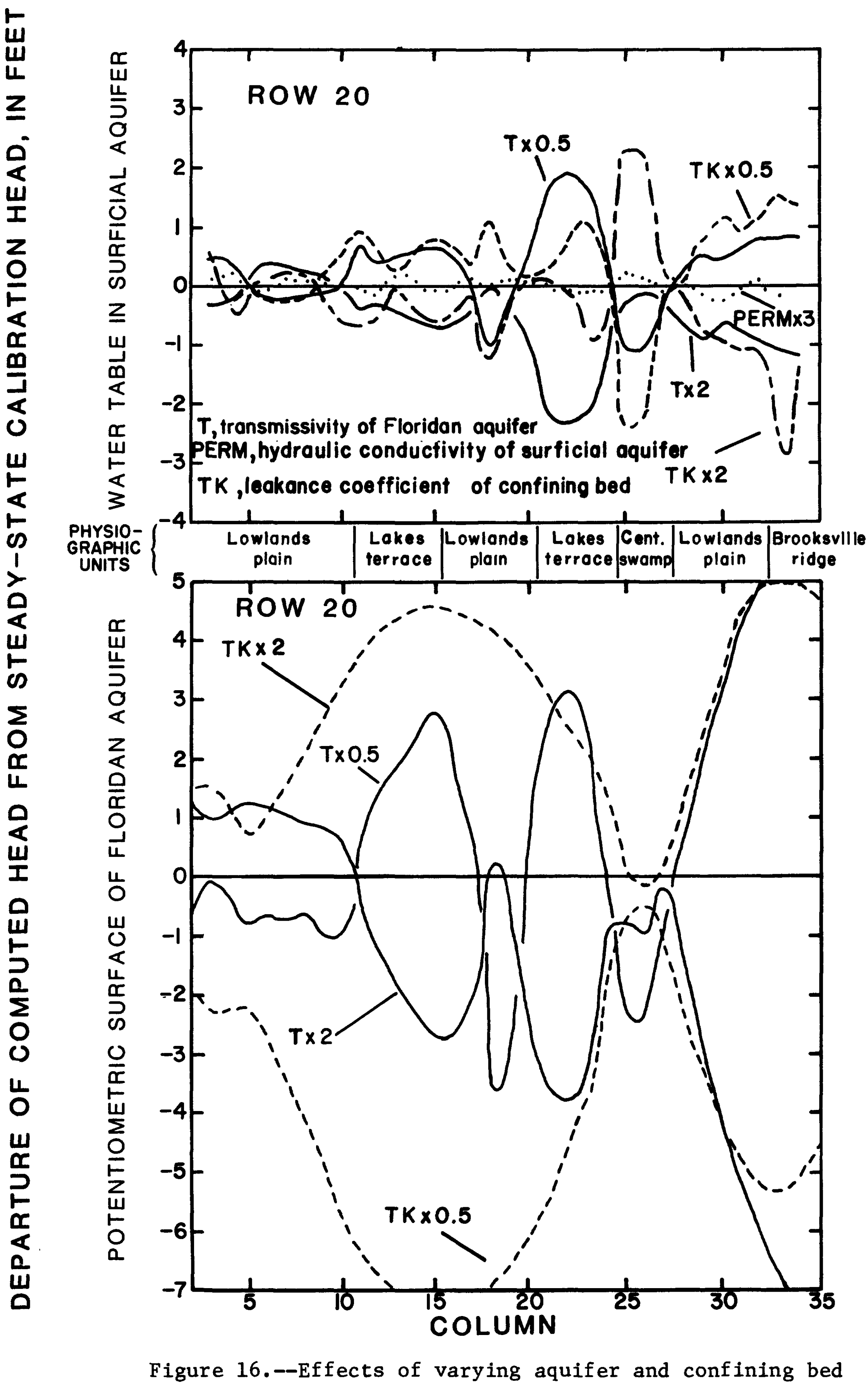


Figure 16.--Effects of varying aquifer and confining bed hydraulic parameters on the steady-state calibration.

Varying the ET-runoff capture rate and recharge has a slightly greater effect on the water table than the potentiometric surface. One might expect to see a much larger effect on the water table because these changes directly apply to inflow to and outflow from the surficial aquifer. But, due to the relatively high leakage rate from the surficial aquifer through the upper confining bed and the dampening effect on heads in this aquifer by the ET-runoff capture function, head deviations from the steady-state calibration are nearly the same in each aquifer. Although not depicted in figure 15, the ridge areas are sensitive to recharge. The water table in the ridges responds dramatically to small changes in recharge because the leakance coefficient is low and the water table generally lies 10 feet or more below land surface, thereby nullifying the dampening effect of ET-runoff capture. Other than in ridge areas, the effects of increasing or reducing recharge are dampened by increasing or reducing ET-runoff outflow. In the swampy areas ET-runoff is high and changing this parameter strongly influences the calibration, as can be seen at columns 25-26 of figure 15.

Because the model is sensitive to ET-runoff capture and recharge, better estimates of these input parameters would produce a more accurate model. A preliminary model was calibrated that assumed the water table would drop 1 foot for each 1.8 inches captured from ET and runoff. This preliminary calibration produced about twice the observed water-table fluctuations under different pumping conditions and, thus, was a poor validation. Subsequently, the model was recalibrated using a higher potential ET-runoff capture rate where the water table would drop 1 foot for each 3.8 inches of water captured. This resulted in more realistic fluctuations of the water table. Overall, the model indicates that better definition is needed of (1) recharge rate of various soil types and physiographic units, (2) relation between recharge and depth of water table, (3) potential evapotranspiration rate from the water table, and (4) relation between evapotranspiration and depth of water table.

Of the hydraulic parameters tested, the model is most sensitive to changes in leakance coefficient of the upper confining bed, moderately sensitive to transmissivity of the Floridan aquifer, and least sensitive to hydraulic conductivity of the surficial aquifer. Average deviations in the water table are relatively small compared to those in the potentiometric surface, showing again the dampening effect of ET-runoff. For example, when leakance was doubled, the potentiometric surface rose 4.6 feet at column 15 (fig. 16), but the water table declined only about 0.5 foot. The increased downward leakage in the center of the modeled area was composed entirely of captured ET-runoff. In ridge areas where the water table generally is 10 feet or more below land surface, evapotranspiration from the water table and the potential for capturing runoff are nil, and small changes in the potentiometric surface sometimes result in large fluctuations in water-table levels.

Tests of the model's sensitivity to boundary conditions were made during the predictive-modeling phase of the study. Ten well fields were pumped at a combined rate of 186.9 Mgal/d and drawdowns in the Floridan aquifer were observed under constant-head, constant-flow, and HCF boundary conditions. Average drawdown at the boundary was zero under constant-head conditions, 1.2 feet under HCF conditions, and 2.5 feet under constant-flow conditions. Average drawdown over the modeled area was 3.4, 3.6, and 4.2 feet, respectively, under these conditions. Had the distance from the model-grid boundary to the constant-head point beyond been less than 15 miles, boundary drawdowns would be equal to or less than 1.2 feet, observed using the 15-mile distance. Increasing distance greater than 15 miles would produce boundary drawdowns equal to or slightly greater than the HCF level.

The sensitivity analysis exemplifies an important limitation of the model whereby the water table can rise above land surface, when actually it can rise only to land surface and becomes surface water with additional rise. Unless ponding occurs, rises at these nodes are not possible because the water table already lies at land surface. Errors in the water-table levels will lead to errors in computed leakage rate through the upper confining bed and potentiometric head in the underlying Floridan aquifer. When using the model for predictive purposes, this limitation should be kept in mind and areas of water-table rise above land surface should be recognized. The model code was modified to flag these areas.

Validation

Model validation is a technique for testing the accuracy of a calibrated model for predictive purposes. The test case chosen for validation involved removing all pumpage from the calibrated steady-state model; recharge in pumping nodes was reduced by subtracting 20 percent of the previous irrigation pumpage (because irrigation-return flow would cease) and 100 percent of the lake augmentation pumpage (all water pumped for lake augmentation was considered to be recharge, and hence, would cease). The natural recharge rate was increased by 10 percent, based on the assumption that rainfall, and subsequently recharge, was 10 percent below normal during the calibration period. The model-simulated water table was compared with the steady-state calibrated water table to check if water-level changes in the surficial aquifer were plausible. The model-simulated potentiometric surface was compared with an estimated potentiometric surface generally unaffected by pumping, mapped by Johnston and others (1980), that represents predevelopment conditions. Statistics of these comparisons are listed in table 5. Comparisons are good statistically; thus, the model was considered to be adequately validated.

The model-simulated predevelopment water table rose a maximum of 10.7 feet above the calibrated water table. The model indicated an average water-table rise of 1.4 feet. The standard deviation of 1.1 feet about the mean indicates that, in about 68 percent of the nodes, the model-simulated water table remained within a range of 0.3 foot lower and 2.5 feet higher than the steady-state calibrated level. The greatest rise occurred at the Eldridge-Wilde well field. In other well fields, the rise due to cessation of pumpage was 2 to 4 feet. Estimated average water levels for 1976-77 are assumed to represent stressed conditions. Figure 17 indicates that should all pumping cease, the water would recover in some areas. Although not discernible at the scale of figure 17, there was a rebound of water-table levels to smooth out depressions caused by pumping in all the well fields. The water table simulated by the validation run was used as the predevelopment starting water table upon which predictive model runs are based.

Comparison of predevelopment and model-simulated potentiometric surfaces was good statistically. Over the 932 nodes within the model-grid boundary, the simulated predevelopment potentiometric surface ranged from 9.4 feet higher than to 11.6 feet lower than the estimated level. The mean was 1.8 feet higher than the estimated level. The standard deviation about the mean of the residuals was 3.5 feet, which indicates that the model-simulated potentiometric surface matched within a range of 5.3 feet higher than to 1.7 feet lower than the estimated predevelopment level at about 68 percent of the nodes. A correlation coefficient of 0.9899 indicates a good correlation between the two surfaces.

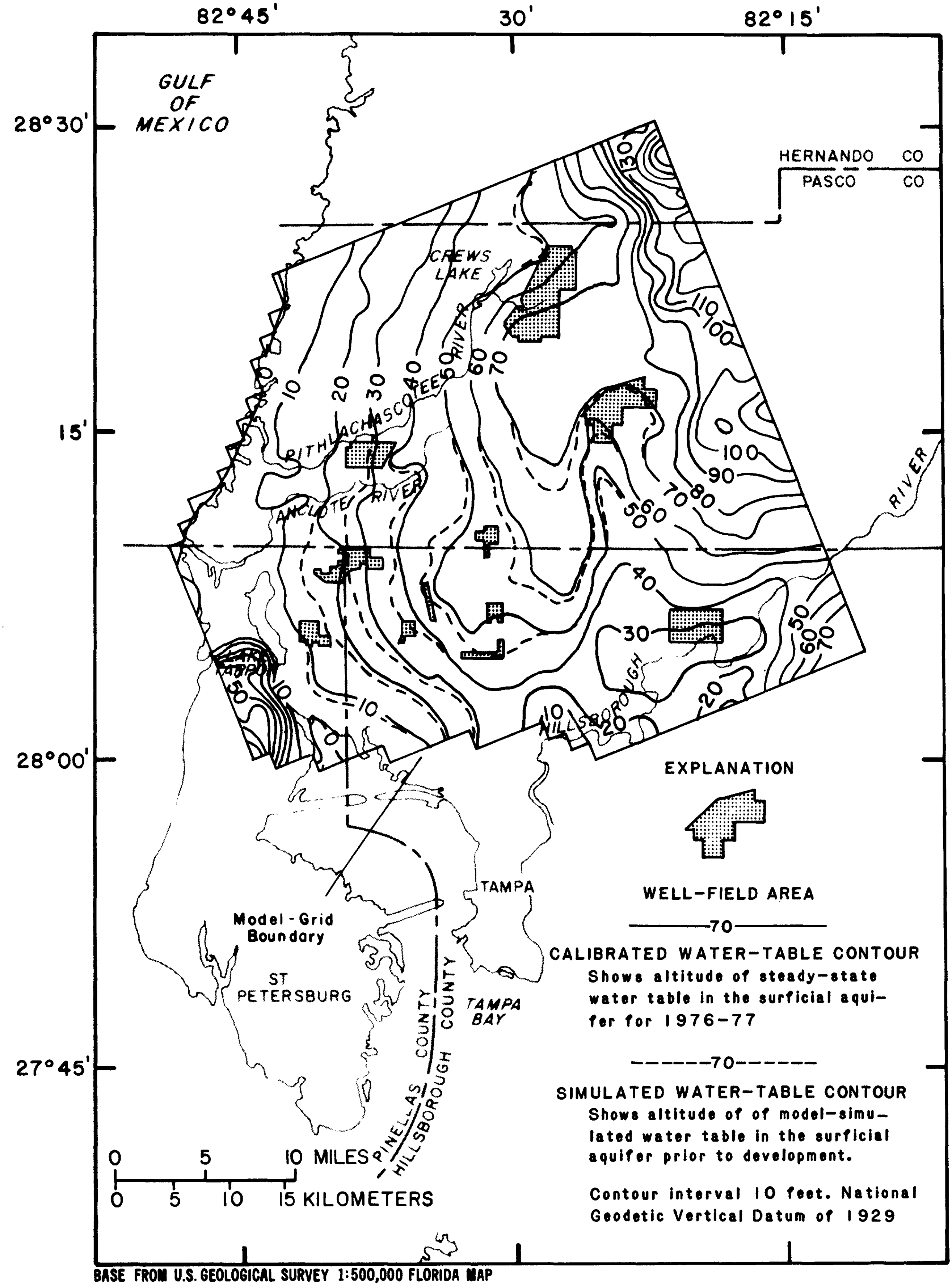


Figure 17.--Comparison of steady-state calibrated and model-simulated predevelopment water tables, representing model validation.

Table 5.--Statistics of model validation

Statistic	Calibrated steady-state versus model-simulated water table	Estimated prestressed versus model-simulated potentiometric surface
Number of active nodes	814	932
Maximum range in residuals[1/] (feet)	0 to (-10.7)	11.6 to (-9.4)
Mode of residuals (feet)	- .7	-3.7
Median residual (feet)	-1.1	-1.9
Mean residual (feet)	-1.4	-1.8
Standard deviation of residuals (feet)	1.1	3.5
Correlation coefficient	.9992	.9899

1/ Residuals were computed by subtracting model-simulated water levels from the calibrated steady-state water table and estimated prestressed potentiometric surface, respectively. A negative residual indicates that the model-simulated water level is higher than the water level with which it is compared, and the reverse is indicated by a positive residual.

Comparison between the estimated and simulated potentiometric surfaces for predevelopment conditions is shown in figure 18. The wide range in model residuals between the two surfaces (21 feet) may be due to several factors. For example, the map of the estimated historic potentiometric surface may be in error where data are sparse and specifically in areas where the predevelopment head is lower than the average steady-state head. Errors could be greater along the coasts of the Gulf of Mexico and Tampa Bay where upwelling of freshwater results in upward flow in the aquifer and where channel dredging may have changed the hydraulic properties of the upper confining bed between predevelopment and September 1976 to May 1977 average maps. Although these errors may not represent model-calibration errors, they serve to increase the statistical errors of the model validation.

The model validation represents average hydrologic conditions prior to pumping. The water balance under these conditions will differ from that of the calibrated model in that recharge and pumpage have been altered. These alterations in turn affect ET-runoff from the water table and leakage. Table 6 lists the model-computed water balance for the surficial aquifer in each physiographic unit and for the surficial and Floridan aquifers over the total modeled area. It conforms to the conceptual model and is the water balance upon which all predictive runs of the model are based.

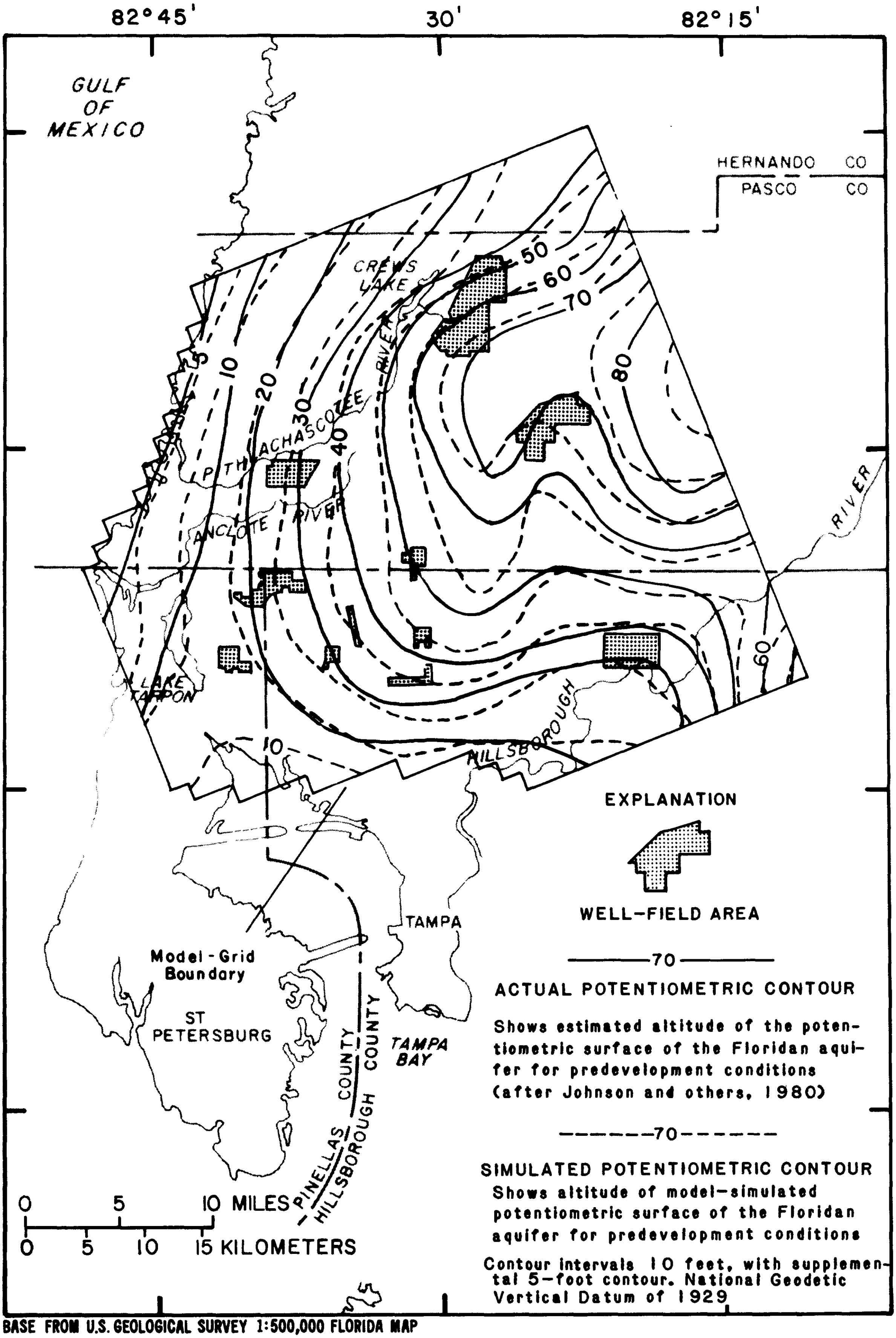


Figure 18.--Comparison of estimated and model-simulated potentiometric surfaces for predevelopment conditions, representing model validation.

Table 6.--Water balance for the surficial and Floridan aquifers simulated by the model under average hydrologic conditions prior to pumping

A. SURFICIAL AQUIFER BY PHYSIOGRAPHIC UNIT

Physiographic unit	Area (mi^2)	Recharge (in/yr)	ET-runoff from water table (in/yr)	Net leakage up (-) or down (+) (in/yr)
Coastal marsh	25	18.6	25.0	-6.3
Lowlands plain	496	25.9	20.4	5.4
Brooksville ridge	41	20.6	8.9	11.3
Lakes terrace	159	30.0	19.4	10.5
Central swamp	82	16.3	26.9	-10.6
Coastal sand ridge	11	20.4	10.0	9.4

B. SURFICIAL AQUIFER

	Area (mi^2)	QRE Recharge (in/yr)	ETRO ET-runoff from water table (in/yr)	UL Upward leakage (in/yr)	DL Downward leakage (in/yr)
Average for model	814	25.1	20.3	1.6	6.4

Water balance: QRE + UL = ETRO + DL

C. FLORIDAN AQUIFER

	Area (mi^2)	UL Upward leakage (in/yr)	DL Downward leakage (in/yr)	BI Boundary inflow (in/yr)	BO Boundary outflow (in/yr)
Average for model	932	1.6	6.7	1.1	6.2

Water balance: DL + BI = UL + BO

The water table and potentiometric surface simulated by the validation run were used as predevelopment starting heads upon which predictive-model runs are based. This zeros out the drawdown array computed by the model and puts the system in equilibrium for the start of a predictive run. Had the estimated predevelopment potentiometric surface been input as the starting head, then the system would only be near equilibrium, and predicted drawdowns under an anticipated pumping condition would contain errors carried over from the validation run.

PREDICTIVE MODELING

The quasi-three-dimensional model may be applied to various field problems. An example presented here illustrates options available in the program. An example field problem is presented, and results are compared to the phase 1 two-dimensional model results.

Example Field Problem

The field problem involves determining water-balance and water-level changes that can be expected as a result of pumping all 10 well fields at their annual average permitted or proposed rates with recharge varying 20 percent above and below the average rate. The model simulates wet conditions when recharge is above average and dry conditions where recharge is below average. The well fields currently (1981) are permitted by the Southwest Florida Water Management District to pump 186.9 Mgal/d from 164 wells (table 7). Within each well field, all wells were assumed to pump at the same rate and were assigned to the square-mile grid block in which they occur. Thus, pumpage was distributed as a function of well location rather than evenly throughout each well field.

Attachment C illustrates the data deck for the model interrogation of average recharge conditions. Attachment D illustrates the model output generated by the data deck. Figures 19-22 compare anticipated drawdowns in the water table and potentiometric surface under high, low, and average recharge conditions. Table 8 summarizes water-balance and water-level data under the various simulation runs and compares these values with initial nonpumping conditions.

The drawdown maps show a series of coalescing cones of depression. Because the well fields are close together, the cones will overlap or interfere with one another as they spread out. It should be realized that drawdown in the proximity of a single well field is increased by pumping from nearby well fields. Attachment E shows the model-simulated limits of cones of depression that should develop in the surficial and Floridan aquifers as the 10 well fields are pumped individually. Attachment E also shows three-dimensional graphical plots of the water table and potentiometric surface before and after pumping 10 well fields simultaneously.

When all 10 well fields are pumped simultaneously under average recharge conditions, the water table can be expected to drop 2 feet or more from nonpumping conditions over an area of about 163 mi^2. A 2-foot or greater decline in the potentiometric surface would occur over an area of about 505 mi^2. The maximum drawdowns occur at the well fields. For the entire modeled area, average drawdowns of 1.3 feet and 3.6 feet would occur in the surficial aquifer and Floridan aquifer, respectively. Recharge accounts for about 90 percent of the

Table 7.--Annual average permitted pumping rates used for model simulations

[Southwest Florida Water Management District, written commun., 1982]

Well field	Annual average permitted pumping rate (Mgal/d)	Number of wells
Cross Bar Ranch	30	17
Cypress Creek	30	10
Starkey	8	5
Pasco County	16.9	8
Eldridge-Wilde	35.2	58
East Lake	3	8
Cosme	19	23
Section 21	18	7
Morris Bridge	18	20
Northwest[1/]	8.8	8
Total	186.9	164

1/ Consumptive use permit No. 206676 is pending approval by the Southwest Florida Water Management District.

inflow to the system, and ET-runoff from the water table accounts for about 58 percent of the outflow. Of the 187 Mgal/d pumped, 159 Mgal/d were derived from reduced ET-runoff and the remainder from a combination of increased boundary inflow and downward leakage (table 8). Although the amount of water captured from ET-runoff seems high, it represents reduced ET and runoff from the water table and possibly increased recharge when the water table is lowered.

Under high recharge conditions, the 2-foot cone of depression decreases from 163 to 41 mi^2 in the water table and from 505 to 323 mi^2 in the Floridan aquifer. More than 90 percent (178 of 194 Mgal/d) of the increased recharge would be lost to evapotranspiration, however, leaving little of this increased quantity of water to leak to the Floridan aquifer.

Compared to average recharge conditions, inflow and outflow trends under low recharge conditions are reversed with respect to wet recharge conditions. The 2-foot cone of depression would expand from 163 mi^2 under average recharge conditions to 460 mi^2 under low recharge conditions in the water table and from 505 to 755 mi^2 in the Floridan aquifer. The water table would decline about 3.2 feet, or 1.9 feet more than under average recharge conditions. The average decline in the potentiometric surface would be less than the water-table decline, about 1.4 feet more than under average recharge conditions. In the ridge areas and north of the Cross Bar Ranch well field where there is little or no ET-runoff,

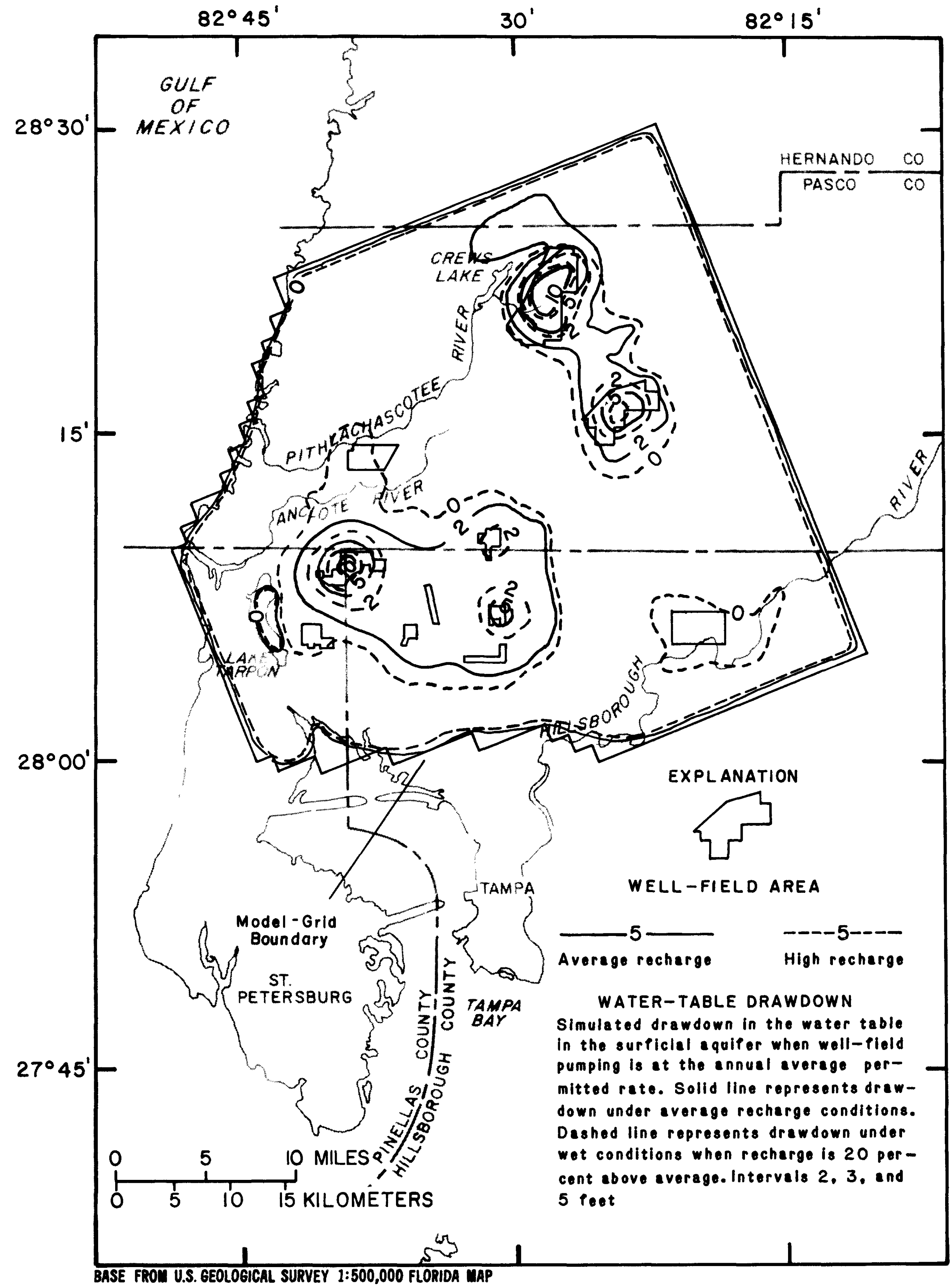
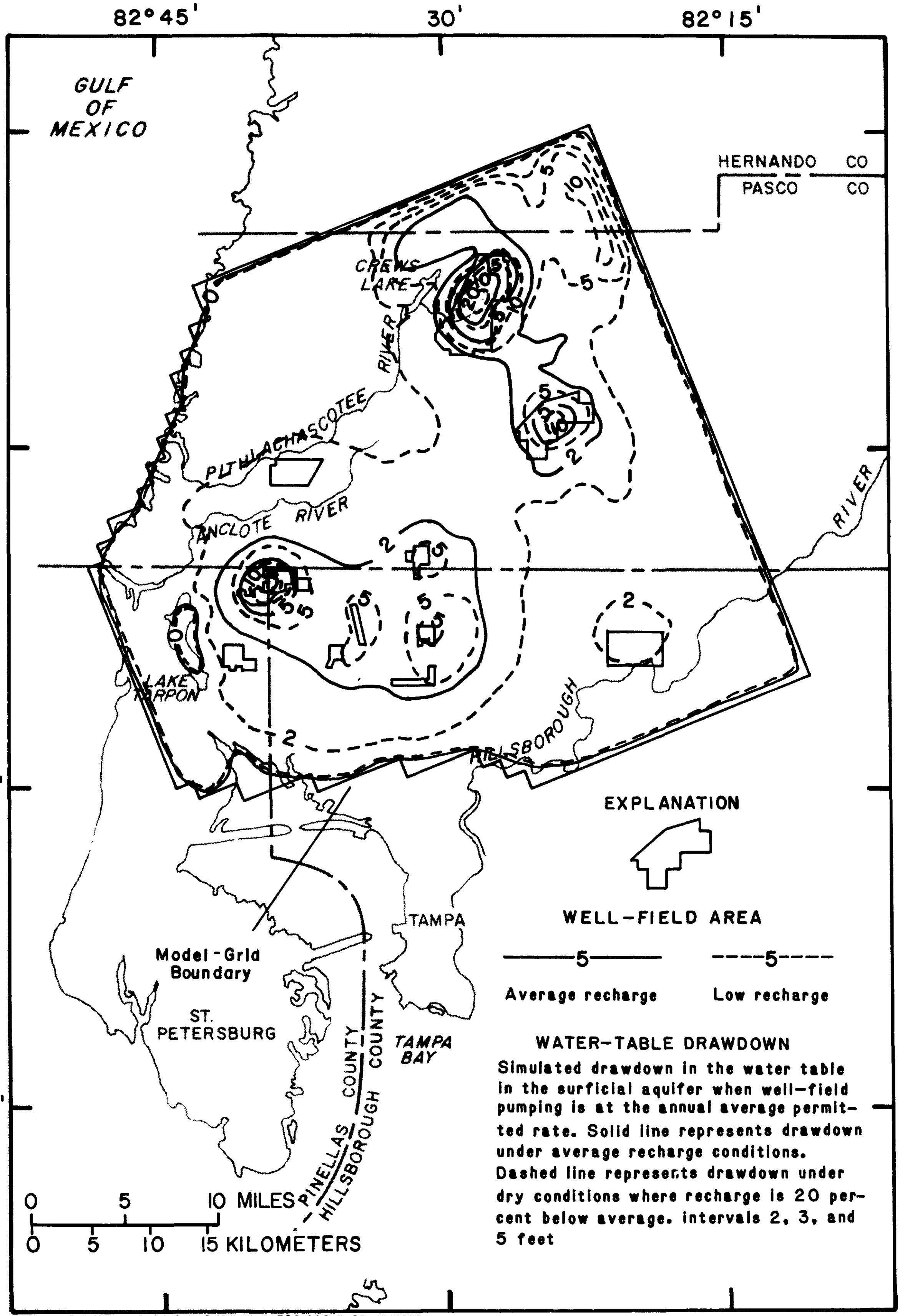


Figure 19.--Model-simulated drawdown in the water table in the surficial aquifer under average and high recharge conditions with well fields pumping at the annual average permitted rates.



BASE FROM U.S. GEOLOGICAL SURVEY 1:500,000 FLORIDA MAP

Figure 20.--Model-simulated drawdown in the water table in the surficial aquifer under average and low recharge conditions with well fields pumping at the annual average permitted rates.

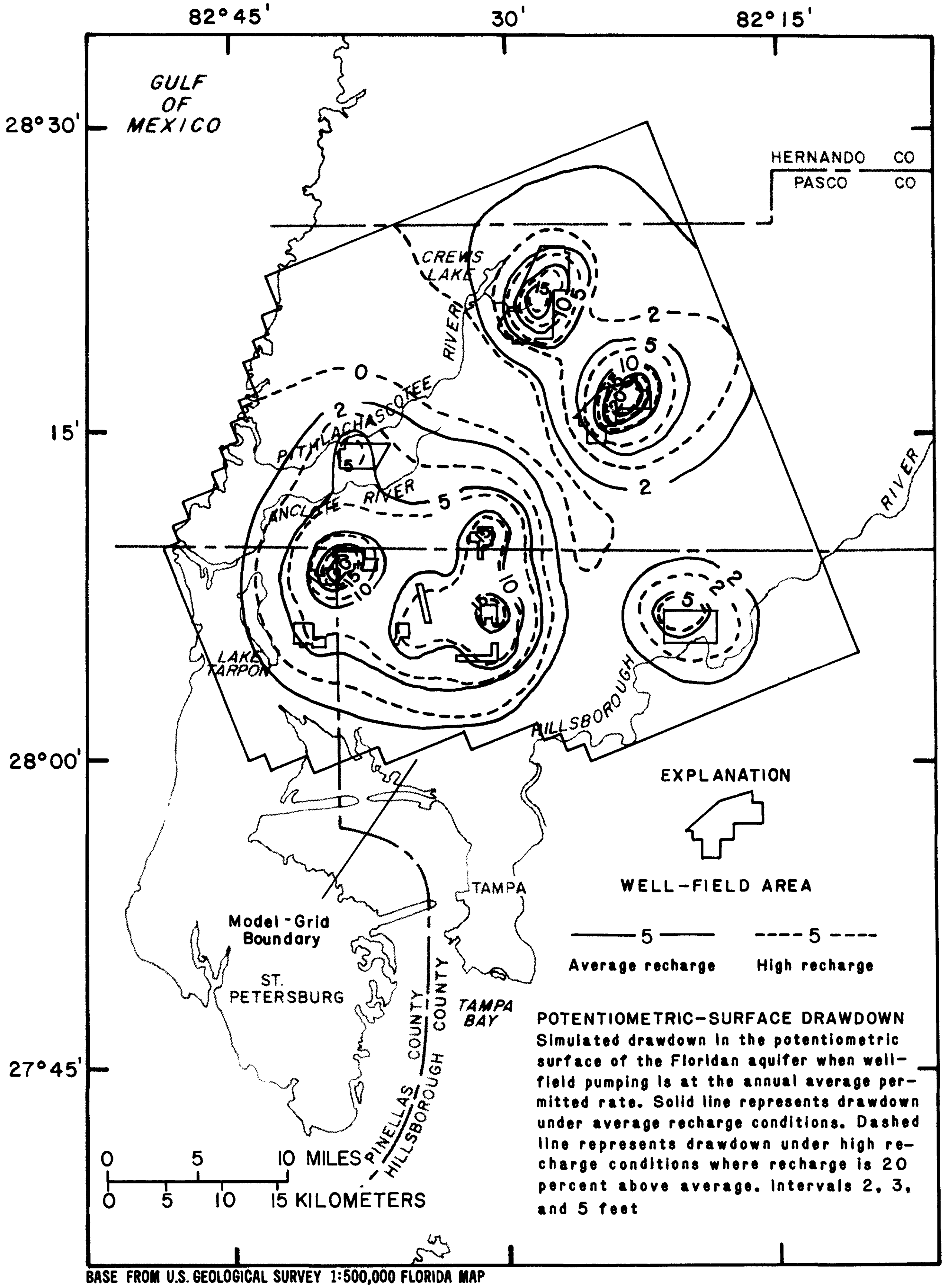


Figure 21.--Model-simulated drawdown in the potentiometric surface of the Floridan aquifer under average and high recharge conditions with well fields pumping at the annual average permitted rates.

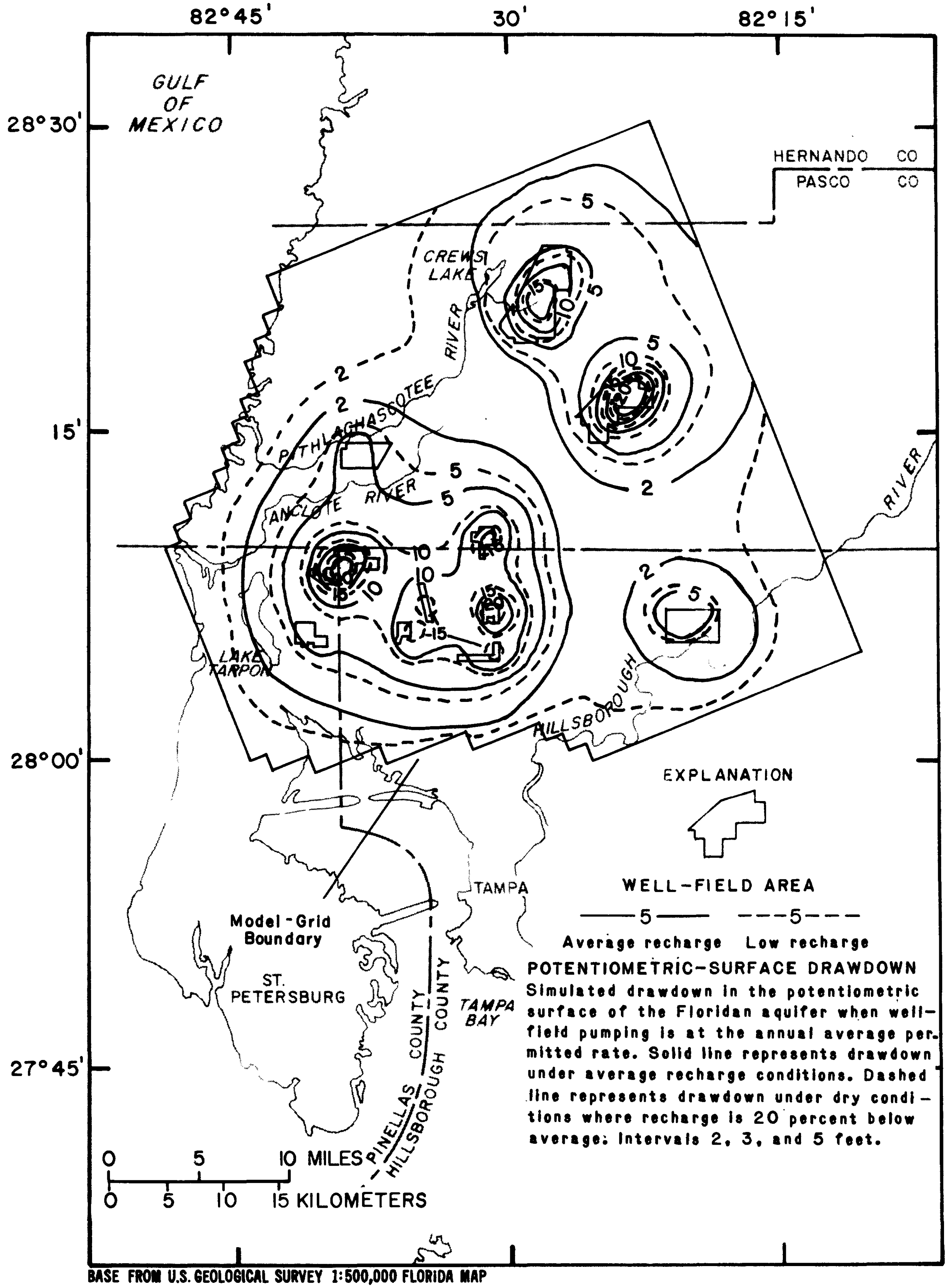


Figure 22.--Model-simulated drawdown in the potentiometric surface of the Floridan aquifer under average and low recharge conditions with well fields pumping at the annual average permitted rates.

Table 8.--Summary of water-balance and water-level data simulated by the model under varying conditions of recharge and pumping

A. WATER BALANCE FOR SURFICIAL AQUIFER (814 mi^2)

	QRE Recharge (in/yr)	ETRO ET-runoff from water table (in/yr)	UL Upward leakage (in/yr)	DL Downward leakage (in/yr)
Initial nonpumping condition	25.1	20.3	1.6	6.4
Pumping with high recharge	30.1	20.8	1.0	10.3
Pumping with average recharge	25.1	16.2	1.0	9.9
Pumping with low recharge	20.0	11.7	1.0	9.4

Water balance: QRE + UL = ETRO + DL

B. WATER BALANCE FOR FLORIDAN AQUIFER (932 mi^2)

	UL Upward leakage (in/yr)	DL Downward leakage (in/yr)	BI Boundary inflow (in/yr)	BO Boundary outflow (in/yr)	Pumpage (in/yr)
Initial nonpumping condition	1.6	6.7	1.1	6.2	0
Pumping with high recharge	1.1	10.1	1.2	6.0	4.2
Pumping with average recharge	1.1	9.8	1.2	5.7	4.2
Pumping with low recharge	1.0	9.4	1.2	5.4	4.2

Water balance: DL + BI = UL + BO + P

C. WATER-LEVEL CHANGE DATA

Recharge condition	Water table			Potentiometric surface		
	High	Average	Low	High	Average	Low
Area encompassing 2 feet or more drawdown (mi^2)	41	163	460	323	505	755
Area encompassing 5 feet or more drawdown (mi^2)	10	23	116	154	207	318
Maximum rise (feet)	10.2	0	0	.8	0	0
Maximum drawdown (feet)	9.9	14.9	19.3	21.9	23.2	26.0
Average drawdown (+) or rise (-) (feet)	1.0	1.3	3.2	2.5	3.6	5.0

relatively large declines develop in the water table. These declines resemble cones of depression, but probably result more from reduced recharge than from pumping. In areas where the water table is within 10 feet of land surface, a reduction in recharge results in a reduction in ET-runoff, and the water table declines moderately. The water-table decline is dampened by the capture of ET-runoff. In parts of the ridge areas, the water table is below the maximum ET-runoff capture depth (10 feet). This results in no dampening and an increased water-table decline.

Figures 19 through 22 illustrate water-level changes from predevelopment conditions due to the combined effects of pumping and varying recharge. Just the effects of pumping are illustrated under the average recharge condition. Under the high and low recharge conditions the effects of varying recharge could be negated by running the model with no pumping and varying recharge by 20 percent. The respective simulated water levels could then be input as starting heads for simulations under pumping conditions with high and low recharge. This modeling technique would filter out the effects of varying recharge and produce maps of drawdown caused only by pumping. A test of this type indicated that less than 3 feet of the water-table drawdown northeast of the Cross Bar Ranch well field was caused by pumping under the low recharge condition.

The constant-head boundary limits the accuracy for simulating changes in the water table near the perimeter of the model. For example, where a cone of depression reaches the boundary, the constant-head condition holds the water table constant, indicating that the boundary is an infinite source of water for the aquifer. Had a constant-flow boundary been used in the surficial aquifer, no change in boundary flow could be induced by pumping, and the water table would be lowered in excess of what might actually occur. Based on the sensitivity analysis of boundary conditions in the Floridan aquifer, the HCF condition would produce a water table somewhere near the extremes simulated under the constant-head and constant-flow conditions. However, the CSS and HSS arrays used for HCF in the Floridan aquifer were already dedicated to the ET-runoff capture function in the surficial aquifer, thus they were not available for HCF. The user should be aware that the model has a limited capability for predicting changes in hydrologic conditions within the surficial aquifer near the boundary.

Comparisons of Quasi-Three-Dimensional and Two-Dimensional Model Simulations

The phase 1 two-dimensional (2-D) model and phase 2 quasi-three-dimensional (Q-3-D) model produce different results when interrogated under the same pumping conditions. Because boundary conditions and hydraulic characteristics of the upper confining bed and Floridan aquifer are similar in both models, the differences may be attributed primarily to activating the water table in the Q-3-D model.

Maximum drawdowns in the potentiometric surface in the well fields simulated by each model are listed in table 9. Drawdown predicted by the Q-3-D model when the 10 well fields are pumped simultaneously at permitted capacities (table 7) is greater in every well field and averages about 4 feet more than that simulated by the 2-D model. In the 2-D model, the water table is held constant, but

Table 9.--Comparison of maximum drawdowns at 10 well fields simulated by the quasi-three-dimensional and two-dimensional models under various pumping conditions

Well field	Pumping rate (Mgal/d)	Maximum drawdown (feet)			
		Pump 10 well fields 1/		Pump individual well fields	
		Potentiometric surface		Water table	Potentiometric surface
		Q-3-D	2-D	Q-3-D	Q-3-D
Cross Bar Ranch	30	18.3	7.8	14.6	17.9
Cypress Creek	30	23.2	19.8	7.2	22.8
Starkey	8	7.5	5.5	1.5	5.7
Pasco County	16.9	15.5	13.0	3.1	11.5
Eldridge-Wilde	35.2	21.3	14.6	9.1	19.3
East Lake	3	6.5	4.4	.6	2.5
Cosme	19	13.5	10.3	2.5	9.9
Section 21	18	19.5	11.2	4.1	14.0
Morris Bridge	18	7.7	6.3	1.9	7.6
Northwest 2/	8.8	13.9	--	2.2	7.8

1/ Because 10 well fields are pumped simultaneously, maximum drawdown in the proximity of a single well field is increased by pumping from nearby well fields.

2/ Northwest well field was not proposed at time of 2-D model run.

in the Q-3-D model, it declines in response to the change in leakage induced by lowering the potentiometric surface at the well fields. Because leakage is proportional to head difference between the potentiometric surface and water table, the potentiometric surface must be drawn down more in the Q-3-D model than the 2-D model to induce a similar quantity of leakage. The additional drawdown results in a larger cone of depression around each well field and greater drawdown at the well-field boundaries than predicted by the 2-D model.

The comparison of maximum drawdowns in the well fields adds perspective to the 2-D and Q-3-D model simulations. The 2-D model minimizes drawdown, whereas the Q-3-D model depicts more realistic movement of the potentiometric surface. The two models may be used for comparing or bracketing expected drawdowns. However, the Q-3-D model, the final product of this two-phased investigation, is considered to more accurately represent the hydrogeologic system.

Comparison of model results between the Q-3-D model and the 2-D model of Robertson and Mallory (1977) could not be made as their model did not simulate drawdown in the Floridan aquifer. But, because leakance coefficient of the upper confining bed and transmissivity of the Floridan aquifer varies as much as 100 percent outside the well field areas where data are sparse, the models should not agree precisely.

At the Cypress Creek well field, a 2-D model by Ryder (1978) indicated that drawdown in the potentiometric surface would be at least 5 feet over an area of about 7 mi^2 and that maximum drawdown should be about 15 feet when the well field is pumped at 30 Mgal/d. Again, this model contains a fixed water table, so drawdown should be less than that simulated by the Q-3-D model. The map of drawdown at Cypress Creek well field presented in attachment E supports this contention in that the 5-foot cone of depression in the Floridan aquifer should expand over a 27-mi^2 area and maximum drawdown should be about 23 feet. Maximum drawdown in the water table should be about 7 feet. Note that the head difference between the water table and potentiometric surface in the grid block of maximum drawdown is 16 feet, which compares favorably with Ryder's (1978) 15-foot head difference.

At the Morris Bridge well field, the Q-3-D model by Ryder and others (1980) indicated that when the well field is pumped at 40 Mgal/d, drawdown in the potentiometric surface would be 5 feet or more over an area of 20 mi^2 and that maximum drawdown should be about 15 feet. In the current Q-3-D model study, the well field was pumped at its permitted average rate of 18 Mgal/d, thus drawdown and spread of the cone of depression should be about half those predicted by the model developed by Ryder and others (1980). The map of drawdown at Morris Bridge well field presented in attachment E indicates that drawdown of 5 feet or more should spread over 8 mi^2 and maximum drawdown in the potentiometric surface should be about 7.6 feet. Water-table declines simulated by the two models were similar.

LIMITATIONS OF MODEL APPLICATION

A conceptual approach to ground-water modeling was used in the application of this model. The hydrogeologic system was conceptualized, its parameters identified, and it was transformed to the mathematical analog. The mathematical model approximates the physical processes that control the conceptual model, but it is only an approximate representation of the prototype.

The hydrogeology has been simplified to the extent that an operational mathematical model could be constructed. The mathematical solution is an approximate solution to the differential equations that define the system. Because the model grid is on a coarse regional scale of 1 mi^2, the localized impact of pumping small quantities of water will not be accurately depicted. Also, because of mathematical approximations associated with simulating boundary flow, the impact of pumping large quantities of water near the model-grid boundary may not be accurately depicted. Boundary assumptions also limit the accuracy for simulating drawdown in the water table near the perimeter of the model under other than average recharge conditions. Additional computational errors may be introduced in coastal areas, particularly in the East Lake, Eldridge-Wilde, and Starkey well fields, because the model does not consider movement of the freshwater-saltwater interface and the resultant displacement of a less dense fluid by another of greater density. A model limitation that could lead to significant errors occurs when the water table rises above land surface or falls to the base of the surficial aquifer. The model will flag areas where those phenomena occur. The model also only grossly accounts for changes in recharge and runoff that result from changes in the water table. Finally, because the model assumes a steady-state condition, the solution is not time dependent, and the time required for computed heads to reach these levels cannot be determined from this model.

The predictive-model runs exemplify the types of analyses possible with the Q-3-D model. Generally, it can be used to compute water-balance and regional water-level changes in response to various distributions of pumping and conditions of recharge. Local changes such as inflections in the water table near streams cannot be computed because any stream generally occupies less than one-fiftieth the area of a node. Because the model simulates long-term average water-level changes that should result from pumping, extreme high or low conditions could be significantly different from simulated conditions. Ideally, the model should represent all characteristics of the prototype, but realistically, it represents a few of the more important characteristics of the hydrologic system. The model simulates ground-water flow on a megascopic scale.

COMPUTER PROGRAM

The computer program documented here is written for the AMDAHL[1] 470-V6 MVS system installed at the U.S. Geological Survey office in Reston, Va. The generic program is documented in Trescott (1975) with an expansion of the documentation in Trescott and Larson (1976). The program was modified for this study to (1) include the HCF condition in the lower layer, (2) compute ET-runoff capture from the upper layer, (3) produce parameter maps, (4) generate drawdown data in a format compatible with the CALCOMP (California Computer Products, Inc., 1971) contouring program, and (5) replace or add certain iteration parameters used in the strongly implicit procedure. Because the FORTRAN code of Trescott was modified extensively, the model may be considered as developed specifically for the well-field area. The model is not recommended for other applications unless the code is reviewed. A complete listing of the computer program is presented in attachment A.

Memory requirements and running time depend upon the size and complexity of the physical situation being simulated. For the field application documented herein, which utilized 1,224 nodes per layer over two layers, an average model run required 144,000 bytes of core memory on the FORTRAN G1 compiler, 300,000 bytes for executing the program, and about 15 seconds of Central Processing Unit time on the Geological Survey's computer.

Head-Controlled Flux Condition

Theory

In a recent modeling investigation (Wilson and Gerhart, 1980), a head-controlled flux (HCF) condition was introduced. The HCF condition allows head and flux to change at the model-grid boundary, thus adding flexibility to the Q-3-D model (Trescott, 1975) that previously incorporated only constant-head and constant-flux conditions. Under the HCF condition, flux across the model-grid boundary in the Floridan aquifer varies as a function of the potentiometric surface

[1]The use of brand names in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.

at the HCF grid block. Because transmissivity of the surficial aquifer is low, boundary flux is not considered to be significant, and the HCF condition was not applied to the upper layer.

The HCF condition is useful in situations where simulated stresses spread to a model boundary (thus rendering constant head or constant flux unrealistic), and it is undesirable to increase the size of the modeled area by expanding the grid to a point where stress effects are negligible. Although the physical boundaries of the model grid remain stable, the HCF condition calculates a boundary-flow component based on a strip of aquifer as wide as the HCF grid-block edge and extending laterally a specified distance to a point of constant head. Thus, the HCF condition does not expand the model area or the grid upon which numerical solutions to the flow equation are calculated.

Figure 23 is a conceptualization of the HCF condition. The assumptions are made that (1) there is a point beyond the model grid (at distance L) where the water table (HSS) and the stressed potentiometric surface (PHI) will remain constant and are equal to the starting potentiometric surface (STRT); and (2) the transmissivity (T) and confining-bed leakance (TK) are constant in the aquifer strip between the model-grid boundary and the constant-head boundary. The assumptions allow reasonable finite boundaries to be placed on extensive aquifer systems that lack natural hydrologic boundaries.

Equations for solving boundary discharge under the HCF condition were developed at the U.S. Geological Survey's Northeast Region Research Project Office (J. V. Tracy and S. P. Larson, written commun., 1979). Names of variables used here conform to names of variables used in the model code. The governing equation for steady flow in the region $0 \leq x \leq L$ outside the modeled area is:

$$\frac{\partial^2 PHI_x}{\partial x^2} - \frac{TK}{T}(PHI_x - HSS) = 0, \qquad (5)$$

where PHI_x = altitude of the stressed potentiometric surface at distance x (feet);
HSS = altitude of the water table (feet);
TK = confining-bed leakance (feet per second per foot);
T = transmissivity of the Floridan aquifer (feet squared per second);
x = the distance from the model-grid boundary, for which the equation is to be solved (feet).

Under the assumption that the water table is constant in the aquifer strip:

$$\frac{\partial^2 HSS}{\partial x^2} = 0, \qquad (6)$$

when subtracted from both sides of equation 5

$$\frac{\partial^2 PHI_x}{\partial x^2} - \frac{\partial^2 HSS}{\partial x^2} - \frac{TK}{T}(PHI_x - HSS) = 0. \qquad (7)$$

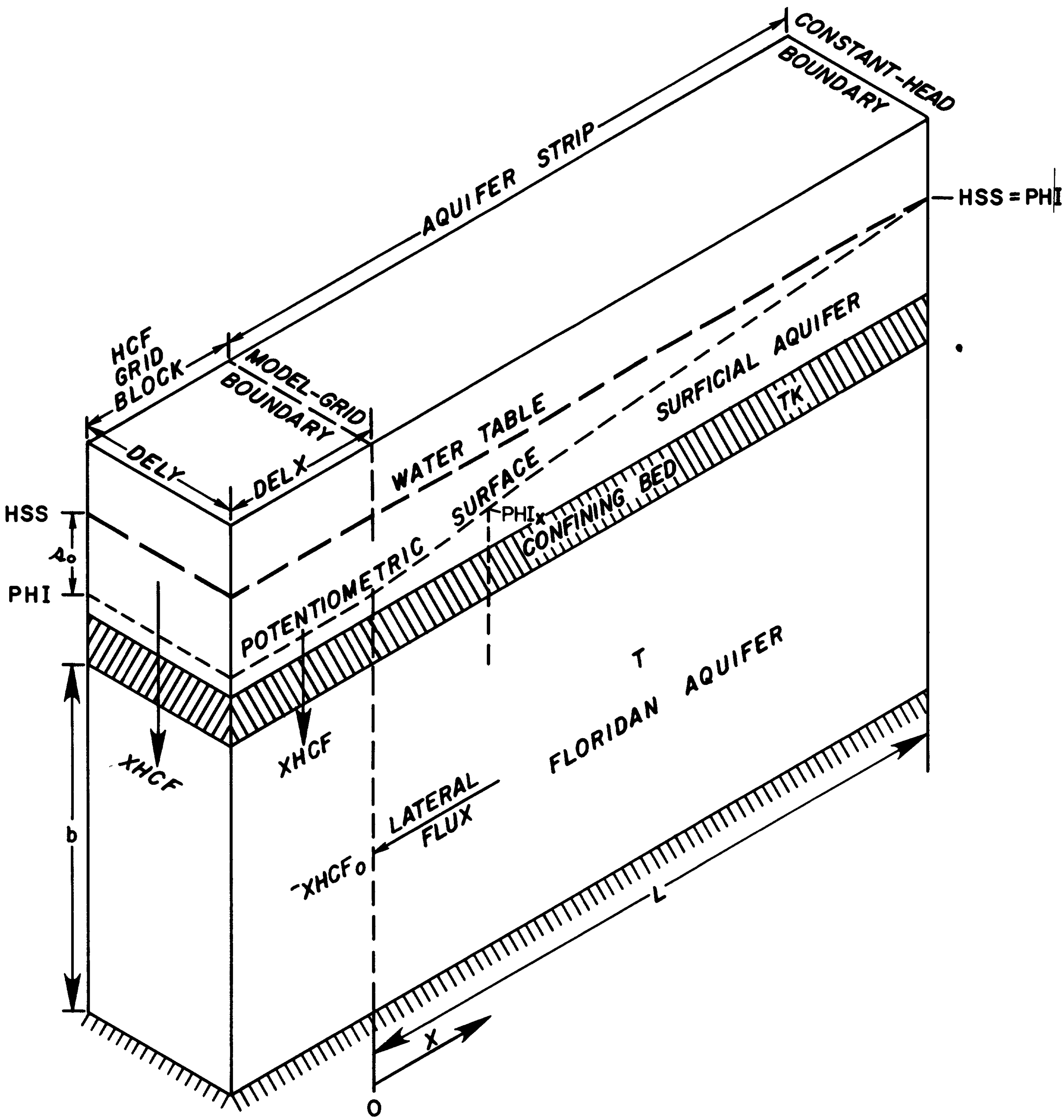


Figure 23.--Conceptualization of the head-controlled flux (HCF) condition, as applied to boundaries of the quasi-three-dimensional model.

Therefore

$$\frac{\partial^2 s}{\partial x^2} - \lambda s = 0, \tag{8}$$

where

$$s = PHI_x - HSS, \text{ and}$$

$$\lambda = \frac{TK}{T} .$$

Verruijt (1970, p. 30) showed the solution to be of the form:

$$s = c_1 e^{x\sqrt{\lambda}} + c_2 e^{-x\sqrt{\lambda}}. \tag{9}$$

Boundary conditions are

$$s = PHI - HSS = s_0 \text{ at } x = 0, \text{ and}$$

$$s = 0 \text{ at } x = L.$$

Therefore

$$s_0 = c_1 e^0 + c_2 e^{-0} = c_1 + c_2, \tag{10}$$

$$0 = c_1 e^{L\sqrt{\lambda}} + c_2 e^{-L\sqrt{\lambda}}. \tag{11}$$

Solving 10 and 11 simultaneously for c_1 and c_2

$$c_1 = \frac{-s_0\ e^{-2L\sqrt{\lambda}}}{(1-e^{-2L\sqrt{\lambda}})} , \tag{12}$$

$$c_2 = \frac{s_0}{(1-e^{-2L\sqrt{\lambda}})} , \tag{13}$$

and

$$s = s_0 \frac{(e^{-x\sqrt{\lambda}} - e^{(x-2L)\sqrt{\lambda}})}{(1 - e^{-2L\sqrt{\lambda}})} . \tag{14}$$

If equation 8 is solved for s, then Darcy's law may be applied at the model-grid boundary (x = 0) to solve for lateral boundary flux, $XHCF_0$:

$$XHCF_0 = -\frac{T\partial s}{\partial x}\bigg|_{x=0}, \tag{15}$$

$$= -T \left. \frac{-\sqrt{\lambda}\, e^{-x\sqrt{\lambda}} - \sqrt{\lambda}\, e^{(x-2L)\sqrt{\lambda}}\, s_0}{(1 - e^{-2L\sqrt{\lambda}})} \right|_{x=0} \tag{16}$$

$$= -Ts_0 \frac{(-\sqrt{\lambda} - \sqrt{\lambda}\, e^{-2L\sqrt{\lambda}})}{(1 - e^{-2L\sqrt{\lambda}})} \tag{17}$$

$$= -Ts_0 \sqrt{\lambda} \frac{(1 + e^{-2L\sqrt{\lambda}})}{(1 - e^{-2L\sqrt{\lambda}})} \tag{18}$$

$$= -Ts_0 \sqrt{\lambda} \frac{(1 + e^{-2L\sqrt{\lambda}})}{(1 - e^{-2L\sqrt{\lambda}})} \tag{19}$$

$$XHCF_0 = -CSSs_0 = -CSS\ (HSS - PHI). \tag{20}$$

Inflow to the model area is $-XHCF_0$, or CSS(HSS-PHI). $XHCF_0$ is the volumetric flow per unit width and this must be multiplied by the grid-block width (DELY, in fig. 23) to obtain the horizontal volumetric flow rate Q across the grid face:

$$Q = -XHCF_0 \cdot DELY. \tag{21}$$

This volume of water is distributed in the model as vertical leakage over the HCF grid block by dividing Q by the grid-block area:

$$XHCF = \frac{-XHCF_0 \cdot DELY}{DELX \cdot DELY} \tag{22}$$

XHCF is really only normalized to be consistent dimensionally with the other fluxes computed by the model. The true flux is the quotient of Q and the grid face area (DELY • b). The grid-block area is used as the divisor instead because DELX • DELY is used as a multiplier in the CHECKI subroutine to convert all fluxes to volumetric flow rates.

Substituting equation 19 for $XHCF_0$ results in the equation:

$$XHCF = (HSS - PHI) \cdot \frac{T\sqrt{\lambda}}{DELX} \cdot \frac{(1 + e^{-2L\sqrt{\lambda}})}{(1 - e^{-2L\sqrt{\lambda}})} \tag{23}$$

which is the product of the head difference in the boundary grid block (HSS-PHI) and the HCF condition leakage factor, CSS, described earlier in equation 3. The resulting function for boundary flux:

$$XHCF = (HSS - PHI) \cdot CSS \tag{24}$$

is a form of equation 4 and is listed several times in the SOLVE and CHECKI subroutines of the program code in Attachment A. CSS is the HCF condition leakage factor comprising transmissivity, leakance, length of the aquifer strip outside the model-grid boundary, and length of HCF grid block parallel to the boundary flux (see equation 3).

Equation 24 is a generalized expression for discharge as a function of head--hence the name "head-controlled flux." It is generalized in the sense that the constant CSS will be different for other system conceptualizations. For example, if the aquifer beyond the model-grid boundary were not leaky, CSS would be different, but equation 24 would still be valid.

The expression for lateral flux ($XHCF_0$) at a boundary is exactly analogous to vertical leakage; the constant CSS can be considered as a "leakance." This constant is added to the vertical leakage in the HCF grid block(s). With this increased vertical leakage, the amount of water flowing into or out of the HCF grid block is the sum of true vertical leakage and lateral flow at the edge.

Assumptions and Restrictions

An important assumption in using the HCF condition is that of uniform aquifer properties beyond the model-grid boundary. Transmissivity, vertical hydraulic conductivity of the confining bed, confining bed thickness, and so forth, are all considered to be uniform and equal to their respective values in the HCF grid blocks from which they derive. If the data support this assumption, then the HCF condition can be a fair approximation; however, if the data show a wide range of values or an irregular distribution of values, then the use of the HCF condition should be qualified.

A source of error in the HCF condition is in the estimation of flow across the model-grid boundary at the corners of the model area. Figure 24 indicates that there is a substantial area at each corner in which the amount of boundary flow caused by a head change is ignored.

Use

The programming changes and additions that are necessary to include the HCF condition in the Q-3-D model are listed in attachment A. The data-deck instructions listed in attachment B include instructions used to specify the HCF condition in a model run.

An HCF grid block is defined as a grid block on the edge of the model grid that has an outside edge perpendicular to the main direction of flow that will be caused by a change in head in the HCF grid block (fig. 24). In irregularly shaped grids, there may be many grid blocks that could be designated corner grid blocks (grid blocks with two edges corresponding to the model-grid boundary). To avoid overlapping of the aquifer strips extending out from each boundary grid

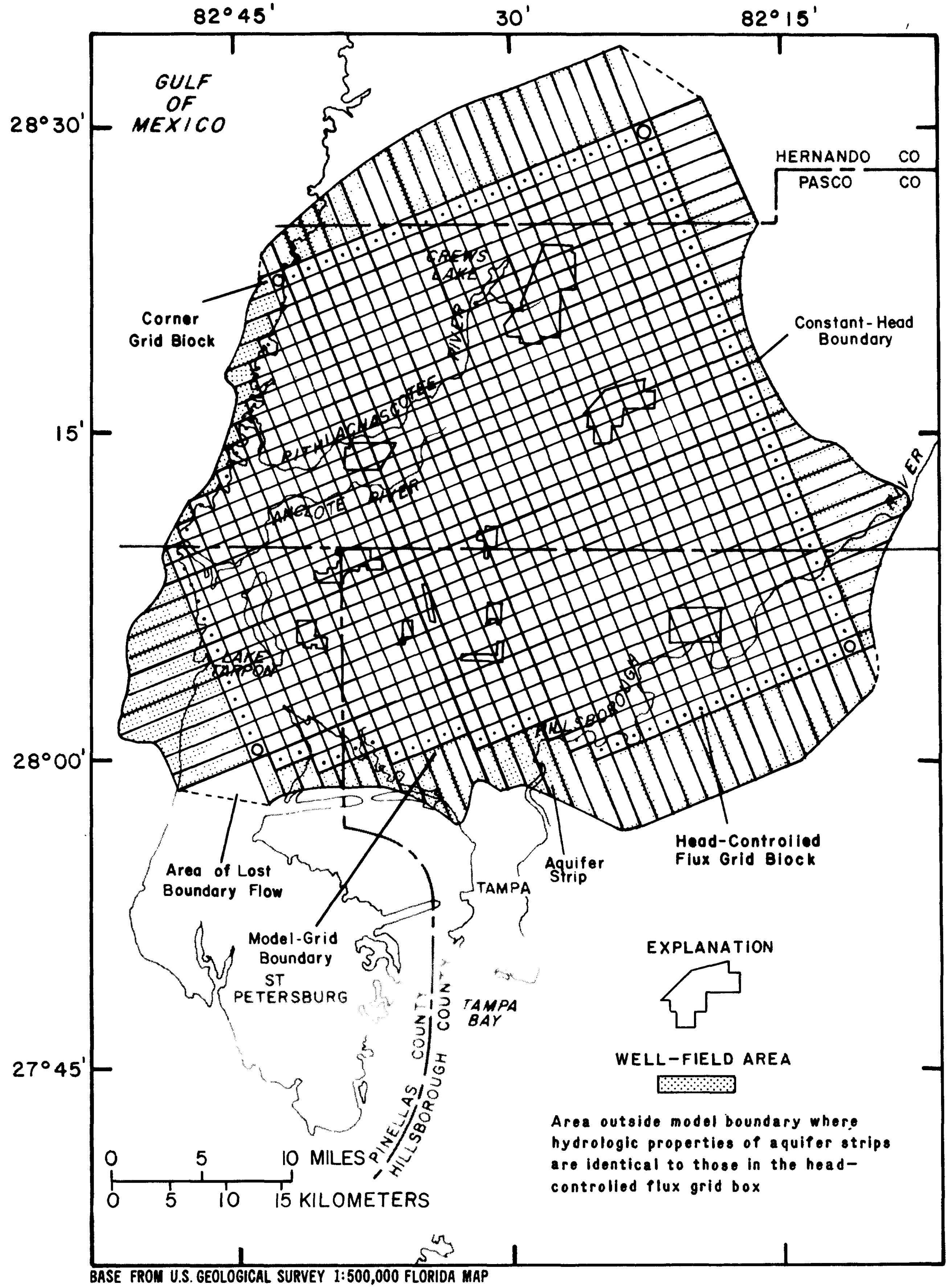


Figure 24.--Well-fields area model with head-controlled flux (HCF) condition, showing HCF and corner grid blocks, areas of lost boundary flow, and orientation of aquifer strips (modified from Hutchinson and others, 1981).

block, the program changes outlined in attachments A and B require that the user designate only four of these possible corners as corner grid blocks. An additional requirement is that between two corner grid blocks, a boundary must be straight or convex with respect to the model area. Between two corner grid blocks, all the aquifer strips extend out in the same direction from the model-grid boundary. The model area in figure 24 is a typical case that conforms to the above requirements specified in the program changes in attachment A.

Flow rates at each HCF grid block may be printed out by removing the "C" from column 1 of card 11710 of the program code (attachment A). The total leakage that is due to lateral HCF flow into or out of the model-grid boundary nodes is included as leakage in the mass balance printout.

Finally, if the HCF condition is to be used in a steady-state calibration, the water levels in the grid blocks adjacent to the HCF grid blocks and just across the boundary from them must be included in the STRT matrix. The transmissivities in these grid blocks must be zero, however, since they are beyond the model-grid boundary.

Evapotranspiration-Runoff Capture

Evapotranspiration (ET) from the water table and runoff (RO) captured by lowering the water table are modeled together as a head-dependent outflow function. Coding changes for incorporating ET-runoff into the model (Trescott, 1975) were described by J. V. Tracy and S. P. Larson (written commun., in an advanced modeling seminar at the U.S. Geological Survey Training Center in Denver, Colo. The mathematical form of the equation for determining the volumetric ET-runoff rate in the model is equivalent to equation 24:

$$ETFLUX = CSS \cdot (HSS - PHI) \tag{25}$$

where
- ETFLUX = ET-runoff flux (feet per second);
- CSS = maximum ET-runoff rate (per unit area) divided by maximum depth at which ET-runoff capture occurs (feet per second per foot);
- HSS = altitude of the base of the ET-runoff capture zone (feet); and
- PHI = altitude of the water table (feet).

Corrections to the computed ET-runoff flux must be made under two conditions:

1. The water table lies below the base of the ET-runoff capture zone--ET-runoff would become positive, representing inflow to the system.
2. The water table rises above land surface--ET-runoff would exceed the potential ET-runoff capture rate, representing excessive outflow from the system.

Program modifications were made to check for and correct these special cases. This was accomplished by first computing a total ET-runoff flux using equation 25. Then a check was made for conditions 1 and 2 above. The total ET-runoff flux was then adjusted by subtracting the extra inflow or adding back the excessive outflow. Thus, the same arrays are utilized in the model to compute head-controlled flux across the perimeter of the modeled area in the Floridan aquifer (layer 1) and ET-runoff flux from the surface of the water table in the surficial aquifer (layer 2).

Parameter Maps

The original computer program of Trescott (1975) produced maps of head and drawdown and listed input parameters in tabular form. To expedite the calibration procedure, C. H. Tibbals (U.S. Geological Survey, written commun., 1981) modified the program to produce maps of transmissivity and leakage. This modification was expanded upon for the well-field areas model so that the program would produce additional maps of head difference between the water table and potentiometric surface, recharge rate to the water table, ET-runoff rate from the water table, leakage rate through the upper confining bed, and the distribution of pumpage.

The parameter maps provide a useful tool for assessing predictive model runs and simplifying the calibration procedure. For example, under predicted pumping conditions, areas of greatest change in ET-runoff, leakage, and reversal of head can be easily detected. The map of pumpage distribution allows correlation of pumping centers with the other parameter maps and helps locate errors in pumping rates input to the model for predictive runs.

Contour Mapping

A program modification that proved useful during the modeling process was the ability to punch drawdown and hydraulic head in the format used by the CALCOMP (California Computer Products, 1971) contouring program. All contoured illustrations in this report were traced from machine-drawn maps produced by the CALCOMP contouring program.

To punch the model output in CALCOMP format, cards 6290 and 6500 of the program are activated manually. The punched cards are then combined with control cards described in the CALCOMP manual (1971) and submitted as a separate program to the Survey's computer. Contour maps output from the CALCOMP contouring program are displayed on a Tektronix 4014-1 terminal at the U.S. Geological Survey Tampa Subdistrict Office. The output was written to magnetic tape for processing on a flat-bed plotter that draws contours on translucent paper to overlay base maps of any scale.

SAS/GRAPH, a program published by the SAS Institute, Inc. (1980), was used to portray three-dimensional graphical representations of the water table and potentiometric surface under predevelopment and pumping conditions (attachment E). The procedure for 3-D plotting is the same as that for the CALCOMP plots. The 3-D plots exhibit depth perspective that cannot be perceived from contour maps.

Iteration Parameters

The strongly implicit procedure (SIP) utilizes an iterative scheme to solve the flow matrix in the model. In this approach, a modifying matrix is added to the flow matrix thereby simplifying factorization. The iterative technique results in considerable savings in computer time and storage over the method of Gaussian elimination (Trescott, 1975, p. 12).

The original version of the model cycles a sequence of iteration parameters ranging from zero to 1 until convergence is achieved. The minimum parameter is not critical and zero is normally chosen. Trescott (1975, p. 25) recommends that,

> "if the sequence of parameters computed by the equations in the program are all (except the first parameter) close to 1.0 and if this results in slow convergence or even divergence, bypass the computations in the model and insert WMAX ≃ 0.99863."

For expediency in the well-fields model, line 7430 was inserted to override computation of the maximum iteration parameter, setting it equal to the value recommended by Trescott.

Convergence may be achieved more rapidly by multiplying the finite-difference residual by an acceleration parameter, BETA, based on test results of Trescott and others (1976, p. 27) that emphasize the advantages of this extra SIP iteration parameter. BETA was introduced as a multiplier in lines 8300, 8430, 9210, and 9340 of the computer program. In the early stages of the well-field model development, several values were chosen for BETA based on an optimum range of 0.1 to 1.5 inferred by Trescott and others (1976). Early test runs indicated that this model is relatively insensitive to BETA values near 1.0, so it was held constant at unity during the calibration, validation, and prediction phases of the modeling process.

SUMMARY AND CONCLUSIONS

Ten well fields north of Tampa are proposed or are currently supplying the city of Tampa and Gulf Coast municipalities with freshwater. A Q-3-D model of ground-water flow was developed to gain a better understanding of the hydrology and to facilitate water-resources planning and management. This report describes development of the Q-3-D model and its application in assessment of the impact of existing and proposed well fields. The study was preceded by a phase 1 two-dimensional model, used for planning and management during development of the more complex phase 2 model.

The Q-3-D model accounts for inflow to and outflow from two aquifers (surficial and Floridan) separated by a leaky confining bed. Water pumped from the Floridan aquifer at a well field at steady state is supplied by reducing outflow or increasing inflow laterally across the model boundary and by reducing upward leakage or increasing downward leakage through the overlying confining bed. Changes in the amount of vertical leakage induce declines in the water table of the surficial aquifer. Lowering the water table reduces the supply of water available for evapotranspiration by surface vegetation, reduces base streamflow and storm runoff, and increases the aquifer's capacity for accepting recharge. Ultimately, the source of the pumped water is by capture of water that would normally be subject to evapotranspiration or runoff. Thus, the model may be used to assess the effects of pumping one well field, or the interference effects of pumping multiple well fields, on drawdown in the aquifers, changes in leakage, ET-runoff, and lateral flow.

The Q-3-D model has advantages over the 2-D model in that the upper layer (surficial aquifer) is active and the water table may vary. Because the water table in the 2-D model was held constant, drawdown in the Floridan aquifer was minimized. The Q-3-D model more accurately simulates the physical system by allowing movement of the water table, thereby minimizing leakage changes and maximizing drawdowns.

Example model-interrogation runs simulate water-level and water-balance changes that can be expected as a result of pumping all 10 well fields simultaneously at annual average permitted rates totaling 186.9 Mgal/d from the Floridan aquifer with recharge varying 20 percent more and less than the long-term average rate. Under these conditions, water-level and water-balance changes with respect to nonpumping conditions should be as follows:

1. Under high recharge conditions, the water table should decline an average of 1.0 foot, and the potentiometric surface should decline an average of 2.5 feet. If average recharge increases from 25 to 30 inches per year, downward leakage should increase from 6.7 to 10.1 inches per year, and ET-runoff from the water table should increase from 20.3 to 20.8 inches per year.
2. Under average recharge conditions, the water table should decline an average of 1.3 feet, and the potentiometric surface should decline an average of 3.6 feet. If recharge remains at 25 inches per year, downward leakage should increase from 6.7 to 9.8 inches per year, and ET-runoff should decrease from 20.3 to 16.2 inches per year.
3. Under low recharge conditions, the water table should decline an average of 3.2 feet, and the potentiometric surface should decline an average of 5.0 feet. If recharge is reduced from 25 to 20 inches per year, downward leakage should increase from 6.7 to 9.4 inches per year, and ET-runoff should decrease from 20.3 to 11.7 inches per year.

Maximum drawdown in the Floridan aquifer simulated by the Q-3-D model is greater in every well field and averages about 4 feet more than maximum drawdown simulated by the 2-D model previously developed for the area. Under average recharge conditions, about 75 percent of the pumped water is derived by increasing downward leakage. The remaining 25 percent is gained by reducing natural upward leakage in swamp and marsh areas and by slightly reducing outflow along the model boundary. Ultimately, more than 95 percent of the pumped water is derived by reducing evapotranspiration from the water table and runoff.

When well fields are pumped individually, drawdown in the potentiometric surface is less than when all 10 well fields are pumped simultaneously. Drawdown is much greater in the center of the modeled area where well fields are in close proximity to one another, thus increasing interference effects. Interference effects range from about 0.1 foot of additional drawdown at Morris Bridge well field to 6.1 feet of additional drawdown at Northwest well field.

Conclusions drawn from this modeling study concerning hydrology of the aquifer system and impact of pumping include:

1. Transmissivity of the Floridan aquifer ranges from about 26,000 to 475,000 ft^2/d.

2. Leakance coefficient of the upper confining bed ranges from about 0.00015 to 0.008 (ft/d)/ft.

3. Recharge rate to the surficial aquifer ranges from near zero in the coastal marsh and central swamp physiographic units to 30 inches per year in the lakes terrace physiographic unit.

4. Evapotranspiration plus runoff from the water table in the surficial aquifer ranges from zero in some ridge areas where the water table is deep to 38 inches per year in some swampy areas where the water table lies at land surface and is maintained by upward leakage from the Floridan aquifer.

5. The annual water balance for the surficial aquifer, representing long-term average hydrologic conditions prior to pumping, equates inflow and outflow as:

Recharge	+	Upward leakage	=	Evapotranspiration plus runoff from water table	+	Downward leakage
25.1 inches	+	1.6 inches	=	20.3 inches	+	6.4 inches

6. The annual water balance for the Floridan aquifer equates inflow and outflow as:

Downward leakage	+	Boundary inflow	=	Upward leakage	+	Boundary outflow
6.7 inches	+	1.1 inches	=	1.6 inches	+	6.2 inches

7. Nearly all of the water pumped from the Floridan aquifer is derived by increasing leakage.

8. Pumpage from the Floridan aquifer is ultimately derived by capturing water that would normally be subject to evapotranspiration or runoff.

9. Well-field interference significantly increases drawdown at the Starkey, Pasco County, Eldrige-Wilde, East Lake, Cosme, Section 21, and Northwest well fields, which are in close proximity to one another.

10. Concentrated pumping from the Floridan aquifer develops extensive cones of depression in the potentiometric surface and the water table.

11. Possible adverse impacts of pumping from the municipal well fields include upconing of deep saline water, saltwater encroachment along the coast, interference with existing private wells, lowering lake levels, inducing sinkhole collapse, and alteration of vegetal cover.

The well-field areas model results could be improved by increasing the accuracy of the input data. Additional data are needed to define the distribution of potential evapotranspiration and how it varies with depth. An evaluation of recharge potential based on soil type, topography, and depth to water table would allow the model to be programmed so that recharge varies in response to water-table fluctuations. The model could then forecast the decline in recharge as the water table rises to land surface, or conversely, the increase in recharge over former swampy areas that go dry.

The Q-3-D model has been developed for regional assessment of environmental impact and management of the ground-water reservoir to avoid potentially large drawdowns. The model can also aid water resources managers, hydrologists, and the general public in the following:

1. Regulating drawdowns;
2. Evaluating well permits;
3. Considering economic constraints of power consumption and well spacing;
4. Assessing the potential for saltwater intrusion;
5. Assessing the potential impact of well-field development on lake levels;
6. Siting water-level and water-quality monitoring wells;
7. Relating water-table fluctuations to changes in vegetation; and
8. Designing aquifer tests.

Although the guidelines presented here are general, they provide a framework for the effective utilization of the model. The decisionmaker should be able to understand the model, recognize its limitations and predictive capabilities, and make knowledgeable evaluations of its output.

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ATTACHMENT A: COMPUTER PROGRAM LISTING

The generic FORTRAN program by Trescott (1975) for simulating three-dimensional ground-water flow has been modified to a 1,576-card program. Major coding changes were made in the "SOLVE" subroutine to accommodate the HCF condition, ET-runoff capture, and iteration parameters. The "CHECKI" subroutine was modified to incorporate ET-runoff and boundary flux in the mass balance and to compute statistics. The "PRINTAI" subroutine was modified to produce parameter maps.

ATTACHMENT A: COMPUTER PROGRAM LISTING (modified from Trescott, 1975)

```
C      -----------------------------------------------------------------
C      FINITE-DIFFERENCE MODEL FOR SIMULATION OF GROUND-WATER FLOW IN
C      THREE DIMENSIONS, SEPTEMBER, 1975 BY P.C. TRESCOTT, U. S. G. S.
C      WITH CONTRIBUTIONS TO MAIN, DATAI AND SOLVE BY S.P. LARSON
C      MODIFIED BY C. TIBBALS AND C. HUTCHINSON, 1981
C      -----------------------------------------------------------------
C      SPECIFICATIONS:
       REAL *8YSTR
       DIMENSION Y(52000) , L(25), HEADNG(33), NAME(42), INFT(2,2), IOFT(
      19,4), DUM(3)
       EQUIVALENCE (YSTR,Y(1))
       COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
      1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
      2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
       COMMON /SPARAM/ TMAX,CDLT,DELT,ERR,TEST,SUM,SUMP,QR
       COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
      1EVEL5(4),LEVEL6(4),LEVEL7(4)
       DATA NAME/2*4H    ,4H   S,4HTART,4HING ,4HHEAD,4H    ,4H STO,4HRAG
      1E,4H COE,4HFFIC,4HIENT,2*4H    ,4H  TR,4HANSM,4HISSI,4HVITY,5*4H
      2 ,4H  TK,4H  HY,4HDRAU,4HLIC ,4HCOND,4HUCTI,4HVITY,2*4H    ,4HBOT
      3T,4HOM E,4HLEVA,4HTION,2*4H    ,4H   R,4HECHA,4HRGE ,4HRATE/
       DATA INFT/4H(20F,4H4.0),4H(8F1,4H0.4)/
       DATA IOFT/4H(1H0,4H,I2,,4H2X,2,4H0F6.,4H1/(5,4HX,20,4HF6.1,4H)) ,
      14H    ,4H(1H0,4H,I5,,4H14F9,4H.5/(,4H1H ,,4H5X,1,4H4F9.,4H5)) ,4H
      2    ,4H(1H0,4H,I5,,4H10E1,4H2.5/,4H(1H ,4H,5X,,4H10E1,4H2.5),4H)
      3,4H(1H0,4H,I5,,4H10E1,4H1.3/,4H(1H ,4H,5X,,4H10E1,4H1.3),4H)   /
       DEFINE FILE 2(20,1200,U,KKK),3(1,50,U,KKK),4(1,24,U,KKK),8(3,1,U,K
      1KK),9(3,1200,U,KKK)
C      .................................................................
C      ---READ TITLE, PROGRAM SIZE AND OPTIONS---
       READ (5,200) HEADNG
       WRITE (6,190) HEADNG
       READ (5,160) IO,JO,KO,ITMAX,NCH
       WRITE (6,180) IO,JO,KO,ITMAX,NCH
       READ (5,210) IDRAW,IHEAD,IFLO,IDK1,IDK2,IWATER,IQRE,IPU1,IPU2,ITK
      1,IEQN
       WRITE (6,220) IDRAW,IHEAD,IFLO,IDK1,IDK2,IWATER,IQRE,IPU1,IPU2,ITK
      1,IEQN
       IERR=0
C      ---COMPUTE DIMENSIONS FOR ARRAYS---
       J1=JO-1
       I1=IO-1
       K1=KO-1
       I2=IO-2
       J2=JO-2
       K2=KO-2
       IMAX=MAXO(IO,JO)
```

```
      NCD=MAXO(1,NCH)
      ITMX1=ITMAX+1
      ISIZ=IO*JO*KO
      IK1=IO*JO
      IK2=MAXO(IK1*K1,1)
      ISUM=2*ISIZ+1
      L(1)=1
      DO 30 I=2,14
      IF (I.NE.8) GO TO 20
      L(8)=ISUM
      ISUM=ISUM+IK2
      IF (IK2.EQ.1) GO TO 10
      IK=IO
      JK=JO
      K5=K1
      GO TO 30
   10 IK=1
      JK=1
      K5=1
      GO TO 30
   20 L(I)=ISUM
      ISUM=ISUM+ISIZ
   30 CONTINUE
      L(15)=ISUM
      ISUM=ISUM+JO
      L(16)=ISUM
      ISUM=ISUM+IO
      L(17)=ISUM
      ISUM=ISUM+KO
      L(18)=ISUM
      ISUM=ISUM+IMAX
      L(19)=ISUM
      ISUM=ISUM+KO*3
      L(20)=ISUM
      ISUM=ISUM+ITMX1
      L(21)=ISUM
      ISUM=ISUM+3*NCD
      L(22)=ISUM
      ISUM=ISUM+NCD
      L(23)=ISUM
      IF (IWATER.NE.ICHK(6)) GO TO 40
      ISUM=ISUM+IK1
      L(24)=ISUM
      ISUM=ISUM+IK1
      IP=IO
      JP=JO
      GO TO 50
   40 ISUM=ISUM+1
      L(24)=ISUM
      ISUM=ISUM+1
      IP=1
      JP=1
```

```
   50 L(25)=ISUM
      IF (IQRE.NE.ICHK(7)) GO TO 60
      ISUM=ISUM+ISIZ
      IQ=IO
      JQ=JO
      KQ=KO
      GO TO 70
   60 ISUM=ISUM+1
      IQ=1
      JQ=1
      KQ=1
   70 LCSS=ISUM
      ISUM=ISUM+ISIZ
      LHSS=ISUM
      ISUM=ISUM+ISIZ
      LHB=ISUM
      ISUM=ISUM+ISIZ
      LETRAT=ISUM
      ISUM=ISUM+ISIZ
      WRITE (6,170) ISUM
C     ---PASS INITIAL ADDRESSES OF ARRAYS TO SUBROUTINES---
      CALL DATAI(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),Y(L(5)),Y(L(6)),Y(L(7))
     1,Y(L(8)),Y(L(9)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(19)),Y(L(23)),Y(L(
     224)),Y(L(25)))
      CALL STEP(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),Y(L(5)),Y(L(6)),Y(L(7)),
     1Y(L(8)),Y(L(9)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(19)),Y(L(18)),Y(L(2
     20)))
      CALL SOLVE(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),Y(L(5)),Y(L(6)),Y(L(7))
     1,Y(L(8)),Y(L(9)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(19)),Y(L(10)),Y(L(
     211)),Y(L(12)),Y(L(13)),Y(L(14)),Y(L(20)),Y(L(25)),Y(LCSS),Y(LHSS),
     3Y(LHB))
      CALL COEF(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),Y(L(5)),Y(L(6)),Y(L(7)),
     1Y(L(8)),Y(L(9)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(19)),Y(L(23)),Y(L(2
     24)),Y(L(25)))
      CALL CHECKI(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),Y(L(5)),Y(L(6)),Y(L(7)
     1),Y(L(8)),Y(L(9)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(19)),Y(L(21)),Y(L
     2(22)),Y(L(25)),Y(LCSS),Y(LHSS),Y(LHB),Y(LETRAT))
      CALL PRNTAI(Y(L(1)),Y(L(2)),Y(L(4)),Y(L(5)),Y(L(9)),Y(L(15)),Y(L(1
     16)),Y(L(25)),Y(L(8)),Y(LETRAT))
C     ---START COMPUTATIONS---
C     ************************
C     ---READ AND WRITE DATA FOR GROUPS II AND III---
      CALL DATAIN
      IRN=1
      NIJ=IO*JO
      DO 80 K=1,KO
      LOC=L(2)+(K-1)*NIJ
   80 CALL ARRAY(Y(LOC),INFT(1,2),IOFT(1,1),NAME(1),IRN,DUM)
      DO 90 K=1,KO
      LOC=L(5)+(K-1)*NIJ
   90 CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,2),NAME(7),IRN,DUM)
      DO 100 K=1,KO
```

```
      LOC=L(4)+(K-1)*NIJ
      L1=L(19)+K-1
      L2=L(19)+K0+K-1
      L3=L(19)+2*K0+K-1
      CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,2),NAME(13),IRN,DUM)
      Y(L1)=DUM(1)
      Y(L2)=DUM(2)
      Y(L3)=DUM(3)
  100 WRITE (6,230) K,Y(L1),Y(L2),Y(L3)
      IF (ITK.NE.ICHK(10)) GO TO 120
      DO 110 K=1,K1
      LOC=L(8)+(K-1)*NIJ
  110 CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,3),NAME(19),IRN,DUM)
  120 IF (IWATER.NE.ICHK(6)) GO TO 130
      K=K0
      CALL ARRAY(Y(L(23)),INFT(1,1),IOFT(1,4),NAME(25),IRN,DUM)
      CALL ARRAY(Y(L(24)),INFT(1,1),IOFT(1,1),NAME(31),IRN,DUM)
  130 IF (IQRE.NE.ICHK(7)) GO TO 132
      DO 131 K=1,K0
      LOC=L(25)+(K-1)*NIJ
  131 CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,4),NAME(37),IRN,DUM)
  132 DO 135 K=1,K0
      LOC=LCSS+(K-1)*NIJ
  135 CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,3),
     $  24H        ET-RUNOFF/DEPTH    ,IRN,DUM)
      DO 136 K=1,K0
      LOC=LHSS+(K-1)*NIJ
  136 CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,1),
     $  24H1=HCF HD  2=LSD-ET DPTH ,IRN,DUM)
      DO 137 K=1,K0
      LOC=LHB+(K-1)*NIJ
  137 CALL ARRAY(Y(LOC),INFT(1,1),IOFT(1,1),
     $  24H      LAND SURFACE       ,IRN,DUM)
      CALL MDAT
C     ---COMPUTE TRANSMISSIVITY FOR UNCONFINED LAYER---
      IF (IWATER.EQ.ICHK(6)) CALL TRANS(1)
C     ---COMPUTE T COEFFICIENTS---
      CALL TCOF
C     ---COMPUTE ITERATION PARAMETERS---
      CALL ITER
C     ---READ TIME PARAMETERS AND PUMPING DATA FOR A NEW PUMPING PERIOD-
  140 CALL NEWPER
      KT=0
      IFINAL=0
C     ---START NEW TIME STEP COMPUTATIONS---
  150 CALL NEWSTP
C     ---START NEW ITERATION IF MAXIMUM NO. ITERATIONS NOT EXCEEDED---
      CALL NEWITA
C     ---PRINT OUTPUT AT DESIGNATED TIME STEPS---
      CALL OUTPUT
C     ---LAST TIME STEP IN PUMPING PERIOD ?---
      IF (IFINAL.NE.1) GO TO 150
```

```
C       ---CHECK FOR NEW PUMPING PERIOD---
        IF (KP.LT.NPER) GO TO 140
        STOP
C       ---FORMATS---
  160 FORMAT (8I10)
  170 FORMAT ('0',54X,'WORDS OF VECTOR Y USED =',I7)
  180 FORMAT ('0',62X,'NUMBER OF ROWS =',I5/60X,'NUMBER OF COLUMNS =',I5
     1/61X,'NUMBER OF LAYERS =',I5//39X,'MAXIMUM PERMITTED NUMBER OF ITE
     2RATIONS =',I5//48X,'NUMBER OF CONSTANT HEAD NODES =',I5)
  190 FORMAT ('1',33A4)
  200 FORMAT (20A4)
  210 FORMAT (16(A4,1X))
  220 FORMAT ('-SIMULATION OPTIONS:  ',13(A4,4X))
  230 FORMAT (1H0,44X,'DIRECTIONAL TRANSMISSIVITY MULTIPLICATION FACTORS
     1 FOR LAYER',I3,/,76X,'X =',G15.7/76X,'Y =',G15.7/76X,'Z =',G15.7)
        END
```

```
      SUBROUTINE DATAI(PHI,STRT,OLD,T,S,TR,TC,TK,WELL,DELX,DELY,DELZ,FAC
     1T,PERM,BOTTOM,QRE)
C     ------------------------------------------------------------------
C     READ AND WRITE DATA
C     ------------------------------------------------------------------
C     SPECIFICATIONS:
      REAL *8PHI
      REAL *8XLABEL,YLABEL,TITLE,XN1,MESUR
      DIMENSION PHI(IO,JO,KO), STRT(IO,JO,KO), OLD(IO,JO,KO), T(IO,JO,K0
     1), S(IO,JO,KO), TR(IO,JO,KO), TC(IO,JO,KO), TK(IK,JK,K5), WELL(IO,
     2JO,KO), DELX(JO), DELY(IO), DELZ(KO), FACT(KO,3), PERM(IP,JP), BOT
     3TOM(IP,JP), QRE(IQ,JQ,KQ), TF(3), A(IO,JO), IN(6), IOFT(9), INFT(2
     44), IWELLO(10)
      COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
     1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
     2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
      COMMON /SPARAM/ TMAX,CDLT,DELT,ERR,TEST,SUM,SUMP,QR
      COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
     1EVEL5(4),LEVEL6(4),LEVEL7(4)
      COMMON /CK/ ETFLXT,STORT,QRET,CHST,CHDT,FLUXT,PUMPT,CFLUXT,FLXNT
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(6),XN1,MESUR,PRNT(122),BLANK
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2,FACT3,FACT4,FACT5,FACT6,F
     3ACT7
      COMMON /B/ BETA
      RETURN
C     ..................................................................
C     ********************
      ENTRY DATAIN
C     ********************
C     ---READ AND WRITE SCALAR PARAMETERS---
      READ (5,330) NPER,KTH,ERR,LENGTH,BETA
      WRITE (6,340) NPER,KTH,ERR
      WRITE(6,346) BETA
      READ (5,460) XSCALE,YSCALE,DINCH,FACT1,(LEVEL1(I),I=1,4),FACT2,(LE
     1VEL2(I),I=1,4),FACT3,(LEVEL3(I),I=1,4),FACT4,(LEVEL4(I),I=1,4),FAC
     2T5,(LEVEL5(I),I=1,4),FACT6,(LEVEL6(I),I=1,4),FACT7,(LEVEL7(I),I=1,
     34),MESUR
      IF (XSCALE.NE.0.) WRITE (6,470) XSCALE,YSCALE,MESUR,MESUR,DINCH,FA
     1CT1,LEVEL1,FACT2,LEVEL2,FACT3,LEVEL3,FACT4,LEVEL4,FACT5,LEVEL5,FAC
     2T6,LEVEL6,FACT7,LEVEL7
C     ---READ CUMULATIVE MASS BALANCE PARAMETERS---
      READ (5,450) SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETFL
     1XT,FLXNT
      IF (IDK1.EQ.ICHK(4)) GO TO 20
      IF (IPU1.NE.ICHK(8)) GO TO 50
C     ---READ INITIAL HEAD VALUES FROM CARDS---
```

```
      DO 10 K=1,KO
      DO 10 I=1,IO
   10 READ (5,360) (PHI(I,J,K),J=1,JO)
      GO TO 30
C     ---READ INITIAL HEAD AND MASS BALANCE PARAMETERS FROM DISK---
   20 READ (4) PHI,SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETFL
     1XT,FLXNT
      REWIND 4
   30 WRITE (6,430) SUM
      DO 40 K=1,KO
      WRITE (6,440) K
      DO 40 I=1,IO
   40 WRITE (6,350) I,(PHI(I,J,K),J=1,JO)
   50 DO 60 K=1,KO
      DO 60 I=1,IO
      DO 60 J=1,JO
      WELL(I,J,K)=0.
      TR(I,J,K)=0.
      TC(I,J,K)=0.
      IF (K.NE.KO) TK(I,J,K)=0.
   60 CONTINUE
      RETURN
C     *********************
      ENTRY ARRAY(A,INFT,IOFT,IN,IRN,TF)
C     *********************
      READ (5,330) FAC,IVAR,IPRN,TF,IRECS,IRECD
      IPRN=1
      IC=4*IRECS+2*IVAR+IPRN+1
      GO TO (70,70,90,90,120,120), IC
   70 DO 80 I=1,IO
      DO 80 J=1,JO
   80 A(I,J)=FAC
      WRITE (6,280) IN,FAC,K
      GO TO 140
   90 IF (IC.EQ.3) WRITE (6,290) IN,K
      DO 110 I=1,IO
      READ (5,INFT) (A(I,J),J=1,JO)
      DO 100 J=1,JO
  100 A(I,J)=A(I,J)*FAC
  110 IF (IC.EQ.3) WRITE (6,IOFT) I,(A(I,J),J=1,JO)
      GO TO 140
  120 READ (2'IRN) A
      IF (IC.EQ.6) GO TO 140
      WRITE (6,290) IN,K
      DO 130 I=1,IO
  130 WRITE (6,IOFT) I,(A(I,J),J=1,JO)
  140 IF (IRECD.EQ.1) WRITE (2'IRN) A
      IRN=IRN+1
      RETURN
C     *********************
      ENTRY MDAT
C     *********************
```

```
       NCHCK=0
      DO 150 K=1,KO
      DO 150 I=1,IO
      DO 150 J=1,JO
      IF (I.EQ.1.OR.I.EQ.IO.OR.J.EQ.1.OR.J.EQ.JO) T(I,J,K)=0.
      IF (IDK1.NE.ICHK(4).AND.IPU1.NE.ICHK(8)) PHI(I,J,K)=STRT(I,J,K)
      IF (IWATER.EQ.ICHK(6).AND.K.EQ.KO) GO TO 147
      IF(T(I,J,K).EQ.0.OR.S(I,J,K).GE.0) GO TO 147
      NCHCK=NCHCK+1
  147 IF (K.NE.KO.OR.IWATER.NE.ICHK(6)) GO TO 150
      IF (I.EQ.1.OR.I.EQ.IO.OR.J.EQ.1.OR.J.EQ.JO) PERM(I,J)=0.
      IF(PERM(I,J).EQ.0.OR.S(I,J,K).GE.0) GO TO 150
      NCHCK=NCHCK+1
  150 CONTINUE
      IF(NCHCK.EQ.NCH)GO TO 152
      WRITE(6,475)NCHCK,NCH
C     ............................ DELX ..............................
  152 IRN3=1
      READ (5,330) FAC,IVAR,IPRN,TF,IRECS,IRECD
      IF(IRECS.EQ.1) READ(3'IRN3) DELX
      IF(IRECS.EQ.1) GOTO 171
      IF (IVAR.EQ.1) READ (5,330) (DELX(J),J=1,JO)
      DO 170 J=1,JO
      IF (IVAR.NE.1) GO TO 160
      DELX(J)=DELX(J)*FAC
      GO TO 170
  160 DELX(J)=FAC
  170 CONTINUE
  171 IF(IRECD.EQ.1) WRITE(3'IRN3) DELX
      IF (IVAR.EQ.1.AND.IPRN.NE.1) WRITE (6,370) (DELX(J),J=1,JO)
      IF (IVAR.EQ.0) WRITE (6,300) FAC
C     ............................ DELY ..............................
      IRN4=1
      READ (5,330) FAC,IVAR,IPRN,TF,IRECS,IRECD
      IF(IRECS.EQ.1) READ(4'IRN4) DELY
      IF(IRECS.EQ.1) GO TO 191
      IF (IVAR.EQ.1) READ (5,330) (DELY(I),I=1,IO)
      DO 190 I=1,IO
      IF (IVAR.NE.1) GO TO 180
      DELY(I)=DELY(I)*FAC
      GO TO 190
  180 DELY(I)=FAC
  190 CONTINUE
  191 IF(IRECD.EQ.1) WRITE(4'IRN4) DELY
      IF (IVAR.EQ.1.AND.IPRN.NE.1) WRITE (6,380) (DELY(I),I=1,IO)
      IF (IVAR.EQ.0) WRITE (6,310) FAC
C     ............................ DELZ ..............................
      IRN8=1
      READ (5,330) FAC,IVAR,IPRN,TF,IRECS,IRECD
      IF(IRECS.EQ.1) READ(8'IRN8) DELZ
      IF(IRECS.EQ.1) GOTO 211
      IF (IVAR.EQ.1) READ (5,330) (DELZ(K),K=1,KO)
```

```
      DO 210 K=1,KO
  211 IF(IRECD.EQ.1) WRITE(8'IRN8) DELZ
      IRN8=IRN8+1
      IF (IVAR.NE.1) GO TO 200
      DELZ(K)=DELZ(K)*FAC
      GO TO 210
  200 DELZ(K)=FAC
  210 CONTINUE
      IF (IVAR.EQ.1.AND.IPRN.NE.1) WRITE (6,390) (DELZ(K),K=1,KO)
      IF (IVAR.EQ.0) WRITE (6,320) FAC
C     ---INITIALIZE VARIABLES---
      B=0.
      D=0.
      F=0.
      H=0.
      SU=0.
      Z=0.
      IF (XSCALE.NE.0.) CALL MAP
      RETURN
C     ..................................................................
C     ---READ TIME PARAMETERS AND PUMPING DATA FOR A NEW PUMPING PERIOD-
C     *********************
      ENTRY NEWPER
C     *********************
      IRN9=1
      READ (5,330) KP,KPM1,NWEL,TMAX,NUMT,CDLT,DELT
C     ---COMPUTE ACTUAL DELT AND NUMT---
      DT=DELT/24.
      TM=0.0
      DO 220 I=1,NUMT
      DT=CDLT*DT
      TM=TM+DT
      IF (TM.GE.TMAX) GO TO 230
  220 CONTINUE
      GO TO 240
  230 DELT=TMAX/TM*DELT
      NUMT=I
  240 WRITE (6,400) KP,TMAX,NUMT,DELT,CDLT
      DELT=DELT*3600.
      TMAX=TMAX*86400.
      SUMP=0.0
C     ---READ AND WRITE WELL PUMPING RATES---
      WRITE (6,410) NWEL
      IF (NWEL.EQ.0) GO TO 260
      IF(SUMP.EQ.0.0) GO TO 241
      DO 246 K=1,KO
      READ(5,330) FAC,IVAR,IPRN,TF,IRECS,IRECD
      IF(IRECS.EQ.1) READ(9'IRN9) A
      IF(IRECS.EQ.1)GOTO 242
      IF(IVAR.EQ.0)GO TO 244
      DO 247 I=1,IO
  247 READ(5,331)(A(I,J),J=1,JO)
```

```
      DO 248 I=1,IO
      DO 248 J=1,JO
      A(I,J)=A(I,J)*FAC
  248 CONTINUE
      GO TO 242
  244 DO 261 I=1,IO
      DO 261 J=1,JO
  261 A(I,J)=FAC
  242 DO 249 I=1,IO
      DO 249 J=1,JO
      WELL(I,J,K)=A(I,J)/(DELX(J)*DELY(I))
  249 CONTINUE
      DO 243 I=1,IO
      IF(IVAR.EQ.1.AND.IPRN.NE.1) WRITE(6,332) I,(WELL(I,J,K),J=1,JO)
  243 CONTINUE
      IF(IVAR.EQ.0) WRITE(6,333) K,FAC
      IF(IRECD.EQ.1) WRITE(9'IRN9) A
      IRN9=IRN9+1
  246 CONTINUE
      GO TO 260
  241 DO 245 K=1,KO
      DO 245 I=1,IO
      DO 245 J=1,JO
  245 WELL(I,J,K)=0.0
      DO 250 II=1,NWEL
      READ (5,335) K,I,J,WELL(I,J,K),(IWELLO(KK),KK=1,10)
      WELMGD=WELL(I,J,K)*.646317
      WRITE (6,420) K,I,J,WELL(I,J,K),WELMGD,(IWELLO(KK),KK=1,10)
  250 WELL(I,J,K)=WELL(I,J,K)/(DELX(J)*DELY(I))
  260 RETURN
C     ---FORMATS---
  280 FORMAT (1H0,52X,6A4,' =',G15.7,' FOR LAYER',I3)
  290 FORMAT (1H1,45X,6A4,' MATRIX, LAYER',I3/46X,41('-'))
  300 FORMAT ('0',72X,'DELX =',G15.7)
  310 FORMAT ('0',72X,'DELY =',G15.7)
  320 FORMAT ('0',72X,'DELZ =',G15.7)
  330 FORMAT (8G10.0)
  331 FORMAT(20F4.1)
  332 FORMAT(' ',I2,10F8.1)
  333 FORMAT('0',72X,'PUMPING IN LAYER',2X,I2,2X,'=',G15.7)
  335 FORMAT (4G10.0,10A4)
  340 FORMAT ('0',51X,'NUMBER OF PUMPING PERIODS =',I5/49X,'TIME STEPS B
     1ETWEEN PRINTOUTS =',I5//51X,'ERROR CRITERIA FOR CLOSURE =',G15.7/)
  346 FORMAT('0',72X,'BETA= ',F4.2)
  350 FORMAT ('0',I2,2X,20F6.1/(5X,20F6.1))
  360 FORMAT (8F10.4)
  370 FORMAT (1H1,46X,40HGRID SPACING IN PROTOTYPE IN X DIRECTION/47X,40
     1('-')//('0',12F10.0))
  380 FORMAT (1H-,46X,40HGRID SPACING IN PROTOTYPE IN Y DIRECTION/47X,40
     1('-')//('0',12F10.0))
  390 FORMAT (1H-,46X,40HGRID SPACING IN PROTOTYPE IN Z DIRECTION/47X,40
     1('-')//('0',12F10.0))
```

```
400 FORMAT ('-',50X,'PUMPING PERIOD NO.',I4,':',F10.2,' DAYS'/51X,38('
   1-')//53X,'NUMBER OF TIME STEPS=',I6//59X,'DELT IN HOURS =',F10.3//
   253X,'MULTIPLIER FOR DELT =',F10.3)
410 FORMAT ('-',53X,I4,' WELLS'/55X,9('-')//39X,'AQ',8X,'ROW',7X,'COL'
   1,8X,'CFS',10X,'MGD',/)
420 FORMAT (31X,3I10,2F13.2,10A4)
430 FORMAT ('-',40X,' CONTINUATION - HEAD AFTER ',G20.7,' SEC PUMPING
   1'/42X,58('-'))
440 FORMAT ('1',55X,'INITIAL  HEAD MATRIX, LAYER',I3/56X,30('-'))
450 FORMAT (4G20.10)
460 FORMAT (3G7.0,7(G3.0,4I1),5X,A5)
470 FORMAT ('0',30X,'ON ALPHAMERIC MAP:'/40X,'MULTIPLICATION FACTOR FO
   1R X DIMENSION =',G15.7/40X,'MULTIPLICATION FACTOR FOR Y DIMENSION
   2=',G15.7/55X,' MAP SCALE IN UNITS OF',A12/49X,'NUMBER OF ',A8,' P
   3ER INCH =',G15.7/43X,'MULTIPLICATION FACTOR FOR DRAWDOWN =',G15.7,
   4' PRINTED FOR LAYERS',4I2/47X,'MULTIPLICATION FACTOR FOR HEAD =',G
   515.7,' PRINTED FOR LAYERS',4I2/47X,'MULT FACTOR FOR HEAD DIFFERENC
   6 =',G15.7,' PRINTED FOR LAYERS',4I2/47X,'MULTIPLICATION FACTOR FOR
   7 RECH =',G15.7,' PRINTED FOR LAYERS',4I2/44X,'MULTIPLICATION FACT
   8FOR ET-RUNOFF =',G15.7,' PRINTED FOR LAYERS',4I2/44X,'MULTIPLICATI
   9ON FACTOR FOR LEAKAGE =',G15.7,' PRINTED FOR LAYERS',4I2/44X,'MULT
   1IPLICATION FACTOR FOR PUMPAGE =',G15.7,'PRINTED FOR LAYERS',4I2)
475 FORMAT(1H0,10X,11(1H*)/11X,1H*/9H WARNING ,1H*/11X,11(1H*)//5X,
   281H THE NUMBER OF CONSTANT HEAD NODES CODED IN AND THE NUMBER COMP
   3UTED DO NOT AGREE:/11X, 21HTHE NUMBER COMPUTED =,I5/11X,21HTHE NUM
   4BER CODED IN =,I5//2X,100(1H+))
    END
```

```
      SUBROUTINE STEP(PHI,STRT,OLD,T,S,TR,TC,TK,WELL,DELX,DELY,DELZ,FACT
     1,DDN,TEST3)
C     ------------------------------------------------------------------
C     INITIALIZE DATA FOR A NEW TIME STEP AND PRINT RESULTS
C     ------------------------------------------------------------------
C     SPECIFICATIONS:
      REAL *8PHI
      REAL *8XLABEL,YLABEL,TITLE,XN1,MESUR
      DIMENSION PHI(IO,JO,KO), STRT(IO,JO,KO), OLD(IO,JO,KO), T(IO,JO,KO
     1), S(IO,JO,KO), TR(IO,JO,KO), TC(IO,JO,KO), TK(IK,JK,K5), WELL(IO,
     2JO,KO), DELX(JO), DELY(IO), DELZ(KO), FACT(KO,3), DDN(IMAX), TEST3
     3(ITMX1), ITTO(50)
      COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
     1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
     2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
      COMMON /SPARAM/ TMAX,CDLT,DELT,ERR,TEST,SUM,SUMP,QR
      COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
     1EVEL5(4),LEVEL6(4),LEVEL7(4)
      COMMON /CK/ ETFLXT,STORT,QRET,CHST,CHDT,FLUXT,PUMPT,CFLUXT,FLXNT
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(6),XN1,MESUR,PRNT(122),BLANK
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2,FACT3,FACT4,FACT5,FACT6,F
     3ACT7,IWELLO(10)
      RETURN
C     ..................................................................
C     ********************
      ENTRY NEWSTP
C     ********************
      KT=KT+1
      IT=0
      DO 10 K=1,KO
      DO 10 I=1,IO
      DO 10 J=1,JO
   10 OLD(I,J,K)=PHI(I,J,K)
      DELT=CDLT*DELT
      SUM=SUM+DELT
      SUMP=SUMP+DELT
      DAYSP=SUMP/86400.
      YRSP=DAYSP/365.
      HRS=SUM/3600.
      SMIN=HRS*60.
      DAYS=HRS/24.
      YRS=DAYS/365.
      RETURN
C     ---PRINT OUTPUT AT DESIGNATED TIME STEPS---
C     *********************
      ENTRY OUTPUT
```

```
C     **********************
      IF (KT.EQ.NUMT) IFINAL=1
      ITTO(KT)=IT
      IF (IT.LE.ITMAX) GO TO 20
      IT=IT-1
      ITTO(KT)=IT
      IERR=2
C     ---IF MAXIMUM ITERATIONS EXCEEDED,WRITE RESULTS ON DISK OR CARDS--
      IF (IDK2.EQ.ICHK(5)) WRITE (4) PHI,SUM,SUMP,PUMPT,CFLUXT,QRET,CHST
     1,CHDT,FLUXT,STORT,ETFLXT,FLXNT
      IF (IPU2.EQ.ICHK(9)) WRITE (7,230) SUM,SUMP,PUMPT,CFLUXT,QRET,CHST
     1,CHDT,FLUXT,STORT,ETFLXT,FLXNT
   20 IF (IFLO.EQ.ICHK(3)) CALL CHECK
      IF (IERR.EQ.2) GO TO 30
      IF (MOD(KT,KTH).NE.0.AND.IFINAL.NE.1) RETURN
   30 WRITE (6,210) KT,DELT,SUM,SMIN,HRS,DAYS,YRS,DAYSP,YRSP
      IF (IFLO.EQ.ICHK(3)) CALL CWRITE
      IT=IT+1
C     ---REMOVE C FROM NEXT CARD TO PRINT HEAD CHANGE FOR ITERATIONS---
C     WRITE (6,180) (TEST3(J),J=1,IT)
      I3=1
      I5=0
  352 I5=I5+40
      I4=MIN0(KT,I5)
      WRITE (6,240) (I,I=I3,I4)
      WRITE (6,260)
      WRITE (6,250) (ITTO(I),I=I3,I4)
      WRITE (6,260)
      IF(KT.LE.I5) GO TO 353
      I3=I3+40
      GO TO 352
C     --MAP DRAWDOWN,HEAD,HEAD DIFF,RECHARGE,ET-RUNOFF,LEAKAGE,PUMPAGE--
  353 IF (XSCALE.EQ.0.) GO TO 88
      IF (FACT1.EQ.0.) GO TO 50
      DO 40 IA=1,4
      II=LEVEL1(IA)
      IF (II.EQ.0) GO TO 50
   40 CALL PRNTA(1,II)
   50 IF (FACT2.EQ.0.) GO TO 65
      DO 60 IA=1,4
      II=LEVEL2(IA)
      IF (II.EQ.0) GO TO 65
   60 CALL PRNTA(2,II)
   65 IF(FACT3.EQ.0) GO TO 75
      DO 67 IA=1,4
      II=LEVEL3(IA)
      IF(II.EQ.0) GO TO 75
   67 CALL PRNTA(3,II)
   75 IF(IQRE.NE.ICHK(7)) GO TO 79
      IF(FACT4.EQ.0) GO TO 79
      DO 77 IA=1,4
      II=LEVEL4(IA)
```

```
      IF(II.EQ.0) GO TO 79
   77 CALL PRNTA(4,II)
   79 IF(FACT5.EQ.0) GO TO 82
      DO 80 IA=1,4
      II=LEVEL5(IA)
      IF(II.EQ.0.) GO TO 82
   80 CALL PRNTA(5,II)
   82 IF(FACT6.EQ.0) GO TO 87
      IF(ITK.NE.ICHK(10)) GO TO 87
      DO 84 IA=1,4
      II=LEVEL6(IA)
      IF(II.EQ.0) GO TO 87
   84 CALL PRNTA(6,II)
   87 IF(FACT7.EQ.0)GO TO 88
      DO 99 IA=1,4
      II=LEVEL7(IA)
      IF(II.EQ.0)GO TO 88
   99 CALL PRNTA(7,II)
   88 IF (IDRAW.NE.ICHK(1)) GO TO 100
C     ---PRINT DRAWDOWN---
      DO 90 K=1,KO
      WRITE (6,200) K
      DO 90 I=1,IO
      DO 89 J=1,JO
      DDN(J)=STRT(I,J,K)-PHI(I,J,K)
      IF(K.EQ.1.AND.T(I,J,K).EQ.0.0) GO TO 89
      IF(K.EQ.2.AND.T(I,J,K-1).EQ.0.0) GO TO 89
C     --REMOVE C FROM COL 1 OF NEXT CARD TO PUNCH DDN IN CALCOMP FORMAT-
      WRITE(7,171) I,J,DDN(J),K
   89 CONTINUE
   90 WRITE (6,170) I,(DDN(J),J=1,JO)
  100 IF (IHEAD.NE.ICHK(2)) GO TO 120
C     ---PRINT HEAD MATRIX---
      DO 110 K=1,KO
      WRITE (6,190) K
      DO 110 I=1,IO
  110 WRITE (6,170) I,(PHI(I,J,K),J=1,JO)
C     ---WRITE ON DISK---
  120 IF (IERR.EQ.2) GO TO 130
      IF (KP.LT.NPER.OR.IFINAL.NE.1) RETURN
      IF (IDK2.EQ.ICHK(5)) WRITE (4) PHI,SUM,SUMP,PUMPT,CFLUXT,QRET,CHST
     1,CHDT,FLUXT,STORT,ETFLXT,FLXNT
C     ---PUNCHED OUTPUT---
  130 IF (IPU2.NE.ICHK(9)) GO TO 160
      IF (IERR.EQ.2) GO TO 140
      WRITE (7,230) SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETF
     1LXT,FLXNT
  140 DO 150 K=1,KO
      DO 150 I=1,IO
  150 WRITE (7,220)  (PHI(I,J,K),J=1,JO)
  160 IF (IERR.EQ.2) STOP
      RETURN
```

STEP

```
C     ---FORMATS---
  170 FORMAT ('0',I4,18F7.2/(5X,18F7.2))
  171 FORMAT(2I5,F5.1,20X,'DDN IN LAYER',I5)
  180 FORMAT ('OMAXIMUM HEAD CHANGE FOR EACH ITERATION:'/' ',39('-')/('0
     1',10F12.4))
  190 FORMAT ('1',55X,'HEAD MATRIX, LAYER',I3/56X,21('-'))
  200 FORMAT ('1',55X,'   DRAWDOWN, LAYER',I3/59X,18('-'))
  210 FORMAT (1H1,44X,57('-')/45X,'|',14X,'TIME STEP NUMBER =',I9,14X,'|
     1'/45X,57('-')//50X,29HSIZE OF TIME STEP IN SECONDS=,F14.2//55X,'TO
     2TAL SIMULATION TIME IN SECONDS=',F14.2/80X,8HMINUTES=,F14.2/82X,6H
     3HOURS=,F14.2/83X,5HDAYS=,F14.2/82X,'YEARS=',F14.2///45X,'DURATION
     4OF CURRENT PUMPING PERIOD IN DAYS=',F14.2/82X,'YEARS=',F14.2//)
  220 FORMAT (8F10.4)
  230 FORMAT (4G20.10)
  240 FORMAT ('OTIME STEP :',40I3)
  250 FORMAT ('OITERATIONS:',40I3)
  260 FORMAT (' ',10('-'))
      END
```

```
      SUBROUTINE SOLVE(PHI,STRT,OLD,T,S,TR,TC,TK,WELL,DELX,DELY,DELZ,FAC
     1T,EL,FL,GL,V,XI,TEST3,QRE,CSS,HSS,HB)
C     ------------------------------------------------------------------
C     SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE
C     ------------------------------------------------------------------
C     SPECIFICATIONS:
      REAL *8PHI,RHO,B,D,F,H,Z,SU,RHOP,W,WMIN,RHO1,RHO2,RHO3,XPART,YPART
     1,ZPART,DMIN1,WMAX,XT,YT,ZT,DABS,DMAX1,DEN,TXM,TYM,TZM
      REAL *8E,AL,BL,CL,A,C,G,WU,TU,U,DL,RES,SUPH,GLXI,ZPHI
      DIMENSION PHI(1), STRT(1), OLD(1), T(1), S(1), TR(1), TC(1), TK(1)
     1, WELL(1), DELX(1), DELY(1), DELZ(1), FACT(KO,3), RHOP(20), TEST3(
     21), EL(1), FL(1), GL(1), V(1), XI(1), QRE(1),CSS(1),HSS(1),HB(1)
      COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
     1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
     2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
      COMMON /SPARAM/ TMAX,CDLT,DELT,ERR,TEST,SUM,SUMP,QR
      COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
     1EVEL5(4),LEVEL6(4),LEVEL7(4)
      COMMON /B/ BETA
      RETURN
C     ..................................................................
C     *********************
      ENTRY ITER
C     *********************
C     ---COMPUTE AND PRINT ITERATION PARAMETERS---
      WRITE (6,240)
      WMIN=1.D0
      DELT=1.
      P2=LENGTH-1
      NT=IO*JO*KO
      NIJ=IO*JO
      XT=3.141593**2/(2.*J2*J2)
      YT=3.141593**2/(2.*I2*I2)
      ZT=3.141593**2/(2.*KO*KO)
      RHO1=0.D0
      RHO2=0.D0
      RHO3=0.D0
      DO 40 K=1,KO
      DO 40 I=2,I1
      DO 40 J=2,J1
      N=I+(J-1)*IO+(K-1)*NIJ
      IF (T(N).EQ.0.) GO TO 40
      D=TR(N-IO)/DELX(J)
      F=TR(N)/DELX(J)
      B=TC(N-1)/DELY(I)
      H=TC(N)/DELY(I)
      SU=0.D0
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```
      Z=0.D0
      IF (K.NE.1) Z=TK(N-NIJ)/DELZ(K)
      IF (K.NE.KO) SU=TK(N)/DELZ(K)
   10 CONTINUE
      TXM=DMAX1(D,F)
      TYM=DMAX1(B,H)
      TZM=DMAX1(SU,Z)
      DEN=DMIN1(D,F)
      IF (DEN.EQ.0.D0) DEN=TXM
      IF (DEN.EQ.0.D0) GO TO 20
      RHO1=DMAX1(RHO1,TYM/DEN)
   20 DEN=DMIN1(B,H)
      IF (DEN.EQ.0.D0) DEN=TYM
      IF (DEN.EQ.0.D0) GO TO 30
      RHO2=DMAX1(RHO2,TXM/DEN)
   30 DEN=DMIN1(SU,Z)
      IF (DEN.EQ.0.D0) DEN=TZM
      IF (DEN.EQ.0.D0) GO TO 40
      RHO3=DMAX1(RHO3,TXM/DEN)
   40 CONTINUE
      XPART=XT/(1.D0+RHO1)
      YPART=YT/(1.D0+RHO2)
      ZPART=ZT/(1.D0+RHO3)
      WMIN=DMIN1(WMIN,XPART,YPART,ZPART)
      WMAX=1.D0-WMIN
      WMAX=.99863
      PJ=-1.
      DO 50 I=1,LENGTH
      PJ=PJ+1.
   50 RHOP(I)=1.D0-(1.D0-WMAX)**(PJ/P2)
C     ---REMOVE C FROM NEXT CARD TO PRINT ITERATION PARAMETERS---
C     WRITE (6,230) LENGTH,(RHOP(J),J=1,LENGTH)
      RETURN
C     ...................................................................
C     ---INITIALIZE DATA FOR A NEW ITERATION---
   60 IT=IT+1
      IF (IT.LE.ITMAX) GO TO 70
      WRITE (6,220)
      CALL OUTPUT
   70 IF (MOD(IT,LENGTH)) 80,80,90
C     ********************
      ENTRY NEWITA
C     ********************
   80 NTH=0
   90 NTH=NTH+1
      W=RHOP(NTH)
      TEST3(IT+1)=0.
      TEST=0.0
      BIG=0.
      DO 100 I=1,NT
      EL(I)=0.
      FL(I)=0.
```

```
      GL(I)=0.
      V(I)=0.
  100 XI(I)=0.
C     ---COMPUTE TRANSMISSIVITY AND T COEFFICIENTS FOR UPPER
C     HYDROLOGIC UNIT WHEN IT IS UNCONFINED---
      IF (IWATER.NE.ICHK(6)) GO TO 110
      CALL TRANS(0)
C     ---CHOOSE SIP NORMAL OR REVERSE ALGORITHM---
  110 IF (MOD(IT,2)) 120,120,170
  120 DO 150 K=1,KO
      DO 150 I=2,I1
      DO 150 J=2,J1
      N=I+(J-1)*IO+(K-1)*NIJ
      NIA=N+1
      NIB=N-1
      NJA=N+IO
      NJB=N-IO
      NKA=N+NIJ
      NKB=N-NIJ
C     ---SKIP COMPUTATIONS IF NODE OUTSIDE MODEL---
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 150
C     ---COMPUTE COEFFICIENTS---
      D=TR(NJB)/DELX(J)
      F=TR(N)/DELX(J)
      B=TC(NIB)/DELY(I)
      H=TC(N)/DELY(I)
      SU=0.D0
      Z=0.D0
      IF(K.EQ.1) GO TO 124
      Z=TK(NKB)
      IF(IEQN.EQ.ICHK(11)) Z=Z/DELZ(K)
  124 IF(K.EQ.KO) GO TO 125
      SU=TK(N)
      IF(IEQN.EQ.ICHK(11))SU=SU/DELZ(K)
  125 RHO=S(N)/DELT
      QR=0.
      IF (IQRE.EQ.ICHK(7)) QR=QRE(N)
C     ---SIP NORMAL ALGORITHM---
C     ---FORWARD SUBSTITUTE, COMPUTING INTERMEDIATE VECTOR V---
  130 E=-B-D-F-H-SU-Z-RHO-CSS(N)
      BL=B/(1.+W*(EL(NIB)+GL(NIB)))
      CL=D/(1.+W*(FL(NJB)+GL(NJB)))
      C=BL*EL(NIB)
      G=CL*FL(NJB)
      WU=CL*GL(NJB)
      U=BL*GL(NIB)
      IF (K.EQ.1) GO TO 140
      AL=Z/(1.+W*(EL(NKB)+FL(NKB)))
      A=AL*EL(NKB)
      TU=AL*FL(NKB)
      DL=E+W*(A+C+G+WU+TU+U)-CL*EL(NJB)-BL*FL(NIB)-AL*GL(NKB)
      EL(N)=(F-W*(A+C))/DL
```

```
      FL(N)=(H-W*(G+TU))/DL
      GL(N)=(SU-W*(WU+U))/DL
      SUPH=0.D0
      IF (K.NE.KO) SUPH=SU*PHI(NKA)
      RES=-B*PHI(NIB)-D*PHI(NJB)-E*PHI(N)-F*PHI(NJA)-H*PHI(NIA)-SUPH-Z*P
     1HI(NKB)-WELL(N)-RHO*OLD(N)-QR-CSS(N)*HSS(N)
      IF(PHI(N).LT.HSS(N).AND.K.EQ.2)RES=RES+CSS(N)*(HSS(N)-PHI(N))
      IF(PHI(N).GT.HB(N).AND.K.EQ.2)RES=RES+CSS(N)*(HB(N)-PHI(N))
      RES=BETA*RES
      V(N)=(RES-AL*V(NKB)-BL*V(NIB)-CL*V(NJB))/DL
      GO TO 150
  140 DL=E+W*(C+G+WU+U)-CL*EL(NJB)-BL*FL(NIB)
      EL(N)=(F-W*C)/DL
      FL(N)=(H-W*G)/DL
      GL(N)=(SU-W*(WU+U))/DL
      SUPH=0.D0
      IF (K.NE.KO) SUPH=SU*PHI(NKA)
      RES=-B*PHI(NIB)-D*PHI(NJB)-E*PHI(N)-F*PHI(NJA)-H*PHI(NIA)-SUPH-WEL
     1L(N)-RHO*OLD(N)-QR-CSS(N)*HSS(N)
      IF(PHI(N).LT.HSS(N).AND.K.EQ.2)RES=RES+CSS(N)*(HSS(N)-PHI(N))
      IF(PHI(N).GT.HB(N).AND.K.EQ.2)RES=RES+CSS(N)*(HB(N)-PHI(N))
      RES=BETA*RES
      V(N)=(RES-BL*V(NIB)-CL*V(NJB))/DL
  150 CONTINUE
C     ---BACK SUBSTITUTE FOR VECTOR XI---
      DO 160 K=1,KO
      K3=KO-K+1
      DO 160 I=1,I2
      I3=IO-I
      DO 160 J=1,J2
      J3=JO-J
      N=I3+(J3-1)*IO+(K3-1)*NIJ+I-I
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 160
      GLXI=0.D0
      IF (K3.NE.KO) GLXI=GL(N)*XI(N+NIJ)
      XI(N)=V(N)-EL(N)*XI(N+IO)-FL(N)*XI(N+1)-GLXI
C     ---COMPARE MAGNITUDE OF CHANGE WITH CLOSURE CRITERIA---
      TCHK=ABS(XI(N))
      IF (TCHK.GT.BIG) BIG=TCHK
      PHI(N)=PHI(N)+XI(N)
  160 CONTINUE
      IF (BIG.GT.ERR) TEST=1.
      TEST3(IT+1)=BIG
      IF (TEST.EQ.0.) RETURN
      GO TO 60
C     ...................................................................
  170 DO 200 KK=1,KO
      K=KO-KK+1
      DO 200 II=1,I2
      I=IO-II
      DO 200 J=2,J1
      N=I+(J-1)*IO+(K-1)*NIJ
```

```
      NIA=N+1
      NIB=N-1
      NJA=N+IO
      NJB=N-IO
      NKA=N+NIJ
      NKB=N-NIJ
C     ---SKIP COMPUTATIONS IF NODE OUTSIDE AQUIFER---
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 200
C     ---COMPUTE COEFFICIENTS---
      D=TR(NJB)/DELX(J)
      F=TR(N)/DELX(J)
      B=TC(NIB)/DELY(I)
      H=TC(N)/DELY(I)
      SU=0.D0
      Z=0.D0
      IF(K.EQ.1) GO TO 174
      Z=TK(NKB)
      IF(IEQN.EQ.ICHK(11)) Z=Z/DELZ(K)
  174 IF(K.EQ.KO) GO TO 175
      SU=TK(N)
      IF(IEQN.EQ.ICHK(11))SU=SU/DELZ(K)
  175 RHO=S(N)/DELT
      QR=0.
      IF (IQRE.EQ.ICHK(7)) QR=QRE(N)
C     ---SIP REVERSE ALGORITHM---
C     ---FORWARD SUBSTITUTE, COMPUTING INTERMEDIATE VECTOR V---
  180 E=-B-D-F-H-SU-Z-RHO-CSS(N)
      BL=H/(1.+W*(EL(NIA)+GL(NIA)))
      CL=D/(1.+W*(FL(NJB)+GL(NJB)))
      C=BL*EL(NIA)
      G=CL*FL(NJB)
      WU=CL*GL(NJB)
      U=BL*GL(NIA)
      IF (K.EQ.KO) GO TO 190
      AL=SU/(1.+W*(EL(NKA)+FL(NKA)))
      A=AL*EL(NKA)
      TU=AL*FL(NKA)
      DL=E+W*(C+G+A+WU+TU+U)-AL*GL(NKA)-BL*FL(NIA)-CL*EL(NJB)
      EL(N)=(F-W*(C+A))/DL
      FL(N)=(B-W*(G+TU))/DL
      GL(N)=(Z-W*(WU+U))/DL
      ZPHI=0.D0
      IF (K.NE.1) ZPHI=Z*PHI(NKB)
      RES=-B*PHI(NIB)-D*PHI(NJB)-E*PHI(N)-F*PHI(NJA)-H*PHI(NIA)-SU*PHI(N
     1KA)-ZPHI-WELL(N)-RHO*OLD(N)-QR-CSS(N)*HSS(N)
      IF(PHI(N).LT.HSS(N).AND.K.EQ.2)RES=RES+CSS(N)*(HSS(N)-PHI(N))
      IF(PHI(N).GT.HB(N).AND.K.EQ.2)RES=RES+CSS(N)*(HB(N)-PHI(N))
      RES=BETA*RES
      V(N)=(RES-AL*V(NKA)-BL*V(NIA)-CL*V(NJB))/DL
      GO TO 200
  190 DL=E+W*(C+G+WU+U)-BL*FL(NIA)-CL*EL(NJB)
      EL(N)=(F-W*C)/DL
```

```
      FL(N)=(B-W*G)/DL
      GL(N)=(Z-W*(WU+U))/DL
      ZPHI=0.D0
      IF (K.NE.1) ZPHI=Z*PHI(NKB)
      RES=-B*PHI(NIB)-D*PHI(NJB)-E*PHI(N)-F*PHI(NJA)-H*PHI(NIA)-ZPHI-WEL
     1L(N)-RHO*OLD(N)-QR-CSS(N)*HSS(N)
      IF(PHI(N).LT.HSS(N).AND.K.EQ.2)RES=RES+CSS(N)*(HSS(N)-PHI(N))
      IF(PHI(N).GT.HB(N).AND.K.EQ.2)RES=RES+CSS(N)*(HB(N)-PHI(N))
      RES=BETA*RES
      V(N)=(RES-BL*V(NIA)-CL*V(NJB))/DL
  200 CONTINUE
C     ---BACK SUBSTITUTE FOR VECTOR XI---
      DO 210 K=1,K0
      DO 210 I=2,I1
      DO 210 J=1,J2
      J3=J0-J
      N=I+(J3-1)*I0+(K-1)*NIJ
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 210
      GLXI=0.D0
      IF (K.NE.1) GLXI=GL(N)*XI(N-NIJ)
      XI(N)=V(N)-EL(N)*XI(N+I0)-FL(N)*XI(N-1)-GLXI
C     ---COMPARE MAGNITUDE OF CHANGE WITH CLOSURE CRITERIA---
      TCHK=ABS(XI(N))
      IF (TCHK.GT.BIG) BIG=TCHK
      PHI(N)=PHI(N)+XI(N)
  210 CONTINUE
      IF (BIG.GT.ERR) TEST=1.
      TEST3(IT+1)=BIG
      IF (TEST.EQ.0.) RETURN
      GO TO 60
C     ..................................................................
C     ---FORMATS---
  220 FORMAT ('0EXCEEDED PERMITTED NUMBER OF ITERATIONS'/' ',39('*'))
  230 FORMAT (///1H0,I5,22H ITERATION PARAMETERS:,6E15.7/(/28X,6E15.7/))
  240 FORMAT ('-',44X,'SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE'/45X,
     143('_'))
      END
```

```
      SUBROUTINE COEF(PHI,STRT,OLD,T,S,TR,TC,TK,WELL,DELX,DELY,DELZ,FACT
     1,PERM,BOTTOM,QRE)
C     ------------------------------------------------------------------
C     COMPUTE COEFFICIENTS
C     ------------------------------------------------------------------
C     SPECIFICATIONS:
      REAL *8PHI
      DIMENSION PHI(IO,JO,KO), STRT(IO,JO,KO), OLD(IO,JO,KO), T(IO,JO,KO
     1), S(IO,JO,KO), TR(IO,JO,KO), TC(IO,JO,KO), TK(IK,JK,K5), WELL(IO,
     2JO,KO), DELX(JO), DELY(IO), DELZ(KO), FACT(KO,3), PERM(IP,JP), BOT
     3TOM(IP,JP), QRE(IQ,JQ,KQ)
      COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
     1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
     2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
      COMMON /SPARAM/ TMAX,CDLT,DELT,ERR,TEST,SUM,SUMP,QR
      COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
     1EVEL5(4),LEVEL6(4),LEVEL7(4)
      DATA N3=1
      RETURN
C     ..................................................................
C     ---COMPUTE TRANSMISSIVITY FOR UPPER HYDROLOGIC UNIT WHEN
C     IT IS UNCONFINED---
C     **********************
      ENTRY TRANS(N3)
C     **********************
      DO 10 I=2,I1
      DO 10 J=2,J1
      IF (PERM(I,J).EQ.0.) GO TO 10
      T(I,J,KO)=PERM(I,J)*(PHI(I,J,KO)-BOTTOM(I,J))
      IF (T(I,J,KO).GT.0.) GO TO 10
      IF (WELL(I,J,KO).LT.0.) WRITE (6,60) I,J,KO
      IF (WELL(I,J,KO).GE.0.) WRITE (6,70) I,J,KO
      PERM(I,J)=0.
      T(I,J,KO)=0.
      TR(I,J-1,KO)=0.
      TR(I,J,KO)=0.
      TC(I,J,KO)=0.
      TC(I-1,J,KO)=0.
      IF (KO.NE.1) TK(I,J,K1)=0.
      PHI(I,J,KO)=1.D30
   10 CONTINUE
      IF (N3.EQ.1) RETURN
      N1=KO
      N2=KO
      N4=K1
      GO TO 20
C     ---COMPUTE T COEFFICIENTS---
```

```
C     **********************
      ENTRY TCOF
C     **********************
      N1=1
      N2=K0
      N4=1
   20 DO 40 K=N1,N2
      DO 40 I=1,I1
      DO 40 J=1,J1
      IF (T(I,J,K).EQ.0.) GO TO 40
      IF (T(I,J+1,K).EQ.0.) GO TO 30
      TR(I,J,K)=(2.*T(I,J+1,K)*T(I,J,K))/(T(I,J,K)*DELX(J+1)+T(I,J+1,K)*
     1DELX(J))*FACT(K,1)
   30 IF (T(I+1,J,K).EQ.0.) GO TO 40
      TC(I,J,K)=(2.*T(I+1,J,K)*T(I,J,K))/(T(I,J,K)*DELY(I+1)+T(I+1,J,K)*
     1DELY(I))*FACT(K,2)
   40 CONTINUE
      IF (KO.EQ.1.OR.ITK.EQ.ICHK(10).OR.N3.EQ.0) RETURN
      DO 50 K=N4,K1
      DO 50 I=2,I1
      DO 50 J=2,J1
      IF (T(I,J,K+1).EQ.0.) GO TO 50
      T1=T(I,J,K)*FACT(K,3)
      T2=T(I,J,K+1)*FACT(K+1,3)
      TK(I,J,K)=(2.*T2*T1)/(T1*DELZ(K+1)+T2*DELZ(K))
   50 CONTINUE
      RETURN
   60 FORMAT ('-',20('*'),'WELL',2I3,' IN LAYER',I3,' GOES DRY',20('*'))
   70 FORMAT ('-',20('*'),'NODE',2I3,' IN LAYER',I3,' GOES DRY',20('*'))
      END
```

```
      SUBROUTINE CHECKI(PHI,STRT,OLD,T,S,TR,TC,TK,WELL,DELX,DELY,DELZ,FA
     1CT,JFLO,FLOW,QRE,CSS,HSS,HB,ETRAT)
C     ------------------------------------------------------------------
C     COMPUTE A VOLUMETRIC BALANCE
C     ------------------------------------------------------------------
C     SPECIFICATIONS:
      REAL *8PHI
      DIMENSION PHI(IO,JO,KO), STRT(IO,JO,KO), OLD(IO,JO,KO), T(IO,JO,KO
     1), S(IO,JO,KO), TR(IO,JO,KO), TC(IO,JO,KO), TK(IK,JK,K5), WELL(IO,
     2JO,KO), DELX(JO), DELY(IO), DELZ(KO), FACT(KO,3), JFLO(NCH,3), FLO
     3W(NCH),QRE(IQ,JQ,KQ),CSS(IO,JO,KO),HSS(IO,JO,KO),HB(IO,JO,KO),
     4ETRAT(IO,JO,KO)
      COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
     1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
     2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
      COMMON /SPARAM/ TMAX,CDLT,DELT,ERR,TEST,SUM,SUMP,QR
      COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
     1EVEL5(4),LEVEL6(4),LEVEL7(4)
      COMMON /CK/ ETFLXT,STORT,QRET,CHST,CHDT,FLUXT,PUMPT,CFLUXT,FLXNT
      RETURN
C     ..................................................................
C     ********************
      ENTRY CHECK
C     ********************
C     ---INITIALIZE VARIABLES---
      PUMP=0.
      STOR=0.
      FLUXS=0.0
      CHD1=0.0
      CHD2=0.0
      QREFLX=0.
      CFLUX=0.
      FLUX=0.
      ETFLUX=0.
      FLXN=0.0
      II=0
C     ..................................................................
C     ---COMPUTE RATES,STORAGE AND PUMPAGE FOR THIS STEP---
      DO 220 K=1,KO
      DO 220 I=2,I1
      DO 220 J=2,J1
      IF (T(I,J,K).EQ.0.) GO TO 220
      AREA=DELX(J)*DELY(I)
      VOLUME=AREA*DELZ(K)
      IF (S(I,J,K).GE.0.) GO TO 180
C     ---COMPUTE FLOW RATES TO AND FROM CONSTANT HEAD BOUNDARIES---
      II=II+1
```

```
      FLOW(II)=0.
      JFLO(II,1)=K
      JFLO(II,2)=I
      JFLO(II,3)=J
      IF (S(I,J-1,K).LT.0..OR.T(I,J-1,K).EQ.0.) GO TO 30
      X=(PHI(I,J,K)-PHI(I,J-1,K))*TR(I,J-1,K)*DELY(I)
      IF(IEQN.EQ.ICHK(11)) X=X*DELZ(K)
      FLOW(II)=FLOW(II)+X
      IF (X) 10,30,20
   10 CHD1=CHD1+X
      GO TO 30
   20 CHD2=CHD2+X
   30 IF (S(I,J+1,K).LT.0..OR.T(I,J+1,K).EQ.0.) GO TO 60
      X=(PHI(I,J,K)-PHI(I,J+1,K))*DELY(I)*TR(I,J,K)
      IF(IEQN.EQ.ICHK(11)) X=X*DELZ(K)
      FLOW(II)=FLOW(II)+X
      IF (X) 40,60,50
   40 CHD1=CHD1+X
      GO TO 60
   50 CHD2=CHD2+X
   60 IF (K.EQ.1) GO TO 90
      IF (S(I,J,K-1).LT.0..OR.T(I,J,K-1).EQ.0.) GO TO 90
      X=(PHI(I,J,K)-PHI(I,J,K-1))*TK(I,J,K-1)*AREA
      FLOW(II)=FLOW(II)+X
      IF (X) 70,90,80
   70 CHD1=CHD1+X
      GO TO 90
   80 CHD2=CHD2+X
   90 IF (K.EQ.KO) GO TO 120
      IF (S(I,J,K+1).LT.0..OR.T(I,J,K+1).EQ.0.) GO TO 120
      X=(PHI(I,J,K)-PHI(I,J,K+1))*TK(I,J,K)*AREA
      FLOW(II)=FLOW(II)+X
      IF (X) 100,120,110
  100 CHD1=CHD1+X
      GO TO 120
  110 CHD2=CHD2+X
  120 IF (S(I-1,J,K).LT.0..OR.T(I-1,J,K).EQ.0.) GO TO 150
      X=(PHI(I,J,K)-PHI(I-1,J,K))*TC(I-1,J,K)*DELX(J)
      IF(IEQN.EQ.ICHK(11)) X=X*DELZ(K)
      FLOW(II)=FLOW(II)+X
      IF (X) 130,150,140
  130 CHD1=CHD1+X
      GO TO 150
  140 CHD2=CHD2+X
  150 IF (S(I+1,J,K).LT.0..OR.T(I+1,J,K).EQ.0.) GO TO 220
      X=(PHI(I,J,K)-PHI(I+1,J,K))*TC(I,J,K)*DELX(J)
      IF(IEQN.EQ.ICHK(11)) X=X*DELZ(K)
      FLOW(II)=FLOW(II)+X
      IF (X) 160,220,170
  160 CHD1=CHD1+X
      GO TO 220
  170 CHD2=CHD2+X
```

```
      GO TO 220
C      ---CHECK FOR EQUATION BEING SOLVED---
  180 IF(IEQN.EQ.ICHK(11)) GO TO 211
C     ---EQUATION 4---
C     ---RECHARGE AND WELLS---
      IF(IQRE.EQ.ICHK(7))QREFLX=QREFLX+QRE(I,J,K)*AREA
      IF (WELL(I,J,K)) 190,210,200
  190 PUMP=PUMP+WELL(I,J,K)*AREA
      GO TO 210
  200 CFLUX=CFLUX+WELL(I,J,K)*AREA
C     ---COMPUTE VOLUME FROM STORAGE---
  210 STOR=STOR+S(I,J,K)*(OLD(I,J,K)-PHI(I,J,K))*AREA
      HDD=PHI(I,J,K)
      IF(HDD.LT.HSS(I,J,K).AND.K.EQ.2) HDD=HSS(I,J,K)
      IF(HDD.GT.HB(I,J,K).AND.K.EQ.2)HDD=HB(I,J,K)
      XNET=(HSS(I,J,K)-HDD)*CSS(I,J,K)*AREA
      IF(K.EQ.1) GO TO 261
      ETFLUX=ETFLUX+XNET
      GO TO 262
  261 FLUXS=FLUXS+XNET
      IF(XNET.LT.0) FLXN=FLXN-XNET
C     ---COMPUTE ET-RUNOFF RATES IN INCHES PER YEAR--
  262 IF(K.EQ.1) GO TO 219
      IF(HDD.GT.HB(I,J,K))ETRAT(I,J,K)=3.784E08*CSS(I,J,K)*(HB(I,J,K)-
     1HSS(I,J,K))
      IF(HDD.LE.HB(I,J,K).AND.HDD.GT.HSS(I,J,K))ETRAT(I,J,K)=
     13.784E08*CSS(I,J,K)*(HDD-HSS(I,J,K))
      IF(HDD.LE.HSS(I,J,K))ETRAT(I,J,K)=0.0
C     ---PRINT HCF FLOW RATE AT MODEL-GRID BOUNDARY---
  219 IF (K.NE.1) GO TO 220
      XHCF=(HSS(I,J,K)-PHI(I,J,K))*CSS(I,J,K)
      IF(XHCF.EQ.0.0)GO TO 220
C     WRITE(6,295)I,J,XHCF
      WRITE(7,295)I,J,XHCF
      GO TO 220
C     ---EQUATION 3---
C     ---RECHARGE AND WELLS---
  211 IF(IQRE.EQ.ICHK(7))QREFLX=QREFLX+QRE(I,J,K)*VOLUME
      IF (WELL(I,J,K)) 212,214,213
  212 PUMP=PUMP+WELL(I,J,K)*VOLUME
      GO TO 214
  213 CFLUX=CFLUX+WELL(I,J,K)*VOLUME
C     ---COMPUTE VOLUME FROM STORAGE---
  214 STOR=STOR+S(I,J,K)*(OLD(I,J,K)-PHI(I,J,K))*VOLUME
      HDD=PHI(I,J,K)
      IF(HDD.LT.HSS(I,J,K).AND.K.EQ.2)HDD=HSS(I,J,K)
      IF(HDD.GT.HB(I,J,K).AND.K.EQ.2)HDD=HB(I,J,K)
      XNET=(HSS(I,J,K)-HDD)*CSS(I,J,K)*VOLUME
      IF(K.EQ.1) GO TO 271
      ETFLUX=ETFLUX+XNET
      GO TO 220
  271 FLUXS=FLUXS+XNET
```

```
      IF(XNET.LT.0) FLXN=FLXN-XNET
  220 CONTINUE
C     ---DETERMINE IF WATER TABLE RISES ABOVE LAND SURFACE--
      DO 221 K=2,2
      DO 221 I=1,IO
      DO 221 J=1,JO
      RISE=PHI(I,J,K)-HB(I,J,K)
C     -REMOVE C FROM NEXT CARD TO PREVENT WT RISE ABOVE LAND
C     IF(RISE.GT.0.00) PHI(I,J,K)=HB(I,J,K)
  221 IF(RISE.GT.0.0)WRITE(6,296)RISE,I,J
C     ---REMOVE C FROM COL 1 OF NEXT 4 CARDS TO PUNCH ET-RUNOFF--
C     WRITE(7,298)
C     DO 222 K=2,2
C     DO 222 I=1,IO
C 222 WRITE(7,297)(ETRAT(I,J,K),J=1,JO)
C     ..................................................................
C     ---COMPUTE CUMULATIVE VOLUMES, TOTALS, AND DIFFERENCES---
      FLXPT=0.0
      STORT=STORT+STOR
      STOR=STOR/DELT
      FLUXT=FLUXT+FLUXS*DELT
      FLXNT=FLXNT+FLXN*DELT
      FLXPT=FLUXT+FLXNT
      QRET=QRET+QREFLX*DELT
      ETFLXT=ETFLXT-ETFLUX*DELT
      CHDT=CHDT-CHD1*DELT
      CHST=CHST+CHD2*DELT
      PUMPT=PUMPT-PUMP*DELT
      CFLUXT=CFLUXT+CFLUX*DELT
      TOTL1=STORT+QRET+CFLUXT+CHST+FLXPT
      TOTL2=CHDT+PUMPT+ETFLXT+FLXNT
      SUMR=QREFLX+CFLUX+CHD2+CHD1+PUMP+ETFLUX+FLUXS+STOR
      DIFF=TOTL2-TOTL1
      PERCNT=0.0
      IF (TOTL2.EQ.0.) GO TO 230
      PERCNT=DIFF/TOTL2*100.
  230 RETURN
C     ..................................................................
C     ---PRINT RESULTS---
C     ************************
      ENTRY CWRITE
C     ************************
      WRITE (6,260) STOR,QREFLX,STORT,CFLUX,QRET,PUMP,CFLUXT,ETFLUX,CHST
     1,FLXPT,CHD2,TOTL1,CHD1,FLUX,FLUXS,ETFLXT,CHDT,SUMR,PUMPT,FLXNT,TOT
     2L2,DIFF,PERCNT
      WRITE(6,291)
      DO 500 K=1,KO
      ACTNOD=0.
      TOTABR=0.
      TOTPCT=0.
      TTOT=0.
      RTOT=0.
```

```
      RPOS=0.
      RNEG=0.
      POSNOD=0.
      RNEGND=0.
      RMAXD=0.
      RMIND=0.
      RMINT=1000000.
      RMAXT=0.
      RMAXR=0.
      RMINR=0.
      MROW=0
      MCOL=0
      NROW=0
      NCOL=0
      DO 400 I=2,I1
      DO 400 J=2,J1
      IF(T(I,J,K).EQ.0.OR.S(I,J,K).LT.0) GO TO 400
      ACTNOD=ACTNOD+1.
      DDN=STRT(I,J,K)-PHI(I,J,K)
      IF (STRT(I,J,K).EQ.0.0) GO TO 390
      PCT=(ABS(DDN)/STRT(I,J,K))*100.
      TOTPCT=TOTPCT+PCT
  390 TOTABR=TOTABR+ABS(DDN)
      IF(DDN.LT.RMAXD) GO TO 391
      RMAXD=DDN
      MROW=I
      MCOL=J
  391 IF(DDN.GT.RMIND) GO TO 392
      RMIND=DDN
      NROW=I
      NCOL=J
  392 TDUM=T(I,J,K)/(1.5472E-06)
      TTOT=TTOT+TDUM
      IF(TDUM.GE.RMAXT) RMAXT=TDUM
      IF(TDUM.LE.RMINT) RMINT=TDUM
      IF(IQRE.NE.ICHK(7)) GOTO 400
      IF(K.NE.KO) GOTO 400
      RDUM=QRE(I,J,K)/(2.64E-09)
      RTOT=RTOT+RDUM
      IF(RDUM.GE.RMAXR) RMAXR=RDUM
      IF(RDUM.LE.RMINR) RMINR=RDUM
      IF(RDUM.GT.0) RPOS=RPOS+RDUM
      IF(RDUM.GT.0) POSNOD=POSNOD+1.
      IF(RDUM.LT.0) RNEG=RNEG+RDUM
      IF(RDUM.LT.0) RNEGND=RNEGND+1.
  400 CONTINUE
      IF(ACTNOD)500,500,418
  418 AVABER=TOTABR/ACTNOD
      AVPCT=TOTPCT/ACTNOD
      TAV=TTOT/ACTNOD
      WRITE(6,292) K,AVABER,AVPCT,RMAXD,MROW,MCOL,RMIND,NROW,NCOL,TAV,
     1RMAXT,RMINT,ACTNOD
```

```
      IF(IQRE.NE.ICHK(7)) GOTO 500
      IF(K.NE.KO) GOTO 500
      RAV=RTOT/ACTNOD
      IF(POSNOD)420,420,430
  420 AVPOSR=0.
      GO TO 440
  430 AVPOSR=RPOS/POSNOD
  440 IF(RNEGND)450,450,460
  450 AVNEGR=0.
      GO TO 470
  460 AVNEGR=RNEG/RNEGND
  470 WRITE(6,293)
      WRITE(6,294) K,RAV,AVPOSR,POSNOD,AVNEGR,RNEGND,RMAXR,RMINR
  500 CONTINUE
      RETURN
C     ---FORMATS---
C     -------------------------------------------------------------------
  260 FORMAT ('0',10X,'CUMULATIVE MASS BALANCE:',16X,'L**3',23X,'RATES F
     1OR THIS TIME STEP:',16X,'L**3/T'/11X,24('-'),43X,25('-')//20X,'SOU
     2RCES:',69X,'STORAGE =',F20.4/20X,8('-'),68X,'RECHARGE =',F20.4/27X
     3,'STORAGE =',F20.2,35X,'CONSTANT FLUX =',F20.4/26X,'RECHARGE =',F2
     40.2,41X,'PUMPING =',F20.4/21X,'CONSTANT FLUX =',F20.2,30X,'
     5 ET-RUNOFF  =',F20.4/21X,'CONSTANT HEAD =',F20.2,34X,'CONSTANT HEA
     6D:'/27X,'LEAKAGE =',F20.2,46X,'IN =',F20.4/21X,'TOTAL SOURCES =',F
     720.2,45X,'OUT =',F20.4/96X,'LEAKAGE:'/20X,'DISCHARGES:',45X,'FROM 
     8PREVIOUS PUMPING PERIOD =',F20.4/20X,11('-'),68X,'TOTAL =',F20.4/1
     96X,'            ET-RUNOFF =',F20.2/21X,'CONSTANT HEAD =',F20.2,36X,'S
     $UM OF RATES =',F20.4/19X'QUANTITY PUMPED =',F20.2/27X,'LEAKAGE =',
     $F20.2/19X,'TOTAL DISCHARGE =',F20.2//17X,'DISCHARGE-SOURCES =',F20
     $.2/15X,'PER CENT DIFFERENCE =',F20.2//)
  270 FORMAT ('0FLOW RATES TO CONSTANT HEAD NODES:'/' ',34('-')//' ',4(5
     1X,'K',4X,'I',4X,'J',3X,'RATE (IN/YR )')/' ',4(5X,'-',4X,'-',4X,'-'
     2,3X,13('-'))/)
  280 FORMAT (/(1X,4(I6,2I5,F10.1,6X)))
  291 FORMAT('0',17X,'AVG',2X,'ABS CHG',5X,'MAX DDN',7X,'MAX RISE',12X,'
     1AVG T (GPD/FT)',11X,'MAX T',7X,'MIN T',4X,'ACTIVE NODES')
  292 FORMAT(' ',1X,'LAYER',2X,I4,4X,F4.1,3X,F4.1,'%',3X,F5.1,1X,'(',I2,
     1',',I2,')',2X,F5.1,1X,'(',I2,',',I2,')',6X,F11.0,10X,F11.0,4X,F8.0
     2,2X,F10.0)
  293 FORMAT('0',15X,'AVG RECHG (IN/YR)',7X,'AVG POS RECHG',3X,'NO. POS 
     1 NODES',3X,'AVG NEG RECHG',3X,'NO.NEG NODES',3X,'MAX RECHG',7X,'MA
     2X DISCHG')
  294 FORMAT(' ',1X,'LAYER',2X,I4,6X,F6.1,16X,F6.1,9X,F7.0,10X,F6.1,10X
     1,F7.0,8X,F6.1,10X,F6.1)
  295 FORMAT(11X,I2,6X,I2,3X,E15.5,30X,'HCF FLOW')
  296 FORMAT('0WATER TABLE RISES',F6.1,' FEET ABOVE LSD AT ROW',I5,' COL
     1',I5)
  297 FORMAT(20F4.1)
  298 FORMAT(5X,'ET RATES FOLLOW')
      END
```

```
      SUBROUTINE PRNTAI(PHI,STRT,T,S,WELL,DELX,DELY,QRE,TK,ETRAT)
C     ------------------------------------------------------------------
C     PRINT MAPS OF DRAWDOWN, HYDRAULIC HEAD, HEAD DIFFERENCE, RECHARGE,
C     ET-RUNOFF RATE, LEAKAGE RATE, AND PUMPING RATE
C     ------------------------------------------------------------------
C     SPECIFICATIONS:
      REAL *8PHI,Z,XLABEL,YLABEL,TITLE,XN1,MESUR
      REAL *4K
      DIMENSION PHI(IO,JO,KO), STRT(IO,JO,KO), S(IO,JO,KO), WELL(IO,JO,K
     1O), DELX(JO), DELY(IO), T(IO,JO,KO),QRE(IQ,JQ,KQ),TK(IK,JK,K5),
     2ETRAT(IO,JO,KO)
      COMMON /INTEGR/ IO,JO,KO,I1,J1,K1,I,J,K,NPER,KTH,ITMAX,LENGTH,KP,N
     1WEL,NUMT,IFINAL,IT,KT,IHEAD,IDRAW,IFLO,IERR,I2,J2,K2,IMAX,ITMX1,NC
     2H,IDK1,IDK2,IWATER,IQRE,IP,JP,IQ,JQ,IK,JK,K5,IPU1,IPU2,ITK,IEQN,KQ
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(6),XN1,MESUR,PRNT(122),BLANK
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2,FACT3,FACT4,FACT5,FACT6,F
     3ACT7,IWELLO(10)
      RETURN
C     ..................................................................
C     ---INITIALIZE VARIABLES FOR PLOT---
C     ********************
      ENTRY MAP
C     ********************
      YDIM=0.
      WIDTH=0.
      DO 10 J=2,J1
   10 WIDTH=WIDTH+DELX(J)
      DO 20 I=2,I1
   20 YDIM=YDIM+DELY(I)
   30 XSF=DINCH*XSCALE
      YSF=DINCH*YSCALE
      NYD=YDIM/YSF
      IF (NYD*YSF.LE.YDIM-DELY(I1)/2.) NYD=NYD+1
      IF (NYD.LE.12) GO TO 40
      DINCH=YDIM/(12.*YSCALE)
      WRITE (6,330) DINCH
      IF (YSCALE.LT.1.0) WRITE (6,340)
      GO TO 30
   40 NXD=WIDTH/XSF
      IF (NXD*XSF.LE.WIDTH-DELX(J1)/2.) NXD=NXD+1
      N4=NXD*N1+1
      N5=NXD+1
      N6=NYD+1
      N8=N2*NYD+1
      NA(1)=N4/2-1
      NA(2)=N4/2
```

```
      NA(3)=N4/2+3
      NC=(N3-N8-10)/2
      ND=NC+N8
      NE=MAXO(N5,N6)
      VF1(3)=DIGIT(ND)
      VF2(3)=DIGIT(ND)
      VF3(3)=DIGIT(NC)
      XLABEL(3)=MESUR
      YLABEL(6)=MESUR
      DO 60 I=1,NE
      NNX=N5-I
      NNY=I-1
      IF (NNY.GE.N6) GO TO 50
      YN(I)=YSF*NNY/YSCALE
   50 IF (NNX.LT.0) GO TO 60
      XN(I)=XSF*NNX/YSCALE
   60 CONTINUE
      RETURN
C     ..................................................................
C     ********************
      ENTRY PRNTA(NG,LA)
C     ********************
C     ---VARIABLES INITIALIZED EACH TIME A PLOT IS REQUESTED---
      DIST=WIDTH-DELX(J1)/2.
      JJ=J1
      LL=1
      Z=NXD*XSF
      IF (NG.EQ.1.AND.LA.EQ.1)WRITE(6,300)
      IF(NG.EQ.1.AND.LA.EQ.2) WRITE(6,301)
      IF(NG.EQ.2.AND.LA.EQ.1) WRITE(6,302)
      IF(NG.EQ.2.AND.LA.EQ.2) WRITE(6,303)
      IF(NG.EQ.3) WRITE(6,295)
      IF(NG.EQ.4) WRITE(6,297)
      IF(NG.EQ.5) WRITE(6,298)
      IF(NG.EQ.6) WRITE(6,299)
      IF(NG.EQ.7) WRITE(6,311)
      DO 290 I=1,N4
C     ---LOCATE X AXES---
      IF (I.EQ.1.OR.I.EQ.N4) GO TO 70
      PRNT(1)=SYM(12)
      PRNT(N8)=SYM(12)
      IF ((I-1)/N1*N1.NE.I-1) GO TO 90
      PRNT(1)=SYM(14)
      PRNT(N8)=SYM(14)
      GO TO 90
C     ---LOCATE Y AXES---
   70 DO 80 J=1,N8
      IF ((J-1)/N2*N2.EQ.J-1) PRNT(J)=SYM(14)
   80 IF ((J-1)/N2*N2.NE.J-1) PRNT(J)=SYM(13)
C     ---COMPUTE LOCATION OF NODES AND DETERMINE APPROPRIATE SYMBOL---
   90 IF (DIST.LT.0..OR.DIST.LT.Z-XN1*XSF) GO TO 240
      YLEN=DELY(2)/2.
```

```
      DO 220 L=2,I1
      J=YLEN*N2/YSF+1.5
      IF (T(L,JJ,LA).EQ.0.) GO TO 160
      IF (S(L,JJ,LA).LT.0.) GO TO 210
      INDX3=0
      GO TO (100,110,112,114,116,118,119), NG
  100 K=(STRT(L,JJ,LA)-PHI(L,JJ,LA))*FACT1
      GO TO 120
  110 K=PHI(L,JJ,LA)*FACT2
      GO TO 120
  112 K=PHI(L,JJ,LA+1)-PHI(L,JJ,LA)
      GO TO 120
  114 K=QRE(L,JJ,LA)*FACT4/(2.6424E-09)
      GO TO 120
  116 K=ETRAT(L,JJ,LA)*FACT5
      GO TO 120
  118 K=TK(L,JJ,LA)*(PHI(L,JJ,LA+1)-PHI(L,JJ,LA))*FACT6/(2.6424E-09)
C     --REMOVE C FROM COL 1 OF NEXT CARD TO PUNCH LEAKAGE RATE--
      WRITE(7,350)L,JJ,K
      GO TO 120
  119 K=WELL(L,JJ,LA)*.646317*FACT7*DELX(JJ)*DELY(L)
  120 IF (K) 130,160,140
  130 IF (J-2.GT.0) PRNT(J-2)=SYM(13)
      N=-K+.5
      IF (N.LT.100) GO TO 150
      GO TO 190
  140 N=K+.5
      IF (N.LT.100) GO TO 150
      IF (N.GT.999) GO TO 190
      INDX3=N/100
      IF (J-2.GT.0) PRNT(J-2)=SYM(INDX3)
      N=N-INDX3*100
  150 INDX1=MOD(N,10)
      IF (INDX1.EQ.0) INDX1=10
      INDX2=N/10
      IF (INDX2.GT.0) GO TO 180
      INDX2=10
      IF (INDX3.EQ.0) INDX2=15
      GO TO 180
  160 INDX1=15
  170 INDX2=15
  180 IF (J-1.GT.0) PRNT(J-1)=SYM(INDX2)
      PRNT(J)=SYM(INDX1)
      GO TO 220
  190 DO 200 II=1,3
      JI=J-3+II
  200 IF (JI.GT.0) PRNT(JI)=SYM(11)
  210 IF (S(L,JJ,LA).LT.0.) PRNT(J)=SYM(16)
  220 YLEN=YLEN+(DELY(L)+DELY(L+1))/2.
  230 DIST=DIST-(DELX(JJ)+DELX(JJ-1))/2.
      JJ=JJ-1
      IF (JJ.EQ.0) GO TO 240
```

```
      IF (DIST.GT.Z-XN1*XSF) GO TO 230
  240 CONTINUE
C     ---PRINT AXES,LABELS, AND SYMBOLS---
      IF (I-NA(LL).EQ.0) GO TO 260
      IF ((I-1)/N1*N1-(I-1)) 270,250,270
  250 WRITE (6,VF1) (BLANK(J),J=1,NC),(PRNT(J),J=1,N8),XN(1+(I-1)/6)
      GO TO 280
  260 WRITE (6,VF2) (BLANK(J),J=1,NC),(PRNT(J),J=1,N8),XLABEL(LL)
      LL=LL+1
      GO TO 280
  270 WRITE (6,VF2) (BLANK(J),J=1,NC),(PRNT(J),J=1,N8)
C     ---COMPUTE NEW VALUE FOR Z AND INITIALIZE PRNT---
  280 Z=Z-2.*XN1*XSF
      DO 290 J=1,N8
  290 PRNT(J)=SYM(15)
C     ---NUMBER AND LABEL Y AXIS AND PRINT LEGEND---
      WRITE (6,VF3) (BLANK(J),J=1,NC),(YN(I),I=1,N6)
      WRITE (6,320) (YLABEL(I),I=1,6)
      IF (NG.EQ.1) WRITE (6,310) FACT1
      IF (NG.EQ.2) WRITE (6,310) FACT2
      RETURN
C     ---FORMATS---
C     -----------------------------------------------------------------
  295 FORMAT ('1',36X,'HEAD DIFFERENCE *WATER TABLE MINUS POTENTIOMETRIC
     1 SURFACE* FEET',//)
  297 FORMAT ('1',40X,'RATE OF RECHARGE TO SURFICIAL AQUIFER, INCHES PER
     1 YEAR',//)
  298 FORMAT ('1',39X,'ET-RUNOFF FROM SURFICIAL AQUIFER, INCHES PER YEAR
     1',//)
  299 FORMAT ('1',40X,'RATE OF LEAKAGE TO FLORIDAN AQUIFER, INCHES PER Y
     1EAR',//)
  300 FORMAT ('1',40X,'DRAWDOWN IN FLORIDAN AQUIFER, FEET',//)
  301 FORMAT ('1',40X,'DRAWDOWN IN SURFICIAL AQUIFER, FEET',//)
  302 FORMAT ('1',35X,'ALTITUDE OF POTENTIOMETRIC SURFACE OF THE FLORIDA
MOD  1N AQUIFER, FEET',//)
  303 FORMAT ('1',35X,'ALTITUDE OF WATER TABLE IN THE SURFICIAL AQUIFER,
     1 FEET',//)
  310 FORMAT ('0EXPLANATION'/' ',11('-')//' R = CONSTANT HEAD BOUNDARY'/
     1' *** = VALUE EXCEEDED 3 FIGURES'/' MULTIPLICATION FACTOR =',F8.3)
  311 FORMAT('1',40X,'PUMPING RATE FROM FLORIDAN AQUIFER, MGAL/D',//)
  320 FORMAT ('0',39X,6A8)
  330 FORMAT ('0',25X,10('*'),' TO FIT MAP WITHIN 12 INCHES, DINCH REVIS
     1ED TO',G15.7,1X,10('*'))
  340 FORMAT ('0',45X,'NOTE: GENERALLY SCALE SHOULD BE > OR = 1.0')
  350 FORMAT(I5,I5,F10.1,40X,'LEAK')
      END
```

```
      BLOCK DATA
C     ----------
C     SPECIFICATIONS:
      REAL *8XLABEL,YLABEL,TITLE,XN1,MESUR
      COMMON /SARRAY/ ICHK(14),LEVEL1(4),LEVEL2(4),LEVEL3(4),LEVEL4(4),L
     1EVEL5(4),LEVEL6(4),LEVEL7(4)
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(6),XN1,MESUR,PRNT(122),BLANK
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2,FACT3,FACT4,FACT5,FACT6,F
     3ACT7,IWELLO(10)
C     ******************************************************************
      DATA ICHK/'DRAW','HEAD','MASS','DK1','DK2','WATE','RECH','PUN1','P
     1UN2','ITKR','EQN3','TKLR','UNFM','CYCL'/
      DATA SYM/'1','2','3','4','5','6','7','8','9','0','*','|','-','+','
     1 ','R','W'/
      DATA PRNT/122*' '/,N1,N2,N3,XN1/6,10,133,.833333333D-1/,BLANK/60*'
     1 '/,NA(4)/1000/
      DATA XLABEL/' X DIS- ','TANCE IN','  MILES '/,YLABEL/'DISTANCE',' 
     1FROM OR','IGIN IN ','Y DIRECT','ION, IN ','MILES   '/,TITLE/'PLOT 
     2OF ','DRAWDOWN',' ','PLOT OF ','HYDRAULI','C HEAD'/
      DATA DIGIT/'1','2','3','4','5','6','7','8','9','10','11','12','13'
     1,'14','15','16','17','18','19','20','21','22','23','24','25','26',
     2'27','28','29','30','31','32','33','34','35','36','37','38','39','
     340','41','42','43','44','45','46','47','48','49','50','51','52','5
     43','54','55','56','57','58','59','60','61','62','63','64','65','66
     5','67','68','69','70','71','72','73','74','75','76','77','78',' 79
     6','80','81','82','83','84','85','86','87','88','89','90','91','92'
     7,'93','94','95','96','97','98','99','100','101','102','103',' 104'
     8,'105','106','107','108','109','110','111','112','113','114','115'
     9,'116','117','118','119','120','121','122'/
      DATA VF1/'(1H ',',',' ',    ','A1,F','10.2',')'/
      DATA VF2/'(1H ',',',' ',    ','A1,1','X,A8',')'/
      DATA VF3/'(1H0',',',' ',    ','A1,F','3.1,','12F1','0.2)'/
C     ******************************************************************
      END
```

ATTACHMENT B: DATA-DECK INSTRUCTIONS

The data deck supplies input to a FORTRAN program tailored specifically to the hydrogeologic system conceptualized for the well-field areas near Tampa. Instructions for assembling the data deck have been modified from those presented in Trescott (1975). The modifications pertain mainly to setting up the deck to accommodate the HCF condition in the Floridan aquifer (layer 1), ET-runoff from the water table in the surficial aquifer (layer 2), and the addition of an acceleration parameter BETA. Additionally, the instructions have been modified to produce maps that were not available in the original model. These include maps of head difference between the water table and potentiometric surface, recharge rate to the water table, ET-runoff rate from the water table, leakage rate through the upper confining bed, and the distribution of pumpage. All data-deck modifications are denoted by an asterisk.

ATTACHMENT B: DATA-DECK INSTRUCTIONS

[modified from Trescott (1975); * denotes modification]

Group I: Title, Simulation Options, and Problem Dimensions

This group of cards that are read by the main program contain data required to dimension the model. To specify an option on card 4, punch the characters underlined in the definition. For an option not used, that section of card 4 can be left blank.

Note: Default typing of variables applies for all data input.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
1	1-80	20A4	HEADING	Any title the user wishes to print on one line at the start of output.
2	1-52	13A4	do.	
3	1-10	I10	IO	Number of rows.
	11-20	I10	JO	Number of columns.
	21-30	I10	KO	Number of layers.
	31-40	I10	ITMAX	Maximum number or iterations per time step.
	41-50	I10	NCH	Number of constant head nodes.
4	1-4	A4	IDRAW	DRAW to print drawdown.
	6-9	A4	IHEAD	HEAD to print hydraulic head.
	11-14	A4	IFLOW	MASS to compute a mass balance.
	16-18	A3	IDK1	DK1 to read initial head, elapsed time, and mass balance parameters from unit 4 on disk.
	21-23	A3	IDK2	DK2 to write computed head, elapsed time, and mass balance parameters on unit 4 (disk).
	26-29	A4	IWATER	WATE if the upper hydrologic unit is unconfined.
	31-34	A4	IQRE	RECH for a constant recharge that may be a function of space.
	36-39	A4	IPU1	PUN1 to read initial head, elapsed time, and mass balance parameters from cards.
	41-44	A4	IPU2	PUN2 to punch computed head, elapsed time, and mass balance parameters on cards.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
4	46-49	A4	ITK	ITKR to read the value of TK(I,J,K) for simulations in which confining layers are not represented by layers of nodes. TK(I,J,K) = K_{zz}/b.
	51-54	A4	IEQN	EQN3 if equation 3 is being solved; otherwise it is assumed that equation 4 is being solved. Leave blank for Q-3-D.

Group II: Scalar Parameters

The parameters required in every problem are underlined. The other parameters are required as noted; when not required, their location on the card can be left blank. The G format is used to read E, F, and I format data. Minimize mistakes by always right-justifying data in the field. If F format data do not contain significant figures to the right of the decimal point, the decimal point can be omitted.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
1	1-10	G10.0	NPER	Number of pumping periods for the simulation.
	11-20	G10.0	KTH	Number of time steps between printouts.

Note: To print only the results for the final time step in a pumping period, make KTH greater than the expected number of time steps. The program always prints the results for the final time step.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
	21-30	G10.0	ERR	Error criterion for closure (L).

Note: When the head change at all nodes on subsequent iterations is less than this value (for example, 0.01 foot), the program has converged to a solution for the time step.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
	31-40	G10.0	LENGTH	Number of iteration parameters.
	*41-50	G10.0	BETA	Acceleration parameter: probable range is 0.5 to 1.5; less than 1 if diverging; greater than 1 if converging too slowly.
2	1-7	G10.0	XSCALE	Factor to convert model length unit to unit used in X direction on maps (for example, to convert from feet to miles, XSCALE = 5,280). For no maps, card 2 is blank.
	*8-14	G10.0	YSCALE	Factor to convert model length unit to unit used in Y direction on maps.
	*15-21	G10.0	DINCH	Number of map units per inch.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
2	*22-24	G3.0	FACT1	Factor to adjust value of drawdown printed.†
	*25-28	4I1	LEVEL1	Layers for which drawdown maps are to be printed. List the layers starting in column 41; the first zero entry terminates the printing of drawdown maps.
	*29-31	G3.0	FACT2	Factor to adjust value of head printed.
	*32-35	4I1	LEVEL2	Layers for which head maps are to be printed.
	*36-38	G3.0	FACT3	Factor to adjust value of head difference printed.
	*39-42	4I1	LEVEL3	If map of head difference between water table and potentiometric surface is desired, put a 1 in column 39.
	*43-45	G3.0	FACT 4	Factor to adjust value of recharge rate printed.
	*46-49	4I1	LEVEL4	Layers for which maps of recharge rate are to be printed.
	*50-52	G3.0	FACT5	Factor to adjust value of ET-runoff rate printed.
	*53-56	4I1	LEVEL5	Layers for which maps of ET-runoff rate are to be printed.
	*57-59	G3.0	FACT6	Factor to adjust value of leakage rate printed.
	*60-63	4I1	LEVEL6	If map of leakage rate through the upper confining bed is desired, put a 1 in column 60.
	*64-64	G3.0	FACT7	Factor to adjust value of pumping rate printed.
	*67-70	4I1	LEVEL7	Layers for which maps of pumping rate are to be printed.
	*76-80	A5	MESUR	Name of map length unit.

†Value of drawdown or head	FACT1 or FACT2	Printed value
	0.01	1
	0.1	5
52.57	1.0	53
	10.0	526
	100.0	†††

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
3	1-20	G20.10	SUM	Parameters in which elapsed time and cumulative volumes for mass balance are stored. For the start of a simulation, insert three blank cards. For continuation of a previous run using cards as input, replace the three blank cards with the first three cards of punched output from the previous run. Using data from disk for input, leave the three blank cards in the data deck.
	21-40	G20.10	SUMP	
	41-60	G20.10	PUMPT	
	61-80	G20.10	CFLUXT	
4	1-20	G20.10	QRET	
	21-40	G20.10	CHST	
	41-60	G20.10	CHDT	
	61-80	G20.10	FLUXT	
5	1-20	G20.10	STORT	
	21-40	G20.10	ETFLXT	
	41-60	G20.10	FLXNT	

Group III: Array Data

Each of the following data sets (except data set 1) consists of a parameter card and, if the data set contains variable data, a set of data cards for each layer in the model. Each parameter card contains at least five variables.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
Every parameter card	1-10	G10.0	FAC	If IVAR = 0, FAC is the value assigned to every element of the matrix for this layer.
	11-20	G10.0	IVAR	= 0 if no data cards are to be read for this layer.
				= 1 if data cards for this layer follow.
	21-30	G10.0	IPRN	= 0 if input data for this layer are to be printed.
				= 1 if input data for the layer are not to be printed.
Transmissivity parameter cards also have these variables	31-40	G10.0	FACT(K,1)	Multiplication factor for transmissivity in x direction.
	41-50	G10.0	FACT(K,2)	Multiplication factor for transmissivity in the y direction.
	51-60	G10.0	FACT(K,3)	Multiplication factor for hydraulic conductivity in the z direction. (Not used when confining bed nodes are eliminated and TK values are read.)

When data cards are included, start each row on a new card. To prepare a set of data cards for an array that is a function of space, the general procedure is to overlay the finite-difference grid on a contoured map of the parameter and record the average value of the parameter for each finite-difference block on coding forms according to the appropriate format. In general, record only significant digits and no decimal points (except for data set 2); use the multiplication factor to convert the data to their appropriate values. For example, if DELX ranges from 1000 to 15000 feet, coded values should range from 1-15; the multiplication factor (FAC) would be 1000.

DATA SET	COLUMNS	FORMAT	VARIABLE	DEFINITION
1	1-80	8F 10.4	PHI(I,J,K)	Head values for continuation of a previous run (L).

Note: For a new simulation, this data set is omitted. Do not include a parameter card with this data set.

2	1-80	8F 10.4	STRT(I,J,K)	Starting head matrix (L).

Note: Code in HCF potentiometric head in nodes just outside model-grid boundary.

3	1-80	20F 4.0	S(I,J,K)	Storage coefficient (dimensionless).

Note: This matrix is also used to locate constant head boundaries by coding a negative number at constant head nodes. At these nodes, T must be greater than zero.

4	1-80	20F 4.0	T(I,J,K)	Transmissivity (L^2/T).

Note (1): Zero values are required around the perimeter of the T matrix for each layer for reasons inherent in the computation scheme. This is done automatically by the program.

Note (2): See the previous page for the additional requirements on the parameter cards for this data set.

Note (3): If the upper active layer is unconfined and PERM and BOTTOM are to be read for this layer, insert a parameter card for this layer with only the values for FACT on it.

5	1-80	20F 4.0	TK(I,J,K)	Leakance coefficient [(L/T)/L].

Note: This data set is read only if specified in the options. The number of layers of TK values = K' - 1.

6	1-80	20F 4.0	PERM(I,J)	Hydraulic conductivity (L/T) (see note 1 for data set 4).
7	1-80	20F 4.0	BOTTOM(I,J)	Altitude of bottom of water-table unit (L).

Note: Data sets 6 and 7 are required only for simulating unconfined conditions in the upper hydrologic unit.

DATA SET	COLUMNS	FORMAT	VARIABLE	DEFINITION
8	1-80	20F 4.0	QRE(I,J)	Recharge rate (L/T).
9	*1-80	20F 4.0	CSS(I,J,1)	HCF condition leakage factor for layer 1 [(L/T)/L].
10	*1-80	20F 4.0	CSS(I,J,2)	Maximum ET-runoff capture rate divided by maximum ET-runoff capture depth for layer 2 [(L/T)/L].
11	*1-80	20F 4.0	HSS(I,J,1)	HCF condition head factor for layer 1 (L).
12	*1-80	20F 4.0	HSS(I,J,2)	Altitude of the bottom of the ET-runoff capture zone for layer 2 (L).
13	*1-80	20F 4.0	HB(I,J,1)	Blank card.
14	*1-80	20F 4.0	HB(I,J,2)	Altitude of land surface (L).
15	1-80	8G10.0	DELX(J)	Grid spacing in x direction (L).
16	1-80	8G10.0	DELY(I)	Grid spacing in y direction (L).
17	1-80	8G10.0	DELZ(K)	Grid spacing in z direction (L).

Group IV: Parameters That Change with the Pumping Period

The program has two options for the simulation period:

1. To simulate a given number of time steps, set TMAX to a value larger than the expected simulation period. The program will use NUMT, CDLT, and DELT as coded.
2. To simulate a given pumping period, set NUMT larger than the number required for the simulation period (for example, 100). The program will compute the exact DELT (which will be ≤DELT coded) and NUMT to arrive exactly at TMAX on the last time step.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
1	1-10	G10.0	KP	Number of the pumping period.
	11-20	G10.0	KPM1	Number of the previous pumping period.

Note: KPM1 is currently not used.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
	21-30	G10.0	NWEL	Number of wells for this pumping period.
	31-40	G10.0	TMAX	Number of days in this pumping period.
	41-50	G10.0	NUMT	Number of time steps.
	51-60	G10.0	CDLT	Multiplying factor for DELT.

Note: 1.5 is commonly used.

CARD	COLUMNS	FORMAT	VARIABLE	DEFINITION
	61-70	G10.0	DELT	Initial time step in hours.

If NWEL = 0, the following set of cards is omitted.

DATA SET	COLUMNS	FORMAT	VARIABLE	DEFINITION
1 (NWEL cards)	1-10	G10.0	K	Layer in which well is located.
	11-20	G10.0	I	Row location of well.
	21-30	G10.0	J	Column location of well.
	31-40	G10.0	WELL(I,J,K)	Pumping rate (L^3/T), negative for a pumping well.

Note: Radius is required only for those wells, if any, where computation of drawdown at a real well radius is to be made.

ATTACHMENT C: SAMPLE INPUT DATA DECK FOR WELL-FIELD PUMPAGE FIELD PROBLEM

The sample input data deck contains 1,097 cards. Each card is keyed to the data-deck instructions (Attachment B) by group number, card number, and variable name.

There are four groups of cards in the data deck:

Group I. This group contains data that dimensions the model into a 34 x 36 array and provides several job-control options, including the HCF condition.

Group II. This group contains scalar parameters for mapping computed drawdowns, head, head difference, recharge, ET-runoff, leakage, and pumpage. It also provides tolerances for computational errors.

Group III. This group contains the data matricies, 17 of which comprise the input parameters to this model. To reduce programming time and the number of layers, a "Leakance coefficient" array replaces transmissivity, storage, and head arrays that would be necessary to represent the confining bed.

Group IV. This group controls the distribution of pumpage over the model area. The model computes the response of the hydrologic system that will result from imposing pumpage upon the system.

Normally, Groups I, II, and III remain unchanged from the calibrated model. To determine the effects of pumping stresses on the system, Group IV is the only group in which cards are changed.

```
                                 DATA SET                                                        GROUP    CARD    VARIABLE
--------------------------------------------------------------------------------------------------------------------------
NORTH TAMPA WELL-FIELD AREAS QUASI 3-DIMENSIONAL MODEL (FL-33200)                                  I        1      HEADING
PUMP ALL WELL FIELDS AT PERMITTED AVG, RECHARGE AVG                                                         2      HEADING
       34        36         2       100       118                2                                          3
DRAW HEAD MASS           WATE RECH      PUN2 ITKR                                                           4
--------------------------------------------------------------------------------------------------------------------------
        1         1       .01         5       1.0                                                  II       1
   5280   5280      2  112     112     11      12      12      11    -101        MILES                      2
                                                                                                            3
                                                                                                            4
                                                                                                            5
--------------------------------------------------------------------------------------------------------------------------
        1         1         0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0                     III       1      STRT1
    0.0       0.0       0.0       0.0       0.0       1.0000    1.8000    1.8000
    4.5000    7.5000   10.3000   13.8000   16.5000   16.8000   20.5000   21.0000
   23.5000   25.0000   26.3000   28.8000   32.2000   35.4000   37.3000   38.3000
   38.8000   39.3000   40.7000    0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       0.0       1.1220    2.4199    3.7045    5.3066
    7.4714    9.6110   12.0688   14.9592   17.7471   19.6685   22.3552   24.5231
   27.1365   29.4330   31.9078   34.4407   37.2669   39.5961   41.3204   42.7543
   43.8924   45.0906   46.8853   45.5000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       0.0       2.2808    4.3027    6.5295    9.0555
   11.3607   13.7096   16.2599   19.2500   22.1192   24.4011   26.7532   28.9848
   31.1066   33.1713   35.2421   37.4895   39.7458   41.7299   43.3786   44.7762
   45.9942   47.1705   48.2786   44.8000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       2.4721    4.6859    7.1657    9.8948   12.3771
   15.0889   17.7799   20.3723   23.5650   26.0162   28.2228   30.4461   32.4894
   34.2609   36.2294   38.1463   40.1371   42.0741   43.9216   45.5509   46.9104
   48.0859   49.0013   49.6280   46.0000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       2.3409    4.4776    7.0555   10.0687   13.0405   15.7886
   18.6854   21.5385   24.5264   27.4294   29.2934   31.4126   33.5118   35.3432
   37.1042   38.9708   40.6979   42.5333   44.4281   46.2440   47.8310   49.2634
   50.2373   50.9060   50.9223   45.5000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       2.0171    4.2780    7.0203   10.0172   13.0597   16.1540   19.2303
   22.2323   25.3678   28.4250   30.7363   32.4462   34.6951   36.4075   38.0679
   39.8598   41.6912   43.3767   45.3960   47.3008   49.0137   50.5563   51.9396
   52.8096   53.6683   54.2101   50.0000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       3.4710    6.6700    9.8800   12.9704   16.0773   19.1977   22.4315
   26.0442   29.6519   32.8732   35.6178   38.5832   41.6392   43.9904   45.8659
   47.6812   48.1006   49.2485   51.2291   52.4033   53.7686   55.2663   56.1992
   56.9279   58.2326   60.1724   58.5000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    3.4188    5.9440    9.3015   12.4800   15.7284   18.9693   22.2240   25.6107
   29.5270   33.6542   37.6325   41.4721   46.0106   49.9893   53.4604   56.0924
   57.7660   57.8860   58.3363   58.4638   59.0562   60.3093   61.5628   62.5024
   63.1993   64.7301   67.2613   67.0000
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       2.8174
    5.4236    8.8419   12.0107   15.0843   18.3667   21.7044   25.0443   28.6929
   32.7992   37.2664   41.7834   46.4954   51.4350   56.2212   60.4946   63.4203
```

65.3889	66.1097	66.4003	66.0509	66.3178	66.4870	67.4766	69.0654
70.0857	71.3811	73.9264	74.0000				
0.0	0.0	0.0	0.0	0.0	0.0	2.5557	4.8134
7.7750	11.2127	14.2871	17.3861	20.6859	24.0865	27.7298	31.5630
35.7838	40.3314	45.1505	50.1103	55.1591	60.8870	65.6291	68.8377
70.5279	71.3339	71.8012	71.9205	72.0766	71.9769	72.4435	74.1190
75.1637	76.4040	78.0899	75.8000				
0.0	0.0	0.0	0.0	0.0	2.5827	4.6102	7.1519
10.1361	13.2865	16.4124	19.5336	22.9037	26.3436	30.0541	33.8251
37.9872	42.6379	47.4972	52.3718	58.3872	64.3256	69.0997	71.8125
73.3122	74.0085	74.2927	74.5206	74.8781	75.3546	76.1022	77.9158
78.7738	79.6585	80.2615	75.0000				
0.0	0.0	0.0	1.9441	3.6872	4.8973	6.9596	9.7233
12.1639	15.0950	18.3969	21.6527	25.0167	28.5230	32.0720	35.7332
39.9276	44.7221	49.5566	54.3916	60.0450	66.4617	70.7888	73.3145
74.8631	75.2994	75.1981	75.4517	76.0714	76.9664	78.2486	79.9546
81.1722	82.1909	82.7493	77.5000				
0.0	0.0	1.6323	3.0819	4.8743	6.7765	9.0755	11.8496
14.3052	17.2527	20.5901	23.9757	27.3327	30.8145	34.3141	37.8484
41.9003	46.4999	51.2278	55.8862	61.2529	67.4320	71.5824	73.7598
74.8790	75.1523	75.0149	75.3288	76.2044	77.6481	79.6546	81.6916
83.1144	84.5128	85.4554	80.3000				
0.0	1.1564	2.4004	4.0420	5.7267	7.8054	10.1524	12.9281
15.7748	18.9597	22.4797	25.9325	29.3484	32.8547	36.3993	39.8185
43.6651	48.0487	52.5745	56.9975	61.9684	67.5879	71.5695	73.4260
73.8929	73.8105	73.5720	74.1947	75.6548	77.8235	80.5319	82.8628
84.6314	86.5430	88.7704	86.5000				
0.0	1.4301	2.8640	4.5383	6.4049	8.6287	11.3004	14.5605
17.7991	21.2513	24.7413	28.2441	31.5300	34.7653	38.0631	41.4985
45.2933	49.2721	53.5667	57.8802	62.2938	67.4630	70.9053	72.5006
72.1313	71.1739	70.3554	72.0923	74.4570	77.3626	80.7836	83.6120
85.7177	88.0883	90.9251	89.0000				
0.0	1.7967	3.4496	5.1682	7.0757	9.4541	12.5971	16.1907
19.5794	23.2147	26.8082	30.3697	33.7278	36.9147	40.0613	43.3298
46.7121	50.3300	54.2648	58.3335	62.5066	67.2659	69.9738	70.8086
69.3826	66.7925	67.6972	70.3176	73.3497	76.8754	80.8070	84.0103
86.4018	89.0173	92.0722	90.5000				
0.0	2.3959	4.2732	6.0999	7.9769	10.5366	14.1477	17.7363
21.1476	24.7928	28.5808	32.1501	35.5277	38.8042	41.9912	45.0474
48.0776	51.3559	54.9790	58.6601	62.5221	66.7818	68.7703	68.7703
66.2470	63.8277	65.3437	68.9543	72.5397	76.3468	80.6537	84.1681
86.7255	89.3011	92.2470	92.0000				
1.0000	3.3474	5.2280	6.9996	8.7149	11.3319	15.1192	18.7702
22.5025	26.3698	30.1967	33.6645	37.0320	40.4923	43.6470	46.5109
49.3430	52.3888	55.5338	58.8713	62.6125	66.3035	67.3421	65.9309
61.9696	61.3125	63.5638	67.7948	71.9595	76.0635	80.7772	84.2553
86.6817	88.9529	91.2218	90.0000				
1.5000	4.4723	6.3456	7.9328	9.5439	12.3367	15.7692	19.3570
23.1599	27.2418	31.2307	34.7536	38.1304	41.6950	44.9027	47.7648
50.5078	53.3550	56.1010	58.9833	62.3509	65.2819	65.4978	63.0638
59.3387	59.2531	62.3356	66.8163	71.2920	75.5911	80.0909	83.2971
85.5626	87.6146	89.6818	89.2000				
2.0000	5.9974	8.0049	9.0919	10.3066	12.8261	15.9067	19.4658
23.3962	27.5948	31.6445	35.3528	38.8583	42.4636	45.7300	48.6122
51.2216	53.9217	56.4323	59.0335	62.1804	64.1555	63.6123	60.9697
57.0294	57.2354	60.8200	65.2545	69.9499	74.4827	78.3553	81.1262
83.1478	84.9196	86.5944	86.0000				
2.5000	8.0564	9.7001	10.4646	10.9924	12.9349	15.8661	19.3932
23.2870	27.4438	31.5320	35.3614	39.1425	42.8549	46.0420	48.9279
51.5353	54.1277	56.5985	59.1753	61.7640	62.7251	61.5754	58.8916

54.9726	55.2165	58.6779	63.0708	67.4206	71.9373	75.5749	78.0012
79.6586	81.0709	82.2669	80.5000				
4.0000	9.6760	10.8272	11.2941	11.5929	13.0015	15.5036	18.7848
22.4616	26.6332	30.6794	34.6157	38.4657	42.2623	45.6000	48.5306
51.0536	53.7034	56.4262	59.2748	61.1561	60.9479	59.1491	56.1376
52.5955	53.3577	56.3623	60.5077	64.6538	68.7562	72.0754	74.2815
75.5736	76.4999	77.1584	73.5000				
5.0000	10.8414	11.6713	11.6755	11.6391	12.7748	14.8718	17.7637
21.1857	25.1638	29.1575	33.2124	37.1181	40.8705	44.4375	47.5082
50.1614	52.7017	55.4981	58.0191	59.2904	58.4716	55.8125	52.5229
50.2308	50.9741	53.7806	57.5772	61.4287	65.1169	68.1755	70.0578
71.0143	71.4960	71.1856	65.0000				
7.0000	11.9294	12.2326	11.7591	11.1475	11.8994	13.6551	16.1925
19.3730	23.1546	27.0973	31.1211	34.9861	38.9045	42.7333	45.8666
48.5748	50.9663	53.5684	55.5313	56.6419	54.7040	50.6153	47.6638
47.1288	48.5370	50.9995	54.5305	57.8672	61.0943	63.7837	65.4642
66.2429	66.6277	66.5074	63.0000				
7.5000	12.2216	11.8343	10.6981	9.6796	10.2344	11.7348	14.0041
17.0016	20.5671	24.4179	28.5870	32.3600	36.3556	40.1933	43.6748
46.7439	48.8514	50.9306	52.3473	52.1317	49.0551	44.3322	43.0387
43.5699	45.3549	47.8579	51.1650	54.1293	56.7614	59.1351	60.7369
61.4994	61.7693	61.6012	57.5000				
8.0000	11.8839	10.5608	8.9883	7.6679	7.9090	9.2711	11.3105
14.1752	17.5666	21.3610	25.4442	29.2532	33.1167	36.6788	40.1698
43.5430	45.5091	46.9909	47.3298	45.7842	40.8890	38.8579	38.9184
39.8614	41.5817	44.2157	47.1230	49.8392	52.0501	54.1580	55.8781
56.8567	57.4372	57.7085	55.5000				
0.0	6.0000	8.2909	6.4593	5.2286	5.3144	6.2788	8.1109
10.9565	14.2341	17.8909	21.8743	25.7218	29.2720	32.5358	35.2439
38.2188	39.7565	40.8019	40.1783	37.9302	34.5776	34.1120	34.5800
35.7287	37.5394	39.9540	42.3083	44.5827	46.8554	48.8105	51.0197
52.6170	53.7311	53.7610	52.1000				
0.0	0.0	5.0000	2.0000	2.2456	2.4136	2.9835	4.3507
7.5242	10.5532	14.1746	17.9897	21.7928	25.1241	27.7567	29.4954
31.1606	32.0668	32.7306	31.7183	30.2729	29.1524	29.2718	30.0176
31.1135	32.8903	34.9796	36.8503	39.0538	41.5374	44.1885	46.8193
49.2900	50.9118	50.6144	47.5000				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.2993	6.2350	9.9602	13.5665	17.4383	20.7176	22.6537	23.5155
23.8846	24.5619	25.4348	25.0404	25.2059	25.0431	25.4198	26.3151
27.5685	29.2432	31.3800	33.4582	35.4355	37.6346	40.9493	44.8397
48.3084	50.5981	50.7613	48.0000				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0000	6.0000	8.0000	13.0000	15.9794	16.9697	17.5723
18.0222	19.3976	21.2247	22.1963	22.6975	23.1244	23.7186	24.5720
25.8555	27.4882	29.4820	31.8385	34.2409	36.8982	40.0643	44.7213
49.4165	52.7124	53.9960	52.5000				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	8.0000	9.5000	9.5000
9.5000	13.6765	17.2694	19.9021	20.9017	21.6626	22.4127	23.2926
24.6871	26.4678	28.4933	30.7339	33.2709	36.2440	40.7141	46.5739
52.0326	56.4692	59.8533	62.0000				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	3.0000	14.1343	17.0848	18.6491	19.6669	20.5698	21.5358
22.9661	24.7715	26.9898	29.8252	32.4673	36.5822	42.5592	48.9162
55.0751	60.4073	65.6766	71.0000				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	6.0000	15.3296	16.1875	17.3397	18.2274	18.9791

20.4342	22.2253	24.4619	27.5611	30.7418	36.5833	44.1621	51.2480			
58.1165	63.5960	69.7798	80.0000							
0.0	0.0	0.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	C.0	0.0	C.0	0.C	0.0	0.0			
0.0	0.0	C.0	9.0000	10.8000	13.5C00	14.000C	13.0C00			
14.5000	16.0000	18.5000	23.5C00	25.8000	34.8C00	45.500C	52.5C00			
61.0000	65.5000	78.5000	0.0							

1	1	0								
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0	III	1	STRT2
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	C.0	0.0							
0.0	0.0	C.0	0.0	C.0	0.C	0.0	0.0			
0.0	0.0	C.0	0.0	C.0	1.C000	2.000C	5.0C00			
7.0000	17.0000	19.0000	26.0000	24.0000	24.C000	29.000C	37.0C00			
40.0000	44.0000	48.0000	50.0000	55.0000	62.C000	80.000C	85.0C00			
112.0000	124.0000	119.0000	0.0							
0.0	0.0	0.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	0.0	0.0	C.0	2.1395	4.4237	12.3800			
18.8855	21.7783	24.2757	24.2129	27.1397	34.2064	39.0091	42.9492			
45.8742	48.0625	51.7364	55.5875	59.2391	64.3691	90.1614	84.5768			
119.4221	136.6200	160.0000	0.0							
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	C.0	0.0	4.0624	6.3828	11.1572	14.4109			
17.1464	24.2238	22.5139	28.9302	29.5276	34.2693	42.6563	44.8791			
46.7117	49.4484	52.2317	56.5520	58.5968	61.3372	82.8947	88.0683			
121.4078	137.3372	155.0000	0.0							
0.0	0.0	C.0	0.0	C.0	0.C	0.0	0.C			
0.0	0.0	C.0	1.8309	4.2759	9.9429	14.4824	14.7797			
19.3152	25.3578	28.5610	32.4892	33.2539	39.7843	43.8382	45.7219			
47.4576	49.3113	51.0707	54.3632	58.7470	60.4609	67.1825	70.9293			
97.6935	127.0967	120.0000	0.0							
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0			
0.0	0.0	1.7454	5.4736	9.9167	12.6166	16.6497	22.3910			
24.4165	28.3024	32.2416	34.8883	39.0161	43.5963	45.7222	47.8C56			
47.9683	48.5231	49.0519	55.2195	57.8554	60.8502	61.9688	65.6941			
81.4763	122.0563	129.0000	0.0							
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.0			
0.0	1.0000	5.9925	12.0181	13.9789	16.8359	19.5886	25.2945			
33.2901	36.4722	37.5186	41.3883	45.0306	49.4231	48.8509	49.7363			
53.2281	55.7807	55.4356	59.8705	65.2912	67.C709	67.5293	74.9411			
88.6688	123.2551	105.0000	0.0							
0.0	0.0	C.0	0.0	0.0	0.C	0.0	0.C			
0.0	2.5428	9.8728	12.0609	16.5883	19.9364	23.8163	27.3830			
32.1059	36.1393	4C.504C	45.4681	50.2789	53.2186	57.4876	60.8362			
62.7045	63.8341	64.0522	65.7215	66.5627	69.2620	70.8719	85.9952			
113.6367	132.1765	105.000C	0.0							
0.0	0.0	C.0	0.0	0.0	0.C	C.0	0.0			
2.2885	13.2193	14.9860	15.7184	20.1512	24.C778	25.044C	31.8575			
35.1676	39.1774	44.0466	50.4961	54.9295	58.7780	64.4885	66.9467			
69.9782	70.3277	70.4622	70.8430	71.4998	71.C679	72.8966	92.0310			
107.5413	116.0314	115.0000	0.0							
0.0	0.0	C.0	0.0	0.0	0.C	0.0	1.9825			
5.0377	14.9333	15.1444	17.0711	20.6900	23.2904	30.1235	37.7476			
40.6598	42.2028	48.5319	54.3052	56.1760	63.6086	69.5614	73.7C89			
74.5114	74.8861	75.1004	75.1583	75.2329	75.1955	77.099C	88.2657			
96.2892	131.3109	124.0000	0.0							
0.0	0.0	C.0	0.0	C.0	0.C	2.42C7	3.3459			

11.0772	15.2475	17.3957	18.0419	23.1397	25.0399	32.9313	38.3578
39.6891	42.7015	48.5427	53.5405	61.8924	67.3593	73.8259	75.1159
75.8169	76.1367	76.2636	76.3690	76.5364	76.7622	78.2866	100.9196
127.9570	121.3330	119.0000	0.0				
0.0	0.0	0.0	0.0	0.0	2.5473	4.3231	14.9181
8.0777	10.2256	17.2979	19.5407	22.6807	27.4757	30.9758	35.9366
39.7753	45.9502	51.3443	57.6099	62.1395	70.4654	74.1055	75.8155
78.1191	77.7993	76.6883	76.8050	77.6162	78.0352	79.5466	93.6315
95.4395	99.9168	114.0000	0.0				
0.0	0.0	0.0	1.9641	6.3950	9.8446	12.8897	21.0934
15.5199	17.6650	22.3173	26.6471	28.5202	32.3926	36.2810	40.1527
43.0018	46.9638	53.0455	58.7627	63.1826	70.9287	75.0006	76.0194
77.0741	78.2537	76.6059	77.1715	76.7679	77.0915	79.0958	85.4853
89.0822	102.8029	109.0000	0.0				
0.0	0.0	1.7704	6.8868	4.2415	7.3800	6.7717	8.6997
9.7349	12.7401	20.4164	23.7825	27.6149	33.4723	41.1981	42.8617
43.2811	48.0885	54.0298	59.1065	63.6865	69.9473	74.9842	75.8623
75.5453	75.5059	75.3678	74.7307	75.0617	78.7748	85.0623	85.0424
91.2085	95.2055	101.0000	0.0				
0.0	1.0000	0.4119	2.3343	4.0395	5.5850	6.3136	14.7228
18.0041	23.2143	25.9731	30.9695	31.7621	32.7276	34.8707	38.7257
45.1297	47.2730	54.3871	62.1527	65.9689	70.9470	73.5057	75.8597
74.0684	72.6330	64.5998	68.1748	68.2436	72.5505	76.5290	87.7038
92.7591	95.7737	99.0000	0.0				
0.0	0.0	1.3951	1.8491	2.3328	2.5433	7.8312	17.8221
19.3860	25.6215	28.6480	34.0806	37.5779	38.9450	39.6976	44.4196
46.5809	48.5776	53.3420	61.5032	66.9616	71.3125	72.6118	74.0148
71.2903	61.3368	63.3110	66.9442	69.4590	73.2883	75.3831	81.1104
95.1288	101.0999	97.0000	0.0				
0.0	0.0	3.7279	5.9750	4.4628	5.3679	17.5390	20.3257
21.0694	24.2613	29.9903	34.7301	38.2118	40.7714	44.7309	47.9185
47.6835	48.8911	55.6016	61.3066	66.1700	70.6157	71.4920	72.8586
68.2101	57.6443	60.0931	68.2215	70.3185	72.6816	76.8829	90.1942
102.6255	101.4106	99.0000	0.0				
0.0	2.0000	4.8646	7.1538	2.0000	2.0000	17.6980	20.1455
24.6160	29.1710	33.7335	36.6269	39.1502	45.8427	48.3184	48.1452
48.1707	52.8491	57.9595	62.4641	65.6063	70.2334	70.8669	69.9148
56.8144	54.9907	58.5827	67.3251	72.6872	73.9945	92.1479	104.2982
107.1154	105.4239	114.0000	0.0				
0.0	2.0000	4.6162	6.2434	2.0000	11.4947	17.7845	20.3438
23.6950	29.5411	35.3119	38.3391	39.3650	47.0454	50.1395	51.3188
52.8537	56.7417	57.5215	63.1860	66.1127	68.7498	70.0333	66.4902
52.7388	52.9372	60.1495	69.2286	75.4799	77.7324	95.0716	105.4321
110.6195	109.8898	120.0000	0.0				
0.0	9.0000	13.9875	6.7844	2.0000	11.6051	13.8742	18.1818
23.8306	30.0494	34.9046	39.8255	41.1836	47.3091	51.8131	54.0546
53.3149	57.6443	57.5492	61.7780	65.2140	67.7809	69.1441	63.4920
48.3741	50.5894	59.9044	67.0294	76.5901	84.7986	92.4993	97.6395
105.1340	105.6854	109.0000	0.0				
0.0	49.0000	58.6524	36.8355	2.0000	6.5333	14.0124	20.5363
25.8432	30.1794	35.2852	39.8864	46.1074	53.0624	53.1795	55.6342
57.0158	58.2528	58.4167	61.7557	65.0623	66.5781	65.8822	62.6523
47.4110	48.5706	55.5706	65.1503	67.7674	79.3900	88.4607	90.3374
93.6200	96.6567	104.0000	0.0				
0.0	49.0000	43.5350	32.1407	7.8344	7.5904	12.0547	18.9016
22.1606	31.0540	35.0718	39.6477	43.3652	50.7723	53.2273	55.5158
53.8275	58.8237	62.4070	62.8723	65.3318	65.2307	63.3264	58.8755
44.1018	46.3154	52.0600	62.3110	67.1225	74.8634	81.4136	88.4521
89.5225	88.1304	101.0000	0.0				
0.0	49.0000	49.1606	13.9639	7.3482	10.6599	13.4512	17.9003

21.0539	28.7094	32.3852	38.8745	43.4606	46.0073	51.4597	54.5199
54.9672	57.8168	59.5208	61.6916	62.8236	62.3747	59.5618	53.0089
45.7084	42.7360	49.8911	57.8790	63.8879	70.0988	79.8497	83.5751
82.4198	82.3961	86.0000	0.0				
0.0	54.0000	70.9630	20.4342	8.5299	10.4499	13.1279	16.0164
19.0868	25.9761	30.7374	35.1914	37.9663	43.4526	52.2740	52.6292
51.7242	53.7371	57.4636	57.9187	62.6806	59.6627	49.1558	37.9756
39.8166	47.0149	47.5168	57.0552	59.2729	69.4380	72.0079	75.5191
72.3195	74.8482	76.0000	0.0				
0.0	69.0000	66.7597	28.6618	2.7151	8.3066	10.2089	12.4956
16.2382	21.4298	24.8187	35.3835	34.1068	43.3264	48.7567	50.5641
53.2242	51.0982	54.1718	56.9582	57.9099	54.1758	37.4753	33.0464
38.1393	44.7299	46.3650	56.1782	58.4809	63.0272	65.9295	70.0533
68.0053	68.1476	68.0000	0.0				
0.0	79.0000	52.6925	28.1670	0.0	2.1450	8.2671	9.1494
13.2678	17.0863	22.2013	30.1887	31.7567	40.4013	45.0903	50.3678
51.5836	50.0712	50.1934	52.2718	51.7562	37.4532	34.3975	35.6510
38.1237	38.4113	45.9195	51.8640	57.0779	57.8203	57.2886	60.8773
63.1500	65.4174	65.0000	0.0				
0.0	0.0	29.0000	14.0000	0.0	1.4445	2.4586	5.0468
9.4781	14.0251	17.3479	24.9217	30.4207	34.3114	43.1981	42.3358
47.8683	45.9805	45.1695	43.7856	42.1710	28.2526	29.9835	32.3328
34.8453	37.5536	43.7565	45.8669	47.2812	51.1925	53.1009	51.3182
53.1210	59.0567	59.0000	0.0				
0.0	0.0	0.0	0.0	0.0	1.0000	1.0000	3.0000
7.0991	10.8569	16.2338	21.7137	27.8633	32.4484	39.0374	38.8005
43.5766	40.8973	42.0481	39.3826	35.8364	25.2418	29.4505	31.8716
29.9730	34.1142	36.8802	36.7766	40.7852	41.7713	37.8187	39.1606
41.9464	43.7016	48.0000	0.0				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0000	6.0000	11.0000	21.0000	25.0000	32.0459	35.4954	34.2516
30.6946	26.4425	32.4146	35.4155	36.5868	22.3896	21.1017	25.7406
26.8072	27.9821	29.2793	30.5520	32.5474	30.9159	33.0659	35.9870
42.7097	46.8901	53.0000	0.0				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	32.0000	33.0000	32.0000
27.0000	20.1098	21.2599	34.6292	32.4468	26.7469	23.9052	21.6147
22.7333	21.7516	22.0514	23.9331	27.4813	28.5720	31.6648	42.4881
48.0766	57.2619	61.0000	0.0				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	19.0000	20.2980	35.1942	40.5075	37.0146	33.8891	22.2416
29.3770	38.6176	36.9429	23.7997	24.7773	27.7528	33.6329	45.4840
59.3607	67.1839	70.0000	0.0				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	14.0000	26.2130	39.9447	32.2470	32.8690	30.9915
35.2552	37.0842	38.4658	48.4286	43.3716	39.3166	40.8641	51.4803
65.2552	70.3948	76.0000	0.0				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	21.0000	22.0000	24.0000	30.0000	29.0000
34.0000	41.0000	48.0000	48.0000	34.0000	41.0000	51.0000	64.0000
70.0000	73.0000	78.0000	0.0				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0				

```
        0          0          0                                                                      III        1          S1
----------------------------------------------------------------------------------------------------------------------------
        1          1          C
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      III        1          S2
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1  0
 0  0  0  0  0  0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0 -1 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0 -1 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0 -1  0  0 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0 -1 -1 -1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0 -1 -1 -1 -1  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0 -1  0
 0  0  0  0  0  0  0  0 -1 -1 -1 -1 -1  0  0  0  0  0  0  0
```

```
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1   0
   0   0   0   0   0   0   0   0   0   0   0   0   0  -1  -1  -1  -1   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1
  -1  -1  -1  -1  -1  -1  -1  -1  -1  -1  -1  -1  -1  -1  -1   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
-----------------------------------------------------------------------------------------------------
      .01          1           0           1           1
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      III      1      T1
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0  66 100 100 100 100 175 175 175
 175 175 225 225 350 350 450 450 450 550 550 550 550 550 550   0
   0   0   0   0   0   0   0   0   0   0   0   0  66  66  66 100 100 100 100 100
 175 175 225 225 350 350 450 450 450 450 450 550 550 550 550   0
   0   0   0   0   0   0   0   0   0   0   0  66  66  66  66  66  66 100 100 100
 175 175 225 225 350 350 350 450 450 450 450 450 450 550 550   0
   0   0   0   0   0   0   0   0   0   0  66  66  66  66  66  66  66  66  66 100
 175 175 225 225 225 350 350 350 350 350 450 450 450 450 450   0
   0   0   0   0   0   0   0   0   0  66  66  66  66  66  66  66  66  66  66 100
 100 100 175 175 175 225 225 225 225 225 225 350 350 350 350   0
   0   0   0   0   0   0   0   0   0  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  65  65  81 100 100 100 175 175 175 175   0
   0   0   0   0   0   0   0   0  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  30  30  65  65  65  81 100 100 100 100   0
   0   0   0   0   0   0   0  66  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  30  30  30  30  65  81  81  81  81  81   0
   0   0   0   0   0   0  66  66  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  30  30  30  30  30  65  81  81  81  81   0
   0   0   0   0   0  66  66  66  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  30  48  48  48  48  48  81  81  81  81   0
   0   0   0  66  66  66  66  66  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  30  48  48  48  48  48  48  81  81  81   0
   0   0  66  66  66  66  66  66  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  48  48  48  48  48  48  81  81 100 100   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  45  45  45  45
  30  30  30  30  30  48  48  48  48  48  48 100 100 100 100   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  60  60  60
  45  30  30  30  30  30  48  48  48  48  48 100 100 100 100   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  60  60  60
  45  30  30  30  30  30  48  48  48  48  48 100 100 100 100   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  60  60  60
  45  30  30  30  30  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  45
  30  30  30  30  30  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60
  30  30  30  48  48  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60
  30  30  48  48  48  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60
  30  30  48  48  48  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  45  30
  30  48  48  48  48  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  45  30
  30  30  48  48  48  48  48  48  48  48  48  81  81  81  81   0
   0  66  66  66  66  66  66  66  66  66  66  66  66  66  66  66  60  60  45  30
```

```
 30  30  30  48  48  48  48  48  48  48  48  81  81  81  81   0
  0  66  66  66  66  66  66  66  66  66  66  66  66  66  60  60  60  60  45  30
 30  30  30  48  48  48  48  48  48  48  48  81  81  81 100   0
  0  66  66  66  66  66  66  66  66  66  66  66  66  66  60  45  30  30  30  30
 30  30  48  48  48  48  48  48  48  48  48  81  81 100 120   0
  0   0  66  66  66  66  66  66  66  66  66  66  66  66  60  45  30  30  30  30
 30  48  48  48  48  48  48  48  48  48  48  81 100 120 120   0
  0   0   0   0  66  66  66  66  66  66  66  66  66  66  60  45  30  30  30  30
 48  48  48  48  48  48  48  48  48  48 120 120 120 120 120   0
  0   0   0   0   0   0   0   0  66  66  66  66  66  66  66  66  66  66  66 120
120 120 120 120 120 120 120 275 275 275 120 120 120 120 120   0
  0   0   0   0   0   0   0   0   0   0   0   0   0  66  66  66  66  66  66 275
275 275 275 275 275 275 275 275 275 275 275 120 120 120 120   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  66  66 275
275 275 275 275 275 275 275 275 275 275 120 120 120 120 120   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 275 275
275 275 275 275 275 275 275 275 275 120 120 120 120 120 120   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 275
275 275 275 275 275 275 275 120 120 120 120 120 120 120 120   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
------------------------------------------------------------------------------------------------
                                 1         1                                III     1      T2
------------------------------------------------------------------------------------------------
  3.5E-10        1       0                                                  III     1      TK
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0  25  25  25  25  25  12  12  10
 10  10  10  10  10  10  10  10  10  10   2   2   2   2   2   0
  0   0   0   0   0   0   0   0   0   0   0   0  25  25  25  25  12  12  10  10
 10  10  10  10  10  10  10  10  10  10   2   2   2   2   2   0
  0   0   0   0   0   0   0   0   0   0   0  25  25  25  25  12  12  10  10  10
 10  10  10  10  10  10  10  10  10  10   2   2   2   2   2   0
  0   0   0   0   0   0   0   0   0   0  25  25  25  25  12  12  10  10  10  10
 10  12  12  12  12  12  12  12  12  12  10  10   2   2   2   0
  0   0   0   0   0   0   0   0   0  25  25  25  25  12  12  10  10  10  10  10
 10  12  12  12  12  12  12  12  12  12  12  10   2   2   2   0
  0   0   0   0   0   0   0   0   0  25  25  12  12  10  10  10  10  10  10  10
 12  12  25  25  25  25  25  25  12  10  10  10   2   2   2   0
  0   0   0   0   0   0   0   0  25  25  12  12  10  10  10  10  10  10  12  12
 25  25  25  25  25  25  25  25  25  12  10  10   2   2   2   0
  0   0   0   0   0   0   0  25  25  12  12  10  10  10  10  10  10  12  12  25
 25  25  25  25  25  25  25  25  25  25  12  10   5   2   2   0
  0   0   0   0   0   0  25  25  12  12  10  10  10  10  10  10  10  12  12  25
 25  25  25  25  25  25  25  25  25  25  12  10   5   2   2   0
  0   0   0   0   0  25  25  12  12  10  10  10  10  10  10  10  10  10  12  12
 25  25  25  25  25  25  25  25  25  25  12  10   2   2   2   0
  0   0   0  12  12  12  12  10  10  10  10  10  10  10  10  10  10  10  10  12
 12  25  25  25  25  25  25  25  25  25  12   2   2   2   2   0
  0   0  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  12
 12  25  25  25  25  25  25  12  10   5   2   2   2   2   2   0
  0  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  12
 12  25  25  25  25  25  25  12   5   5   2   2   2   2   2   0
  0  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  10  12
 12  25  25  25  25  25  25  12   5   5   2   2   2   2   2   0
  0  10  10  10  10  10  10  12  12  12  12  10  10  10  10  10  10  10  10  12
 12  25  25  25  25  25  25  12  10   5   2   2   2   2   2   0
  0  10  10  10  10  10  12  18  18  18  18  12  10  10  10  10  10  10  10  12
 12  25  25  25  25  25  25  12  10  10   5   2   2   2   2   0
  0  10  10  10  10  10  12  18  18  18  18  12  10  10  10  10  10  10  10  12
```

```
12  25  25  25  25  25  25  12  10  10   5   5   5   5   5   0
 0  10  10  10  10  10  12  18  18  18  18  12  10  10  10  10  10  10  10  12
12  25  25  25  25  25  25  12  10  10   5   5   5   5   5   0
 0  10  10  10  10  10  10  10  12  18  18  12  10  10  10  10  10  10  12  12
25  25  25  25  25  25  12  10  10  10   5   5   5   5   5   0
 0   2   2   2  10  10  10  10  12  18  18  12  10  10  10  10  10  12  12  25
25  25  25  25  25  25  12  10  10  10   5   5   5   5   5   0
 0   2   2   2  10  10  10  10  10  12  12  10  10  10  10  10  10  12  12  25
25  25  25  25  25  12  10  10  10  10   5   5   5   5   5   0
 0   2   2  10  10  10  10  10  10  10  10  10  10  10  10  10  12  12  25  25
25  25  25  25  25  12  10  10  10  10   5   5   5   5   5   0
 0   2   2  10  10  10  10  10  10  10  10  10  10  10  10  10  12  12  25  25
25  25  12  10  10  10  10  10  10   5   5   5   5   5   5   0
 0   2   2   2  10  10  10  10  10  10  10  10  10  10  10  10  12  12  25  25
25  25  12  10  10  10  10  10  10   5   5   5   5   5   5   0
 0   2   2   2  10  10  10  10  10  10  10  10  10  10  10  10  12  12  25  25
25  25  12  10  10  10  10  10  10   5   5   5   5   5   5   0
 0   0   2   2  10  10  10  10  10  10  10  10  10  10  10  10  12  12  25  25
25  12  10  10  10  10  10  10   5   5   5  10  10  10  10   0
 0   0   0   0  10  10  10  10  10  10  10  10  10  10  10  10  10  10  12  12
12  10  10  10  10  10  10  10  10   5  10  20  20  10  10   0
 0   0   0   0   0   0   0   0  10  10  10  10  10  10  10  10  10  10  10  10
10  10  10  10  10  10  10  10  10  10  20  20  20  10  10   0
 0   0   0   0   0   0   0   0   0   0   0   0   0  10  10  10  10  10  10  10
10  10  20  20  20  20  20  20  20  20  20  10  10  10  10   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  10  10  10
10  10  10  10  10  10  10  20  20  20  10  10  10  10  10   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  10  10
10  10  10  10  10  10  10  10  10  10  10  10  10  10  10   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  10
10  10  10  10  10  10  10  10  10  10  10  10  10  10  10   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
--------------------------------------------------------------------------------------------
1.2E-04          1           0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0     III     1      PERM
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   0   1   1   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   0   1   1   1   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   0   0   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   0   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1
 1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
 0   0   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1
```

```
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  0  0  0  0  1  1  1  1  1  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
------------------------------------------------------------------------------------------
          1        1        0
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.     III      1      BOTTOM
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -9.-13.-10. -8.  2. -1.  6.
 4.  4.  9. 17. 20. 24. 28. 30. 35. 42. 55. 55. 82. 94. 89.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -8. -9. -3. -1.  2.  4.  4.
 7. 14. 19. 22. 24. 26. 28. 32. 37. 44. 59. 54. 82.100.130.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -6. -9. -9. -6. -3.  4.  2.  7.
 9. 14. 21. 23. 25. 27. 29. 33. 37. 42. 54. 54. 82.100.125.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -8. -6. -6. -6. -6. -1.  4.  7. 12.
14. 20. 22. 24. 26. 28. 30. 33. 38. 40. 42. 49. 65. 90. 90.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -8. -6. -6. -9. -4.  2.  4.  8. 12. 14.
19. 24. 26. 28. 28. 28. 28. 33. 35. 40. 41. 42. 47. 85. 99.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0. -9.-10. -4. -7. -4. -1.  5. 13. 16. 17. 21.
25. 29. 30. 30. 34. 34. 36. 42. 43. 43. 43. 51. 56. 85. 75.  0.
 0.  0.  0.  0.  0.  0.  0.  0.-10. -8. -6. -9. -4. -1.  3.  7. 12. 16. 20. 25.
```

```
31. 32. 36. 42. 44. 46. 43. 43. 49. 49. 49. 66. 82. 94. 75.  0.
 0.  0.  0.  0.  0.  0.  0.-10. -8. -1. -6. -5. -1.  4.  5. 11. 15. 20. 24. 30.
35. 39. 42. 48. 48. 52. 51. 52. 53. 52. 51. 73. 70. 80. 85.  0.
 0.  0.  0.  0.  0.  0.-10. -8.-11. -1. -6. -4. -1.  2. 10. 17. 25. 27. 33. 39.
36. 44. 47. 54. 55. 55. 55. 55. 55. 57. 57. 67. 63. 94. 94.  0.
 0.  0.  0.  0.  0.-10. -8. -7. -5. -1.  1.  2.  7.  9. 17. 23. 24. 27. 33. 38.
41. 46. 54. 54. 56. 56. 56. 56. 56. 57. 58. 69. 89. 89. 89.  0.
 0.  0.  0.-10.-10. -8.-12. -1. -9. -6.  1.  3.  6. 11. 14. 20. 24. 30. 36. 43.
42. 52. 54. 56. 59. 59. 56. 56. 59. 59. 58. 64. 64. 69. 84.  0.
 0.  0.-10. -8. -9.-11. -9. -1. -1.  1.  6. 11. 12. 16. 20. 24. 27. 31. 37. 43.
47. 56. 56. 56. 59. 61. 56. 56. 55. 56. 58. 64. 64. 69. 79.  0.
 0.-10. -7. -9.-12.-14. -9. -8. -7. -4.  4.  7. 11. 17. 26. 27. 27. 32. 38. 43.
48. 49. 56. 56. 56. 56. 61. 59. 59. 64. 64. 64. 70. 74. 71.  0.
 0.-14. -9.-13.-11.-10. -5. -2.  1.  6.  9. 14. 15. 16. 18. 22. 27. 31. 38. 47.
46. 52. 53. 57. 54. 57. 53. 58. 58. 62. 60. 64. 73. 74. 79.  0.
 0.-10. -8. -8. -8. -8. -3.  1. -3.  3.  6. 12. 16. 22. 23. 28. 30. 33. 33. 40.
46. 52. 53. 55. 57. 50. 51. 56. 59. 61. 60. 60. 74. 79. 77.  0.
 0.-10.-12.-10.-12.-11.  1.  0. -2. -1.  7. 13. 16. 18. 23. 26. 26. 27. 34. 40.
45. 52. 53. 53. 53. 46. 50. 52. 53. 55. 55. 69. 79. 67. 69.  0.
 0. -8.-11.-10. -8. -8.  1. -2. -9. -5.  5.  5.  7. 25. 27. 26. 26. 31. 36. 41.
45. 51. 51. 57. 46. 44. 48. 51. 51. 52. 71. 74. 74. 74. 84.  0.
 0.-13.-10.-10. -8. -5. -4. -3.-11. -8.  1.  6.  7. 15. 28. 29. 31. 35. 36. 42.
45. 47. 51. 51. 42. 42. 48. 53. 54. 56. 76. 74. 79. 79. 90.  0.
 0. -6.-13.-10. -8. -5. -8. -4. -8. -4.  4.  8.  9. 15. 30. 32. 31. 40. 35. 40.
44. 48. 51. 47. 38. 40. 49. 50. 56. 65. 71. 76. 74. 74. 79.  0.
 0. 24. 29.  7. -8.-10. -3. -1. -5. -3.  3.  8. 15. 22. 32. 34. 36. 36. 36. 41.
44. 46. 46. 46. 36. 38. 44. 49. 47. 59. 67. 69. 73. 75. 74.  0.
 0. 24. 14.  2. -5. -9. -5. -3.  0.  0.  3.  7. 11. 20. 22. 34. 31. 37. 41. 43.
44. 45. 43. 43. 33. 36. 42. 47. 52. 55. 60. 68. 69. 69. 71.  0.
 0. 24. 19. -3. -9. -6. -3. -3. -1. -3.  2. 12. 13. 16. 21. 34. 34. 37. 39. 41.
42. 43. 45. 42. 35. 32. 40. 43. 48. 49. 59. 64. 63. 63. 66.  0.
 0. 29. 44. -1. -8. -6. -3. -5. -2.  4. -1.  4.  6. 12. 31. 33. 35. 32. 35. 35.
44. 46. 39. 28. 29. 37. 36. 41. 43. 54. 52. 56. 52. 53. 56.  0.
 0. 44. 39. -1. -7. -8. -6. -3. -5.  5.  3.  4.  2. 12. 31. 31. 32. 29. 33. 36.
37. 41. 27. 24. 28. 37. 36. 41. 43. 43. 46. 51. 48. 48. 48.  0.
 0. 54. 24. -1.-10. -7. -8. -7. -2.  1.  7. 10. 10. 20. 25. 32. 32. 29. 29. 33.
38. 27. 26. 26. 29. 28. 30. 31. 36. 38. 37. 41. 43. 46. 45.  0.
 0.  0.  4.-11.-10. -7. -6.-11. -6. -2.  1.  9.  9. 13. 23. 24. 30. 27. 25. 24.
28. 19. 20. 22. 25. 28. 28. 25. 27. 31. 38. 35. 37. 43. 44.  0.
 0.  0.  0.  0.-10. -9. -9. -7. -8. -4.  1.  2.  7. 12. 19. 19. 23. 24. 22. 19.
20. 16. 20. 22. 20. 24. 21. 21. 25. 26. 28. 28. 30. 33. 38.  0.
 0.  0.  0.  0.  0.  0.  0.  0. -8. -9. -4.  1.  5. 12. 16. 14. 15. 10. 17. 15.
21.  7. 12. 16. 17. 18. 20. 21. 23. 21. 24. 26. 29. 33. 38.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. 12. 13. 12. 12.  4.  4. 19.
12. 11.  8. 12. 13. 12. 13. 13. 19. 19. 22. 27. 28. 37. 41.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  4.  4. 14.
19. 14. 17.  6. 14. 22. 20. 14. 16. 18. 18. 29. 39. 47. 50.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. -1.  1.
17. 10.  6.  9. 14. 14. 15. 33. 28. 22. 27. 34. 45. 50. 56.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  1.
 2.  4. 10.  9. 14. 21. 28. 28. 14. 21. 31. 44. 50. 53. 58.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
-----------------------------------------------------------------------------------------------------
        0         0         0                                                    III       1        QRE1
-----------------------------------------------------------------------------------------------------
  2.90E-09        1         0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 C.0 C.0 C.0 C.0 0.0 C.0 0.0 0.0 0.0 C.0 0.0 C.0   III       1        QRE2
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 C.0 C.0 C.0 C.0 0.0 C.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 C.0 0.0 C.0 C.0 0.0 C.0 C.0 0.0 0.0 C.0 0.0 C.0
```

```
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.015.016.015.025.018.025.017.0
17.027.015.017.018.018.020.022.028.028.013.820.018.822.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.016.020.015.015.013.815.925.017.0
20.015.015.015.015.016.017.020.022.025.020.020.020.022.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.016.010.017.018.015.015.827.028.015.0
16.015.015.015.015.015.015.017.027.022.023.028.020.020.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.016.018.017.019.017.016.018.015.016.015.0
15.015.016.017.015.015.015.015.015.020.023.018.020.018.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.026.028.026.025.020.015.027.827.825.026.0
20.020.028.028.028.026.020.026.020.020.020.025.622.018.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.016.018.017.020.722.026.028.028.028.027.025.0
28.028.028.028.028.028.028.028.028.028.028.028.023.020.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.016.025.022.013.823.928.028.028.028.028.028.028.0
28.028.028.028.028.028.028.028.028.028.028.028.023.0 9.6 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.016.017.023.015.513.920.028.028.028.026.028.028.028.0
28.028.028.028.028.028.028.028.028.028.028.028.017.016.8 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.016.020.023.021.027.312.315.016.021.028.022.020.028.028.0
28.028.028.028.028.028.028.028.028.028.028.028.017.015.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.016.018.017.023.015.617.320.324.025.023.021.020.026.028.028.0
28.028.028.028.028.028.028.028.028.028.028.020.014.020.0 0.0 0.0
 0.0 0.0 0.016.028.028.015.012.121.027.728.026.928.028.028.028.026.025.027.028.0
28.028.028.028.028.028.028.028.028.028.028.020.015.015.0 0.0 0.0
 0.0 0.016.028.027.022.016.021.516.015.720.021.021.020.028.028.025.025.023.028.0
25.928.028.028.028.028.028.028.028.028.023.025.020.020.0 0.0 0.0
 0.0 0.016.016.014.916.016.024.025.028.022.528.024.021.020.020.025.023.027.028.0
26.328.027.227.427.228.016.016.018.020.025.018.022.022.0 0.0 0.0
 0.0 0.020.020.020.018.018.023.022.027.026.026.028.027.023.024.023.028.028.020.5
24.027.527.727.428.016.016.016.018.020.028.020.016.714.3 0.0 0.0
 0.0 0.016.021.015.016.024.828.021.017.027.627.425.119.020.028.023.028.024.026.0
27.027.927.526.128.015.016.028.023.026.024.719.513.614.8 0.0 0.0
 0.0 0.016.715.0 0.0 0.024.028.028.028.028.027.627.627.328.027.020.017.624.028.0
27.526.927.826.015.116.015.018.028.025.025.528.020.021.5 0.0 0.0
 0.0 0.013.920.0 0.022.027.028.028.028.027.827.627.028.028.023.027.028.028.028.0
27.027.228.026.315.016.015.022.028.022.227.225.918.020.0 0.0 0.0
 0.0 0.020.020.0 0.022.018.027.028.026.724.327.227.727.927.928.028.028.028.027.8
27.527.828.023.510.015.016.019.728.026.228.026.121.222.0 0.0 0.0
 0.0 0.018.013.8 0.015.026.028.028.027.626.827.226.727.326.828.028.028.025.028.0
27.827.826.728.010.010.015.027.827.228.027.326.027.922.0 0.0 0.0
 0.0 0.019.716.626.020.024.028.028.028.027.826.028.027.427.728.027.028.028.028.0
28.027.927.925.6 9.515.516.028.028.028.028.028.028.028.0 0.0 0.0
 0.0 0.013.622.023.928.028.028.028.028.026.227.727.227.127.728.028.028.028.027.7
27.627.227.519.210.015.016.028.027.227.228.028.026.022.0 0.0 0.0
 0.0 0.021.128.026.628.028.028.028.028.024.726.627.928.027.028.028.027.627.627.8
28.028.016.016.015.016.015.028.027.028.026.025.615.015.0 0.0 0.0
 0.0 0.021.420.018.027.027.028.028.027.224.027.823.027.527.227.828.028.028.028.0
27.827.016.016.015.016.016.928.028.025.025.027.225.014.8 0.0 0.0
 0.0 0.020.019.4 0.018.028.026.028.027.826.327.623.028.028.028.027.928.027.926.6
28.019.016.016.016.015.022.922.927.017.016.720.215.017.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.018.018.028.028.028.025.028.024.828.028.020.027.823.027.827.6
27.616.016.016.016.016.025.025.020.021.024.326.022.028.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.028.028.028.028.028.027.928.028.028.028.028.023.0
25.017.016.016.016.016.023.020.026.024.016.010.010.018.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.028.027.927.928.028.017.028.0
19.815.316.016.016.016.016.016.016.016.012.810.010.016.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.015.018.024.6
11.520.821.016.016.013.010.0 8.710.010.010.016.715.920.6 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.015.019.7
26.019.028.020.028.028.028.010.010.010.018.017.828.028.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.015.0
```

```
27.015.015.015.016.015.015.024.815.015.021.815.024.024.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
------------------------------------------------------------------------------------------------------
   1.0E-08          1         0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0      III      1      CSS1
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.752.082.082.082.081.761.761.76
1.761.761.981.982.202.202.432.432.432.630.470.470.470.470.470.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.470.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.470.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.460.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.450.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.410.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.330.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.0 0.0 0.0 0.0 1.750.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.0 0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.330.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.330.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.330.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.330.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.710.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.710.0
0.0 1.010.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.710.0
0.0 0.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.710.0
0.0 0.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.300.0
0.0 0.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.330.0
0.0 0.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.360.0
0.0 0.0 0.300.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
```

```
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.370.0
0.0 0.0 0.0 0.0 0.300.300.300.300.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.370.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.011.011.011.011.010.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.370.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.011.011.011.010.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.370.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.010.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.370.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.700.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.370.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.70
1.701.701.701.701.701.701.701.371.371.371.371.371.371.371.370.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
------------------------------------------------------------------------------------------------
  1.02E-08         0         0                                                           III        1          CSS2
------------------------------------------------------------------------------------------------
          1         1         0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0         III        1          HSS1
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0  -2   0   0  -2   0  -6  -2   2
   4  -2   4   0   1   3   5  10  20  25 -30 -36 -57 -79  53   0
   0   0   0   0   0   0   0   0   0   0   0   0  -1   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  80   0
   0   0   0   0   0   0   0   0   0   0   0  -2   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  68   0
   0   0   0   0   0   0   0   0   0   0  -2   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 -10   0
   0   0   0   0   0   0   0   0   0  -2   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  50   0
   0   0   0   0   0   0   0   0   0  -1   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 125   0
   0   0   0   0   0   0   0   0  -1   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 120   0
   0   0   0   0   0   0   0  -2   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 120   0
   0   0   0   0   0   0  -2   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 103   0
   0   0   0   0   0  -2   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  74   0
   0   0   0  -4   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  76   0
   0   0  -3   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  81   0
   0  -2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 123   0
   0  -2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 131   0
   0  -2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 135   0
   0  -2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0 131   0
   0  -1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  97   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  97   0
   0  -1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0  93   0
   0 -11   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
```

```
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  85   0
 0  -5   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  78   0
 0  -4   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  47   0
 0   6   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  67   0
 0   7   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  55   0
 0   4   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  62   0
 0   0   0 -20   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  50   0
 0   0   0   0 -20 -22 -27 -38   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  40   0
 0   0   0   0   0   0   0   0  -7  -8   0   0   6   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  41   0
 0   0   0   0   0   0   0   0   0   0   0   0   0  -3  -1  -1  -1   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  48   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 -10   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  68   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 -10   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0  85   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  -1
-1   4   3  -2   1   1   7  16  14  30  49  56  69  69 100   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
-----------------------------------------------------------------------------------------------
         1         1         0
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.    III      1      HSS2
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. -9. -7. -6.  0.  5. 15. 17. 25.
20. 25. 35. 45. 45. 55. 65. 60. 62. 60. 75. 80.140.130.120.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. -7. -4. -2. 11. 15. 20. 20. 21.
24. 30. 40. 45. 50. 60. 60. 58. 58. 64. 90. 81.140.150.190.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -1.  0.  8. 11. 14. 22. 16. 26.
25. 32. 50. 55. 60. 60. 60. 60. 58. 60. 80. 85.125.140.165.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -5. -1.  5. 10. 10. 15. 19. 22. 30.
30. 39. 51. 54. 55. 55. 55. 55. 57. 60. 70. 70. 95.130.140.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.-10. -5. -1.  5.  7. 12. 19. 20. 25. 29. 32.
37. 43. 45. 47. 47. 47. 47. 55. 60. 60. 60. 65. 77.130.165.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0. -9. -2.  5.  7. 10. 14. 22. 28. 31. 32. 36.
42. 47. 45. 45. 50. 55. 55. 61. 65. 66. 66. 74. 84.140.150.  0.
 0.  0.  0.  0.  0.  0.  0.  0.-10. -5.  5.  7. 11. 14. 17. 20. 25. 29. 34. 40.
46. 48. 53. 57. 59. 61. 61. 64. 65. 65. 66. 90.111.135. 97.  0.
 0.  0.  0.  0.  0.  0.  0. -8. -5.  8. 10. 12. 14. 17. 17. 25. 28. 32. 37. 46.
50. 53. 60. 62. 66. 66. 66. 67. 68. 67. 67.1C6.116.120.120.  0.
 0.  0.  0.  0.  0.  0.-10. -5. -1. 10. 11. 13. 15. 15. 23. 32. 35. 35. 42. 50.
49. 58. 65. 70. 70. 70. 70. 70. 70. 70. 71. 85. 94.140.140.  0.
 0.  0.  0.  0.  0.-10. -4. -4.  5. 10. 10. 14. 19. 20. 28. 32. 34. 37. 41. 46.
57. 62. 70. 70. 70. 70. 70. 70. 70. 70. 71.1C5.130.120.120.  0.
 0.  0.  0.-10.-10. -3. -2. 12.  0.  4. 12. 13. 15. 20. 24. 30. 34. 39. 44. 51.
55. 66. 69. 70. 73. 72. 70. 70. 71. 71. 72. 89. 92. 95.113.  0.
 0.  0. -9. -3. -1.  3. 10. 25. 10. 10. 15. 20. 21. 25. 29. 33. 36. 40. 46. 52.
56. 66. 70. 70. 71. 73. 70. 70. 69. 69. 71. 80. 85.1C0.110.  0.
 0.-10. -3.  0. -4.  1.  1.  1.  3.  6. 14. 17. 21. 28. 35. 36. 36. 41. 48. 52.
57. 64. 70. 70. 69. 69. 69. 67. 67. 71. 79. 78. 86. 90. 96.  0.
 0. -9. -5. -3. -1.  0.  0.  8. 11. 16. 20. 24. 25. 26. 28. 32. 38. 40. 47. 56.
60. 66. 68. 71. 68. 66. 55. 62. 62. 66. 69. 83. 87. 90. 99.  0.
 0. -9. -5. -5. -5. -5.  1. 12. 13. 19. 22. 28. 31. 32. 33. 38. 40. 40. 45. 57.
```

```
62. 67. 67. 69. 65. 52. 55. 61. 63. 67. 67. 75. 91. 98. 97.  0.
 0. -7. -1.  0. -1. -1. 12. 14. 15. 19. 23. 28. 32. 36. 40. 41. 41. 40. 49. 55.
60. 66. 66. 69. 62. 48. 51. 60. 63. 64. 69. 85.100. 98.100.  0.
 0. -6.  0.  3. -8. -6. 12. 13. 18. 23. 28. 30. 32. 40. 42. 41. 42. 48. 52. 56.
59. 66. 66. 66. 48. 44. 50. 62. 65. 66. 87.100.105.102.115.  0.
 0.  0.  0.  0. -8.  5. 11. 13. 16. 23. 30. 32. 32. 41. 44. 46. 46. 50. 50. 57.
60. 64. 66. 62. 42. 42. 54. 64. 69. 72. 90.102.110.108.115.  0.
 0. 15. 10.  0. -8.  5.  8. 10. 16. 24. 30. 34. 34. 41. 46. 48. 46. 51. 50. 55.
60. 63. 66. 59. 38. 40. 55. 62. 71. 81. 87. 93.103.103.106.  0.
 0. 50. 58. 35. -8.  0.  6. 13. 19. 24. 30. 34. 41. 49. 48. 50. 51. 52. 52. 56.
60. 62. 62. 58. 38. 40. 50. 58. 60. 74. 83. 85. 88. 93.103.  0.
 0. 50. 40. 29. -1.  0.  4. 11. 14. 25. 29. 34. 37. 46. 48. 50. 47. 53. 57. 58.
61. 61. 59. 54. 34. 39. 46. 55. 60. 69. 75. 83. 84. 82. 98.  0.
 0. 49. 48.  8. -1.  2.  5. 10. 13. 22. 26. 33. 38. 40. 46. 49. 49. 52. 55. 57.
58. 58. 55. 48. 39. 35. 44. 50. 57. 64. 74. 78. 77. 78. 85.  0.
 0. 55. 70. 15.  0.  2.  5.  8. 11. 19. 25. 29. 31. 37. 48. 47. 45. 47. 53. 52.
60. 56. 44. 30. 33. 42. 42. 50. 52. 63. 66. 70. 69. 72. 73.  0.
 0. 70. 65. 24. -5.  0.  2.  4.  8. 14. 18. 30. 28. 38. 44. 45. 48. 44. 49. 53.
55. 51. 30. 25. 32. 40. 41. 50. 52. 57. 60. 64. 62. 65. 67.  0.
 0. 78. 50. 24.-10. -5.  0.  1.  5.  9. 15. 24. 26. 35. 40. 46. 47. 44. 45. 49.
49. 29. 28. 30. 33. 33. 40. 47. 52. 54. 53. 56. 60. 62. 60.  0.
 0.  0. 29. 14.-10. -5. -4. -4.  1.  6. 10. 18. 25. 28. 39. 39. 44. 42. 41. 39.
38. 21. 24. 27. 30. 33. 38. 40. 42. 46. 47. 44. 47. 53. 52.  0.
 0.  0.  0.  0.-10. -9. -9. -6. -1.  3.  9. 15. 22. 27. 35. 34. 40. 36. 38. 36.
31. 19. 25. 28. 25. 30. 31. 31. 34. 35. 31. 31. 34. 36. 40.  0.
 0.  0.  0.  0.  0.  0.  0.  0. -3. -1.  4. 14. 19. 28. 32. 30. 25. 19. 30. 31.
35. 17. 15. 21. 22. 23. 24. 25. 27. 24. 24. 27. 36. 41. 47.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. 26. 27. 29. 25. 16. 16. 32.
33. 22. 18. 15. 16. 14. 14. 16. 20. 20. 23. 37. 43. 53. 56.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. 15. 17. 35.
40. 37. 30. 16. 23. 35. 32. 16. 16. 19. 26. 40. 54. 63. 65.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. 15. 25.
40. 40. 37. 30. 35. 37. 38. 48. 43. 36. 34. 48. 62. 67. 74.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. 19.
22. 24. 30. 29. 34. 41. 55. 50. 24. 38. 48. 60. 65. 68. 73.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
 0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
--------------------------------------------------------------------------------------------------------
         0            0            0                                                   III        1          HB1
--------------------------------------------------------------------------------------------------------
         1            1            0
                                                                                       III        1          HB2

                                                                1   3   4  10  15  25  27  35
 30  35  45  55  55  65  75  70  72  70  85  90 150 140 130
                                                                3   6   8  21  25  30  30  31
 34  40  50  55  60  70  70  68  68  74 100  91 150 160 200
                                                                9  10  18  21  24  32  26  36
 35  42  60  65  70  70  70  70  68  70  90  95 135 150 175
                                                           5   9  15  20  20  25  29  32  40
 40  49  61  64  65  65  65  65  67  70  80  80 105 140 150
                                                      5   9  15  17  22  29  30  35  39  42
 47  53  55  57  57  57  57  65  70  70  70  75  87 140 175
                                                 1   8  15  17  20  24  32  38  41  42  46
 52  57  55  55  60  65  65  71  75  76  76  84  94 150 160
                                                 5  15  17  21  24  27  30  35  39  44  50
 56  58  63  67  69  71  71  74  75  75  76 100 121 145 107
                                       2   5  18  20  22  24  27  27  35  38  42  47  56
 60  63  70  72  76  76  76  77  78  77  77 116 126 130 130
                                       5   9  20  21  23  25  25  33  42  45  45  52  60
```

```
   59   68   75   80   80   80   80   80   80   80   81   95  104  150  150
                                  6    6   15   20   20   24   29   30   38   42   44   47   51   56
   67   72   80   80   80   80   80   80   80   80   81  115  140  130  130
                             7    8   22   10   14   22   23   25   30   34   40   44   49   54   61
   65   76   79   80   83   82   80   80   81   81   82   99  102  105  123
              1    7    9   13   20   35   20   20   25   30   31   35   39   43   46   50   56   62
   66   76   80   80   81   83   80   80   79   79   81   90   95  110  120
              7   10    6   11   11   11   13   16   24   27   31   38   45   46   46   51   58   62
   67   74   80   80   79   79   79   77   77   81   89   88   96  100  106
         1    5    7    9   10   10   18   21   26   30   34   35   36   38   42   48   50   57   66
   70   76   78   81   78   76   65   72   72   76   79   93   97  100  109
         1    5    5    5    5   11   22   23   29   32   38   41   42   43   48   50   50   55   67
   72   77   77   79   75   62   65   71   73   77   77   85  101  108  107
         3    9   10    9    9   22   24   25   29   33   38   42   46   50   51   51   50   59   65
   70   76   76   80   72   58   61   70   73   74   79   95  110  108  110
         4   10   13    2    4   22   23   28   33   38   40   42   50   52   51   52   58   62   66
   69   76   76   76   58   54   60   72   75   76   97  110  115  112  125
        10   10   10    2   15   21   23   26   33   40   42   42   51   54   56   56   60   60   67
   70   74   76   72   52   52   64   74   79   82  100  112  120  118  125
        25   20   10    2   15   18   20   26   34   40   44   44   51   56   58   56   61   60   65
   70   73   76   69   49   50   65   72   81   91   97  103  113  113  116
        60   68   45    2   10   16   23   29   34   40   44   51   59   58   60   61   62   62   66
   70   72   72   68   48   50   60   68   70   84   93   95   98  103  113
        60   50   39    9   10   14   21   24   35   39   44   47   56   58   60   57   63   67   68
   71   71   69   64   45   49   56   65   70   79   85   93   94   92  108
        59   58   18    9   12   15   20   23   32   36   43   48   50   56   59   59   62   65   67
   68   68   65   58   49   45   54   60   67   74   84   88   87   88   95
    0   65   80   25   10   12   15   18   21   29   35   39   41   47   58   57   55   57   63   62
   70   66   54   40   43   52   52   60   62   73   76   80   79   82   83
        80   75   34    5   10   12   14   18   24   28   40   38   48   54   55   58   54   59   63
   65   61   40   35   42   50   51   60   62   67   70   74   72   75   77
        88   60   34    0    5   10   11   15   19   25   34   36   45   50   56   57   54   55   59
   59   39   38   40   43   43   50   57   62   64   63   66   70   72   70
             39   24    0    5    6    6   11   16   20   28   35   38   49   49   54   52   51   49
   48   31   34   37   40   43   48   50   52   56   57   54   57   63   62
                             1    1    4    9   13   19   25   32   37   45   44   50   46   48   46
   41   29   35   38   35   40   41   41   44   45   41   41   44   46   50
                                            7    9   14   24   29   38   42   40   35   29   40   41
   45   27   25   31   32   33   34   35   37   34   34   38   46   51   57
                                                                 36   37   39   35   26   26   42
   43   32   28   25   26   24   24   26   30   30   33   47   53   63   66
                                                                                     25   27   45
   50   47   40   26   33   45   42   26   26   29   36   50   64   73   75
                                                                                          25   35
   50   50   47   40   45   47   48   58   53   46   44   58   72   77   84
                                                                                               29
   32   34   40   39   44   51   65   60   34   48   58   70   75   78   83

-----------------------------------------------------------------------------------------------
    5280                                                                   III     1     DELX
-----------------------------------------------------------------------------------------------
    5280                                                                   III     1     DELY
-----------------------------------------------------------------------------------------------
       1                                                                   III     1     DELZ
-----------------------------------------------------------------------------------------------
       1        0        53        1        1        1       24            IV      1     WELL
       1        7        27    -5.43
       1        7        28    -8.22
       1        8        25    -2.74
```

1	8	26	-8.22
1	8	27	-5.48
1	8	28	-2.74
1	9	25	-2.74
1	9	26	-5.48
1	10	26	-5.48
1	12	13	-4.96
1	12	14	-2.48
1	13	13	-4.96
1	15	28	-4.65
1	15	29	-13.95
1	15	30	-4.65
1	16	28	-13.95
1	16	27	-4.65
1	16	29	-4.65
1	17	10	-5.64
1	17	11	-1.88
1	18	9	-8.46
1	18	10	-13.16
1	18	11	-9.40
1	18	12	-1.88
1	19	9	-5.64
1	19	10	-8.46
1	19	18	-3.27
1	19	19	-6.54
1	20	18	-9.81
1	20	19	-6.54
1	21	7	-2.90
1	22	7	-1.74
1	21	14	-5.12
1	22	14	-3.84
1	23	12	-6.40
1	23	13	-6.40
1	23	14	-2.56
1	24	12	-5.12
1	23	17	-7.98
1	24	17	-11.97
1	24	18	-7.98
1	27	26	-2.80
1	27	27	-1.40
1	28	26	-2.80
1	28	27	-4.20
1	28	28	-4.20
1	29	26	-1.40
1	29	27	-4.20
1	29	28	-4.20
1	29	29	-2.80
1	26	15	-3.41
1	26	16	-5.11
1	26	17	-5.11

ATTACHMENT D: SAMPLE MODEL OUTPUT FOR WELL-FIELD PUMPAGE FIELD PROBLEM

The sample model printout lists only the pumpage data because it is assumed that all other input arrays will be unchanged for predictive runs. Also listed is a mass balance for the system with helpful statistics. The distributions of drawdown, hydraulic head, head difference, recharge, evapotranspiration, leakage, and pumpage comprise a series of useful maps. In addition to the printout, the model punches cards containing drawdown and hydraulic head.

```
NORTH TAMPA WELL-FIELD AREAS QUASI 3-DIMENSIONAL MODEL (FL-33200)            PUMP ALL WELL FIELDS AT PERMITTED AVG, RECHARGE AVG

                                          NUMBER OF ROWS =   34
                                       NUMBER OF COLUMNS =   36
                                        NUMBER OF LAYERS =    2
                        MAXIMUM PERMITTED NUMBER OF ITERATIONS =  100
                                NUMBER OF CONSTANT HEAD NODES =  118

SIMULATION OPTIONS:  DRAW    HEAD    MASS                 WATE    RECH          PUN2    ITKR

                                      WORDS OF VECTOR Y USED =  50872

                                    NUMBER OF PUMPING PERIODS =    1
                                 TIME STEPS BETWEEN PRINTOUTS =    1

                                   ERROR CRITERIA FOR CLOSURE =   .1000000E-01


                                                BETA= 1.00

                     ON ALPHAMERIC MAP:
                            MULTIPLICATION FACTOR FOR X DIMENSION =   5280.000
                            MULTIPLICATION FACTOR FOR Y DIMENSION =   5280.000
                                            MAP SCALE IN UNITS OF     MILES
                                   NUMBER OF MILES    P ER INCH =   2.000000
                              MULTIPLICATION FACTOR FOR DRAWDOWN =   1.000000     PRINTED FOR LAYERS 1 2 0 0
                                  MULTIPLICATION FACTOR FOR HEAD =   1.000000     PRINTED FOR LAYERS 1 2 0 0
                                 MULT FACTOR FOR HEAD DIFFERENC =   1.000000     PRINTED FOR LAYERS 1 0 0 0
                                  MULTIPLICATION FACTOR FOR RECH =   1.000000     PRINTED FOR LAYERS 2 0 0 0
                               MULTIPLICATION FACT FOR ET-RUNOFF =   1.000000     PRINTED FOR LAYERS 2 0 0 0
                               MULTIPLICATION FACTOR FOR LEAKAGE =   1.000000     PRINTED FOR LAYERS 1 0 0 0
                               MULTIPLICATION FACTOR FOR PUMPAGE =  -10.00000     PRINTED FOR LAYERS 1 0 0 0

                                          STORAGE COEFFICIENT =   .0            FOR LAYER  1

                         DIRECTIONAL TRANSMISSIVITY MULTIPLICATION FACTORS FOR LAYER  1
                                                          X =   1.000000
                                                          Y =   1.000000
                                                          Z =   .0

                                               TRANSMISSIVITY =   .0            FOR LAYER  2

                         DIRECTIONAL TRANSMISSIVITY MULTIPLICATION FACTORS FOR LAYER  2
                                                          X =   1.000000
                                                          Y =   1.000000
                                                          Z =   .0

                                                RECHARGE RATE =   .0            FOR LAYER  1

                                          ET-RUNOFF/DEPTH     =   .1020000E-07 FOR LAYER  2

                                         LAND SURFACE         =   .0            FOR LAYER  1

                                                       DELX =   5280.000
                                                       DELY =   5280.000
                                                       DELZ =   1.000000
```

********** TO FIT MAP WITHIN 12 INCHES, DINCH REVISED TO 2.666666 **********

SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE

PUMPING PERIOD NO. 1: 1.00 DAYS

NUMBER OF TIME STEPS= 1

DELT IN HOURS = 24.000

MULTIPLIER FOR DELT = 1.000

53 WELLS

AQ	ROW	COL	CFS	MGD
1	7	27	-5.48	-3.54
1	7	28	-8.22	-5.31
1	8	25	-2.74	-1.77
1	8	26	-8.22	-5.31
1	8	27	-5.48	-3.54
1	8	28	-2.74	-1.77
1	9	25	-2.74	-1.77
1	9	26	-5.48	-3.54
1	10	26	-5.48	-3.54
1	12	13	-4.96	-3.21
1	12	14	-2.48	-1.60
1	13	13	-4.96	-3.21
1	15	28	-4.65	-3.01
1	15	29	-13.95	-9.02
1	15	30	-4.65	-3.01
1	16	28	-13.95	-9.02
1	16	27	-4.65	-3.01
1	16	29	-4.65	-3.01
1	17	10	-5.64	-3.65
1	17	11	-1.88	-1.22
1	18	9	-8.46	-5.47
1	18	10	-13.16	-8.51
1	18	11	-9.40	-6.08
1	18	12	-1.88	-1.22
1	19	9	-5.64	-3.65
1	19	10	-8.46	-5.47
1	19	18	-3.27	-2.11
1	19	19	-6.54	-4.23
1	20	18	-9.81	-6.34
1	20	19	-6.54	-4.23
1	21	7	-2.90	-1.87
1	22	7	-1.74	-1.12
1	21	14	-5.12	-3.31
1	22	14	-3.84	-2.48
1	23	12	-6.40	-4.14
1	23	13	-6.40	-4.14
1	23	14	-2.56	-1.65
1	24	12	-5.12	-3.31
1	23	17	-7.98	-5.16

1	24	17	-11.97	-7.74
1	24	18	-7.98	-5.16
1	27	26	-2.80	-1.81
1	27	27	-1.40	-0.90
1	28	26	-2.80	-1.81
1	28	27	-4.20	-2.71
1	28	28	-4.20	-2.71
1	29	26	-1.40	-0.90
1	29	27	-4.20	-2.71
1	29	28	-4.20	-2.71
1	29	29	-2.80	-1.81
1	26	15	-3.41	-2.20
1	26	16	-5.11	-3.30
1	26	17	-5.11	-3.30

```
------------------------------------------------------------
|                 TIME STEP NUMBER =        1               |
------------------------------------------------------------

     SIZE OF TIME STEP IN SECONDS=      86400.00

          TOTAL SIMULATION TIME IN SECONDS=      86400.00
                                   MINUTES=       1440.00
                                     HOURS=         24.00
                                      DAYS=          1.00
                                     YEARS=          0.00


DURATION OF CURRENT PUMPING PERIOD IN DAYS=          1.00
                                     YEARS=          0.00


CUMULATIVE MASS BALANCE:             L**3                RATES FOR THIS TIME STEP:                L**3/T
------------------------                                 -------------------------

         SOURCES:                                                              STORAGE =            0.0
         --------                                                             RECHARGE =      1506.3989
                STORAGE =             0.0                                CONSTANT FLUX =            0.0
               RECHARGE =    130152864.                                        PUMPING =      -289.7986
          CONSTANT FLUX =             0.0                                    ET-RUNOFF =      -973.0085
          CONSTANT HEAD =      7171670.00                               CONSTANT HEAD:
               LEAKAGE  =      7066848.00                                           IN =        83.0054
          TOTAL SOURCES =    144391376.                                            OUT =       -12.5743
                                                                              LEAKAGE:
         DISCHARGES:                                        FROM PREVIOUS PUMPING PERIOD =          0.0
         -----------                                                             TOTAL =      -314.0344
              ET-RUNOFF =     84067936.0
          CONSTANT HEAD =      1086423.00                                 SUM OF RATES =        -0.0117
        QUANTITY PUMPED =     25038592.0
                LEAKAGE =     34199408.0
        TOTAL DISCHARGE =    144392352.

      DISCHARGE-SOURCES =          976.00
     PER CENT DIFFERENCE =           0.00


             AVG  ABS CHG     MAX DDN       MAX RISE          AVG T (GPD/FT)        MAX T      MIN T    ACTIVE NODES
LAYER    1   3.6   11.4%    23.2 (15,29)   0.0 ( 0, 0)          624853.         3554809.    193899.       932.
LAYER    2   1.3    3.8%    14.9 ( 8,26)   0.0 ( 0, 0)            1407.            2958.       226.       814.

           AVG RECHG (IN/YR)        AVG POS RECHG    NO. POS  NODES   AVG NEG RECHG   NO.NEG NODES   MAX RECHG      MAX DISCHG
LAYER    2      25.1                     25.1             814.             0.0             0.         30.8            0.0

TIME STEP :  1
----------

ITERATIONS: 38
----------
```

DRAWDOWN IN FLORIDAN AQUIFER, FEET

																																34.67
2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	2	2	1	1	1	1	1	1	1	1	1	0	0	0	0	0	
2	2	2	2	2	2	2	2	2	3	3	3	4	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	32.00
2	2	2	2	2	2	2	2	3	3	3	4	4	4	4	4	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	
2	2	2	2	2	2	3	3	3	3	4	5	5	6	5	5	4	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	
2	2	2	2	3	3	3	3	3	3	4	6	7	9	8	6	4	3	2	2	1	1	1	1	1	2	2	2	2	2	1	1	29.33
2	2	2	3	3	4	4	3	3	3	4	7	10	16	12	8	6	4	3	2	1	1	1	2	2	2	3	3	2	2	2	1	
2	2	3	3	4	5	6	4	4	4	5	8	13	23	19	11	6	4	3	2	1	1	1	2	2	3	4	4	3	2	2	1	
2	2	3	4	5	10	10	7	5	4	5	7	11	18	22	11	6	4	3	2	1	1	2	2	3	5	7	5	3	2	2	1	26.67
2	2	3	4	5	10	15	11	7	5	4	5	7	11	14	8	5	3	2	2	1	1	2	2	4	6	8	5	3	2	2	2	
2	2	3	3	4	8	18	17	13	6	4	4	5	6	7	5	4	2	2	1	1	1	2	2	3	6	6	4	3	2	2	1	
2	2	2	3	4	6	12	12	7	4	3	3	3	3	3	3	2	2	1	1	1	1	1	2	3	3	3	3	2	2	2	1	24.00
1	2	2	2	3	3	5	5	4	3	2	2	2	2	2	2	2	1	1	1	1	1	1	2	2	2	2	2	2	2	1	1	
1	1	2	2	2	2	3	2	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	2	2	1	1	1	1	21.33
1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	5	5	4	3	3	3	2	2	1	1	1	1	1	1	1	
0	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	6	8	9	7	6	5	5	4	3	2	1	1	1	1	1	1	18.67 X DIS- TANCE IN
0	0	1	1	1	1	1	1	1	1	1	1	2	3	3	5	8	13	14	10	9	9	9	7	5	3	2	1	1	1	1		
0	0	0	0	1	1	1	1	1	1	1	2	2	3	4	5	8	12	15	12	11	13	16	12	9	5	3	2	1	1			MILES
0	0	0	0	0	1	1	1	1	2	2	2	3	3	4	5	7	9	11	11	12	17	19	14	14	7	4	2	1				16.00
0	0	0	0	0	1	1	1	2	2	3	3	3	4	4	5	7	8	9	10	12	13	14	12	13	7	4	2	1				
0	0	0	0	0	1	1	1	2	3	4	4	4	4	5	6	7	8	9	11	12	12	12	11	10	7	4	3	2				13.33
0	0	0	0	0	1	1	1	2	4	6	5	5	5	5	6	7	8	10	13	14	13	11	9	8	5	4	2	2				
0	0	0	0	0	1	1	2	2	4	7	8	6	6	6	8	9	9	10	11	12	15	11	8	6	5	3	2					
		0	0	0	1	1	1	2	3	5	5	5	6	8	10	12	11	10	10	11	13	12	8	5	4	3	2					10.67
			0	0	0	1	1	2	3	3	4	5	6	9	13	18	14	11	9	9	9	8	6	4	3	2	1					

```
  |                                                                                                   |
  |            0   0  1   1   1   2  3   3   4   6  9  15  21  18 11   8   7   7  6   4   3   3  2   1  |
  +                                                                                                   +   8.00
  |                   0   1   1   2  2   3   4   5  8  11  17  15 10   8   6   5  4   3   3   2  2   1  |
  |                       0   1   1  2   2   3   4  6   8  10   9  8   7   6   4  4   3   2   2  1      |
  |                                                                                                   |
  +                           1   1  1   2   2   3  4   5   6   6  6   6   5   4  3   2   2   1  1      +   5.33
  |                               1  1   1   2   2  3   4   4   4  4   4   4   3  2   2   1   1  1      |
  |                                  1   1   1   2  2   2   3   3  3   3   3   2  2   2   1   1  1      |
  +                                  1   1   1   1  1   2   2   2  2   2   2   2  2   1   1   1         +   2.67
  |                                                                                                   |
  |                                      1   1   1  1   1   1   1  1   2   2   1  1   1   1   1         |
  |                                          0   1  1   1   1   1  1   1   1   1  1   1   1             |
  +---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+   0.0

 0.0       2.67      5.33      8.00     10.67     13.33     16.00     18.67     21.33     24.00     26.67     29.33     32.00

                         DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES
```

EXPLANATION

R = CONSTANT HEAD BOUNDARY
*** = VALUE EXCEEDED 3 FIGURES
MULTIPLICATION FACTOR =   1.000

DRAWDOWN IN SURFICIAL AQUIFER, FEET

																																34.67
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	1	1	1	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R	
R	1	1	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R	32.00
R	0	0	1	1	1	2	2	1	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	R	
R	0	0	2	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	R	29.33
R	1	1	2	1	1	1	1	1	2	2	1	2	2	2	2	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	R	
R	1	1	1	4	5	4	2	2	2	2	2	2	3	5	3	2	1	1	0	0	0	0	0	1	0	1	1	1	1	1	R	
R	2	3	3	4	9	8	3	2	2	2	2	3	5	8	3	2	1	1	0	0	0	0	1	1	1	2	1	1	1	1	R	26.67
R	2	3	4	2	10	12	5	3	2	2	2	3	5	6	4	2	1	1	0	0	0	0	1	1	2	2	1	1	1	1	R	
R	2	3	3	1	8	15	12	7	3	2	2	2	3	3	2	2	2	1	1	0	0	0	1	1	2	2	1	1	1	1	R	
R	2	2	3	1	3	7	7	3	2	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	0	1	R	24.00
R	2	2	2	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	0	R	
R	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	R	21.33
R	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	R	
R	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	2	1	1	1	1	1	1	0	0	1	0	1	R	
R	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	2	2	2	1	1	0	0	0	0	0	R	18.67 X DIS- TANCE IN
R	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	3	4	3	3	4	4	3	2	1	1	0	0	0	R		
R	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	3	4	3	3	4	5	3	3	1	1	0	0	R			MILES
R	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	3	3	3	5	6	4	4	2	1	1	R				16.00
R	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	3	3	3	4	3	3	2	1	1	R				
R	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	3	3	3	3	3	3	2	1	1	R				13.33
R	0	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	3	3	3	3	2	2	1	1	1	R				
R	R	0	0	0	0	0	0	1	1	2	2	1	1	2	2	2	2	2	3	3	4	3	2	2	1	1	R					
		R	0	0	0	0	0	1	1	1	1	1	2	2	3	4	3	3	3	3	3	3	2	1	1	1	R					10.67
			R	0	0	0	0	0	1	1	1	1	2	3	5	9	5	4	3	3	2	2	2	1	1	1	R					

```
     |                                                                                                          |
     |        R  R 0  0  0  1 1  1  1  2 3  7 11  7 4  3  2  2 1  1  1  1 0  R                             |
     +                                                                                                          +   8.00
     |             R  0  0  0 1  1  1  1 2  4  6  6 3  2  2  1 1  1  1  1 0  R                             |
     |                                                                                                          |
     |                R  0  0 0  2  1  1 2  3  4  4 2  2  1  1 1  1  1  0 R                                 |
     |                                                                                                          |
     +                   R  0 0  0  1  1 1  2  2  2 2  2  1  1 1  1  0  0 R                                 +   5.33
     |                      R 0  0  0  1 1  1  R  1 1  1  1  1 1  0  0  0 R                                 |
     |                        R  0  0  0 1  1  R  R R  R  1  1 0  0  R  R R                                 |
     +                        R  0  0  0 0  0  0  0 1  0  0  0 0  0  0  R                                   +   2.67
     |                                                                                                          |
     |                           R  0  0 0  0  0  0 0  0  0  0 0  0  0  R                                   |
     |                              R  R R  R  R  R R  R  R  R R  R  R                                      |
     +--------+--------+--------+--------+--------+--------+--------+--------+--------+--------+--------+--------+   0.0

    0.0     2.67     5.33     8.00    10.67    13.33    16.00    18.67    21.33    24.00    26.67    29.33    32.00

                         DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES
```

EXPLANATION

R = CONSTANT HEAD BOUNDARY
*** = VALUE EXCEEDED 3 FIGURES
MULTIPLICATION FACTOR =   1.000

ALTITUDE OF POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, FEET

																																34.67
45	46	48	49	52	58	65	72	76	78	80	83	86	88	89	90	89	88	85	81	76	70	66	61	57	53	50	50	54	59	65	69	
43	45	47	49	52	56	63	69	74	77	79	81	83	84	86	86	86	86	83	80	75	71	66	61	57	53	50	50	52	56	60	63	
																																32.00
42	44	46	48	51	55	61	68	73	76	78	79	80	81	82	83	84	83	81	78	74	70	65	61	56	52	48	47	48	51	54	58	
41	43	45	47	50	54	60	66	71	75	76	77	78	78	79	80	81	81	79	76	73	69	64	60	55	50	46	43	43	45	48	51	
39	41	43	45	48	52	59	65	70	73	74	74	73	72	73	75	76	77	76	74	71	67	63	58	53	47	42	39	38	39	41	43	29.33
38	40	41	43	46	50	57	63	69	72	73	71	67	62	64	68	71	72	72	70	67	64	60	55	50	45	39	35	35	34	35	35	
35	37	39	41	43	47	53	62	68	71	71	69	63	51	55	62	65	67	67	66	63	60	56	52	47	41	35	32	31	31	31	29	
32	35	37	39	41	42	48	59	67	70	71	69	63	54	48	58	61	63	63	61	59	56	53	49	44	38	30	29	29	28	28	26	26.67
30	33	35	37	38	39	43	56	64	69	71	70	66	59	54	57	59	59	59	57	55	52	49	46	41	34	27	26	26	26	25	23	
28	31	33	36	37	40	40	49	59	68	71	71	69	65	60	59	58	57	55	54	52	50	47	43	38	32	27	25	25	24	23	21	
																																24.00
25	29	32	34	36	42	46	54	63	69	72	72	71	69	66	63	60	58	56	54	52	49	46	42	37	32	28	25	24	23	21	19	
23	27	30	33	35	42	51	58	65	69	71	72	72	71	69	67	64	62	60	58	55	51	46	41	37	32	28	24	23	22	20	18	
21	25	29	32	34	42	51	58	64	68	70	70	70	70	69	67	66	64	62	60	58	55	49	43	37	32	28	24	22	21	19	17	21.33
19	23	27	30	33	40	49	55	60	63	66	67	67	66	66	65	64	63	62	61	59	57	53	48	39	33	28	24	22	20	19	16	
17	21	25	28	31	38	45	51	54	58	59	60	61	61	60	60	59	58	57	58	58	56	54	50	44	36	29	24	22	20	18	15	
14	19	23	27	30	35	41	46	49	52	53	55	55	56	55	55	53	51	51	52	54	53	51	48	44	38	30	24	21	19	16	15	18.67 X DIS- TANCE IN
12	16	20	24	28	32	37	41	44	47	48	50	51	51	51	50	48	43	43	46	48	47	44	44	42	38	31	24	20	16	13		
9	13	17	21	25	29	33	37	39	41	43	45	46	46	46	46	44	41	38	43	42	40	35	37	37	35	29	23	18	13			MILES
																																16.00
7	11	15	18	22	25	29	32	35	36	38	40	41	42	43	43	42	41	40	40	39	33	29	33	30	31	27	22	17				
5	9	12	15	19	22	25	28	30	32	33	35	37	38	39	40	40	40	39	39	37	34	32	31	27	28	25	21	16				
4	6	10	13	16	19	21	24	26	27	28	30	32	34	35	36	37	37	37	35	34	32	31	30	26	26	24	20	15				13.33
2	4	7	10	13	15	18	20	22	23	23	25	28	30	31	32	33	33	33	30	29	27	28	27	26	24	21	18	14				
1	2	5	7	10	12	15	17	18	19	18	20	24	26	27	28	28	29	29	28	26	23	24	24	23	21	19	15					
		2	4	7	9	12	14	15	16	17	19	21	22	23	22	21	24	25	26	24	20	20	21	20	18	15	12					10.67
			2	4	6	9	11	13	14	15	16	18	18	18	15	12	17	21	23	22	20	19	19	17	15	12	9					

```
 |                                                                               |
 |         2  3  5  8 10 11 12 14 14 15 14  9  5  9 16 19 19 19 18 16 14 12  9  5   |
 +                                                                               +  8.00
 |               3  5  7  9 10 11 12 12 12 10  6  8 13 16 16 16 15 14 11  9  6  3   |
 |                  2  4  6  8  9 10 10 10 10  9 10 12 13 13 13 13 11  9  6  3      |
 |                                                                               |
 +                     2  4  6  7  8  8  8  9  9 10 10  9 10 11 11  9  7  5  2      +  5.33
 |                        2  4  5  6  6  7  7  7  8  9  9  9 10 10  8  6  4  1      |
 |                           3  4  4  5  5  6  6  7  7  8  9  9  9  8  6  4  1      |
 +                           1  2  3  3  4  4  5  6  7  8  9 10 10  9  8  5         +  2.67
 |                                                                               |
 |                              1  2  2  2  3  4  5  7  8  9 10 11 11 10  7         |
 |                                 1  1  1  2  3  4  5  7  8 10 11 11 11            |
 +---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+  0.0
0.0     2.67      5.33      8.00     10.67     13.33     16.00     18.67     21.33     24.00     26.67     29.33     32.00

                    DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES
```

EXPLANATION

R = CONSTANT HEAD BOUNDARY
*** = VALUE EXCEEDED 3 FIGURES
MULTIPLICATION FACTOR =   1.000

ALTITUDE OF WATER TABLE IN THE SURFICIAL AQUIFER, FEET

																																34.67
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	135	136	126	121	122	131	114	130	121	100	103	95	96	101	101	105	110	105	96	88	82	75	68	65	59	44	47	57	67	70	R	
R	118	120	98	81	88	113	105	96	126	95	89	91	92	95	102	107	110	105	93	89	82	72	68	63	53	42	42	48	59	65	R	32.00
R	84	88	70	65	74	84	90	88	98	93	85	85	87	81	90	104	105	97	90	88	83	75	70	61	51	39	35	42	45	51	R	
R	90	83	65	61	67	70	72	76	77	78	79	85	76	75	76	91	95	92	88	81	80	72	66	57	53	37	32	31	33	41	R	29.33
R	63	61	59	60	66	68	70	74	75	76	76	77	70	71	71	73	77	84	79	74	70	69	63	58	51	41	30	28	27	39	R	
R	59	58	58	54	61	62	69	74	75	75	75	73	65	65	68	71	74	76	67	67	64	59	58	56	47	40	32	26	24	43	R	
R	53	54	51	51	50	58	68	73	74	75	75	72	63	59	65	65	68	66	65	62	58	57	56	51	45	35	29	23	23	48	R	26.67
R	49	49	48	48	46	52	65	72	74	75	74	72	60	57	56	56	59	59	55	52	50	47	46	45	42	35	28	21	36	38	R	
R	46	47	46	47	48	49	59	68	73	76	76	73	70	58	55	53	51	49	48	46	42	47	44	38	36	33	27	21	38	36	R	
R	44	44	45	47	50	55	63	71	74	77	76	74	73	70	67	56	52	48	47	44	45	39	38	37	34	29	26	22	29	34	R	24.00
R	41	43	43	47	48	58	65	72	74	75	75	75	75	73	72	69	66	63	62	58	52	38	33	35	32	31	25	21	22	31	R	
R	38	41	42	45	48	56	63	69	73	74	74	74	73	72	71	70	69	68	65	63	59	49	37	34	30	29	21	23	34	32	R	21.33
R	34	34	39	43	49	53	58	63	67	70	71	69	70	71	70	69	68	67	66	64	62	59	53	37	28	25	22	26	36	31	R	
R	27	29	33	39	45	50	55	56	62	62	63	63	65	66	65	65	65	63	63	64	61	61	57	51	41	35	36	31	40	39	R	
R	24	29	32	35	41	45	50	54	53	57	58	59	62	61	60	61	61	59	58	60	59	56	55	51	43	39	35	34	35	26	R	18.67 X DIS- TANCE IN
R	24	22	28	32	37	40	44	48	48	51	53	54	54	52	54	56	54	54	55	60	55	53	51	48	44	41	32	21	20	R		
R	22	24	25	28	36	36	39	42	42	46	47	48	47	48	48	51	54	54	55	56	54	49	48	48	44	40	26	20	R			MILES
R	19	17	19	24	33	32	35	40	39	39	42	43	44	46	46	46	50	50	54	51	50	46	49	48	46	43	30	R				16.00
R	12	14	15	22	25	27	32	37	38	35	39	42	38	43	47	46	49	52	53	53	51	49	47	47	40	38	34	R				
R	4	11	14	17	19	24	25	30	32	30	35	40	34	38	43	47	48	49	50	50	48	49	46	42	42	38	35	R				13.33
R	2	6	10	12	17	20	24	23	24	26	31	32	31	38	39	44	45	45	50	47	43	41	41	38	33	32	31	R				
R	R	4	4	10	14	16	20	20	22	21	27	26	30	36	36	37	37	39	43	40	40	35	32	30	29	27	R					
		R	2	5	12	12	15	17	17	18	25	22	29	32	32	33	35	37	37	37	35	32	33	29	24	21	R					10.67
			R	2	6	10	15	15	17	16	21	19	24	26	25	25	30	31	32	33	30	29	23	21	17	16	R					

```
        |                                                                                                     |
        |            R  R  2 13 15 15 10 17 12 22 23 17 18 22 26 27 29 27 25 20 16 13 10  R                   |
        +                                                                                                     +  8.00
        |                  R  2  5 11  8 15  9 17 17 17 18 18 21 24 21 20 18 15 13  9  7  R                   |
        |                     R  2  3 14 19  8 14 16 17 16 17 16 19 17 17 15 12  9  5  R                      |
        |                                                                                                     |
        +                        R  2  4 12  6  5  7 16 16 16 12 12 11 12 12 10  8  2  R                      +  5.33
        |                           R  2  9  7  5  2  4  R 10 11  5  7 10 10  8  2  1  R                      |
        |                              R  6  4  4  2  4  R  R  R  R  7  7  8  2  R  R  R                      |
        +                              R  2  7  2  1  6  7  6  6 37 32 14 20 29 28  R                         +  2.67
        |                                                                                                     |
        |                                 R  2  0  1  3  5  4 14 59 43 49 71 67 53  R                         |
        |                                    R  R  R  R  R  R  R  R  R  R  R  R  R                            |
        +---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+  0.0
       0.0      2.67      5.33      8.00     10.67     13.33     16.00     18.67     21.33     24.00     26.67     29.33     32.00

                                        DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES
```

EXPLANATION

R = CONSTANT HEAD BOUNDARY
*** = VALUE EXCEEDED 3 FIGURES
MULTIPLICATION FACTOR =   1.000

HEAD DIFFERENCE *WATER TABLE MINUS POTENTIOMETRIC SURFACE* FEET

```
+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+   34.67
|                                                                                                                       |
|74 114107  71  77  47 40  43  48  41 34  26  15  11  8   9  25  32 24  23  25  16 10   7   8   6- 2   3   7  11 11   9 |
|81  90 89  77  69  66 68  45  56  44 20  21  12  11 15  15  19  24 22  17  13  12  9   7   9   6- 7 - 3   5  11 10  10 |
+70  74 74  49  31  34 53  38  23  51 17  10  11  11 13  19  23  27 24  15  15  12  7   7   7   1- 7 - 5 - 1   8 11  12 +   32.00
|44  42 43  23  15  21 24  23  16  23 17   8   7   9  2  10  23  24 18  14  15  14 11  10   6   1- 7 - 8 - 1 - 0  3  13 |
|                                                                                                                       |
+41  49 39  20  13  14 11   7   7   4  4   5  11   4  2   1  15  18 16  14  11  13  9   8   4   6- 5 - 7 - 7 - 6- 1   8 +   29.33
|24  24 19  15  14  16 12   6   5   3  3   5  10   9  7   3   2   5 12   9   7   6  9   8   7   6  2 - 5 - 7 - 7  4   6 |
|20  21 18  17  11  14  9   8   5   4  4   6  10  14 10   6   6   7  9   2   4   3  2   6   9   5  5 - 0 - 5 - 7 12   5 |
+18  18 16  12  10   9  9   9   6   4  4   7   8   9 11   7   4   5  4   3   3   1  4   7   7   7  5   1 - 6 - 5 20  22 +   26.67
|                                                                                                                       |
|18  17 14  10   9   7  9   9   7   5  4   4   6   0  3 - 1 - 2 - 0  1 - 2 - 3 - 3- 2   0   4   8  8   2 - 6  10 13  25 |
|16  15 13  10  10   9  9   9   9   5  5   5   4   5- 2 - 3 - 5 - 5- 6 - 6 - 6 - 7- 0   1 - 1   5  6   2 - 4  14 13  20 |
+15  15 12  10  10   9  9   9   8   5  5   4   3   4  4   4 - 4 - 6- 8 - 7 - 8 - 4- 6 - 4   0   2  1   1 - 2   6 13  15 +   24.00
|14  14 12  10  12   6  8   6   7   5  3   3   3   4  4   5   5   4  3   4   3   1- 9 - 9 - 2 - 1  4   1 - 2   0 10  11 |
|                                                                                                                       |
+ 8  12 12  10  11   6  5   5   5   6  4   4   4   3  3   4   4   5  6   5   5   4- 1 - 6 - 3 - 3  1 - 3   1  12 12  13 +   21.33
| 5  11  7   9  10   9  4   3   3   4  4   4   3   4  5   5   5   5  5   5   5   5  6   6 - 3 - 5- 3 - 2   5  15 13   8 |
| 7   6  4   5   7   7  5   4   1   4  3   3   3   5  6   6   6   7  6   6   6   5  7   7   7   5  6  12  10  20 21   7 |
+12   5  6   6   5   6  4   4   5   2  4   4   3   6  5   5   8  10  9   6   7   6  5   7   7   5  9  11  13  16 10   6 +   18.67
|                                                                                                                       |  X DIS-
| 7   8  3   4   4   5  3   3   4   2  3   3   3   3  2   4   8  11 11   9  12   9  9   7   6   6 11   8   1   4  1     |  TANCE IN
| 8   8  7   4   3   7  3   2   3   1  2   2   2   0  1   2   6  13 15  12  13  14 14  10  11  10 11   3   2   6         |  MILES
+ 0   8  2   1   3   8  3   3   6   3  1   3   2   2  3   4   4   9 10  14  12  17 17  16  18  15 15   8  10             +   16.00
- 0   3  2 - 1   3   3  2   4   7   6  2   4   5 - 0  4   7   7  10 12  14  16  17 17  16  20  13 12  13  16             |
|                                                                                                                       |
- 2 - 2  1   2   1   1  2   1   4   5  2   5   8 - 0  3   7  10  11 13  15  16  16 18  16  16  16 14  15  18             +   13.33
- 1 - 2- 1   0 - 0   1  2   3   1   1  3   6   4   2  6   7  11  12 12  20  19  15 13  14  13   9 10  13  18             |
- 1 - 2- 1 - 3   0   1  2   3   2   3  3   7   2   4  9   8   9   8  9  15  14  17 11   8   7   8  8  10                 |
+       - 2 - 3 - 1   3  0   2   1   1  1   7   2   7  9  10  12  11 11  11  13  16 13  12   9   6  6   9                 +   10.67
|                                                                                                                       |
|             - 2 - 2 - 0  1   4   2   3  1   5   2   6  8  10  13  13 10   9  11  10  9   5   4   2  4   2               |
```

```
 |                                                                                   |
 |         - 2 - 2- 3   5   5   3- 3   3 - 3   7  9   8 13  13  9   8 10   8  7   4   2   2  2   1          |
 +                                                                                   +    8.00
 |              - 3 - 3 - 2   2- 2   3 - 3   4  5   7 13  10  8   8  4   4  3   2   1   0  1 - 1         |
 |                                                                                   |
 |                 - 2 - 2 - 3  6   9 - 2   3  6   7  7   7  4   6  4   3  2   1 - 1 - 2- 0             |
 |                                                                                   |
 +                    - 2 - 2- 2   5 - 2 - 3- 2   7  7   6  2   3  1   1  2   0   0 - 3- 1             +    5.33
 |                       - 2- 2   4   1 - 1- 5 - 3 - 5   2  2 - 3 - 3   0  0 - 1 - 5 - 3- 0           |
 |                         - 3   2 - 0 - 1- 3 - 2 - 4 - 5- 5 - 6 - 2 - 3- 1 - 6 - 6 - 4- 1            |
 +                         - 1 - 1   4 - 1- 2   1   1 - 0- 1  28  23   4 10  19  20   9               +    2.67
 |                                                                                   |
 |                            - 1 - 0 - 2- 1   0   1 - 1   7  50  34  39 60  56  43  22                |
 |                               - 1   0- 1 - 2 - 1 - 2   4  42  41  39 43  58  68                     |
 +---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+    0.0
0.0      2.67      5.33      8.00     10.67     13.33     16.00     18.67     21.33     24.00     26.67     29.33     32.00
                              DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES
```

RATE OF RECHARGE TO SURFICIAL AQUIFER, INCHES PER YEAR

																																34.67
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	24	24	22	20	20	22	11	18	16	22	16	22	24	16	16	24	22	24	24	31	24	16	16	19	31	20	18	23	31	26	R	
R	21	22	22	22	24	25	25	19	19	15	16	22	24	18	15	22	20	23	31	31	29	16	27	16	24	11	11	17	31	26	R	32.00
R	22	22	31	20	28	31	31	31	31	22	22	27	20	22	21	31	28	29	29	31	31	28	30	22	29	11	11	18	20	16	R	
R	15	22	25	25	22	31	31	31	31	31	31	25	27	31	27	28	30	31	30	31	31	29	27	18	27	18	14	11	20	24	R	29.33
R	31	27	24	22	22	31	31	31	31	31	31	31	22	22	29	27	24	29	31	31	30	31	27	19	23	26	18	11	11	16	R	
R	31	24	30	16	22	31	31	31	31	31	31	31	20	20	25	31	31	31	30	31	30	30	31	30	22	29	18	11	11	16	R	
R	24	22	19	16	29	31	31	31	31	31	31	31	18	18	31	20	24	22	31	31	31	31	31	25	27	22	18	10	11	27	R	26.67
R	22	19	16	16	22	31	31	31	31	31	31	31	18	18	18	16	16	18	16	18	18	16	19	25	27	25	18	11	31	16	R	
R	20	18	16	16	29	31	31	31	31	31	31	31	31	18	16	18	18	16	11	17	16	18	18	16	18	18	18	14	31	16	R	
R	20	16	16	16	31	31	31	31	31	31	31	31	30	31	31	17	16	11	11	10	11	16	16	18	18	18	18	18	31	18	R	24.00
R	19	16	16	19	31	31	31	31	31	31	31	31	30	30	29	29	29	26	31	28	21	18	18	18	18	18	18	18	22	16	R	
R	16	16	16	18	31	31	31	31	31	31	31	31	30	30	30	31	31	31	29	31	30	18	18	18	18	18	18	23	31	16	R	21.33
R	30	16	16	16	22	31	31	31	31	31	31	31	31	30	31	30	30	31	31	31	30	31	30	21	18	19	17	23	21	16	R	
R	19	22	18	16	22	31	31	31	31	31	31	28	29	26	30	30	30	30	31	31	30	31	31	31	30	27	22	13	29	30	R	
R	19	19	16	16	29	27	31	31	31	31	31	31	31	22	29	31	31	31	31	31	30	31	31	29	30	25	31	27	22	16	R	18.67
R	27	27	31	18	27	30	31	31	31	31	30	25	30	31	26	26	31	31	27	31	31	30	31	31	31	31	19	20	16	R		X DIS- TANCE IN
R	20	17	30	16	31	31	31	31	22	29	27	27	25	31	31	19	31	31	31	31	31	30	31	31	25	31	31	16	R			MILES 16.00
R	27	15	17	20	31	31	31	29	24	22	29	27	27	25	25	22	30	31	31	30	31	31	31	31	31	31	31	R				
R	16	16	16	18	16	31	31	31	31	23	31	31	22	26	31	30	25	31	31	31	31	31	31	31	22	31	31	R				
R	18	16	20	19	22	29	31	31	23	25	31	31	22	25	22	31	31	31	29	30	30	30	30	31	31	31	31	R				13.33
R	16	22	19	21	27	24	31	31	18	27	31	22	23	30	21	30	31	31	30	30	30	31	30	31	31	31	31	R				
R	R	18	11	19	29	23	26	22	16	26	31	23	26	31	28	30	30	30	29	31	30	31	25	25	27	31	R					
		R	18	20	31	19	15	15	13	22	30	23	31	29	30	30	30	30	30	29	30	29	31	30	31	31	R					10.67
			R	18	29	20	24	17	30	19	31	22	25	29	30	31	31	27	29	31	29	27	26	29	27	31	R					

```
      R    R 18  27  25  23 17  30  17  31 30  19  31  31 29  30  31  31 31  30  31  31 31   R
                R  18  19  25 25  23  18  27 24  23  31  31 31  31  31  31 31  31  31  31 31   R
                    R  18  22 19  13  24  26 25  31  31  31 30  31  31  31 31  31  29  31  R

                        R  18 20  16  18  18 20  27  26  30 20  29  26  31 31  30  31  20  R
                            R 18  31  24  18 20  18   R  24 24  16  22  31 31  30  20  20  R
                               R  31  30  16 22  16   R   R  R   R  29  26 29  20   R   R  R
                               R  18  31  18 22  23  16  22 22  15  18  24 31  22  21   R

                                   R  18  18 22  18  18  15 22  20  22  15 23  23  22   R
                                       R   R  R   R   R   R  R   R   R   R  R   R   R
```

Y-axis values: 8.00, 5.33, 2.67, 0.0

X-axis values: 0.0, 2.67, 5.33, 8.00, 10.67, 13.33, 16.00, 18.67, 21.33, 24.00, 26.67, 29.33, 32.00

DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES

ET-RUNOFF FROM SURFICIAL AQUIFER, INCHES PER YEAR

																																34.67
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R									4	18	10	19	21	11	12	12	6	9	13	23	16	11	12	13	23	29	22	16	16	13	R	
																																32.00
R			10	17	17	9		7		12	15	19	21	15	9	6	1	7	21	21	20	12	23	12	23	29	24	19	20	12	R	
R	13	11	1	0	1			10		17	20	26	17	22	19	15	12	17	20	20	21	21	23	18	27	29	33	20	20	13	R	
R	0	11		5	3	16	20	20	24	25	30	22	27	30	27	17	18	20	20	24	22	23	22	16	23	25	32	30	28	25	R	29.33
R		3			0	12	10	15	20	19	27	24	16	17	25	25	18	12	19	21	22	24	22	14	19	25	24	29	31	11	R	
R	2		3				5	14	18	17	23	24	11	6	18	23	21	19	28	26	25	27	23	17	19	22	18	24	30		R	
R							2	11	17	18	20	18	3		19	13	16	17	26	27	29	26	22	16	18	16	17	25	26		R	26.67
R				2				7	15	18	16	11	17	7	20	24	18	16	20	22	21	20	18	19	16	15	15	26	17		R	
R				1					13	16	13	17	15	24	28	34	36	37	31	27	28	18	16	17	12	10	15	26	12		R	
																																24.00
R					2			4	15	15	19	20	18	19	19	30	37	38	34	37	24	25	22	17	15	16	16	22	23		R	
R				0	12	6	10	7	15	19	20	20	16	16	12	12	15	15	16	17	17	29	29	20	18	13	16	23	23	2	R	
R				0	11	13	13	14	12	18	17	17	19	19	19	16	13	9	13	14	15	18	27	23	21	16	22	20	14		R	21.33
R	15	7	1	1	8	18	20	20	19	16	17	21	17	14	15	13	14	14	14	13	14	11	10	30	26	23	19	17			R	
R	11	16	11	7	11	15	18	26	18	27	27	24	21	17	21	21	18	12	12	11	13	6	7	7	13	17	5		1		R	
R	12	11	9	10	20	20	16	15	28	24	25	26	21	14	20	18	15	17	10	9	9	14	8	7	15	11	16	9		4	R	18.67
																																X DIS- TANCE IN
R	16	25	25	12	21	24	26	24	28	27	26	21	26	29	21	15	16	14	13	11	2	1	7	11	10	13	8	19	12	R		
R	7	8	24	12	21	27	27	27	21	25	25	25	25	29	29	11	14	10	11	10	8	8	14	14	10	16	27	15	R			MILES
																																16.00
R	15	12	16	17	20	27	27	21	20	20	25	25	24	21	20	17	17	17	12	14	4	4	5	2	7	10	20	R				
R	5	13	18	13	12	28	25	21	23	20	25	23	22	20	21	21	13	14	11	10	8	8	9	4	5	14	14	R				
R	25	12	17	17	21	25	30	26	16	23	24	20	22	21	13	18	16	13	9	9	9	5	8	9	10	12	11	R				13.33
R	24	24	19	21	26	22	26	30	16	23	23	16	21	21	12	15	15	15	3	5	10	14	12	13	19	17	13	R				
R	R	19	20	18	26	21	22	20	12	23	22	20	21	19	16	19	19	18	9	13	7	16	15	16	16	20	R					
		R	26	24	26	19	13	14	12	21	20	21	21	16	15	12	12	11	12	11	9	13	13	19	23	23	R					10.67
			R	26	30	18	18	14	26	17	24	20	17	16	8		0	3	7	14	16	14	21	24	25	26	R					

```
|                                                                                                  |
|            R   R 28  19  17  18 21  26  22  22 15              7  11  15  19 21  24  28  28 29   R   |
+                                                                                                  +  8.00
|                 R  27  22  22 29  18  22  22 16   7   1   8 19  18  25  26 27  28  29  31 30   R   |
|                                                                                                  |
|                    R  26  27 10      27  22 16  13  13  15 24  23  25  26 27  30  29  33  R       |
|                                                                                                  |
+                       R  23 23   9  20  21 22  16  15  19 17  25  26  29 29  29  30  24  R       +  5.33
|                          R 20  25  23  19 26  21   R  21 21  21  26  31 30  30  26  24  R       |
|                             R  27  30  18 26  19   R   R  R   R  32  30 31  28   R   R  R       |
+                             R  18  26  19 25  21  14  22 24   7  12  21 19  18  16   R          +  2.67
|                                                                                                  |
|                                R  18  20 24  17  18  17 14   2  13   4  3   7  10   R          |
|                                   R   R  R   R   R   R  R   R   R   R  R   R   R              |
+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+  0.0
0.0      2.67      5.33      8.00     10.67     13.33     16.00     18.67     21.33     24.00     26.67     29.33     32.00
                              DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES
```

RATE OF LEAKAGE TO FLORIDAN AQUIFER, INCHES PER YEAR

																																34.67
20	30	28	19	20	12	11	11	13	11	9	7	4	3	2	2	16	21	16	15	16	10	7	5	5	8	-3	4	10	14	14	11	
21	24	24	20	18	17	18	12	15	12	5	6	3	3	4	4	12	16	15	11	8	8	6	5	6	8	-9	-4	7	15	14	13	
19	20	20	13	8	9	14	25	15	13	5	3	3	3	3	5	15	18	16	10	10	8	5	5	5	2	-18	-13	-1	11	14	16	32.00
12	11	11	31	21	27	31	31	21	31	5	2	2	2	1	3	15	16	12	9	10	10	7	7	4	2	-18	-21	-2	-0	4	18	
11	13	10	26	21	19	15	12	11	7	7	1	3	1	1	1	10	12	11	10	7	8	6	5	3	4	-7	-18	-19	-8	-1	10	29.33
32	31	25	24	22	21	18	21	16	11	12	3	7	6	5	3	3	6	16	12	10	8	6	5	5	4	2	-6	-18	-19	5	7	
26	28	24	26	17	22	31	25	17	12	14	8	7	9	13	8	7	9	11	2	5	5	3	8	12	4	6	-0	-13	-19	16	6	
23	24	22	19	16	29	31	28	20	14	13	11	13	14	18	12	6	8	5	5	4	2	5	9	9	9	7	1	-16	-15	26	29	26.67
24	22	19	17	15	22	31	31	24	15	13	15	19	0	10	-3	-8	-2	1	-3	-4	-4	-3	0	6	11	10	2	-15	14	17	33	
22	20	18	17	16	29	31	31	31	17	15	17	14	15	-6	-12	-16	-18	-20	-20	-10	-12	-0	1	-1	6	8	2	-11	18	17	27	
19	20	16	17	17	29	31	31	26	16	16	12	11	12	12	12	-13	-20	-26	-23	-26	-13	-8	-5	0	2	2	2	-5	8	17	20	24.00
18	19	16	17	19	19	25	21	23	15	12	10	11	14	14	17	16	14	11	15	11	4	-12	-12	-2	-1	5	1	-5	0	14	15	
10	16	16	16	17	20	18	18	17	18	13	13	13	11	11	12	14	18	21	17	16	15	-1	-9	-5	-4	2	-4	3	17	16	17	21.33
7	14	9	15	16	14	13	11	11	12	15	13	10	14	16	16	17	16	16	17	18	16	19	20	-9	-8	-4	-2	6	20	17	10	
9	8	6	6	10	11	16	13	5	13	4	4	4	8	10	9	9	11	18	18	20	17	25	23	23	17	10	16	13	27	28	9	
15	7	8	8	6	8	7	14	15	3	6	6	5	9	8	9	12	16	14	21	22	21	17	23	22	16	14	15	18	21	13	8	18.67
12	11	3	6	6	7	5	4	6	3	4	4	4	4	2	6	11	14	17	14	19	29	29	24	20	20	17	11	1	5	1		X DISTANCE IN
12	13	9	6	4	10	4	4	4	1	3	2	2	0	1	2	8	17	20	20	21	23	23	17	17	16	15	4	2	8			MILES
-1	12	4	1	3	10	4	4	8	4	2	4	2	3	4	5	6	12	14	18	16	27	27	26	28	23	20	11	14				16.00
-1	11	3	-1	5	4	3	5	10	8	3	6	7	-0	6	9	9	13	17	19	21	22	23	21	27	17	16	17	21				
-5	-7	5	3	1	1	3	1	5	7	2	6	10	-0	4	9	13	15	17	20	22	21	24	22	21	21	19	19	23				13.33
-5	-7	-2	0	-0	2	2	5	1	2	4	7	6	2	8	9	14	15	16	26	25	20	17	18	17	12	13	17	23				
-4	-7	-2	-9	0	2	2	4	2	4	4	9	3	6	11	11	12	11	13	20	18	23	15	10	9	11	11	13					
		-8	-8	-5	4	0	2	2	1	2	9	2	10	12	15	18	18	18	18	17	21	17	16	12	8	8	12					10.67
			-7	-8	-1	2	6	3	4	2	6	2	8	13	23	31	30	23	22	17	13	12	6	5	2	5	3					

```
      - 6 - 7-10   8   7   5- 4   4 - 4   9 14  19  31  31 22  19  15  11  9   6   3   2  2   1
+                                                                                                  +  8.00
               -10 - 9 - 3   3- 3   4 - 4   6  8  17  30  23 12  13   6   5  4   2   1   0  1 - 2
                   - 8 - 8 - 5  9  13 - 3   4  9  17  17  16  6   8   6   5  3   1 - 1 - 2- 0

                       - 7 - 6- 3   7 - 2 - 3- 2  11  11  10  3   4   1   2  2   0   0 - 4- 1
+                                                                                                  +  5.33
                           - 7- 3   5   1 - 2- 6 - 3 - 7   3  2 - 4 - 4   0  0 - 1 - 6 - 4- 1
                              - 4   3 - 1 - 1- 4 - 2 - 5 - 6- 7 - 8 - 2 - 4- 2 - 8 - 8 - 6- 2
                              - 2 - 1   5 - 2- 3   1   2 - 0- 1   7   6   5 13   5   5   2
+                                                                                                  +  2.67

                                  - 1 - 0 - 2- 2   0   1 - 1  9  13   9  10 16  15  11   6
                                      - 1   0- 2 - 2 - 1 - 2  5  11  11  10 11  15  18
+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+  0.0
0.0      2.67      5.33      8.00     10.67     13.33     16.00     18.67     21.33     24.00     26.67     29.33     32.00
```

DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES

PUMPING RATE FROM FLORIDAN AQUIFER, MGAL/D

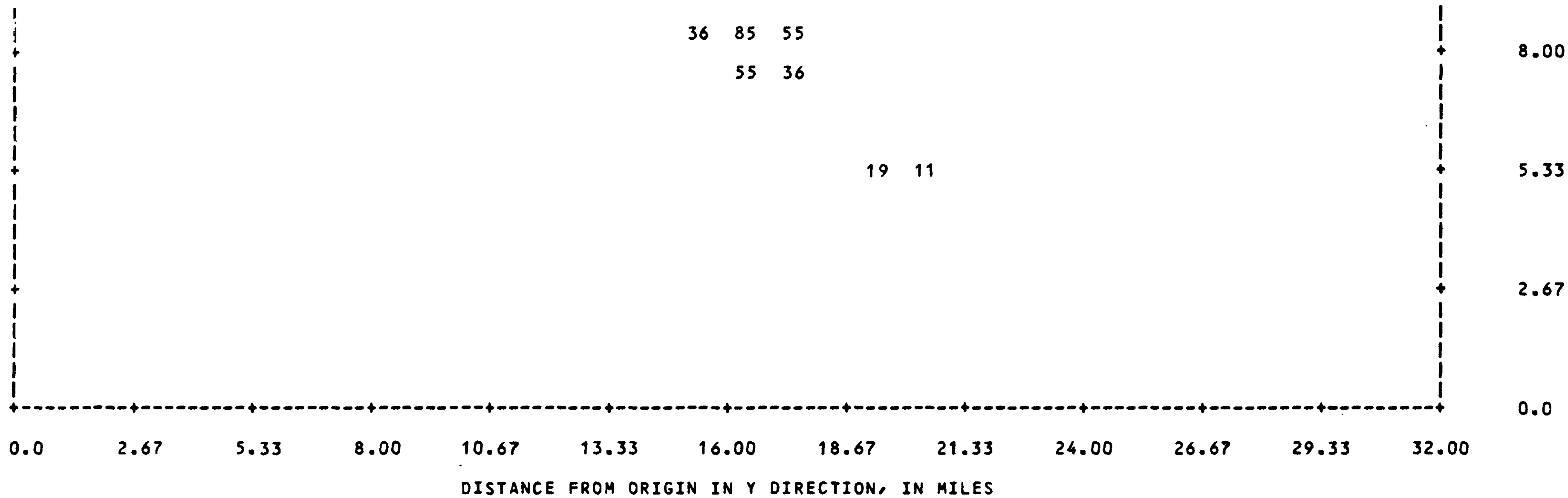
```
                                                                                                                            34.67

                                                                                                                            32.00

                                                                                                                            29.33
                                                  30
                                                  90 30                                                 18
                    53 18                         30 90                                             27   27                 26.67
                    35 35                            30                                           9 27   27
                       53  35  35                                                               18 18     9
                                                                                                                            24.00
                       18  18

                                                                                                                            21.33

                                                                                                                            18.67
                                                                                                                         X DIS-
                                                                                                                        TANCE IN
                                                                 42 42
                                                                 21 63             52                                   MILES
                                                                                                                            16.00
                                                                                52 77       33
                                                                                            33
                                                                                            22                              13.33
                                      16                                 33  25  17
                                      32  32                                     41
                                                             12                  41 33                                      10.67
                                                         12  61
```


36 85 55
55 36
19 11
8.00
5.33
2.67
0.0
0.0 2.67 5.33 8.00 10.67 13.33 16.00 18.67 21.33 24.00 26.67 29.33 32.00
DISTANCE FROM ORIGIN IN Y DIRECTION, IN MILES

DRAWDOWN, LAYER 1

1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.05	0.07	0.10	0.16	0.25
	0.35	0.49	0.69	0.91	1.16	1.42	1.67	1.83	1.94	1.96	1.95	1.94	2.00	2.00	1.96	1.92	1.89	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.09	0.12	0.17	0.23	0.32
	0.45	0.65	0.89	1.15	1.46	1.78	2.05	2.24	2.33	2.35	2.28	2.19	2.14	2.08	2.02	1.97	1.92	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.13	0.16	0.19	0.24	0.30	0.41
	0.55	0.78	1.05	1.35	1.73	2.11	2.45	2.74	2.86	2.82	2.65	2.46	2.31	2.18	2.08	2.01	1.94	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.14	0.19	0.23	0.26	0.29	0.32	0.37	0.46
	0.62	0.87	1.14	1.49	1.94	2.42	2.94	3.42	3.62	3.52	3.15	2.76	2.47	2.27	2.14	2.04	1.97	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.17	0.26	0.33	0.38	0.41	0.43	0.43	0.45	0.51
	0.65	0.85	1.13	1.55	2.08	2.71	3.58	4.49	4.98	4.88	3.98	3.16	2.62	2.34	2.19	2.07	1.98	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.28	0.43	0.55	0.62	0.64	0.63	0.59	0.55	0.55
	0.62	0.75	0.98	1.43	2.13	3.47	5.95	8.48	10.40	9.55	5.48	3.68	2.80	2.41	2.24	2.10	1.97	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.39	0.55	0.73	0.88	0.97	0.98	0.91	0.81	0.70	0.63
	0.62	0.68	0.86	1.37	2.51	5.14	11.63	18.29	15.24	10.08	5.89	3.77	2.88	2.53	2.32	2.15	1.98	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.46	0.67	0.91	1.16	1.39	1.52	1.49	1.33	1.13	0.92	0.75
	0.67	0.66	0.80	1.31	2.48	5.18	11.54	16.78	10.55	7.04	4.48	3.24	2.79	2.61	2.43	2.26	2.05	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.52	0.77	1.06	1.38	1.75	2.14	2.42	2.29	1.93	1.55	1.20	0.93
	0.77	0.69	0.76	1.14	2.02	3.83	7.25	12.67	7.34	4.99	3.66	2.97	2.78	2.69	2.57	2.41	2.19	0.0
11	0.0	0.0	0.0	0.0	0.0	0.60	0.86	1.18	1.54	1.97	2.51	3.22	3.98	3.58	2.74	2.07	1.54	1.16
	0.93	0.80	0.77	0.97	1.52	2.55	4.13	5.72	4.92	4.28	3.78	3.39	3.16	3.05	2.88	2.65	2.39	0.0
12	0.0	0.0	0.0	0.64	0.86	1.01	1.31	1.71	2.14	2.66	3.39	4.62	7.14	5.70	3.64	2.60	1.91	1.44
	1.15	0.97	0.85	0.89	1.20	1.84	2.79	3.84	4.44	4.76	4.80	4.46	4.05	3.69	3.30	2.96	2.65	0.0
13	0.0	0.0	0.58	0.80	1.08	1.40	1.83	2.38	2.87	3.44	4.14	5.25	7.51	5.33	3.86	2.94	2.26	1.78
	1.46	1.21	1.00	0.90	1.10	1.62	2.59	3.93	5.30	6.82	7.51	6.85	5.56	4.57	3.82	3.28	2.90	0.0
14	0.0	0.48	0.70	0.99	1.36	1.84	2.44	3.14	3.85	4.47	4.92	5.31	5.65	4.81	3.93	3.24	2.69	2.26
	1.91	1.60	1.28	1.03	1.13	1.65	2.83	4.75	7.46	10.88	12.73	10.44	7.27	5.25	4.25	3.53	3.06	0.0
15	0.0	0.54	0.83	1.20	1.70	2.36	3.21	4.25	5.34	6.16	6.30	6.02	5.58	4.87	4.20	3.68	3.27	2.92
	2.56	2.14	1.70	1.26	1.24	1.76	3.10	5.92	10.95	18.38	23.20	15.81	8.80	5.65	4.41	3.60	3.08	0.0
16	0.0	0.61	0.96	1.42	2.06	2.94	4.16	5.76	7.69	9.21	8.79	7.55	6.38	5.44	4.78	4.36	4.09	3.86
	3.47	2.86	2.18	1.52	1.36	1.83	3.25	6.61	13.84	22.00	18.84	12.47	7.89	5.37	4.23	3.45	2.94	0.0
17	0.0	0.69	1.10	1.63	2.39	3.51	5.17	7.66	11.42	15.36	13.19	9.86	7.65	6.34	5.64	5.36	5.37	5.42
	5.00	3.96	2.83	1.83	1.45	1.74	2.87	5.02	8.25	11.39	10.87	8.43	6.12	4.60	3.71	3.04	2.57	0.0
18	0.0	0.77	1.21	1.80	2.63	3.93	6.01	9.55	16.85	21.34	18.08	12.26	8.87	7.34	6.68	6.65	7.17	7.98
	7.78	5.80	3.67	2.12	1.50	1.55	2.26	3.59	5.01	6.40	6.46	5.55	4.47	3.61	3.00	2.48	2.01	0.0
19	0.0	0.85	1.31	1.92	2.78	4.14	6.15	9.25	15.04	17.86	13.79	10.95	9.18	8.29	7.85	8.11	9.40	12.30
	12.74	8.08	4.68	2.41	1.53	1.43	1.79	2.47	3.16	3.85	4.00	3.68	3.21	2.76	2.37	1.98	1.60	0.0
20	0.0	0.97	1.42	2.00	2.83	4.16	5.98	7.79	10.12	11.28	10.56	9.92	9.63	9.70	9.17	9.43	11.04	15.49

	13.83	8.53	4.72	2.38	1.49	1.28	1.40	1.76	2.16	2.51	2.62	2.52	2.33	2.11	1.86	1.58	1.28	0.0
21	0.0	1.19	1.54	2.06	2.80	4.15	6.46	6.66	7.63	8.44	9.00	9.79	10.76	12.77	10.72	10.43	11.07	11.62
	10.14	7.15	4.11	2.15	1.39	1.15	1.16	1.34	1.59	1.78	1.85	1.82	1.75	1.64	1.48	1.28	1.06	0.0
22	0.0	1.24	1.53	1.96	2.58	3.65	5.36	5.51	6.24	7.26	8.69	10.70	12.05	13.56	11.69	11.64	12.42	11.21
	8.86	5.75	3.22	1.89	1.31	1.09	1.08	1.20	1.35	1.44	1.46	1.44	1.40	1.33	1.22	1.08	0.94	0.0
23	0.0	1.20	1.43	1.73	2.20	2.90	3.78	4.39	5.24	6.57	8.88	13.47	14.50	13.39	12.14	13.29	17.07	13.09
	8.76	5.19	2.87	1.70	1.24	1.12	1.14	1.27	1.36	1.38	1.35	1.29	1.22	1.15	1.05	0.93	0.82	0.0
24	0.0	1.12	1.29	1.50	1.83	2.30	2.88	3.50	4.35	5.64	7.77	11.57	11.01	10.95	11.54	13.76	19.47	16.32
	9.14	4.93	2.63	1.61	1.30	1.30	1.42	1.58	1.64	1.59	1.46	1.34	1.18	1.06	0.95	0.83	0.73	0.0
25	0.0	1.03	1.17	1.32	1.52	1.84	2.26	2.78	3.48	4.48	5.86	7.54	8.23	9.05	10.55	12.46	13.86	11.52
	7.34	4.08	2.26	1.51	1.40	1.57	1.88	2.22	2.29	2.10	1.80	1.53	1.25	1.05	0.90	0.77	0.66	0.0
26	0.0	0.96	1.05	1.15	1.25	1.48	1.79	2.18	2.71	3.41	4.31	5.32	6.23	7.54	10.45	13.21	13.93	8.55
	5.07	2.94	1.82	1.42	1.54	1.91	2.58	3.47	3.56	3.04	2.39	1.85	1.40	1.09	0.89	0.72	0.61	0.0
27	0.0	0.0	0.95	1.00	1.05	1.20	1.42	1.70	2.06	2.53	3.11	3.78	4.50	5.41	6.60	7.45	7.07	5.07
	3.21	2.06	1.47	1.41	1.64	2.23	3.45	6.04	5.97	4.58	3.22	2.26	1.60	1.16	0.89	0.69	0.53	0.0
28	0.0	0.0	0.0	0.0	0.89	0.99	1.14	1.33	1.52	1.81	2.18	2.61	3.10	3.63	4.08	4.18	3.70	2.87
	2.05	1.50	1.30	1.36	1.63	2.24	3.50	6.33	7.71	6.79	3.91	2.57	1.75	1.28	0.93	0.70	0.50	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.06	1.20	1.42	1.69	1.99	2.34	2.51	2.42	2.09	1.75
	1.42	1.22	1.21	1.32	1.57	2.02	2.80	4.14	5.22	4.70	3.78	2.76	1.96	1.36	0.96	0.69	0.49	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.51	1.54	1.48	1.34	1.22
	1.12	1.09	1.15	1.26	1.46	1.78	2.23	2.78	3.20	3.28	2.90	2.37	1.88	1.37	0.95	0.66	0.46	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.82
	0.88	0.98	1.05	1.18	1.34	1.58	1.88	2.20	2.43	2.47	2.30	2.04	1.63	1.18	0.84	0.60	0.42	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.74	0.85	0.94	1.05	1.19	1.36	1.57	1.77	1.91	1.98	1.89	1.63	1.26	0.95	0.70	0.51	0.37	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.75	0.80	0.89	1.00	1.14	1.29	1.42	1.51	1.49	1.39	1.16	0.92	0.71	0.53	0.40	0.32	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DRAWDOWN, LAYER 2

1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.06	0.08	0.07	0.09
	0.11	0.17	0.23	0.30	1.42	1.74	2.00	2.20	2.28	2.25	0.59	1.06	0.14	0.16	1.29	1.21	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.08	0.09	0.07	0.09	0.10
	0.14	0.20	0.27	0.36	1.69	2.10	2.46	2.74	2.86	2.76	0.94	0.64	0.16	0.17	1.28	1.29	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.11	0.12	0.09	0.09	0.10	0.12
	0.16	0.22	0.29	0.44	1.89	2.38	2.90	3.36	3.57	3.48	0.95	1.62	2.30	0.59	0.18	1.25	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.12	0.15	0.17	0.12	0.12	0.11	0.12	0.13
	0.17	0.22	0.29	0.45	0.62	0.80	1.28	1.36	1.53	4.35	3.91	1.15	0.78	0.60	0.17	1.27	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.16	0.18	0.16	0.16	0.15	0.14	0.14
	0.16	0.19	0.29	0.42	0.98	1.61	2.78	7.55	9.88	9.49	4.66	0.96	0.72	0.63	0.17	1.28	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.26	0.21	0.26	0.25	0.25	0.23	0.21	0.18	0.16
	0.18	0.20	0.40	0.64	1.16	2.38	7.26	14.92	11.61	8.02	4.07	1.11	0.76	2.42	0.19	1.26	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.31	0.27	0.34	0.36	0.39	0.38	0.34	0.29	0.23	0.22
	0.20	0.30	0.37	0.61	1.15	2.40	6.85	11.65	5.36	3.26	2.07	1.49	0.84	2.50	2.05	1.72	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.35	0.31	0.40	0.45	0.55	0.62	0.59	0.49	0.40	0.31	0.27
	0.23	0.32	0.35	0.53	0.94	1.77	3.36	6.89	3.39	2.31	1.69	1.37	0.82	0.72	0.45	1.31	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.40	0.35	0.45	0.50	0.64	0.83	1.02	0.92	0.70	0.53	0.39	0.30
	0.27	0.24	0.35	0.45	0.70	1.18	1.91	2.65	2.28	1.98	1.75	1.56	0.95	2.79	1.53	0.20	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.29	0.39	0.44	0.55	0.68	0.87	1.18	1.82	1.45	0.93	0.66	0.49	0.37
	0.30	0.28	0.25	0.41	0.56	0.85	1.29	1.77	2.05	2.19	2.21	2.05	1.17	0.27	0.24	0.19	0.0	0.0
13	0.0	0.0	0.0	0.20	0.27	0.36	0.48	2.19	0.74	0.88	1.06	1.34	1.91	1.36	0.99	0.75	0.58	0.46
	0.37	0.35	0.29	0.42	0.51	0.75	1.20	1.82	2.44	1.99	1.92	1.02	0.37	0.29	0.25	0.21	0.0	0.0
14	0.0	0.0	0.18	0.25	0.35	0.47	0.63	0.82	0.99	1.15	1.26	1.36	1.45	1.23	1.00	0.83	0.69	0.58
	0.49	0.47	0.38	0.48	0.52	0.77	1.31	2.20	3.43	3.16	1.87	1.52	0.47	0.34	0.27	0.23	0.0	0.0
15	0.0	0.0	0.21	0.31	0.43	0.60	0.82	1.09	1.37	1.57	1.61	1.54	1.43	1.25	1.08	0.94	0.84	0.75
	0.65	0.62	0.50	0.58	0.58	0.81	1.43	2.72	5.07	5.36	3.41	2.31	0.57	0.36	0.28	0.23	0.0	0.0
16	0.0	0.0	0.25	0.36	0.53	0.75	1.07	1.68	2.26	2.70	2.57	1.93	1.63	1.39	1.22	1.11	1.05	0.99
	0.89	0.83	0.64	0.70	0.63	0.84	1.49	3.07	6.38	7.52	4.80	1.83	0.52	0.35	0.27	0.22	0.0	0.0
17	0.0	0.0	0.28	0.42	0.61	0.90	1.51	2.92	4.37	6.84	5.04	2.88	1.96	1.62	1.44	1.37	1.37	1.39
	1.28	1.16	0.83	0.84	0.67	0.80	1.32	2.33	3.82	3.31	2.78	2.15	0.90	0.30	0.24	0.20	0.0	0.0
18	0.0	0.0	0.31	0.46	0.0	0.0	1.75	3.65	6.43	11.08	8.62	3.59	2.27	1.87	1.71	1.70	1.84	2.04
	1.99	1.69	1.07	0.98	0.69	0.71	1.05	2.19	2.32	1.87	1.65	1.42	0.65	0.52	0.44	0.36	0.0	0.0
19	0.0	0.0	0.34	0.49	0.0	1.05	1.80	3.53	5.73	7.21	5.27	3.20	2.36	2.12	2.00	2.07	2.40	3.13
	3.25	2.35	1.37	1.11	0.71	0.66	1.23	1.65	1.46	1.12	1.02	0.94	0.47	0.40	0.35	0.29	0.0	0.0
20	0.0	0.0	0.36	0.51	0.0	1.06	1.53	2.01	2.98	4.31	4.03	2.90	2.47	2.48	2.34	2.41	2.83	3.94

	4.02	2.50	2.17	1.10	0.69	0.59	0.65	1.13	0.63	0.64	0.67	0.64	0.34	0.31	0.27	0.23	0.0	0.0
21	0.0 2.97	0.0 3.29	0.10 1.90	0.13 0.99	0.0 0.64	1.06 0.53	1.64 0.54	1.70 0.62	2.23 0.46	3.22 0.45	3.43 0.48	2.86 0.46	2.75 0.26	3.24 0.24	2.74 0.22	2.66 0.19	2.83 0.0	3.38 0.0
22	0.0 2.59	0.0 2.65	0.10 1.49	0.12 0.87	0.66 0.61	0.94 0.50	1.37 0.50	1.41 0.35	1.60 0.35	2.12 0.37	2.54 0.37	2.74 0.37	3.09 0.21	3.45 0.19	2.99 0.18	2.97 0.16	3.19 0.0	3.27 0.0
23	0.0 4.03	0.0 2.40	0.09 1.33	0.44 0.79	0.56 0.57	0.74 0.51	0.97 0.53	1.12 0.37	1.34 0.35	1.68 0.35	2.28 0.34	3.42 0.33	3.68 0.18	3.42 0.17	3.11 0.15	3.40 0.14	4.96 0.0	3.82 0.0
24	0.0 4.20	0.0 2.28	0.08 1.21	0.38 0.74	0.47 0.38	0.59 0.34	0.74 0.37	0.90 0.40	1.11 0.42	1.44 0.40	1.99 0.37	2.94 0.20	2.82 0.17	2.80 0.16	2.94 0.14	3.52 0.12	5.67 0.0	4.75 0.0
25	0.0 3.38	0.0 1.89	0.07 1.05	0.08 0.69	0.39 0.41	0.47 0.40	0.58 0.48	0.71 0.57	0.89 0.59	1.14 0.54	1.51 0.46	1.92 0.22	2.11 0.18	2.31 0.15	2.69 0.13	3.19 0.11	4.03 0.0	3.37 0.0
26	0.0 2.34	0.0 1.36	0.07 0.84	0.07 0.66	0.0 0.45	0.38 0.49	0.46 0.66	0.56 0.89	0.69 0.91	0.87 0.78	1.10 0.60	1.36 0.27	1.60 0.21	1.93 0.16	2.67 0.13	3.36 0.11	4.04 0.0	2.50 0.0
27	0.0 1.48	0.0 0.95	0.0 0.68	0.0 0.42	0.0 0.42	0.31 0.57	0.36 0.88	0.43 1.54	0.53 1.52	0.65 1.17	0.80 0.48	0.97 0.33	1.15 0.23	1.39 0.29	1.68 0.23	1.92 0.18	2.06 0.0	1.49 0.0
28	0.0 0.60	0.0 0.44	0.0 0.38	0.0 0.35	0.0 0.42	0.0 0.57	0.0 0.90	0.0 1.61	0.39 1.96	0.46 1.73	0.55 0.99	0.67 0.38	0.79 0.45	0.93 0.52	1.04 0.38	1.07 0.18	0.95 0.0	0.73 0.0
29	0.0 0.36	0.0 0.31	0.0 0.31	0.0 0.34	0.0 0.40	0.0 0.52	0.0 0.72	0.0 1.06	0.0 1.33	0.0 1.20	0.0 0.96	0.0 0.71	0.0 0.80	0.59 0.55	0.64 0.39	0.62 0.18	0.54 0.0	0.45 0.0
30	0.0 0.29	0.0 0.28	0.0 1.09	0.0 0.33	0.0 0.59	0.0 0.73	0.0 0.91	0.0 1.14	0.0 1.31	0.0 1.34	0.0 1.18	0.0 0.97	0.0 0.77	0.0 0.35	0.0 0.24	0.0 0.17	0.0 0.0	0.31 0.0
31	0.0 0.23	0.0 0.39	0.0 0.28	0.0 1.07	0.0 0.35	0.0 0.41	0.0 0.48	0.0 0.56	0.0 0.61	0.0 1.01	0.0 0.94	0.0 0.83	0.0 0.42	0.0 0.30	0.0 0.21	0.0 0.15	0.0 0.0	0.0 0.0
32	0.0 0.0	0.0 0.22	0.0 0.86	0.0 1.03	0.0 1.11	0.0 0.35	0.0 0.80	0.0 1.44	0.0 0.57	0.0 0.68	0.0 0.76	0.0 0.42	0.0 0.32	0.0 0.24	0.0 0.18	0.0 0.13	0.0 0.0	0.0 0.0
33	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
34	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0

HEAD MATRIX, LAYER 1

1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00	1.80	1.80	4.50	7.50
	10.30	13.80	16.50	16.80	20.50	21.00	23.50	25.00	26.30	28.80	32.20	35.40	37.30	38.30	38.80	39.30	40.70	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.08	2.37	3.63	5.20	7.31	9.36
	11.72	14.47	17.06	18.76	21.19	23.10	25.46	27.60	29.97	32.48	35.32	37.66	39.32	40.76	41.93	43.17	44.99	45.50
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.22	4.21	6.41	8.89	11.13	13.39
	15.81	18.60	21.23	23.25	25.29	27.21	29.06	30.93	32.91	35.14	37.47	39.54	41.24	42.70	43.97	45.21	46.36	44.80
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.37	4.55	7.00	9.70	12.14	14.79	17.37
	19.82	22.78	24.97	26.87	28.72	30.38	31.81	33.49	35.28	37.31	39.42	41.46	43.24	44.73	46.00	47.00	47.68	46.00
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.20	4.29	6.83	9.81	12.75	15.46	18.31	21.08
	23.90	26.56	28.15	29.93	31.58	32.93	34.16	35.55	37.08	39.01	41.28	43.49	45.36	46.99	48.09	48.86	48.96	45.50
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.84	4.02	6.69	9.64	12.65	15.73	18.80	21.78	24.86
	27.78	29.88	31.32	33.15	34.33	35.36	36.28	37.20	38.39	40.52	43.33	45.85	47.93	49.60	50.62	51.59	52.23	50.00
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.19	6.24	9.33	12.35	15.44	18.57	21.84	25.50	29.10
	32.25	34.87	37.60	40.21	41.86	42.40	41.73	39.62	38.84	41.68	46.93	50.09	52.46	53.79	54.69	56.13	58.20	58.50
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.02	5.39	8.57	11.60	14.75	17.99	21.31	24.80	28.82	33.02
	37.01	40.79	45.15	48.61	50.95	50.96	46.14	39.59	43.10	48.38	53.17	56.54	58.69	59.97	60.88	62.58	65.28	67.00
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.35	4.75	7.93	10.85	13.70	16.84	20.21	23.71	27.56	31.88	36.51
	41.11	45.84	50.63	54.91	58.01	58.24	53.85	49.33	55.85	59.01	61.83	63.25	64.68	66.46	67.66	69.12	71.87	74.00
10	0.0	0.0	0.0	0.0	0.0	0.0	2.03	4.05	6.72	9.83	12.54	15.25	18.27	21.80	25.80	30.01	34.58	39.40
	44.38	49.42	54.39	59.74	63.60	65.01	63.28	58.67	64.46	66.93	68.41	69.00	69.66	71.43	72.59	73.99	75.90	75.80
11	0.0	0.0	0.0	0.0	0.0	1.98	3.75	5.97	8.60	11.32	13.90	16.31	18.92	22.77	27.32	31.75	36.44	41.47
	46.57	51.57	57.62	63.35	67.58	69.26	69.18	68.29	69.37	70.24	71.10	71.97	72.94	74.86	75.89	77.01	77.87	75.00
12	0.0	0.0	0.0	1.31	2.83	3.89	5.65	8.02	10.03	12.43	15.01	17.03	17.88	22.82	28.44	33.14	38.02	43.28
	48.40	53.43	59.19	65.57	69.58	71.47	72.07	71.46	70.76	70.69	71.27	72.50	74.20	76.26	77.88	79.23	80.10	77.50
13	0.0	0.0	1.05	2.28	3.80	5.37	7.24	9.47	11.43	13.81	16.45	18.72	19.82	25.49	30.45	34.91	39.64	44.72
	49.77	54.68	60.25	66.53	70.49	72.14	72.29	71.22	69.72	68.51	68.69	70.80	74.09	77.12	79.29	81.23	82.56	80.30
14	0.0	0.67	1.70	3.05	4.36	5.97	7.71	9.78	11.92	14.49	17.56	20.62	23.70	28.04	32.47	36.57	40.97	45.79
	50.66	55.40	60.69	66.56	70.44	71.77	71.07	69.06	66.12	63.32	62.92	67.39	73.27	77.61	80.39	83.01	85.71	86.50
15	0.0	0.89	2.04	3.34	4.71	6.27	8.09	10.31	12.46	15.09	18.44	22.22	25.95	29.89	33.86	37.82	42.02	46.35
	51.01	55.74	60.60	66.21	69.66	70.74	69.03	65.25	59.41	53.71	51.25	61.56	71.99	77.96	81.30	84.49	87.84	89.00
16	0.0	1.18	2.49	3.74	5.02	6.51	8.44	10.43	11.89	14.00	18.02	22.82	27.35	31.47	35.28	38.97	42.62	46.47
	50.80	55.47	60.32	65.74	68.61	68.98	66.14	60.18	53.85	48.32	54.51	64.40	72.92	78.64	82.17	85.57	89.14	90.50
17	0.0	1.70	3.18	4.47	5.59	7.03	8.98	10.08	9.73	9.43	15.39	22.30	27.88	32.46	36.36	39.69	42.71	45.94
	49.97	54.70	59.69	64.95	67.32	67.04	63.37	58.81	57.09	57.57	61.67	67.91	74.54	79.57	83.01	86.26	89.68	92.00
18	1.00	2.58	4.02	5.20	6.09	7.41	9.11	9.22	5.66	5.03	12.12	21.40	28.17	33.15	36.96	39.86	42.17	44.41
	47.76	53.08	58.94	64.18	65.84	64.38	59.71	57.73	58.56	61.39	65.50	70.51	76.31	80.65	83.68	86.48	89.21	90.00
19	1.50	3.62	5.03	6.01	6.77	8.20	9.62	10.11	8.12	9.38	17.44	23.81	28.95	33.41	37.06	39.66	41.11	41.06
	43.36	50.91	57.67	62.87	63.97	61.64	57.55	56.78	59.18	62.97	67.29	71.91	76.88	80.54	83.19	85.63	88.09	89.20
20	2.00	5.03	6.59	7.09	7.48	8.67	9.93	11.68	13.28	16.31	21.08	25.43	29.23	32.77	36.56	39.19	40.18	38.44

	42.60	50.50	57.46	61.77	62.12	59.69	55.63	55.47	58.66	62.75	67.33	71.96	76.02	79.02	81.29	83.34	85.31	86.00
21	2.50 46.46	6.87 52.03	8.16 57.65	8.40 60.58	8.19 60.19	8.78 57.74	9.41 53.81	12.73 53.88	15.66 57.09	19.00 61.29	22.53 65.57	25.57 70.12	28.38 73.82	30.08 76.36	35.32 78.18	38.50 79.79	40.46 81.21	42.51 80.50
22	4.00 47.57	8.43 53.53	9.30 57.93	9.33 59.06	9.01 57.84	9.35 55.05	10.14 51.52	13.27 52.15	16.22 55.02	19.37 59.07	21.99 63.19	23.91 67.32	26.42 70.67	28.71 72.95	33.91 74.35	36.89 75.42	38.63 76.22	42.49 73.50
23	5.00 46.74	9.64 52.83	10.24 56.42	9.95 56.77	9.44 54.57	9.87 51.41	11.09 49.09	13.38 49.71	15.94 52.42	18.59 56.20	20.28 60.08	19.75 63.83	22.62 66.95	27.48 68.91	32.29 69.97	34.22 70.56	33.09 70.36	39.61 65.00
24	7.00 44.43	10.81 50.60	10.94 54.01	10.26 53.10	9.32 49.32	9.60 46.36	10.77 45.71	12.69 46.96	15.03 49.36	17.52 52.94	19.32 56.41	19.55 59.76	23.98 62.60	27.96 64.40	31.19 65.29	32.11 65.79	29.11 65.78	34.65 63.00
25	7.50 43.59	11.19 48.26	10.67 49.87	9.37 47.55	8.16 42.93	8.40 41.47	9.48 41.69	11.22 43.14	13.52 45.56	16.09 49.06	18.56 52.33	21.05 55.24	24.13 57.89	27.31 59.69	29.65 60.60	31.22 61.00	32.89 60.94	37.33 57.50
26	8.00 41.92	10.92 44.39	9.51 43.96	7.84 39.47	6.42 37.32	6.43 37.01	7.49 37.28	9.13 38.11	11.47 40.66	14.16 44.08	17.05 47.45	20.13 50.20	23.03 52.76	25.58 54.79	26.23 55.97	26.96 56.71	29.62 57.10	36.96 55.50
27	0.0 37.59	6.00 38.12	7.34 36.46	5.46 33.17	4.18 32.47	4.11 32.35	4.86 32.27	6.41 31.50	8.90 33.98	11.71 37.73	14.78 41.37	18.09 44.60	21.22 47.21	23.87 49.86	25.93 51.73	27.79 53.04	31.15 53.23	34.68 52.10
28	0.0 30.68	0.0 30.22	5.00 28.97	2.00 27.79	1.35 27.64	1.43 27.78	1.84 27.62	3.02 26.56	6.00 27.27	8.75 30.06	12.00 35.14	15.38 38.97	18.69 42.43	21.50 45.54	23.68 48.36	25.32 50.22	27.46 50.11	29.20 47.50
29	0.0 24.01	0.0 23.82	0.0 23.99	0.0 23.72	0.0 23.85	0.0 24.30	0.0 24.77	0.0 25.10	3.24 26.16	5.04 28.76	8.54 31.66	11.88 34.87	15.44 38.99	18.37 43.48	20.15 47.35	21.10 49.91	21.79 50.27	22.81 48.00
30	0.0 20.10	0.0 21.10	0.0 21.55	0.0 21.86	0.0 22.25	0.0 22.79	0.0 23.62	0.0 24.71	0.0 26.29	1.00 28.56	6.00 31.34	8.00 34.52	13.00 38.18	14.47 43.35	15.43 48.47	16.09 52.05	16.68 53.53	18.17 52.50
31	0.0 16.39	0.0 18.92	0.0 19.85	0.0 20.49	0.0 21.07	0.0 21.71	0.0 22.80	0.0 24.27	0.0 26.06	0.0 28.26	0.0 30.97	0.0 34.20	0.0 39.08	8.00 45.39	9.50 51.19	9.50 55.87	9.50 59.43	12.86 62.00
32	0.0 13.39	0.0 16.24	0.0 17.71	0.0 18.62	0.0 19.38	0.0 20.18	0.0 21.40	0.0 23.00	0.0 25.08	0.0 27.85	0.0 30.58	0.0 34.95	0.0 41.30	0.0 47.97	0.0 54.38	0.0 59.90	0.0 65.31	3.00 71.00
33	0.0 6.00	0.0 14.58	0.0 15.39	0.0 16.45	0.0 17.23	0.0 17.84	0.0 19.15	0.0 20.80	0.0 22.96	0.0 26.07	0.0 29.35	0.0 35.42	0.0 43.24	0.0 50.54	0.0 57.59	0.0 63.20	0.0 69.46	0.0 80.00
34	0.0 0.0	0.0 9.00	0.0 10.80	0.0 13.50	0.0 14.00	0.0 13.00	0.0 14.50	0.0 16.00	0.0 18.50	0.0 23.50	0.0 25.80	0.0 34.80	0.0 45.50	0.0 52.50	0.0 61.00	0.0 65.50	0.0 78.50	0.0 0.0

HEAD MATRIX, LAYER 2

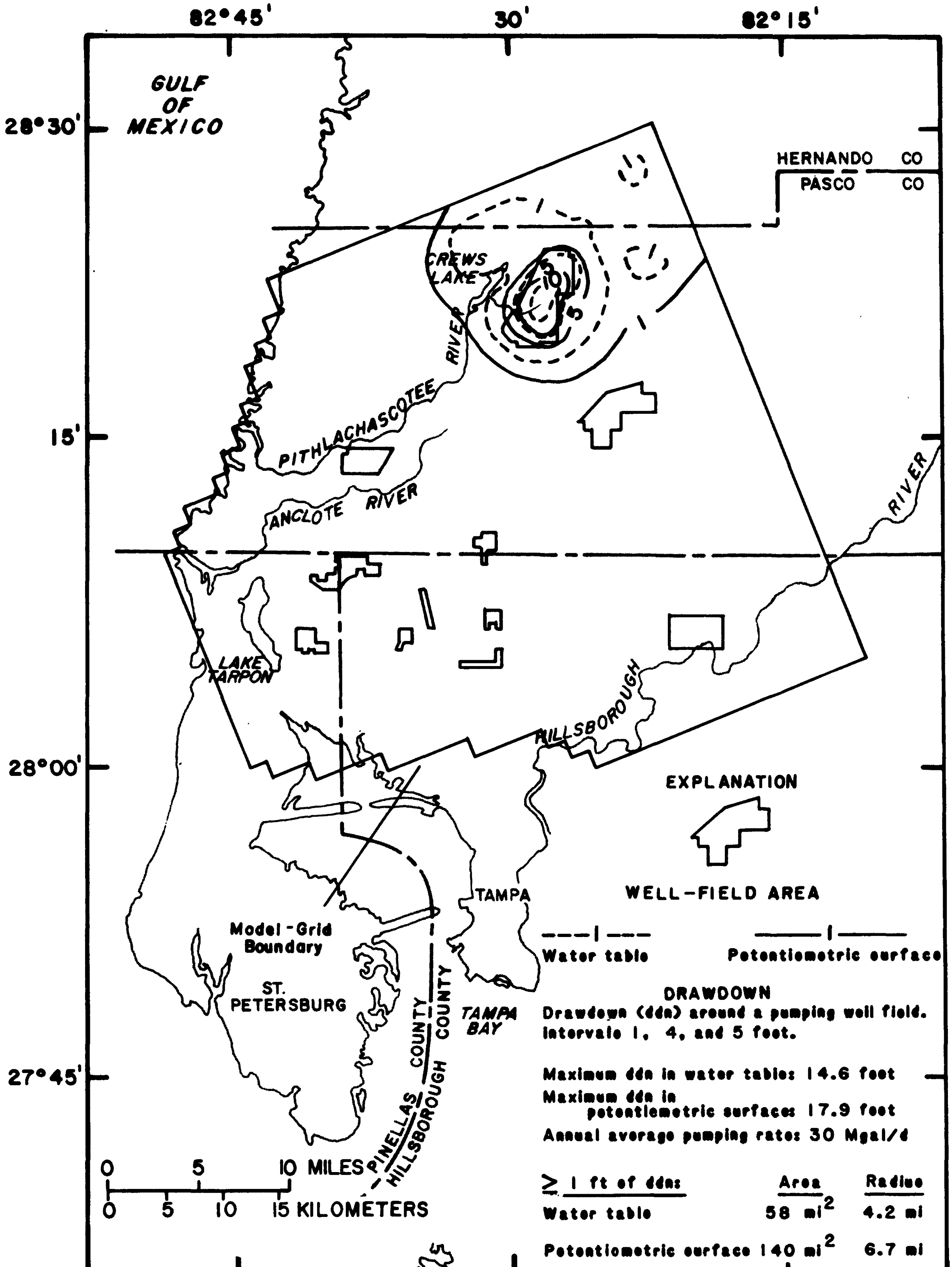
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00	2.00	5.00	7.00	17.00
	19.00	26.00	24.00	24.00	29.00	37.00	40.00	44.00	48.00	50.00	55.00	62.00	80.00	85.00	112.00	124.00	119.00	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.10	4.37	12.30	18.82	21.68
	24.16	24.05	26.91	33.91	37.59	41.21	43.87	45.86	49.45	53.34	58.65	63.31	90.03	84.42	118.13	135.41	160.00	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.00	6.31	11.07	14.34	17.06	24.12
	22.37	28.73	29.26	33.91	40.96	42.77	44.26	46.71	49.38	53.79	57.66	60.70	82.73	87.90	120.13	136.05	155.00	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.74	4.17	9.82	14.40	14.68	19.22	25.24
	28.40	32.27	32.96	39.34	41.95	43.34	44.55	45.95	47.50	50.88	57.80	58.84	64.88	70.34	97.51	125.85	120.00	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.63	5.32	9.74	12.50	16.52	22.28	24.30	28.17
	32.08	34.67	38.73	43.15	45.11	47.00	46.68	47.16	47.52	50.87	53.94	59.70	61.19	65.09	81.30	120.79	129.00	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00	5.79	11.86	13.80	16.67	19.43	25.14	33.15	36.33
	37.36	41.20	44.74	49.00	47.87	48.13	50.45	48.24	45.55	50.38	60.63	66.11	66.81	74.31	88.50	121.98	105.00	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.29	9.66	11.80	16.34	19.69	23.58	27.17	31.93	35.98
	40.32	45.27	49.88	52.58	56.33	58.46	55.44	48.91	52.44	57.70	62.49	68.15	70.12	83.58	113.45	130.92	105.00	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.98	12.95	14.65	15.36	19.76	23.70	24.70	31.57	34.93	38.96
	43.85	50.19	54.56	58.17	63.34	64.54	63.13	58.68	65.10	67.58	69.42	69.57	72.06	89.53	105.49	114.31	115.00	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.63	4.73	14.53	14.70	16.53	20.07	22.70	29.63	37.35	40.35	41.93
	48.31	53.99	55.82	63.08	68.62	71.94	71.16	68.00	71.71	72.85	73.54	73.82	76.28	87.55	95.84	130.00	124.00	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	2.02	3.00	10.63	14.75	16.75	17.22	22.12	24.12	32.23	37.83	39.29	42.40
	48.27	53.30	61.54	66.91	73.12	73.94	73.91	73.49	73.99	74.39	74.79	75.20	77.34	98.12	126.42	121.13	119.00	0.0
12	0.0	0.0	0.0	0.0	0.0	2.25	3.94	14.47	7.53	9.54	16.43	18.36	20.86	26.02	30.04	35.27	39.29	45.58
	51.05	57.33	61.89	70.06	73.55	74.96	76.83	76.02	74.64	74.61	75.40	75.98	78.37	93.36	95.20	99.73	114.00	0.0
13	0.0	0.0	0.0	1.76	6.12	9.49	12.41	18.90	14.78	16.79	21.26	25.31	26.61	31.03	35.29	39.40	42.42	46.51
	52.67	58.41	62.89	70.51	74.49	75.27	75.88	76.44	74.16	75.18	74.85	76.08	78.73	85.19	88.83	102.60	109.00	0.0
14	0.0	0.0	1.59	6.64	3.89	6.91	6.15	7.88	8.74	11.59	19.16	22.42	26.17	32.24	40.20	42.03	42.59	47.51
	53.54	58.64	63.31	69.47	74.46	75.10	74.24	73.31	71.94	71.57	73.19	77.26	84.60	84.70	90.94	94.98	101.00	0.0
15	0.0	1.00	0.20	2.03	3.61	4.98	5.49	13.64	16.64	21.64	24.36	29.43	30.34	31.48	33.79	37.78	44.29	46.52
	53.73	61.53	65.47	70.37	72.93	75.05	72.64	69.91	59.53	62.82	64.83	70.24	75.96	87.34	92.48	95.54	99.00	0.0
16	0.0	0.0	1.15	1.48	1.81	1.79	6.76	16.14	17.13	22.93	26.08	32.15	35.95	37.55	38.47	43.31	45.53	47.59
	52.45	60.67	66.32	70.61	71.98	73.17	69.80	58.27	56.93	59.42	64.66	71.46	74.87	80.76	94.86	100.88	97.00	0.0
17	0.0	0.0	3.45	5.56	3.85	4.47	16.03	17.40	16.70	17.42	24.95	31.85	36.25	39.15	43.29	46.55	46.31	47.50
	54.32	60.15	65.34	69.77	70.82	72.06	66.89	55.32	56.28	64.91	67.54	70.53	75.98	89.89	102.39	101.21	99.00	0.0
18	0.0	2.00	4.56	6.70	2.00	2.00	15.94	16.49	18.19	18.09	25.11	33.04	36.88	43.97	46.61	46.44	46.33	50.81
	55.97	60.78	64.53	69.26	70.17	69.20	55.77	52.80	56.27	65.46	71.04	72.57	91.50	103.78	106.68	105.07	114.00	0.0
19	0.0	2.00	4.28	5.76	2.00	10.44	15.99	16.81	17.96	22.33	30.04	35.14	37.01	44.93	48.13	49.25	50.45	53.61
	54.27	60.84	64.74	67.64	69.33	65.83	51.51	51.29	58.69	68.11	74.46	76.79	94.60	105.03	110.27	109.60	120.00	0.0
20	0.0	9.00	13.63	6.27	2.00	10.55	12.34	16.18	20.85	25.74	30.87	36.93	38.71	44.83	49.47	51.65	50.49	53.71

	53.53	59.28	63.04	66.68	68.46	62.90	47.72	49.46	59.27	66.39	75.92	84.16	92.16	97.33	104.86	105.46	109.00	0.0
21	0.0	49.00	58.56	36.71	2.00	5.47	12.37	18.83	23.62	26.96	31.86	37.03	43.36	49.83	50.44	52.97	54.19	54.87
	55.45	58.47	63.16	65.58	65.24	62.12	46.87	47.95	55.11	64.70	67.29	78.93	88.20	90.10	93.40	96.47	104.00	0.0
22	0.0	49.00	43.44	32.02	7.17	6.66	10.68	17.49	20.56	28.94	32.53	36.91	40.28	47.33	50.24	52.55	50.64	55.56
	59.82	60.22	63.84	64.36	62.72	58.37	43.60	45.96	51.71	61.94	66.75	74.50	81.21	88.26	89.34	87.97	101.00	0.0
23	0.0	49.00	49.07	13.52	6.78	9.92	12.49	16.78	19.71	27.03	30.11	35.45	39.78	42.59	48.35	51.12	50.01	54.00
	55.49	59.30	61.49	61.59	58.99	52.49	45.18	42.36	49.54	57.53	63.54	69.77	79.67	83.41	82.27	82.26	86.00	0.0
24	0.0	54.00	70.88	20.05	8.06	9.86	12.39	15.12	17.97	24.53	28.75	32.25	35.15	40.65	49.33	49.11	46.05	48.98
	53.26	55.64	61.47	58.92	48.78	37.64	39.45	46.61	47.10	56.65	58.90	69.24	71.83	75.36	72.18	74.73	76.00	0.0
25	0.0	69.00	66.69	28.58	2.32	7.84	9.63	11.78	15.35	20.29	23.31	33.46	31.99	41.02	46.06	47.37	49.19	47.73
	50.79	55.07	56.86	53.48	37.06	32.64	37.66	44.16	45.78	55.64	58.02	62.80	65.75	69.90	67.87	68.04	68.00	0.0
26	0.0	79.00	52.63	28.09	0.0	1.77	7.81	8.59	12.57	16.21	21.10	28.83	30.16	38.48	42.42	47.01	47.55	47.57
	47.85	50.91	50.92	36.79	33.95	35.16	37.47	37.52	45.01	51.09	56.47	57.55	57.08	60.72	63.02	65.31	65.00	0.0
27	0.0	0.0	29.00	14.00	0.0	1.14	2.10	4.61	8.95	13.38	16.55	23.95	29.27	32.92	41.52	40.42	45.81	44.49
	43.69	42.83	41.49	27.84	29.56	31.76	33.96	36.01	42.24	44.70	46.80	50.86	52.87	51.02	52.89	58.88	59.00	0.0
28	0.0	0.0	0.0	0.0	0.0	1.00	1.00	3.00	6.71	10.40	15.68	21.05	27.07	31.52	38.00	37.73	42.63	40.16
	41.45	38.94	35.46	24.89	29.03	31.30	29.08	32.50	34.92	35.05	39.79	41.39	37.37	38.64	41.57	43.52	48.00	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.00	6.00	11.00	21.00	25.00	31.45	34.86	33.64	30.16	25.99
	32.05	35.10	36.27	22.05	20.70	25.22	26.09	26.92	27.95	29.35	31.58	30.21	32.27	35.43	42.32	46.71	53.00	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.00	33.00	32.00	27.00	19.80
	20.97	34.35	31.36	26.41	23.31	20.89	21.82	20.62	20.75	22.60	26.30	27.61	30.90	42.14	47.83	57.09	61.00	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.00
	20.07	34.80	40.23	35.95	33.54	21.83	28.89	38.06	36.33	22.79	23.83	26.92	33.21	45.18	59.15	67.03	70.00	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	14.00	25.99	39.09	31.22	31.76	30.64	34.46	35.65	37.89	47.75	42.61	38.90	40.54	51.24	65.08	70.27	76.00	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	21.00	22.00	24.00	30.00	29.00	34.00	41.00	48.00	48.00	34.00	41.00	51.00	64.00	70.00	73.00	78.00	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ATTACHMENT E: MAPS AND THREE-DIMENSIONAL GRAPHICS OF MODEL SIMULATIONS

Model-interrogation runs were made to evaluate well-field interference that may result from pumping all 10 well fields simultaneously. This involved separate simulations of drawdown at each well field for comparison with drawdown due to pumping all 10 well fields. Although not included in the main report, these separate simulations may be useful to water managers and planners. Figures 25-34 map the extent of cones of depression in the water table and Floridan aquifer as simulated by the model under average recharge conditions with pumping fixed at annual average permitted rates.

Three-dimensional graphical representations of the water table and potentiometric surface under predevelopment and pumping conditions were made using SAS/GRAPH (figs. 35-40). Although not useful technically, the plots exhibit depth perspective that cannot be perceived from contour maps. The plots clearly show cones of depression around the well fields and clearly indicate areas where well-field interference should occur. From a management standpoint, the graphical plots certainly simplify the conveyance of technical data to the general public.



BASE FROM U.S. GEOLOGICAL SURVEY 1:500,000 FLORIDA MAP

Figure 25.--Model-simulated drawdown at Cross Bar Ranch well field.

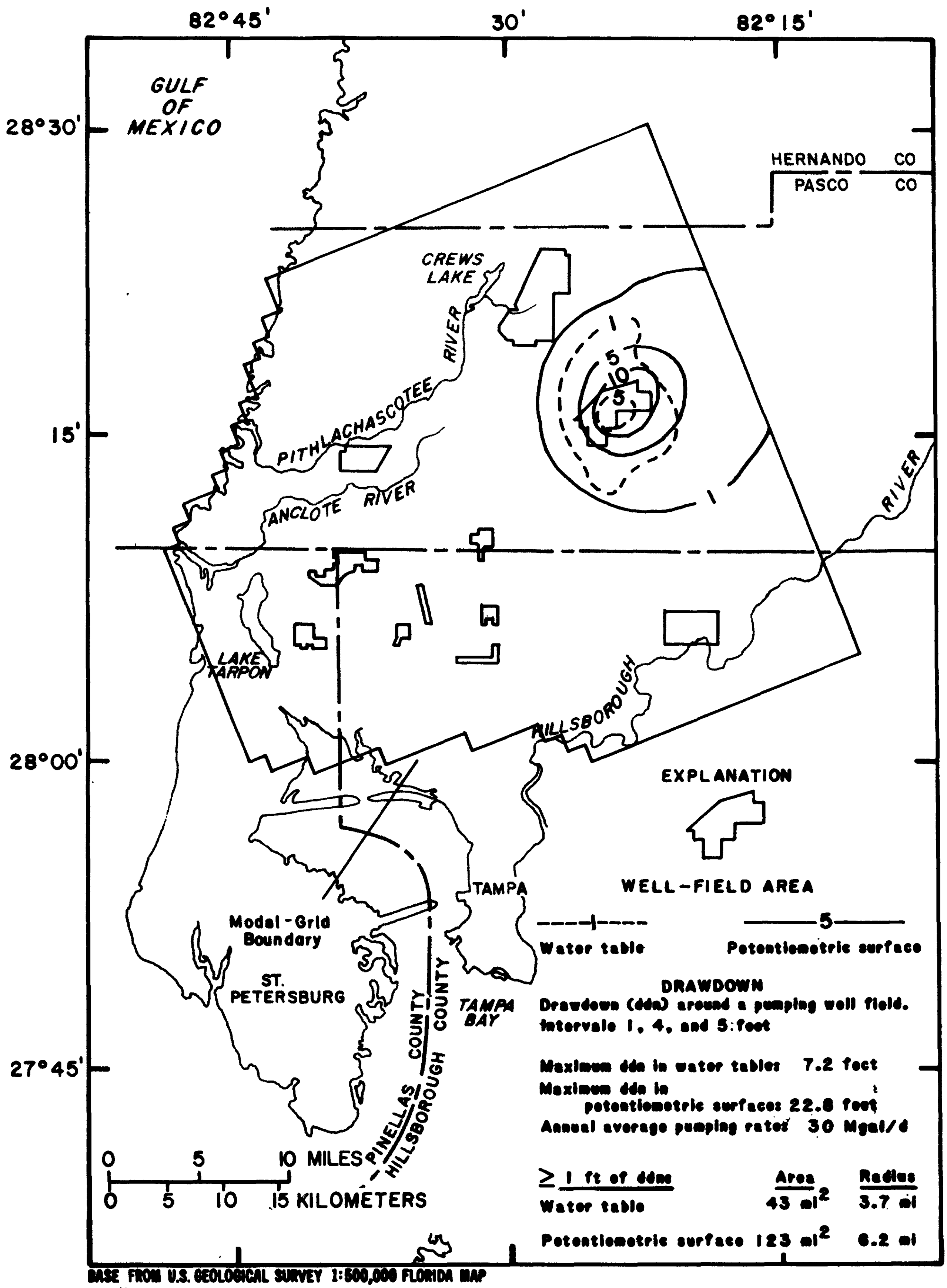
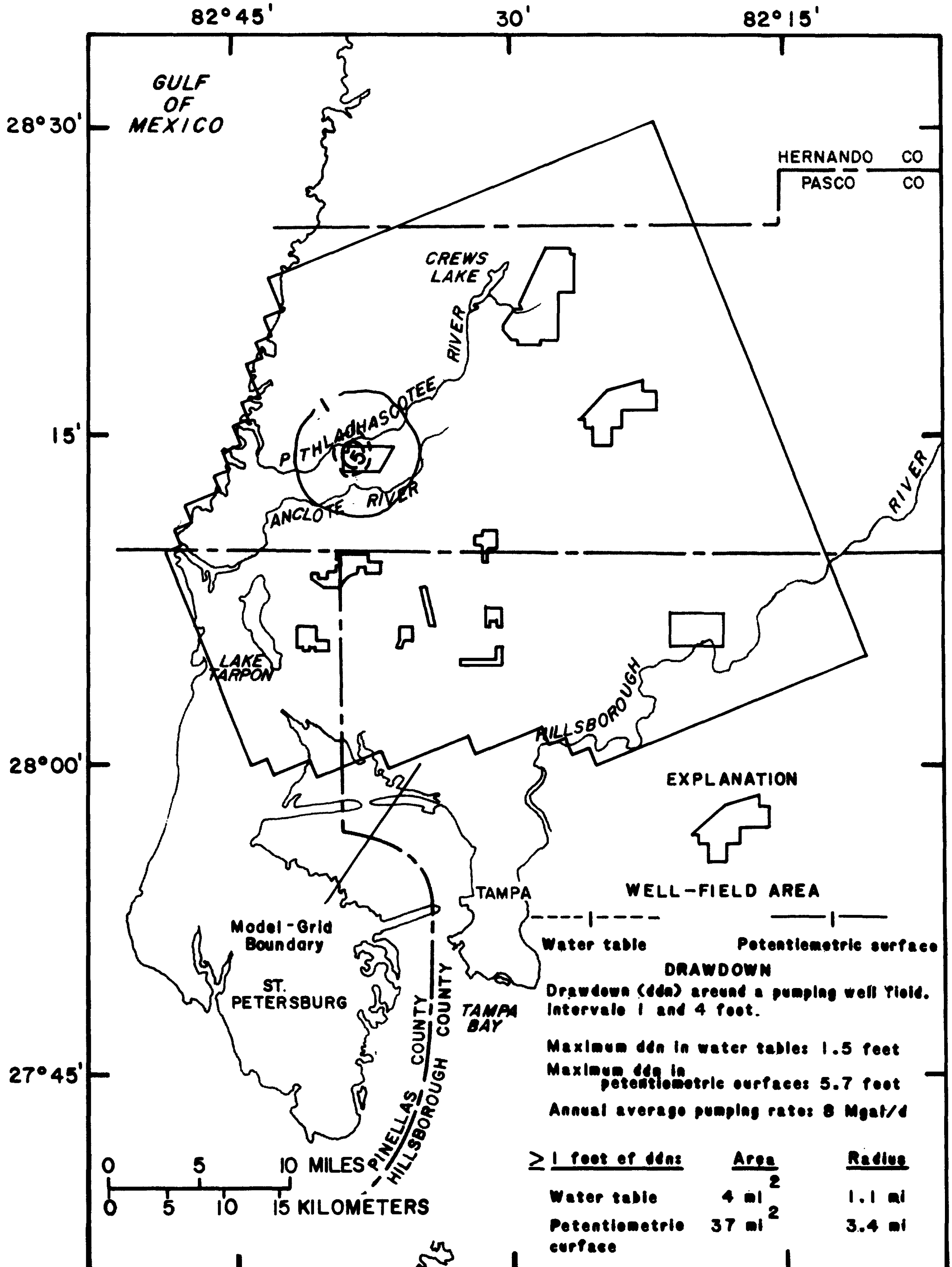
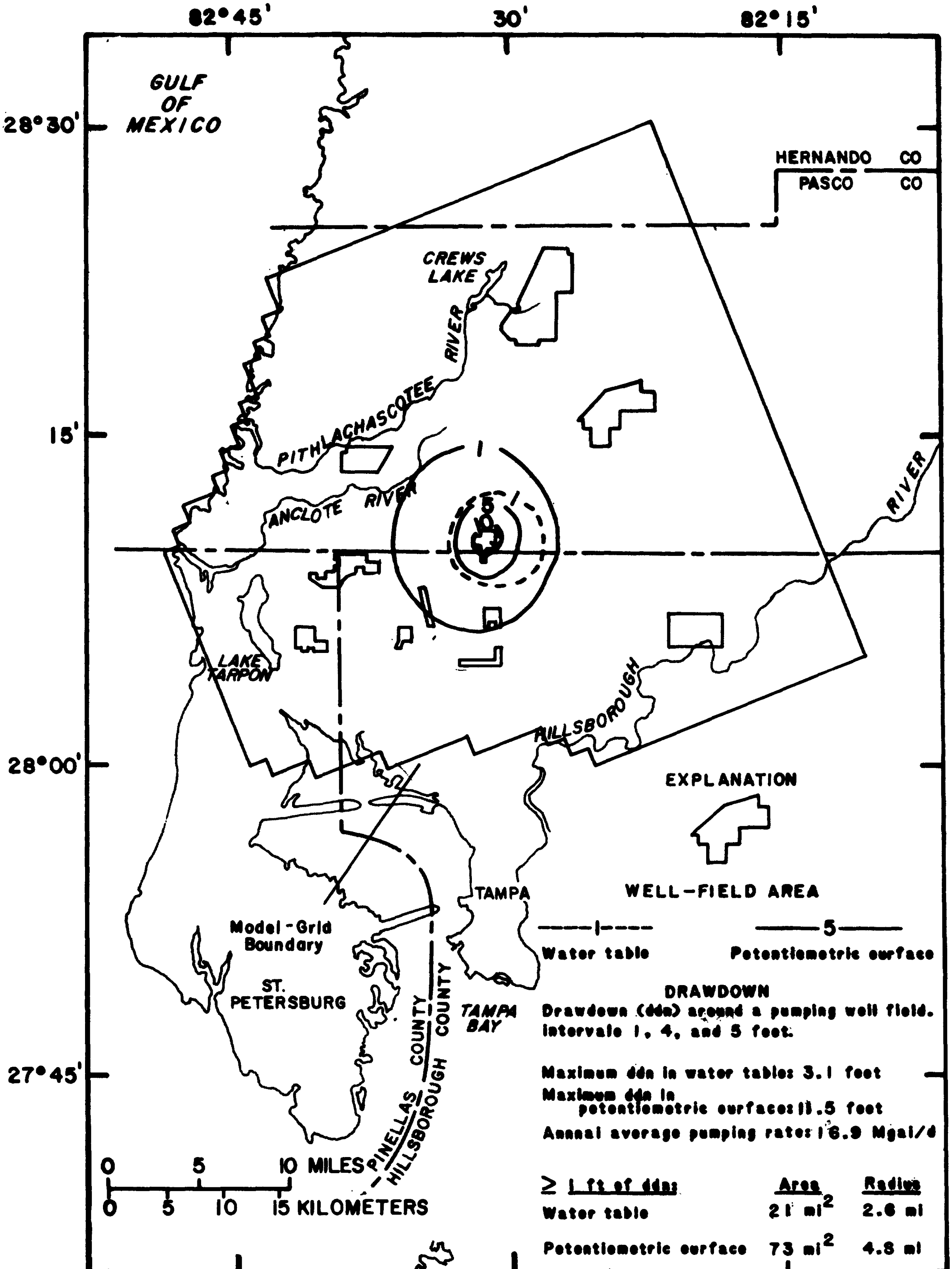


Figure 26.--Model-simulated drawdown at Cypress Creek well field.



BASE FROM U.S. GEOLOGICAL SURVEY 1:500,000 FLORIDA MAP

Figure 27.--Model-simulated drawdown at Starkey well field.



BASE FROM U.S. GEOLOGICAL SURVEY 1:500,000 FLORIDA MAP

Figure 28.--Model-simulated drawdown at Pasco County well field.

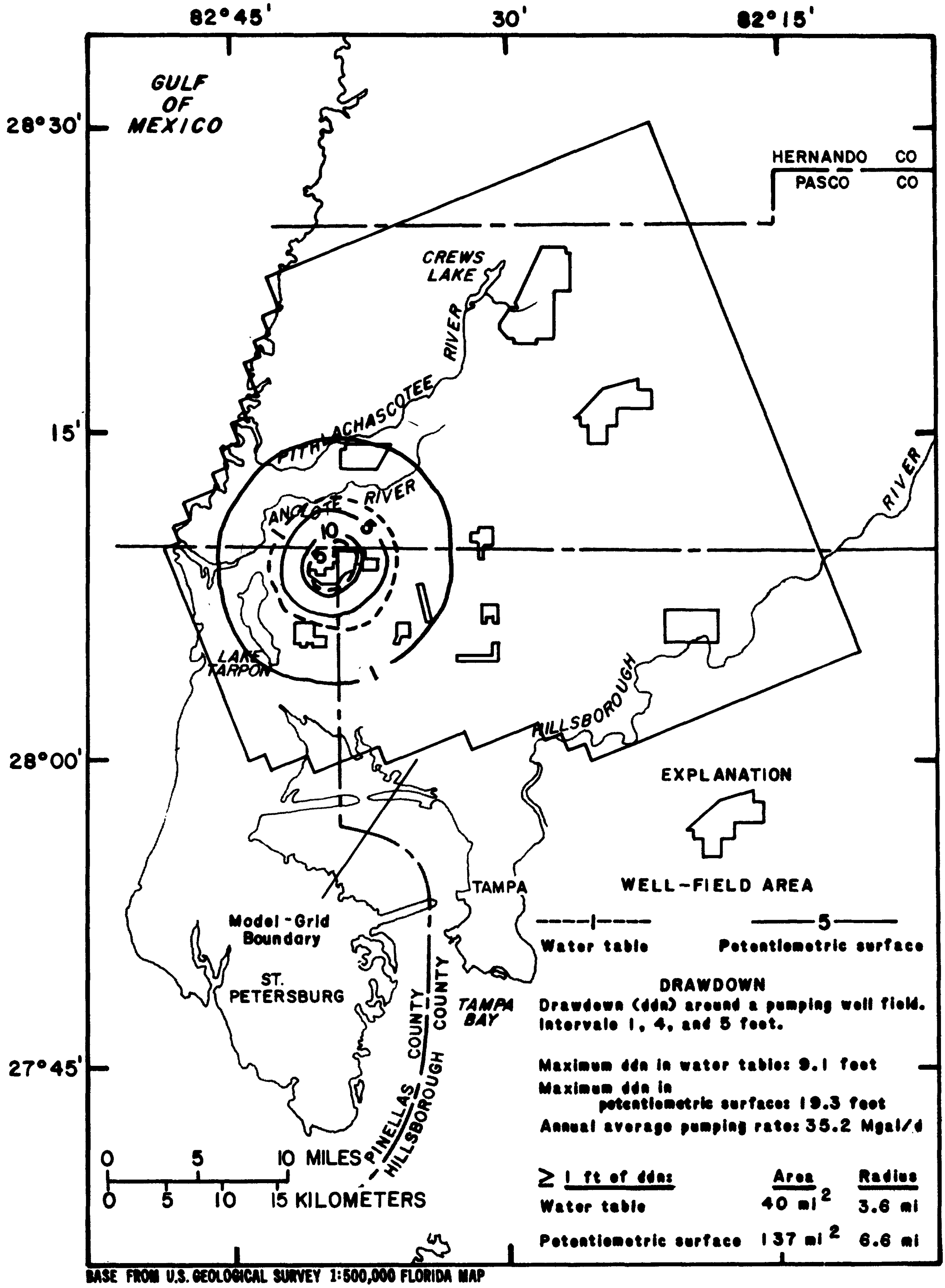


Figure 29.--Model-simulated drawdown at Eldridge-Wilde well field.

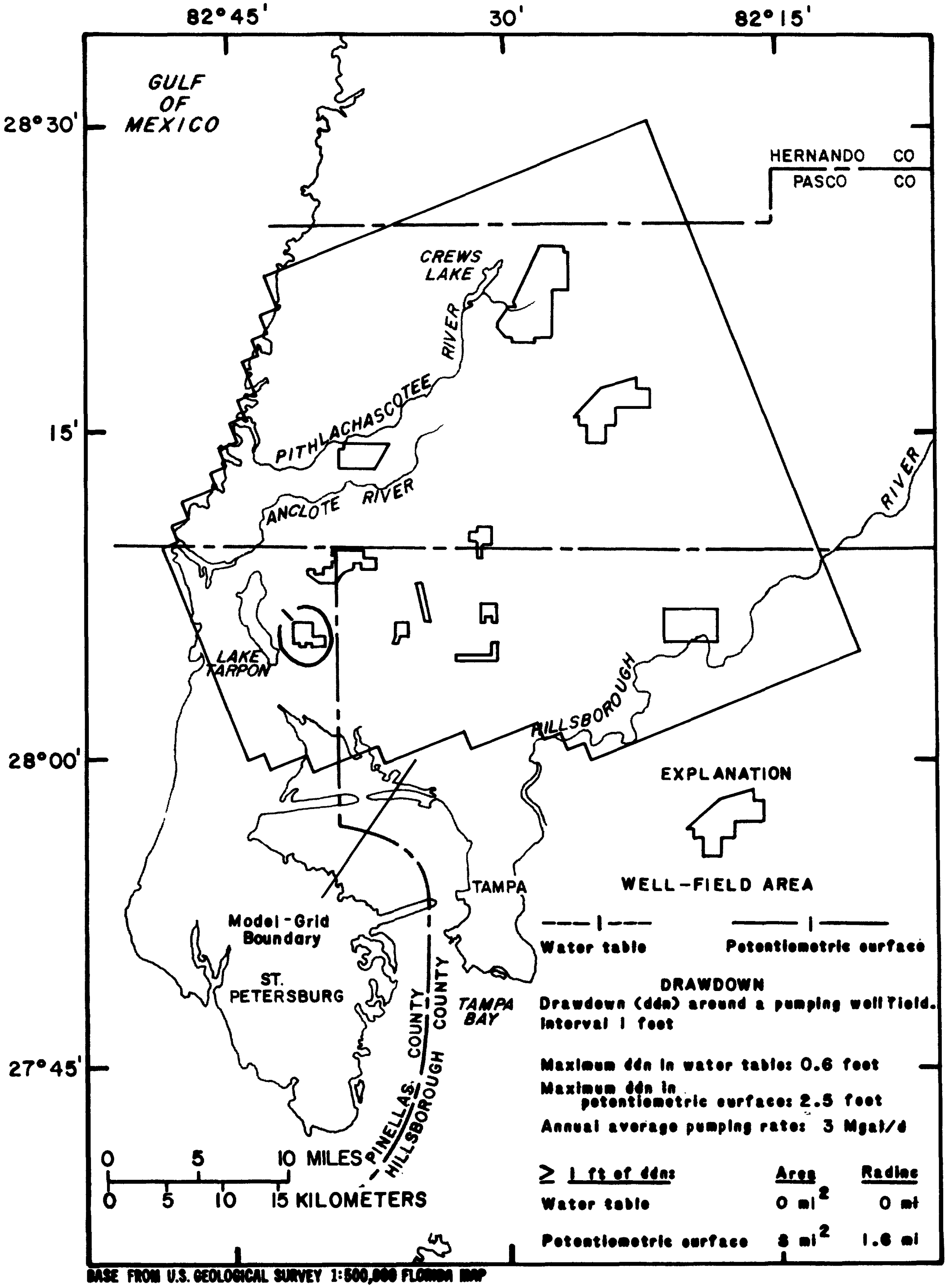


Figure 30.--Model-simulated drawdown at East Lake well field.

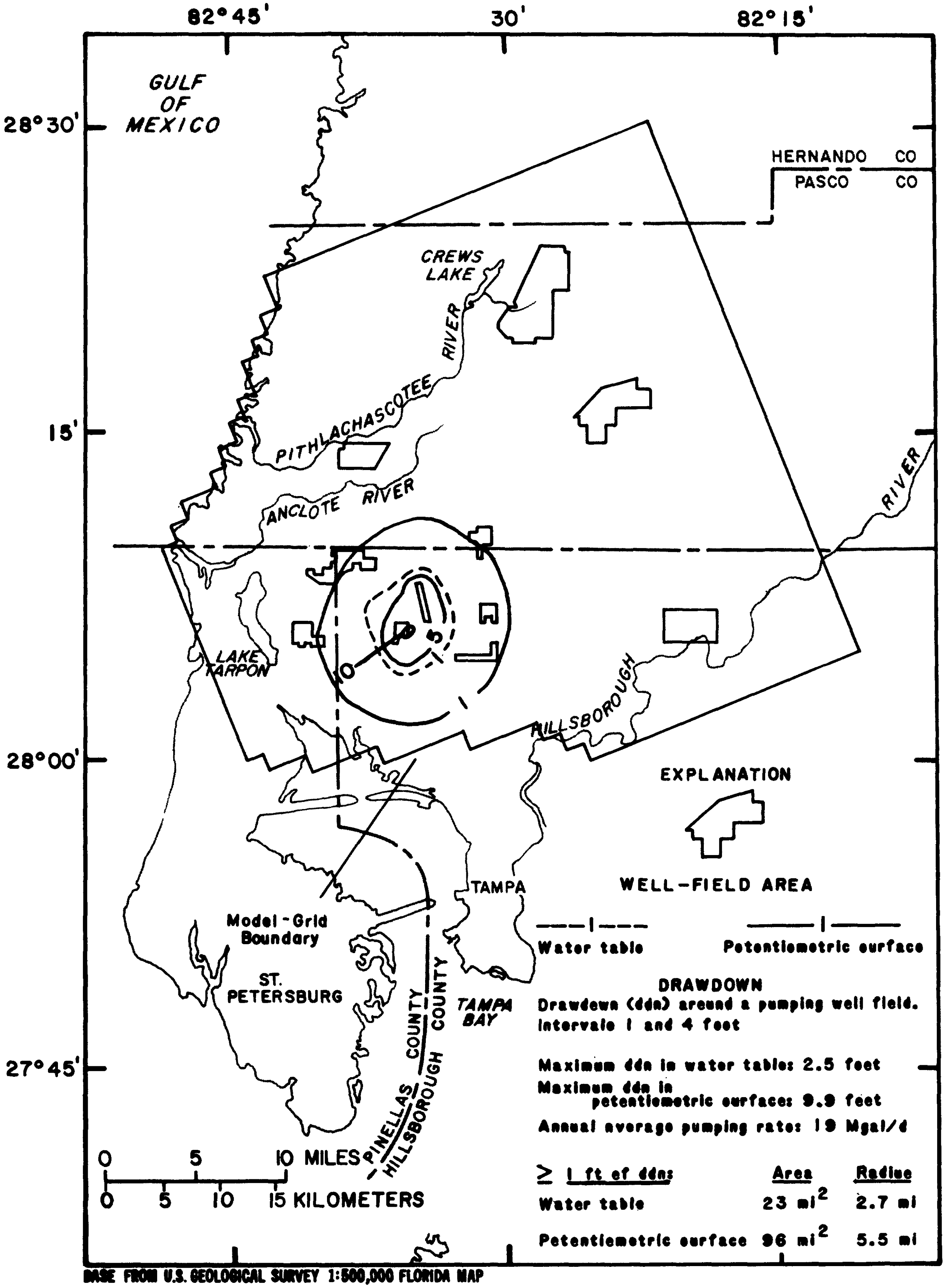


Figure 31.--Model-simulated drawdown at Cosme well field.

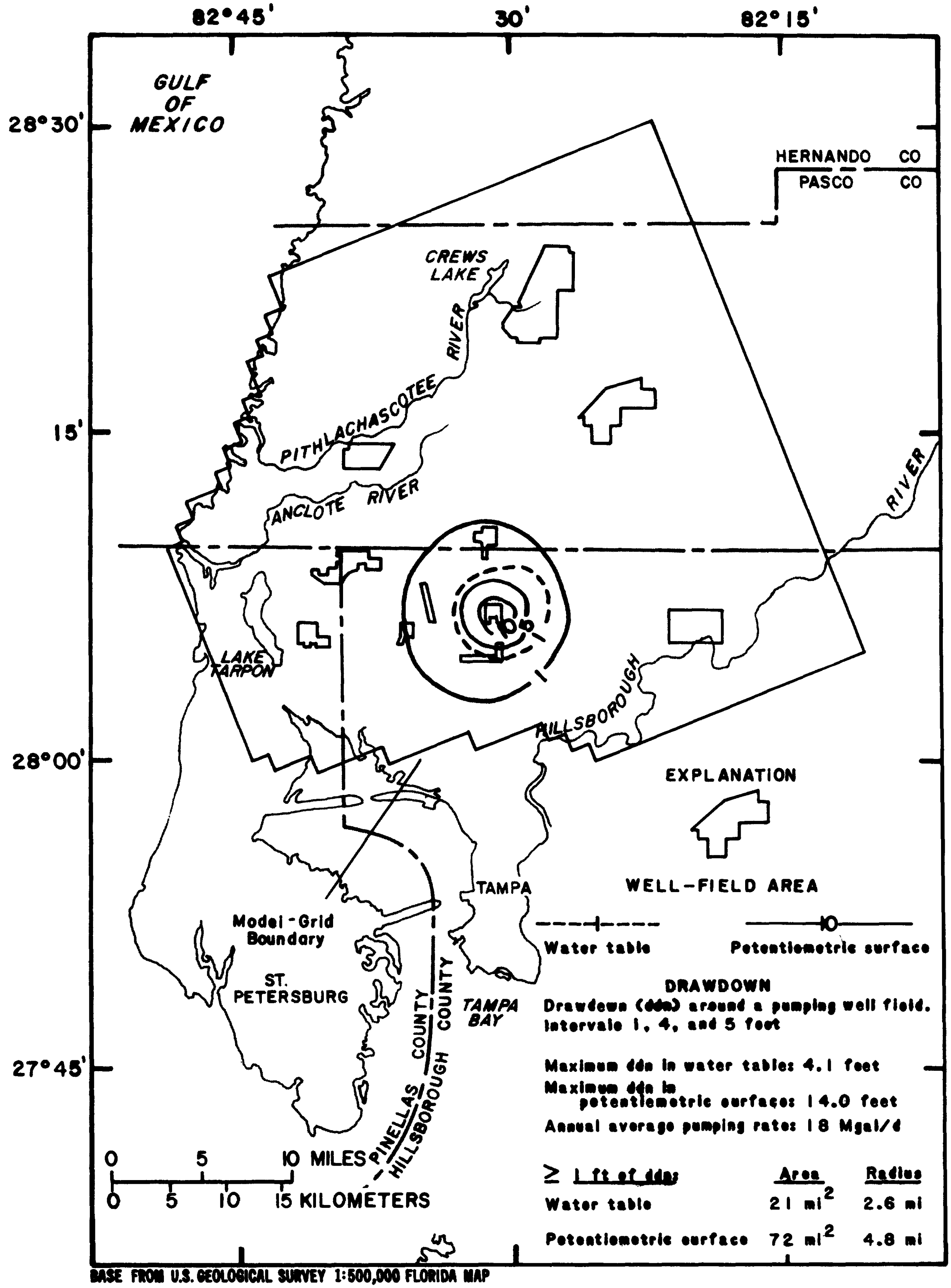


Figure 32.--Model-simulated drawdown* at Section 21 well field.

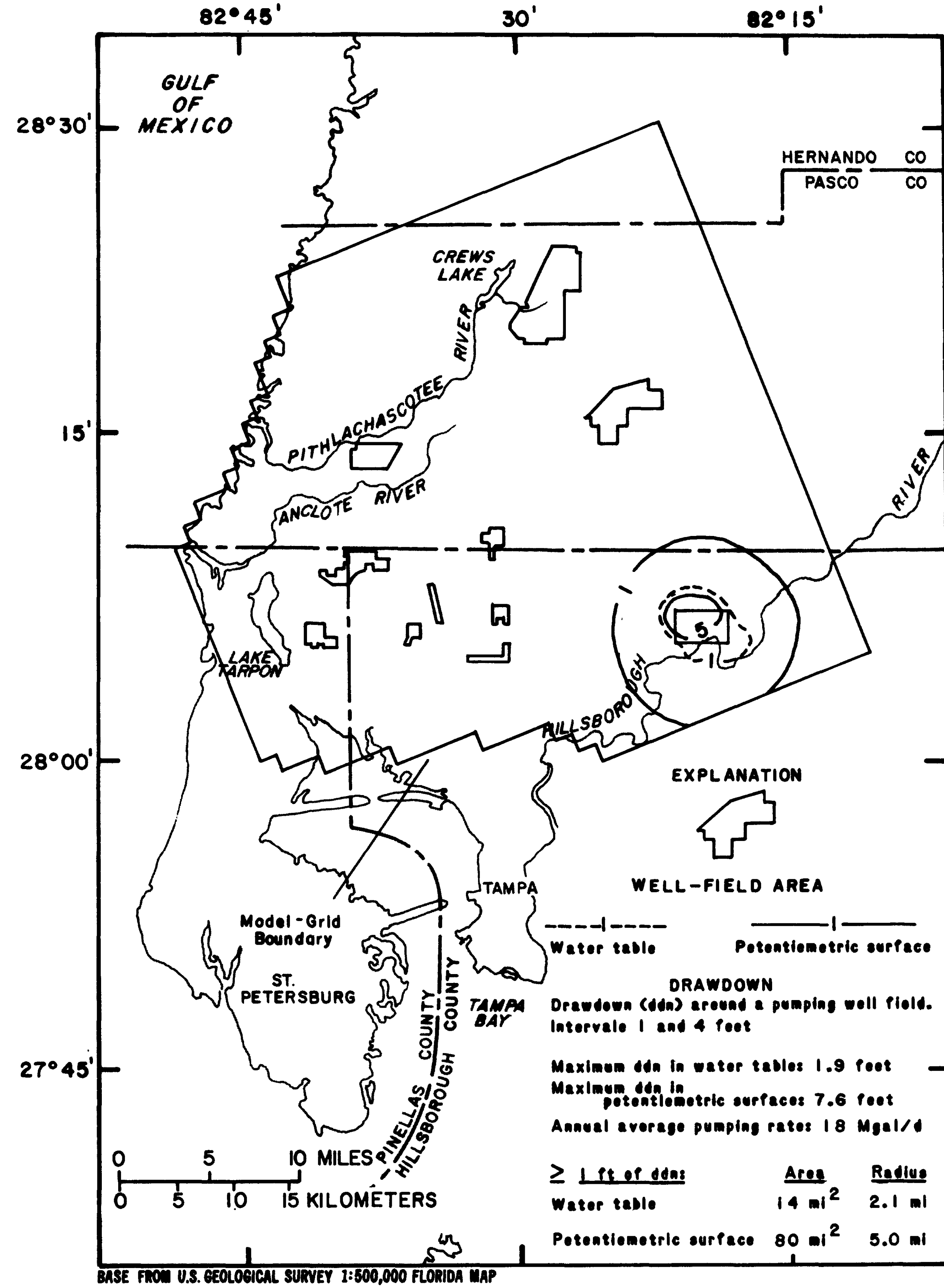
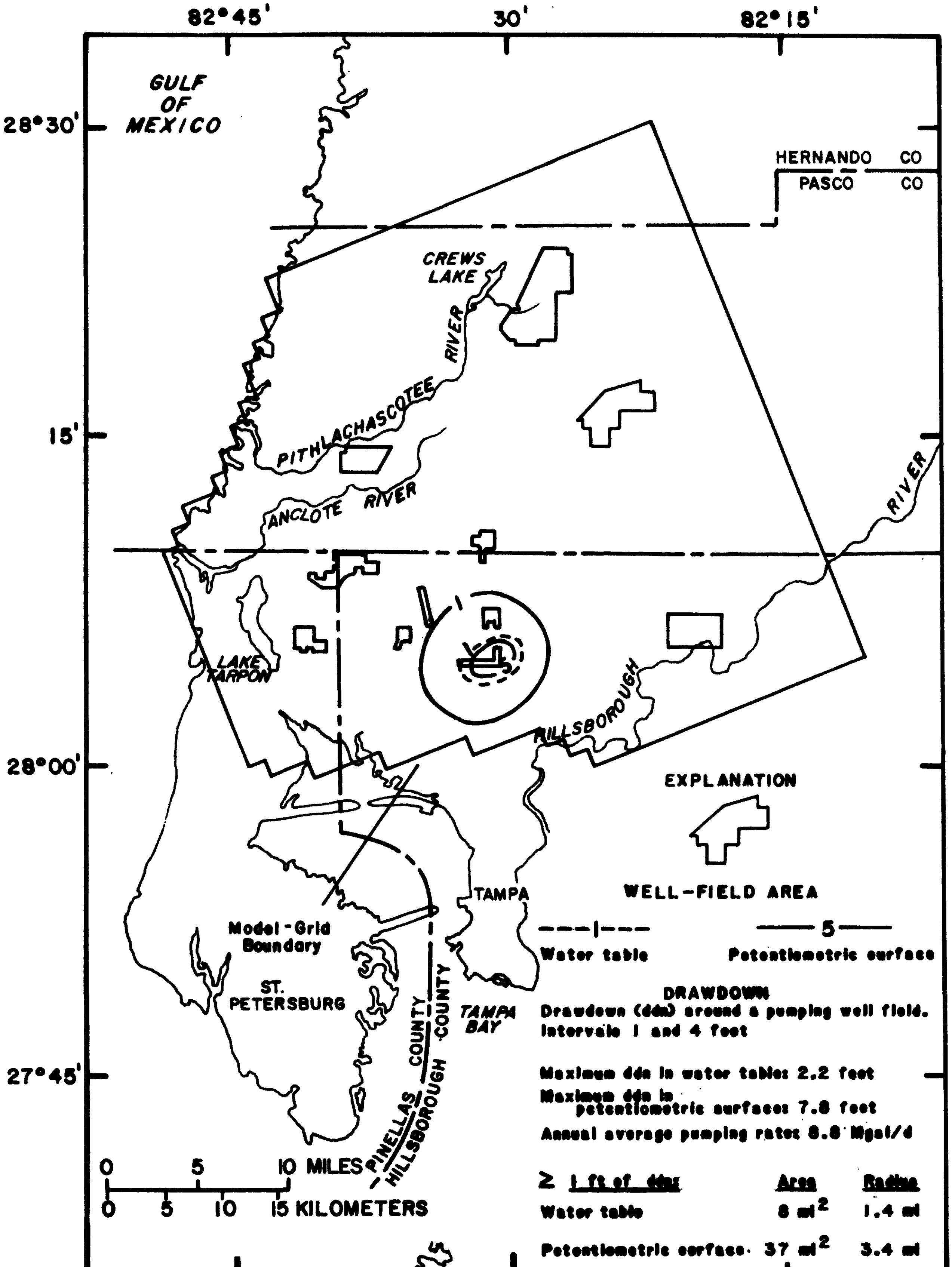


Figure 33.--Model-simulated drawdown at Morris Bridge well field.



BASE FROM U.S. GEOLOGICAL SURVEY 1:500,000 FLORIDA MAP

Figure 34.--Model-simulated drawdown at Northwest well field.

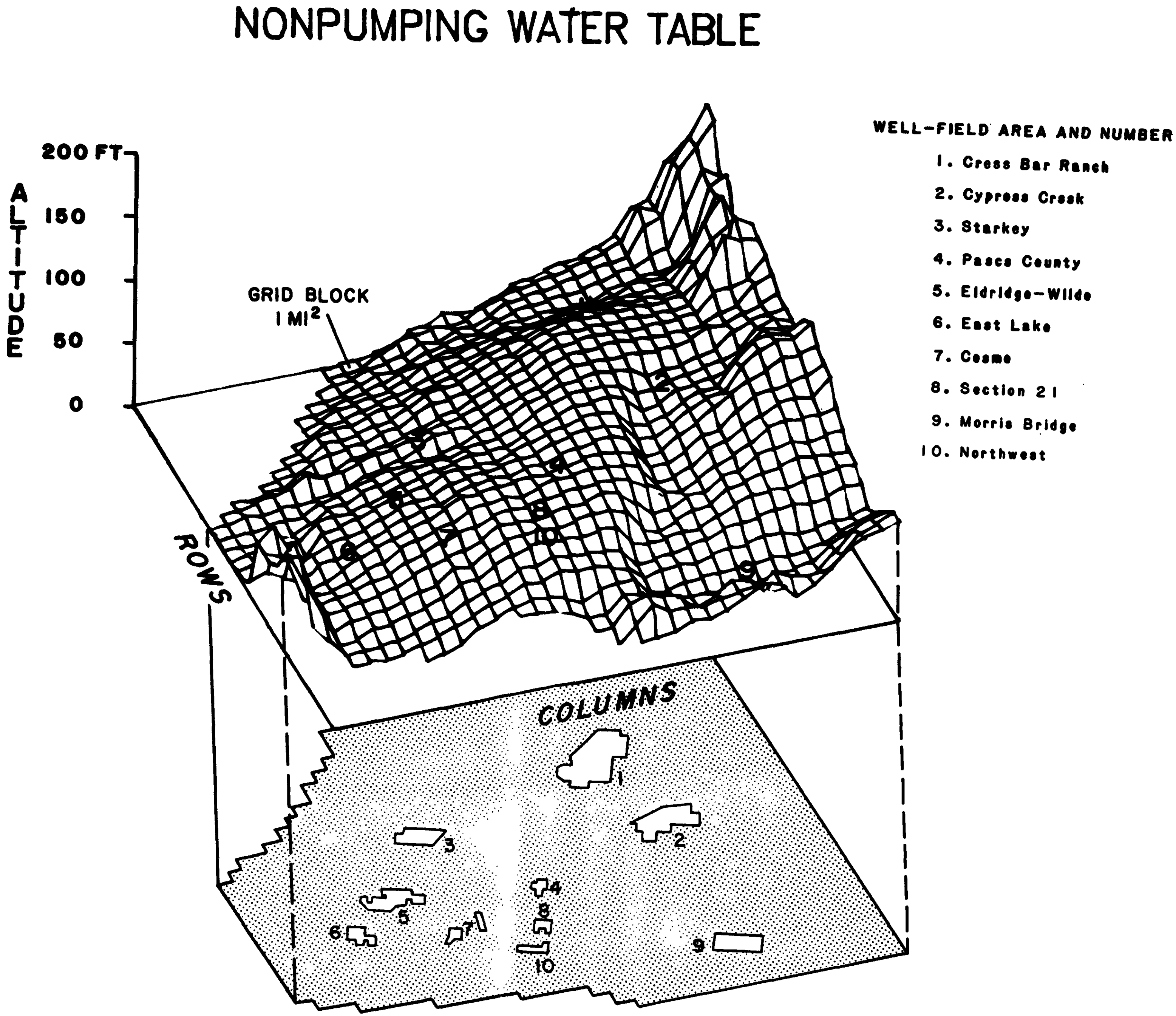


Figure 35.--Water table in the surficial aquifer under nonpumping conditions.

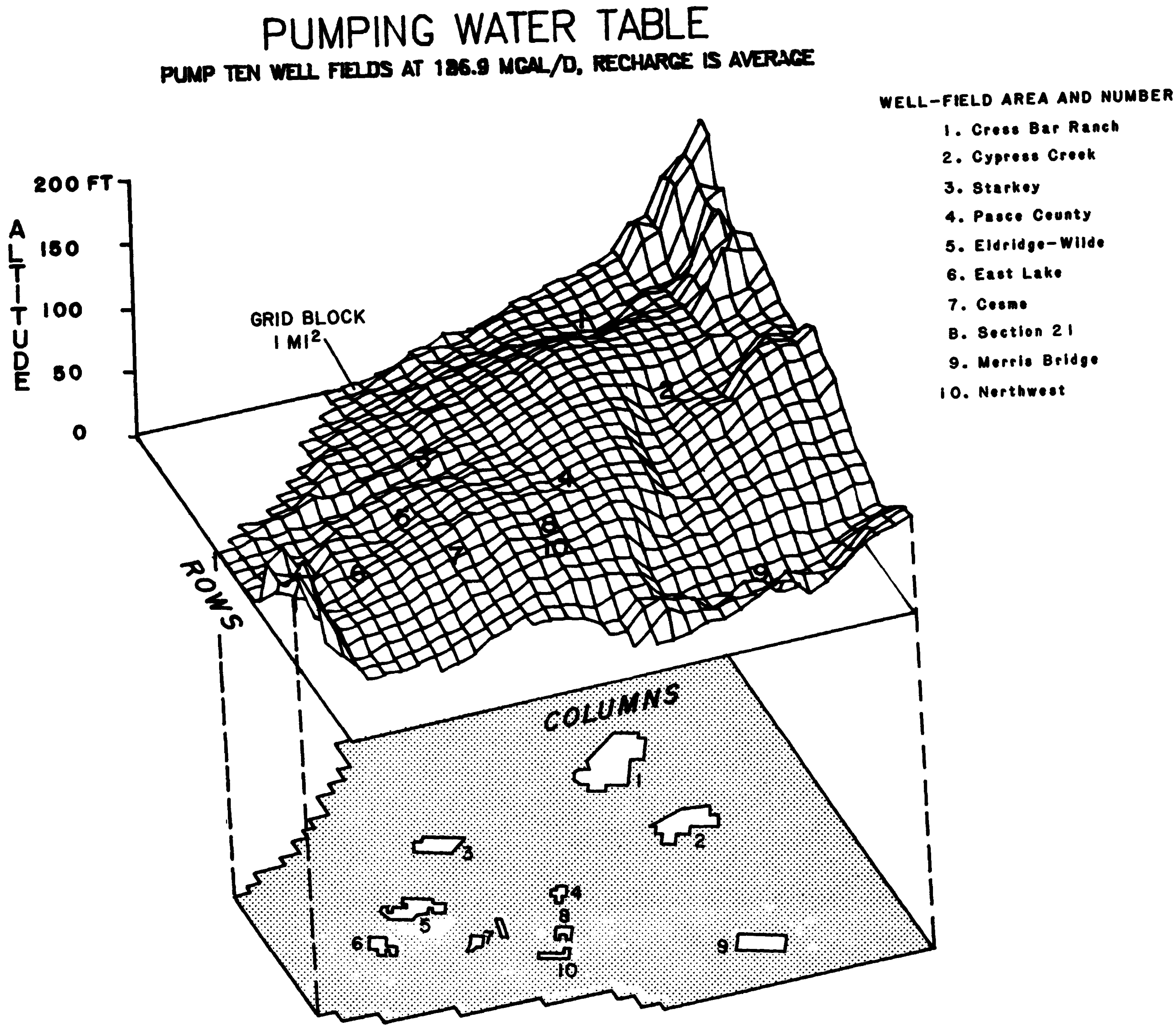


Figure 36.--Water table in the surficial aquifer under pumping conditions.

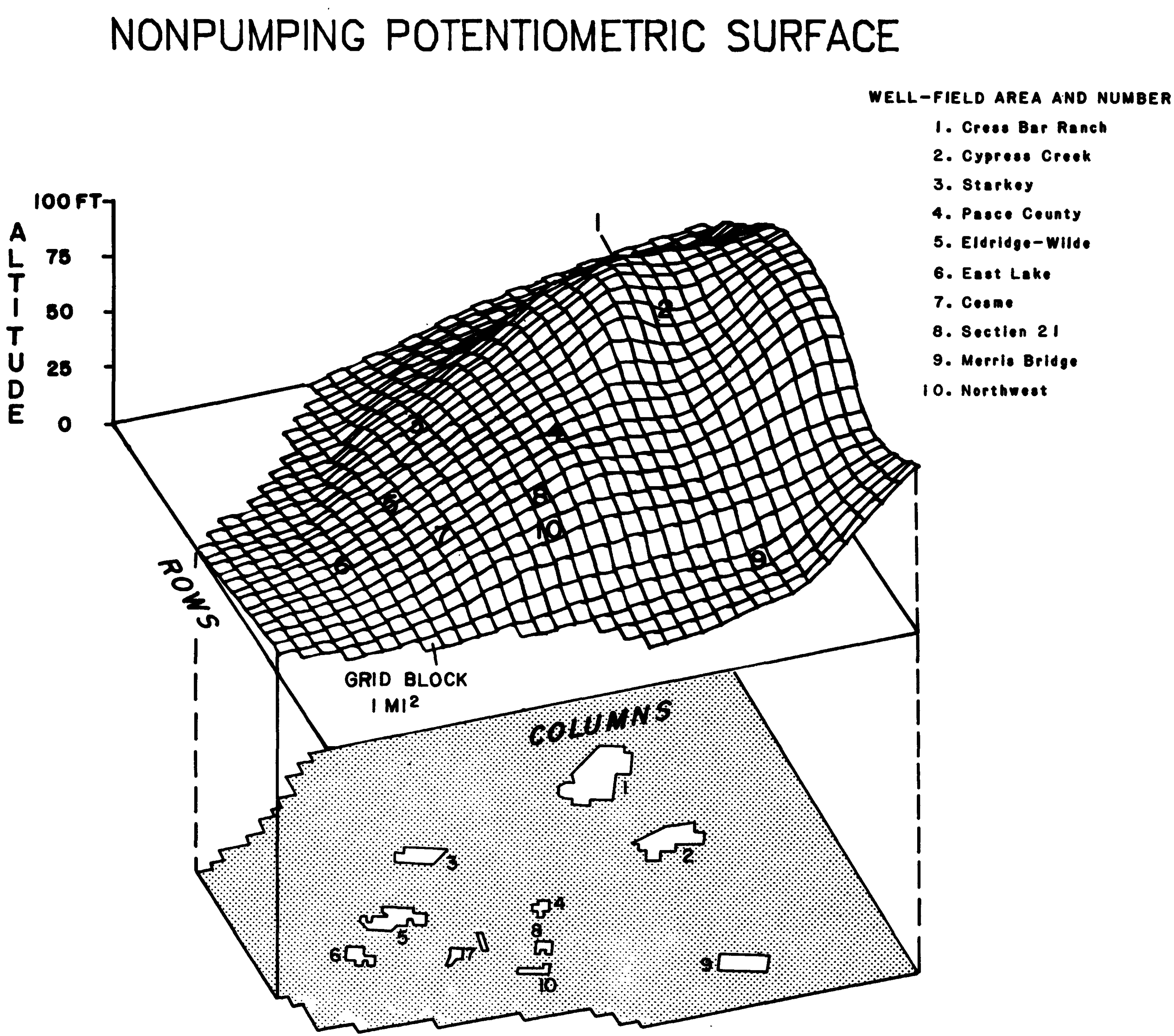


Figure 37.--Potentiometric surface of the Floridan aquifer under nonpumping conditions.

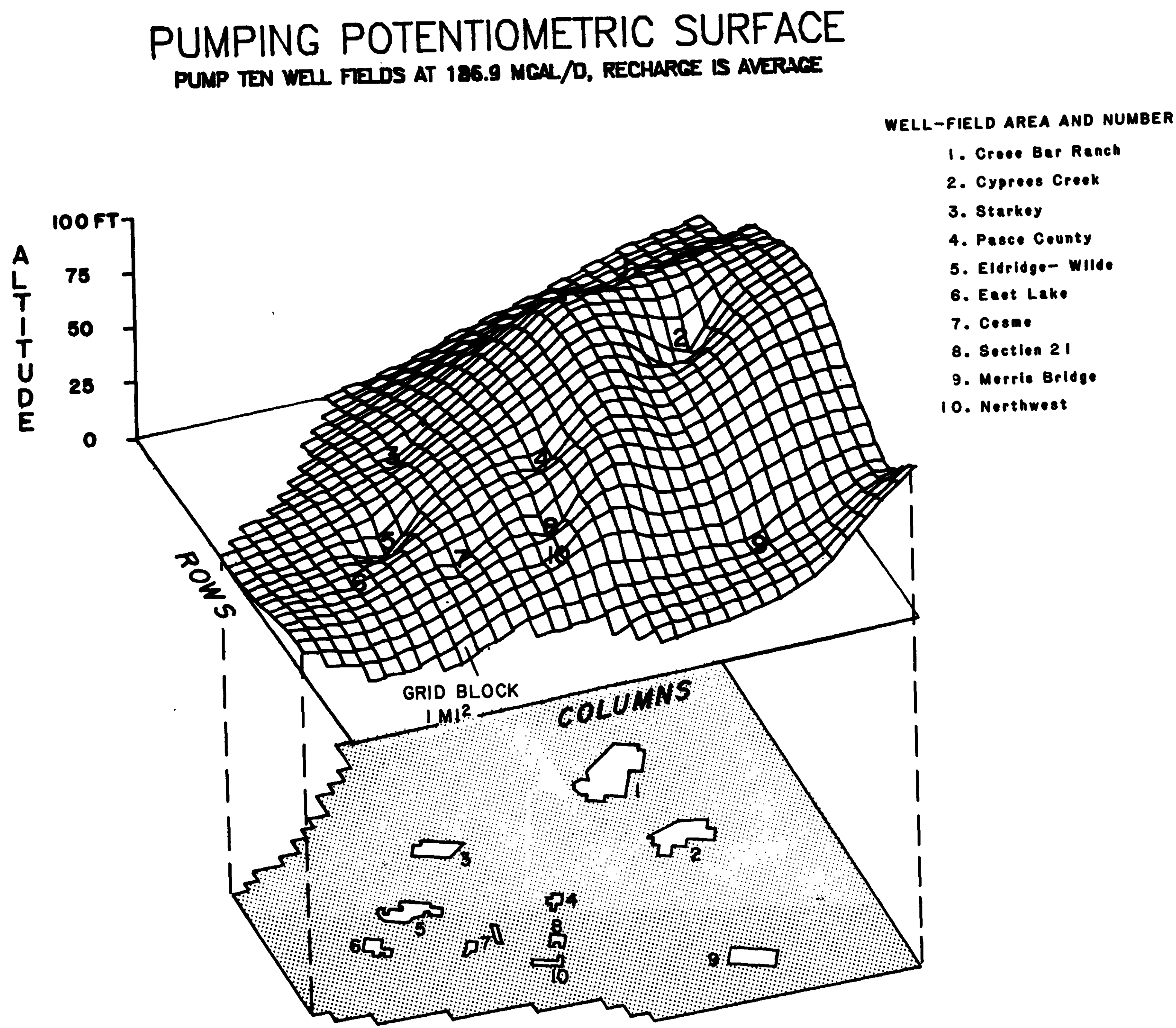


Figure 38.--Potentiometric surface of the Floridan aquifer under pumping conditions.

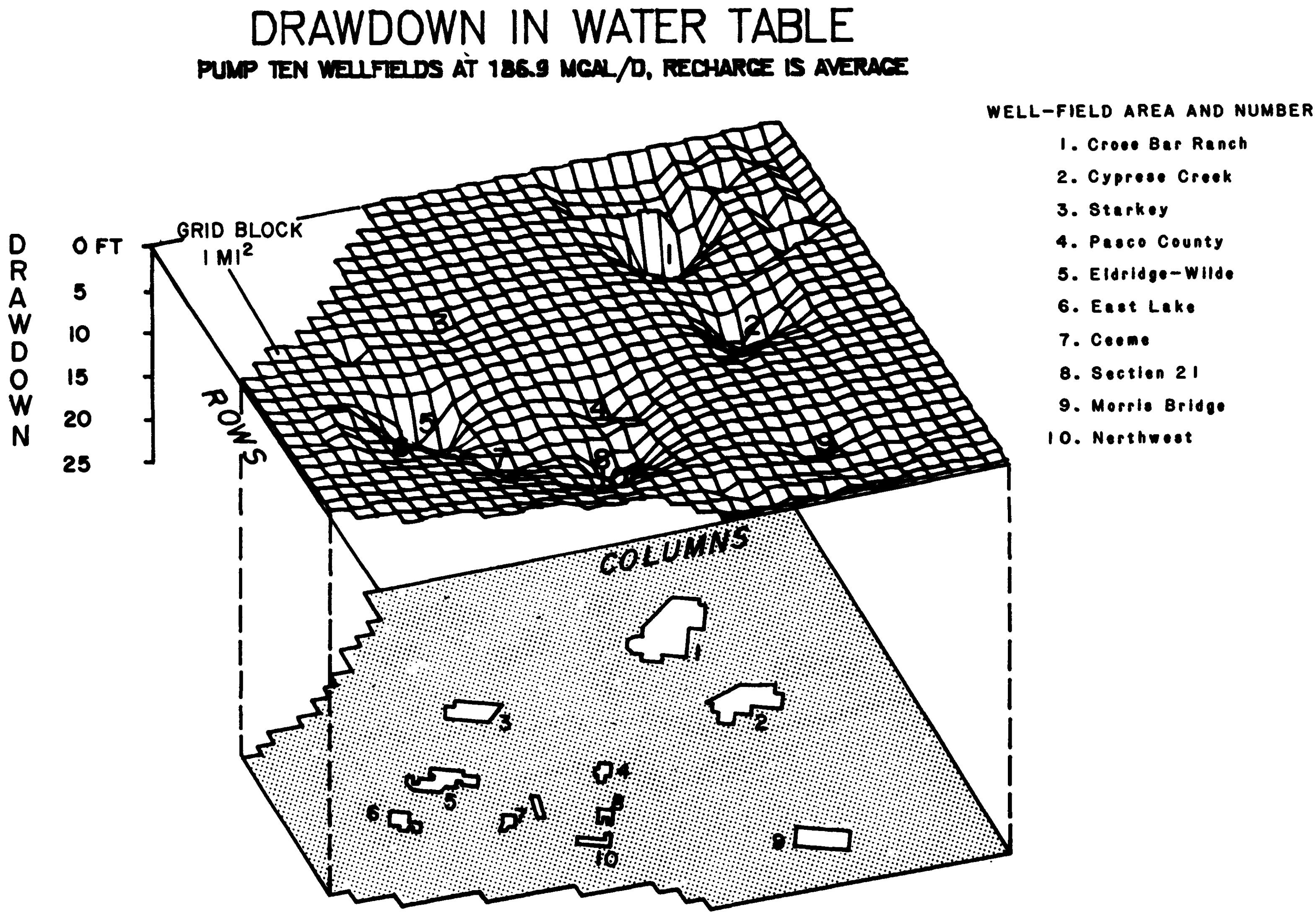


Figure 39.--Drawdown in the water table in the surficial aquifer under pumping conditions.

DRAWDOWN IN POTENTIOMETRIC SURFACE

PUMP TEN WELL FIELDS AT 186.9 MGAL/D, RECHARGE IS AVERAGE

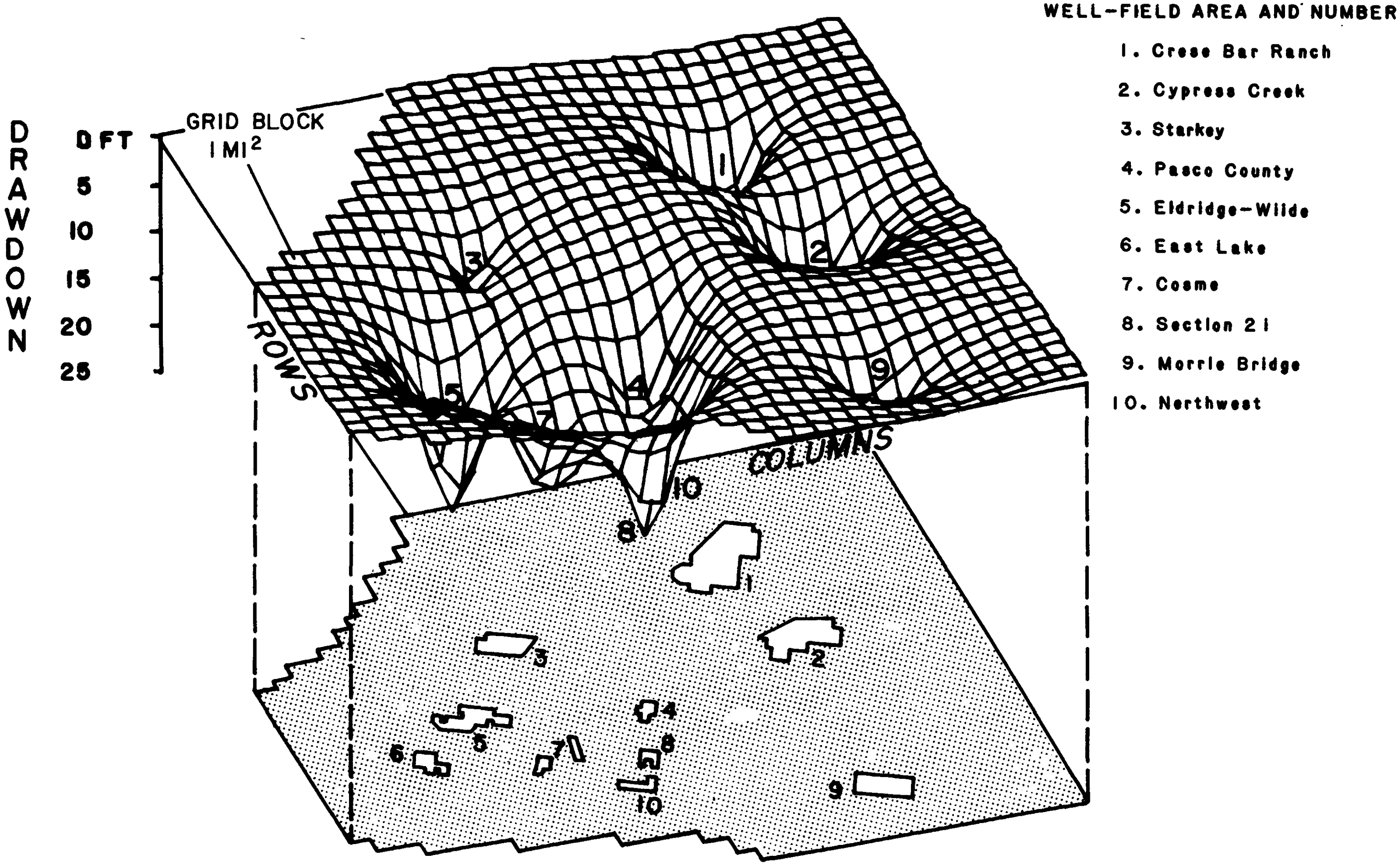


Figure 40.--Drawdown in the potentiometric surface of the Floridan aquifer under pumping conditions.