LAND DRAINAGE AND SOIL RECLAMATION PROCEDURES IN ARID AND SUB-HUMID AREAS OF DEVELOPING COUNTRIES

USING, AS AN EXAMPLE

THE ATLANTICO-3 PROJECT, COLOMBIA

by

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PREFACE

This study was financed by the United States Agency for International Development (AID) under contract AID / csd-2167, Water Management Research in Arid and Sub-Humid Lands of Less Developed Countries. Invaluable support and cooperation were extended by the Instituto Colombiano Agropecuario (ICA) and the Instituto Colombiano de la Reforma Agraria (INCORA). These two Colombian agencies furnished counterpart professionals, technical and secretarial personnel, field workers, office space, laboratory facilities, locally available supplies and equipment, and, of course, the study problems. The USAID / Colombia Mission furnished essential logistic support and services necessary to the comfortable maintenance of the families of the University personnel in Colombia.

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SUMMARY AND CONCLUSIONS

Studies were implemented in Stage I of the South Sector of the Atlantico-3 Project where high water table conditions and the resulting increase of soil salinity were beginning to have adverse effects on parts of a 300 hectare citrus plantation. The work was orientated to determine the drainage requirements and design criteria for water table control on the less saline soils, and to reclaim and improve salt affected areas.

Soil Studies

The soil texture is extremely variable in the study areas. This variation is not only with depth in the profile, but is also apparent from site to site. At about 2 meters there is a heavy clay layer underlying the study area. Soil samples were analyzed by the INCORA soils laboratory at El Limon and the ICA regional soils laboratory near Monteria.

The results of the chemical analyses from the two laboratories do not correlate well with each other. Extreme care must be utilized in interpreting the results of these analyses. Generally, the upper 75 cm of the soil in the drainage study area was initially non-saline, while the lower 125 cm of the 2 meter profile was saline. The degree of alkalinity which existed in the citrus area could not be determined accurately. According to the INCORA analyses only about 15 percent of the samples analyzed were sodic, while the results from the ICA laboratory indicate that about 40 percent were sodic.

The infiltration tests verified the extreme variability of the texture of the surface soil. The rate of infiltration generally correlates with distance from the juncture of the Dique Canal with the Magdalena River. This is in agreement with the method of deposition of this soil as sediment loads in successive inundations of flood waters from the canal and river.

Drainage Study

In the 16 ha study area six tile drain lines were installed by INCORA at a depth of 2 meters at spacings of 49 and 98 meters. Throughout the same area 134 observation wells were installed to monitor the effect of the drainage system on the water table.

After the tile drainage system was installed and had been in operation during a period of intense rain, the surface drainage in the study area was improved by the construction of a network of shallow surface ditches which diverted excess surface water into the bordering deep open drains before it could accumulate in several major topographic depressions located throughout the study area and infiltrate into the soil.

Effectiveness of Drainage System and Reclamation of Salty Soils

Several methods were employed to evaluate the effectiveness of the drainage system. They included:

1. Construction of isoline maps to show:
   a. The groundwater elevation as contours on specific dates.
   b. The depth from the surface to the water table as contours on specific dates.
2. Construction of hydrographs to show the fluctuation of the water levels in specific observation wells with time. When compared with similar graphs of rainfall, water level in the Dique Canal, the construction of the drainage system, and the draining of the borrow pit, these hydrographs show the effect of these parameters on groundwater levels.
3. Estimation of removal of groundwater and salt by the drainage system from weekly measurements of flow and salinity. When compared with the estimated amount of salt present in the soil, these data give an idea of the success of the drainage system and leaching.

Other information bearing on the possible reclamation of the salt affected soils, but which depends upon satisfactory drainage, included the following measurements:

1. Infiltration capacities of the soil.
2. Soil salinity as indicated by the electrical conductivity.
3. Soil texture, exchangeable sodium status, and pH of the soil.
4. Removal of salts by leaching.

The principal source of the high water table in the citrus zone was determined to be from rainfall during the intense rainy season collecting in surface depressions because of the uneven topography. This problem was aggravated by the open borrow pit along the upper edge of the orchard which acted in turn as a collector of surface water and then as a line source of recharge to the 2 meter profile situated on the heavy clay layer.

Before the surface drainage was markedly improved, the tile drain system could not cope with the intense rains. The water levels rose abruptly in and near depressions which collected surface water in spite of the subterranean drainage. The groundwater was completely removed to a 2 meter depth by the tile lines during the dry season. With the surface drainage situation improved, the rainy season from August to November, 1972, had little apparent effect on the groundwater levels in the study area.

Importance of Surface Drainage

In the early stages of a project such as this is, surface drainage should be provided to remove the runoff from the intense rains that may be expected. Surface water from rain or irrigation should not be permitted to accumulate in surface depressions and seep into the soil. When such surface drainage is provided in connection with the land grading and preparation necessary for the initial introduction of crops, the extra cost would be minimal in comparison with the cost of providing it after a perennial crop is established.

Development of a Drainage Function

Two drainage functions, one quadratic in form and the other exponential, were developed as an aid in the design of drainage systems in regions of similar circumstances:

$$H = H_1 e^{-0.024\,T}$$

and

$$H = H_1 (1 - 0.031\,T^{0.82})$$

where

H = the predicted head above the drain level in meters

H_1 = the initial head above the drain level in meters

T = the elapsed time after the initial head level in days

It was found that without a source of constant recharge the water table declined at a relatively uniform rate throughout the area. The average time for the water table to drop half the distance to the drain level was about 30 days, which is considered to be satisfactory performance. This would indicate that a drain spacing of about 100 meters (the maximum used in the analyses) would satisfy these soil conditions.

Removal of Salt from Soil Profile

About 16 percent of the salt initially present in the profile was removed with the drainage water after about one year of operation of the system. A much larger quantity of salt could have been removed during that time had irrigation not been discontinued and purposeful leaching been conducted. Unfortunately, the rainfall during 1972 was only about 80 percent of normal. One year of good irrigation management and some additional leaching could greatly improve the saline condition in the citrus orchard.

Leaching Study

The study demonstrated that with a minimal amount of leaching and no special soil amendments applied, the soils north of the citrus zone, which are now out of production because of the high water table and salinity, can be reclaimed for crop use if adequate drainage is first provided for the area to be reclaimed. The average salt content in the first meter of the soil profile in the leaching plots was reduced from an estimated 46.6 tons per hectare on June 19, 1972, before leaching to 11.0 tons per hectare, May 27-29, 1973, after the rice harvest. This was a reduction of approximatley 76 percent of the salt initially present.

Paddy rice can be grown on these salty soils during the leaching process provided the surface is properly graded and prepared for contour flooding. Yields of 8 metric tons per hectare were obtained on small paddies with only minimal leaching prior to planting. After leaching, rice could be irrigated by either flooding or sprinkler irrigation.

Overall Conclusions

The data obtained indicate that the soils in the study area can be drained and reclaimed from their saline condition when both surface and subsurface drainage are provided. The economics of drainage and reclamation on a larger scale was not investigated in these studies, although some cost data were secured.

Significance of the Study

The results accomplished in this study through better water management, including surface and subsurface drainage combined with adequate leaching, are typical of what might be accomplished in other areas throughout Latin America where high water tables and saline soils are present. There are many such areas in every country in Latin America where irrigation projects have been developed.

Application of Results to Atlantico-3

To make practical use of the results of these investigations the following suggestions can be listed:

1. INCORA should complete the deep open drainage system that now exists in the citrus for the area that is to be cropped under irrigation. The system should have a regular maintenance program of cleaning and sediment control to insure its efficient operation.

2. The borrow pits paralleling the dike should be earth filled with the excavated material from the deep open drainage system to avoid the collection of rain water in them. In many instances it would be simple to at least drain the borrow pits into a nearby canal of the open drainage system.

3. A set of enforced regulations and control should be imposed on the use of irrigation water from the sprinkler hydrants. Non-conformity with the rules should be met with economic and/or social punitive measures. No free flowing open hydrants should be sanctioned.

4. The natural surface drainage should be improved and maintained throughout the area served by the open drainage system to insure that all excess rain water will rapidly move into the drainage canals and not stand for long periods of time in surface depressions.

5. The tile drainage system throughout the citrus orchard should be periodically cleaned and flushed to insure that it remains functional. A frequent inspection should be made of all drain tile outlets to assure that they are clear of weeds and mud and free flowing.

6. Irrigation within the citrus area should be closely supervised and programmed to provide a more adequate, uniform coverage. The irrigation frequency should be adequate to maintain soil moisture within an acceptable range in the root zone. Proper management will provide sufficient excess water to move any accumulated salts down through the soil profile and out through the drainage system.

7. In highly salinized areas, blocks of land bounded by the open drain system can be selected and provided with sufficient internal drainage to permit the planting of an inundated rice crop without unduly influencing the groundwater conditions in bordering blocks. The leaching obtained by this action should sufficiently prepare the soil for subsequent crops of cotton, soya, etc., provided that good water management is continued. Good water management requires that there be continuous, close contact between the farmers and the INCORA or ICA professionals.

Transferral of Results to Other Areas

Considerable information was obtained in this study with very simple equipment, construction, and instrumentation. The observation wells used in the investigations were, by design, made of low cost, locally available materials which were easy to install and maintain. With sufficient wells located throughout the study area the water table conditions were readily monitored and the fluctuations documented by regular, weekly measurements. The main consideration in installing these observation wells, other than their placement to the proper depth, is to locate them where there will be a minimum amount of damage by agricultural machinery and to protect them from vandalism. Observation wells should be installed to a depth of about one meter below the present or proposed depth of the drainage system.

The most valuable single piece of laboratory equipment was found to be a good electrical conductivity meter. With this meter, together with an accurate balance and a laboratory oven, relatively rapid determinations of the salt contents of both soil and water samples may be made. This equipment proved to be sufficient to monitor the changes of salinity over a period of time and to estimate total quantities of salt evacuated from the plot. A more detailed analysis would require the availability of a more complete soils laboratory having sophisticated, expensive equipment. If a reliable facility is available, it would be well to use it to obtain accurate and complete soil and water analyses which would serve to initially identify and describe the soil and / or water quality problems. Monitoring in the field of the effects of the reclamation procedures can be efficiently accomplished with the equipment mentioned above.

The simple procedure developed in the second stage of the leaching study would be the quickest and most economical means of conducting a similar trial in another area. The construction of the dikes between the paddies was accomplished using a disc border former (levee disc). The measurement of the water through a small flume was more accurate than the methods used in the first stage which required more instrumentation in the form of stilling wells and a hook gage. Most desirable of all, the planting and growing of a rice crop during the leaching process provided an economical return from the land during the reclamation process. In any leaching procedure it must be understood that adequate drainage is essential to carry away the salts and excess water.

The importance of surface drainage in high rainfall areas cannot be over-emphasized. Prior to the introduction of crops the natural surface drainage routes should be determined and improved where necessary. In many instances this operation can be done at the same time, with little additional expense, as the land is initially cleared and prepared for crops. Major drainage paths should be developed to assure that all excess surface water can rapidly flow out of the area. Rather than planting in regular geometric patterns across the surface drainage paths, it would be desirable to plant along contours so as to keep natural drainage paths open. All surface depressions within the area after the land preparation step is accomplished should be connected with the surface drainage system so that water will not remain on the surface.

All borrow areas within a project area should be filled in wherever possible to avoid their acting as collection basins for excess rain water. If this is not possible, an attempt should be made to drain them through the drainage system. All surface water that can be evacuated from an area during the rainy season will not have to be drained away later with a more expensive buried tile drainage system. If there is not a major source of subterranean water which must be drained in an area to be developed, it is possible that good surface drainage and judicious use of irrigation water on the prepared land will avoid the development of a high water table and the necessity of installing a tile drainage system during the life of a project.

The results of this study have strongly indicated the need for strict control and management of the experimental tract and the irrigation system. Control of the water table is of prime importance to the economic success of the project. This requires a system of rules and regulations pertaining to the use of the irrigation facilities, enforcement of the rules by careful supervision, and frequent patrol of the system. A good extension service is essential to train the users in the best methods of water use for efficient and economical results within the limitations imposed by soils, climate, and water table conditions.

INTRODUCTION

Objective

The objective of the research performed under the contract between the U. S. Agency for International Development (USAID) and Utah State University (USU) was to assist the Colombian Institute of Agricultural Research (ICA) in planning and carrying out a program of water management research at the Santa Lucia Station in the Atlantico-3 Project of the Colombian Institute of Agrarian Land Reform (INCORA): Specifically the work was to be oriented to the solution of two main problems:

1. Determination of the drainage requirements and design criteria for water table control on the less saline soils.
2. Reclamation and improvement of salt affected areas.

The data and information obtained would be used in the national development of land and water resources in Colombia and elsewhere as applicable. Such information is of special interest to agencies such as INCORA in the development of irrigation districts and to farmers in general. This program was to be an integral part of the program of ICA for research in Colombia.

Location

The study area, 16 hectares, is located in a citrus grove on lands near the Santa Lucia Research Station on the Santa Lucia Farm. The station is situated on the southwest edge of the Atlantico-3 Project in the so-called light soils area of Stage 1 of the South Sector of the project. It borders the Dique Canal near its juncture with the Magdalena River. Barranquilla, the capital city of the Department of Atlantico, is located 100 km by road to the north of the study area. (See Figures 1 and 2).

Topography

The South Sector of the Atlantico-3 Project (comprising some 37,500 hectares) is in a closed depression having a rough micro-relief and elevations ranging from slightly below sea level to about 8 meters above sea level. Included are secondary depressions of various sizes, which were formerly lakes and swamps, and a series of low ridges along old waterways, which served as communication channels between the lakes and swamps.

The banks of the Magdalena River and the Dique Canal, which bound the area on the east and southwest, are at the elevation of 6 to 8 meters above the lowest part of the project area. The northern part of the South Sector is bounded by the lower slopes of low hills having elevations ranging from 8 meters to 30 meters above sea level. The sector forms a closed basin in the shape of a shallow bowl with the Santa Lucia Station located along the rim of the bowl and with some land drainage from the station northwards toward the center of the South Sector.

In the past the region formed a part of the Magdalena River delta, an area of interconnected lakes and swamps, some of which had a direct linkage to the sea. The reclamation of the area began in 1953 with the construction of a protective embankment along the Magdalena River between Calamar and Puerto Giraldo. It continued with the construction of a similar embankment along the Dique Canal between Calamar and Villa Rosa in 1959. The Guajaro Dam which forms the western border of the basin was completed in 1964-65. This dam closed the basin and eliminated the annual flooding of the area and allowed it to dry up. The first agricultural development in the closed basin was initiated by INCORA in 1964. Figure 3 shows the state of the South Sector prior to the construction of any flood protection works.

Soils

The soils in the citrus grove are generally described by INCORA as the "light" soils in the project. Because of the manner of deposition from periodic inundation of flood flows from the river, coarser material is generally deposited nearest the sources of inundation, i.e. the Magdalena River and the Dique Canal. The soil particles become generally finer as one progresses away from these sources.

The soil profile consists of many layers generally beginning with a clay loam at the surface, a sandy loam layer from 25 to 75 cm deep, a sand lens varying from 25 cm to 75 cm in thickness below the sandy loam, and another clay loam layer beneath the sand.

Below these strata there is generally a thick body of clay of indeterminate depth. The pattern of this profile is very erratic from one location to another. Sometimes the sand layer extends from the surface to a depth of about 1.5 meters. In other locations sand is not encountered. Tables A-11 through A-15 give the texture classification of each sample taken for salinity analysis. The extreme variability is obvious. Figure 4 shows three typical particle size distribution curves for the soil textures as determined by physical analyses in the laboratory for one sample site to a depth of 1 meter. This site corresponds to location 1-A in the infiltration studies, Figure 12 and Table A-22.*

Climate

The climate of the region is tropical and semi-arid. Temperatures range from an average maximum of 38°C (100°F) to an average minimum of 20°C (68°F). The mean temperatures are nearly constant throughout the year, varying from 25° to 30°C (77° to 86°F).

Humidity is relatively high, ranging from an average minimum of 70 percent during the dry season to an average maximum of 90 percent during the rainy season.

Winds are light to moderate with the prevailing winds coming from the west and northwest.

Pan evaporation, as measured in the project area, is about 2,000 mm per year and varies from 225 mm for March to 138 mm for November.

*The prefix A on table numbers indicates that the tables are in the Appendix.

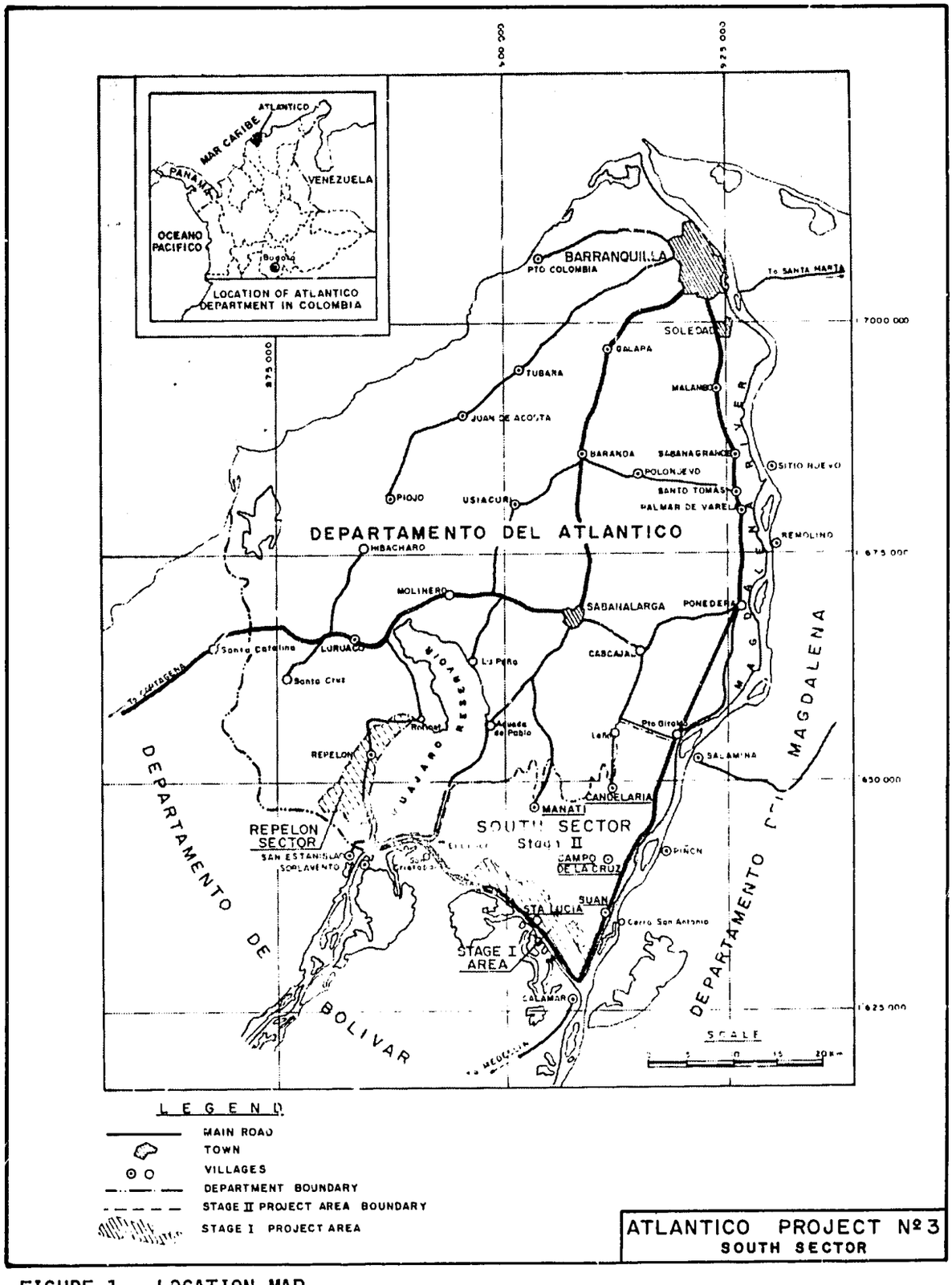


FIGURE 1. LOCATION MAP

(COURTESY TAHAL CONSULTING ENGINEERS LTD. & INCORA)

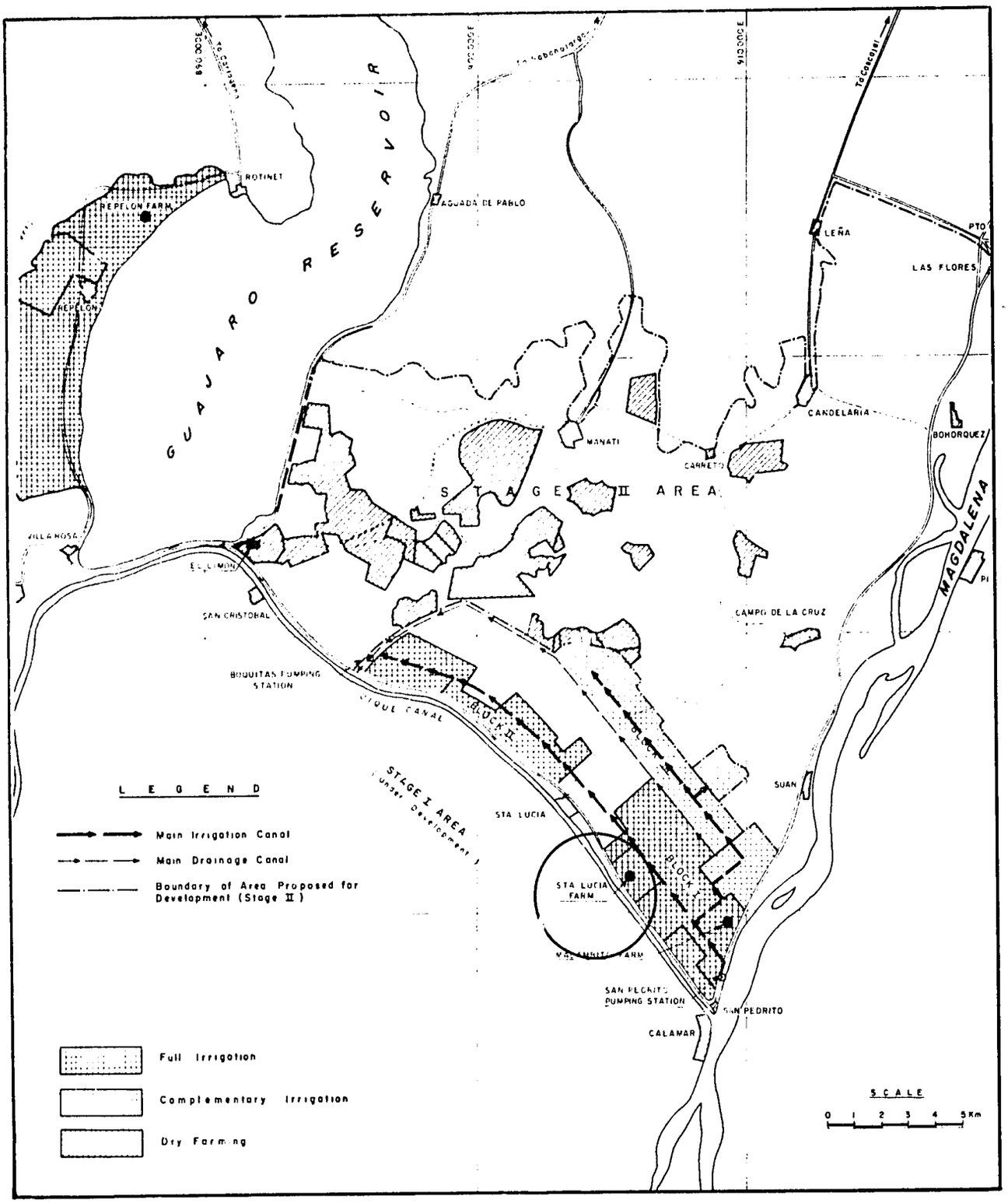


FIGURE 2. LOCATION OF SANTA LUCIA FARM

(COURTESY TAHAL CONSULTING ENGINEERS LTD. & INCORA)

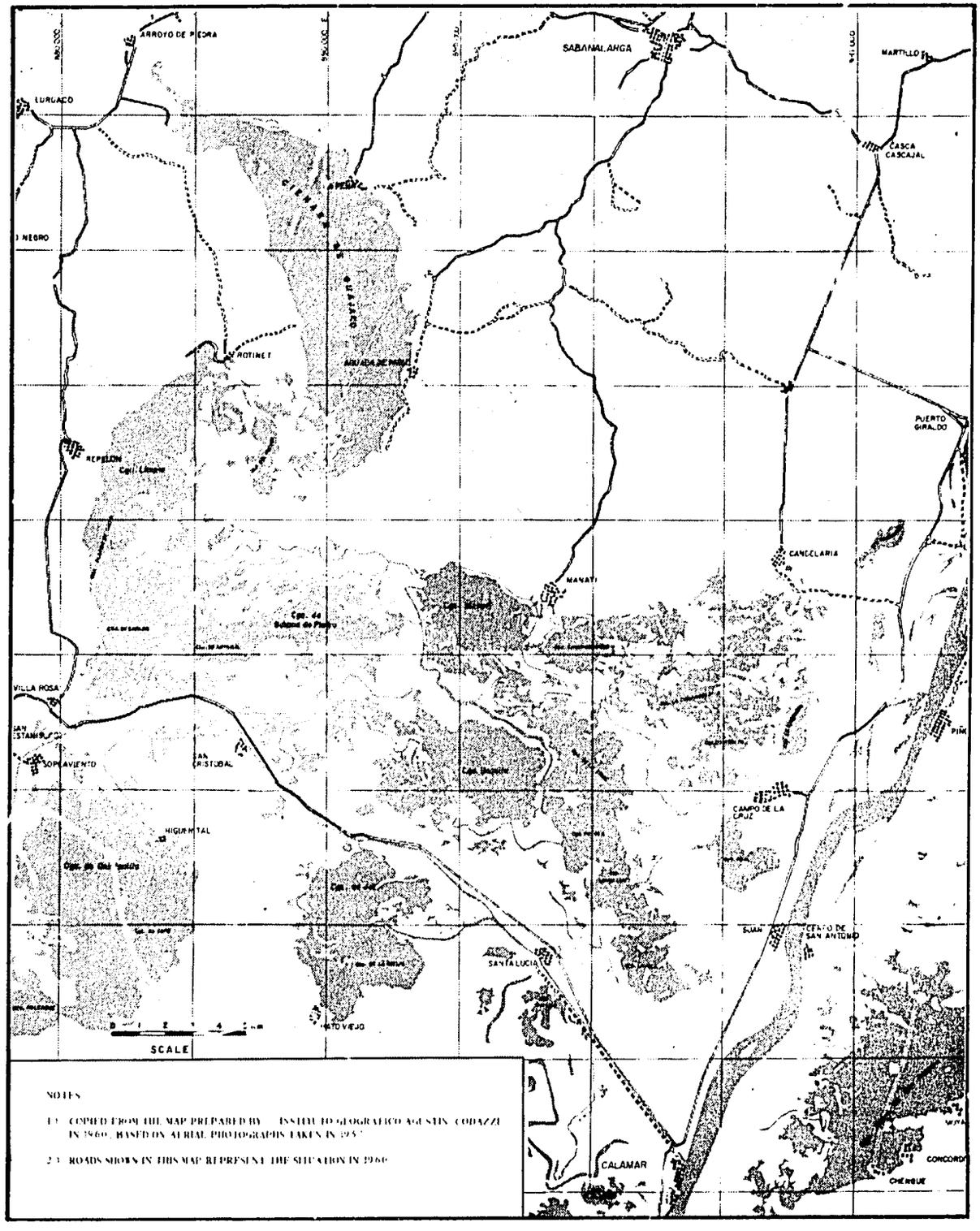


FIGURE 3. FLOODED AREAS IN 1953 BEFORE RECLAMATION OF PROJECT AREA

(COURTESY TAHAL CONSULTING ENGINEERS LTD. & INCORA)

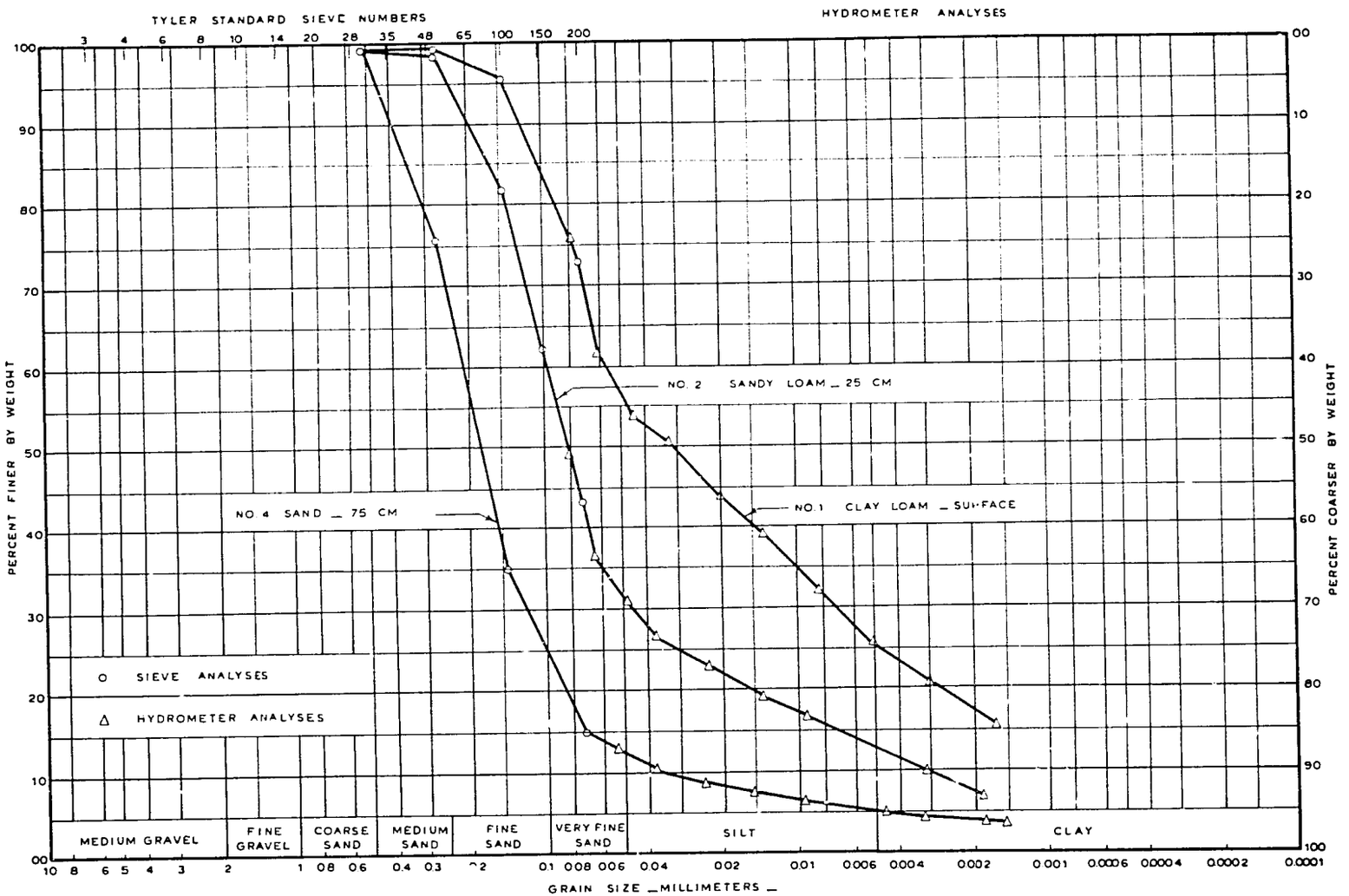


FIGURE 4. TYPICAL GRAIN SIZE DISTRIBUTION CURVES FOR ONE SAMPLE SITE

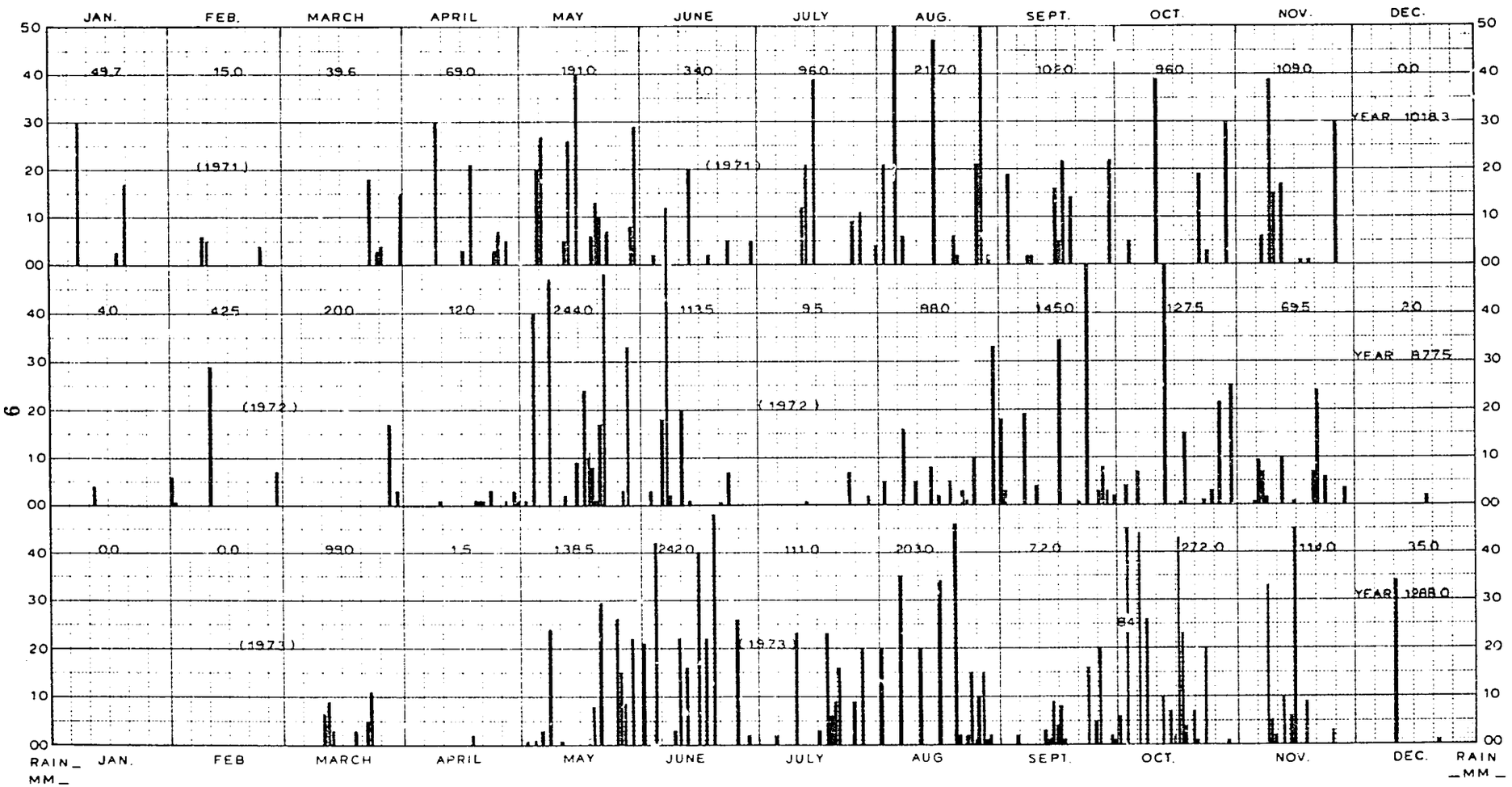


FIGURE 5. RAINFALL AT SANTA LUCIA STATION, 1971-73

Annual precipitation averages about 1,000 mm per year and is spread over a rainy season of about 7 months from mid-April to mid-November. In July and August the rainfall is normally lower than for the other rainy months. December, January, February, and March are essentially dry months. The annu l, as well as the monthly precipitation, varies considerably from one year to another, and from one area of the project to another. The daily rainfall distribution in the rainy season is irregular; at times rainfall may be well distributed over the month, while at other times the monthly total may occur in only 2 or 3 rainstorms. The storms are frequently of high intensity causing surface runoff into the depressions. Dry spells of 10 days or more are frequent during the rainy season. The rainfall at the Santa Lucia Station during the period, January, 1971, through December, 1973, is shown in Figure 5. The monthly rainfall and accumulated rain for 1971, 1972, and 1973 are tabulated in Table 1. The magnitude of the storms for the same period is summarized in Table 1a.

Table 1. Monthly Rainfall at Santa Lucia Station.

	1971		1972		1973	
	Rain	Acc. R	Rain	Acc. R	Rain	Acc. R
	mm	mm	mm	mm	mm	mm
Jan	49.7	49.7	4.0	4.0	0.0	0.0
Feb	15.0	64.7	42.5	46.5	0.0	0.0
Mar	39.6	104.3	20.0	66.5	99.0	99.0
Apr	69.0	173.3	12.0	78.5	1.5	100.5
May	191.0	364.3	244.0	322.5	138.5	239.0
Jun	34.00	398.3	113.5	436.0	242.0	481.0
Jul	96.0	494.3	9.5	445.5	111.0	592.0
Aug	217.0	711.3	88.0	533.5	203.0	795.0
Sep	102.0	813.3	145.0	678.5	72.0	867.0
Oct	96.0	909.3	127.5	806.0	272.0	1139.0
Nov	109.0	1018.3	69.5	875.5	114.0	1253.0
Dec	0.0	1018.3	2.0	877.5	35.0	1288.0
Annual		1018.3		877.5		1288.0

Hydrology

The water levels in the Magdalena River and the Dique Canal generally peak during the latter part of November and the first part of December. They then decrease until about the middle of March, at which time they begin to rise again to a mid-year peak towards the end of June There is generally another lowering of the level during July and August followed by a steady rise again to the maximum in November or December. The hydrographs from one year to the next are erratic. The December peak is generally higher than the June maximum, but the reverse is often the case, as it was in 1972. A year of near maximum flooding, such as occurred in 1971, can be followed by a long-term minimum flow such as that which began in the latter part of 1972. Figure 6 demonstrates the wide variation with the 1971, 1972, and 1973 hydrographs of

Table 1a. Magnitude of Storms at Santa Lucia Station.

Month	Rain	Days of rain with 10 or more millimeters	20	30	40	50	Max. Daily
1971	mm	Days					mm
Jan	50	2	1	1	0	0	30
Feb	15	0	0	0	0	0	6
Mar	40	2	0	0	0	0	18
Apr	69	2	2	1	0	0	30
May	191	7	5	1	1	0	40
Jun	34	1	1	0	0	0	20
Jul	96	4	2	1	0	0	39
Aug	217	5	5	3	3	1	61
Sep	102	5	2	0	0	0	22
Oct	96	3	3	2	0	0	39
Nov	109	4	2	2	0	0	39
Dec	0	0	0	0	0	0	0
Annual	1018	35	21	11	4	1	
1972							
Jan	4	0	0	0	0	0	4
Feb	42	1	1	0	0	0	29
Mar	20	1	0	0	0	0	17
Apr	12	0	0	0	0	0	3
May	244	7	5	4	3	0	48
Jun	114	3	3	1	1	1	62
Jul	9	0	0	0	0	0	7
Aug	88	3	1	1	0	0	33
Sep	145	4	2	2	1	1	50
Oct	128	4	3	1	1	1	50
Nov	69	2	1	0	0	0	24
Dec	2	0	0	0	0	0	2
Annual	877	25	16	9	6	3	
1973							
Jan	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0
Mar	99	1	0	0	0	0	11
Apr	2	0	0	0	0	0	2
May	138	5	4	0	0	0	29
Jun	242	8	7	3	2	0	48
Jul	111	4	2	0	0	0	23
Aug	203	7	5	3	1	0	46
Sep	72	2	1	0	0	0	20
Oct	272	7	4	3	3	1	84
Nov	114	3	2	2	1	0	45
Dec	35	1	1	1	0	0	34
Annual	1288	38	26	12	7	1	

the Dique Canal at the Santa Lucia Farm. There is some correspondence of the water stage with the rainy period in the area, but it is more reflective of the magnitude of the rains which occur earlier in the

mountains of the interior of Colombia. Water levels for the first and fifteenth of each month are given in Table 2.

Table 2. Water Levels in Dique Canal at Santa Lucia
First and Fifteenth of Each Month

	1971		1972		1973	
Month	1st	15th	1st	15th	1st	15th
	Elevation in meters above sea level +100					
Jan	107.20	106.75	105.75*	104.95	103.50	102.78
Feb	106.32	105.79	104.69	104.47*	100.10*	100.57
Mar	105.52	105.18	103.29	103.00	99.96	101.40
Apr	105.53	105.83	103.81*	103.47*	101.82	101.69
May	106.00	106.26	104.81*	105.43	102.90	103.19
Jun	106.61	107.09	106.09*	106.46	103.74	103.69
Jul	107.17*	106.84	106.80*	106.45*	104.68	104.54
Aug	106.35*	106.16	105.30*	104.30*	104.73	105.11
Sep	106.29	106.63	104.80	104.57	105.40*	106.08*
Oct	106.82	106.98	104.64*	104.90*	106.60	107.13
Nov	107.10*	107.47*	105.05*	105.52	107.42	107.49
Dec	107.46*	106.85*	105.67	105.23	107.53	107.68

* Estimated. Water level not measured on day indicated.

Development of South Sector

Stage 1 of the development of the South Sector was commenced in 1964 as shown in Figure 2. About 300 hectares of citrus were planted on the Santa Lucia Farm commencing in about 1966. The soils in this area are much sandier and somewhat higher in elevation than the heavier soils located towards the center of the project.

Sprinkler irrigation was chosen for the area, probably because of the lighter texture of the soil and the micro relief of the surface. Considerable grading would have been required for surface irrigation methods.

No attempt was made to even superfically grade the land surface before (or after) planting the citrus grove. The sprinkler system consists of a system of buried parallel main lines which extend through the grove in a direction normal to the Dique Canal at 200 meter spacings. At this time the main line is temporarily supplied by a centrally located floating pumping station on the Dique Canal. Rain Bird #30 W - 5/32" sprinklers are used on a 14 m x 14 m spacing — the trees being planted on a 7 m x 7 m grid.

Problems in Citrus Grove

By 1968 the soils in the portion of the citrus grove nearest to the center of the basin were beginning to salinize and the trees located there began to die first Water tables rose gradually throughout the plantation and trees died in a randomized pattern (Photo 1). This was attributed largely to the fluctuating and generally rising water table and to the concurrent increase in the soil salinity. The problem was compounded as the trees reached maturity. As the rooting depth developed downward, the aerated zone decreased simultaneously with the rise of the water table. Even though the water table may not have inundated the roots, the capillary rise of the saline moisture into the root zone proved detrimental to the trees. The rise in the water levels in this zone, which borders along the Dique Canal, was generally believed to be caused by the proximity to the canal in which the water level during the flood stage was often higher than the ground surface in the citrus grove.

Other factors also contributed to the decline and demise of the trees. Among these were disease, varietal and root stock differences more or less susceptible to the rigors of the climate, some of which were known to be more susceptible to disease, and other problems. These factors were considered to contribute to the general weakness of some of the trees, but the overwhelming problem that defeated the weakened trees was the rise in the water table.

Experimental Area

An area of 16 hectares located in the westerly portion of the citrus grove, which was the part most affected by salinity, was selected for the experimental work. This was the part of the grove most distant from the Magdalena River. The water table was generally higher in this block than in other parts of the citrus grove. The study area is bounded on the southwest side by the Dique Canal and on the southeast and northwest sides by two 2-meter deep open drains spaced at 400 meters (Photo 2). Figure 7 shows the topography, natural drainage lines and the bordering open drains of the study area. From this figure it is apparent that the principal slope is to the north away from the Dique Canal and, also that the surface is irregular with no completely clear natural surface drainage. There are some beginnings of natural drainage but the paths lead to depressions in the area where surface water accumulates.

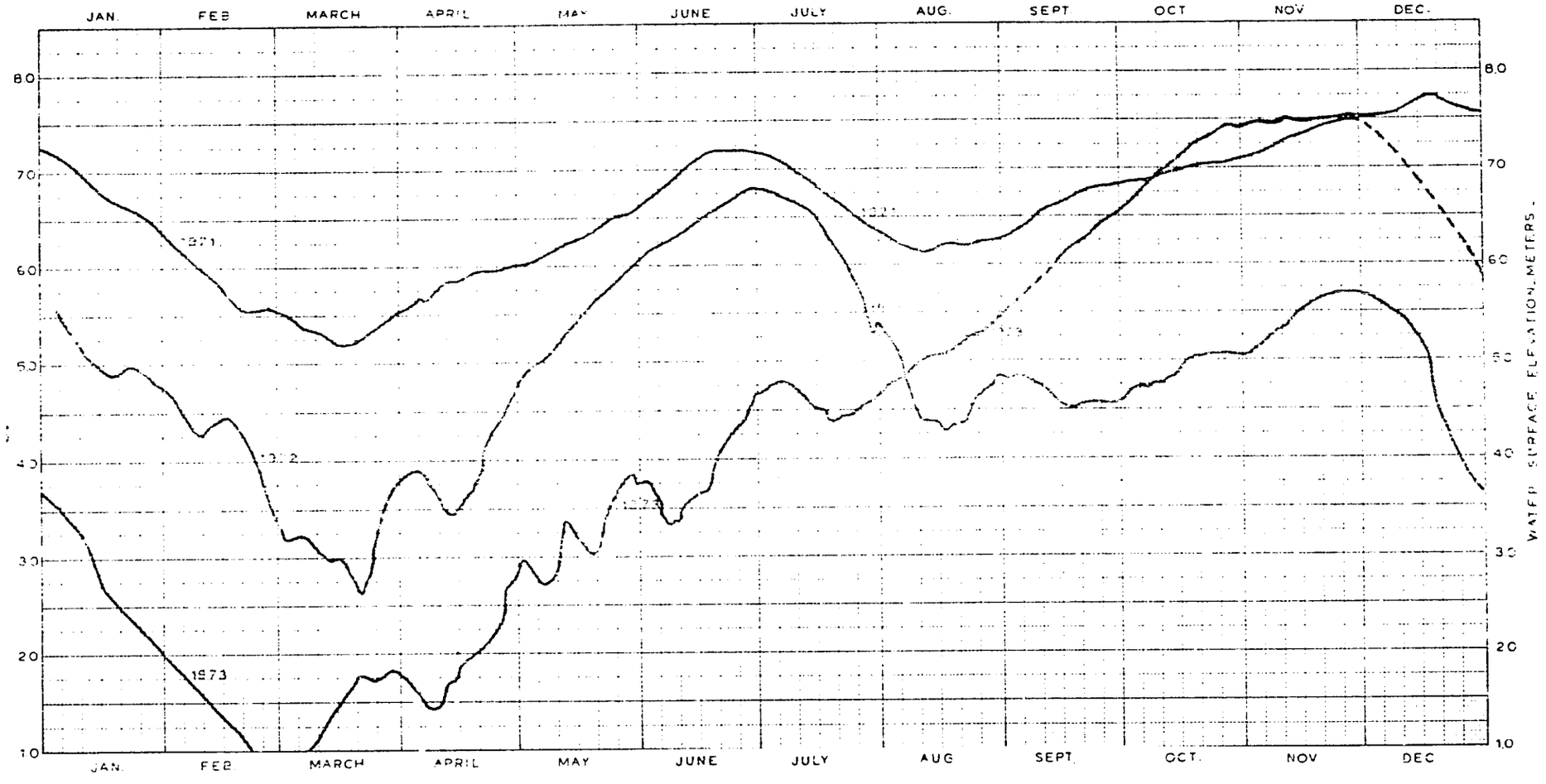


FIGURE 6. WATER LEVELS IN DIQUE CANAL AT SANTA LUCIA, 1971-73

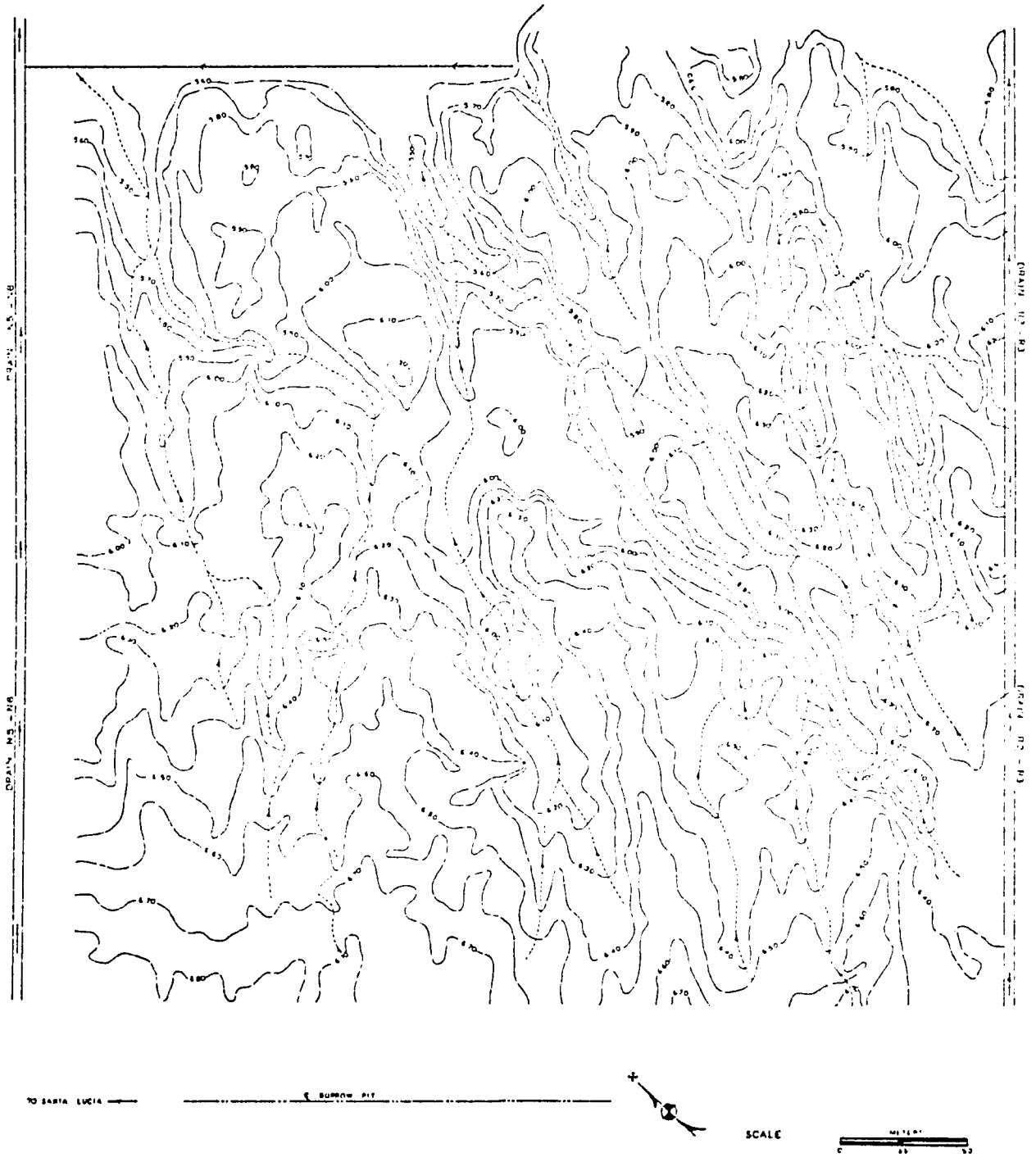


FIGURE 7. TOPOGRAPHIC MAP OF STUDY AREA IN CITRUS AREA

Photo 1. The Citrus Dying in a Randomized Pattern

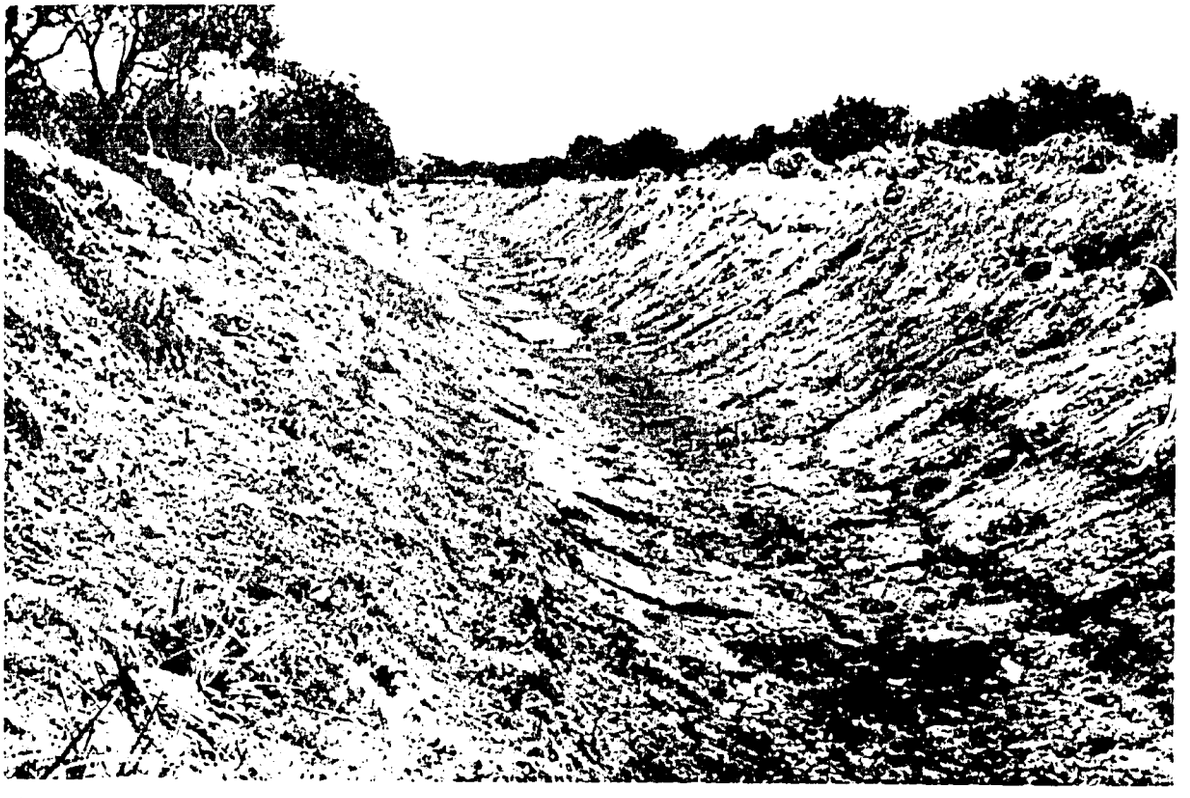


Photo 2. Open Drain Bordering Study Area

Soil Salinity

In June, 1971, the soils in the study area were sampled to establish the initial conditions of salinity and exchangeable sodium status. A grid containing 40 sites was established and each site was sampled to a depth of 2 meters at each change of texture. Figure 8 shows the location of these sites. The samples were split in half and a complete set of samples was sent to two soils laboratories for analysis: 1) The Soils Laboratory at El Limon, the INCORA administrative center for the Atlantico-3 Project, and 2) The Soils Laboratory at Turipana, the ICA regional research station near Monteria, Colombia. The INCORA El Limon Laboratory was set up to determine the soil salinity conditions on lands being developed within the Atlantico-3 Project. Electrical conductivity readings, pH, and the amounts of calcium and magnesium cations were determined on the saturated soil extracts. An estimation of the exchangeable sodium percentage (ESP) on the soil particles was then made indirectly using the relationships and graphs in the U.S. Salinity Laboratory Handbook 60, **Diagnosis and Improvement of Saline and Alkali Soils.**

The ICA Turipana Laboratory was established to meet the needs of ICA researchers throughout Colombia. It is equipped to give complete direct analyses of all the exchangeable cations as well as the more simple electrical conductivity and pH determinations. The laboratory is some distance from the project, so direct communication with the laboratory technicians is infrequent.

Conductivity Measurements

A complete listing of the analyses as given by each laboratory is given in Table A-11 through A-15.* There is reasonable agreement of the two laboratories on the electrical conductivity determinations; however, there are a few instances of widely differing values on the same sample. In general the upper 75 cm of the study area was initially non-saline with an average EC of 2.1 mmhos/cm and the lower 125 cm was saline with an average EC of 5.7 mmhos/cm. An EC value of 4 mmhos/cm is considered the dividing line between non-saline and saline soils. Sixty-nine or 36 percent of the 191 samples analyzed by ICA had a conductance of 4 mmhos/cm or more. Of the 153 samples analyzed by INCORA, 48 or 31 percent were saline. About 12 percent of the sites were saline throughout the profile.

A total of 145 soil samples were analyzed by both laboratories. Of these, the INCORA conductivity values averaged 3.27 mmhos and the ICA values averaged 4.02 mmhos. The average ratio of the INCORA values (y) to the ICA values (x) was

$$y = 0.8143\ x \qquad (1)$$

and the mean absolute difference, expressed as the percentage of the mean measured y value was

$$ERC = 22.2$$

When 5 wild points are eliminated, leaving the most consistent 140 pairs of values, the best relationship is

$$y = 0.8244\ x \qquad (2)$$

and the mean absolute difference was

$$ERC = 18.4 \text{ percent}$$

Exchangeable Sodium Percentage (ESP)

The ESP values as determined from data supplied by the two laboratories were plotted as shown in Figure 9. As indicated, there was a large scatter of the points. The INCORA values were determined by an indirect method based on relationships developed by the U. S. Salinity Laboratory for different soil conditions. These empirical relationships may not be reliable when applied to soils developed under different climatic conditions, unless studies such as these do indicate that the results obtained correlate well with those obtained by direct analyses. This was not found to be the case.

There are gross inconsistencies within the ICA analyses which also lead to doubts as to the accuracy of these results, giving no real basis for comparison between the two laboratories. In about 20 percent of the analyses the sum of the exchangeable cations given for the sample is greater than the determined cation exchange capacity (CEC) of the sample in question. Also, the CEC value was not determined for an additional 20 percent of the samples. Since about 40 percent of the CEC analyses by ICA are either questionable or lacking, the ESP values given in Tables A-11 through A-15 were determined using the sum of the exchangeable cations (CAT) rather than the CEC values. On this basis about 40 percent of the samples would be classified by ICA as sodic while the INCORA determinations indicate that only about 15 percent of the samples analyzed were sodic.

Two regression equations were determined from the data by the method of least squares. One equation expresses the y values (INCORA) as a function of the x values (ICA) and the other, x as a function of y. The ICA values in this instance cannot be assumed to be correct and the INCORA values in error. The regression equations obtained from the analyses are:

$$y = 1.2175 + 0.298\ x \qquad (3)$$

and

$$x = 11.286 + 0.821\ y \qquad (4)$$

Equation (4) can also be written

$$y = -13.748 + 1.218\ x \qquad (5)$$

The R^2 values for equations (3) and (4) are the same, 0.2446, which indicates a poor correlation because of the large scatter.

Another equation, which represents a line through the origin and the centroid of all of the points, is

$$y = 0.3728\ x \qquad (6)$$

Equation (7) represents a line that passes through two centroids representing the points for which the x values are smaller and larger than the mean x value.

$$y = 1.134 + 0.303\ x \qquad (7)$$

It might also be assumed that the line that best

*All tables with the A prefix are in the Appendix.

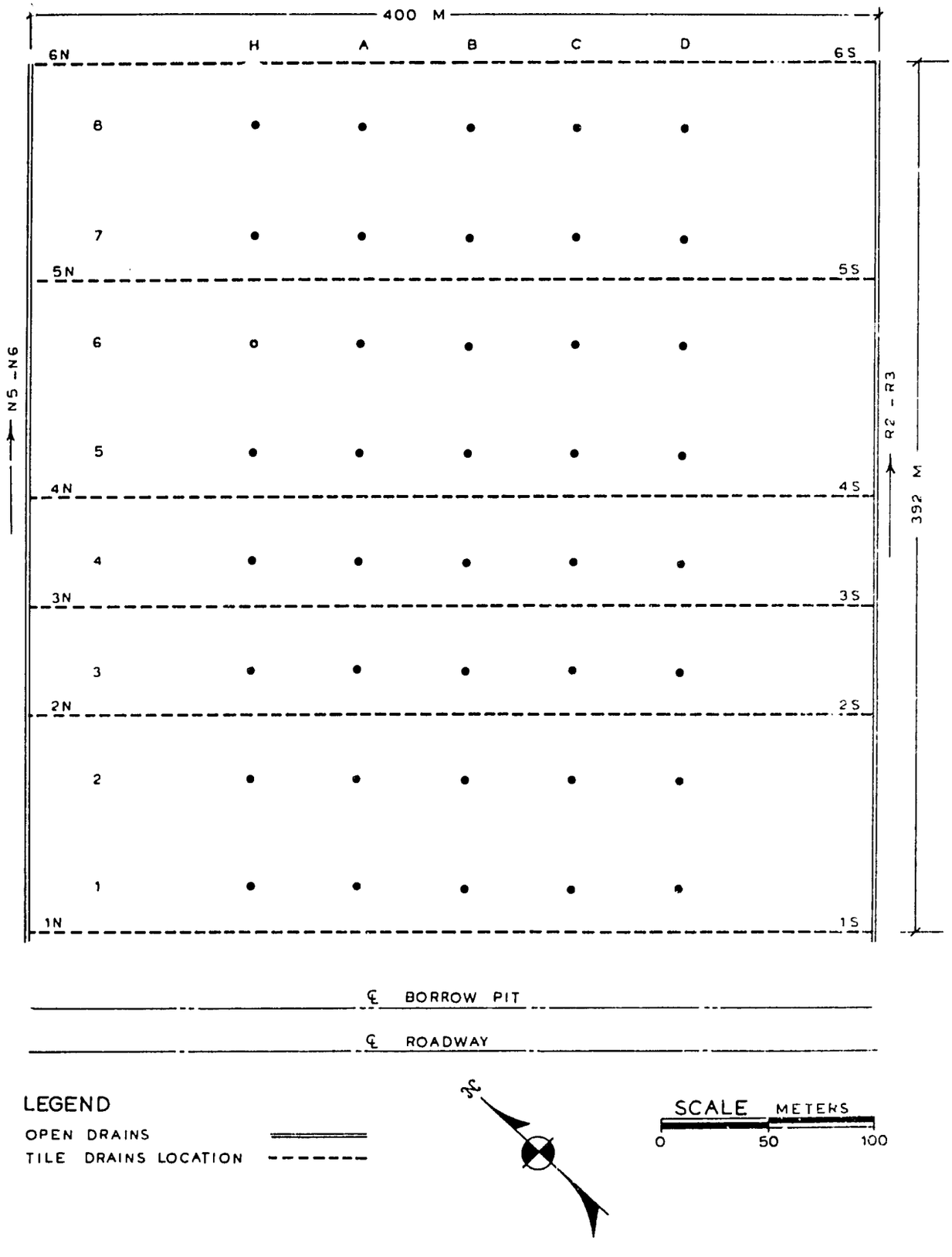


FIGURE 8. LOCATION OF SOIL SAMPLE SITES IN STUDY AREA

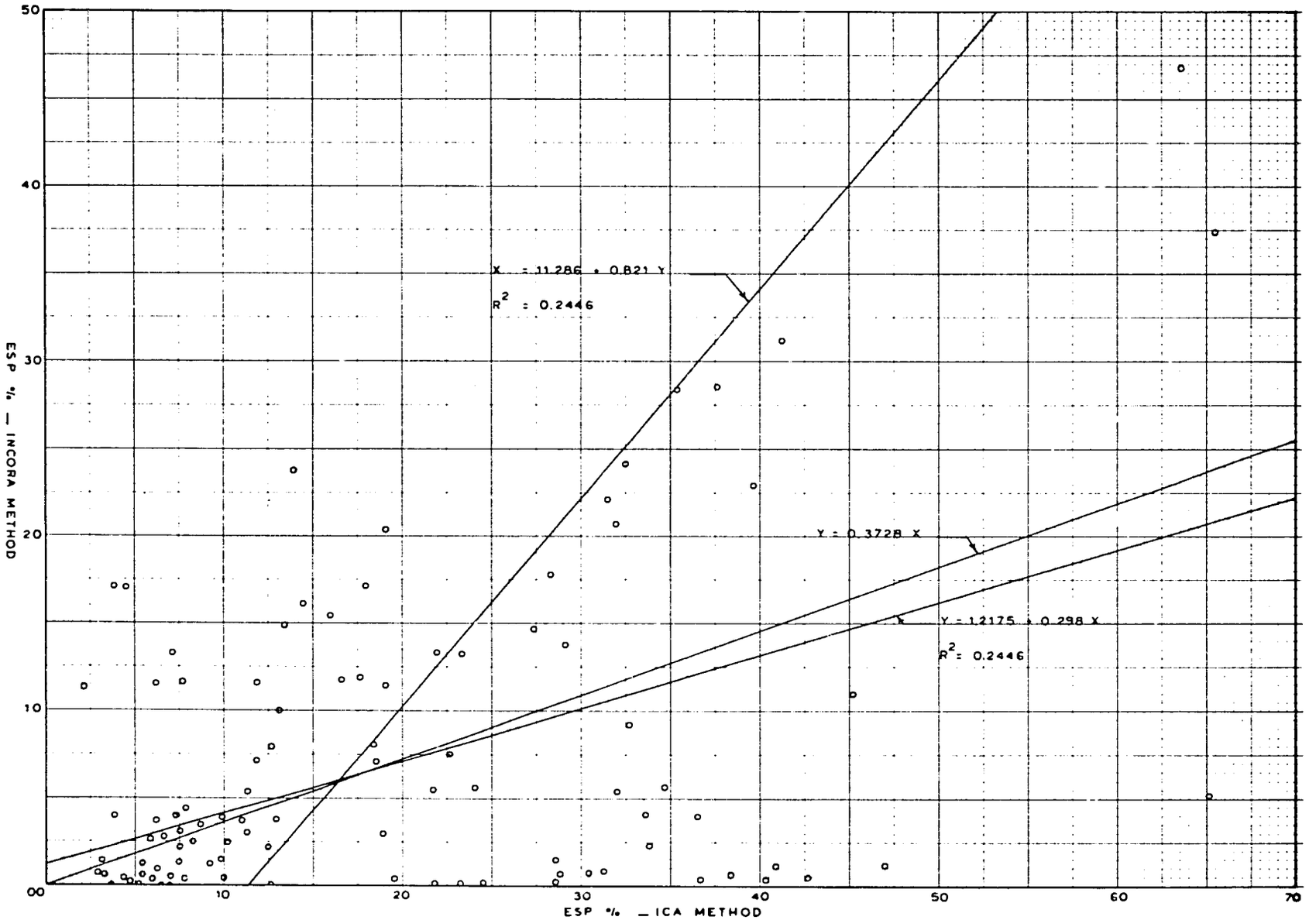


FIGURE 9. COMPARISON OF EXCHANGEABLE SODIUM PERCENTAGES OF ICA AND INCORA METHODS

represents the relationship of the x and y variables would be the one that bisects the angle between the lines represented by equations (3) and (4). The equation for this line is

$$y = -4.265 + 0.635\,x \qquad (8)$$

For this line the error (deviation) was taken as the distance from any point to the line measured normal to the line. The following tabulation shows the mean absolute errors for these equations all expressed as a percentage of the mean y value.

Equation	Mean Absolute Error
(3)	87.6
(6)	85.8
(7)	87.4
(8)	83.1

Equations (3), (4), and (6) are shown in Figure 9. The R^2 values and the mean error values in the above tabulations indicate that there was no satisfactory relationship between the x and y values.

Salt in Soil Profile

Based upon the average value of the EC measurements as obtained by ICA and INCORA, the quantity of salt in the soil profile was estimated at each sample site. The results for each soil sample are given in Tables A-16 through A-20. When either the ICA or the INCORA value of EC (ECA or ECI) values are missing (tabulated as .00), the mean value, ECAV, is taken as the other value.

The estimated amount of salt in the profile is summarized in Table 3 in tons per hectare for both the surface 60 cm of depth and the full 2.0 meter profile. The data have been arranged in the table to correspond with the locations as defined in Figure 8 showing the soil sample sites.

Table 3. Summary, Salt in Soil Profile, Citrus Orchard

Row	H	A	B	C	D	Average
	Salt in tons per hectare in 60 cm depth of soil					
8	9.43	2.26	6.82	2.85	15.26	7.32
7	25.80	2.02	3.27	4.06	1.54	7.34
6	1.28	14.20	2.00	2.62	1.16	4.25
5	.90	2.33	1.26	1.92	1.88	1.66
4	4.28	11.92	.61	1.32	1.28	3.88
3	1.40	1.16	2.59	2.13	1.74	1.80
2	1.52	1.81	3.66	4.81	8.53	4.07
1	1.53	2.05	2.19	3.37	3.66	2.56
Average	5.77	4.72	2.80	2.88	4.38	4.11
	Salt in tons per hectare in 2 meters depth of soil					
8	81.2	17.8	44.8	9.6	92.4	49.2
7	112.8	37.3	43.7	43.5	73.5	62.2
6	14.0	56.3	68.2	39.1	22.1	39.9
5	34.9	22.8	3.3	54.6	36.3	30.4
4	25.9	32.1	14.1	6.5	4.6	16.6
3	33.4	25.1	14.1	4.7	17.2	19.9
2	18.0	11.0	24.9	23.3	38.2	23.1
1	5.9	32.4	21.4	40.4	23.5	24.7
Average	41.4	29.3	29.3	27.7	38.5	33.2

Most of the salt present at the time of sampling, June 1971, was located below the 60 cm depth. The average amount in the upper 60 cm was 4.1 metric tons per hectare while the full 2 meters contain 33.2 metric tons per hectare. This is approximately equivalent to an average electrical-conductivity of 2.1 mmhos/cm in the upper layer (non-saline) and 5.7 mmhos/cm in the lower 140 cm. A conductance of 4 mmhos/cm would correspond to about 7.6 tons per hectare in 60 cm and 23 tons per hectare in 2 meters. This amount of salt is exceeded in the surface 60 cm layer at only six of the 48 sampling sites, or 12.5 percent of the locations.

The information contained in Table 3 regarding the amount of salt in the profile is shown in Figures 10 and 11 in the form of salt contours.

Infiltration Test

Sixty double ring infiltration tests were made in the 16 hectare study area. Twenty sites were selected as shown in Figure 12 and 3 replications conducted simultaneously at each site. The three replications were grouped together in an equilateral triangular pattern with five meters separating the rings (Photo 3). A double ring method was used with an outside ring constructed of earth. The inside steel ring was driven to a depth of 10 cm (Photo 4). The annular space between the two rings was kept flooded during the test. The depth of water within the steel ring was maintained between 10 and 15 cm depth. Water level readings were recorded at intervals from the beginning of the test of : 1, 3, 5, 10, 20, 30, 45, 60, 90, 120, 180, and 240 minutes (Photo 5). The soil was sampled prior to each test for moisture content, and at the end of each test for both moisture content and bulk density. The initial sample was taken outside but near each ring (Photo 6). The data obtained from each of the 60 tests are given in Table A-21.

Figure 13 shows the depth of infiltration over the study area after 1 hour as determined by the average of the three rings at each site. The infiltration is generally highest in the south corner of the plot and lowest in the north corner with an intermediate area of low infiltration. This represents the general direction of the original deposition of the sediments from the Magdalena River and the Dique Canal. The coarser particles, being heavier, were deposited first and represent a somewhat sandier soil with a greater rate of infiltration than the finer, more silty sediments, deposited towards the north corner. The pre-existing topography trapped waters of both inundation and rain runoff in the low areas which allowed greater amounts of fine particles to be deposited over time in certain areas. This second pattern is superimposed over the pattern of deposition according to distance from the flood source and the irregular contours of infiltration shown in Figure 13 result. In addition to the low spots being areas of entrapment for finer sediments, during the predrainage epoch these low spots were the parts with the groundwater levels nearest to the soil surface. As a consequence the soil between the phreatic level and the surface was generally maintained in a wetter condition which also tends to reduce the rate of infiltration.

Figure 14 shows the average infiltration rate in centimeters per hour for the 4-hour period of the test. The same general pattern is maintained, but the

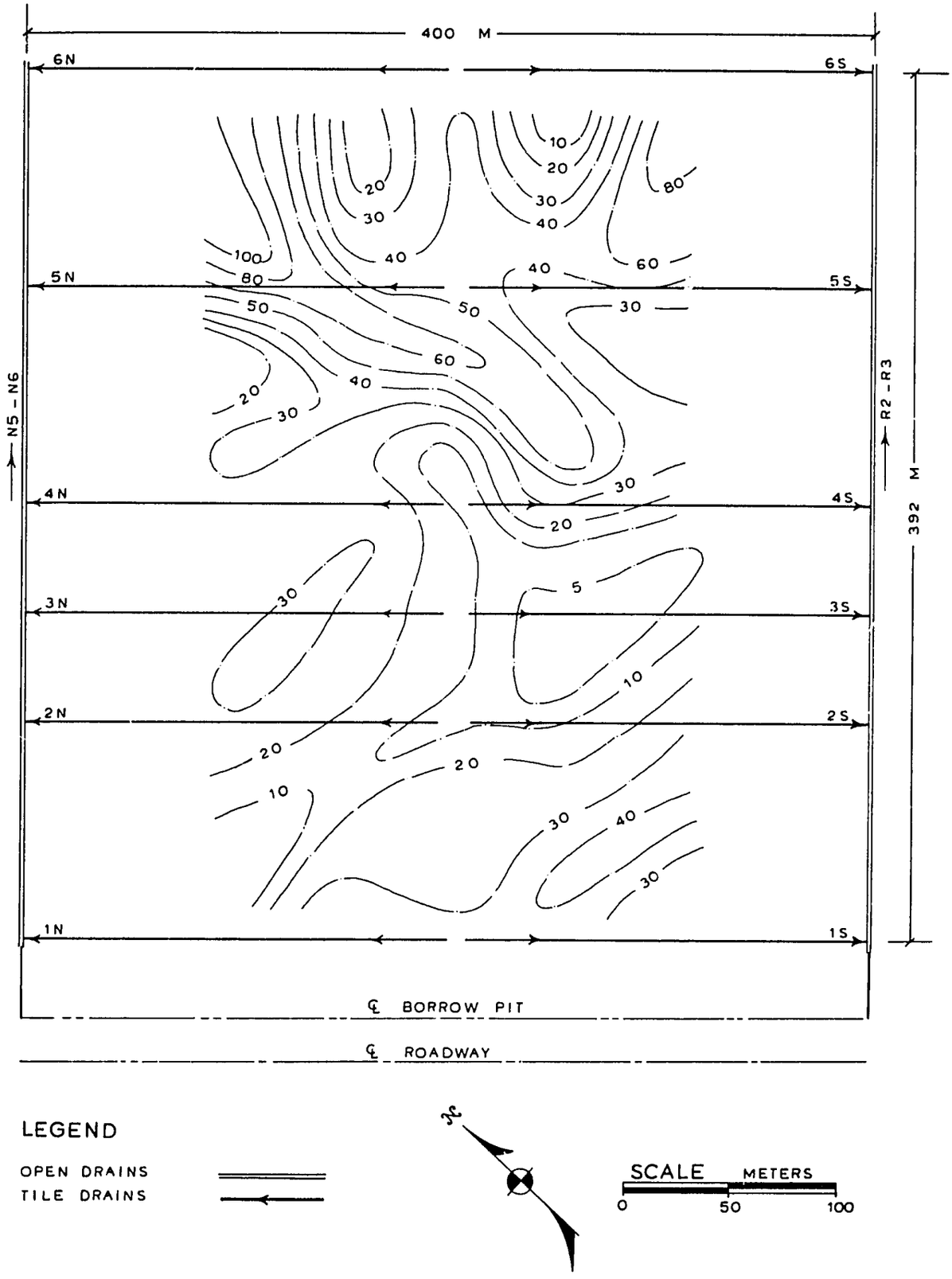


FIGURE 10. ISOLINE MAP OF ESTIMATED SALT IN STUDY AREA TO 2-METER DEPTH IN T/HA

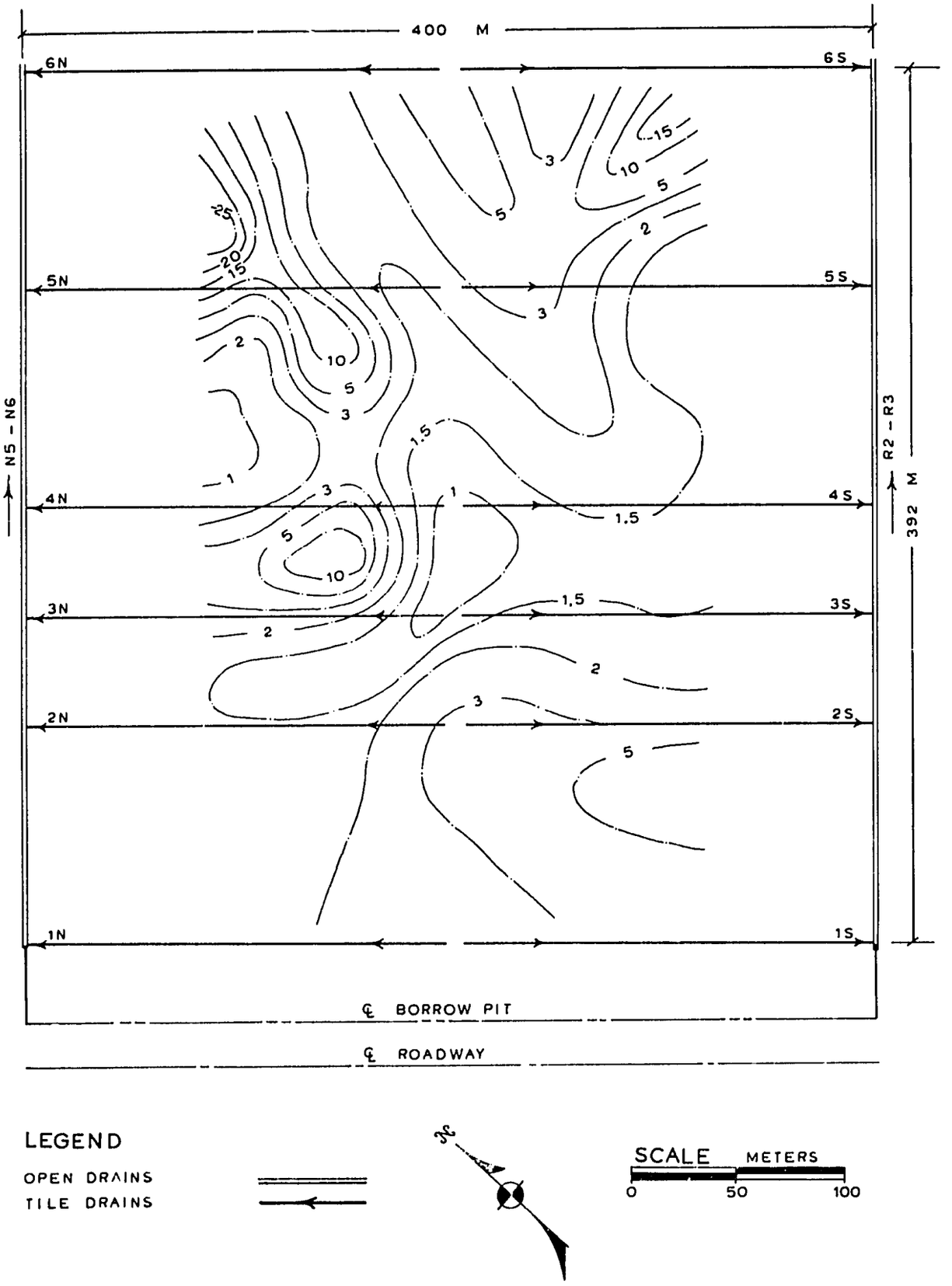


FIGURE 11. ISOLINE MAP OF ESTIMATED SALT TO DEPTH OF 60 CM IN T/HA

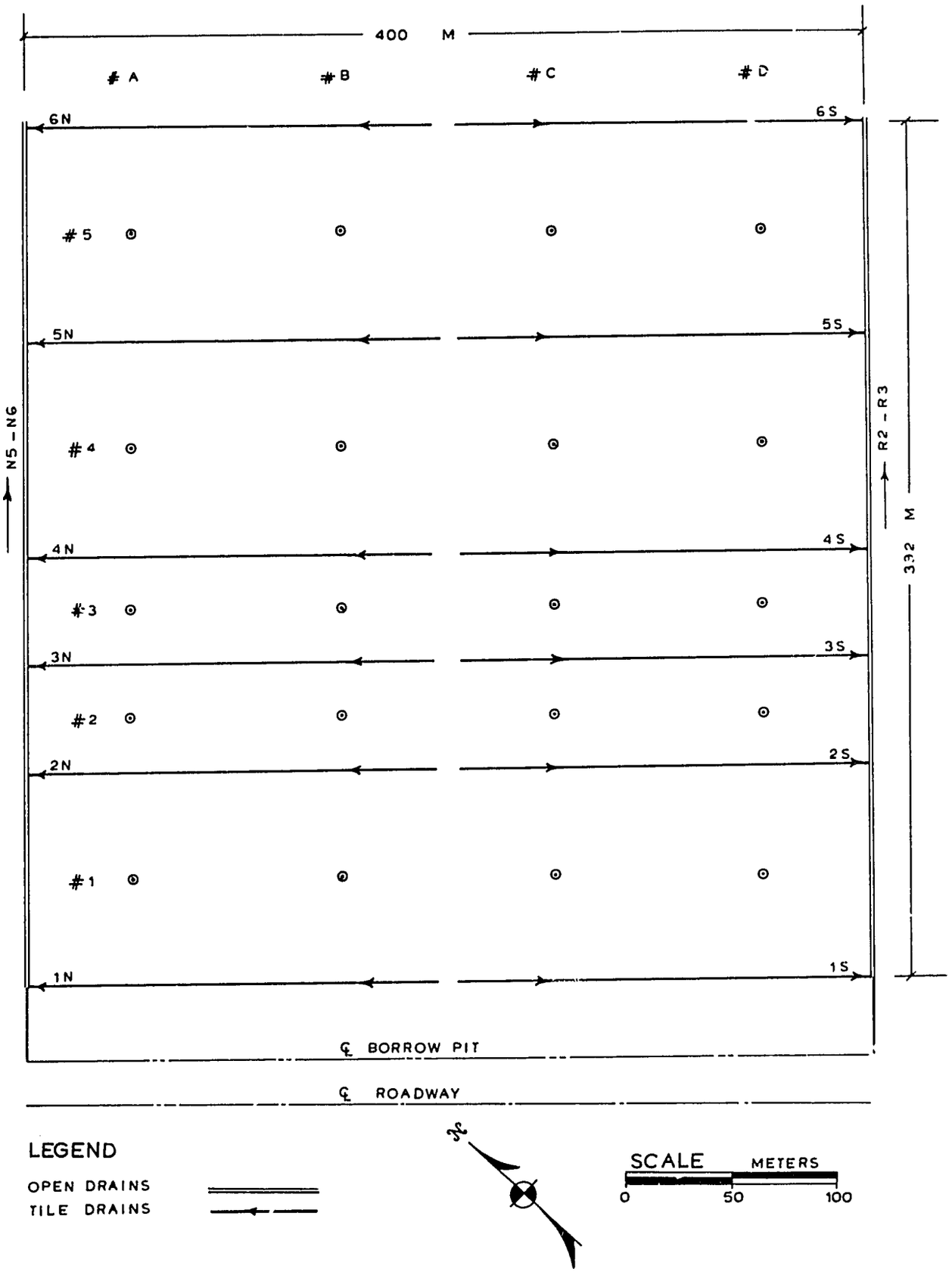


FIGURE 12. LOCATION OF INFILTRATION SITES IN STUDY AREA

Photo 3 (above). Infiltration Site Showing Equilateral Triangular Pattern of Replications

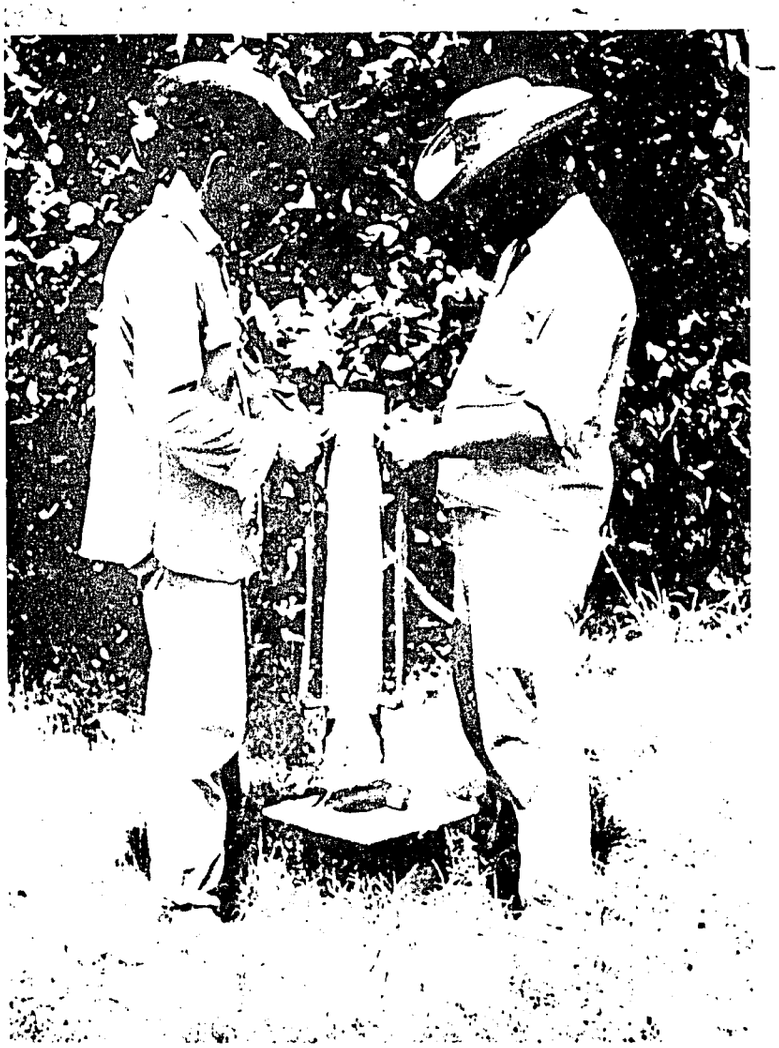


Photo 4. Driving Steel Ring for Infiltration Test

Photo 5. Recording Water Level During Infiltration Test

Photo 6. Taking Soil Sample after Infiltration Test

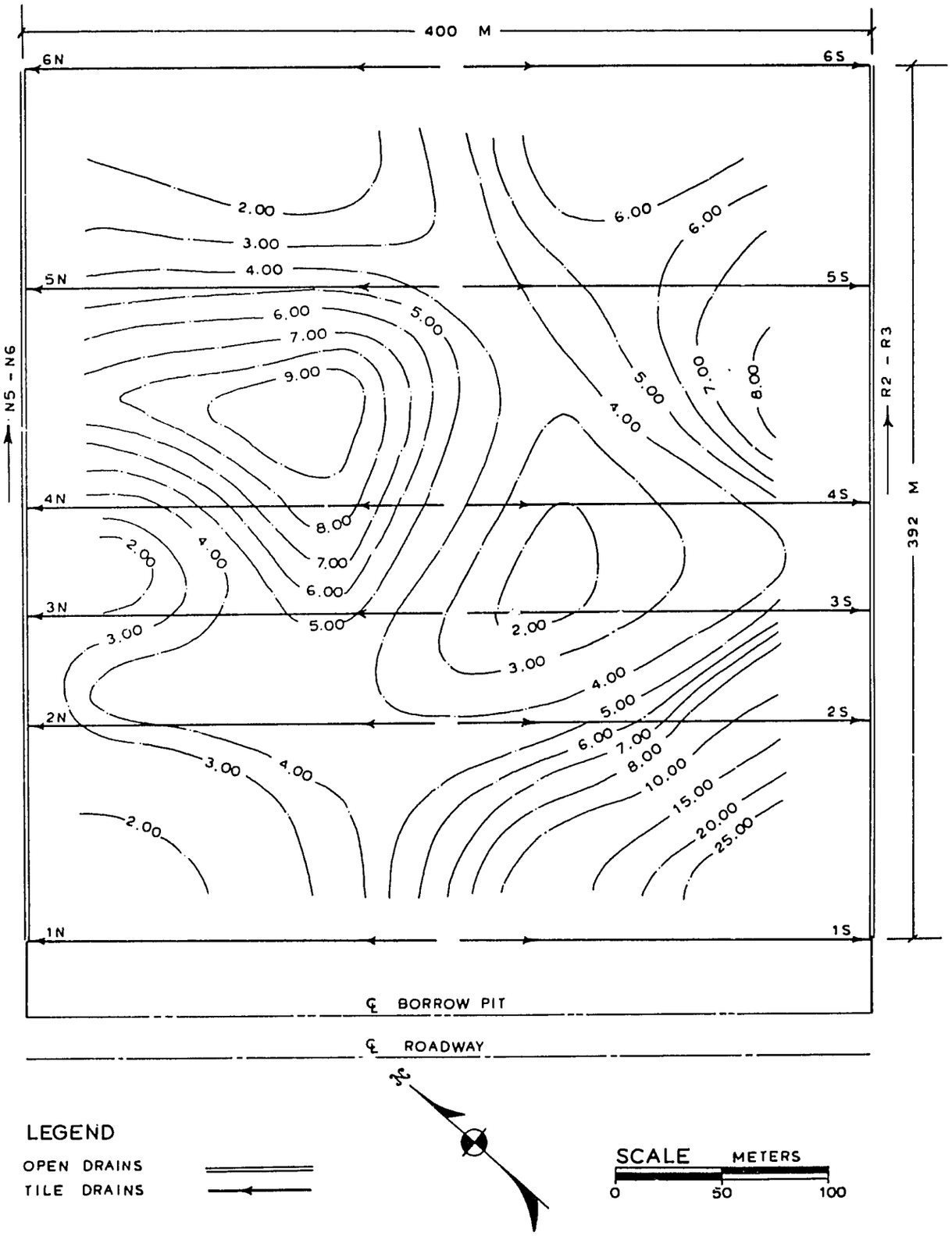


FIGURE 13. ISOLINE MAP SHOWING AVERAGE MEASURED DEPTH OF INFILTRATION AFTER ONE HOUR IN CM

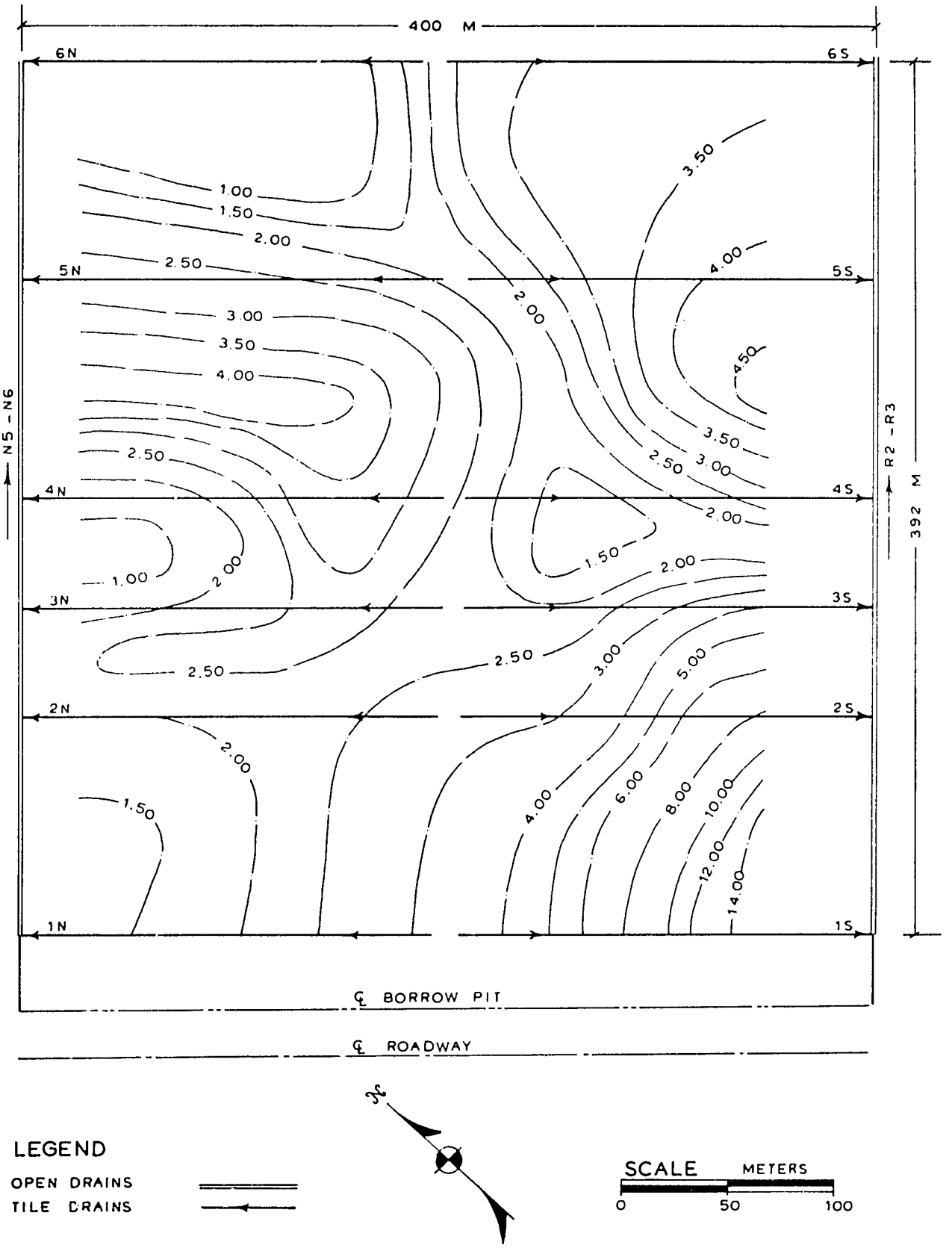


FIGURE 14. ISOLINE MAP SHOWING AVERAGE MEASURED INFILTRATION RATE FOR 4-HOURS IN CM/HOUR

Photo 7. Stunted and Dying Citrus in Study Area

Photo 8. Water in Borrow Pit Bordering Study Area

overall rate is reduced. This is to be expected from the nature of the infiltration function, and is generally more representative of the infiltration rates during the rainy season, when the soil is usually more moist, and during an irrigation period of 8 hours or more.

The infiltration tests were all analyzed with two mathematical functions using all of the data for T from 20 minutes to 4 hours. The equations were:

$$Y = A + B\sqrt{T} + C\,T \qquad (9)$$

and

$$Y = D\,T^{x} \qquad (10)$$

in which

Y is the cumulative infiltration in centimeters,
T is the total elapsed time in hours,

and

A,B,C,D, and x are empirical constants.

Because of the extreme variability of the soil, even from one ring to another at a single site, the constants show a wide range of variation from one test ring to another (Tables A-22 and A-23.) Each form of the equation fits the data equally well in most cases, however the quadratic form shows a slight improvement over the exponential form. The overall average errors for the two equations was 3.1 and 4.0 expressed as a percentage of the measured Y values.

When all of the constants for each test for both equations are averaged, the following equations result:

$$Y = -1.4 + 8.4\sqrt{T} - 0.62\,T \qquad (11)$$

and

$$Y = 6.14\,T^{0.5} \qquad (12)$$

With the extreme variation obtained from the tests this generalization is almost meaningless. The average overall error obtained by the above average equations is about 200 percent for each equation.

Photo 9 Measuring Discharge from Tile Drain

DRAINAGE STUDIES

At the initiation of this study in 1971 the water table in the study area was generally within 1 meter of the soil surface. At some locations it was less than 50 cm from the surface. Many of the citrus trees were stunted and dying, while others had died and had been replaced (Photo 7). This condition had greatly alarmed the INCORA officials and their number one priority was to save the citrus grove. There was some speculation that the immediate primary source of the high water in the orchard was percolation from the nearby Dique Canal where the water levels were very high during this period as shown in Figure 6.

The material that had been used to construct the dike separating the Dique Canal from the project area had all been excavated in situ from the project side of the dike. This borrow pit, which parallels the dike for its entire length, had been left open in the region of the citrus plantation. When the water level in the Dique Canal was high, the borrow pit was generally full of water (Photo 8). The water in the borrow pit appeared to fluctuate with the stage of the canal. It appeared obvious, therefore, that the high water level in the Dique Canal was the primary source of the high groundwater levels in the grove. Evidence obtained later indicated otherwise.

Drain Spacing

In order to study the effect of drain spacing on the water table in the zone, the design as shown in Figure 15 was selected. Six tile drain lines were installed at a depth of 2 meters at spacings of 49 and 98 meters as shown. The selected spacings were at multiples of the 7-meter grid spacing of the trees. With the drains installed in this configuration, it would be possible to select a set of three lines (making the others inoperative) to evaluate spacings of 49, 98, 147 and 196 meters. Because of the bordering effect of the two deep open drains on both sides of the study area, it was

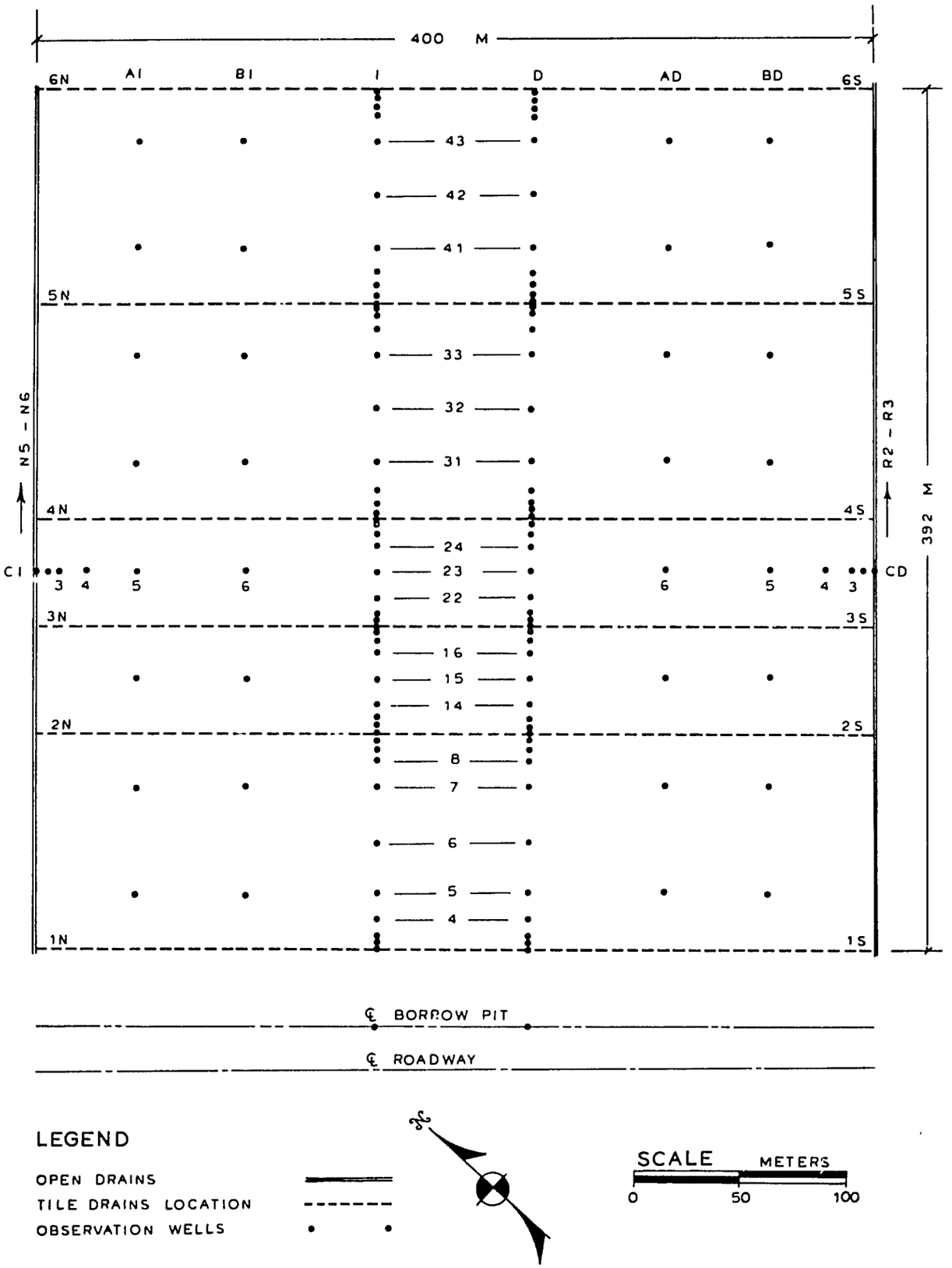


FIGURE 15. LOCATION OF TILE DRAINS AND OBSERVATION WELLS IN STUDY AREA

decided to monitor flows from the center portion of the area at manholes set over the drainage lines at points 100 meters from each outlet to the open drains. Immediately after the construction of each line, and before the manholes were installed, the outflow and its electrical conductivity were measured on a weekly basis at the locations where the tile lines discharged into the open drains (Photo 9). This made it possible to visually determine that the drain was functioning properly (Tables A-24 through A-35, and Figure 29).

Location of Observation Wells

A network of observation wells was also installed, as shown in Figure 15, to monitor the groundwater levels (Photo 10). Most of these wells were grouped on two lines at the 1/3 points of the center section between the manholes. This would make it possible to obtain accurate profiles of the water table over the buried drains. These wells were spaced as shown in Figure 16 with 7 wells between the drains spaced 49 meters apart and 9 wells between the drains spaced at 98 meters. Additional wells were placed next to each drain as shown. A line of observation wells was also constructed through the center of the area parallel with and between tile drains 3 and 4 in order to show the effects of the bordering open drains. The remainder of the area was filled in by wells on a 49 meter checkerboard grid to evaluate the general over-all effect of the drainage system.

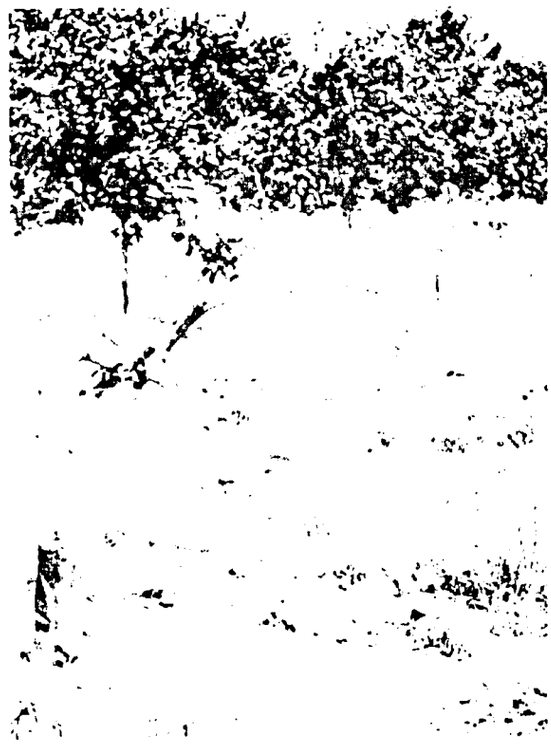


Photo 10 Observation Wells Along I Line Through Study Area

Details of Observation Wells

The wells consist of a 2-meter or greater length of ½" or ¾" diameter PVC plastic tube perforated in the bottom meter section. The perforated section is surrounded by a sand-gravel filter. The top of the observation well was generally set about 10 cm above the ground surface (except in depressions), and was protected by a damaged length of concrete drain tile filled with concrete as shown in Figure 17 and Photo 10. The observation well placed over a drain line was installed at the time the drain line was laid to insure that the well was properly placed in relation to the drain. Figure 17 also illustrates the position of the PVC tube in relation to the drain tile. Before the filter

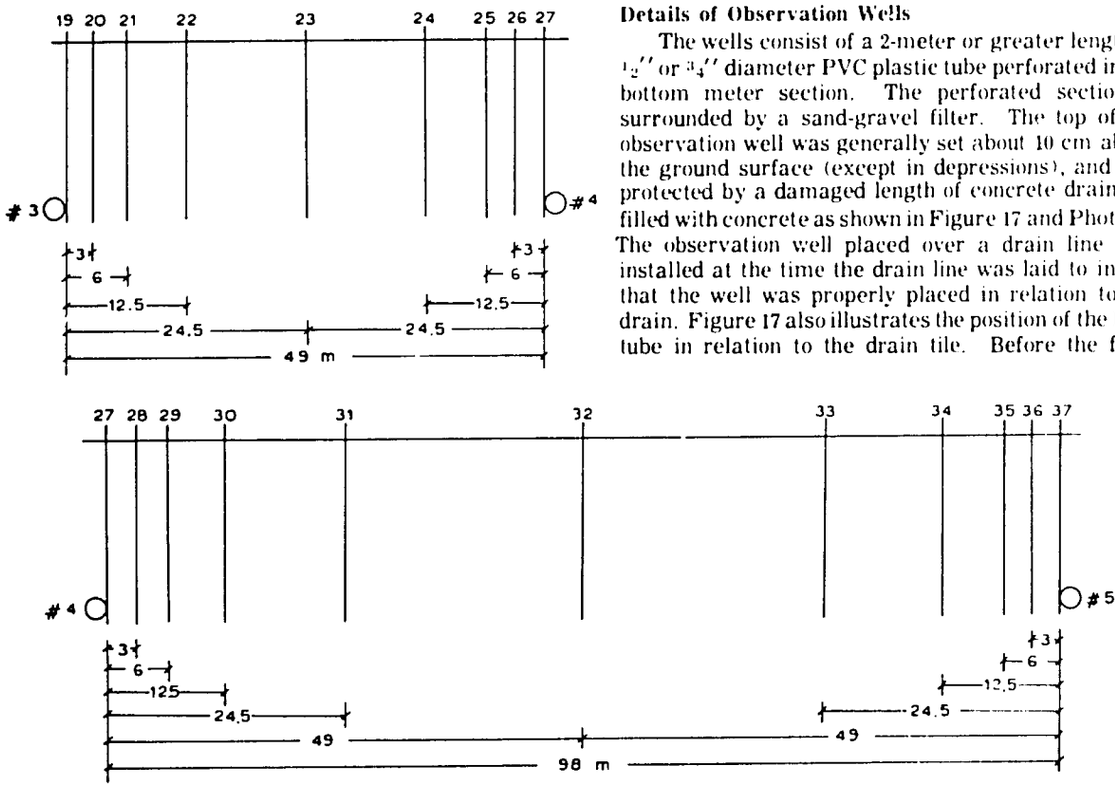


FIGURE 16. SPACING OF OBSERVATION WELLS RELATIVE TO TILE DRAINS

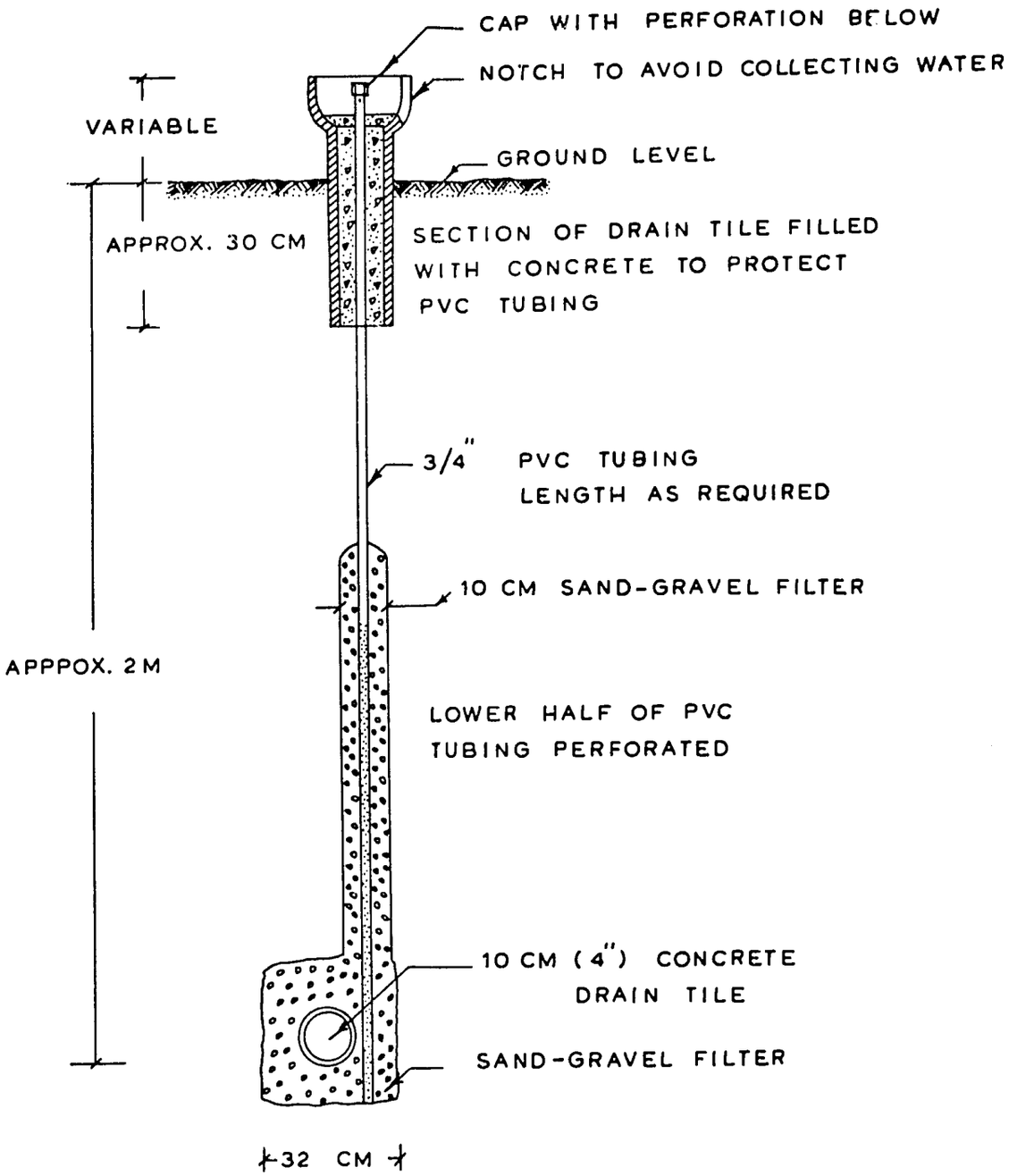


FIGURE 17. DETAILS OF OBSERVATION WELLS AND PLACEMENT AT TILE DRAINS

material was placed around the drain, the PVC tube was positioned with its lower extremity adjacent to and extending approximately 10 cm below the drain tile. When the PVC tube was in position the filter material was placed around the tile and the perforated section of the PVC tube. Before the trench was backfilled the filter material around the PVC tube was held temporarily in position with a short section of 4-inch aluminum sprinkler irrigation tubing (Photo 11). After the trench was backfilled to the height of the vertical well filter, the aluminum tubing was extracted. Water level measurements were begun soon after construction of each well and were continued on an approximately weekly basis thereafter until the water levels were below the bottom of the wells.

Installation of Drainage System and Observation Wells

Since INCORA officials were anxious to install the drainage system in the citrus orchard without waiting for a preliminary period of investigation, the construction of the drainage lines was initiated before the complete network of observation wells was installed. Therefore, a detailed knowledge of the water levels in the study area prior to the installation of the drainage system was not as complete as would be desired.

The installations of the drainage system and the observation wells were initiated about the same time in August, 1971. The drain lines were installed to an approximate depth of 2 meters with a slope of 0.2 percent from the center of the area towards the two bordering open drains (Photos 12 and 13). Drain line 1S was constructed of 4 inch (10 cm) corrugated

Photo 11 Observation Well being Installed over a Drain Line

Photo 12 Preparation of Trench for Drain Tile

plastic drain tubing. The other lines were constructed with 4 inch (10 cm) bell joint concrete pipe. Lines 2N, 3N, 4N, 4S, 6N and a portion of 2S consist of 1-meter sections of pipe while the others are made with 60 cm sections. Each drain pipe is surrounded by a gravel envelope 10 cm thick (Photo 14). The particle size of the filter has a gradation of 1 mm to 25 mm. The installed cost of the system was Pesos $54.42 meter (U.S. $0.74 ft.). On an area basis the cost was Pesos $843.47 hectare (U.S. $146.70 acre). Tile drain construction in the study area was completed in mid-January, 1973.

During the initial construction of the tile drains some difficulty was encountered where the groundwater levels were high (Photo 15). Anticipating that the water levels would be high near the borrow pit, a decision was made to drain it before constructing drain lines 1N and 1S. During the latter part of October, 1971, a 6-inch drain pipe was installed between the borrow pit and the southwest end of the open drain N5 — N6 bordering the area (Photo 16). The effect of draining the borrow pit was almost immediately noticeable in observation wells 5I and 5D as shown by the hydrographs in Figure 18. The pipe became plugged with trash on about November 8 and was cleaned on November 16, 1971. A 6-inch pipe was also installed between the borrow pit and open drain R2 — R3 soon thereafter. These occurrences are also reflected in the hydrographs, Figure 18. During this same period the level of the Dique Canal was increasing and was generally higher than the ground surface at these wells. In late December these hydrographs were influenced by the construction of drains 1N and 1S.

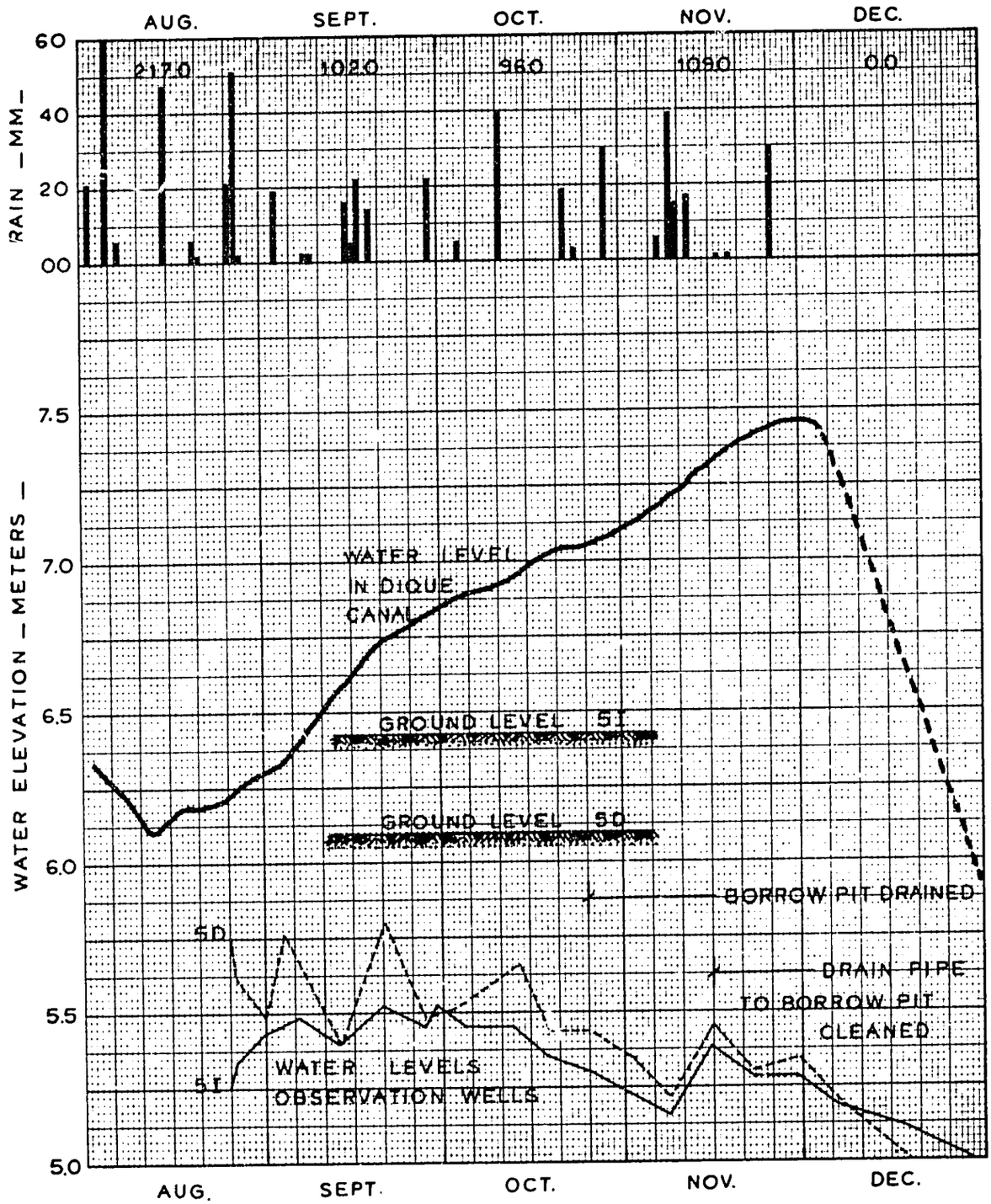


FIGURE 18. HYDROGRAPH OF WATER LEVELS IN OBSERVATION WELLS 5 I AND 5 D COMPARED WITH RAINFALL AND DIQUE CANAL LEVELS, 1971

Photo 13 (above). Maintaining Slope of 0.2 Percent on Drain Line

Photo 14 (right). Corrugated Plastic Drain Pipe with Filter

Water Level Measurements

The first measurements on the observation wells were made August 25, 1971. Figure 18 shows water level hydrographs of observation wells 5I and 5D, together with the water level in the Dique Canal and the rainfall, during the autumn of 1971. These were two of the first wells constructed. The erratic fluctuation corresponds with the occurrence of rainfall but does not correlate with water level in the Dique Canal. These two wells are near the side of the citrus area adjacent to and about 40 meters from the borrow pit. There is little surface area above these wells which would contribute surface runoff from rainfall to these two well sites. The nearest body of water which would influence levels at these points was in the borrow pit. It was thought that the water level in this borrow pit was influenced by the Dique Canal. A comparison of the well readings with precipitation and the canal hydrograph suggests that rainfall runoff from the dike and surrounding ground surface collecting in the borrow pit is the principal influencing factor.

Figure 19 shows the groundwater elevations on November 29 just after the last rain of 1971. The flow gradient was generally northerly from the borrow pit. Figure 20 shows the depth to the water table a month later on December 27, 1971. One half of the proposed

tile drainage system had been installed by this date. The topography as plotted from ground surface elevations at all of the observation wells is shown in Figure 21. This figure does not show the minor irregularities in the topography that is shown in Figure 7. Some of the variations found in the depth to water table maps is due to the irregularities in surface topography rather than in water table elevations. No work had been done to improve surface drainage at this time, as the necessity of such work had not been anticipated by INCORA.

The intense rains of May and early June, 1972, climaxed by a heavy rain of 62 mm on June 7, had an immediate influence on the groundwater levels and flow from the drain lines. Figure 22 is a hydrograph for well 31 I, which was typical of wells in the lower part of the area. This figure shows that after the installation of tile line 4 N in October, 1971, there was a drop in the groundwater level at this location of about 40 cm, and that after February 2, 1972, the well was dry until about the middle of May. It then rose sharply reaching a peak on June 8 about 12 cm below the ground level. The water level then dropped rapidly until early August and continued at a low level during the remainder of the year.

Figure 29 shows the flow from drain 4 N together with the rainfall and electrical conductance of the drain flow. There is a striking similarity between the groundwater level and drain flow. The early peak in drain flow on May 25 was undoubtedly due to the fact that drain 4 N crossed a depression where considerable runoff accumulated during the May rains. The second peak coincided more nearly with the general groundwater levels.

Photo 15 Banks of Trench Caving-in because of High Water Table Conditions During Construction

Photo 16. Construction of Trench to Receive Pipe through which to Drain the Borrow Pit

The water table elevations on June 8, 1972, the day following the heavy rain of 62 mm, are shown in Figure 23. The water table had not had time to level out and there were extreme variations in the water elevations at different wells. The highest levels generally occurred between the tile drains and coincided with the major depressions in the surface where water accumulated.

The depth to the water table is shown in Figure 24 for the same date, June 8. This figure shows that there were two large areas and a smaller one where the water table was less than 50 cm from the surface, and one depression where water was ponded on the surface.

As was indicated by Figure 22, there was a rapid drop in the water table after June 8. Figure 25 shows the water table elevations on June 21, 13 days later. By this time the water table had lowered appreciably. The corresponding depths to the water table on this date are shown in Figure 26. The water level in the study area continued to drop during the following dry month.

The conditions prevalent on July 17 are shown in Figures 27 and 28. The next rainy season began a week later on July 24.

Another method of showing graphically the lowering of the water table during this period from June 8 to July 3 was to plot profiles along lines I and D as shown in Figure 30. This figure shows the ground profile, the location and elevation of the tops of the observation wells together with the water levels on five dates at approximately weekly intervals. The approximate inside bottom elevation of the drains at these locations is also shown. Although all drains had been constructed prior to these dates, the water level profiles show little or no depression over 2 S, 3 N, 3 S, 4 S and it would appear that these drains are not functioning properly at these locations. The reason is unknown but it may be due to improper placement of the gravel filter around the tile drains when there was water in the trench.

There is a depression in the ground surface at observation well 27 over drain 4 N. Apparently this surface depression filled with water and caused a rapid rise in the groundwater elevations at observation wells 25 to 32 except for number 27 which was adjacent to drain 4 N. The depressions in the groundwater elevations at this drain are what might be expected at all drains if they were functioning properly.

Surface Drainage and Filling of Borrow Pit

During the dry period in June and July, 1972, the surface drainage was somewhat improved by the construction of six shallow surface drains paralleling the buried tile lines which more or less intercepted the short, discontinous surface collector paths. A large part of the excess surface water was in this way diverted to the deep open drains to remove it from the area (Photo 17). At the same time the borrow pit along the side of the plot closest to the Dique Canal was partially filled in with soil to avoid surface water from collecting in it (Photo 18).

This drainage and filling of the borrow pit appeared to be effective in lowering the water table in the southwestern part of the study area. Tile drain 1 S did not flow after its installation in January, 1972, until June. Drain 1 N flowed for only a short period in January and February, 1972. It began flowing about June 1 and again on August 24. It flowed very little during October and November (Tables A-24 through A-35).

Two observation wells were installed on the center line of the filled-in borrow pit, on lines I and D, in July, 1972. Measurements on these wells showed that the water table at these locations was 2 meters or more below the ground surface, while the water level in the Dique Canal was as much as 2 meters above the water table at these sites.

After the rains during August through November totaling 430 mm, the water table conditions on November 23 were as shown in Figure 31 and 32. The depth to groundwater throughout this rainy period was maintained at a depth of 1.5 meters or more over most of the study area. Figure 29 and Tables A-24 through A-35 show that the tile drainage flow was relatively low and uniform during this period. The improved surface drainage appeared to be effective in eliminating any rapid rise in the water table levels such as occurred prior to June 8.

Water table conditions on December 29, 1972, 38 days after the last major rain, are shown in Figures 33 and 34. After that date, the observation wells were dry over all of the area until sometime in June, 1973.

After about five months of intensive rain some of the drain tiles had begun to drip by the middle of October, 1973, but there was not sufficient flow to measure until October 30. At that time line 1 N was still dry and line 1 S was flowing at a rate of 0.24 liters per second (Table 4). The difference in drain flow is attributed to the fact that the borrow pit opposite line 1 N had been filled in with earth, while over one half of the section of the borrow pit facing line 1 S was still open and had filled with rainwater. Line 1 S was undoubtedly receiving water from the borrow pit. On November 15, 1973, the groundwater situation was as shown by Figures 35 and 36. The south corner of the area shows the influence of the open borrow pit. The north corner also shows a high water table caused by broken and open main line sprinkler hydrants which flowed for several weeks unattended. Except for these locations, the water levels in the study area remained at tolerable depths through the six months of intense rain which ended November 15, 1973. The relatively high groundwater in the east corner, drained by lines 5 S and 6 S, was caused by the water ponded in the open drain R2-R3. The outlets of lines 5 S and 6 S were buried in several centimeters of silt in addition to being inundated by the standing water. The outlets of drains 3 S and 4 S were also submerged after the heavy rains in late November. The slope of the open drain R2-R3 was such that drains 1 S and 2 S were always free flowing. Outlets of drains 1 N to 5 N were never submerged, but 6 N was inundated occasionally.

The rainy season in the mountains of the interior of Colombia continued for an additional period and maintained high levels in the Dique Canal through

Table 1. Discharge and Electrical Conductivity from Drain Tile System for 1973 and January, 1974

		Oct. 30	Dec. 6**	Dec. 18	Dec. 28	Jan. 4	Jan. 11
1 N	Q (l/sec)	0.000	0.000	0.000	0.489	0.487	*
	EC (mmhos)				1.7	1.7	
1 S	Q (l/sec)	0.244	0.542	0.676	0.650	0.539	0.490
	EC (mmhos)	3.4	5.0	0.94	0.93	0.90	
2 N	Q (l/sec)	0.027	0.036	0.031	0.026	0.022	0.019
	EC (mmhos)	3.8	7.5	1.5	1.6	1.6	
2 S	Q (l/sec)	0.086	0.048	0.032	0.014	0.051	0.015
	EC (mmhos)	2.8	5.2	0.44	1.2	1.6	
3 S	Q (l/sec)	0.059	0.054	0.034		0.104	0.031
	EC (mmhos)	3.5	6.5	0.19		1.08	
4 N	Q (l/sec)	0.078	0.077	0.068	0.053	0.044	0.030
	EC (mmhos)	5.4	7.6	1.5	1.6	1.6	
5 N	Q (l/sec)	0.108	0.049	0.034	0.026	0.027	0.012
	EC (mmhos)	12.2	17.0	3.1	1.7	2.7	

*Drain outlet inundated. No reliable measurement.
**No satisfactory explanation for the high electrical conductances shown for Dec. 6.

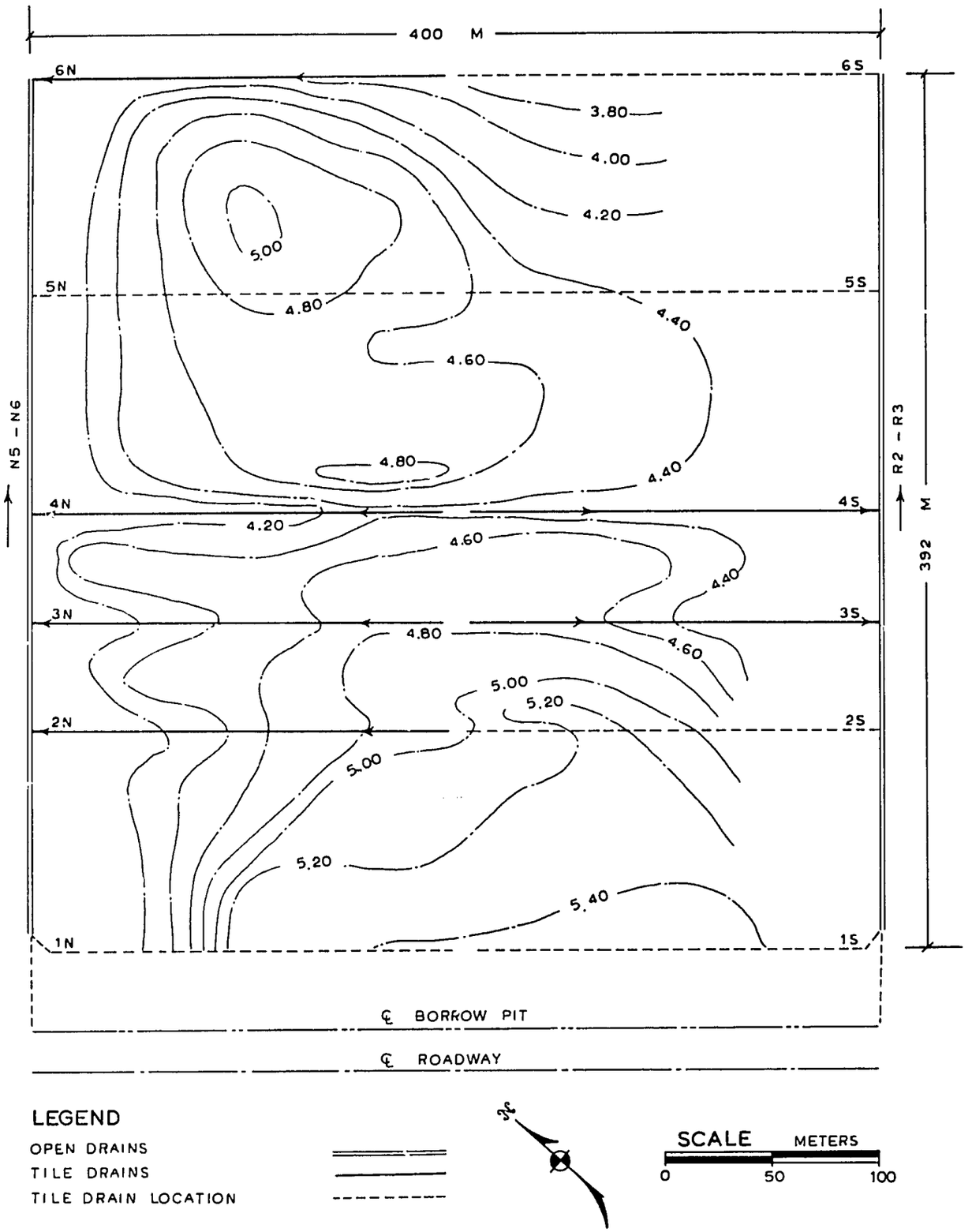


FIGURE 19. ISOLINE MAP OF GROUNDWATER ELEVATIONS IN METERS ON NOVEMBER 29, 1971 AFTER LAST RAIN

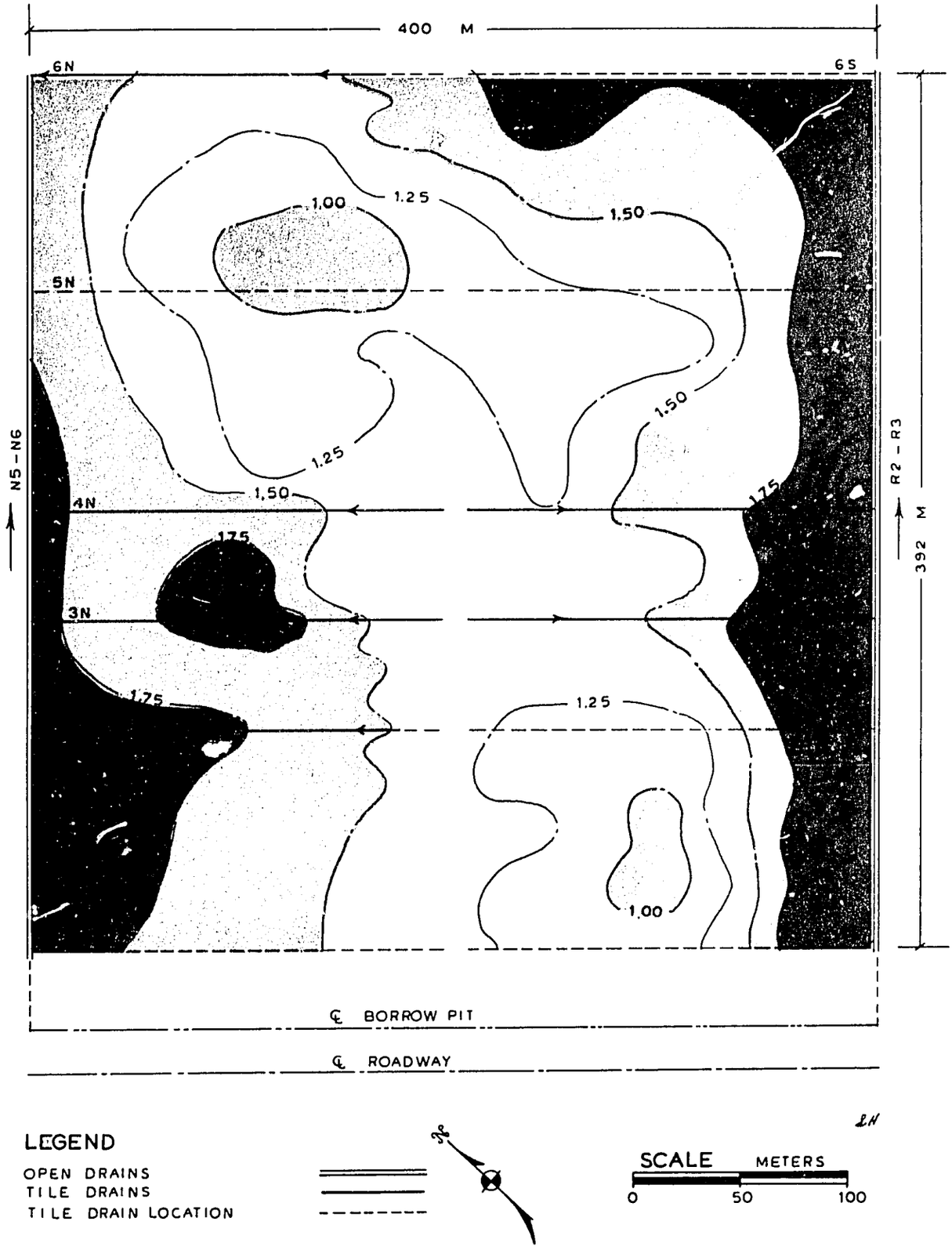


FIGURE 20. DEPTH IN METERS TO WATER TABLE FROM SURFACE ON DECEMBER 27, 1971, ONE MONTH AFTER LAST RAIN

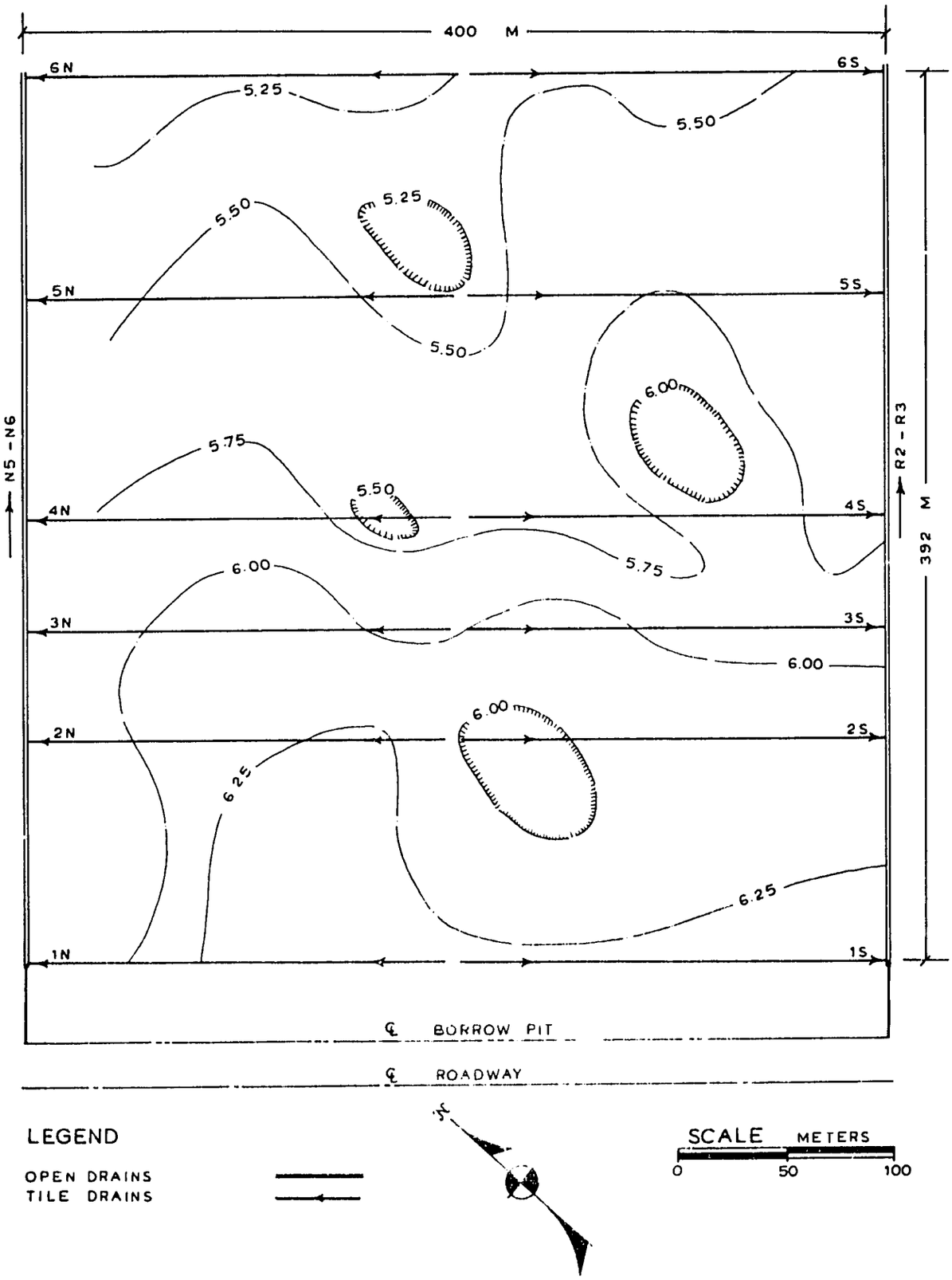


FIGURE 21. TOPOGRAPHIC MAP OF STUDY AREA FROM ELEVATIONS AT OBSERVATION WELLS, ELEVATION IN METERS

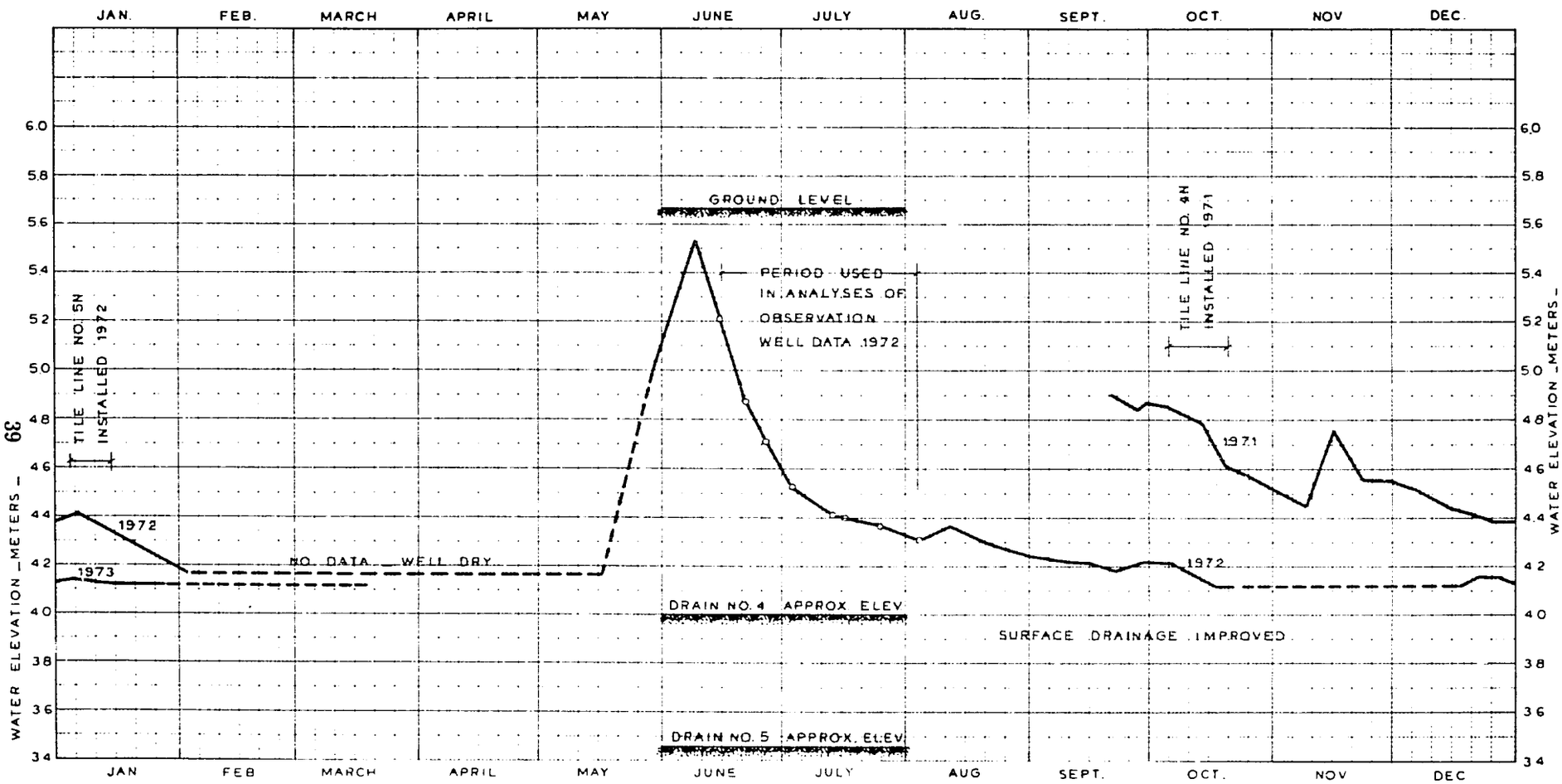


FIGURE 22. HYDROGRAPH OF WATER LEVELS IN OBSERVATION WELL 31 I , 1971-72

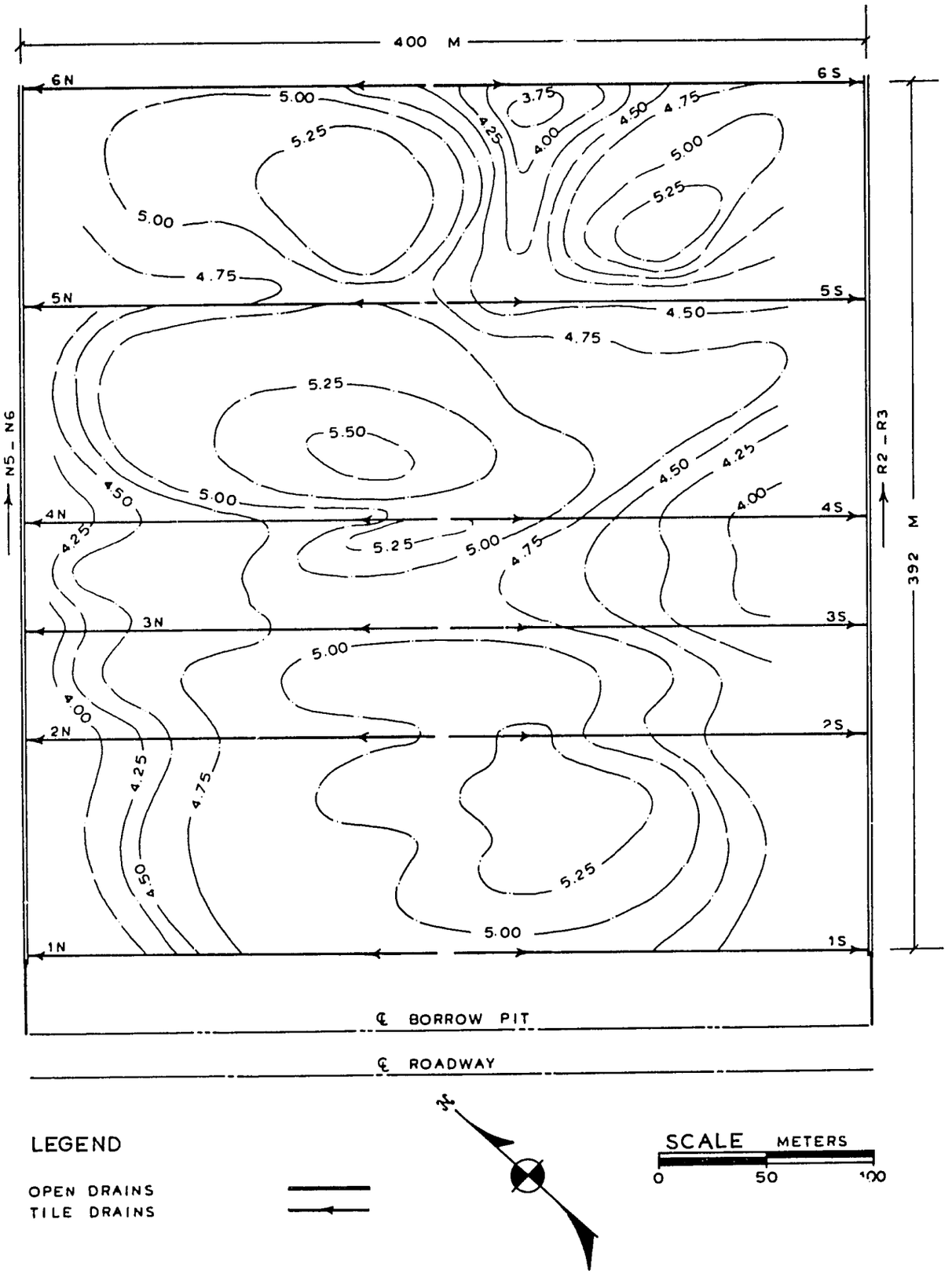


FIGURE 23. MAP OF GROUNDWATER ELEVATIONS IN METERS AFTER HEAVY RAINS JUNE 8, 1972

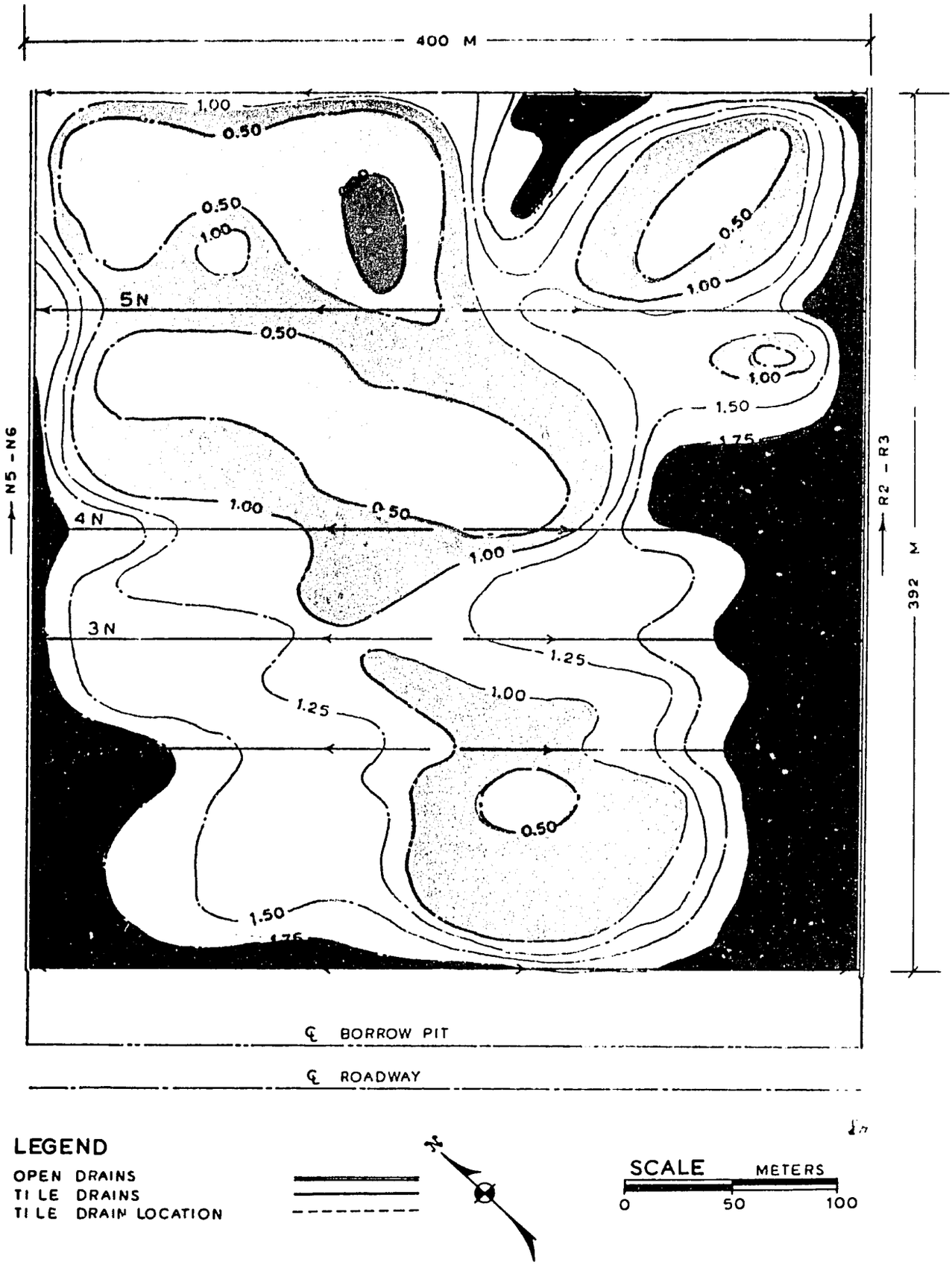


FIGURE 24. DEPTH IN METERS TO WATER TABLE ON JUNE 8, 1972 AFTER HEAVY RAINS

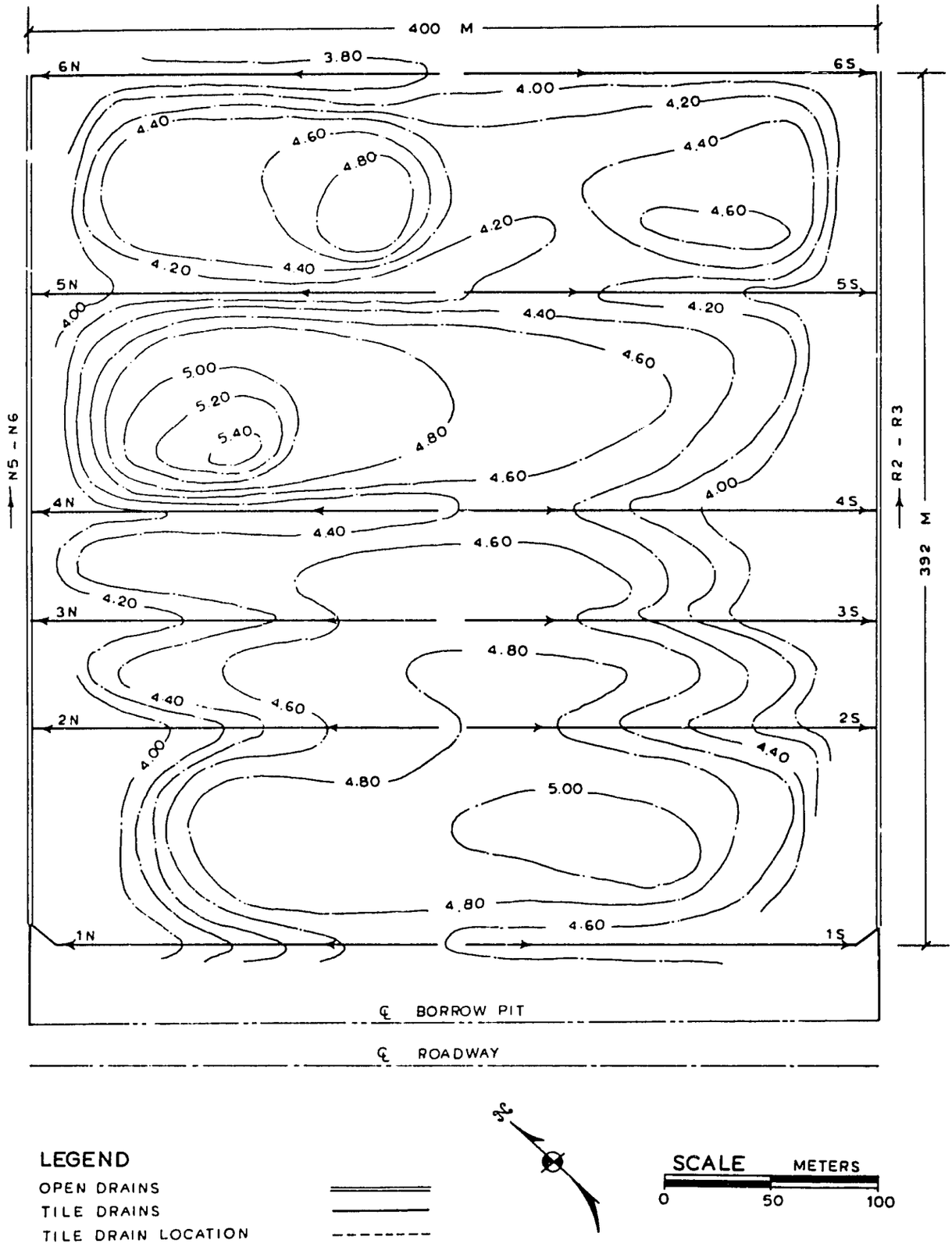


FIGURE 25. GROUNDWATER ELEVATIONS IN METERS ON JUNE 21, 1972

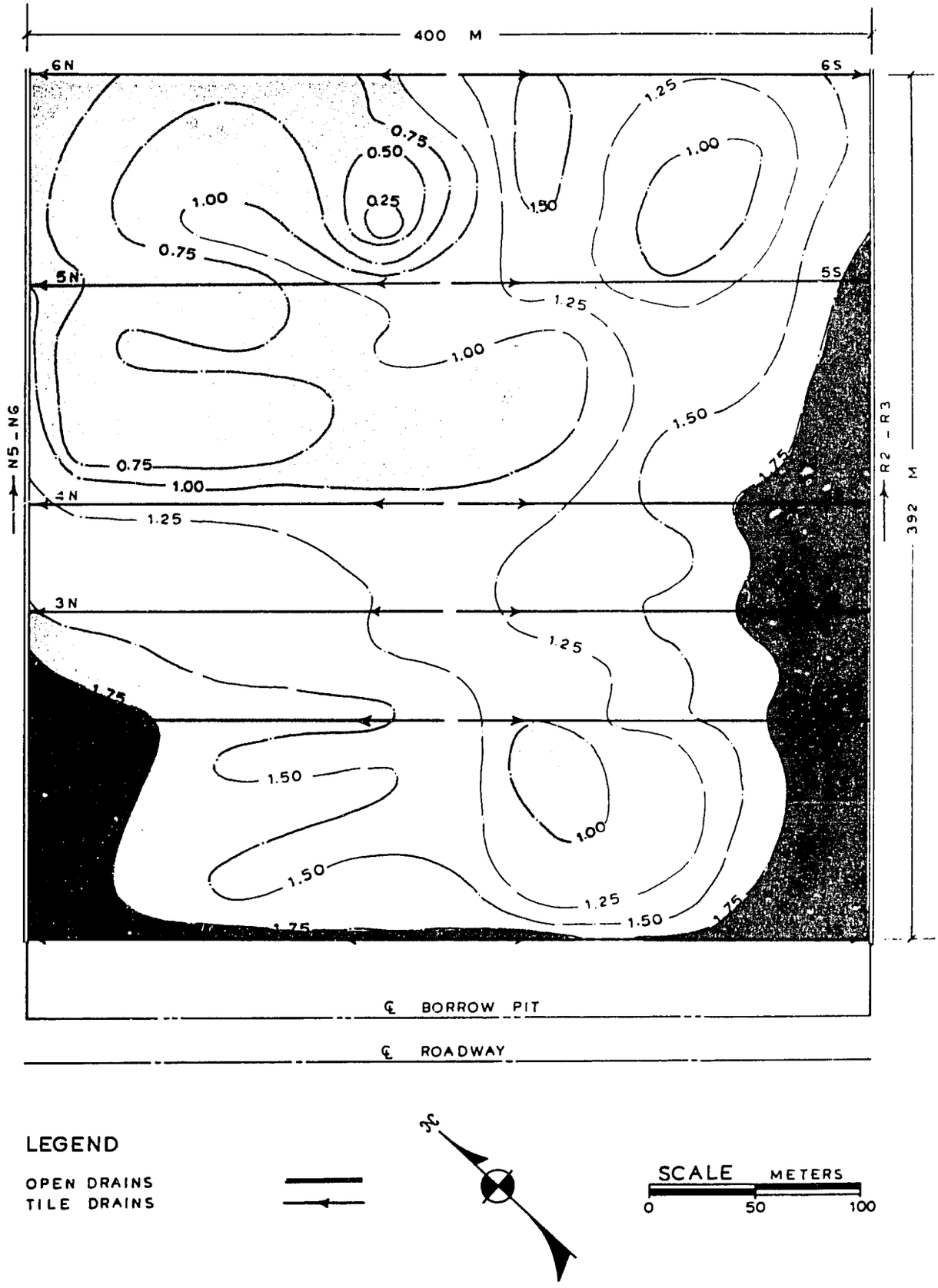


FIGURE 26. WATER TABLE DEPTHS IN METERS, JUNE 21,1972

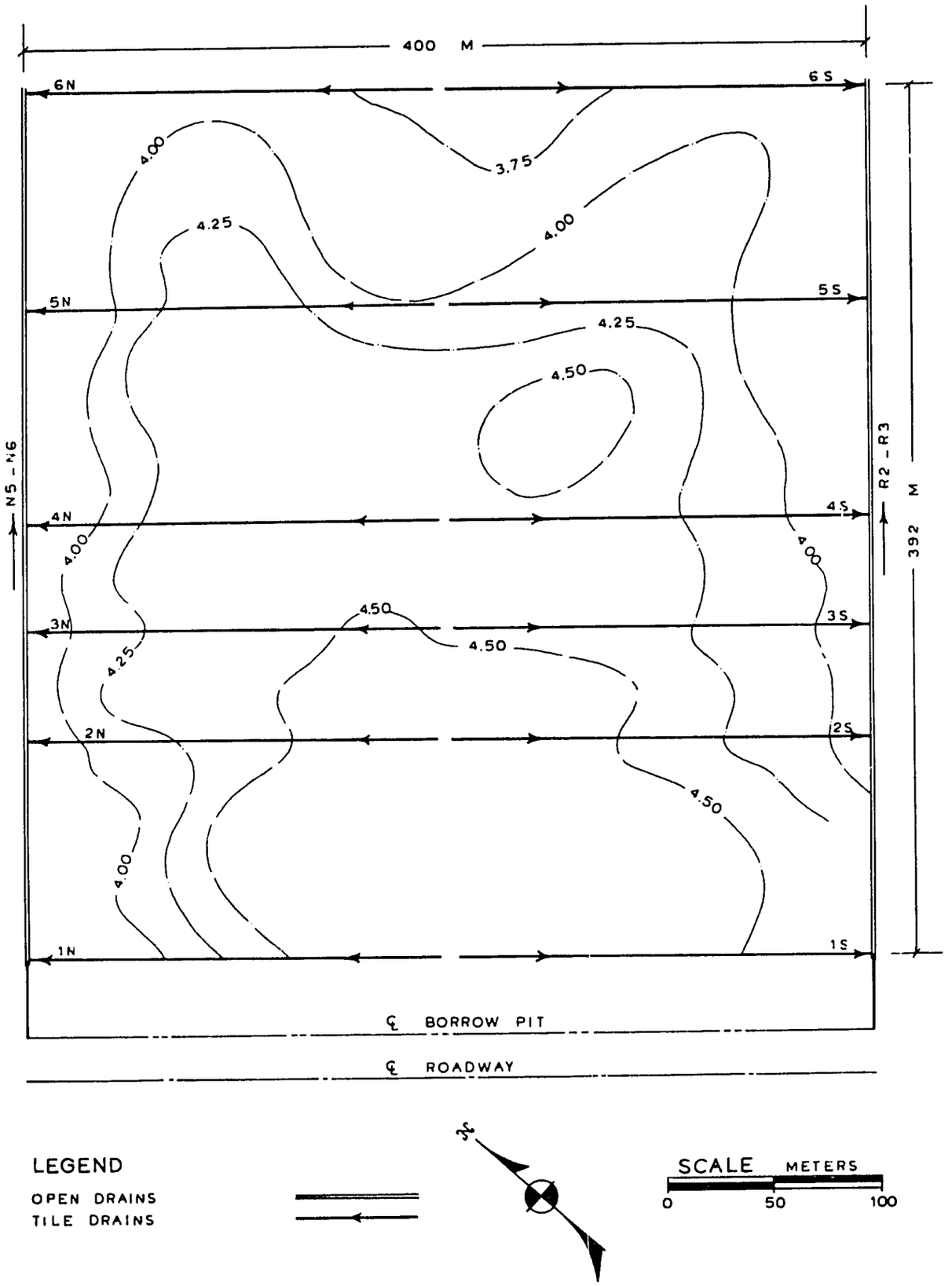


FIGURE 27. GROUNDWATER ELEVATIONS IN METERS, JULY 17,1972

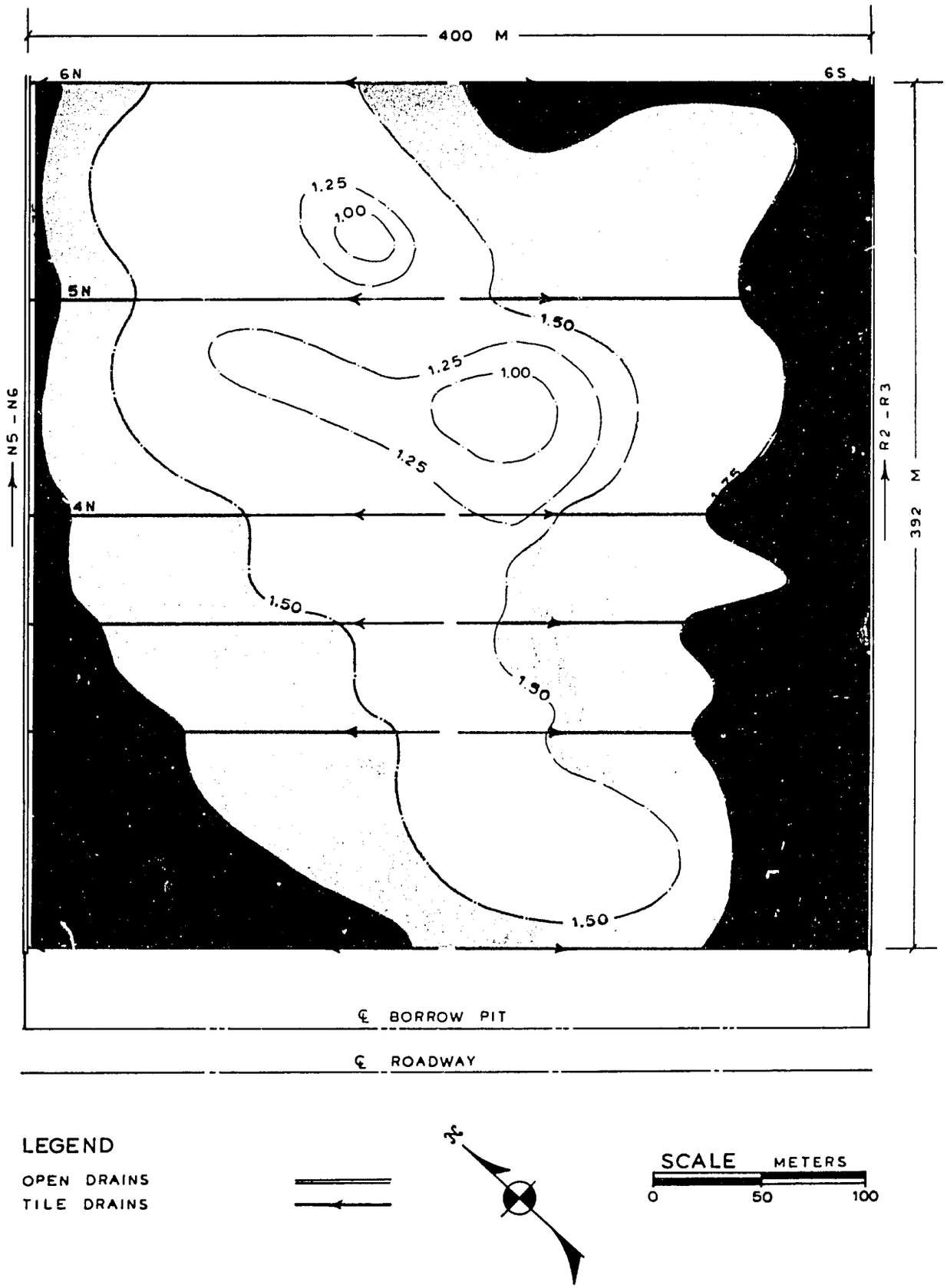


FIGURE 28. WATER TABLE DEPTHS IN METERS, JULY 17, 1972

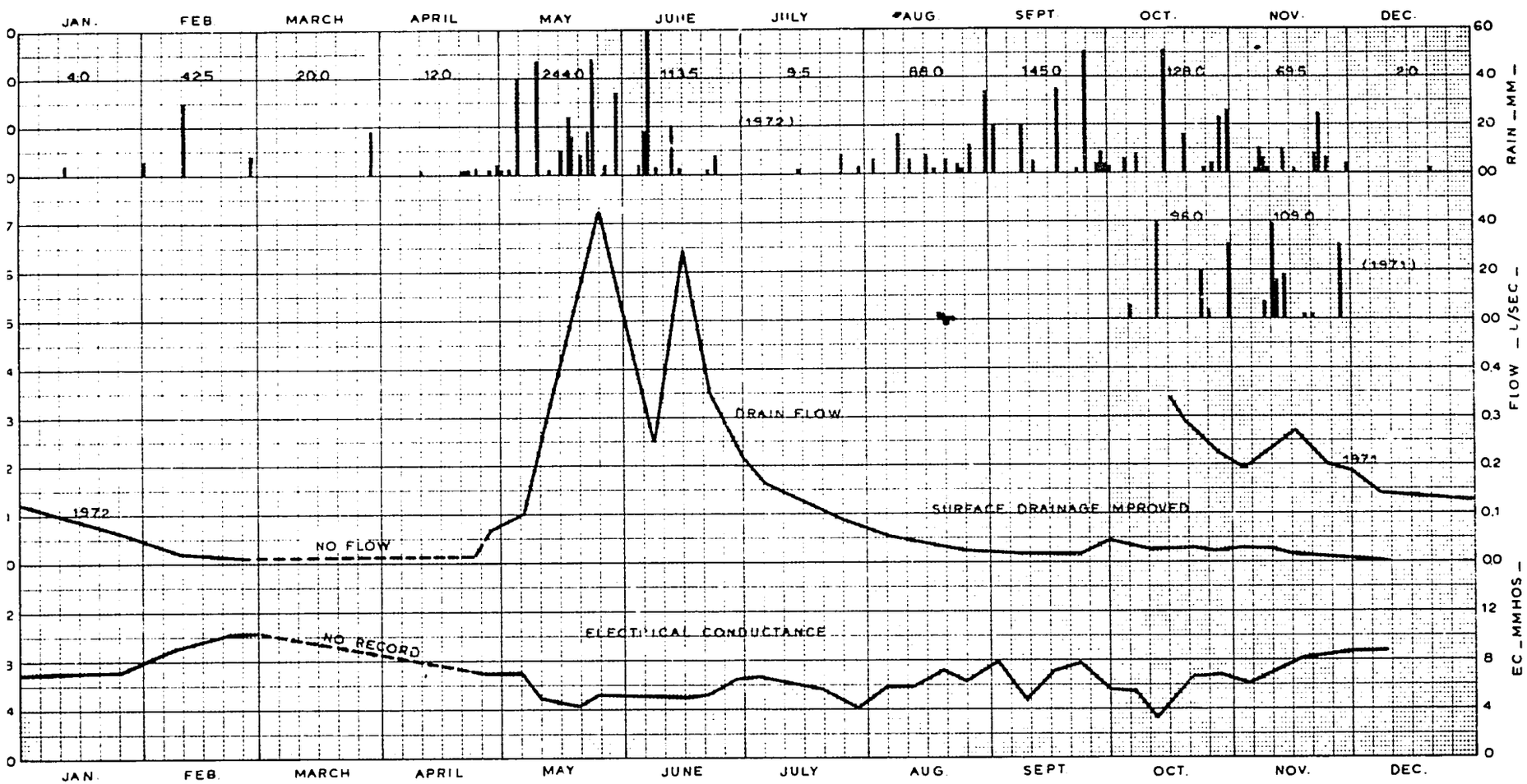


FIGURE 29. HYDROGRAPH OF FLOW FROM DRAIN 4N TOGETHER WITH RAINFALL AND ELECTRICAL CONDUCTIVITY OF FLOW

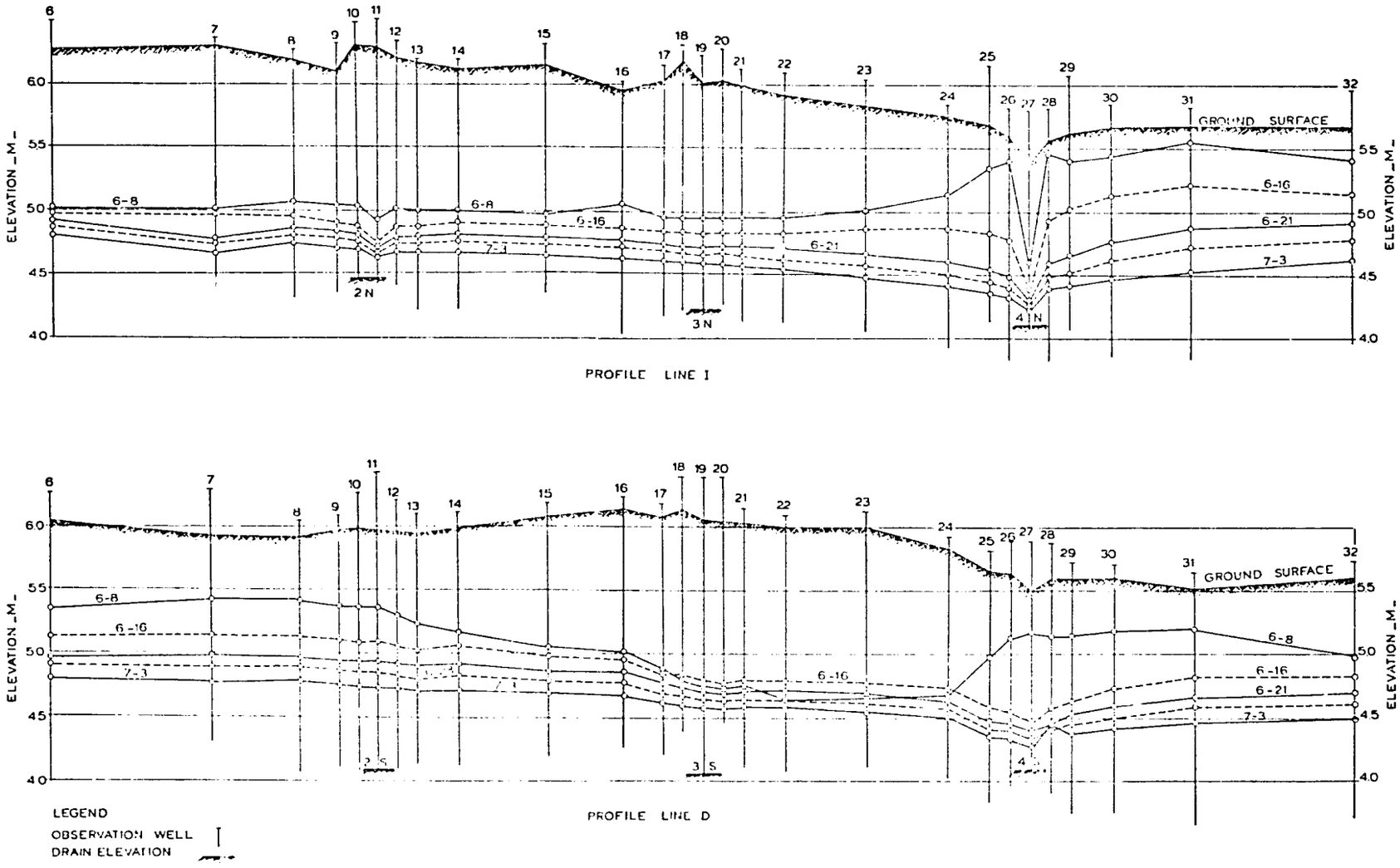


FIGURE 30. WATER LEVEL PROFILES ON LINES I AND D, JUNE 8 TO JULY 3, 1972

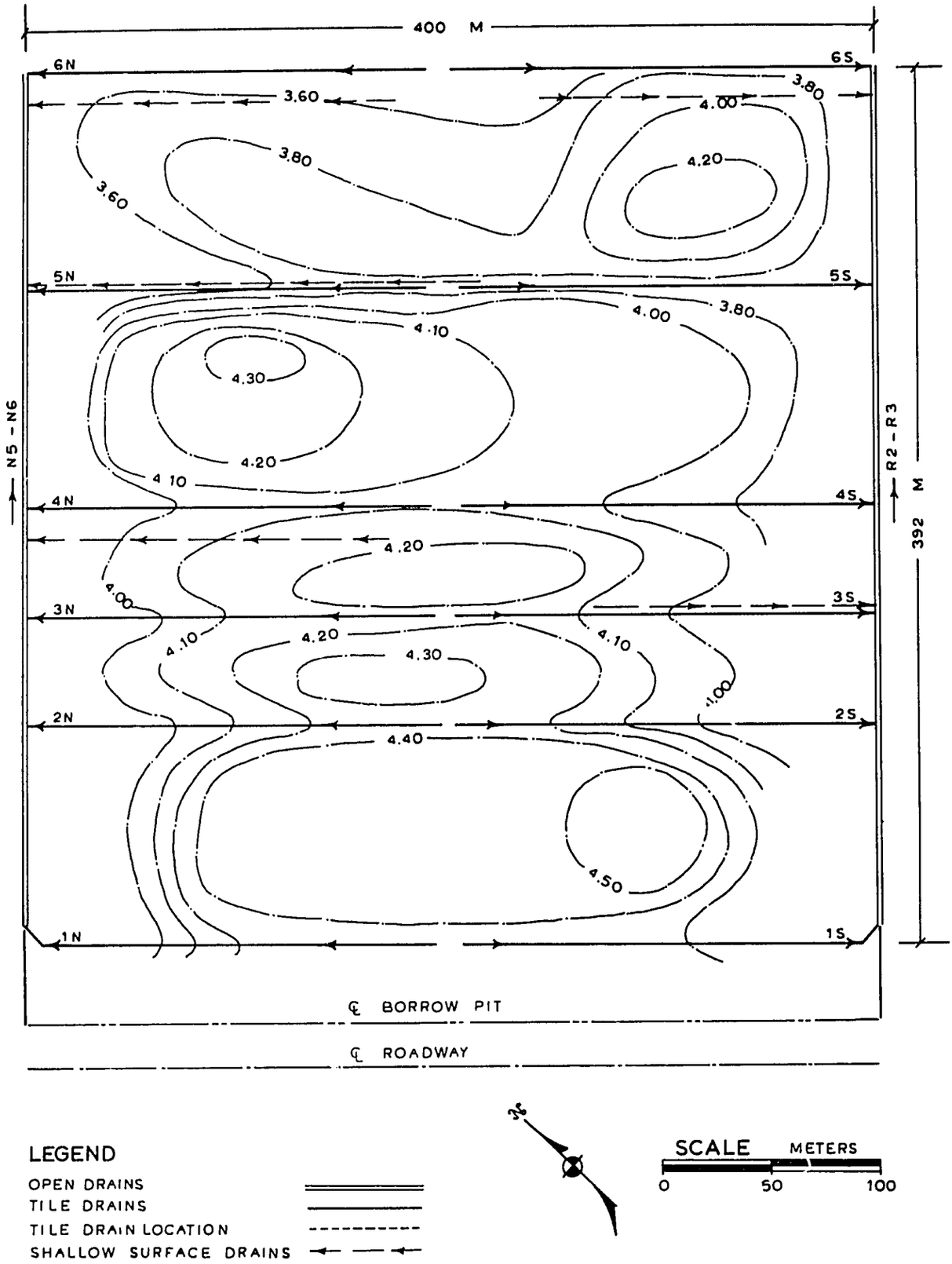


FIGURE 31. GROUNDWATER ELEVATIONS IN METERS, NOVEMBER 23, 1972

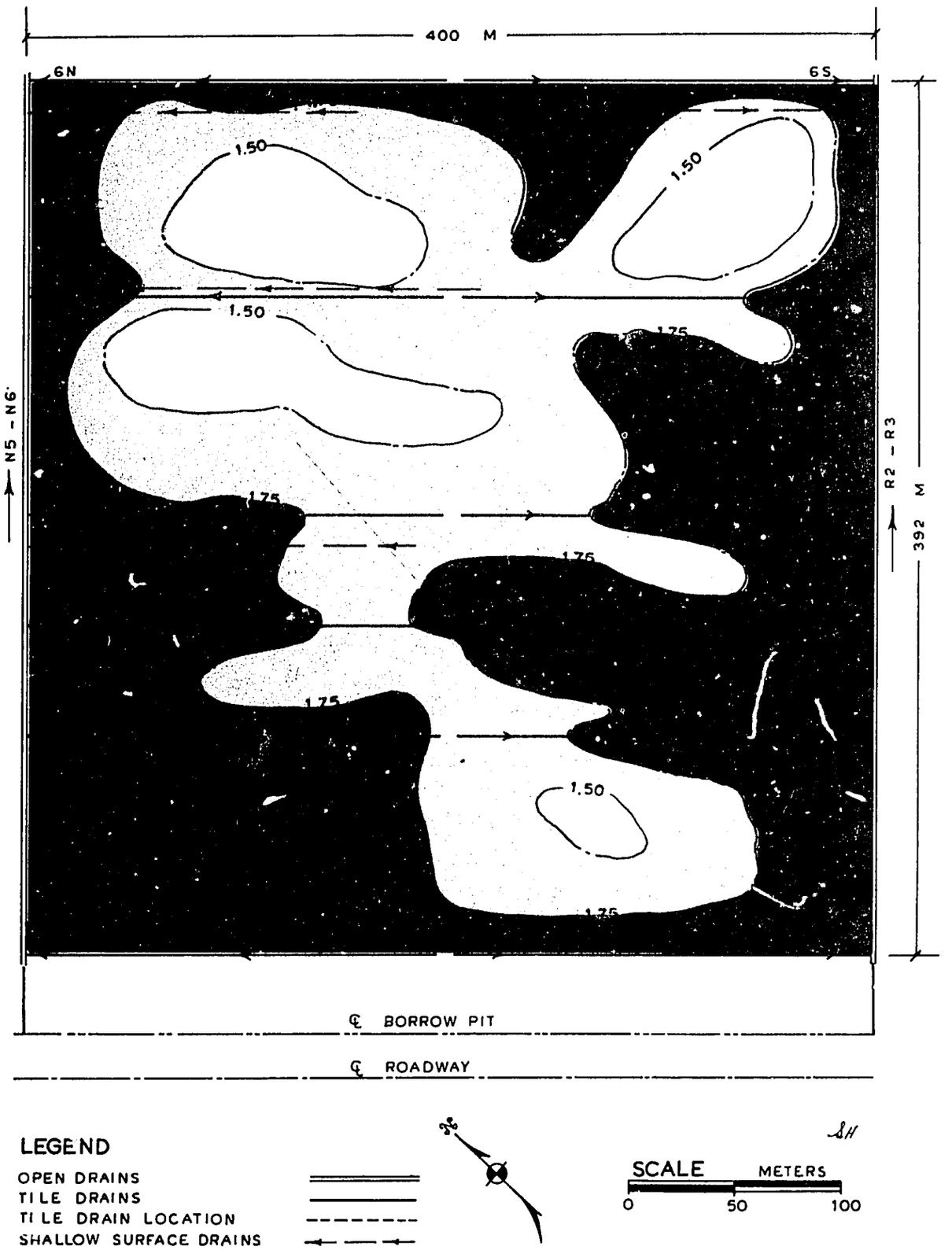


FIGURE 32. WATER TABLE DEPTHS IN METERS, NOVEMBER 23, 1972

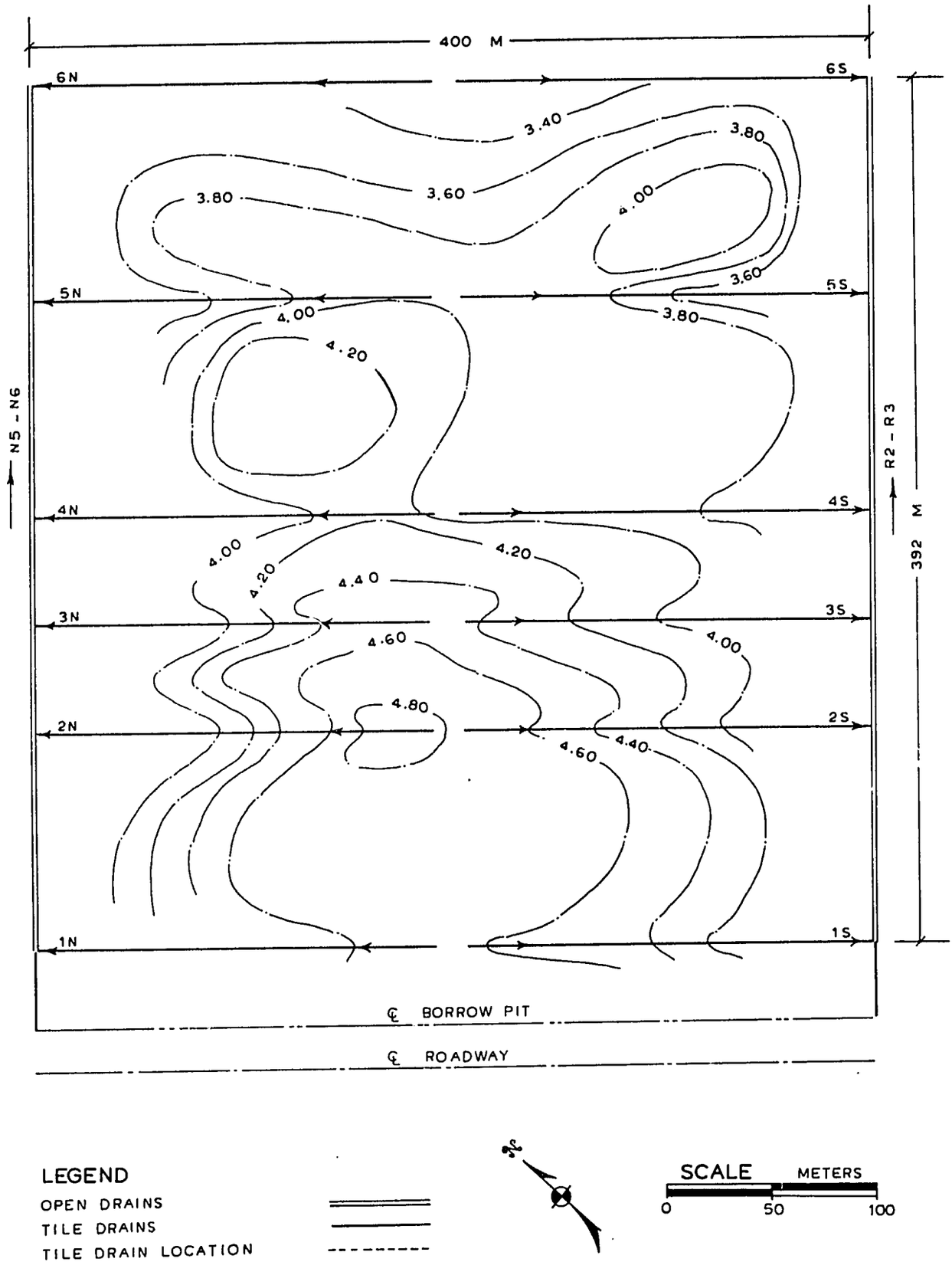


FIGURE 33. GROUNDWATER ELEVATIONS IN METERS, DECEMBER 29, 1972

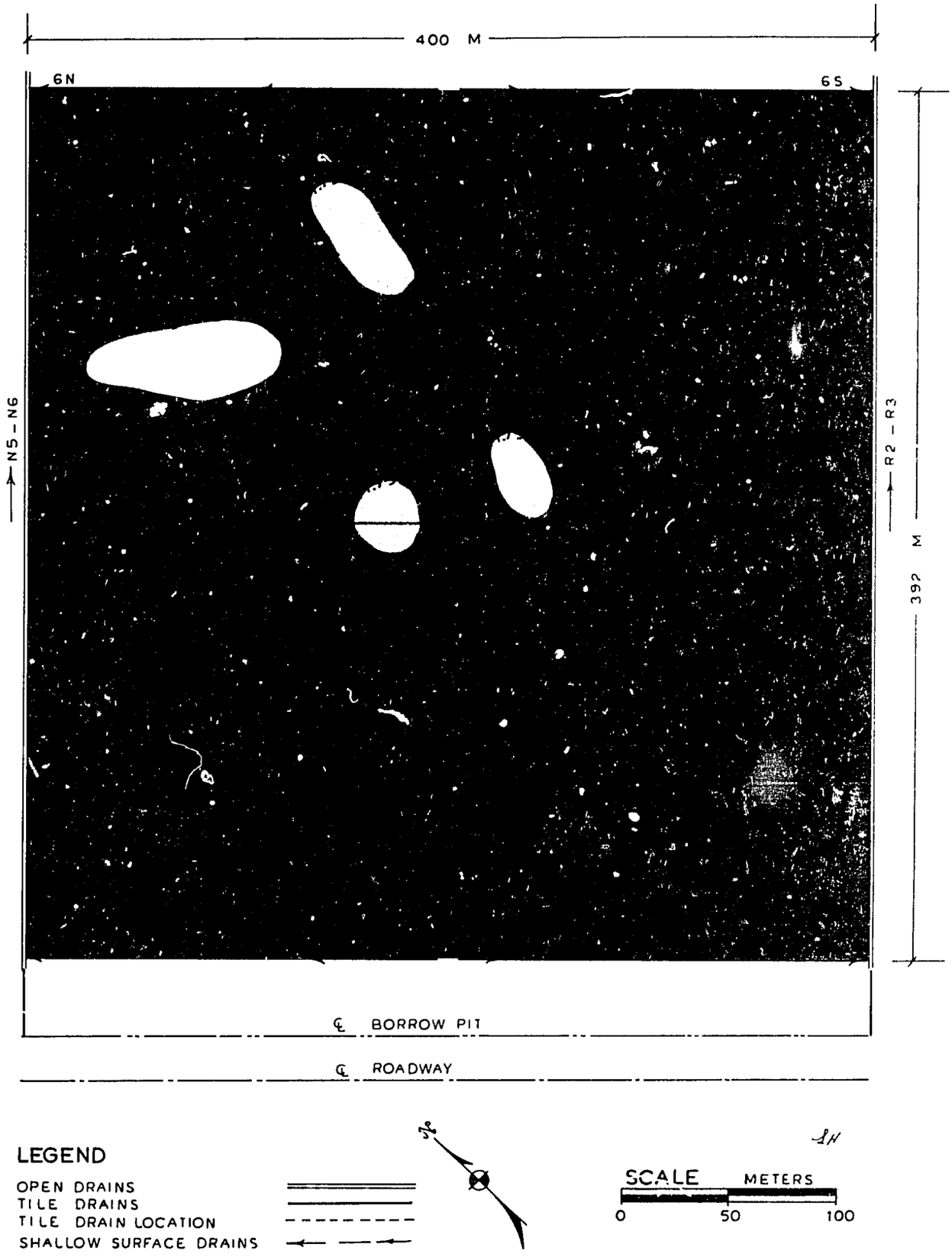


FIGURE 34. WATER TABLE DEPTHS IN METERS, DECEMBER 29, 1972

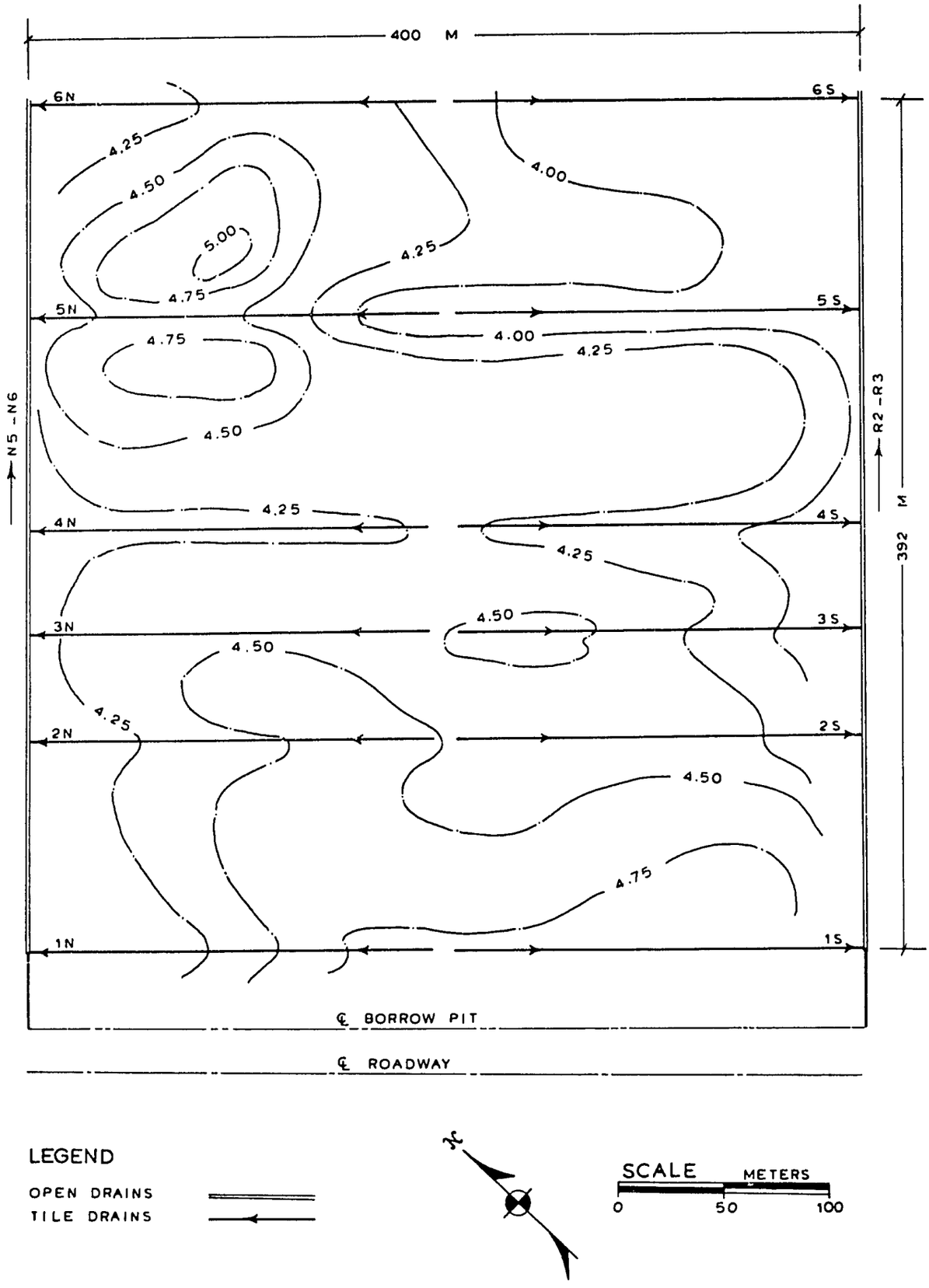


FIGURE 35. GROUNDWATER ELEVATIONS IN METERS, NOVEMBER 15, 1973

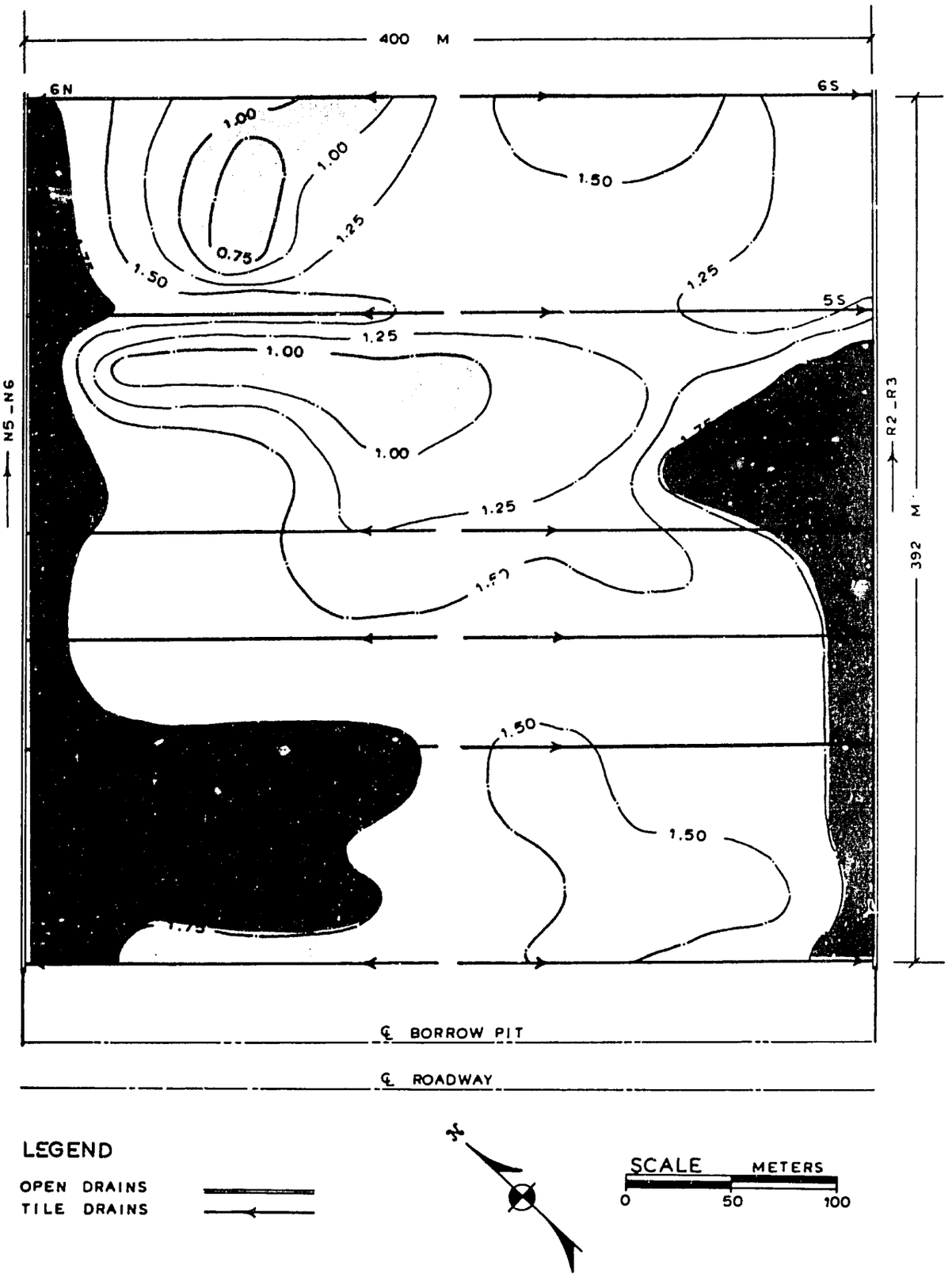


FIGURE 36. WATER TABLE DEPTHS IN METERS, NOVEMBER 15, 1973

Photo 17. Surface Drain Conducting Excess Surface Water to Deep Open Drains

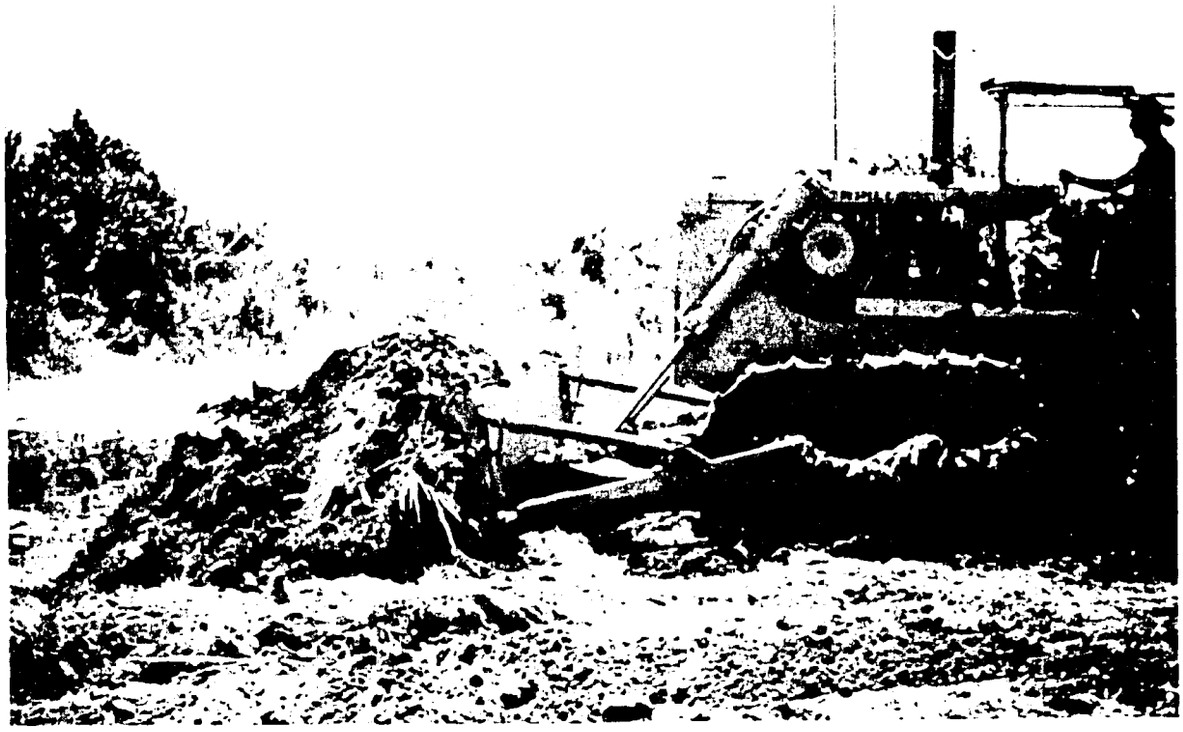


Photo 18. Filling in the Borrow Pit with Earth Excavated from the Deep Open Drains

November and December as shown in Figure 6. During this peak flow period, the canal overflows its normal channel and inundates the area between the channel and the roadway on the dike bordering the citrus. During this high stage the canal becomes a major contributor to the groundwater in the citrus area as evidenced by commencement of flow from line 1 N in late December, 1973. With lines 1 N and 1 S functioning as interceptor drains there was no further increase in water levels in the citrus area. In late December the canal level began to drop in the usual manner.

Removal of Salt from Study Area

From the flow rates and electrical conductivity measurements recorded for each drainage line, the amount of salt carried out of the area by the drainage water was computed as given in Tables A-24 through A-35. This information is summarized in Table 5.

Because the N drains were constructed earlier than the S drains and because they usually flowed at a higher rate, the total volume of water removed from the N side up to the end of 1972 was almost 2.5 times that drained from the S side. As the average conductivity of the effluent was higher on the N side, 64 metric tons of salt were removed from that half of the area while less than 19 tons were taken out of the S portion. A total of about 83 tons of salt was removed from the study area through the tile system up to the end of 1972. This was an average of about 5.19 tons/hectare and can be compared with an estimated 33.2 tons/hectare present in the 2-meter profile prior to the installation of the drainage system (Table 3). Thus, about 16 percent of the salt initially present in the profile had been removed with the drainage water after about one year of operation.

Irrigation in the citrus grove was essentially discontinued in April, 1972. Rainfall during 1972 was only about 80 percent of normal. Since no purposeful leaching was conducted to remove salt from the soil profile, it was surprising that this much salt was removed. Had normal irrigation been practiced throughout the year, and especially if excess water had been applied to leach the soil, a much larger quantity of salt could undoubtedly have been removed. It was, therefore, unfortunate that a decision was made to abandon the citrus in the study area at that time.

Analysis of Data to Develop Drainage Functions

The observation well data for the period June 15 through August 25, 1972, were analyzed to develop drainage functions. These dates were selected as this was the longest period of consistent decline of water levels in most of the wells (Figure 22). The initial date represents the time of the highest stabilized levels after the heavy rains of May and early June. August 25 is the last day of generally measurable levels in the selected wells. After the surface drainage was improved the water levels did not rise enough to give a period of sufficient length for such an analysis.

Tables A-36 through A-44 list each well analyzed, the ground surface elevation at the well, the elevation of the drain of influence, and the distance to that drain. The time intervals of the measurements, water elevations, and the rainfall recorded during each interval are also given. The number of observations included in these analyses varied from 4 (June 15 to July 3) for some wells to 9 (June 15 to Aug 11) for other wells. In each case the longest period of decline that was not significantly influenced by the rainfall, by opened hydrants (Photos 19 and 20), or by occasional non-supervised irrigations was used. The period in each case was terminated when a rise in the water level occurred, or when the decline was appreciably less than would have been expected.

The purpose of these analyses was to develop functions that would be useful in the design of drainage systems. Attempts were initially made to make adjustments for loss of water from the soil by evapotranspiration and additions to soil moisture by rainfall and/or irrigation. Because the data included no actual dates or amounts of water applied, and since the effect on the water table due to losses of soil moisture by evapotranspiration had to be estimated, it

Table 5 .Summary of Drainage Water and Salt Outflow, Citrus Orchard.

Drain No.	From Mo Da Yr	To Mo Da Yr	Int Days	Flow L Sec	EC mmhos	Flow M^3 Day	Volume M^3	Salt Kg Day	Salt Tons
1S	5 31 72	7 18 72	48	.0436	4.76	3.77	181	11.66	0.560
2S	11 09 71	11 17 72	295	.0632	3.53	5.46	1610	12.52	3.694
3S	11 09 71	11 10 72	236	.0586	5.37	5.06	1195	17.69	4.174
4S	11 09 71	12 01 72	287	.0585	4.52	5.06	1452	14.85	4.262
5S	1 31 72	11 10 72	145	.0425	8.50	3.67	532	20.28	2.941
6S	4 20 72	11 17 72	191	.0262	10.67	2.26	432	15.67	2.994
S Drains, Totals and Avg.			1202	.2925	5.31	25.28	5401	92.68	18.625
1N	1 18 72	11 17 72	170	.0657	6.26	5.69	965	23.11	3.928
2N	9 24 71	11 17 72	326	.0988	8.50	8.54	2784	47.18	15.379
3N	7 19 71	12 08 72	360	.0991	5.95	8.56	3083	33.11	11.918
4N	10 08 71	12 08 72	376	.1274	5.89	11.01	4139	42.17	15.856
5N	1 18 72	12 08 72	273	.0557	7.93	4.81	1314	24.82	6.777
6N	9 24 71	11 17 72	265	.0492	14.36	4.25	1127	39.70	10.521
N Drains, Totals and Avg.			1770	.4960	7.38	42.86	13413	210.09	64.380
All Drains, Totals and Avg.			2972	.7886	6.79	68.13	18814	304.77	83.005

Photo 19. Open Hydrant on Buried Main Sprinkler Line in Study Area

Photo 20. Three Open Hydrants in the Study Area. A Constant Source of Problems in the Study

was decided to use only the period of continuous decline, and not correct for evapotranspiration, rainfall, or irrigation. Thus, the rate of decline of the water levels was that which occurred under normal evapotranspiration with minimal rainfall (8 mm during the shortest period and 44 mm for the longest period).

The equations are expressed as the hydraulic head, (head) or height of the water level above the drain level, as a function of the total time interval and initial head.

The analyses of the data were accomplished using Fortran V and the Univac 1108 computer. Two equations were developed expressing the hydraulic head, H_F and H_A, or height of the water level in the observation wells above the drain level, as functions of the total time interval, T, and the initial head, H_1. All measurements are in meters, and time, T, in days. The equations are:

$$H_F = H_1 \, e^{-TF} \tag{13}$$

and

$$H_A = H_1 \, (1 - A \, T^{XP}) \tag{14}$$

in which

H_F and H_A are the computed hydraulic heads in meters above the drain level at time T in days.

Table 6. Summary of Observation Well Data to Compute HF = H1 EXP (T*F) and HA = H1*(1-A*TXP)**

Location	DTD	N	F	A	XP	TF50	TA50	AERF	AERA
14 I	12	4	0228	0269	8750	30 4	28 2	0 49	0 38
14 D	12	7	0168	0266	7903	41 2	41 0	1 69	1 67
16 I	12	4	0221	0262	8750	31 4	29 1	0 46	0 36
16 D	12	4	0203	0235	8892	34 1	31 1	0 06	0 13
22 I	12	4	0307	0422	7967	22 6	22 3	1 06	0 77
22 D	12	7	0161	0225	8308	42 9	41 7	1 76	1 88
24 I	12	4	0419	0583	7661	16 5	16 5	2 35	2 45
24 D	12	8	0169	0276	7771	41 1	41 6	1 52	1 23
Average	12	(42)	0235	0317	8250	32 5	31 4	1 17	1 11
5 I	24	6	0197	0176	9602	35 3	32 6	2 76	2 44
5 D	24	8	0287	0423	7564	24 2	26 2	2 01	4 74
7 I	24	4	0373	0410	8694	18 6	17 8	2 09	3 11
7 D	24	7	0163	0254	7954	42 6	42 4	1 19	1 15
15 I	24	4	0214	0254	8750	32 4	30 1	0 43	0 35
15 D	24	5	0191	0306	7750	36 3	36 8	1 48	0 78
23 I	24	4	0310	0295	9392	22 3	20 4	0 63	0 82
23 D	24	9	0165	0231	8195	42 1	42 6	1 34	1 92
31 I	24	5	0361	0472	7931	19 2	19 6	2 69	4 89
31 D	24	4	0265	0359	8117	26 2	25 7	0 43	0 10
33 I	24	5	0246	0324	8244	28 2	27 6	0 52	1 19
33 D	24	5	0324	0413	8098	21 4	21 8	1 41	0 66
41 I	24	8	0372	0773	6251	18 6	19 8	3 41	7 52
43 I	24	7	0305	0488	7316	22 8	24 0	1 80	1 05
Average	24	(81)	0270	0370	8133	27 9	27 7	1 59	2 19
6 I	49	5	0186	0241	8496	37 2	35 5	1 06	1 13
6 D	49	9	0167	0324	7287	41 6	42 7	1 54	1 40
32 I	49	5	0275	0474	7235	25 2	26 0	2 10	1 25
32 D	49	4	0246	0309	8453	28 2	26 9	0 74	0 69
42 I	49	7	0240	0203	9510	28 9	29 1	1 76	4 69
Average	49	(30)	0223	0310	8196	32 2	32 0	1 44	1 83
Overall Avg		(153)	0250	0343	8179	30 1	29 6	1 55	2 04

H_1 = initial head above drain level in meters
e = base of Naperian logarithms
F and A are constants in the respective equations
xp = the exponent of T in Equation 14.

The measured and predicted heads, H(I), HF(I) and HA(I) for each time interval, T(I), together with the best fit values of the constants F, A and XP, and the average relative errors for the computed heads, AERF and AERA, in percent of the measured heads, H(I), are given in Tables A-36 through A-44. These tables have been summarized in Table 6, which also gives the time in days, TF50 and TA50, for the water level to drop half of the distance from the initial head, H_1, to the drain level.

The 27 observation wells chosen for this study were those midway between drains or at the quarter points for which the distances to the nearest drain, DTD, varied from 12 to 49 meters as given. This analysis indicates that the water table declines at a relatively uniform rate throughout the area.

The extreme range of each of the constants, their mean values and standard deviations are as follows:

Constant	Range	Mean Value	Standard Deviation
F	.0163—.0419	.0250	.0075
A	.0203—.0773	.0343	.0133
XP	.6251—.9602	.8179	.0750
TF50 days	16.5—42.9	30.1	8.5
TA50 days	16.5—42.7	29.6	8.4
AERF, percent	0.06—3.41	1.55	0.83
AERA, percent	0.10—7.52	2.04	1.77

The individual equations fitted the data well, but because of the heterogeneity of the soil in the area, there were appreciable variations in the constants. The average time for the water table to drop half the distance to the drain level was about 30 days, but for individual wells it varied from 16.5 to about 43 days. This is considered to be satisfactory performance and would indicate that a drain spacing of about 100 meters would satisfy these soil conditions.

Average modified values of the constants F, A, and XP that produced minimum errors were developed for use in Equations 13 and 14 in order to have one set of constants for the study area. They were:

$$A = 0.031$$
$$F = 0.024$$
$$XP = 0.82$$

For these constants the overall average error was then about 11 percent by both equations. Using the constants, Equation 14 can be written:

$$(H_1 - H_A) / H_1 = 0.031 \, T^{0.82} \tag{15}$$

This equation plots as a straight line on log-log graph paper as shown in Figure 37. The vertical short lines in this Figure indicate the range of the measured values of the ratio, $(H_1 - H) / H_1$, for all observation wells and all time intervals. This ratio is given as Y(I) in Tables A-36 through A-44. The circles plotted in Figure 37 represent the mean values of the measured ratios for each time interval. These mean ratios are given as AY(I) at the bottom of Table A-44.

Equation 13, using $F = 0.024$, can also be written in the same form as Equation 15 to become:

$$(H_1 - H_F) / H_1 = 1 - e^{-.024T} \qquad (16)$$

When plotted on log-log graph paper this equation is a curve as shown in Figure 37. Equation 16 can also be rewritten as

$$H_F / H_1 = e^{-.024T}$$

which would plot as a straight line on semi-log graph paper. The ratios H_F/H_1 are given as RH(I) in Tables A-36 through A-44, and the mean values, as ARH(I), in Table A-44.

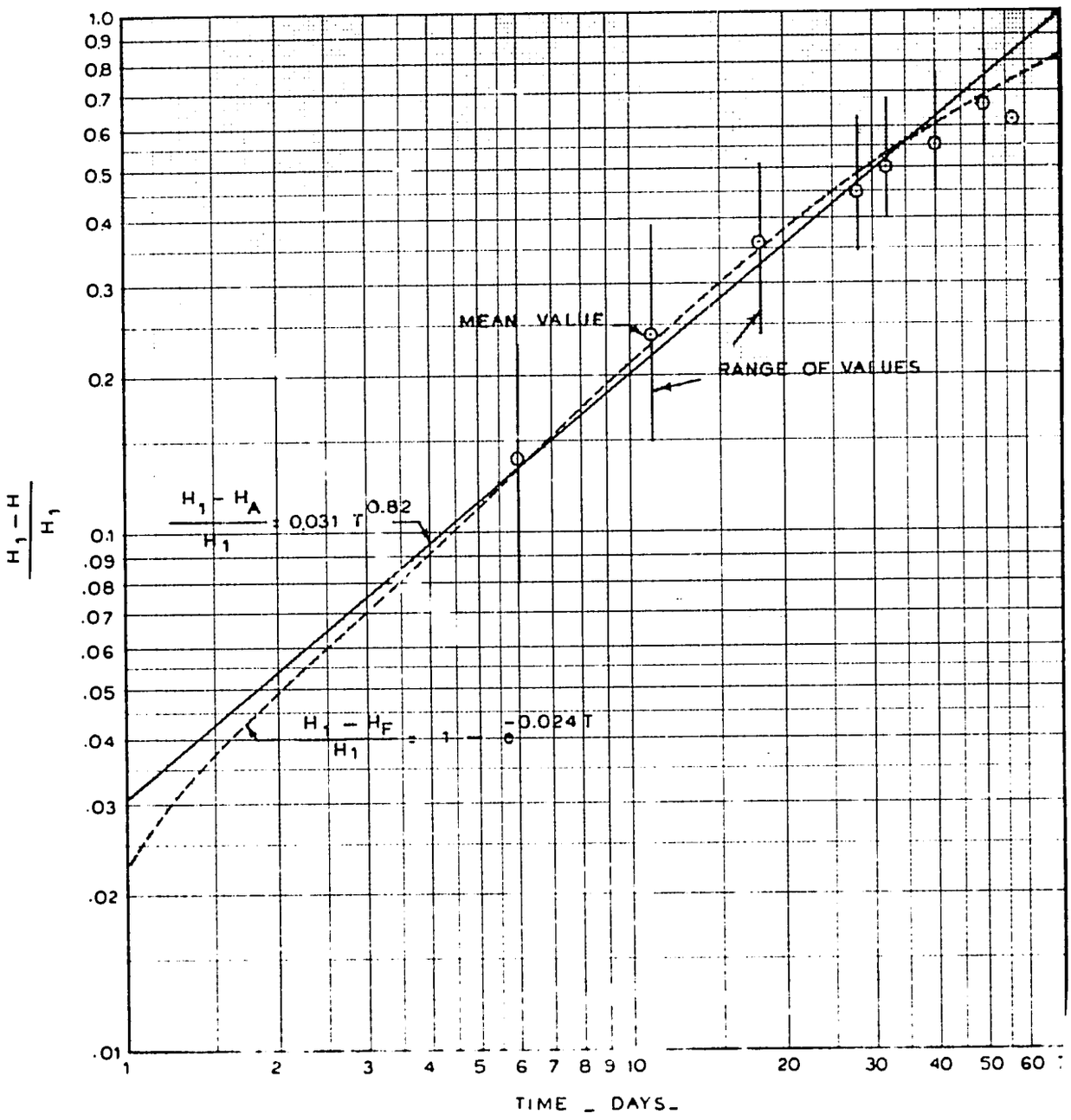


FIGURE 37. COMPARISON OF EQUATIONS WITH MEANS AND RANGES OF MEASURED VALUES

LEACHING STUDY

Site Selection

A leaching site was selected in an area along the northeast side of the citrus plantation where the soils appeared to be extremely saline. This location was about 800 meters to the southeast of the drainage study and adjacent to one of the large open drains. All of the citrus trees which were originally planted in this area had died from adverse salinity and groundwater problems (Photo 21). During the dry season the ground surface in the selected area had many large patches of white salts on the surface. The only vegetation present was salt tolerant varieties of weeds. Except for the deep open drains crossing this zone at about 400 meter intervals, there is no drainage system installed in this area. The leaching experiment was placed near an open drain in order to permit the movement of water and salt away from the leaching area.

Experimental Design

As initially conceived, there were to be two rows of eight, 5 meter x 5 meter, leaching plots on each side of the open drain. The two rows on one side of the drain were to receive 500 mm of applied leaching water and the two on the other side were to receive 1000 mm of water. Figure 38 represents the configuration for the plots on one side of the open drain. Except for water application, the design on both sides of the canal was to be symmetrical in layout and consist of the same treatments. Plots 1 through 4 in all four rows were to receive an application of gypsum at the rate of 31.25 metric tons per hectare. Plots 5 through 8 were to receive no gypsum. Plots 1, 2, 5 and 6 would have the surface of the soil well disturbed to a depth of about 15 cm, and the remaining plots, 3, 4, 7 and 8, would have the soil surface left undisturbed.

In this manner there would be on each side of the drain

4 plots undisturbed with no gypsum
4 plots disturbed with no gypsum
4 plots undisturbed with gypsum
4 plots disturbed with gypsum

As orginally planned, the treatments in all 32 plots were to be randomized. However, in order not to have some dry plots surrounded by others being leached and thus a gradient producing water and salt movement towards the dry one, it was decided to group the treatments so as to minimize movement of water and salt from one treatment to another. The final arrangement of plots on the southeast side of the drain was as shown in Figure 38.

Each 5 x 5 meter plot was surrounded by a compacted earth dike about 50 cm in height (Photo 22). This height was sufficient to avoid inundation of the dikes by excessively heavy rains which occurred occasionally.

Each dike was covered on the top and sides by a thin plastic membrane to minimize losses of water by evaporation from the dike surfaces (Photo 23) and this membrane was protected by a thin layer of soil cement. The dimensions of the dike left an effective plot size of 4 x 4 meters.

The construction of the dikes was accomplished by hand and was time consuming. Work was initiated about November, 1971, in order to take advantage of the following dry period, January through April, for leaching. Because of unforeseen difficulties, construction had to be discontinued after about one month. This preliminary construction work was destroyed by the heavy rains in May and early June, 1972. Construction work was resumed about mid-June. Because of the time involved in construction it was then decided to complete the construction of one half of the experiment on the southeast side of the drain, and begin the leaching before constructing the plots for the second half of the experiment.

Water Level Measurements

Observation wells and batteries of piezometers were installed as shown in Figure 38 to monitor groundwater levels and determine gradients during the leaching process. The observation wells were of the same design as in the drainage experiment and were installed to a depth of 2.0 meters. The piezometers were installed to depths of 1.0, 1.5, 2.0 and 2.5 meters in each battery of 4 piezometers. They were constructed of ½" black iron pipe.

Stilling wells were constructed on one outside corner of each leaching basin and were connected to the center of the basin along a diagonal from the corner with a ¾" perforated PVC tube on the floor of the basin. Water levels were then measured in the stilling wells by means of a hook-gage reading to tenths of millimeters (Photo 24). One additional plot was constructed and lined to form an evaporation basin as shown in Photo 25.

Soil Sampling

The soil was sampled in each test plot initially to a depth of 2 meters at each textural change (Photo 26). The initial samples were taken on June 19, 1972. It was intended to obtain complete analyses of all exchangeable cations, the cation-exchange-capacity, pH, electrical conductivity of the saturation extract and the texture for the initial samples. Intermediate sampling was to go to only a depth of 1 meter, and would require only analyses of electrical conductivity of the saturation extract and pH. The final sampling at the end of the test was to be the full 2 meters of depth, but with the same analyses as for the intermediate samples. Because of the discrepancies shown earlier in the results obtained from the available laboratories, the time required to receive the results, as well as the inaccuracies shown; the initial samples were analyzed at the Santa Lucia Station for only pH and electrical conductivity.

Because of the delay in final preparation for the first leaching application, and the rain which occurred during this delay, each plot was sampled a second time to a depth of 1 meter prior to leaching on August 2, 1972. On November 21, 1972, after applying 750 mm of water, a third sampling was made to a depth of 1 meter. This was followed after the last water application with a fourth sampling on December 19, 1972, to a depth of 1 meter. The results of the analyses to 1 meter of depth are given in Tables A-45 through A-48.

At this point a salt sensitive crop (upland rice) was planted to evaluate physiologically the effects of leach-

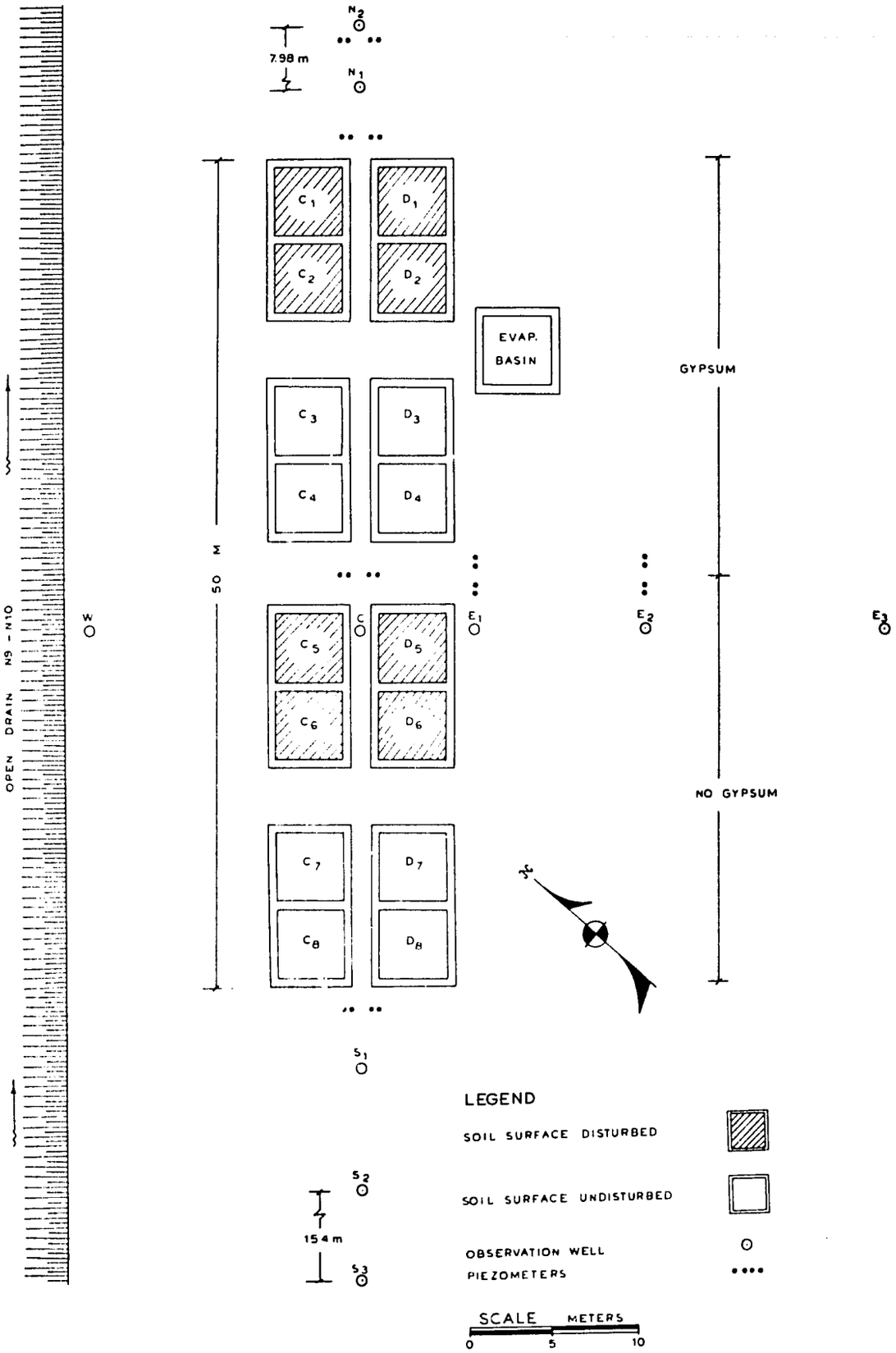


FIGURE 38. LAYOUT OF LEACHING STUDY ON SOUTHEAST SIDE OF DRAIN

Photo 21. Dead Citrus Trees in Area of Leaching Study

Photo 22. Construction of the 50 cm Dikes Surrounding the Leaching Plots

Photo 23 (above). Placement of the Plastic Membrane on the Dikes in the Leaching Plots

Photo 24. Measuring the Water Level in a Leaching Plot with a Hook Gauge

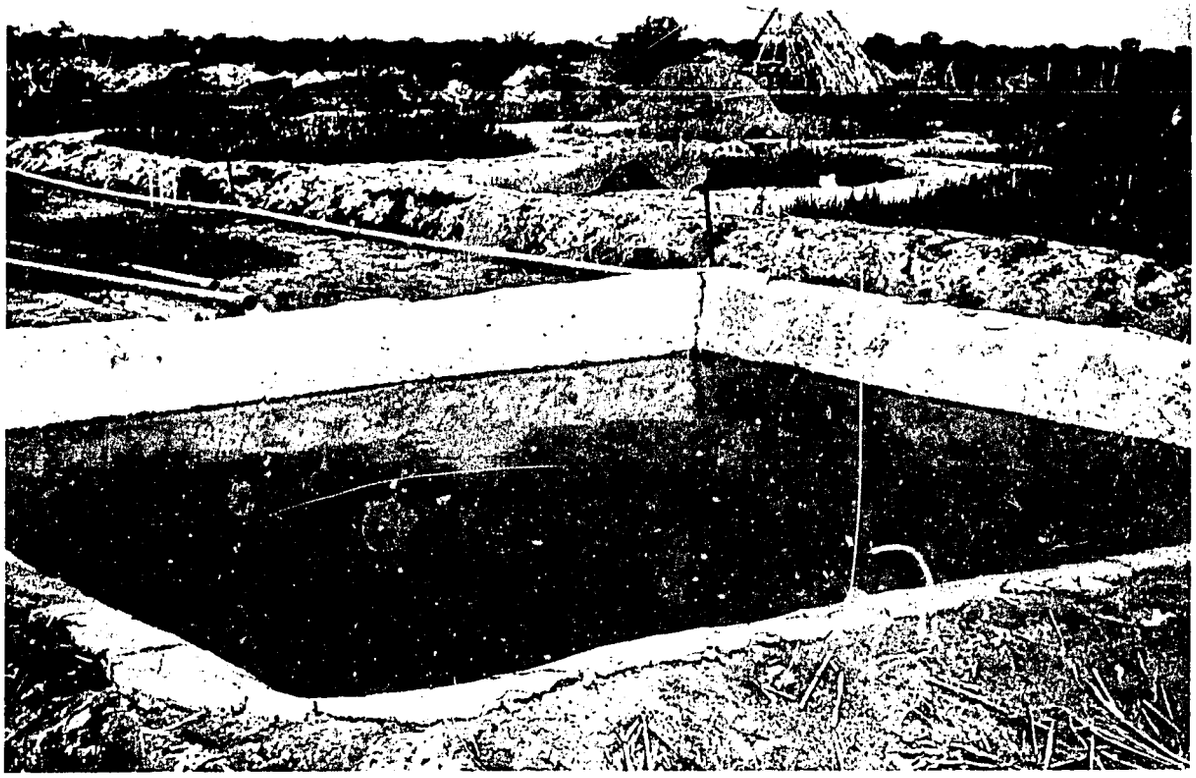


Photo 25. Evaporation Basin for Leaching Study

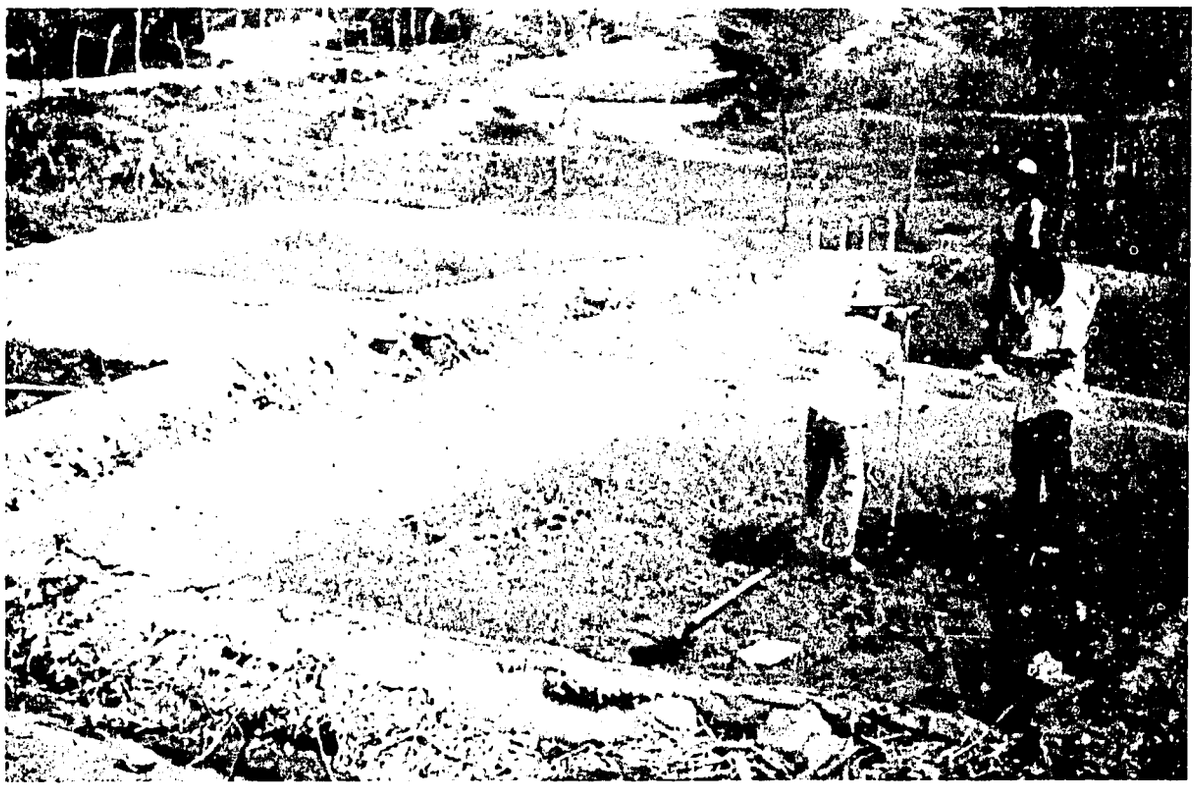


Photo 26. Taking Soil Sample in Leaching Plot

ing. A final soil sampling to a depth of 2 meters was made on May 27, 1973, after the crop was harvested.

The gypsum was applied to those plots which required it between the first and second soil samplings in July, 1972. One 50 kg sack of gypsum was applied to each 16 square meter plot, which was at the rate of 31.25 metric tons per hectare.

Quality of Leaching Water

The irrigation water used for leaching was of excellent quality. This water was pumped from the Dique Canal and distributed through an underground pipe line. The conductance measurements on this water indicated a range of from 110 to 160 micromhos per cm (EC x 10^6) during the period of high flow in the Rio Magdalena to about 230 during the low flow. The plots were leached during the period August 31 to November 23, 1972, during the high flow period when the conductance was at a minimum. The principal ions were reported to be Ca and HCO_3.

Water Applications

Water was not measured onto the plots volumetrically. A hook gage reading for each plot was determined which would correspond with an average 25 cm depth in the basin. Water was added to the basins by means of a 4" aluminum irrigation pipe from a nearby buried main pressure line until the 25 cm depth was attained. Some infiltration occurred before this depth was reached, but in proportion to the total amount of water that was added in the short time required to fill the basin, this unmeasured infiltration was considered negligible.

Leaching water was applied in four 25 cm increments during the course of the experiment. All disturbed plots were cultivated prior to each application of water. The soil surface was permitted to dry between each application for a period of 20 to 30 days. This permitted the water table to drop about 50 to 60 cm below the soil surface before the next application.

Analyses

The profiles of the water table along both axes of the test plots during the course of the experiment are shown in Figure 39. A general rise in the water table occurred with application II and III, which coincided with heavy rains in conjunction with the leaching applications in September and October. Applications I and IV did not produce such a general rise. A hydrograph of the center observation well, C, plotted with the rainfall and water application is shown in Figure 40.

The time required for the water to disappear from the surface of each plot, Table 7, does not appear to be influenced significantly by the treatment in the test plot. It seems more to be a function of the geometry of the layout of the plots and the groundwater mound build-up under the plots by the leaching application (Figure 39). Referring to Table 7 it can be seen that when the groundwater was generally low, as for the first application, the time of infiltration was short, 7 days or less for all plots. For applications II and III, where the water table was higher due to the rains it was somewhat longer, 9 to 14 days for the center plots where the groundwater build-up was greater, but it was only about 2 days in the end plots.

Table 7. Infiltration Data for Leaching Plots, 1972

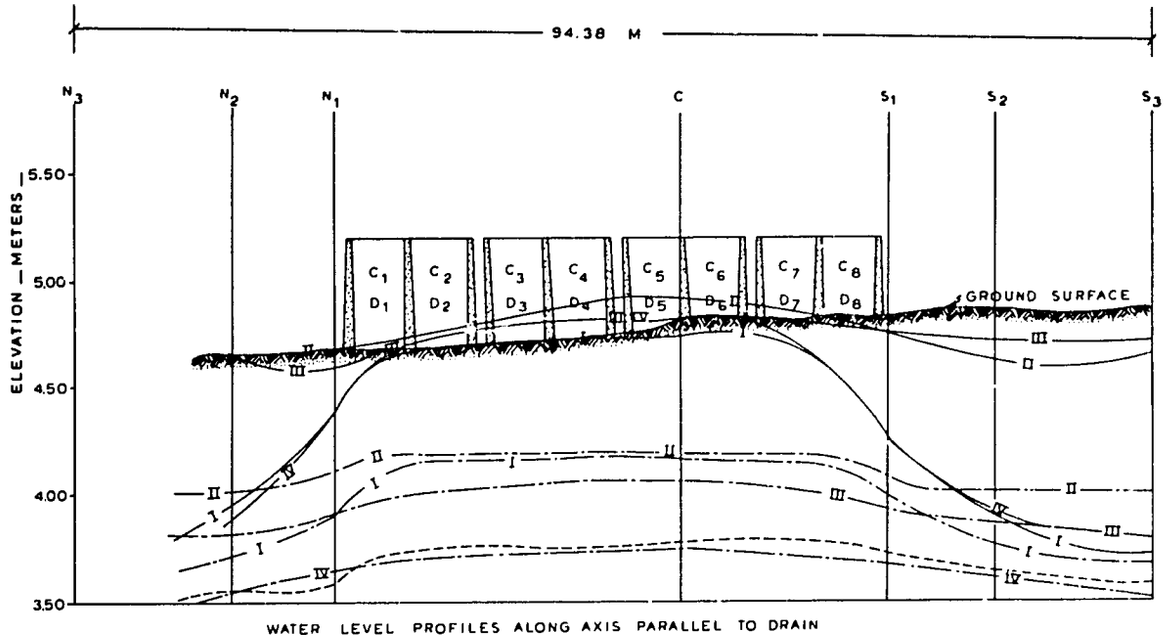
Treatments		Plot No.	Applications and Dates 1 8/31†	2 9/19-	3 10/24-	4 11/23
			Days for water to disappear*			
Gypsum	Disturbed	C-1	2	3-4	3	2-4
		D-1	2-4	2	2	2-4
		C-2	2	6	3	2-4
		D-2	2-4	11-13	11-13	6
	Un-Disturbed	C-3	2	10-12	11-13	6
		D-3	2-4	14	11-13	7
		C-4	4	14	10-12	6
		D-4	5-7	14	10-12	9-11
No Gypsum	Disturbed	C-5	4	10	10	5
		D-5	5-7	7	7-9	4
		C-6	5-7	10	11-13	7
		D-6	5-7	9	10-12	5
	Un-Disturbed	C-7	5-7	11-13	11-13	8
		D-7	5-7	10	8-10	6
		C-8	2	3	3	2-4
		D-8	2	3	3	2-4
Rainfall	Period		8/31-9/18	9/19-10/23	10/24-11/22	11/23-12/31
		mm	79	144	110	12

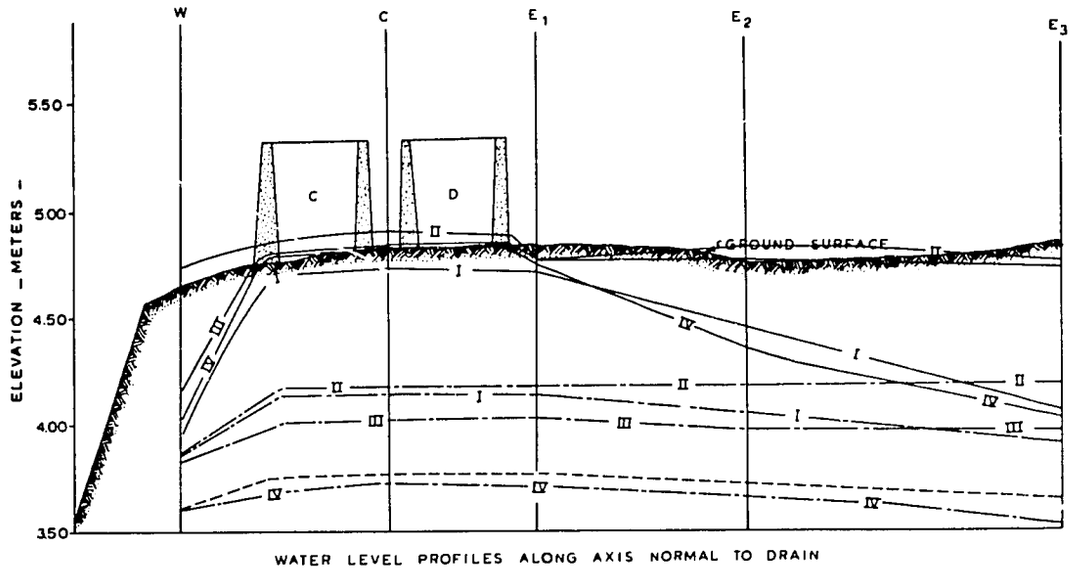
†Application date with hyphen (-) indicates that the applications were not completed on date given.

*Double figures represent data observed on a Monday or the day after a holiday. The water may have disappeared before the last day indicated.

The infiltration rates for the fourth application were essentially a repeat of the first application. After a depth of 1 meter had been applied plus the rainfall, the infiltration rates were essentially the same as at the end of the first application. A physical change in the soil structure due to the dispersion effect of a high exchangeable sodium content after the leaching is not apparent in this test. The plots without the gypsum treatment maintained intake rates about as high as for the plots that received gypsum at the rate of 31.25 metric tons per hectare.

Table 8 indicates that there were no significant differences in the mean infiltration times for the different treatments: gypsum vs. no gypsum or disturbed vs. undisturbed. There were, however, significant differences based on location of the plots. The four end plots averaged 2.72 ± 0.5 days while the eight center plots averaged 7.90 ± 3.5. The reason is apparent from Figure 39 which shows that the infiltration time was controlled by the build-up of the water table mound under the plots and the lower horizontal gradients away from this mound. It was somewhat surprising that there was no significant difference in the infiltration times for all C plots nearest the drain and the D plots farther away: 6.39 ± 3.3 vs. 6.81 ± 3.6.





WATER APPLIED			WATER LEVELS			RAINFALL
			----------	AUG	23	
I.	250 MM	—SEP 4—				65 MM
			—— I ——	SEP	7	23 MM
			—·— I —·—	SEP	15	85 MM
II.	250 MM	—SEP 19—				
			—— II ——	SEP	25	94 MM
			—·— II —·—	OCT	23	50 MM
III.	250 MM	—OCT 24—				
			—— III ——	OCT	31	66 MM
IV.	250 MM	—NOV 23—	—·— III —·—	NOV	23	0 MM
			—— IV ——	NOV	24	6 MM
			—·— IV —·—	DEC	29	

FIGURE 39. WATER LEVEL PROFILES IN LEACHING STUDY

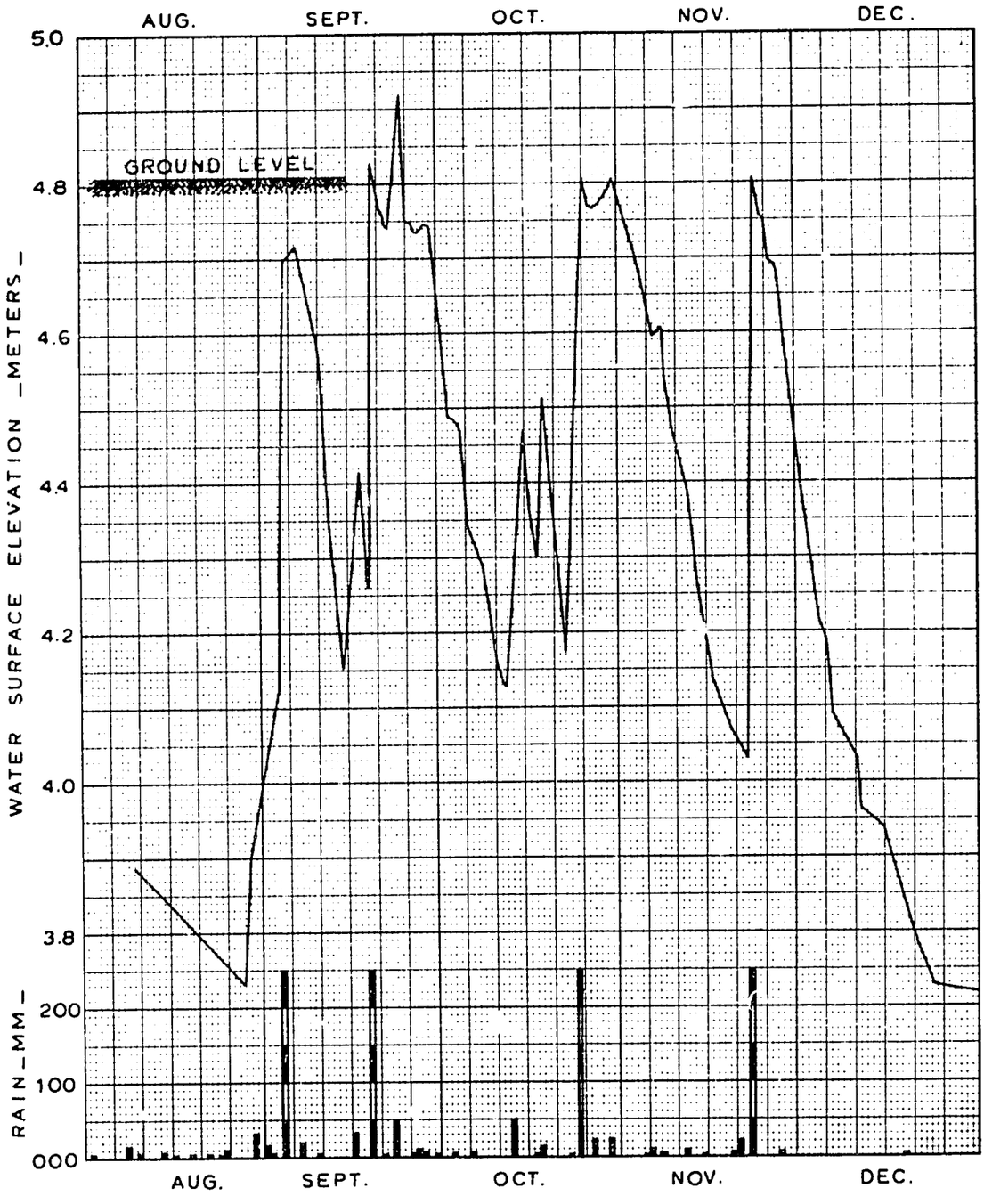


FIGURE 40. HYDROGRAPH OF OBSERVATION WELL "C" DURING LEACHING STUDY

Table 8. Comparison of Mean Infiltration Times in Days and Standard Deviations for Different Treatments and Locations

No. of Plots	Treatment or location	Mean Time Days	Standard Deviation
4	Gypsum, dist.	4.28	3.2
4	Gypsum, undist.	8.94	4.1
4	No gypsum, dist.	7.50	2.6
4	No gypsum, undist.	5.69	3.5
8	Gypsum	6.61	4.3
8	No gypsum	6.59	3.2
8	Disturbed	5.89	3.3
8	Undisturbed	7.31	4.1
8	Center plots	8.22	3.4
8	End plots	4.98	3.4
4	End plots	2.72	0.5
12	Center plots	7.90	3.5
8	C plots	6.39	3.8
8	D plots	6.81	3.6
16	All plots	6.60	3.8

The visual appearance of the soil surface was the same, and of good granular structure, in all plots except C5, D5, C6 and D6. These were the four plots which received no gypsum but had the soil surface disturbed. The surface in these plots became hard upon drying, was lined with deep cracks, and was almost completely barren of vegetative growth throughout the experiment. (Photo 27). All of the other plots had a luxuriant growth of weeds of a type completely dissimilar from the surrounding salt tolerant weeds. The four plots receiving no gypsum nor mechanical surface treatment had the most rampant weeds (Photo 28). The seeds for these weeds probably came in with the leaching water through the irrigation system. It is interesting to note that water did not stand any longer in the four barren plots than in any of the others, in spite of their apparent poorer physical condition.

Salt in Soil Profile

An estimate of the amount of salt present in each stratum of the upper meter of the profile at each sampling date is given in Tables A-45 through A-48. In general there appeared to be a slight increase in salt, probably due to evapotranspiration, between the first and second sampling dates with no leaching and only 22 mm of rain. There was, however, considerable variation in individual plots that cannot be explained. Between the second and third sampling dates there was a significant decrease in salt, during which time 750 mm of water was applied, plus 438 mm of rain. Again between the third and fourth sampling dates, there appeared to be a slight gain in salt in most of the plots, although this is probably not significant. During this period there was only 250 mm of water applied plus 12 mm of rain. Evapotranspiration probably accounted for most of this, so little effective leaching occurred. A summary of the estimated amount of salt present for each treatment on the four dates is given in Table 9.

Table 9. Summary, Estimate of Salt in Leaching Plots*
(top meter of soil profile, tons per hectare)

Plots	Gypsum		No Gypsum	
	Disturbed C,D 1,2	Undist. C,D 3,4	Disturbed C,D 5,6	Undist. C,D 7,8
Dates	Tons Per Hectare			
First June 19	44.4 (4.8)	50.7 (11.4)	42.6 (10.4)	48.6 (4.6)
Second August 2	56.1 (5.0)	51.0 (10.4)	55.3 (21.0)	51.9 (17.5)
Third November 21	28.1 (5.9)	22.4 (13.1)	19.8 (9.6)	14.0 (4.4)
Fourth December 19	31.0 (4.6)	29.9 (13.3)	17.3 (9.0)	18.5 (5.9)

* Means and (standard deviations).
Upper limit for non-saline soil about 15 tons/ha

Photo 27. Plot D-6 in Leaching Study after 750 mm of Leaching Water Applied Showing Barren Condition of the Soil Surface

Photo 28. Plot C-8 in Leaching Study after 750 mm of Leaching Water Applied Showing Weed Growth

PHYSIOLOGICAL EVALUATION OF LEACHING STUDY

Experimental Design

At the termination of the leaching stage, the 16 leached plots were prepared for seeding. In addition to these 16 plots, six control plots of the same size with small dikes around them were prepared for seeding (Photo 29). The lines of the two rows of leached plots were extended at both extremities to accommodate the additional six in the design. Four were constructed at the northeast end and two at the southwest end. All 22 plots received identical treatment thereafter.

Rice Variety

The rice variety CICA-4, which is recommended for both inundated and upland conditions, was selected for the study. To avoid further leaching and to approximate upland conditions, it was decided to apply light frequent applications of water by sprinkling.

The seed available was tested and found to have 80 percent germination. It was seeded at the ICA recommended rate of 140 kg ha. At the tested germination, this amounted to 112 kg ha of viable seed planted or 179 gm per plot.

Fertilization

The cultural practices were the same for all 22 seeded plots. Nitrogen in the form of urea was applied in four applications. Phosphorus and potassium were applied in single applications as given in Table 10.

Table 10. Fertilizer Application, Timing and Rate

No.	Time of Application	Plant Nutrients		
		N	P_2O_5	K_2O
		kg ha	kg Ha	kg ha
1	At seeding	77.5	–	–
2	At 48 days	72.5	–	–
3	At 62 days (panicle initiation)	50.0	40	100
4	At 92 days (flowering)	50.0	–	–

Irrigation Method

Rainbird # 25A-7° FP-TNT-1 8'' sprinklers were selected for the test. Two sprinkler lines were laid parallel to the long axis of the experiment along the outside edges. Sprinklers were placed at each joint and were set to cover ½ circles between the two lines. This arrangement fixed the spacing at 7 m x 12 m. The distance between lines was too great for normal uniform coverage, but the sprinkler distribution at normal operating pressure with no wind appeared to be good. This, in conjunction with the impermeable dikes with sloping sides around each plot which concentrated water from the edges into the plot, compensated for the wide spacing. It was later found that during the sprinkling there was a breeze from the southeast at right angles to the sprinkler lines which disturbed the sprinkler pattern. The sprinkler line closest to the drainage canal did not adequately cover its intended area because of this breeze. The condition was not obvious until the growth reflected it. The position of this line was then changed to the long axis position between the two rows of plots and fixed for half circle operation downwind toward the drain. This produced a more uniform distribution pattern.

Problems with Irrigation System

Prior to germination of the rice, the sprinklers were set up outside the experimental area to test coverage, distribution, and available pressure. A minimum pressure of 25 psi was required for the satisfactory application of water. This minimum pressure was available during the initial test. When the system was set up January 12, 1973, to germinate the rice seed it was found that the available pressure was not adequate to operate the sprinklers satisfactorily and the distribution was poor. The system was operated for only a few minutes, but during this time sufficient water was applied in some places to produce germination, while in other places the soil remained essentially dry. The next day an attempt was made again; there was more pressure but it was still insufficient for uniform coverage. During the next week no water was available.

Finally, on January 21 an attempt was made to save the seeds which germinated by attaching a garden hose to the main water line and using the water stored in the line to uniformly wet the plots. This provided sufficient water for about 2 days. Later it was decided to give up the idea of sprinkling to supply water requirements without additional leaching, and to flood the plots from the main irrigation line. By January 25 there was water in the lines, but inadequate pressure. The plots were flooded with about 8 cm of water (Photo 30). It was necessary to apply this depth in order to adequately cover all parts of each plot. Since it was initially intended to sprinkle, the plots had not been leveled and invariably had low corners or depressions. This had the effect of leaching parts of the plots. The plots were flooded three additional times, the last being on February 22 (Photo 31). A total of 28 cm of water was applied during this period. Since the rooting depth of the rice plant is very shallow it was necessary to irrigate when the surface layer became dry. The plants were showing stress prior to each irrigation in spite of the fact that there was sufficient water deeper in the profile. Because excessive water had been applied in parts of the plots, nitrogen deficiency became apparent and an additional application of nitrogen was made on March 1. This was at the rate of 72.5 kg / ha shown in Table 10.

From this point the minimum pressure requirement of 25 psi was generally available in the mainline, and for all but one of the remaining irrigations the sprinkler system was used (Photo 32). Approximately 2.5 cm of water was applied at intervals as demanded by the evapotranspiration. One application of 10 cm was made by flooding on April 6

Photo 29. Seeding the Leached Plots with CICA-4 Rice

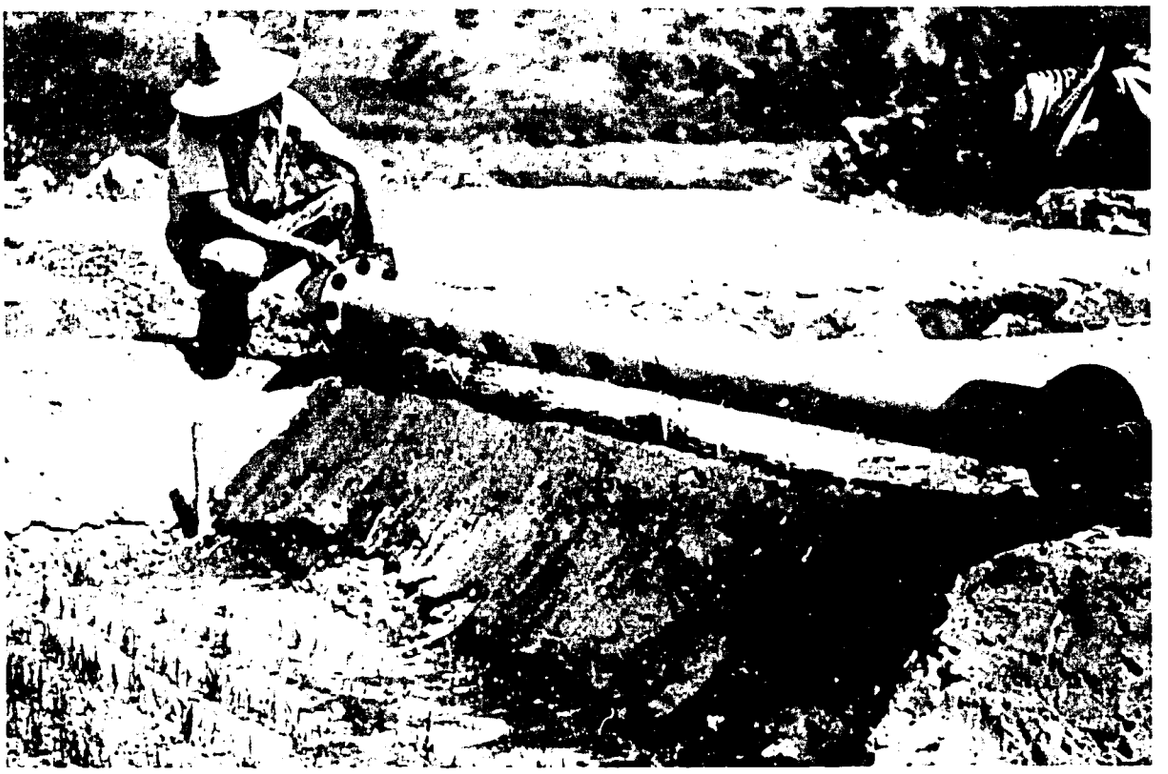


Photo 30. Flooding Rice Seedlings in Leached Plot Using a Section of Gated Pipe to Distribute Water. (January 25, 1973)

Photo 31. Flooding Young Rice Plants in Leached Plot Using a Section of Corrugated Plastic Drain Pipe to Distribute Water (February 8, 1973)

Photo 32. Sprinkling Young Rice Plants in Leached Plots (March 15, 1973)

for mouse and stem borer control. A total of 90 cm of water was thus applied, including 38 cm by flooding. In addition to the irrigation water, 7.7 cm of rainfall occurred during the growth stage of the rice.

Insect and Disease Control

A regular program of insect and disease control was followed throughout the experiment (Photo 33). Stem borers were noticed in some plots by April 1. The 10 cm of water applied on April 6 for stem borer control, as recommended by ICA, did not prove effective. By April 17 a source of the insecticide BHC was located and it was applied in foliar spray at the rate of 2 kg of active ingredient per hectare. The BHC controlled the stem borers and was applied weekly until maturation.

Results

The unleached control plots, because of the leaching they received by the initial irrigation by flooding, had about the same germination as the other plots. The initial attempts at sprinkler irrigation caused some germination in corners but the plants died before flooding was introduced. Later growth during sprinkling did proceed at a somewhat reduced rate.

The experimental area is surrounded by a maintained barb-wire fence. However, on the long weekend of March 19, burros were permitted, by an unauthorized person, to enter the area and were later removed with the gate closed behind them. The animals ate the rice in all six control plots which then appeared as if a lawn mower had been applied to them. The 16 leached plots, having higher dikes around them, were left untouched. The rice in the control plots later re-grew and formed seeds, but was behind the remaining plots in stage of growth.

Soil Analyses

Soil samples were taken during the period May 27-29, 1973, to a depth of 2 meters in each plot and analyzed at the Santa Lucia Laboratory.

The analyses for the first 1 meter of soil are given in Table A-49. The samples were taken in depth measurements of 5 to 55 cm according to visual indication of changes in texture. The laboratory determined the pH and electrical conductance, EC, on the saturation extract in the same manner as for the previous samples. Estimates of total salt present expressed in kilograms per hectare (kg / ha), and for the first meter of the profile, in tons per hectare were made at USU. The changes that have occurred since the initial sampling, June 19, 1972, and the fourth sampling, December 19, 1972, are briefly summarized in the following tabulation.

For the first meter of the soil profile:

Average Salt Present	C plots t/ha	D plots t/ha	E-F plots t/ha
June 19, 1972	49.42	43.74	
December 19, 1972	21.51	26.80	
May 27-29, 1973	10.68	11.22	28.88
Reduction in Salt, tons per ha			
6-19-72 to 12-19-72	27.91	16.94	
12-19-72 to 5-27-73	10.84	15.22	
6-19-72 to 5-27-29-73	38.75	32.52	

	C plots	D plots
Reduction in Percent		
6-19-72 to 12-19-72	56.60	38.73
12-19-72 to 5-27-73	50.40	56.79
6-19-72 to 5-27-29-73	78.40	74.35

The above tabulation shows that the reduction in salt in percent of that present at the beginning of each period averaged about 48 percent during the leaching period and 54 percent during the growth period. For the entire period, June 19, 1972, to May 27, 1973, the reduction in salt averaged nearly 76 percent. These results emphasize the improvement that can take place in a saline soil when drainage and leaching is provided.

The control plots, E and F, which were not leached or sampled for a salt content prior to planting, had more than twice as much salt in the first meter of soil after harvest as the C and D plots which were leached prior to planting. The average of 28.9 tons / ha can also be compared with the average salt content of 46.6 tons / ha in the first meter of soil for the sixteen C and D plots at the time of the initial sampling, June 19, 1972 before leaching. If the average salt content in the six E and F plots had been the same as for the C and D plots in June, 1972, this would have been a reduction of 38 percent during the growth of the rice without any attempt at leaching.

Table A-50 gives the estimate of salt in the soil profile to a depth of 2 meters at the time of the first sampling, June 19, 1972. Table A-51 gives the corresponding data for the final sampling, May 27-29, 1973. Table A-52 summarizes the estimated amount of salt in the 2-meter profile on both dates and gives the change in tons per hectare and as a percentage. Table A-53 gives the amount of salt percent in the second meter on both dates and the change during the year in tons per hectare and as a percentage. Table A-54 also gives the amount of salt present on both dates and the amounts in the second meter expressed as a percentage of that in the 2-meter profile.

These tables show that during the year, there was a substantial reduction in salt present in the 2-meter profile and also in the second meter considered separately. These data are briefly summarized in the following tabulation.

For the 2-meter soil profile:

Average Salt Present	C plots t/ha	D plots t/ha
June 19, 1972	77.42	70.20
May 27-29, 1973	21.46	24.14
Change, 6-19-72 to 5-27-73	-55.96	-46.06
Change, percent	72.28	65.61
For the second meter of the soil profile:		
June 19, 1972	28.00	26.46
May 27-29, 1973	10.70	12.92
Change, 6-19-72 to 5-27-73	-17.21	-13.54
Change, percent	61.46	51.17
Pct. of salt in 2nd meter 6-72	36.17	37.69
Pct. of salt in 2nd meter 5-73	50.28	53.52

Rice Growth and Harvest

There was a wide variation of growth of the rice in many of the plots which might be explained by several factors:

1) The pre-germination and later dying in the first

Photo 33 (above). Spraying Rice in Leached Plots

Photo 34. Introducing Water into the Paddies of the Second Stage of the Leaching Study through a Measuring Flume

attempts to sprinkle irrigate. These dead or poor zones coincided with the sprinkler positions and areas of coverage.

2) The later attempts at flooding the ungerminated seeds and small plants from a gated pipe along the sides of the plots reduced growth on the side from which water flowed. Some of the seeds were washed away, those that remained were buried in silt, and salts were washed from the walls of the plot onto the seedlings.

3) The wind pattern caused poor development on the upwind side of the C row of plots.

The rice in the leaching plots was harvested during the period May 22-23, 1973. Where the poor growth could be explained by one of the above, that area was not harvested at the beginning. The well developed portion of each row was harvested and the corresponding number of meters of harvested plants was recorded. The total number of meters of good plants harvested in each plot is given in Table A-55 as meters in rows (M IN ROWS) and the equivalent area (EQUIV AREA) corresponding to this total length of rows is also given. The yield in grams of rice, where the growth was good, together with the yield on the equivalent area, in tons per ha is also given.

Later the rest of the plot was harvested and the total yield in grams and in tons per ha for the total area, 16 square meters, is also given in Table A-55. Considering that there were many difficulties with water, especially at the germination stage, as well as with insects and birds, the average yield of 3.9 metric tons per ha on the best developed portions was quite good. The average yield for the 16 C and D plots was 1.9 tons per ha which was not very satisfactory.

SECOND STAGE OF LEACHING STUDY

Experimental Design

Because of manpower and financial limitations, the construction of the second half of the experiment on the northwest side of the drainage canal was not accomplished by the time the leaching stage had been completed on the first half. At that time it was decided to incorporate what had been observed from the treatments already conducted into a single treatment in the second half. Further, it was decided to show that the land need not necessarily be out of production during the leaching process by growing inundated rice during this stage of the experiment.

The block of land reserved for this second stage of the experiment was disc plowed in both major directions sufficiently to roughly level the land. A topographic map was made of the prepared land and elevation contours at 4 cm intervals were selected which would divide the block into three sections which could be leveled into irregular shaped rice paddies (Figure 41). Dikes were formed along the two contour lines and around the outside boundary of the area. Water was introduced through a measuring flume into each paddy area (Photo 34) and allowed to stand for three to four days. Water was then introduced into the paddies once again, and they were leveled by hand using a board to move the soil and using the depth of water as a leveling guide (Photo 35). This action also puddled the soil sufficiently to maintain sufficient water on the surface with a small constant inflow for the inundated rice growth. Pregerminated rice was broadcast into a thin layer of water on the prepared paddies. No gypsum was applied. The germination and rice stand appeared to be quite satisfactory (Photos 36 and 37).

Analysis of Soil Samples

The rice paddies were sampled on a 5 meter by 5 meter grid as shown in the accompanying sketch, Figure 42. The plot is roughly 15 m x 50 m. The sample sites are five meters in from the edge and are separated from each other by five meters. All sampling was done to one meter at each change of texture. Samples were taken on the 15th and 16th of February, 1973. The results of the analyses made in the Santa Lucia Laboratory on 1:1 extracts are given in Table A-56. There are some very saline spots. The less saline areas occur in the mid-portion of row "A" (A-5 to A-8) which is near the irregular boundary delineating a low spot where rain water collected prior to the preparation of the area for rice paddies.

A summary of the estimated salt content of the first meter of the soil profile before leaching is given below.

Sample Site	A Row t/ha	B Row t/ha
1	87.2	137.0
2	117.8	98.5
3	92.9	98.8
4	80.0	106.1
5	58.9	107.7
6	58.2	94.5
7	35.5	93.1
8	46.6	81.8
9	75.5	50.4
Mean	72.4	96.4

These mean values cannot be compared directly with the estimated salt in the leaching plots prior to leaching, June 19, 1972 (Tables A-45 to A-48), since these previous estimates of salt present were made from conductance measurements on saturation extracts for which the average moisture content was estimated at 40 percent which may have been too low. The estimated average salt content on June 19, for the C plots was 49.4 tons per hectare and for the D plots, 43.7 tons per hectare, with an average of 46.6 tons per hectare. These values were only approximately half of what was estimated for the A and B rows in the rice paddy area before leaching. Since both areas were at approximately the same distance from the open drain, and might be expected to have about the same salt

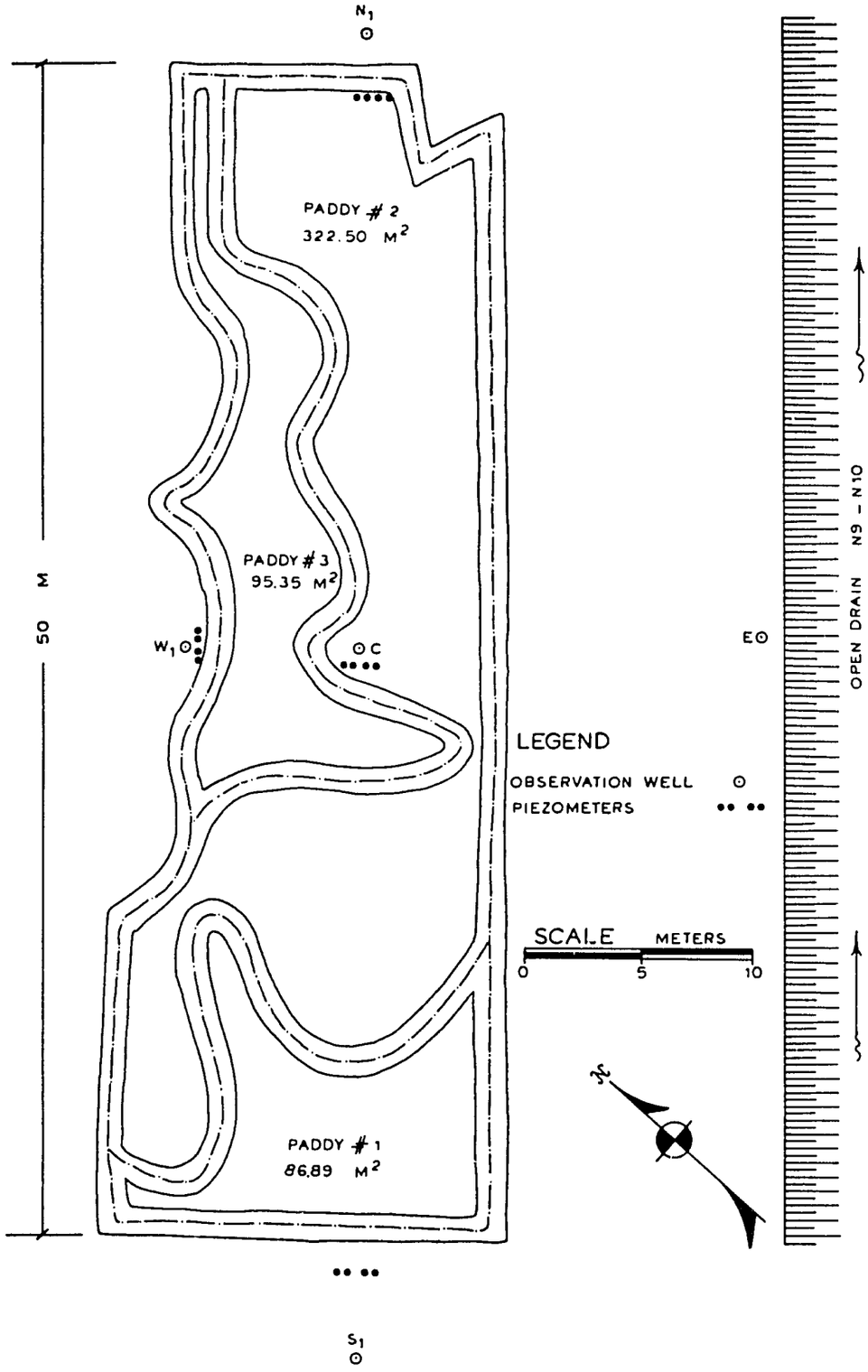


FIGURE 41. MAP OF RICE PADDY AREA ON NORTHWEST SIDE OF DRAIN

Photo 35. Leveling a Rice Paddy in the Second Stage of the Leaching Study Using the Water Depth as a Guide

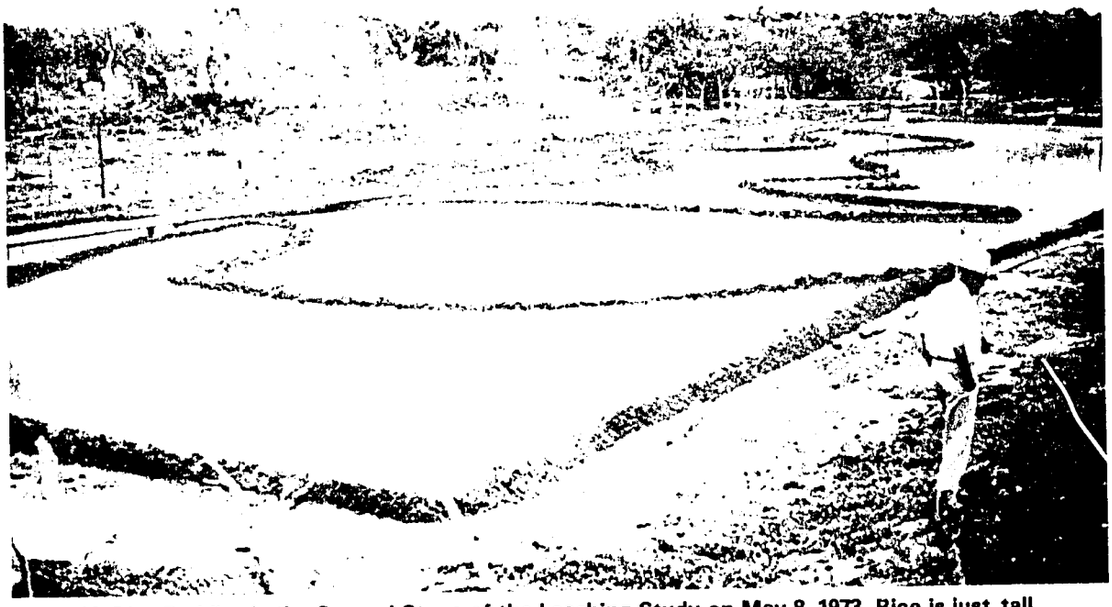


Photo 36. Rice Paddies in the Second Stage of the Leaching Study on May 8, 1973. Rice is just tall enough to fill the paddies with water

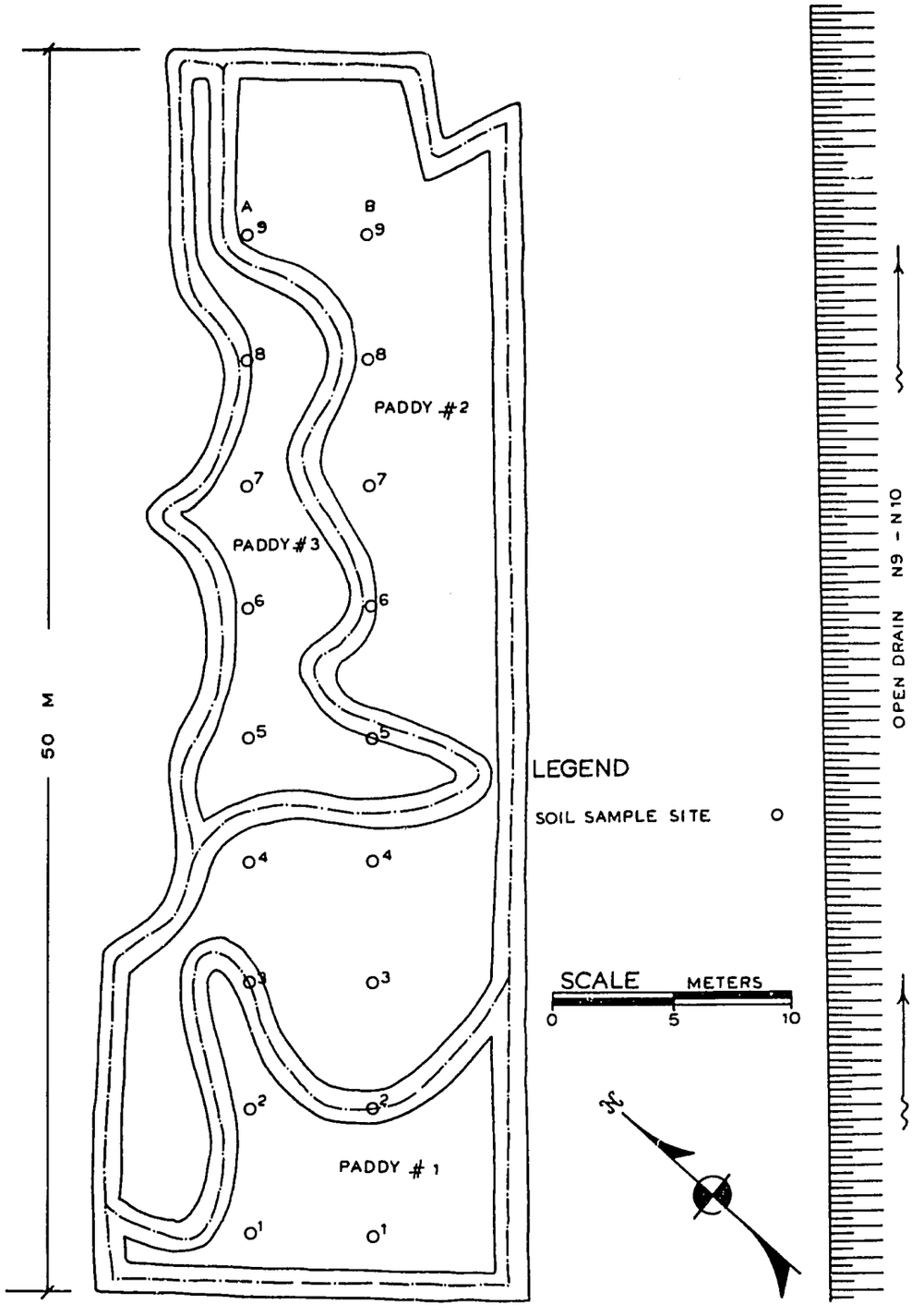


FIGURE 42. MAP OF RICE PADDIES SHOWING LOCATION OF SOIL SAMPLES

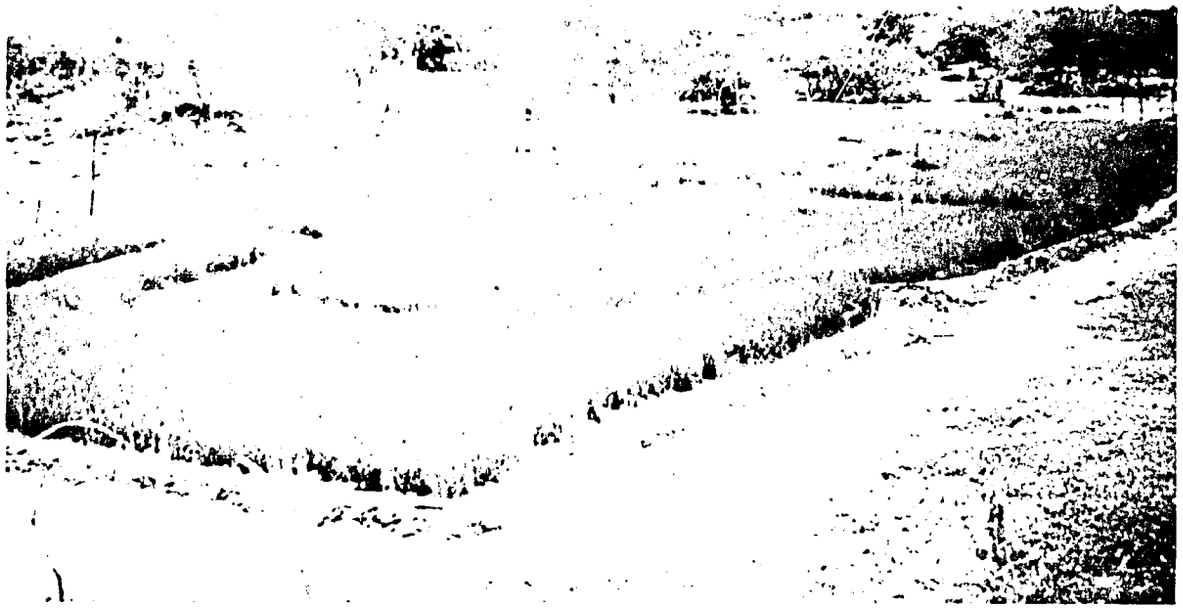


Photo 37. Rice Paddies in the Second Stage of the Leaching Study on May 28, 1973

content initially, there appears to be no satisfactory explanation except that the estimated moisture content of the saturation extracts was too low. This would have had to have been about 80 percent to obtain good agreement, and such a value is obviously too high for saturation extracts.

Irrigation

Water was applied through a small V-notch plastic measuring flume. Flumes were placed to measure water onto the study area as well as at the low spot at the exit to measure water off the area. Tubes were placed at the high water mark of each paddy to conduct the excess water to the adjacent, lower paddy (4 cm difference between water levels). Initially, water was filled into each paddy individually until all were full and water could flow from Paddy 1 to Paddy 2 to Paddy 3. From that time water was fed only into the corner of Paddy 1. The records show that approximately 212.5 cm of water was applied to Paddy No. 1, 179.5 to Paddy No. 2 and 218.6 cm to Paddy No. 3 with an overall weighted average of 193.2 cm as given in the following tabulation which includes the rain measured at the Santa Lucia climatic station.

Date	Irrigation cm	Rain cm	Total cm	Comments
April 5-24	57.8		57.8	For soil preparation
April 26-28	17.7		17.7	Rice Seeded
May	68.4	13.8	82.2	
June	24.7	24.2	48.9	
July	24.6	9.1	33.7	
Aug 1-14		7.5	7.5	Harvested
TOTALS	193.2	54.6	247.8	

The electrical conductivity of the water during this period of low flow in the Rio Magdalena was about 230 micromhos per cm. This is considered to be a water of excellent quality for irrigation.

Seeding

Pregerminated CICA-4 rice was broadcast by hand into the prepared, wet paddies (about one-centimeter of water on the surface) at the effective rate of 96.7 kg per ha (90 percent germination).

Fertilizers

The day before seeding, 50 kg per ha of N, 40 kg per ha of P_2O_5, and 100 kg per ha of K_2O were applied to all paddies. An additional 2.0 kg per ha of $MnSO_4$ was applied to Paddy 3.

On May 18, June 12, and July 10, additional applications of N were made at 50 kg per ha for a total of 200 kg per ha.

Insecticide

On May 17, 20.0 kg per ha of active BHC were applied in powder form to the water to act systemically in the rice plant. Due to an error in calculation this was 10 times too much, but no adverse effects were noted. No stem borers became noticeable and this treatment was not repeated. Two foliar applications of Toxaphene and one of Sevin were made on May 25, June 25, and July 11. No other chemicals were used. No insects or disease problem was ever noticed.

Harvest

On August 13 and 14, 1973, all of the paddy rice was harvested. No attempt was made to delineate better or poorer spots. The tabulation below gives the breakdown on rice yield per paddy. The overall average yield of 8.0 metric tons per hectare is very good.

Paddy	Area m2	kg	Yield metric tons / ha
1	86.9	66	7.60
2A	139.5	114	8.17
2B	183.1	144	7.86
3	95.4	80	8.34
Total	504.8	404	8.00

There have been numerous inquiries from people in the area wanting help to grow rice.

SUGGESTIONS FOR FUTURE RESEARCH

For INCORA and ICA to fully realize the benefits to be gained from the research already conducted, and to determine whether or not this zone can produce citrus economically, further research should be conducted by ICA. The following suggestions are offered.

1. The 16 hectare block considered in this report should be turned over to the ICA Santa Lucia Research Farm to be controlled and managed by ICA professionals for research purposes.

2. This block should be maintained in citrus. Dead and dying trees should be replaced. The surface drainage should be improved so that there are no depressions where water accumulates following rains or irrigation.

3. The present drainage system should be maintained in good condition. Tile drains should be inspected periodically to insure that they are open and functioning. The bordering open drains should be cleaned regularly and carefully graded so that water does not stand in pools but flows out of the lower end into the major collector drain.

4. The ground water observation wells should be maintained and monitored periodically. The results should be analyzed, tabulated, and/or plotted at appropriate intervals to document water table conditions.

5. The irrigation system should be improved by repairing or replacing defective hydrants, and by maintaining adequate pressure so that satisfactory distribution of water is assured. Soil moisture conditions should be maintained at desirable levels, avoiding deficiencies and excessive applications.

6. Good standard cultural practices relative to weed, insect and disease control; pruning; and fertilization are essential. The control of these practices should be the responsibility of knowledgeable professionals.

7. The salinity levels in the soil profile should be monitored annually at an appropriate date. Soil samples should be obtained in increments of 25 cm to a depth of one meter at the same locations as for this study. To minimize the error in the estimate of amount of salt present, it is recommended that for the next sampling the following determinations are made:

a. Electrical conductance (EC) of saturation extracts as in the past.

b. Moisture percent of the saturation pastes.

c. Electrical conductance of 1 to 1 extracts (1 part dry soil to 1 part distilled water).

d. Total dissolved solids (TDS) in 1 to 1 extracts.

e. Sodium (Na) and Chloride (Cl) ions, if practical, expressed as milliequivalents per liter of one to one extracts.

Following the next sampling, EC determinations on one to one extracts may suffice to adequately monitor the salinity levels in the soil.

8. Measurement of the flow and EC of the water from the tile drains should be made at weekly intervals when the flow is appreciable.

9. The remainder of the borrow pit bordering the 16 ha tract should be filled with soil excavated from the open drains as was done for the part of it near the line 1N. The results obtained indicated that this was effective in lowering the groundwater levels near that drain.

10. Because of the effectiveness of the leaching on the production of rice in the second phase of the leaching study, it is recommended that a similar, but larger test be conducted on a suitable area of the more highly salinized soils. The procedure suggested is:

a. Select a suitable tract extending between two open drains, and within the area in which tile drains were installed. A suitable tract, if available, would be bounded on the southwest and northeast sides by tile lines, with an additional tile line through the center. This would be an area of 8 ha, 200 m by 400 m.

b. Loosen the soil by any available tillage implement, plow or other cultivator, to a depth of 15 to 20 cm.

c. Rough grade the area to fill depressions and form a relatively smooth surface. The surface need not be graded to a plane, but all minor surface irregularities should be removed so that surface drainage could be achieved. This grading may require one or more cultivations in places to adequately loosen the soil.

d. After this rough grading, the surface should be further smoothed with a land plane, if available. Two or more passes normal to each other is recommended.

e. Carefully survey the area to establish contour lines at contour intervals of about 5 cm. These contour lines can be conveniently marked on the soil with a burlap sack containing some lime. Marks should be placed sufficiently close together so that they could be followed by a tractor operator.

f. Levees (borders) should be constructed with a plow or preferably a levee disc with two or three large disc blades on each side throwing the soil to the center. Two or more passes along the levees will be required to bring them to the desired size and compactness.

g. The areas between borders shoutd then be filled with water and held there for several days to leach salt from the surface soil so that the rice will germinate.

h. The amount of water used in this initial leaching should be determined by measuring the flow and keeping track of the time of application. This leaching should preferably be done with a continuous flow day and night until completed.

i. Rice can be planted by broadcasting the seed in the flooded paddies, or the water could be drained away and the surface dried sufficiently so that the seed could be drilled into the soil.

j. Approved cultural practices should be followed. It is important that stem borers be controlled and that animals be excluded from the area.

11. In connection with such an experiment to determine the success of leaching during the growth of the rice crop, it would be highly desirable to measure the salt reduction in the soil during this period. For this purpose, the following suggestions are offered.

a. Sample the soil in each paddy after the grading and smoothing of the surface. Two samples in 50 cm increments to a depth of one meter at each location should suffice. Sample locations should be decided upon and laid out in a grid at a spacing of 50 m and located on a map so that later sampling could be done at approximately the same locations. At this spacing there would be 32 sample locations in 8 ha.

b. Conductance determinations on 1 to 1 extracts should be made in the laboratory.

c. Following the harvest of the rice, a second set of samples should be taken and analyzed, and results reported.

APPENDIX

TABLE A-11. ANALYSTS OF SALINITY DATA, CITRUS ORCHARD, SAMPLE SITES A-1 TO A-8.

ANALYSES BY ICA				INCORA			ICA								INCORA						
SAMPLE NO	DEPTH CM	TEX-TURE	PH	PH 1.1	PH 1.5	EC MM/CM	EC	EXCHANGEABLE CATIONS CA	MG	K	NA	CAT	CEC	ESP	ESP	SOLUBLE SALTS NA	CA+MG	TOTAL	SALINITY SP	SAR	CLASS
								ME PER 100 GRAMS								ME PER LITER					
A-1	0-15	S	7.0	6.8	7.0	1.15	1.80	4.00	.68	.06	.32	5.1	8.6	6.3	.6	2.6	9.0	11.6	22.7	1.2	N
	15-30	SL	6.9	6.8	7.0	.55	2.20	6.40	2.57	.24	.80	10.0	11.8	8.0	.0	1.2	4.0	5.2	23.3	.9	N
	30-60	S	7.0	6.7	7.0	.33	1.60	3.60	1.96	.14	.20	5.8	8.2	3.4	.2	1.0	2.0	3.0	33.0	1.0	N
	60-75	L	6.9	7.7	6.8	2.50	4.00	8.40	3.30	.06	.78	12.5	11.4	6.2	.0	.1	27.0	27.1	.5	.0	L
	75-150	S	7.6	7.0	7.4	5.50	7.30	4.80	3.22	.06	.60	8.7	9.8	6.9	13.1	39.1	25.0	64.1	61.0	11.1	S1
	150-200	CL	7.8	7.5	7.8	7.00	8.10	16.80	4.30	.08	5.00	26.2	21.2	19.1	12.8	45.4	37.0	83.4	55.6	10.8	S1
A-2	0-20	SL	6.6	6.5	6.7	2.00	1.80	6.40	2.57	.22	.41	9.6	11.6	4.3	2.1	6.3	15.0	21.3	29.5	2.3	L
	20-60	S	6.9	6.7	6.7	.60	.50	3.60	1.03	.12	.20	5.0	7.6	4.0	1.2	2.2	3.5	5.7	38.9	1.7	N
	75-175	SL	7.1	6.8	7.0	.95	.60	8.40	1.74	.04	.24	10.4	11.8	2.3	1.1	3.0	6.5	9.5	31.3	1.6	N
	175-200	C	7.3	7.0	7.2	4.40	6.80	4.00	1.07	.08	.68	5.8	8.2	11.4	11.4	30.3	20.0	50.3	60.2	9.6	S1
A-3	0-15	L	7.0	6.6	6.8	.77	.80	8.00	3.31	.18	.58	12.1	16.4	4.8	.5	2.0	5.5	7.5	26.9	1.2	N
	15-80	S	7.1	6.7	6.7	.70	.50	4.00	1.46	.06	.32	5.8	9.6	5.5	.4	1.8	5.0	6.8	26.2	1.1	N
	90-110	L	7.2	7.8	8.0	4.00	1.10	8.80	3.70	.06	.60	13.2	15.4	4.6	16.9	34.3	11.0	45.3	75.7	14.6	S1NA
	110-200	CL	8.2	7.3	7.5	7.50	3.80	5.20	2.21	.04	1.20	8.6	13.0	13.9	23.9	69.9	20.0	89.9	77.8	22.1	S1NA
A-4	0-20	L	6.7	6.7	6.8	6.00	8.30	9.20	4.40	.18	2.80	16.6	13.2	16.9	11.5	39.5	32.0	70.5	58.6	9.6	S1
	20-80	S	7.6	7.0	7.2	5.50	6.80	4.00	1.07	.04	1.44	6.5	9.2	27.0	.0	.0	.0	64.1	.0	.0	
	80-100	L	8.2	8.0	8.2	7.00	6.60	7.20	3.33	.06	3.80	14.4	13.4	26.4	21.3	52.4	21.0	83.4	74.8	19.3	S1NA
	100-120	LC	8.2	7.9	8.1	3.20	2.50	10.00	4.00	.06	5.60	19.7	21.4	28.5	17.5	28.5	7.0	35.5	80.3	15.3	NA
	120-200	S	8.6	6.9	7.5	3.30	5.40	4.00	1.00	.04	1.20	6.2	3.4	19.2	19.9	30.7	6.0	36.7	83.7	17.7	NA
A-5	0-30	CL	6.7	6.7	6.7	1.15	1.10	8.00	3.70	.16	8.40	20.3	15.6	41.5	.0	1.6	10.0	11.6	14.1	.7	N
	30-45	S	7.0	6.7	7.0	.37	2.20	4.00	1.85	.14	5.00	11.0	8.2	45.5	.0	.9	2.5	3.4	26.1	.8	N
	45-75	SL	6.9	6.6	6.7	.56	1.20	9.20	4.40	.08	8.00	21.7	16.0	36.9	.0	.8	4.5	5.3	15.3	.5	N
	75-125	C	6.9	7.2	7.5	2.50	9.80	5.60	2.20	.04	4.20	12.0	11.2	34.9	5.4	12.6	14.5	27.1	46.0	4.7	L
	125-200	S	6.9	6.7	7.3	2.90	3.00	4.00	1.85	.06	11.00	16.9	13.0	65.1	5.0	13.4	18.5	31.9	42.0	4.4	L
A-6	0-15	CL	7.0	6.5	6.7	2.00	2.30	8.80	3.30	.14	7.20	19.4	17.8	37.0	3.9	8.8	12.5	21.3	41.3	3.5	L
	15-75	LS	8.2	7.2	7.2	9.00	9.00	4.40	.67	.04	2.40	7.5	11.8	32.0	22.0	78.7	31.0	109.7	71.7	20.0	S2NA
	75-125	S	8.7	8.5	8.5	6.50	6.50	1.60	1.52	.04	6.00	9.2	8.2	65.5	37.2	70.9	0.0	76.9	92.2	40.9	S1NA
	125-200	CL	8.4	8.2	8.7	9.00	9.80	4.80	2.22	.12	12.60	19.7	31.6	63.8	46.5	103.7	6.0	109.7	94.5	59.9	S2NA
A-7	0-10	CL	6.8	6.6	6.9	2.30	2.10	6.00	1.41	.24	1.80	9.4	18.8	19.0	12.8	18.8	6.0	24.8	75.8	10.8	L
	10-45	S	6.7	6.3	6.7	.85	.90	4.00	2.24	.28	.92	7.4	9.0	12.4	1.9	3.4	5.0	8.4	40.3	2.1	N
	45-75	L	6.6	6.3	6.7	.46	.60	9.20	3.80	.12	.82	13.9	17.6	5.9	.3	1.3	3.0	4.3	30.1	1.1	N
	75-200	C	7.3	6.7	6.6	5.20	7.10	8.80	9.50	.12	5.20	23.6	21.4	27.0	5.2	20.3	40.0	60.3	33.7	4.5	S1
A-8	0-15	SL	6.6	6.5	6.8	1.70	1.80	8.80	4.10	.38	.74	14.0	13.6	5.3	.6	3.3	14.5	17.8	18.7	1.2	N
	15-35	S	6.8	7.2	7.1	.85	1.00	4.40	3.79	.16	1.50	9.8	10.2	15.2	.0	1.4	7.0	8.4	16.4	.7	N
	35-65	SL	.0	7.0	7.3	1.15	.00	.00	.00	.00	.00	.0	.0	.0	2.3	4.6	7.0	11.6	39.9	2.5	N
	65-85	SL	6.9	6.6	6.8	1.10	1.10	5.20	4.94	.12	1.30	11.6	12.2	11.2	3.0	5.1	6.0	11.1	45.9	2.9	N
	85-125	CSL	6.8	6.6	6.8	1.30	1.20	10.00	4.80	.06	1.20	16.1	18.2	7.5	3.6	6.3	7.0	13.3	47.4	3.4	N
	125-200	L	6.7	.0	.0	.00	4.70	9.20	7.20	.10	2.80	19.3	21.2	14.5	.0	.0	.0	.0	.0	.0	

NOTE - 0. INDICATES MISSING OR IMPROBABLE DATA.

TABLE A-12. ANALYSTS OF SALINITY DATA, CITRUS ORCHARD, SAMPLE SITES B-1 TO B-8.

ANALYSES BY ICA				INCORA			ICA								INCORA						
SAMPLE NO	DEPTH CM	TEX-TURE	PH	PH 1.1	PH 1.5	EC MM/CM	EC	EXCHANGEABLE CATIONS CA	MG	K	NA	CAT	CEC	ESP	ESP	SOLUBLE SALTS NA	CA+MG	TOTAL	SALINITY SP	SAR	CLASS
								ME PER 100 GRAMS								ME PER LITER					
B-1	0-30	S	6.6	6.8	7.0	1.90	1.60	8.00	1.90	.22	.64	10.8	11.0	5.9	1.2	4.6	15.5	20.1	23.0	1.7	N
	30-60	S	7.4	6.5	7.0	.98	.86	6.00	1.80	.06	2.60	10.5	.0	24.9	.0	1.3	8.5	9.8	13.1	.6	N
	60-90	S	7.1	.0	.0	.00	2.30	5.60	2.20	.06	.78	8.6	.0	9.0	.0	.0	.0	.0	.0	.0	
	90-140	S	.0	6.9	7.4	2.00	.00	.00	.00	.00	.00	.0	.0	.0	2.7	7.3	14.0	21.3	34.2	2.8	L
	140-200	CL	7.2	6.7	7.3	5.50	6.40	13.20	5.50	.08	1.19	20.0	.0	6.0	2.5	13.1	51.0	64.1	20.5	2.6	S1
B-2	0-20	SL	7.1	7.2	6.8	1.70	1.90	6.40	3.70	.26	.54	10.9	.0	5.0	.6	3.3	14.5	17.8	18.7	1.2	N
	20-60	SL	6.9	6.7	6.3	1.45	2.50	8.00	2.90	.08	.42	11.4	.0	3.7	.5	7.0	12.0	15.0	20.0	1.2	N
	60-90	SL	6.9	6.8	7.0	2.00	2.20	8.00	2.14	.08	.92	11.1	.0	8.3	5.0	10.3	11.0	21.3	48.3	4.4	L
	90-140	S	7.0	6.8	6.8	3.60	3.10	5.20	2.21	.08	1.14	8.6	.0	13.2	14.7	29.4	11.0	40.4	72.8	12.5	N
	140-200	LC	7.4	6.8	6.8	5.50	6.40	10.00	6.40	.06	2.20	18.7	.0	11.8	11.5	36.1	28.0	64.1	56.3	9.7	S1
B-3	0-35	SL	6.6	5.7	6.7	1.50	1.70	8.40	3.70	.32	.40	12.8	.0	3.1	1.2	4.1	11.5	15.6	26.1	1.7	N
	35-75	L	6.4	6.5	6.6	.75	.80	8.00	2.14	.08	.54	10.8	.0	5.0	1.5	2.8	4.5	7.3	38.4	1.9	N
	75-140	C	6.7	6.6	6.7	3.75	3.10	8.40	9.10	.20	3.08	20.8	.0	14.8	13.5	29.2	13.0	42.2	69.2	11.5	L
	140-200	S	7.0	6.7	7.4	.46	.80	3.20	1.87	.08	.32	5.5	.0	5.9	.7	1.3	3.0	4.3	30.1	1.1	N
B-4	0-15	SL	7.1	6.8	7.2	.80	1.00	6.40	3.74	.14	4.20	14.5	.0	29.0	.3	1.8	6.0	7.8	23.5	1.1	N
	15-60	S	7.2	6.8	7.2	.40	.50	2.80	1.10	.08	.30	4.3	.0	7.0	.0	.7	3.0	3.7	18.6	.6	N
	60-100	S	7.3	7.1	7.3	.48	.80	4.40	1.84	.08	.70	7.0	.0	10.0	2.4	2.5	2.0	4.5	55.5	2.5	N
	100-185	S	7.6	7.2	7.3	2.80	3.40	2.80	1.10	.08	1.90	5.9	.0	32.3	5.4	13.7	17.0	30.7	44.7	4.7	L
	185-200	C	7.5	7.4	7.4	8.50	7.80	6.80	6.10	.04	.54	13.5	.0	4.0	24.5	79.1	24.0	103.1	76.7	22.8	S2NA
B-5	0-20	L	6.2	7.0	7.3	.90	1.10	10.00	4.00	.68	.82	15.5	.0	5.3	1.2	2.9	6.0	8.9	32.7	1.7	N
	20-50	S	6.5	6.4	6.5	.42	.50	4.00	2.63	.22	.32	7.2	.0	4.5	.0	.9	3.0	3.9	22.8	.7	N
	50-110	L	6.1	6.3	7.0	.37	.50	9.20	2.90	.14	.52	12.8	.0	4.1	.0	.9	2.5	3.4	26.1	.8	N
	110-200	LS	6.4	6.9	7.0	.38	.50	8.80	2.90	.10	.40	12.2	.0	3.3	.0	1.0	2.5	3.5	28.2	.9	N
B-6	0-15	LS	6.9	6.6	6.8	1.00	1.50	5.20	3.77	.18	.88	10.0	.0	8.8	3.3	5.0	5.0	10.0	50.0	3.2	N
	15-35	S	6.9	6.8	6.7	.52	.70	4.40	1.45	.12	.50	6.5	.0	7.7	1.0	1.9	3.0	4.9	38.8	1.6	N
	35-60	SL	6.7	6.4	6.8	1.30	1.40	10.00	2.10	.08	.88	13.1	.0	6.7	2.6	5.3	8.0	13.3	39.9	2.7	N
	60-90	S	7.4	7.1	7.2	4.00	4.80	6.00	2.19	.06	1.82	10.1	.0	18.1	16.9	34.3	11.0	45.3	75.7	14.6	S1NA
	90-200	C	8.0	8.0	8.0	10.00	15.00	8.80	8.00	.18	12.04	29.0	.0	41.5	31.1	102.0	21.0	123.0	82.9	31.5	S2NA
B-7	0-50		.0	6.7	7.0	1.00	.00	.00	.00	.00	.00	.0	.0	.0	3.3	5.0	5.0	10.0	50.0	3.2	N
	75-100		.0	7.1	7.3	8.00	.00	.00	.00	.00	.00	.0	.0	.0	14.8	56.5	40.0	96.5	58.5	12.6	S2NA
	100-160		.0	7.3	7.6	7.50	.00	.00	.00	.00	.00	.0	.0	.0	18.3	60.9	29.0	89.9	67.7	16.0	S1NA
	160-200		.0	7.0	7.3	12.50	.00	.00	.00	.00	.00	.0	.0	.0	23.6	107.9	49.0	156.9	68.8	21.8	S2NA
B-8	0-15	S	6.9	6.8	7.1	1.05	1.00	7.60	3.32	.50	.80	12.2	.0	6.5	.0	1.0	9.5	10.5	9.9	.5	N
	15-35	SL	6.9	6.6	6.8	1.25	2.00	6.40	1.40	.16	.86	8.8	.0	9.8	1.3	3.8	9.0	12.8	29.4	1.8	N
	35-75	L	6.3	6.7	6.7	5.90	5.90	5.20	1.30	.10	1.52	8.1	.0	18.7	6.6	26.2	43.0	69.2	37.9	5.7	S1
	75-90	L	7.0	7.0	7.0	6.50	7.40	10.80	4.00	.48	1.26	16.5	13.0	7.6	11.5	40.9	36.0	76.9	53.2	9.6	S1
	90-125	SL	7.1	6.7	6.3	8.00	8.80	8.00	3.70	.44	2.66	14.8	.0	18.0	17.0	61.5	35.0	96.5	63.7	14.7	S2NA
	125-145	S	7.1	6.8	6.8	11.00	14.00	11.20	8.40	.40	3.30	23.9	12.6	14.9	15.9	75.5	61.0	136.5	55.3	13.7	S2NA
	145-200	SL	7.1	6.9	7.3	8.50	8.40	14.80	7.00	.50	4.34	26.6	16.8	16.7	15.1	60.1	43.0	103.1	58.3	13.0	S2NA

NOTE - 0. INDICATES MISSING OR IMPROBABLE DATA.

TABLE A-13. ANALYSES OF SALINITY DATA, CITRUS ORCHARD, SAMPLE SITES C-1 TO C-8.

ANALYSES BY ICA				INCORA			ICA								INCORA						
SAMPLE NO	DEPTH CM	TEX-TURE	PH	PH 1.1	PH 1.5	EC MM/CM	EC	EXCHANGEABLE CATIONS CA	MG	K	NA	CAT	CEC	ESP	ESP	SOLUBLE SALTS NA	CA+MG	TOTAL	SALINITY SP	SAR	CLASS
								ME PER 100 GRAMS								ME PER LITER					
C-1	0-15	S	7.0	7.1	7.2	1.80	4.60	10.80	2.90	.43	.96	15.0	9.8	6.4	1.8	5.5	13.5	19.0	28.9	2.1	N
	15-45	S	6.3	6.7	7.0	.90	1.50	6.00	1.80	.08	1.58	9.5	6.0	16.7	1.2	2.9	6.0	8.9	32.7	1.7	N
	45-60	SL	7.2	7.2	7.0	1.90	2.60	10.80	4.40	.05	1.26	16.5	10.6	7.6	2.1	6.1	14.0	20.1	30.5	2.3	N
	60-85	LS	7.3	7.3	7.0	4.50	5.20	12.80	4.70	.05	.72	18.3	12.0	3.9	3.6	14.5	37.0	51.5	28.2	3.4	S1
	85-130	S	7.3	7.2	7.5	7.50	8.40	7.20	5.60	.05	1.46	14.3	6.0	10.2	7.3	32.9	57.0	89.9	36.6	6.2	S1
	130-200	SL	7.4	6.8	7.0	9.00	12.00	11.60	4.40	.10	5.12	21.2	16.2	24.1	4.9	27.7	82.0	109.7	25.2	4.3	S2
C-2	0-25	SL	7.9	6.7	6.8	4.46	5.10	9.60	5.90	.26	4.60	20.4	14.8	22.6	7.3	23.2	27.8	51.0	45.5	6.2	N
	25-90	LS	7.0	6.8	7.2	.75	.90	9.00	3.85	.33	6.08	19.3	15.6	31.6	.6	2.1	5.5	7.6	27.9	1.3	N
	90-160	S	7.4	.0	.0	.00	3.70	7.20	2.16	.08	4.96	14.4	16.2	34.4	.0	.0	.0	.0	.0	.0	
	160-200	LS	7.5	7.5	7.5	8.00	8.70	11.20	5.20	.08	8.16	24.6	12.2	33.1	9.4	41.5	55.0	96.5	43.0	7.9	S2
C-3	0-15	LS	6.1	5.9	6.3	.70	1.10	7.60	2.54	.66	6.80	17.6	14.2	38.6	.4	1.8	5.0	5.8	26.2	1.1	N
	15-85	SL	7.0	6.7	6.9	.57	1.80	4.80	3.00	.16	5.44	13.4	36.4	40.6	.0	.9	4.5	5.4	17.0	.6	N
	85-105	SL	6.8	7.0	6.9	.32	.30	10.40	4.40	.14	4.60	19.5	13.8	23.5	.0	.9	2.0	2.9	30.8	.9	N
	105-150	S	7.1	7.0	7.6	.29	.30	2.40	.72	.04	1.86	5.0	5.2	37.1	.0	.6	2.0	2.6	22.9	.6	N
	150-170	CL	7.0	6.8	7.5	.47	1.00	12.20	6.70	.14	8.40	27.4	6.0	30.6	.4	1.4	3.0	4.4	31.7	1.1	N
	170-200	S	7.1	7.0	7.0	.38	.70	6.00	2.97	.08	8.20	17.2	7.4	47.5	.9	1.5	2.0	3.5	42.6	1.5	N
C-4	0-15	SL	6.4	6.5	7.0	1.30	.80	10.00	3.30	.26	.42	14.0	15.0	3.0	.5	2.8	10.5	13.3	21.1	1.2	N
	15-95	S	6.5	6.5	7.0	.95	.39	3.20	2.26	.16	.22	5.8	7.2	3.8	2.8	4.5	5.0	9.5	47.1	2.8	N
	95-130	S	7.3	7.7	7.7	.44	.27	4.80	1.05	.08	.32	6.2	9.2	5.1	.0	1.1	3.0	4.1	26.6	.9	N
	130-160	LS	7.3	7.2	7.2	.44	1.10	5.20	2.60	.08	.86	8.7	10.6	9.8	.0	.6	3.5	4.1	14.4	.4	N
	160-200	C	6.2	7.0	7.0	2.20	1.60	5.20	2.60	.40	.54	8.7	11.4	6.2	5.8	12.1	11.5	23.6	51.3	5.1	L
C-5	0-15	S	7.2	7.0	7.2	.40	1.00	6.40	5.30	.74	3.52	16.0	14.6	22.1	.0	.7	3.0	3.7	18.6	.6	N
	15-70	S	6.7	6.4	7.0	.66	2.00	4.00	2.24	.08	2.56	8.9	8.0	28.8	1.2	2.4	4.0	6.4	37.1	1.7	N
	70-85	L	6.7	6.3	6.8	8.50	8.40	12.40	2.40	.10	6.24	21.1	20.8	29.5	13.6	56.1	47.0	103.1	54.4	11.6	S2NA
	85-145	S	7.4	6.8	7.3	11.00	12.00	[illegible]	.38	.08	5.76	14.4	9.6	39.9	22.6	94.5	42.0	136.5	69.2	20.6	S3NA
	145-200	SL	7.5	7.2	7.5	17.00	16.00	[illegible]	[illegible]	.08	12.48	32.9	15.2	38.0	28.5	156.4	63.0	219.4	71.3	27.9	S3NA
C-6	0-20	SL	7.2	7.0	7.0	1.70	1.90	[illegible]	1.60	.12	2.56	10.5	10.6	24.4	5.7	9.8	8.0	17.8	55.1	4.9	N
	20-70	S	6.8	6.9	7.1	1.00	1.70	3.20	1.09	.08	3.04	7.4	20.0	41.0	1.1	3.0	7.0	10.0	30.0	1.6	N
	70-75	SL	6.5	6.6	6.8	3.20	6.00	4.00	1.24	.10	2.72	8.1	16.0	33.7	4.0	12.5	23.0	35.5	35.3	3.7	L
	75-180	S	7.3	6.5	7.0	6.50	8.60	3.60	2.25	.08	4.96	10.9	6.6	45.5	10.6	38.9	38.0	76.9	50.6	8.9	S1
	180-200	CL	7.4	7.3	7.3	13.50	20.00	13.60	7.80	.12	10.50	32.0	.0	32.8	23.8	115.6	55.0	170.6	67.8	22.1	S2NA
C-7	0-20	SL	6.8	6.7	6.8	1.15	6.40	10.40	2.85	.39	.86	14.5	14.7	5.9	1.1	3.3	8.3	11.6	28.7	1.6	N
	20-50	SL	7.2	7.0	7.2	.60	.70	8.00	2.10	.08	.42	10.6	19.8	4.0	1.2	2.2	3.5	5.7	38.9	1.7	N
	50-160	S	7.0	7.2	7.3	2.20	5.40	3.60	2.25	.06	1.80	7.7	8.2	23.3	12.9	18.1	5.5	23.6	76.7	10.9	L
	160-200	CL	6.8	6.8	6.8	16.50	19.00	13.60	8.20	.10	12.18	34.1	22.4	35.7	28.5	152.4	60.0	212.4	71.7	27.8	S3NA
C-8	0-15	SC	7.1	7.2	7.0	1.50	1.90	10.00	2.90	.68	.48	14.1	15.6	3.4	.9	3.6	12.0	15.6	22.9	1.5	N
	15-85	L	7.3	7.2	7.0	.95	1.40	6.80	4.12	.06	.42	11.4	20.0	3.7	1.1	3.0	6.5	9.5	31.3	1.6	N
	85-105	SL	7.4	7.3	7.2	.65	1.00	8.00	2.53	.06	.40	11.0	22.0	3.6	1.1	2.3	4.0	6.3	36.0	1.6	N
	105-135	S	7.4	7.3	7.3	.32	.48	6.40	2.97	.08	.22	9.7	10.2	2.3	.0	.9	2.0	2.9	30.8	.9	N
	135-200	CL	7.1	7.0	6.8	1.90	1.70	12.00	5.30	.12	1.32	19.7	20.0	6.7	6.0	11.6	8.5	20.1	57.8	5.6	N

NOTE - 0. INDICATES MISSING OR IMPROBABLE DATA.

TABLE A-14. ANALYSTS OF SALINITY DATA, CITRUS ORCHARD, SAMPLE SITES D-1 TO D-8.

ANALYSES BY ICA				TNCORA			ICA								TNCORA						
SAMPLE NO	DEPTH CM	TEX-TURE	PH	PH 1.1	PH 1.5	EC MM/CM	EC	EXCHANGEABLE CATIONS CA	MG	K	NA	CAT	CEC	ESP	ESP	SOLUBLE SALTS NA	CA+MG	TOTAL	SALINITY SP	SAR	CLASS
								ME PER 100 GRAMS								ME PER LITER					
D-1	0-15	LS	7.0	6.9	7.3	2.00	2.20	6.40	1.40	.28	1.80	9.9	16.0	18.2	.4	3.3	18.0	21.3	15.4	1.1	L
	15-55	S	7.0	8.5	8.5	1.48	2.30	4.40	2.23	.26	.82	7.7	9.8	10.6	.7	3.3	12.0	15.3	21.7	1.4	N
	55-160	LS	7.2	6.8	7.0	3.00	4.40	8.00	2.53	.06	1.60	12.2	11.8	13.1	3.6	11.1	22.0	33.1	33.6	3.4	L
	160-200	CL	7.4	7.3	7.3	4.90	4.90	12.00	5.90	.08	4.34	22.3	20.4	19.4	11.2	32.5	24.0	56.5	57.5	9.4	S1
D-2	0-20	SL	7.8	7.7	8.2	4.40	5.40	15.60	2.70	1.18	1.36	20.8	21.4	5.5	2.8	12.3	38.0	50.7	24.9	2.8	S1
	20-35	SL	6.8	6.8	7.2	2.10	2.40	8.80	1.73	.34	.64	11.5	15.6	5.6	1.5	5.5	17.0	22.5	24.3	1.9	L
	35-70	SL	7.1	6.7	7.2	5.50	5.40	11.60	2.00	.06	1.18	14.8	15.6	8.0	4.1	19.1	46.0	69.1	28.3	3.8	S1
	70-140	LS	7.4	7.0	7.7	7.60	7.20	10.00	1.70	.04	1.58	13.3	11.0	11.9	6.7	31.2	60.0	91.2	34.2	5.7	S1
	140-200	SL	7.4	7.0	7.0	5.80	6.20	14.00	5.50	.08	2.52	22.1	19.0	11.4	4.9	20.9	47.0	67.9	30.8	4.3	S1
D-3	0-15	L	6.2	6.5	6.3	.95	1.00	12.40	3.20	.38	1.26	17.2	16.0	7.3	.2	2.0	7.5	9.5	30.7	1.0	N
	15-55	SL	6.5	6.2	6.5	.85	.90	9.60	2.10	.10	1.22	13.0	15.6	9.4	.8	2.4	6.0	8.4	28.4	1.4	N
	55-115	LS	7.4	.0	.0	.00	.60	7.60	1.75	.08	.84	10.3	13.0	8.2	.0	.0	.0	.0	.0	.0	
	115-145	SL	7.3	7.2	7.5	1.90	1.90	12.00	2.80	.08	1.26	16.1	20.0	7.8	3.5	9.1	12.0	20.1	40.4	3.3	N
	145-200	CL	7.2	7.2	7.2	5.20	6.00	15.60	3.90	.08	2.10	21.7	21.4	9.7	6.7	24.3	36.0	60.3	40.3	5.7	S1
D-4	0-40	SL	6.8	7.2	7.2	.68	.61	7.20	1.38	.12	.66	9.4	12.2	7.1	.0	1.0	5.6	6.6	14.7	.6	N
	40-80	SL	7.4	7.1	7.2	.90	.80	6.40	1.40	.06	.84	8.7	11.0	9.7	2.3	3.9	5.0	8.9	43.9	2.5	N
	80-100	SL	8.2	8.0	8.2	.80	1.00	12.00	1.60	.06	.82	14.5	14.8	5.7	2.7	3.8	4.0	7.8	49.0	2.7	N
	100-120	SL	8.1	7.8	8.2	.57	.70	9.20	2.50	.08	.74	12.5	8.8	5.9	.2	1.4	4.0	5.4	26.2	1.0	N
	120-150	LS	7.4	7.4	7.2	.47	.70	8.00	3.31	.06	.46	11.9	13.2	3.9	.0	.9	3.5	4.4	20.3	.7	N
	150-200	CL	7.3	7.4	7.3	.48	.80	10.00	9.50	.12	1.06	20.7	22.6	5.1	.5	1.5	3.0	4.5	73.2	1.2	N
D-5	0-20	L	7.0	6.7	7.4	1.15	2.30	15.60	5.90	.12	1.46	23.0	25.4	6.4	1.4	3.6	8.0	11.6	31.3	1.8	N
	20-35	S	6.7	6.7	6.6	.34	.35	4.00	2.63	.08	.62	7.3	13.8	8.5	.3	1.1	2.0	3.1	75.2	1.1	N
	35-50	S	6.8	6.6	6.6	.45	.50	4.40	3.40	.06	.34	8.2	14.4	4.1	.0	.7	3.5	4.2	16.4	.5	N
	50-75	SL	6.9	6.8	6.9	1.20	.64	7.60	3.32	.06	.38	11.4	19.2	3.3	6.9	8.2	4.0	12.2	67.2	5.8	N
	75-105	SL	7.2	7.0	7.0	2.80	4.00	13.60	5.90	.10	1.06	20.7	25.0	5.1	.7	4.7	26.0	30.7	15.4	1.3	L
	105-115	S	7.4	7.2	7.4	4.00	5.00	4.80	3.78	.06	.94	9.6	13.6	9.8	1.9	9.3	36.0	45.3	20.6	2.2	S1
	115-160	SL	7.3	7.4	7.4	6.90	8.00	8.00	5.30	.04	1.96	15.3	19.6	12.8	7.6	32.1	50.0	82.1	39.1	6.4	S1
	160-200	CL	6.8	6.7	7.0	10.00	13.00	10.40	7.50	.04	3.92	21.9	24.8	17.9	11.5	56.0	67.0	123.0	45.5	9.7	S2
D-6	0-25	SL	6.9	6.2	6.7	.68	1.00	8.00	5.60	.20	.54	14.3	21.0	3.8	.0	1.1	5.5	6.6	16.3	.6	N
	25-95	LS	7.1	7.0	7.0	.40	.48	6.00	3.36	.06	1.00	10.4	16.6	9.6	.0	.7	3.0	3.7	18.0	.6	N
	95-200	CL	6.8	7.0	7.5	2.30	7.20	8.80	6.00	.06	4.06	18.9	28.2	21.5	12.5	18.8	6.0	24.8	75.8	12.6	N
D-7	0-10	SL	7.1	6.5	6.8	.65	2.30	6.00	4.32	.34	2.60	13.9	19.2	12.1	2.6	3.3	3.0	6.3	52.0	2.7	N
	10-70	LS	6.9	6.7	7.0	.34	1.00	6.00	2.97	.06	2.24	11.3	16.8	19.3	.0	.6	2.5	3.1	19.0	.5	N
	70-150	SL	.0	7.0	7.2	12.50	.00	.00	.00	.00	.00	.0	.0	.0	16.7	85.3	71.0	156.3	54.7	14.4	S2
	150-200	CL	7.0	6.8	7.0	18.00	21.00	11.60	7.90	.06	8.40	28.0	26.6	30.0	24.0	146.5	87.0	233.5	52.7	27.2	S3NA
D-8	0-15	SL	7.0	6.8	7.0	2.80	3.00	5.60	2.98	.40	1.12	10.1	16.0	11.1	3.6	10.7	20.0	30.7	34.9	3.4	L
	15-45	SL	6.7	6.8	6.9	5.50	7.80	8.00	5.30	.08	2.66	16.0	18.0	16.6	7.8	28.1	36.0	64.1	43.9	6.6	S1
	45-60	CL	6.7	6.6	6.8	9.50	15.00	14.00	8.60	.08	5.40	28.1	28.2	19.4	11.0	52.3	64.0	116.3	45.0	9.3	S2
	60-120	SL	7.0	6.8	7.2	7.00	12.00	6.00	5.71	.06	4.34	15.7	16.8	27.6	14.6	50.4	33.0	83.4	60.4	12.4	S1NA
	120-200	CL	.0	6.8	6.8	18.00	.00	.00	.00	.00	.00	.0	.0	.0	25.9	154.5	79.0	233.5	56.2	24.6	S3NA

NOTE - 0. INDICATES MISSING OR IMPROBABLE DATA.

TABLE A-15. ANALYSTS OF SALINITY DATA, CITRUS ORCHARD, SAMPLE SITES H-1 TO H-8.

ANALYSES BY ICA

SITE NO	SAMPLE DEPTH CM	TEXTURE	PH	EC MM/CM	EXCHANGEABLE CATIONS CA	MG	K	NA	CAT	CEC	ESPA	ESPC
					ME PER 100 GRAMS							
H-1	0-20	SL	7.4	1.10	8.00	2.92	.46	.92	12.3	19.2	4.8	7.5
	20-80	SL	7.2	.65	5.80	2.58	.09	1.75	10.2	16.7	10.5	17.1
	80-130	SL	7.0	.90	7.00	3.53	.08	1.95	12.6	18.1	10.7	15.8
	130-150	LS	6.9	1.20	6.80	2.95	.06	2.53	12.4	16.4	16.2	21.1
	150-165	SL	7.1	1.00	7.20	3.72	.06	2.10	13.1	18.2	11.5	16.1
	165-200	CL	7.3	.90	12.00	5.90	.10	1.82	19.8	24.6	7.4	9.2
H-2	0-15	SL	7.0	1.40	6.40	4.13	.40	1.34	12.3	20.0	6.7	10.9
	15-30	S	6.7	.90	4.00	3.41	.08	.88	8.4	13.4	6.6	10.5
	30-40	SL	6.9	.80	6.00	2.97	.12	1.54	10.6	15.4	10.0	14.5
	40-60	SL	6.8	.36	3.80	2.83	.06	.20	6.0	.0	3.0	2.9
	60-95	S	7.0	.48	4.40	2.82	.09	.73	8.0	.0	10.9	9.1
	95-130	SL	7.1	.90	8.00	4.50	.08	.42	13.0	.0	3.2	3.2
	130-150	SL	7.0	4.20	8.00	6.00	.08	1.25	15.3	.0	8.1	8.2
	150-200	SCL	7.0	6.80	6.20	5.72	.07	.86	12.8	.0	8.4	6.7
H-3	0-40	SL	6.6	.70	4.00	3.41	.08	.68	8.2	.0	5.7	8.3
	40-70	SCL	6.8	.70	7.60	5.70	.08	1.76	15.1	20.8	5.6	11.6
	70-95	S	6.7	.70	3.20	3.00	.06	1.90	8.2	14.0	13.6	23.3
	95-125	SCL	6.7	.70	8.40	5.60	.10	1.28	15.4	20.8	6.1	8.3
	125-200	L	8.0	13.00	9.60	8.70	.18	14.00	32.5	29.8	47.0	43.1
H-4	0-15	LS	6.9	.87	4.70	4.55	.13	1.72	10.7	16.2	8.0	12.3
	15-55	S	6.8	3.10	4.00	3.02	.08	1.46	8.6	13.0	11.2	17.1
	55-95	LS	7.1	3.00	4.40	4.18	.08	1.12	9.8	10.4	6.8	11.5
	95-125	S	7.0	.60	2.00	2.29	.06	.14	4.5	4.0	.4	3.1
	125-165	CL	7.1	6.10	7.20	5.30	.06	7.04	19.6	15.0	46.0	35.9
	165-200	S	7.4	8.20	1.60	1.52	.04	4.64	7.8	5.4	80.0	59.5
H-5	0-10	LS	7.0	.70	6.80	4.90	.12	.04	11.9	13.0	.3	.3
	10-60	S	7.3	.50	2.00	3.07	.06	.06	5.2	6.8	.8	1.2
	60-100	SCL	6.7	4.50	7.20	6.10	.06	1.58	14.9	9.4	16.8	10.6
	100-130	S	7.6	9.00	3.20	3.00	.04	5.92	12.2	9.0	65.7	48.7
	130-200	CL	8.0	7.00	4.80	2.22	.14	8.32	15.5	16.2	51.3	53.7
H-6	0-50	L	6.5	.60	6.00	6.00	.26	.20	12.5	14.0	1.4	1.6
	50-90	SL	6.8	.60	4.80	4.34	.14	.80	10.1	12.2	6.5	7.9
	90-200	CL	7.9	2.70	4.80	7.70	.14	5.92	18.6	14.4	41.1	31.9
H-7	0-30	SL	6.8	8.00	6.00	4.92	.06	2.08	13.1	9.6	21.7	15.9
	30-60	SL	7.4	19.00	4.40	4.00	.06	5.28	13.7	9.2	57.4	38.4
	60-80	L	7.3	16.00	14.00	8.20	.06	9.12	31.4	15.8	57.7	29.1
	80-95	S	7.8	16.00	2.00	3.85	.04	8.16	14.0	16.0	51.0	58.1
	95-200	CL	7.9	16.00	5.60	5.30	.10	13.12	24.1	16.0	82.0	54.4
H-8	0-20	SL	6.8	7.10	9.20	7.60	.20	3.80	20.8	16.4	23.2	18.3
	20-40	CL	7.0	4.20	8.00	6.00	.06	1.92	16.0	13.4	14.3	12.0
	40-70	S	7.0	2.70	2.00	3.46	.04	1.16	6.7	5.8	20.0	17.4
	70-200	C	7.5	12.00	10.80	10.30	.12	14.56	35.8	21.4	68.0	40.7

TABLE A-16. ESTIMATE OF SALT IN SOIL PROFILE, A-1 TO A-8.

SAMPLE NO	TEX-TURE	D1 CM	D2 CM	DP CM	SAT PC	ECI MILLIMHOS/CM	ECA MILLIMHOS/CM	ECAV MILLIMHOS/CM	SALT KG/HA	T SALT TONS/HA
A-1	S	0	15	15	30	1.15	1.80	1.47	604	
	SL	15	30	15	35	.55	2.20	1.37	656	
	S	30	60	30	30	.33	1.60	.96	790	
	L	60	75	15	40	2.50	4.00	3.25	1774	
	S	75	150	75	30	5.50	7.30	6.40	13103	
	CL	150	200	50	45	7.00	8.10	7.55	15458	32.4
A-2	SL	0	20	20	35	2.00	1.80	1.90	1210	
	S	20	60	40	30	.60	.50	.55	600	
	SL	60	175	115	35	.95	.60	.77	2838	
	C	175	200	25	50	4.40	6.80	5.60	6769	11.0
A-3	L	0	15	15	40	.77	.80	.78	428	
	S	15	80	65	30	.70	.50	.60	1064	
	L	80	110	30	40	4.00	1.10	2.55	2784	
	CL	110	200	90	45	7.50	3.80	5.65	20823	25.1
A-4	L	0	20	20	40	6.00	8.30	7.15	5205	
	S	20	80	60	30	5.50	6.80	6.15	10073	
	L	80	100	20	40	7.00	6.60	6.80	4950	
	LC	100	120	20	45	3.20	2.50	2.85	2334	
	S	120	200	80	30	3.30	5.40	4.35	9500	32.1
A-5	CL	0	30	30	45	1.15	1.10	1.12	1382	
	S	30	45	15	30	.37	2.20	1.28	526	
	SL	45	75	30	35	.56	1.20	.88	840	
	C	75	125	50	50	2.50	9.80	6.15	13991	
	S	125	200	75	30	2.90	3.00	2.95	6040	22.8
A-6	CL	0	15	15	45	2.00	2.30	2.15	1320	
	LS	15	75	60	35	9.00	9.00	9.00	17198	
	S	75	125	50	30	6.50	6.50	6.50	8872	
	CL	125	200	75	45	9.00	9.80	9.40	28869	56.3
A-7	CL	0	10	10	45	2.30	2.10	2.20	900	
	S	10	45	35	30	.85	.90	.88	836	
	L	45	75	30	40	.46	.60	.53	578	
	C	75	200	125	50	5.20	7.10	6.15	34978	37.3
A-8	SL	0	15	15	35	1.70	1.80	1.75	836	
	S	15	35	20	30	.85	1.00	.92	505	
	SL	35	65	30	35	1.15	1.15	1.15	1098	
	SL	65	85	20	35	1.10	1.10	1.10	700	
	CSL	85	125	40	40	1.30	1.20	1.25	1819	
	L	125	200	75	40	4.70	4.70	4.70	12830	17.8
AVERAGE AMOUNT OF SALT IN SOIL PROFILE TO DEPTH OF 2 MTS										29.3

TABLE A-17. ESTIMATE OF SALT IN SOIL PROFILE, B-1 TO B-8.

SAMPLE NO	TEX-TURE	D1 CM	D2 CM	DP CM	SAT PC	ECI MILLIMHOS/CM	ECA MILLIMHOS/CM	ECAV MILLIMHOS/CM	SALT KG/HA	T SALT TONS/HA
B-1	S	0	30	30	30	1.90	1.60	1.75	1433	
	S	30	60	30	30	.98	.86	.92	753	
	S	60	90	30	30	.00	2.30	2.30	1883	
	S	90	140	50	30	2.00	.00	2.00	2729	
	CL	140	200	60	45	5.50	6.40	5.95	14619	21.4
B-2	SL	0	20	20	35	1.70	1.90	1.80	1146	
	SL	20	60	40	35	1.45	2.50	1.97	2516	
	SL	60	90	30	35	2.00	2.20	2.10	2006	
	S	90	140	50	30	3.60	3.10	3.35	4572	
	LC	140	200	60	45	5.50	6.40	5.95	14619	24.9
B-3	SL	0	35	35	35	1.50	1.70	1.60	1783	
	L	35	75	40	40	.75	.80	.77	1128	
	C	75	140	65	50	3.75	3.10	3.42	10129	
	S	140	200	60	30	.46	.80	.63	1031	14.1
B-4	SL	0	15	15	5	.80	1.00	.90	61	
	S	15	60	45	30	.40	.50	.45	552	
	S	60	100	40	30	.48	.80	.64	698	
	S	100	185	85	30	2.80	3.40	3.10	7193	
	C	185	200	15	50	8.50	7.80	8.15	5562	14.1
B-5	L	0	20	20	40	.90	1.10	1.00	727	
	S	20	50	30	30	.42	.50	.46	376	
	L	50	110	60	40	.37	.50	.43	950	
	LS	110	200	90	35	.38	.50	.44	1261	3.3
B-6	LS	0	15	15	35	1.00	1.50	1.25	597	
	S	15	35	20	30	.52	.70	.61	333	
	SL	35	60	25	35	1.30	1.40	1.35	1074	
	S	60	90	30	30	4.00	4.80	4.40	3603	
	C	90	200	110	50	10.00	15.00	12.50	62562	68.2
B-7		0	50	50	40	1.00	.00	1.00	1819	
		50	100	50	40	4.00	.00	4.00	7279	
		100	160	60	40	7.50	.00	7.50	16379	
		160	200	40	40	12.50	.00	12.50	18199	43.7
B-8	S	0	15	15	30	1.05	1.00	1.02	419	
	SL	15	35	20	35	1.25	2.00	1.62	1035	
	L	35	75	40	40	5.90	.00	5.90	8590	
	L	75	90	15	40	6.50	7.40	6.95	3794	
	SL	90	125	35	35	8.00	8.80	8.40	9363	
	S	125	145	20	30	11.00	14.00	12.50	6824	
	SL	145	200	55	35	8.50	8.40	8.45	14802	44.8
AVERAGE AMOUNT OF SALT IN SOIL PROFILE TO DEPTH OF 2 MTS										29.3

TABLE A-18. ESTIMATE OF SALT IN SOIL PROFILE, C-1 TO C-8.

SAMPLE NO	TEX-TURE	D1 CM	D2 CM	DP CM	SAT PC	ECI MILLIMHOS/CM	ECA MILLIMHOS/CM	ECAV MILLIMHOS/CM	SALT KG/HA	T SALT TONS/HA
C-1	S	0	15	15	30	1.80	4.60	3.20	1310	
	S	15	45	30	30	.90	1.50	1.20	982	
	SL	45	60	15	35	1.90	2.60	2.25	1074	
	LS	60	85	25	35	4.50	5.20	4.85	3861	
	S	85	130	45	30	7.50	8.40	7.95	9766	
	SL	130	200	70	35	9.00	12.00	10.50	23409	40.4
C-2	SL	0	25	25	35	4.46	5.10	4.78	3806	
	LS	25	60	35	35	.80	1.00	.90	1003	
	LS	60	90	30	35	.75	.80	.77	740	
	S	90	160	70	30	.00	3.70	3.70	7070	
	LS	160	200	40	35	8.00	8.70	8.35	10637	23.3
C-3	LS	0	15	15	35	.70	1.10	.90	429	
	SL	15	85	70	35	.57	1.80	1.18	2641	
	SL	85	105	20	35	.32	.30	.31	197	
	S	105	150	45	30	.29	.30	.29	362	
	CL	150	170	20	45	.47	1.00	.73	601	
	S	170	200	30	30	.38	.70	.54	442	4.7
C-4	SL	0	15	15	35	1.30	.80	1.05	501	
	S	15	95	80	30	.95	.39	.67	1463	
	S	95	130	35	30	.44	.27	.36	339	
	LS	130	160	30	35	.44	1.10	.77	735	
	C	160	200	40	50	2.20	1.60	1.90	3457	6.5
C-5	S	0	15	15	30	.40	1.00	.70	286	
	S	15	70	55	30	.66	2.00	1.33	1996	
	L	70	85	15	40	8.50	8.40	8.45	4613	
	S	85	145	60	30	11.00	12.00	11.50	18836	
	SL	145	200	55	35	17.00	16.00	16.50	28903	54.6
C-6	SL	0	20	20	35	1.70	1.90	1.80	1146	
	S	20	70	50	30	1.00	1.70	1.35	1842	
	SL	70	75	5	35	3.20	6.00	4.60	732	
	S	75	180	105	30	6.50	8.60	7.55	21642	
	CL	180	200	20	45	13.50	20.00	16.75	13718	39.1
C-7	SL	0	20	20	35	1.15	6.40	3.77	2404	
	SL	20	50	30	35	.60	.70	.65	621	
	S	50	160	110	30	2.20	5.40	3.80	11411	
	CL	160	200	40	45	16.50	19.00	17.75	29074	43.5
C-8	SC	0	15	15	40	1.50	1.90	1.70	928	
	L	15	85	70	40	.95	1.40	1.17	2993	
	SL	85	105	20	35	.65	1.00	.82	525	
	S	105	135	30	30	.32	.48	.40	327	
	CL	135	200	65	45	1.90	1.70	1.80	4791	9.6

AVERAGE AMOUNT OF SALT IN SOIL PROFILE TO DEPTH OF 2 MTS 27.7

TABLE A-19. ESTIMATE OF SALT IN SOIL PROFILE, D-1 TO D-8.

SAMPLE NO	TEX-TURE	D1 CM	D2 CM	DP CM	SAT PC	ECI MILLIMHOS/CM	ECA MILLIMHOS/CM	ECAV MILLIMHOS/CM	SALT KG/HA	T SALT TONS/HA
D-1	LS	0	15	15	35	2.00	2.20	2.10	1003	
	S	15	55	40	30	1.48	2.30	1.89	2063	
	LS	55	160	105	35	3.00	4.40	3.70	12373	
	CL	160	200	40	45	4.90	4.90	4.90	8026	23.5
D-2	SL	0	20	20	35	4.40	5.40	4.90	3121	
	SL	20	35	15	35	2.10	2.40	2.25	1074	
	SL	35	70	35	35	5.50	5.40	5.45	6075	
	LS	70	140	70	35	7.60	7.20	7.40	16498	
	SL	140	200	60	35	5.80	6.20	6.00	11465	38.2
D-3	L	0	15	15	40	.95	1.00	.98	532	
	SL	15	55	40	35	.85	.90	.88	1114	
	LS	55	115	60	35	.00	.60	.60	1146	
	SL	115	145	30	35	1.90	1.90	1.90	1815	
	CL	145	200	55	45	5.20	6.00	5.60	12612	17.2
D-4	SL	0	40	40	35	.68	.61	.64	821	
	S	40	80	40	30	.90	.80	.85	928	
	SL	80	100	20	35	.80	1.00	.90	573	
	SL	100	120	20	35	.57	.70	.63	404	
	LS	120	150	30	35	.47	.70	.59	558	
	CL	150	200	50	45	.48	.80	.64	1310	4.6
D-5	L	0	20	20	40	1.15	2.30	1.73	1255	
	S	20	35	15	30	.34	.35	.34	141	
	S	35	50	15	30	.45	.50	.47	194	
	SL	50	75	25	35	1.20	.64	.92	732	
	SL	75	105	30	35	2.80	4.00	3.40	3248	
	S	105	115	10	30	4.00	5.00	4.50	1228	
	SL	115	160	45	35	6.90	8.00	7.45	10677	
	CL	160	200	40	45	10.00	13.00	11.50	18836	36.3
D-6	SL	0	25	25	35	.68	1.00	.84	668	
	LS	25	95	70	35	.40	.48	.44	980	
	CL	95	200	105	45	2.30	7.20	4.75	20423	22.1
D-7	SL	0	10	10	35	.65	2.30	1.47	469	
	LS	10	70	60	35	.34	1.00	.67	1280	
	SL	70	150	80	35	12.50	.00	12.50	31849	
	CL	150	200	50	45	18.00	21.00	19.50	39926	73.5
D-8	SL	0	15	15	35	2.80	3.00	2.90	1385	
	SL	15	45	30	35	5.50	7.80	6.65	6354	
	CL	45	60	15	45	9.50	15.00	12.25	7524	
	SL	60	120	60	35	7.00	12.00	9.50	18154	
	CL	120	200	80	45	18.00	.00	18.00	58967	92.4

AVERAGE AMOUNT OF SALT IN SOIL PROFILE TO DEPTH OF 2 MTS 38.5

TABLE A-20. ESTIMATE OF SALT IN SOIL PROFILE, H-1 TO H-8.

SAMPLE NO	TEX-TURE	D1 CM	D2 CM	DP CM	SAT PC	ECI	ECA	ECAV	SALT KG/HA	T SALT TONS/HA
						MILLIMHOS/CM				
H-1	SL	0	20	20	35	.00	1.10	1.10	700	
	SL	20	80	60	35	.00	.65	.65	1242	
	SL	80	130	50	35	.00	.90	.90	1433	
	LS	130	150	20	35	.00	1.20	1.20	764	
	SL	150	165	15	35	.00	1.00	1.00	477	
	CL	165	200	35	45	.00	.90	.90	1289	5.9
H-2	SL	0	15	15	35	.00	1.40	1.40	668	
	S	15	30	15	30	.00	.90	.90	368	
	SL	30	40	10	35	.00	.80	.80	254	
	SL	40	60	20	35	.00	.36	.36	229	
	S	60	95	35	30	.00	.48	.48	458	
	SL	95	130	35	35	.00	.90	.90	1003	
	SL	130	150	20	35	.00	4.20	4.20	2675	
	SCL	150	200	50	40	.00	6.80	6.80	12375	18.0
H-3	SL	0	40	40	35	.00	.70	.70	891	
	SCL	40	70	30	40	.00	.70	.70	764	
	S	70	95	25	30	.00	.70	.70	477	
	SCL	95	125	30	40	.00	.70	.70	764	
	L	125	200	75	40	.00	13.00	13.00	35489	38.4
H-4	LS	0	15	15	35	.00	.87	.87	415	
	S	15	55	40	30	.00	3.10	3.10	3385	
	LS	55	95	40	35	.00	3.00	3.00	3821	
	S	95	125	30	30	.00	.60	.60	491	
	CL	125	165	40	45	.00	6.10	6.10	9991	
	S	165	200	35	30	.00	8.20	8.20	7835	25.9
H-5	LS	0	10	10	35	.00	.70	.70	222	
	S	10	60	50	30	.00	.50	.50	682	
	SCL	60	100	40	40	.00	4.50	4.50	6551	
	S	100	130	30	30	.00	9.00	9.00	7370	
	CL	130	200	70	45	.00	7.00	7.00	20065	34.9
H-6	L	0	50	50	40	.00	.60	.60	1091	
	SL	50	90	40	35	.00	.60	.60	764	
	CL	90	200	110	45	.00	2.70	2.70	12162	14.0
H-7	SL	0	30	30	35	.00	8.00	8.00	7643	
	SL	30	50	30	35	.00	19.00	19.00	18154	
	L	60	80	20	40	.00	16.00	16.00	11647	
	S	80	95	15	30	.00	16.00	16.00	6551	
	CL	95	200	105	45	.00	16.00	16.00	68795	112.8
H-8	SL	0	20	20	35	.00	7.10	7.10	4522	
	CL	20	40	20	45	.00	4.20	4.20	3439	
	S	40	70	30	30	.00	2.70	2.70	2211	
	C	70	200	130	50	.00	12.00	12.00	70979	81.2

AVERAGE AMOUNT OF SALT IN SOIL PROFILE TO DEPTH OF 2 MTS 41.4

TABLE A-21. INFILTRATION DATA, CITRUS ORCHARD SITES 1-A 1 TO 5-D 3.

	TIME IN MINUTES FROM BEGINNING OF TEST													
SITE	1	3	5	10	20	30	45	60	90	120	180	240	SMPI	SMPF
	(ACCUMULATED DEPTH OF INFILTRATION IN MILLIMETERS)													
1-A 1	3	5	6	7	9	10	11	12	13	15	20	22	12.54	30.06
1-A 2	1	2	6	11	17	23	30	35	46	56	73	89	12.05	30.72
1-A 3	0	1	2	3	5	6	8	9	11	12	15	18	12.44	33.05
2-A 1	5	9	11	20	30	36	47	65	87	107	157	180	12.92	31.96
2-A 2	4	10	15	23	33	36	41	48	53	79	111	136	12.93	35.84
2-A 3	2	4	5	7	9	10	11	13	15	17	20	23	9.67	31.64
3-A 1	7	9	10	11	13	14	15	16	17	18	19	20	9.13	19.96
3-A 2	4	6	8	9	10	11	12	13	15	16	18	21	8.20	22.19
3-A 3	3	4	5	6	8	10	12	14	16	18	20	22	13.89	25.00
4-A 1	5	10	13	20	37	42	67	89	126	162	184	217	18.42	33.12
4-A 2	10	34	48	68	90	101	120	145	183	215	236	274	14.40	30.47
4-A 3	3	4	5	6	7	7	8	8	9	10	10	11	19.09	30.19
5-A 1	1	1	2	3	4	5	6	7	8	9	10	12	29.46	39.26
5-A 2	1	1	2	6	7	8	10	11	12	13	15	16	33.45	37.87
5-A 3	1	2	6	11	20	29	37	44	55	67	77	88	24.31	37.37
1-B 1	4	10	13	22	35	46	60	70	85	95	110	127	17.12	37.60
1-B 2	6	10	14	18	27	35	46	56	71	92	114	137	13.63	30.75
1-B 3	2	9	12	17	22	25	30	33	37	40	44	48	11.28	29.40
2-B 1	2	7	10	14	22	30	39	48	77	106	139	169	10.43	35.67
2-B 2	2	3	5	6	7	8	9	10	12	13	15	16	16.52	31.51
2-B 3	4	12	13	21	31	47	55	67	81	91	111	131	26.30	32.79
3-B 1	1	1	2	3	4	5	6	7	9	10	12	13	28.40	32.76
3-B 2	10	20	35	50	65	80	95	110	129	146	164	182	23.77	34.34
3-B 3	10	20	30	40	65	81	95	112	132	160	182	202	17.12	28.88
4-B 1	5	8	11	14	17	20	22	24	27	32	38	45	14.50	28.57
4-B 2	5	25	40	60	110	145	189	227	239	241	286	314	10.06	30.16
4-B 3	1	12	20	30	38	45	50	60	70	80	105	120	8.90	28.40
5-B 1	1	2	2	2	3	4	5	6	6	7	7	8	19.00	39.09
5-B 2	5	6	7	8	10	11	12	13	15	17	19	20	24.73	40.60
5-B 3	7	10	11	12	13	14	15	16	16	17	17	18	28.77	41.02
1-C 1	3	10	16	31	53	80	100	113	121	128	138	148	22.81	33.09
1-C 2	3	10	13	20	30	38	46	55	73	85	104	118	14.34	34.13
1-C 3	2	12	20	33	60	87	116	137	157	179	209	227	19.21	31.70
2-C 1	2	5	8	12	19	25	32	40	50	60	73	92	14.80	29.94
2-C 2	3	4	5	6	7	8	9	11	14	16	19	22	19.92	31.87
2-C 3	7	11	15	22	35	45	55	68	90	115	140	167	17.88	28.56
3-C 1	1	4	6	9	13	16	20	24	30	37	45	51	17.73	28.77
3-C 2	0	2	3	5	7	9	11	19	32	48	64	80	10.32	33.67
3-C 3	2	3	4	5	6	9	10	11	12	14	18	21	18.96	36.33
4-C 1	0	10	11	15	20	23	26	28	33	39	42	48	13.37	31.80
4-C 2	4	6	8	10	15	17	20	22	27	30	35	40	10.76	29.58
4-C 3	5	8	10	15	22	30	40	47	63	88	113	131	11.30	31.32
5-C 1	2	11	15	25	32	37	38	47	54	62	75	87	11.10	31.23
5-C 2	11	23	28	35	53	78	105	131	175	205	235	270	9.11	32.35
5-C 3	4	5	7	10	12	13	14	15	20	22	25	29	10.65	32.00
1-D 1	17	35	50	59	114	174	281	359	471	524	571	674	7.55	27.17
1-D 2	23	55	74	105	154	194	250	290	366	420	505	570	6.63	26.51
1-D 3	16	26	55	80	105	145	178	203	260	308	385	445	8.09	32.21
2-D 1	8	16	21	23	31	40	50	59	74	91	108	154	13.66	31.88
2-D 2	8	18	25	40	55	78	90	107	143	184	223	260	14.09	30.62
2-D 3	10	25	31	46	65	88	111	128	170	198	230	280	16.96	31.77
3-D 1	5	10	13	20	30	38	52	64	84	108	151	166	11.84	29.96
3-D 2	2	5	7	11	13	14	16	17	18	20	22	24	14.09	30.62
3-D 3	2	4	5	7	9	10	11	12	15	19	22	24	9.17	28.21
4-D 1	5	14	20	35	55	70	90	111	146	191	239	241	7.95	20.93
4-D 2	5	15	20	30	43	63	80	100	146	172	214	259	7.19	27.34
4-D 3	5	8	10	14	19	23	28	30	35	41	47	53	7.42	27.84
5-D 1	3	6	10	19	36	47	64	77	102	122	157	187	29.55	32.20
5-D 2	4	8	12	20	23	30	35	40	47	54	72	92	30.29	31.94
5-D 3	5	10	15	23	37	42	50	60	74	92	124	160		

SMPI AND SMPF - SOIL MOISTURE PERCENTAGE BY VOLUME, INITIAL AND FINAL.

TABLE A-22. SUMMARY OF INFILTRATION CONSTANTS A, B, C, D AND X, CITRUS ORCHARD, SITES 1-A TO 5-B.

LOCATION	NO	SOIL MOISTURE INITIAL	FINAL	DIFF	QUADRATIC EQUATION Y=A+B*T+C*T A	B	C	RC	AER	EXPONENTIAL EQUATION Y=D*T**X D	X	RO	AEO
SITE 1-A	1	12.54	30.06	17.52	.660	.181	.321	.968	4.0	1.260	.349	1.007	6.4
SITE 1-A	2	12.05	30.74	18.69	-.295	3.006	.813	1.007	.9	3.562	.655	1.001	.9
SITE 1-A	3	12.44	33.05	20.61	-.111	1.127	-.111	1.007	2.8	.884	.495	1.003	2.6
SITE 2-A	1	12.92	31.96	19.04	.344	2.307	3.530	.951	4.3	6.359	.773	.998	3.5
SITE 2-A	2	12.93	35.84	22.91	3.653	-3.247	4.233	.987	4.5	5.401	.582	1.021	10.4
SITE 2-A	3	9.67	31.64	21.97	.357	.928	.208	.995	1.5	1.305	.390	1.000	1.9
SITE 3-A	1	9.13	19.96	10.83	.741	1.121	-.260	1.001	.9	1.582	.173	1.000	.6
SITE 3-A	2	8.20	22.19	13.99	.586	.758	-.024	1.016	1.9	1.334	.294	1.000	2.4
SITE 3-A	3	13.89	25.00	11.11	-.321	2.246	-.521	1.003	1.9	1.323	.396	1.000	3.3
SITE 4-A	1	18.42	33.12	14.70	-3.097	11.497	.589	1.010	5.6	8.194	.791	.985	9.7
SITE 4-A	2	14.40	30.47	16.07	1.215	14.030	-.512	1.016	3.4	14.439	.487	.995	3.8
SITE 4-A	3	19.09	30.19	11.10	.595	.191	.032	1.023	3.1	.831	.203	.999	2.7
SITE 5-A	1	29.46	39.26	9.80	-.163	1.142	-.265	1.020	4.6	.668	.412	1.002	2.5
SITE 5-A	2	33.45	37.87	4.42	-.046	1.475	-.342	.988	2.8	1.048	.319	1.002	2.5
SITE 5-A	3	24.31	37.37	13.06	-1.890	7.380	-1.028	1.014	1.6	4.203	.578	.998	5.0
SITE 1-B	1	17.12	37.60	20.48	-2.722	12.275	-2.469	1.012	2.4	6.606	.497	1.000	4.0
SITE 1-B	2	13.63	30.75	17.12	-.732	5.420	.921	1.002	1.5	5.563	.660	.999	1.6
SITE 1-B	3	11.28	29.40	18.12	.148	4.119	-.956	1.003	1.7	3.191	.309	1.000	2.3
SITE 2-B	1	16.43	35.67	19.24	1.807	-2.451	5.494	1.010	7.0	5.216	.891	.985	5.0
SITE 2-B	2	16.52	31.51	14.99	.276	.745	-.023	.998	1.7	1.011	.354	.998	1.7
SITE 2-B	3	26.30	32.79	6.49	-3.105	12.074	-2.195	1.011	3.9	6.355	.529	1.003	3.0
SITE 3-B	1	28.40	32.76	4.36	-.023	.744	-.023	.997	2.3	.694	.497	.996	2.6
SITE 3-B	2	23.77	34.34	10.57	-1.286	15.178	-2.844	1.004	1.3	10.627	.411	1.000	2.4
SITE 3-B	3	17.12	28.88	11.76	-.699	13.249	-1.349	1.000	1.5	10.999	.464	.999	2.2
SITE 4-B	1	14.50	28.57	14.07	.879	1.317	.224	1.008	1.7	2.507	.372	1.004	3.7
SITE 4-B	2	10.06	30.16	20.10	-14.543	53.565	-16.708	.983	7.6	19.638	.357	1.008	6.2
SITE 4-B	3	8.90	28.40	19.50	1.237	3.830	.797	.977	2.2	6.075	.463	1.004	3.9
SITE 5-B	1	19.00	39.09	20.09	-.401	1.510	-.502	1.011	8.2	.521	.331	1.007	6.6
SITE 5-B	2	24.73	40.60	15.87	.643	.558	.095	.997	2.4	1.340	.306	.998	2.2
SITE 5-B	3	28.77	41.02	12.25	.606	1.499	-.498	1.004	3.0	1.535	.114	1.001	1.9

TABLE A-23. SUMMARY OF INFILTRATION CONSTANTS A, B, C, D AND X: CITRUS ORCHARD, SITES 1-C TO 5-D.

LOCATION	NO	SOIL MOISTURE INITIAL	FINAL	DIFF	QUADRATIC EQUATION $Y=A+B*\sqrt{T}+C*T$ A	B	C	RC	AER	EXPONENTIAL EQUATION $Y=D*T^{*X}$ D	X	RO	AEO
SITE 1-C	1	22.81	33.09	10.28	-8.397	29.308	-9.461	1.013	6.7	9.978	.333	1.008	7.4
SITE 1-C	2	14.34	34.13	19.79	-.026	4.860	.675	1.002	2.6	5.535	.578	.994	2.6
SITE 1-C	3	19.21	31.78	12.57	-8.747	29.750	-7.352	.996	2.9	12.363	.490	1.004	5.7
SITE 2-C	1	14.80	29.94	15.14	-1.218	5.687	-.405	1.016	3.4	3.855	.618	1.001	2.0
SITE 2-C	2	19.92	31.87	11.95	.227	.748	.127	1.002	2.4	1.114	.499	.996	2.5
SITE 2-C	3	17.88	28.56	10.68	.006	5.074	1.768	1.007	2.6	6.896	.656	.995	2.5
SITE 3-C	1	17.73	28.77	11.04	-.069	2.222	.229	.993	2.0	2.387	.572	.997	1.8
SITE 3-C	2	10.32	33.67	23.35	.709	-1.667	2.843	.992	8.1	1.865	1.129	[illegible]	9.0
SITE 3-C	3	18.96	36.33	17.37	-.195	1.482	-.195	.993	4.8	1.082	.439	1.010	4.5
SITE 4-C	1	13.92	31.80	17.88	.995	1.696	.137	1.010	1.7	2.900	.362	.999	1.4
SITE 4-C	2	10.75	29.58	18.83	.610	1.508	.105	1.010	1.4	2.260	.408	.998	1.1
SITE 4-C	3	11.30	31.32	20.02	.333	1.667	2.665	.992	4.9	4.892	.740	.998	3.9
SITE 5-C	1	11.10	31.23	20.13	1.276	3.140	.236	.990	2.1	4.730	.412	1.001	3.3
SITE 5-C	2	9.11	32.35	23.24	-7.613	24.691	-3.745	1.018	2.2	12.107	.652	.994	7.6
SITE 5-C	3	10.65	32.00	21.35	1.149	-.192	.584	1.027	4.9	1.650	.402	.995	3.8
SITE 1-D	1	7.55	27.17	19.62	-37.518	100.386	-25.841	1.029	5.1	30.092	.682	.998	13.1
SITE 1-D	2	6.63	26.51	19.88	-4.590	36.076	-2.436	1.002	.9	28.392	.533	.998	2.6
SITE 1-D	3	8.09	32.21	24.12	-2.063	21.037	1.460	1.007	1.8	20.568	.568	1.000	1.5
SITE 2-D	1	13.66	31.88	18.22	-.730	6.902	.063	1.057	6.8	6.031	.604	1.007	4.9
SITE 2-D	2	14.04	30.62	16.58	.170	7.560	3.107	1.013	4.0	11.116	.637	.996	3.1
SITE 2-D	3	16.96	31.77	14.81	-2.680	16.787	-.871	1.034	2.4	12.791	.580	.997	3.2
SITE 3-D	1	11.84	29.96	18.12	.264	2.681	3.185	.958	5.1	6.418	.723	.999	3.5
SITE 3-D	2	14.04	30.62	16.58	.621	1.304	-.228	.998	1.6	1.690	.238	1.001	1.3
SITE 3-D	3	9.17	28.21	19.04	.818	-.187	.568	1.000	5.2	1.314	.448	.997	4.8
SITE 4-D	1	7.95	20.43	12.48	-.031	7.181	3.529	.962	7.6	11.005	.659	.992	6.0
SITE 4-D	2	7.19	27.34	20.15	-2.497	10.872	1.847	1.022	3.4	9.899	.735	.990	4.5
SITE 4-D	3	7.42	27.84	20.42	.258	2.996	-.244	1.003	1.2	2.997	.415	1.000	1.2
SITE 5-D	1	29.55	32.20	2.65	-1.387	8.023	1.063	1.000	.8	7.587	.667	.998	1.7
SITE 5-D	2	30.29	31.94	1.65	.154	3.579	.305	1.009	4.3	4.118	.504	1.011	5.3
SITE 5-D	3	33.95	37.17	3.22	2.207	.932	2.856	.999	1.6	6.384	.594	1.009	6.1

TABLE A-24. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 1 S.

YEAR	MO	DAY	INT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
72	6	7	7	.0275	4.70	8.32	1.19	8.3	32.70	1.81	12.7	57	
72	6	14	7	.1050	6.00	40.07	5.72	48.4	139.74	19.91	152.0	85	
72	6	20	6	.0860	4.80	49.51	8.25	97.9	173.77	28.26	325.8		
72	6	27	7	.0571	4.40	43.77	6.19	141.2	129.39	18.48	455.2	8	
72	7	4	7	.0271	4.00	25.48	3.64	166.6	59.51	9.00	524.7	7	
72	7	10	6	.0119	3.70	10.11	1.68	176.7	25.30	4.22	550.0		
72	7	18	8	.0000	3.70	4.11	.51	180.8	8.89	1.24	559.9		
TOTALS AND AVG			48	.0436	4.76		3.77	180.8		11.66	559.9		

TABLE A-25. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 2 S.

71	11	16	7	.1720	5.40	52.01	7.43	52.0	31.28	13.04	91.3		
71	11	23	7	.2295	3.70	121.26	17.32	173.7	359.63	51.23	449.9	2	
71	11	30	7	.1730	4.10	121.56	17.37	294.8	309.17	44.02	758.1	30	
71	12	6	6	.1340	4.00	79.57	13.26	374.4	209.48	34.91	967.6		
72	1	25	50	.0474	4.20	391.92	7.84	756.2	1044.21	20.88	2011.8	4	
72	2	7	13	.0295	4.30	43.19	3.32	809.4	118.70	9.19	2131.1	6	
72	2	10	3	.0250	4.40	7.06	2.35	816.5	19.97	6.66	2151.0		
72	2	22	12	.0596	4.90	43.86	3.65	860.3	132.56	11.05	2283.6	29	
72	2	29	7	.0001	4.90	19.05	2.58	878.4	57.59	8.21	2341.1	7	
72	4	27	7	.0410	2.60	12.43	1.78	890.8	30.29	4.33	2371.4	27	IRRIGATION
72	5	5	8	.0110	2.40	17.97	2.25	908.8	29.20	3.65	2400.6	46	
72	5	9	4	.0740	2.20	14.69	3.67	923.5	21.96	5.49	2422.6	47	
72	5	19	10	.0400	2.60	49.25	4.92	972.7	76.83	7.68	2499.4	46	
72	5	24	5	.1350	2.80	37.80	7.56	1010.5	66.34	13.27	2565.7	74	
72	6	7	14	.0760	3.00	127.61	9.12	1138.1	240.55	17.18	2806.3	57	
72	6	14	7	.1290	3.10	61.99	8.86	1200.1	122.90	17.56	2929.2	85	
72	6	20	6	.1280	3.00	66.61	11.10	1266.8	132.00	22.01	3061.2		
72	6	27	7	.0909	3.30	66.17	9.45	1332.9	135.47	19.35	3196.7	8	
72	7	4	7	.0671	3.50	46.24	6.61	1379.2	102.18	14.60	3298.9	7	
72	7	10	6	.0511	2.40	29.34	4.89	1408.5	56.26	9.38	3355.2		
72	7	19	9	.0237	3.30	25.85	3.27	1434.3	47.89	5.32	3403.0		
72	7	28	10	.0001	3.30	10.28	1.03	1444.6	22.05	2.21	3425.1		
72	9	1	7	.0520	1.34	15.76	2.25	1460.4	26.32	3.76	3451.4	43	
72	9	8	7	.0128	1.90	19.60	2.80	1480.0	23.82	3.40	3475.2	40	
72	9	15	7	.0001	1.90	3.30	.56	1483.9	4.82	.69	3480.1	4	
72	9	22	7	.0054	2.30	1.69	.24	1485.5	2.27	.32	3482.3	35	
72	9	29	7	.0642	2.20	21.05	3.01	1506.6	30.79	4.40	3513.1	64	
72	10	6	7	.0386	2.34	31.09	4.44	1537.7	45.83	6.55	3559.0	7	
72	10	11	5	.0193	2.45	12.51	2.50	1550.2	19.47	3.89	3578.4	7	
72	10	20	9	.0260	2.87	17.61	1.96	1567.8	30.45	3.38	3609.9	65	
72	10	27	7	.0093	2.83	10.67	1.52	1578.5	19.77	2.82	3629.7	4	
72	11	3	7	.0320	3.30	12.49	1.78	1591.0	24.88	3.55	3653.6	47	
72	11	10	7	.0149	3.30	14.18	2.02	1605.1	30.42	4.35	3684.0	19	
72	11	17	7	.0000	3.30	4.51	.64	1609.6	9.66	1.38	3693.6	11	
TOTALS AND AVG			205	.0632	3.57		5.46	1609.6		12.52	3693.6		

TABLE A-26. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 3 S.

YEAR	MO	DAY	INT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
71	11	16	7	.3070	7.30	92.84	13.26	92.8	220.26	31.47	220.3		
71	11	23	7	.2100	6.50	156.34	22.33	249.2	701.19	100.17	921.4	2	
71	11	30	7	.1660	6.30	113.70	16.24	362.9	473.00	67.57	1394.4	30	
71	12	5	6	.1170	6.20	73.35	12.23	436.2	298.00	49.67	1692.4		
72	1	25	50	.0234	5.70	303.26	6.07	739.5	1172.87	23.46	2865.3	4	
72	2	7	13	.0150	6.50	21.57	1.66	761.1	85.51	6.58	2950.8	6	
72	2	14	7	.0001	6.50	4.57	.55	765.6	19.29	2.76	2970.1	29	
72	5	9	4	.0012	3.60	.22	.06	765.9	.74	.18	2970.9	47	
72	5	19	10	.0210	4.60	9.59	.96	775.4	25.56	2.56	2996.4	46	
72	5	24	5	.0685	3.10	19.33	3.87	794.8	48.38	9.68	3044.8	74	
72	6	7	14	.0512	5.10	72.39	5.17	867.2	192.93	13.78	3237.7	57	
72	6	14	7	.1110	4.80	49.05	7.01	916.2	157.82	22.55	3395.5	85	
72	6	13	5	.1400	4.80	54.22	10.84	970.4	168.15	33.83	3564.7		
72	6	20	1	.3940	.40	23.07	23.07	993.5	38.99	38.99	3603.7		OPEN HYDRANT
72	6	21	1	.1400	4.80	23.07	23.07	1016.6	33.99	38.99	3642.7		
72	6	27	6	.0543	4.90	50.36	8.39	1066.9	158.77	26.46	3801.4	8	
72	7	4	7	.0406	5.80	28.70	4.10	1095.6	99.80	14.26	3901.2	7	
72	7	10	6	.0353	4.20	19.67	3.28	1115.3	63.94	10.66	3965.2		
72	7	18	8	.0246	4.60	20.70	2.59	1136.0	59.21	7.40	4024.4		
72	7	28	10	.0363	3.90	26.31	2.63	1162.3	72.68	7.27	4097.1		
72	8	4	7	.0051	4.40	12.52	1.79	1174.8	33.77	4.82	4130.8	5	
72	8	11	7	.0001	4.40	1.57	.22	1176.4	4.50	.64	4135.3	21	
72	9	1	3	.0056	1.78	.74	.25	1177.1	1.48	.49	4136.8	43	
72	9	8	7	.0001	4.00	1.72	.25	1178.9	3.24	.46	4140.0	40	
72	9	29	7	.0169	2.84	5.14	.73	1184.0	11.43	1.63	4151.5	64	
72	10	6	7	.0046	2.95	6.50	.93	1190.5	12.23	1.75	4163.7	7	
72	10	11	5	.0001	4.00	1.02	.20	1191.5	2.29	.46	4166.0	7	
72	11	3	5	.0068	3.40	1.49	.30	1193.0	3.59	.72	4169.6	47	
72	11	10	7	.0000	4.00	2.06	.29	1195.1	4.35	.71	4174.5	18	
TOTALS AND AVG			236	.0586	5.37		5.06	1195.1		17.69	4174.5		

TABLE A-27. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 4 S.

YEAR	MO	DAY	TNT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
71	11	16	7	.1400	6.00	42.34	6.05	42.3	82.56	11.79	82.6		
71	11	23	7	.0977	6.10	71.88	10.27	114.2	282.67	40.38	365.2	2	
71	11	30	7	.0782	5.90	53.19	7.60	167.4	207.45	29.64	572.7	30	
71	12	6	7	.0673	6.00	44.00	6.29	211.4	170.17	24.31	742.8		
72	1	25	50	.0111	5.60	169.34	3.39	380.8	638.43	12.77	1381.3	4	
72	2	7	13	.0001	6.00	6.23	.48	387.0	22.71	1.82	1405.0	6	
72	5	3	4	.0350	3.70	6.07	1.52	393.1	19.12	4.78	1424.1	47	
72	5	13	10	.0638	4.80	42.68	4.27	435.8	117.31	11.72	1542.0	46	
72	5	24	5	.2700	3.00	72.10	14.42	507.9	182.79	36.55	1724.8	74	
72	6	7	14	.0696	4.60	205.39	14.67	713.7	507.31	36.24	2232.1	57	
72	6	14	7	.1670	3.80	71.55	10.22	784.8	195.37	27.90	2427.4	95	
72	6	20	6	.0934	4.70	67.50	11.25	852.3	196.46	31.09	2617.9		
72	6	27	7	.0579	4.50	45.75	6.54	898.1	136.80	19.54	2750.7	9	
72	7	4	7	.1500	3.10	62.37	8.38	960.9	155.29	22.18	2906.0	7	
72	7	10	6	.0850	3.80	60.91	10.15	1021.8	136.60	22.77	3042.6		
72	7	18	8	.0521	4.20	47.78	5.97	1069.7	122.19	15.40	3165.9		
72	7	29	10	.0154	3.10	29.16	2.92	1098.4	72.87	7.32	3238.7		
72	8	4	7	.0780	2.15	28.24	4.03	1126.6	51.36	7.41	3290.6	6	
72	8	1.	7	.0130	3.90	27.52	3.93	1154.2	51.47	7.35	3342.0	21	
72	8	13	7	.0001	4.00	3.26	.57	1158.1	9.76	1.42	3351.8	10	
72	9	1	7	.0235	2.21	7.14	1.02	1165.7	15.80	2.26	3367.6	43	
72	9	8	7	.0126	3.10	10.92	1.56	1176.2	22.97	3.28	3389.5	40	
72	9	15	7	.0001	4.00	3.44	.55	1180.0	9.96	1.27	3397.4	4	
72	9	29	7	.0553	3.50	19.79	2.83	1199.8	49.21	6.89	3446.6	64	
72	10	6	7	.1180	4.40	55.41	7.92	1255.2	142.32	20.33	3589.0	7	
72	10	11	5	.0472	4.10	35.68	7.14	1290.9	90.57	18.11	3680.5	7	
72	10	20	9	.0427	4.50	34.[illegible]	3.88	1324.9	97.69	10.85	3784.2	55	
72	10	27	7	.0343	5.40	23.25	3.32	1348.1	74.92	10.70	3859.1	4	
72	11	2	6	.0300	5.40	16.67	2.78	1365.8	52.56	8.75	3917.6	47	
72	11	7	1	.1530	4.40	7.91	7.91	1373.7	25.18	25.18	3942.8		OPEN HYDRANT
72	11	4	1	.0300	4.40	7.91	7.91	1381.6	25.18	25.18	3968.0		
72	11	10	6	.0233	5.60	12.93	2.15	1395.4	40.33	9.27	4017.4	13	
72	11	17	7	.0507	7.40	22.28	3.20	1417.8	94.55	17.51	4111.9	11	
72	11	24	7	.0306	6.50	24.59	3.51	1442.4	111.00	15.97	4223.0	37	
72	12	1	7	.0000	6.50	8.25	1.17	1451.7	39.10	5.59	4262.1	3	
TOTALS AND AVG			287	.0585	4.52		5.06	1451.7		14.85	4262.1		

TABLE A-28. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 5 S.

YEAR	MO	DAY	INT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
72	2	7	7	.2200	10.70	66.53	9.50	66.5	231.35	33.05	231.4	6	OPEN HYDRANT
72	2	22	15	.0237	6.80	157.92	10.53	224.4	899.16	59.98	1129.5	29	
72	2	29	7	.0001	7.00	7.20	1.03	231.6	32.28	4.61	1161.8	7	
72	5	9	4	.0150	7.60	2.61	.65	234.3	12.38	3.10	1174.2	47	
72	5	13	10	.0109	8.10	11.19	1.12	245.4	57.09	5.71	1231.3	46	
72	5	24	5	.0925	7.30	22.33	4.47	267.8	116.14	23.23	1347.4	74	
72	6	7	14	.0295	10.80	73.79	5.27	341.6	448.43	32.03	1795.8	57	
72	6	14	7	.1010	9.30	39.48	5.64	381.0	265.49	37.93	2061.3	85	
72	6	20	6	.0538	11.60	40.12	6.69	421.1	280.37	46.73	2341.7		
72	6	27	7	.0207	10.20	22.53	3.22	443.7	159.62	22.80	2501.3	8	
72	7	4	7	.0029	9.40	7.14	1.02	450.8	45.46	6.49	2546.8	7	
72	7	10	6	.0001	10.00	.78	.13	451.6	4.90	.82	2551.7		
72	7	18	1	.3020	.20	13.05	13.05	464.6	43.52	43.52	2595.2		
72	7	20	2	.0001	10.00	26.10	13.05	490.7	87.04	43.52	2682.2		
72	9	15	7	.0384	6.20	11.64	1.66	502.4	61.30	8.76	2743.5	4	
72	9	22	7	.0096	10.60	14.21	2.03	516.6	77.60	11.09	2821.1	35	
72	9	29	7	.0119	12.20	6.20	.89	522.8	45.94	6.56	2867.1	54	
72	10	6	7	.0044	12.50	4.93	.70	527.7	39.57	5.65	2906.6	7	
72	10	11	5	.0001	13.00	.97	.19	528.7	8.06	1.61	2914.7	7	
72	11	3	7	.0056	11.40	1.72	.25	530.4	13.67	1.95	2928.3	47	
72	11	10	7	.0000	12.00	1.69	.24	532.1	12.88	1.84	2941.2	18	
TOTALS AND AVG			245	.0425	8.50		3.67	532.1		20.28	2941.2		

ABLE A-29. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 6 S.

YEAR	MO	DAY	TNT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
72	4	27	7	.0080	12.90	3.42	.35	2.4	10.14	1.45	10.1	27	IRRIGATION
72	5	5	8	.0050	10.60	4.49	.56	6.9	34.31	4.29	44.5	46	
72	5	9	4	.0210	11.50	4.49	1.12	11.4	32.27	8.07	76.7	47	
72	5	13	10	.0213	14.20	18.53	1.85	29.9	154.80	15.48	231.5	46	
72	5	24	5	.0780	8.30	21.59	4.32	51.5	162.00	32.40	393.5	74	
72	6	7	14	.0291	13.40	64.77	4.63	116.3	469.45	33.53	863.0	57	
72	6	14	7	.0517	13.20	24.43	3.49	140.7	211.23	30.18	1074.2	85	
72	6	20	6	.0331	11.50	21.98	3.66	162.7	176.45	29.41	1250.6		
72	6	27	7	.0176	13.50	15.33	2.19	178.0	124.57	17.80	1375.2	8	
72	7	4	7	.0091	16.50	8.07	1.15	186.1	78.72	11.25	1453.9	7	
72	7	10	6	.0058	10.80	3.80	.64	190.0	33.26	5.54	1487.2		
72	7	18	9	.0031	13.00	2.04	.23	192.0	15.24	1.91	1502.4		
72	8	11	4	.0175	9.80	3.04	.76	195.1	22.54	5.63	1525.0	21	
72	9	18	7	.0076	10.20	7.59	1.08	202.6	51.06	7.29	1576.0	10	
72	9	24	6	.0153	3.10	6.07	1.01	208.7	27.60	4.60	1603.6	8	
72	9	1	8	.0208	12.10	12.05	1.58	221.4	62.49	7.81	1666.1	43	
72	9	9	7	.0202	9.80	12.40	1.77	233.8	88.25	12.61	1754.4	40	
72	9	15	7	.0476	7.80	20.50	2.93	254.3	117.28	16.75	1871.6	4	
72	9	22	7	.0700	9.30	35.56	5.08	289.8	198.49	28.07	2069.1	35	
72	9	29	7	.0955	9.30	47.02	6.72	336.9	282.73	40.39	2350.9	64	
72	10	6	7	.0350	11.70	36.44	5.21	373.3	248.70	35.53	2599.6	7	
72	10	11	5	.0206	8.20	12.51	2.40	385.3	77.67	15.53	2677.2	7	
72	10	20	9	.0217	9.00	16.45	1.83	401.7	91.93	10.21	2769.2	65	
72	10	27	7	.0083	12.30	9.07	1.30	410.8	64.28	9.19	2833.4	4	
72	11	3	7	.0210	11.00	8.80	1.27	419.7	69.53	9.79	2902.0	47	
72	11	10	7	.0094	12.00	9.19	1.31	428.9	69.72	9.82	2970.7	18	
72	11	17	7	.0000	13.00	2.84	.41	431.7	23.10	7.70	2993.8	11	
TOTALS AND AVG			121	.0262	10.67		2.25	431.7		15.67	2993.8		

TOTAL DAYS OF OUTFLOW, VOLUME AND SALT FOR 5 DRAINS

			1202	.2925	5.71		25.28	5401.0		92.68	18625.2		

TABLE A-30. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 1 N.

YEAR	MO	DAY	INT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
72	1	25	7	.0226	7.00	6.83	.93	6.8	15.55	2.22	15.5	4	IRRIGATION
72	2	7	13	.0636	7.30	48.41	3.72	55.2	224.99	17.31	240.5	6	
72	2	22	15	.0555	8.40	77.18	5.15	132.4	393.79	26.25	634.3	29	
72	2	29	7	.0001	8.40	16.81	2.40	149.2	91.80	13.11	726.1	7	
72	6	7	7	.3220	5.70	97.40	13.91	246.6	446.35	63.76	1172.5	57	
72	6	14	7	.2050	6.90	159.36	22.77	406.0	652.60	93.23	1825.1	85	
72	6	20	6	.1210	6.60	84.50	14.08	490.5	370.74	61.79	2195.8		
72	6	27	7	.1960	6.60	95.86	13.69	586.4	411.24	58.75	2607.1	8	
72	7	4	7	.1260	6.80	97.37	13.91	683.7	424.06	60.58	3031.1	7	
72	7	10	6	.0963	4.70	57.62	9.60	741.4	215.36	35.89	3246.5		
72	7	18	8	.0242	6.60	41.64	5.21	783.0	152.94	19.12	3399.4		
72	7	28	10	.0325	5.80	24.49	2.45	807.5	98.71	9.87	3498.1		
72	8	4	7	.0193	5.60	15.66	2.24	823.2	58.04	8.29	3556.2	5	
72	8	11	7	.0165	7.00	10.83	1.55	834.0	44.33	6.33	3600.5	21	
72	8	18	7	.0042	7.00	6.26	.89	840.2	28.48	4.07	3629.0	10	
72	8	24	6	.0001	7.00	1.11	.19	841.4	5.07	.85	3634.0	3	
72	9	29	1	.5900	.72	25.49	25.49	866.9	63.96	63.96	3698.0	64	OPEN HYDRANT
72	9	30	1	.0500	.72	27.65	27.65	894.5	12.94	12.94	3710.9		EST. FLOW AND EC.
72	10	6	6	.0268	5.90	19.91	3.32	914.4	42.83	7.14	3753.8	2	
72	10	11	5	.0140	5.00	8.81	1.76	923.2	31.22	6.24	3785.0	7	
72	10	20	9	.0001	5.00	5.48	.61	928.7	17.82	1.98	3802.8	55	
72	11	3	7	.0454	5.40	13.76	1.97	942.5	46.51	6.64	3849.3	47	
72	11	10	7	.0144	5.40	18.09	2.58	960.5	63.47	9.07	3912.8	18	
72	11	17	7	.0000	5.40	4.35	.62	964.9	15.28	2.18	3928.1	11	
TOTALS AND AVG			170	.0657	6.26		5.68	964.9		23.11	3928.1		

TABLE A-31. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 2 N.

YEAR	MO	DAY	TNT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AO SALT KGS	RAIN MM.	EXPLANATIONS
71	10	1	7	.4170	9.70	126.10	18.01	126.1	397.53	56.79	397.5	22	
71	10	15	14	.2540	9.85	405.82	28.99	531.9	2578.48	184.18	2976.0	44	
71	10	18	3	.2180	10.00	61.17	20.39	593.1	394.67	131.54	3370.6		
71	10	26	8	.1700	9.00	134.09	16.76	727.2	828.02	103.50	4198.7	22	
71	11	2	7	.1470	11.20	95.80	13.69	823.0	629.33	89.90	4828.0	30	
71	11	15	13	.1000	11.20	138.72	10.67	961.8	1009.85	77.68	5837.8	77	
71	11	16	1	.2110	9.40	13.44	13.44	975.2	89.95	89.95	5927.8		
71	11	23	7	.1610	9.60	112.49	16.07	1087.7	694.64	99.23	6622.4	2	
71	11	30	7	.1550	9.60	95.59	13.65	1183.2	596.29	85.18	7218.7	30	
71	12	6	7	.1160	9.50	81.95	11.71	1265.2	508.71	72.67	7727.4		
72	1	25	50	.0476	9.90	353.35	7.07	1618.6	2182.10	43.64	9909.5	4	
72	2	7	13	.0168	7.30	36.17	2.78	1654.7	197.47	15.19	10107.0	6	
72	2	22	15	.0001	7.30	10.35	.72	1665.7	51.96	3.46	10159.0	22	
72	4	27	7	.0500	6.30	15.15	2.16	1680.9	66.96	9.57	10225.9	27	IRRIGATION
72	5	5	8	.0830	8.60	45.96	5.75	1726.8	222.59	27.82	10448.5	46	
72	5	9	4	.2980	6.80	64.11	16.03	1790.9	320.80	80.22	10769.4	47	
72	5	13	10	.1370	8.90	183.60	18.36	1974.5	936.82	93.68	11706.2	46	
72	5	24	5	.2700	7.00	87.91	17.58	2062.4	454.29	90.86	12160.5	74	
72	6	7	14	.1310	5.60	242.52	17.32	2305.0	992.14	70.94	13153.6	57	
72	6	14	7	.1810	7.90	94.35	13.48	2399.3	410.89	58.70	13564.5	95	
72	6	20	6	.1310	7.60	80.87	13.48	2480.2	404.76	67.46	13969.3		
72	6	27	7	.0918	6.50	67.37	9.62	2547.5	308.74	44.11	14278.0	8	
72	7	4	7	.0673	8.00	48.11	6.87	2595.7	226.73	32.39	14504.7	7	
72	7	10	6	.0913	7.30	41.11	6.85	2636.8	204.43	34.07	14709.1		
72	7	18	8	.0471	8.00	47.83	5.98	2684.6	237.84	29.73	14947.0		
72	7	28	10	.0292	7.10	32.53	3.25	2717.1	159.64	15.96	15106.6		
72	8	4	7	.0228	5.80	16.42	2.20	2732.6	64.66	9.24	15171.3	5	
72	8	11	7	.0143	5.40	11.22	1.60	2743.9	40.94	5.87	15212.1	21	
72	8	13	4	.0001	5.40	2.49	.62	2746.3	8.73	2.18	15220.9	10	
72	9	29	7	.0173	6.20	5.26	.75	2751.5	19.84	2.83	15240.7	43	
72	10	6	8	.0120	6.50	10.13	1.27	2761.6	41.80	5.22	15282.5	71	
72	10	11	5	.0063	6.90	3.95	.79	2765.6	17.21	3.44	15299.7	7	
72	10	20	9	.0092	7.20	6.03	.67	2771.6	27.82	3.07	15327.3	85	
72	10	27	7	.0001	7.20	2.81	.40	2774.4	13.16	1.88	15340.5	4	
72	11	3	7	.0107	6.10	3.27	.47	2777.7	14.10	2.02	15354.6	47	
72	11	10	7	.0050	6.10	4.75	.58	2782.5	18.82	2.69	15373.4	18	
72	11	17	7	.0000	6.10	1.51	.22	2784.0	6.00	.86	15379.4	11	
TOTALS AND AVG			326	.0988	8.50		8.54	2784.0		47.18	15379.4		

TABLE A-32. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 3 N.

YEAR	MO	DAY	TNT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	PATN MM.	EXPLANATIONS
71	10	26	7	.2780	6.60	84.07	12.01	84.1	180.32	25.76	180.3	22	
71	11	2	7	.2250	6.90	152.11	21.73	236.2	697.37	95.34	847.7	30	
71	11	16	14	.2290	6.40	274.58	19.61	510.8	1186.87	84.78	2034.6		
71	11	23	7	.1720	6.80	121.26	17.32	632.0	520.22	74.32	2554.8	2	
71	11	30	7	.1770	6.50	105.54	15.08	737.6	456.19	65.17	3011.0	30	
71	12	5	6	.1360	6.80	81.13	13.52	818.7	350.69	58.45	3361.6		
72	1	25	50	.0695	6.30	443.88	8.88	1262.6	1889.82	37.80	5251.5	4	
72	2	7	13	.0231	8.00	52.00	4.00	1314.6	241.69	18.59	5493.2	6	
72	2	22	15	.0035	8.40	17.24	1.15	1331.8	91.87	6.12	5585.0	29	
72	2	24	2	.0001	8.40	.31	.16	1332.1	1.70	.85	5586.7		
72	4	27	7	.0490	6.40	14.85	2.12	1347.0	71.42	10.20	5658.1	27	IRRIGATION
72	5	5	8	.0990	5.20	51.15	6.39	1398.1	192.83	24.10	5851.0	46	
72	5	9	4	.2790	5.20	65.32	16.33	1463.4	220.78	55.19	6071.8	47	
72	5	19	10	.3570	6.20	274.75	27.48	1738.2	1017.96	101.80	7089.7	46	
72	5	24	5	.4200	4.10	167.83	33.57	1906.0	561.82	112.36	7651.5	74	
72	6	7	14	.2150	6.50	384.05	27.43	2290.1	1323.05	94.50	8974.6	57	
72	6	14	7	.2090	6.00	128.22	18.32	2418.3	520.88	74.41	9495.5	85	
72	6	20	6	.1620	6.10	96.16	16.03	2514.4	378.16	63.03	9873.6		
72	6	27	7	.1260	6.60	87.09	12.44	2601.5	359.47	51.35	10233.1	8	
72	7	4	7	.1040	6.00	69.55	9.94	2671.1	284.82	40.69	10517.9	7	
72	7	10	6	.0935	4.80	51.19	8.53	2722.3	179.68	29.95	10697.6		
72	7	19	8	.0748	4.60	58.16	7.27	2780.4	177.69	22.21	10875.3		
72	7	28	10	.0687	5.00	61.99	6.20	2842.4	193.42	19.34	11068.7		
72	8	4	7	.0540	2.40	37.10	5.30	2879.5	89.24	12.75	11157.9	5	
72	8	11	7	.0478	6.10	30.78	4.40	2910.3	85.04	12.15	11243.0	21	
72	8	18	7	.0258	6.50	22.26	3.18	2932.6	91.14	13.02	11334.1	10	
72	8	24	6	.0158	5.70	10.78	1.80	2943.4	42.75	7.13	11376.9	9	
72	9	1	8	.0135	7.00	10.16	1.27	2953.5	41.94	5.24	11418.8	43	
72	9	8	7	.0126	4.80	7.92	1.13	2961.4	30.38	4.34	11449.2	40	
72	9	15	7	.0092	5.60	6.59	.94	2968.0	22.28	3.18	11471.5	4	
72	9	22	7	.0068	8.50	4.84	.69	2972.9	22.17	3.17	11493.6	35	
72	9	29	7	.0436	5.60	15.24	2.18	2988.1	69.84	9.98	11563.5	64	
72	10	6	7	.0322	5.40	22.92	3.27	3011.0	81.95	11.71	11645.4	7	
72	10	11	5	.0197	3.50	11.21	2.24	3022.2	32.43	6.49	11677.9	7	
72	10	20	9	.0234	6.50	16.76	1.86	3039.0	54.45	6.05	11732.3	65	
72	10	27	7	.0104	6.60	10.22	1.46	3049.2	43.52	6.22	11775.8	4	
72	11	3	7	.0246	5.40	10.58	1.51	3059.8	41.28	5.90	11817.1	47	
72	11	10	7	.0138	6.40	11.61	1.66	3071.4	44.53	6.36	11861.6	18	
72	11	17	7	.0059	8.00	5.96	.85	3077.4	27.88	3.98	11889.5	11	
72	11	24	7	.0039	9.70	2.96	.42	3080.3	16.08	2.30	11905.6	37	
72	12	1	7	.0026	6.60	1.97	.28	3082.3	9.77	1.40	11915.4	3	
72	12	8	7	.0000	6.60	.79	.11	3083.1	3.37	.48	11918.8		
TOTALS AND AVG			360	.0991	5.95		8.56	3083.1		33.11	11918.8		

TABLE A-33. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 4 N.

YEAR	MO	DAY	INT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
71	10	15	7	.3460	7.20	104.63	14.95	104.6	244.94	34.99	244.8	39	
71	10	18	3	.2970	7.20	82.68	27.56	187.3	386.96	128.99	631.8		
71	10	26	8	.2260	7.20	179.02	22.38	366.3	837.82	104.73	1469.6	22	
71	11	2	7	.1920	7.40	126.40	18.06	492.7	599.78	85.68	2069.4	30	
71	11	13	11	.1320	7.40	153.96	14.00	646.7	740.57	67.32	2810.0	77	
71	11	16	3	.2770	6.20	53.01	17.67	699.7	234.29	78.10	3044.3		
71	11	23	7	.1990	6.70	143.64	20.52	843.4	602.21	86.03	3646.5	2	
71	11	30	7	.1870	6.70	116.42	16.63	959.8	507.03	72.43	4153.5	30	
71	12	6	6	.1430	6.60	85.54	14.26	1045.3	369.73	61.62	4523.2		
72	1	25	50	.0596	7.10	437.62	8.75	1482.9	1948.49	39.97	6471.7	4	
72	2	7	13	.0235	9.00	46.67	3.59	1529.6	244.20	18.78	6715.9	6	
72	2	22	15	.0106	10.20	22.10	1.47	1551.7	137.98	9.19	6853.8	29	
72	2	29	7	.0001	10.20	3.24	.46	1554.9	21.46	3.06	6875.2	7	
72	4	27	7	.0720	7.00	21.80	3.11	1576.7	121.98	17.41	6997.1	27	
72	5	5	8	.0930	7.00	57.02	7.13	1633.8	259.46	32.43	7256.6	46	
72	5	9	4	.2260	5.[illegible]	55.12	13.78	1688.9	216.77	54.19	7473.4	47	
72	5	13	10	.5640	4.30	341.28	34.13	2030.2	1042.61	104.26	8516.0	46	
72	5	24	5	.5400	5.10	238.46	47.69	2268.6	728.51	145.70	9244.5	74	
72	6	7	14	.2450	5.00	474.77	33.91	2743.4	1558.47	111.32	10802.9	57	
72	6	14	7	.6530	4.30	271.56	38.79	3014.9	877.77	124.82	11676.6	85	
72	6	20	6	.3080	5.10	264.64	44.11	3279.6	800.09	143.35	12536.7		
72	6	27	7	.2360	6.[illegible]	82.65	26.09	3362.2	682.65	97.52	13219.4	8	
72	7	4	7	.1670	6.50	121.87	17.41	3584.1	510.93	72.99	13730.3	7	
72	7	10	6	.1440	6.10	80.61	13.44	3664.7	370.10	55.02	14060.4		
72	7	18	8	.1110	5.60	88.13	11.02	3752.8	335.11	41.89	14395.5		
72	7	28	10	.0788	4.20	81.91	8.19	3834.8	255.55	25.56	14651.1		
72	8	4	7	.0595	5.70	41.76	5.97	3876.5	131.85	18.81	14782.7	5	
72	8	11	7	.0484	5.[illegible]	32.63	4.66	3909.1	121.[illegible]	17.42	14904.7	21	
72	8	18	7	.0334	7.10	24.74	3.53	3933.8	103.71	14.82	15008.4	10	
72	8	24	6	.0230	5.20	14.60	2.44	3948.5	63.19	10.53	15071.6	3	
72	9	1	9	.0229	7.80	15.80	1.88	3964.4	72.18	8.02	15143.7	42	
72	9	8	7	.0184	[illegible]	12.46	1.78	3976.9	46.97	7.13	15190.7	40	
72	9	15	7	.0137	7.10	9.[illegible]	1.39	3986.6	39.60	[illegible]	15230.3	4	
72	9	22	7	.0138	7.80	8.37	1.19	3994.9	43.[illegible]	5.75	15270.5	35	
72	9	29	7	.0445	5.60	17.[illegible]	2.50	4012.5	76.78	10.[illegible]	15347.3	64	
72	10	6	7	.0312	5.40	22.8[illegible]	3.27	4035.4	81.24	11.[illegible]	15429.1	7	
72	10	11	5	.0216	3.10	11.4[illegible]	2.28	4046.8	71.51	6.30	15460.6	7	
72	10	20	9	.0307	6.80	20.33	2.26	4067.1	64.1[illegible]	7.10	15524.7	85	
72	10	27	7	.0191	6.80	15.06	2.15	4082.2	65.52	9.37	15590.3	4	
72	11	7	7	.0304	6.00	14.07	2.14	4097.2	62.37	8.90	15652.6	47	
72	11	10	7	.0220	7.00	15.85	2.26	4113.0	66.95	9.56	15719.6	18	
72	11	17	7	.0163	8.00	11.58	1.65	4124.6	56.46	8.07	15776.0	11	
72	11	24	7	.0097	8.20	7.86	1.12	4132.5	41.40	5.91	15817.4	37	
72	12	1	7	.0066	8.70	4.93	.70	4137.4	27.07	3.87	15844.5	3	
72	12	8	7	.0000	8.70	2.00	.29	4139.4	11.29	1.61	15855.8		
TOTALS AND AVG			376	.1274	5.89		11.01	4139.4		42.17	15855.8		

TABLE A-34. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 5 N.

YEAR	MO	DAY	TNT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	PAIN MM.	EXPLANATIONS
72	1	25	7	.0621	10.00	18.78	2.68	18.9	61.03	8.72	61.0	4	
72	2	7	13	.0267	13.00	49.97	3.84	68.6	372.78	28.68	433.3	6	
72	2	22	15	.0119	14.20	25.01	1.67	93.7	221.11	14.74	654.9	29	
72	2	29	7	.0001	15.00	3.63	.52	97.3	34.44	4.92	689.4	7	
72	4	27	7	.0110	9.00	3.36	.48	100.6	25.18	3.74	715.5	27	IRRIGATION
72	5	19	12	.0940	7.90	54.43	4.54	155.1	298.97	24.91	1014.5	46	
72	5	9	10	.1520	9.10	106.27	10.63	261.4	587.15	58.72	1601.7	47	
72	5	23	4	.2000	9.00	60.83	15.21	322.2	357.81	89.45	1959.5	74	EST. FLOW AND EC
72	5	24	1	1.0000	6.40	51.84	51.84	374.0	259.46	259.46	2218.9		OPEN HYDRANT
72	5	25	1	.2000	4.00	51.84	51.84	425.9	175.22	175.22	2394.1		EST. FLOW AND EC
72	6	7	13	.1730	4.10	209.48	16.11	635.7	551.45	42.42	2945.6	57	
72	6	14	7	.3500	7.10	158.16	22.59	793.5	575.68	82.24	3521.3	85	
72	6	20	6	.1860	8.10	138.93	23.16	932.4	686.32	114.39	4207.6		
72	6	27	7	.1110	8.50	89.81	12.83	1022.2	484.54	69.22	4692.1	9	
72	7	4	7	.0700	11.10	54.73	7.82	1077.0	348.66	49.81	5040.8	7	
72	7	10	6	.0482	8.60	30.64	5.11	1107.6	196.16	32.69	5237.0		
72	7	18	8	.0242	11.60	25.02	3.13	1132.6	164.27	20.53	5401.2		
72	7	28	10	.0115	9.30	15.42	1.54	1148.0	104.76	10.48	5506.0		
72	8	4	7	.0193	9.00	9.31	1.33	1157.4	55.39	7.91	5561.4	5	
72	8	11	7	.0149	10.50	10.34	1.48	1167.7	65.54	9.36	5626.9	21	
72	8	18	7	.0058	11.20	6.26	.89	1174.0	45.37	6.48	5672.3	10	
72	8	24	6	.0031	6.60	2.31	.38	1176.3	13.80	2.30	5686.1	9	
72	9	1	7	.0296	13.10	9.89	1.41	1186.2	63.31	9.04	5749.4	43	
72	9	8	7	.0246	5.60	16.39	2.34	1202.5	99.61	14.23	5849.0	40	
72	9	15	7	.0182	12.60	12.94	1.85	1215.5	76.56	10.94	5925.6	4	
72	9	22	7	.0136	13.60	9.62	1.37	1225.1	81.88	11.70	6007.4	35	
72	9	29	7	.0294	13.80	13.00	1.86	1238.1	115.79	16.54	6123.2	64	
72	10	6	7	.0195	8.20	14.79	2.11	1252.9	105.73	15.10	6229.0	7	
72	10	11	5	.0120	13.70	6.80	1.36	1259.7	48.43	9.69	6277.4	7	
72	10	20	9	.0165	15.10	11.08	1.23	1270.8	103.72	11.52	6381.1	65	
72	10	27	7	.0100	10.70	8.01	1.14	1278.8	67.19	9.60	6448.3	4	
72	11	3	7	.0174	14.30	8.29	1.18	1287.1	67.32	9.62	6515.6	47	
72	11	10	7	.0125	14.60	9.04	1.29	1296.1	84.92	12.13	6600.5	18	
72	11	17	7	.0086	15.00	6.38	.91	1302.5	61.38	8.77	6661.9	11	
72	11	24	7	.0066	16.00	4.60	.66	1307.1	46.31	6.62	6708.2	37	
72	12	1	7	.0081	15.00	4.45	.64	1311.5	44.79	6.40	6753.0	3	
72	12	8	7	.0000	15.00	2.45	.35	1314.0	23.88	3.41	6776.9		
TOTALS AND AVG			273	.0557	7.93		4.81	1314.0		24.82	6776.9		

TABLE A-35. TILE DRAIN FLOW, ELECTRICAL CONDUCTIVITY AND SALT CONTENT, DRAIN 6 N.

YEAR	MO	DAY	YNT DAYS	FLOW L/SEC	EC MMHOS	VOLUME CU MTS	FLOW M3/DAY	AC VOL CU MTS	SALT KGS	SALT KG/DAY	AC SALT KGS	RAIN MM.	EXPLANATIONS
71	10	1	7	.1020	17.70	30.84	4.41	30.8	177.43	25.35	177.4		
71	10	15	14	.0920	17.50	117.33	8.38	148.2	1342.27	95.88	1519.7		
71	10	18	3	.0820	17.20	22.55	7.52	170.7	254.31	84.77	1774.0		
71	10	26	8	.0579	17.50	48.35	6.04	219.1	545.26	68.16	2319.3	22	
71	11	2	7	.0500	18.20	32.63	4.66	251.7	378.58	54.08	2697.9	30	
71	11	13	11	.0300	18.50	38.02	3.46	289.7	453.44	41.22	3151.3	77	
71	11	16	3	.0904	18.50	15.60	5.20	305.3	187.64	62.55	3338.9		
71	11	23	7	.0734	18.40	49.53	7.08	354.9	594.03	84.86	3933.0	2	
71	11	30	7	.0745	17.20	44.72	6.39	399.6	517.47	73.92	4450.4	30	
71	12	6	6	.0444	17.80	30.82	5.14	430.4	350.56	58.43	4801.0		
72	1	25	50	.0404	10.60	183.17	3.66	613.6	1690.64	33.81	6491.6	4	
72	2	7	13	.0001	12.00	22.74	1.75	636.3	167.06	12.85	6658.7	6	
72	5	9	4	.0390	11.60	6.76	1.69	643.1	51.82	12.96	6710.5	47	
72	6	7	29	.0823	14.40	151.96	5.24	795.0	1284.10	44.28	7994.6	177	
72	6	14	7	.2310	9.10	94.74	13.53	889.8	723.59	103.37	8718.2	85	
72	6	20	6	.1260	12.60	92.53	15.42	982.3	652.60	108.77	9370.8		
72	6	27	7	.0532	12.20	54.19	7.74	1036.5	436.77	62.40	9807.6	8	
72	7	4	7	.0338	11.60	26.31	3.76	1062.8	203.50	29.07	10011.1	7	
72	7	10	6	.0253	13.80	15.32	2.55	1078.1	126.46	21.08	10137.5		
72	7	19	8	.0133	11.10	13.34	1.67	1091.5	107.96	13.49	10245.5		
72	7	28	10	.0091	8.40	9.68	.97	1101.1	61.33	6.13	10306.8		
72	8	4	7	.0001	8.40	2.78	.40	1103.9	15.19	2.17	10322.0	5	
72	8	11	4	.0050	11.00	.88	.22	1104.3	5.56	1.39	10327.6	21	
72	8	18	7	.0023	9.40	2.21	.32	1107.0	14.64	2.09	10342.2	10	
72	8	24	6	.0001	10.00	.62	.10	1107.6	3.92	.65	10346.1	9	
72	11	3	7	.0091	14.00	2.78	.40	1110.4	21.70	3.10	10367.8	47	
72	11	10	7	.0233	14.00	9.80	1.40	1120.2	89.16	12.74	10457.0	18	
72	11	17	7	.0000	14.00	7.05	1.01	1127.3	64.12	9.16	10521.1	11	
TOTALS AND AVG			265	.0492	14.36		4.25	1127.3		39.70	10521.1		

TOTAL DAYS OF OUTFLOW, VOLUME AND SALT FOR N DRAINS

			1770	.4960	7.38		42.86	13412.6		210.09	64380.0		

TOTAL DAYS OF OUTFLOW, VOLUME AND SALT FOR ALL DRAINS

			2972	.7896	6.79		68.13	12813.6		302.77	83005.1		

TABLE A-36. ANALYSIS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS. HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 5 I SURF EL = 6.43 DRAIN EL = 4.43 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.95	4.89	4.87	4.79	4.74	4.69	4.67	.00	.00	.00	.00
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.52	.46	.44	.36	.31	.26
HF(I) =	.52	.46	.42	.37	.30	.28
HA(I) =	.52	.47	.43	.37	.30	.26
RH(I) =	1.00	.88	.85	.69	.60	.50
Y(I) =	.00	.12	.15	.31	.40	.50
EF(I) =	.00	.46	-4.80	1.39	-3.27	6.61
EA(I) =	.00	1.91	-2.64	3.61	-4.75	1.75

F = .0197 TF50 = 35.3 AERF = 2.76 RAHF = .997
A = .0176 XP = .9602 TA50 = 32.6 AERA = 2.44 RAHA = 1.000

OBSERVATION WELL 5 D SURF EL = 6.09 DRAIN EL = 4.35 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.08	4.96	4.90	4.79	4.69	4.63	4.58	4.52	4.48	4.47	4.45
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.73	.61	.55	.44	.34	.28	.23	.17
HF(I) =	.73	.61	.53	.44	.33	.29	.23	.17
HA(I) =	.73	.61	.54	.46	.35	.31	.23	.13
RH(I) =	1.00	.84	.75	.60	.47	.38	.32	.23
Y(I) =	.00	.16	.25	.40	.53	.62	.68	.77
EF(I) =	.00	.76	-3.17	-.97	-3.79	4.17	.83	2.41
EA(I) =	.00	.05	-1.69	3.46	1.82	9.07	-1.16	-20.65

F = .0287 TF50 = 24.2 AERF = 2.01 RAHF = .996
A = .0423 XP = .7564 TA50 = 26.2 AERA = 4.74 RAHA = 1.000

OBSERVATION WELL 6 I SURF EL = 6.26 DRAIN EL = 4.31 D T D = 49 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.99	4.91	4.87	4.79	4.72	4.70	4.64	4.60	4.63	4.59	4.55
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.68	.60	.56	.48	.41
HF(I) =	.68	.61	.55	.49	.40
HA(I) =	.68	.60	.55	.49	.40
RH(I) =	1.00	.88	.82	.71	.60
Y(I) =	.00	.12	.18	.29	.40
EF(I) =	.00	1.35	-1.07	1.31	-1.55
EA(I) =	.00	.81	-1.02	1.86	-1.97

F = .0186 TF50 = 37.2 AERF = 1.06 RAHF = 1.001
A = .0241 XP = .8496 TA50 = 35.5 AERA = 1.13 RAHA = 1.000

TABLE A-37. ANALYSIS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS. HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 6 D SURF EL = 6.02 DRAIN EL = 4.01 D T D = 49 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.14	5.01	4.93	4.83	4.72	4.67	4.59	4.52	4.46	4.45	4.44
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.13	1.00	.92	.82	.71	.66	.58	.51	.45		
HF(I) =	1.13	1.02	.94	.84	.71	.66	.58	.49	.44		
HA(I) =	1.13	.99	.92	.83	.71	.67	.59	.50	.43		
RH(I) =	1.00	.88	.81	.73	.63	.58	.51	.45	.40		
Y(I) =	.00	.12	.19	.27	.37	.42	.49	.55	.60		
EF(I) =	.00	2.24	2.25	2.08	-.21	.43	.01	-3.72	-2.90		
EA(I) =	.00	-.52	-.03	1.09	.64	1.83	1.94	-2.72	-3.87		

F = .0167 TF50 = 41.6 AERF = 1.54 RAHF = 1.004
A = .0324 XP = .7287 TA50 = 42.7 AERA = 1.40 RAHA = 1.000

OBSERVATION WELL 7 I SURF EL = 6.31 DRAIN EL = 4.31 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.97	4.84	4.73	4.66	4.65	4.61	4.63	4.61	4.56	4.55	4.52
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	.66	.53	.42	.35							
HF(I) =	.66	.53	.44	.34							
HA(I) =	.66	.53	.44	.33							
RH(I) =	1.00	.80	.64	.53							
Y(I) =	.00	.20	.36	.47							
EF(I) =	.00	-.45	4.25	-3.65							
EA(I) =	.00	.29	5.33	-6.83							

F = .0373 TF50 = 18.6 AERF = 2.09 RAHF = 1.001
A = .0410 XP = .8694 TA50 = 17.8 AERA = 3.11 RAHA = 1.000

OBSERVATION WELL 7 D SURF EL = 5.91 DRAIN EL = 4.01 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.08	4.98	4.90	4.78	4.71	4.65	4.57	4.49	4.43	4.42	4.40
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.07	.97	.89	.77	.70	.64	.56				
HF(I) =	1.07	.97	.89	.80	.68	.64	.56				
HA(I) =	1.07	.96	.89	.80	.69	.64	.56				
RH(I) =	1.00	.91	.83	.72	.65	.60	.52				
Y(I) =	.00	.09	.17	.28	.35	.40	.48				
EF(I) =	.00	.05	.52	3.67	-3.09	-.68	-.35				
EA(I) =	.00	-1.34	-.33	3.81	-2.10	.34	-.16				

F = .0163 TF50 = 42.6 AERF = 1.19 RAHF = 1.001
A = .0254 XP = .7954 TA50 = 42.4 AERA = 1.15 RAHA = 1.000

TABLE A-38. ANALYSTS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATTONS, HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 14 I SURF EL = 6.10 DRAIN EL = 4.20 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.90	4.81	4.75	4.66	4.69	4.65	4.60	4.58	4.52	4.48	4.45
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.70	.61	.55	.46
HF(I) =	.70	.61	.54	.46
HA(I) =	.70	.61	.55	.46
RH(I) =	1.00	.87	.79	.66
Y(I) =	.00	.13	.21	.34
EF(I) =	.00	.07	-.98	.92
EA(I) =	.00	-.05	-.64	.83

F = .0228 TF50 = 30.4 AERF = .49 RAHF = 1.000
A = .0269 XP = .8750 TA50 = 28.2 AERA = .38 RAHA = 1.000

OBSERVATION WELL 14 D SURF EL = 5.98 DRAIN EL = 4.01 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.00	4.91	4.82	4.71	4.64	4.59	4.53	4.49	4.43	4.41	4.38
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.99	.90	.81	.70	.63	.58	.52
HF(I) =	.99	.89	.82	.73	.62	.58	.50
HA(I) =	.99	.88	.82	.73	.62	.58	.50
RH(I) =	1.00	.91	.82	.71	.64	.59	.53
Y(I) =	.00	.09	.18	.29	.36	.41	.47
EF(I) =	.00	-.57	1.56	4.45	-1.93	-.41	-2.92
EA(I) =	.00	-2.04	.62	4.54	-.98	.53	-2.96

F = .0168 TF50 = 41.2 AERF = 1.69 RAHF = 1.002
A = .0266 XP = .7903 TA50 = 41.0 AERA = 1.67 RAHA = 1.000

OBSERVATION WELL 15 I SURF EL = 6.14 DRAIN EL = 4.14 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.88	4.79	4.73	4.64	4.66	4.62	4.60	4.57	4.50	4.47	4.44
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.74	.65	.59	.50
HF(I) =	.74	.65	.58	.50
HA(I) =	.74	.65	.59	.50
RH(I) =	1.00	.88	.80	.68
Y(I) =	.00	.12	.20	.32
EF(I) =	.00	.14	-.86	.73
EA(I) =	.00	-.05	-.59	.76

F = .0214 TF50 = 32.4 AERF = .43 RAHF = 1.000
A = .0254 XP = .8750 TA50 = 30.1 AERA = .35 RAHA = 1.000

TABLE A-33. ANALYSIS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS. HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 15 D SURF EL = 6.07 DRAIN EL = 4.00 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.97	4.85	4.78	4.68	4.59	4.55	4.53	4.48	4.41	4.39	4.36
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.97	.85	.78	.68	.59
HF(I) =	.97	.87	.79	.69	.57
HA(I) =	.97	.85	.78	.69	.58
RH(I) =	1.00	.88	.80	.70	.61
Y(I) =	.00	.12	.20	.30	.39
EF(I) =	.00	1.77	.81	1.17	-3.66
EA(I) =	.00	.13	-.02	1.68	-2.09

F = .0191 TF50 = 36.3 AERF = 1.48 RAHF = 1.002
A = .0306 XP = .7750 TA50 = 36.8 AERA = .78 RAHA = 1.000

OBSERVATION WELL 16 I SURF EL = 5.95 DRAIN EL = 4.14 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.86	4.77	4.71	4.62	4.62	4.56	4.63	4.54	4.45	4.41	4.38
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.72	.63	.57	.48
HF(I) =	.72	.63	.56	.48
HA(I) =	.72	.63	.57	.48
RH(I) =	1.00	.87	.79	.67
Y(I) =	.00	.13	.21	.33
EF(I) =	.00	.11	-.92	.82
EA(I) =	.00	-.05	-.61	.79

F = .0221 TF50 = 31.4 AERF = .46 RAHF = 1.000
A = .0262 XP = .8750 TA50 = 29.1 AERA = .36 RAHA = 1.000

OBSERVATION WELL 16 D SURF EL = 6.14 DRAIN EL = 4.00 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.95	4.84	4.76	4.66	4.60	4.52	4.59	4.50	4.43	4.41	4.38
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.95	.84	.76	.66
HF(I) =	.95	.84	.76	.66
HA(I) =	.95	.84	.76	.66
RH(I) =	1.00	.88	.80	.69
Y(I) =	.00	.12	.20	.31
EF(I) =	.00	.13	-.01	-.11
EA(I) =	.00	.02	.22	-.27

F = .0203 TF50 = 34.1 AERF = .06 RAHF = 1.000
A = .0235 XP = .8892 TA50 = 31.1 AERA = .13 RAHA = 1.000

TABLE A-40. ANALYSIS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS, HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 22 I SURF EL = 5.91 DRAIN EL = 4.14 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.82	4.70	4.62	4.54	4.53	4.49	4.51	4.43	4.35	4.32	4.29
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.68	.56	.48	.40
HF(I) =	.68	.57	.49	.39
HA(I) =	.68	.56	.49	.39
RH(I) =	1.00	.82	.71	.59
Y(I) =	.00	.18	.29	.41
EF(I) =	.00	1.02	1.11	-2.10
EA(I) =	.00	.09	1.31	-1.69

F = .0307 TF50 = 22.6 AERF = 1.06 RAHF = 1.001
A = .0422 XP = .7967 TA50 = 22.3 AERA = .77 RAHA = 1.000

OBSERVATION WELL 22 D SURF EL = 5.98 DRAIN EL = 4.00 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.78	4.70	4.65	4.59	4.49	4.45	4.43	4.39	4.29	4.28	4.27
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.78	.70	.65	.59	.49	.45	.43
HF(I) =	.78	.71	.65	.58	.50	.47	.41
HA(I) =	.78	.70	.65	.59	.50	.47	.40
RH(I) =	1.00	.90	.83	.76	.63	.58	.55
Y(I) =	.00	.10	.17	.24	.37	.42	.45
EF(I) =	.00	1.14	.47	-1.14	1.28	3.38	-4.92
EA(I) =	.00	.31	.18	-.67	2.05	3.82	-6.17

F = .0161 TF50 = 42.9 AERF = 1.76 RAHF = 1.001
A = .0225 XP = .8308 TA50 = 41.7 AERA = 1.88 RAHA = 1.000

OBSERVATION WELL 23 I SURF EL = 5.83 DRAIN EL = 4.07 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.76	4.65	4.56	4.46	4.43	4.40	4.42	4.35	4.30	4.25	4.23
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.69	.58	.49	.39
HF(I) =	.69	.57	.49	.39
HA(I) =	.69	.58	.50	.38
RH(I) =	1.00	.84	.71	.57
Y(I) =	.00	.16	.29	.43
EF(I) =	.00	-1.25	.08	1.18
EA(I) =	.00	.09	1.35	-1.83

F = .0310 TF50 = 22.3 AERF = .63 RAHF = .999
A = .0295 XP = .9392 TA50 = 20.4 AERA = .82 RAHA = 1.000

TABLE A-41. ANALYSIS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS. HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 23 D SURF EL = 6.00 DRAIN EL = 3.90 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.77	4.68	4.64	4.54	4.46	4.41	4.35	4.29	4.23	4.22	4.19
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	.87	.78	.74	.64	.56	.51	.45	.39	.33		
HF(I) =	.87	.79	.73	.65	.55	.51	.45	.38	.34		
HA(I) =	.87	.78	.73	.66	.56	.53	.46	.37	.32		
RH(I) =	1.00	.90	.85	.74	.64	.59	.52	.45	.38		
Y(I) =	.00	.10	.15	.26	.36	.41	.48	.55	.62		
EF(I) =	.00	1.05	-1.91	1.08	-2.02	.73	.08	-2.05	3.16		
EA(I) =	.00	.35	-1.82	2.38	.27	3.10	1.50	-4.14	-3.76		

F = .0165 TF50 = 42.1 AERF = 1.34 RAHF = .999
A = .0231 XP = .8195 TA50 = 42.6 AERA = 1.92 RAHA = 1.000

OBSERVATION WELL 24 I SURF EL = 5.75 DRAIN EL = 4.07 D T D = 12 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.76	4.60	4.49	4.41	4.37	4.36	4.37	4.30	4.24	4.22	4.20
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	.69	.53	.42	.34							
HF(I) =	.69	.54	.43	.32							
HA(I) =	.69	.53	.44	.32							
RH(I) =	1.00	.77	.61	.49							
Y(I) =	.00	.23	.39	.51							
EF(I) =	.00	1.22	3.57	-4.61							
EA(I) =	.00	.22	4.12	-5.44							

F = .0419 TF50 = 16.5 AERF = 2.35 RAHF = 1.003
A = .0583 XP = .7661 TA50 = 16.5 AERA = 2.45 RAHA = 1.000

OBSERVATION WELL 24 D SURF EL = 5.84 DRAIN EL = 3.90 D T D = 12 MTS

T(I) =	.0	6.0	11.0	1 .0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.73	4.64	4.59	4.50	4.44	4.38	4.33	4.25	4.18	4.16	4.13
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	.83	.74	.69	.60	.54	.48	.43	.35			
HF(I) =	.83	.75	.69	.61	.52	.48	.42	.36			
HA(I) =	.83	.74	.68	.61	.53	.49	.43	.35			
RH(I) =	1.00	.89	.83	.72	.65	.58	.52	.42			
Y(I) =	.00	.11	.17	.28	.35	.42	.48	.58			
EF(I) =	.00	1.36	-.09	2.09	-4.19	.75	-1.74	1.97			
EA(I) =	.00	-.28	-1.09	2.28	-2.77	2.44	-.54	.42			

F = .0169 TF50 = 41.1 AERF = 1.52 RAHF = 1.001
A = .0276 XP = .7771 TA50 = 41.6 AERA = 1.23 RAHA = 1.000

TABLE A-42. ANALYSTS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS, HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 31 I SURF EL = 5.67 DRAIN EL = 4.00 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.06	4.86	4.71	4.52	4.41	4.39	4.36	4.30	4.36	4.31	4.27
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.06	.86	.71	.52	.41						
HF(I) =	1.06	.85	.71	.55	.39						
HA(I) =	1.06	.85	.73	.56	.36						
RH(I) =	1.00	.81	.67	.49	.39						
Y(I) =	.00	.19	.33	.51	.61						
EF(I) =	.00	-.73	.41	6.51	-5.81						
EA(I) =	.00	-.83	2.11	8.64	-12.88						

F = .0361 TF50 = 19.2 AERF = 2.69 RAHF = 1.002
A = .0472 XP = .7931 TA50 = 19.6 AERA = 4.89 RAHA = 1.000

OBSERVATION WELL 31 D SURF EL = 5.52 DRAIN EL = 3.90 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.81	4.67	4.58	4.47	4.65	4.58	4.42	4.31	4.24	4.19	4.16
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	.91	.77	.68	.57							
HF(I) =	.91	.78	.68	.57							
HA(I) =	.91	.77	.68	.57							
RH(I) =	1.00	.85	.75	.63							
Y(I) =	.00	.15	.25	.37							
EF(I) =	.00	.83	.03	-.85							
EA(I) =	.00	.01	.17	-.22							

F = .0265 TF50 = 26.2 AERF = .43 RAHF = 1.001
A = .0359 XP = .8117 TA50 = 25.7 AERA = .10 RAHA = 1.000

OBSERVATION WELL 32 I SURF EL = 5.67 DRAIN EL = 3.80 D T D = 49 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.13	4.90	4.77	4.60	4.45	4.61	4.63	4.61	4.56	4.55	4.52
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.33	1.10	.97	.80	.65						
HF(I) =	1.33	1.13	.98	.81	.62						
HA(I) =	1.33	1.10	.97	.82	.63						
RH(I) =	1.00	.83	.73	.60	.49						
Y(I) =	.00	.17	.27	.40	.51						
EF(I) =	.00	2.54	1.37	1.42	-5.15						
EA(I) =	.00	-.04	.29	2.48	-3.42						

F = .0275 TF50 = 25.2 AERF = 2.10 RAHF = 1.004
A = .0474 XP = .7235 TA50 = 26.0 AERA = 1.25 RAHA = 1.000

TABLE A-43. ANALYSTS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATTONS. HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 32 D SURF EL = 5.60 DRAIN EL = 3.90 D T D = 49 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.83	4.70	4.62	4.49	4.42	4.67	4.45	4.32	4.22	4.15	4.10
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.93	.80	.72	.59
HF(I) =	.93	.80	.71	.60
HA(I) =	.93	.80	.71	.60
RH(I) =	1.00	.86	.77	.63
Y(I) =	.00	.14	.23	.37
EF(I) =	.00	.29	-1.47	1.20
EA(I) =	.00	-.10	-1.15	1.53

F = .0246 TF50 = 28.2 AERF = .74 RAHF = 1.000
A = .0309 XP = .8453 TA50 = 26.9 AERA = .69 RAHA = 1.000

OBSERVATION WELL 33 I SURF EL = 5.83 DRAIN EL = 3.80 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.96	4.80	4.68	4.54	4.39	4.37	4.36	.00	.00	.00	.00
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	1.16	1.00	.88	.74	.59
HF(I) =	1.16	1.00	.88	.74	.58
HA(I) =	1.16	1.00	.89	.75	.57
RH(I) =	1.00	.86	.76	.64	.51
Y(I) =	.00	.14	.24	.36	.49
EF(I) =	.00	.09	.56	.66	-1.29
EA(I) =	.00	-.47	.97	1.70	-2.79

F = .0246 TF50 = 28.2 AERF = .52 RAHF = 1.001
A = .0324 XP = .8244 TA50 = 27.6 AERA = 1.19 RAHA = 1.000

OBSERVATION WELL 33 D SURF EL = 5.58 DRAIN EL = 4.00 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.77	4.64	4.54	4.44	4.30	4.45	4.37	4.25	4.17	4.12	4.10
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00

H(I) =	.77	.64	.54	.44	.30
HF(I) =	.77	.63	.54	.43	.31
HA(I) =	.77	.63	.55	.44	.30
RH(I) =	1.00	.83	.70	.57	.39
Y(I) =	.00	.17	.30	.43	.61
EF(I) =	.00	-.95	-.17	-2.35	3.57
EA(I) =	.00	-.89	1.54	-.07	-.79

F = .0324 TF50 = 21.4 AERF = 1.41 RAHF = .998
A = .0413 XP = .8098 TA50 = 21.8 AERA = .66 RAHA = 1.000

TABLE A-44. ANALYSIS OF DRAWDOWN DATA TO COMPUTE DRAINAGE CONSTANTS FOR THE BASIC EQUATIONS, HF = H1/EXP(T*F) AND HA = H1*(1-A*T**XP)

OBSERVATION WELL 41 I SURF EL = 5.01 DRAIN EL = 3.45 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	5.21	4.88	4.52	4.31	4.10	4.01	3.85	3.73	3.64	3.59	3.57
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.76	1.43	1.07	.86	.65	.56	.40	.28			
HF(I) =	1.76	1.41	1.17	.90	.62	.54	.40	.27			
HA(I) =	1.76	1.34	1.15	.93	.67	.57	.39	.19			
RH(I) =	1.00	.81	.61	.49	.37	.32	.23	.16			
Y(I) =	.00	.19	.39	.51	.63	.68	.77	.84			
EF(I) =	.00	-1.55	9.24	4.76	-4.46	-4.43	-.65	-2.16			
EA(I) =	.00	-6.09	7.55	8.28	2.70	2.23	-1.32	-32.02			

F = .0372 TF50 = 18.6 AERF = 3.41 RAHF = 1.008
A = .0773 XP = .6251 TA50 = 19.8 AERA = 7.52 RAHA = 1.000

OBSERVATION WELL 42 I SURF EL = 5.30 DRAIN EL = 3.00 D T D = 49 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.93	4.77	4.49	4.25	3.97	3.86	3.74	3.64	3.54	3.45	3.36
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.93	1.77	1.49	1.25	.97	.86	.74				
HF(I) =	1.93	1.67	1.48	1.25	.99	.90	.74				
HA(I) =	1.93	1.72	1.55	1.32	1.00	.87	.62				
RH(I) =	1.00	.92	.77	.65	.50	.45	.38				
Y(I) =	.00	.08	.23	.35	.50	.55	.62				
EF(I) =	.00	-5.56	-.48	.31	1.72	4.25	.02				
EA(I) =	.00	-3.10	3.86	5.52	3.09	1.63	-15.63				

F = .0240 TF50 = 28.9 AERF = 1.76 RAHF = .995
A = .0203 XP = .9510 TA50 = 29.1 AERA = 4.69 RAHA = 1.000

OBSERVATION WELL 43 I SURF EL = 5.43 DRAIN EL = 3.38 D T D = 24 MTS

T(I) =	.0	6.0	11.0	18.0	28.0	32.0	40.0	50.0	57.0	64.0	71.0
TI(I) =	.0	6.0	5.0	7.0	10.0	4.0	8.0	10.0	7.0	7.0	7.0
WL(I) =	4.94	4.66	4.51	4.29	4.06	3.98	3.82	.00	.00	.00	.00
R(I) =	.00	.00	8.00	.00	.00	1.00	7.00	7.00	21.00	10.00	9.00
H(I) =	1.56	1.28	1.13	.91	.68	.60	.44				
HF(I) =	1.56	1.30	1.12	.90	.67	.59	.46				
HA(I) =	1.56	1.28	1.12	.93	.69	.60	.43				
RH(I) =	1.00	.82	.72	.58	.44	.38	.28				
Y(I) =	.00	.18	.28	.42	.56	.62	.72				
EF(I) =	.00	1.52	-1.24	-.91	-2.20	-1.87	4.88				
EA(I) =	.00	-.20	-.91	2.06	1.16	-.27	-2.76				

F = .0305 TF50 = 22.8 AERF = 1.80 RAHF = .999
A = .0488 XP = .7316 TA50 = 24.0 AERA = 1.05 RAHA = 1.000

ARH(I)=	1.00	.86	.76	.64	.54	.50	.44	.34	.39
AY(I) =	.00	.14	.24	.36	.46	.50	.56	.66	.61

AVERAGES, F = .0250 AERF = 1.55 RATIO (ARAHF) = 1.001
AVERAGES, A = .0343 AXP = .8179 AERA = 2.04 RATIO (ARAHA) = 1.000
AVERAGES, ATF50 = 30.1 ATF5 = 27.7 ATA50 = 29.6 ATA5 = 26.4

TABLE A-45. ESTIMATE OF SALT IN FIRST METER OF SOIL PFFILE, LEACHING PLOTS C-1 TO C-4.

	JUNE 19, 1972	AUGUST 2, 1972	NOVEMBER 21, 1972	DECEMBER 19, 1972
RAIN SINCE JUNE 19, MM		22	438	450
LEACHING WATER APPLIED, MM		0	750	1000
TOTAL, RAIN AND WATER, MM		22	1188	1450
GYPSUM APPLIED IN JULY, TONS PER HECTARE		31.25		

PLOT	NO	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA
C-1	1	0	.00	.0	0.	20	6.19	13.5	9828.	15	7.29	5.7	3112.	20	8.12	6.8	4950.
	2	35	7.02	14.0	17836.	20	7.40	17.7	12886.	35	7.30	7.2	9173.	20	7.45	10.5	7644.
	3	20	6.80	13.5	9828.	30	7.18	14.2	15506.	20	7.22	6.5	4732.	30	7.22	7.8	8518.
	4	30	6.80	7.0	7644.	30	7.59	17.9	19547.	30	6.72	6.2	6770.	30	7.52	6.4	6989.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					41.54				57.77				23.79				28.10
C-2	1	15	6.95	19.0	10374.	20	7.35	12.2	8882.	15	6.99	5.0	2730.	20	7.10	6.0	4368.
	2	45	7.09	16.6	27191.	45	6.60	14.4	23587.	45	6.49	5.9	9664.	45	7.32	5.7	9337.
	3	40	7.57	7.5	10920.	15	7.50	13.0	7098.	40	6.71	7.2	10483.	15	7.50	6.5	3549.
	4	0	.00	.0	0.	20	7.39	19.0	13832.	0	.00	.0	0.	20	7.96	13.2	9610.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					48.48				53.40				22.88				26.86
C-3	1	15	6.68	14.1	7699.	30	7.09	9.8	10702.	15	7.02	4.3	2348.	30	7.72	8.5	9282.
	2	10	6.50	21.0	7644.	40	7.40	13.7	19947.	10	7.45	5.8	2111.	40	8.11	2.4	3494.
	3	10	6.76	17.9	6516.	30	7.70	8.4	9173.	10	8.01	2.5	910.	30	8.00	5.5	6006.
	4	35	7.00	17.0	21658.	0	.00	.0	0.	35	7.60	3.5	4459.	0	.00	.0	0.
	5	30	7.03	18.2	19874.	0	.00	.0	0.	30	7.87	5.5	6006.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					63.39				39.82				15.83				18.78
C-4	1	15	7.20	14.5	7917.	35	7.30	17.0	21658.	15	6.52	3.2	1747.	35	8.35	6.3	8026.
	2	25	7.41	15.5	14105.	35	6.10	15.7	20002.	25	7.20	3.5	3185.	35	6.91	11.1	14141.
	3	30	7.20	17.0	18564.	30	7.59	21.2	23150.	30	7.59	3.2	3494.	30	7.17	8.0	8736.
	4	30	7.04	12.9	14087.	0	.00	.0	0.	30	6.89	2.8	3058.	0	.00	.0	0.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					54.67				64.81				11.48				30.90

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS, OR ABOUT 15 TONS OF SALT IN FIRST METER PER HA.

TABLE A-46. ESTIMATE OF SALT IN FIRST METER OF SOIL PRFILE, LEACHING PLOTS D-1 TO D-4.

	JUNE 19, 1972	AUGUST 7, 1972	NOVEMBER 21, 1972	DECEMBER 19, 1972
RAIN SINCE JUNE 19, MM		22	438	450
LEACHING WATER APPLIED, MM		0	750	1000
TOTAL, RAIN AND WATER, MM		22	1188	1450
GYPSUM APPLIED IN JULY, TONS PER HECTARE		31.25		

PLOT	NO	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA
D-1	1	0	.00	.0	0.	30	6.60	19.0	20748.	0	.00	.0	0.	30	7.11	9.0	9828.
	2	40	6.59	15.0	21840.	10	7.70	14.2	5169.	40	6.61	8.9	12958.	10	7.65	8.6	3130.
	3	10	7.18	14.5	5278.	30	6.51	17.2	18782.	10	6.20	10.1	3676.	30	7.63	10.8	11794.
	4	20	6.90	9.4	6843.	25	6.01	16.0	14560.	20	6.19	10.1	7353.	25	7.23	11.4	10374.
	5	0	.00	.0	0.	0	.00	.0	0.	10	6.97	12.0	4368.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					48.52				62.78				35.44				36.97
D-2	1	15	7.40	23.6	12886.	20	6.20	14.0	10192.	15	6.96	6.3	3440.	20	7.03	5.1	3713.
	2	0	.00	.0	0.	15	6.30	13.0	7098.	0	.00	.0	0.	15	8.31	4.7	2566.
	3	30	7.50	12.2	13322.	30	6.30	14.2	15506.	0	.00	.0	0.	30	7.38	8.5	9282.
	4	55	7.30	6.5	13013.	5	6.25	16.0	2912.	45	6.68	9.0	14742.	5	6.51	10.3	1875.
	5	0	.00	.0	0.	30	6.51	14.0	15288.	0	.00	.0	0.	30	7.92	13.3	14524.
EST SALT, TONS IN TOP M/HA					39.22				51.00				30.30				31.96
D-3	1	10	7.30	32.0	11648.	15	6.21	20.0	10920.	15	6.99	7.8	4259.	15	7.41	8.4	4586.
	2	5	7.40	19.0	3458.	30	6.60	15.0	16380.	20	6.72	9.0	6552.	30	8.07	7.1	7753.
	3	20	7.30	12.2	8882.	25	6.89	10.0	9100.	40	7.45	4.0	5824.	25	7.25	3.7	3367.
	4	40	6.80	6.3	9173.	30	6.96	10.7	11684.	25	7.20	5.2	4732.	30	6.98	5.4	5897.
	5	25	6.80	3.4	3094.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					36.25				48.08				21.37				21.60
D-4	1	20	6.80	17.4	12667.	25	6.19	18.5	16835.	0	.00	.0	0.	25	7.32	18.6	16925.
	2	30	7.20	16.9	13455.	15	6.65	12.9	7043.	30	6.51	15.0	16380.	15	6.40	17.6	9610.
	3	50	6.90	9.5	17290.	20	7.40	9.3	6770.	30	6.29	7.5	8190.	20	7.31	15.0	10920.
	4	0	.00	.0	0.	30	6.80	14.6	15943.	0	.00	.0	0.	30	7.39	7.1	7753.
	5	0	.00	.0	0.	10	7.20	12.8	4659.	0	.00	.0	0.	10	7.27	8.4	3058.
EST SALT, TONS IN TOP M/HA					48.41				51.25				40.95				48.27

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS, OR ABOUT 15 TONS OF SALT IN FIRST METER PER HA.

TABLE A-47. ESTIMATE OF SALT IN FIRST METER OF SOIL PRFILE, LEACHING PLOTS C-5 TO C-8.

	JUNE 19, 1972	AUGUST 2, 1972	NOVEMBER 21, 1972	DECEMBER 19, 1972
RAIN SINCE JUNE 19, MM		22	438	450
LEACHING WATER APPLIED, MM		0	750	1000
TOTAL, RAIN AND WATER, MM		22	1188	1450

NO GYPSUM APPLIED

PLOT	NO	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA
C-5	1	15	7.50	16.5	9009.	20	6.60	12.0	8736.	15	7.22	2.4	1310.	20	7.87	5.3	3858.
	2	30	6.48	14.6	15943.	25	7.91	8.5	7735.	30	6.91	3.9	4259.	25	7.66	10.1	9191.
	3	30	6.90	21.6	23587.	30	6.30	11.0	12012.	30	6.32	3.9	4259.	30	8.10	8.0	8736.
	4	25	6.47	9.5	8645.	25	7.05	18.7	17017.	25	7.40	8.3	8008.	25	7.59	6.4	5824.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					57.18				45.50				17.84				27.61
C-6	1	0	.00	.0	0.	15	7.44	11.0	6006.	20	7.62	2.5	1820.	15	7.85	2.9	1583.
	2	50	6.98	10.5	19110.	15	7.20	13.9	7589.	50	7.20	6.9	12538.	15	8.75	2.2	1201.
	3	25	7.60	5.8	5278.	40	7.23	10.8	15725.	30	7.08	2.5	2730.	40	7.71	1.7	2475.
	4	0	.00	.0	0.	30	7.10	5.5	6006.	0	.00	.0	0.	30	7.89	2.3	2512.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					32.52				35.33				17.11				7.77
C-7	1	15	7.18	16.5	9009.	20	6.18	20.0	14560.	15	7.62	5.0	2730.	20	7.39	3.7	2694.
	2	0	.00	.0	0.	15	6.98	14.8	8081.	20	7.70	3.6	2621.	15	7.80	5.6	3058.
	3	20	6.35	14.0	10192.	15	6.51	8.0	4368.	20	7.42	3.9	2839.	15	7.87	2.5	1365.
	4	25	6.85	14.4	13104.	50	7.70	10.4	18928.	30	8.60	5.5	6006.	50	7.71	4.0	7280.
	5	0	.00	.0	0.	0	.00	.0	0.	15	7.17	2.3	1256.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					53.84				45.94				15.45				14.40
C-8	1	30	7.08	13.6	14851.	30	7.40	30.0	32760.	30	7.44	3.7	4040.	30	7.50	5.2	5678.
	2	5	7.08	13.6	2475.	25	6.29	23.3	21203.	5	6.51	5.8	1056.	25	7.51	4.3	3913.
	3	35	7.28	11.2	14269.	20	7.30	12.4	9027.	35	6.98	5.4	6880.	20	7.09	5.0	3640.
	4	5	7.09	13.9	2530.	25	7.60	16.2	14742.	25	7.70	6.4	5824.	25	7.69	4.9	4459.
	5	25	7.70	10.6	9646.	0	.00	.0	0.	5	6.52	6.4	1165.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					43.77				77.73				18.96				17.69

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS, OR ABOUT 15 TONS OF SALT IN FIRST METER PER HA.

TABLE A-48. ESTIMATE OF SALT IN FIRST METER OF SOIL PRFILE, LEACHING PLOTS D-5 TO D-8.

	JUNE 19, 1972	AUGUST 2, 1972	NOVEMBER 21, 1972	DECEMBER 19, 1972
RAIN SINCE JUNE 19, MM		22	438	450
LEACHING WATER APPLIED, MM		0	750	1000
TOTAL, RAIN AND WATER, MM		22	1188	1450

NO GYPSUM APPLIED

PLOT	NO	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA	DP CM	PH	EC MMHOS	SALT KG/HA
D-5	1	30	6.30	13.0	14196.	30	7.40	28.4	31013.	30	6.99	9.2	10046.	30	7.10	3.2	3494.
	2	15	6.80	11.5	6279.	25	7.06	26.9	24479.	15	7.51	9.1	4969.	25	7.91	4.2	3822.
	3	50	7.58	10.2	18564.	10	7.10	19.1	6952.	20	7.20	9.1	6625.	10	8.01	6.5	2366.
	4	5	7.38	9.0	1638.	35	7.19	16.9	21531.	0	.00	.0	0.	35	7.75	9.5	12103.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					40.68				83.97				33.29				21.79
D-6	1	20	7.40	17.4	12667.	25	7.20	17.5	15925.	20	7.24	3.5	2548.	25	8.28	2.5	2275.
	2	55	7.40	11.0	22022.	25	7.00	20.2	18382.	55	7.30	2.8	5606.	25	7.60	3.2	2912.
	3	25	7.01	5.8	5278.	20	6.35	15.9	11575.	25	6.99	2.9	2639.	20	8.23	2.3	1674.
	4	0	.00	.0	0.	30	7.40	9.6	10483.	0	.00	.0	0.	30	8.12	4.7	5132.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					39.97				56.37				10.79				11.99
D-7	1	30	7.29	20.5	22386.	15	7.52	19.8	10811.	30	7.40	1.5	1638.	15	7.90	5.5	3003.
	2	50	6.59	12.5	22750.	25	7.30	15.0	13650.	50	7.60	2.9	5278.	25	6.99	7.7	7007.
	3	20	7.40	7.9	5751.	30	6.60	11.5	12558.	0	.00	.0	0.	30	7.21	11.7	12776.
	4	0	.00	.0	0.	30	7.60	7.0	7644.	0	.00	.0	0.	30	7.98	3.9	4259.
	5	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					50.89				44.66				8.64				27.05
D-8	1	25	7.20	14.0	12740.	25	7.69	13.2	12012.	25	6.90	3.7	3367.	25	8.89	3.8	3458.
	2	0	.00	.0	0.	25	7.59	8.0	7280.	20	7.62	3.0	2184.	25	7.41	3.0	2730.
	3	25	7.10	11.3	10283.	25	6.58	12.5	11375.	25	7.63	3.2	2912.	25	7.60	3.7	3367.
	4	0	.00	.0	0.	15	6.70	9.5	5187.	10	7.60	4.0	1456.	15	9.10	6.9	3767.
	5	0	.00	.0	0.	10	7.29	9.3	3385.	20	7.90	3.9	2839.	10	8.01	4.0	1456.
EST SALT, TONS IN TOP M/HA					45.05				39.24				12.76				14.78

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS, OR ABOUT 15 TONS OF SALT IN FIRST METER PER HA.

TABLE A-49. ESTIMATE OF SALT IN FIRST METER OF SOIL PROFILE IN LEACHING PLOTS AFTER RICE HARVEST.
MAY 27-29, 1973

SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA
C-1	1	30	7.40	4.5	4914.	D-1	1	25	7.48	3.5	3185.	E-1	1	20	7.20	3.4	2475.
	2	5	8.98	4.3	787.		2	20	7.20	3.0	2839.		2	20	8.09	5.3	3858.
	3	35	7.30	6.6	8408.		3	25	7.50	3.1	2921.		3	40	6.90	.0	0.
	4	5	8.02	3.0	710.		4	10	7.75	3.0	1420.		4	20	6.80	9.5	6916.
	5	25	7.10	4.0	4459.		5	20	7.50	4.1	2985.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					19.27						13.25						13.25
EST. SALT, OCT. 19, 1972+					28.10						36.97						
CHANGE SINCE OCT. 19, 1972					-8.83						-23.72						
PCT. CHANGE SINCE 10-19-72					31.41						64.16						
C-2	1	15	7.98	1.0	546.	D-2	1	30	8.50	1.2	1310.	E-2	1	55	6.80	12.4	24825.
	2	20	8.28	2.0	1456.		2	50	8.30	1.0	1820.		2	5	6.50	14.7	2675.
	3	20	8.04	1.7	1238.		3	20	7.58	2.0	2111.		3	35	7.30	9.8	12485.
	4	30	7.40	2.2	2402.		0	0	.00	.0	0.		4	5	6.70	13.7	2493.
	5	15	8.20	2.7	1474.		0	0	.00	.0	0.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					7.12						5.24						42.48
EST. SALT, OCT. 19, 1972+					26.86						31.96						
CHANGE SINOF OCT. 19, 1972					-19.74						-26.72						
PCT. CHANGE SINCE 10-19-72					73.51						83.60						
C-3	1	20	8.10	4.7	3422.	D-3	1	20	8.26	8.0	5824.	E-3	1	20	7.89	7.3	5314.
	2	50	8.50	2.2	4004.		2	55	7.80	1.3	2603.		2	15	7.16	10.2	5559.
	3	25	8.18	2.8	2548.		3	25	8.25	2.7	2457.		3	10	6.90	11.1	4040.
	4	5	8.50	2.3	419.		0	0	.00	.0	0.		4	25	7.70	11.0	10010.
	0	0	.00	.0	0.		0	0	.00	.0	0.		5	30	6.98	10.7	11684.
EST SALT, TONS IN TOP M/HA					10.39						10.88						36.82
EST. SALT, OCT. 19, 1972+					18.78						21.60						
CHANGE SINCE OCT. 19, 1972					-8.39						-10.72						
POT. CHANGE SINCE 10-19-72					44.56						49.61						
C-4	1	15	8.35	1.8	983.	D-4	1	30	7.89	3.9	4259.	F-1	1	20	7.20	4.2	3058.
	2	30	7.70	1.7	1856.		2	15	6.98	3.7	2020.		2	15	6.72	8.5	4641.
	3	30	7.00	5.5	6006.		3	50	6.95	6.0	10920.		3	10	7.70	8.3	3021.
	4	25	7.60	2.3	2093.		4	5	7.40	5.8	1056.		4	25	6.60	10.7	9737.
	0	0	.00	.0	0.		0	0	.00	.0	0.		5	30	7.10	11.5	12558.
EST SALT, TONS IN TOP M/HA					10.94						18.25						33.01
EST. SALT, OCT. 19, 1972+					30.90						48.27						
CHANGE SINCE OCT. 19, 1972					-19.96						-30.02						
PCT. CHANGE SINCE 10-19-72					64.60						62.18						

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS

+ FROM TABLES A-45 TO A-48

TABLE A-49. CONT. ESTIMATE OF SALT IN FIRST METER OF SOIL PROFILE IN LEACHING PLOTS AFTER RICE HARVEST.
MAY 27-29, 1973

SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA
C-5	1	15	8.10	3.5	1911.	D-5	1	90	8.29	2.8	4077.	F-2	1	20	7.60	2.2	1602.
	2	25	8.12	1.8	1638.		2	70	6.90	4.6	5023.		2	10	7.58	3.5	1274.
	3	30	8.31	3.7	4040.		3	30	6.90	3.9	4259.		3	20	7.30	2.0	1456.
	4	25	8.72	2.3	2093.		0	0	.00	.0	0.		4	25	7.30	5.1	4641.
	5	5	7.92	3.2	582.		0	0	.00	.0	0.		5	25	7.40	7.7	7007.
EST SALT, TONS IN TOP M/HA					10.26						13.36						15.98
EST. SALT, OCT. 19, 1972+					27.61						21.79						
CHANGE SINCE OCT. 19, 1972					-17.35						-8.43						
PCT. CHANGE SINCE 10-19-72					62.82						38.69						
C-6	1	15	8.10	.9	491.	D-6	1	10	8.20	2.1	764.						
	2	10	7.50	.9	328.		2	5	7.69	2.1	382.						
	3	10	8.42	1.4	510.		3	20	8.35	3.2	2330.						
	4	35	7.70	2.1	1401.		4	40	8.40	4.4	6406.						
	5	30	8.30	1.6	1747.		5	25	8.28	1.7	1547.						
EST SALT, TONS IN TOP M/HA					4.48						11.43						
EST. SALT, OCT. 19, 1972+					7.77						11.99						
CHANGE SINCE OCT. 19, 1972					-3.29						-.56						
PCT. CHANGE SINCE 10-19-72					42.38						4.67						
C-7	1	15	8.48	2.9	1583.	D-7	1	15	7.19	2.3	1256.						
	2	45	7.80	2.5	4095.		2	10	8.45	3.8	1383.						
	3	40	8.40	1.4	2038.		3	30	7.20	5.0	5460.						
	0	0	.00	.0	0.		4	45	7.80	1.6	2621.						
EST SALT, TONS IN TOP M/HA					7.72						10.72						
EST. SALT, OCT. 19, 1972+					14.40						27.05						
CHANGE SINCE OCT. 19, 1972					-6.68						-16.33						
PCT. CHANGE SINCE 10-19-72					46.41						60.37						
C-8	1	15	8.20	1.6	874.	D-8	1	20	7.80	1.4	1019.						
	2	35	7.65	4.3	5478.		2	40	8.40	2.3	3349.						
	3	20	7.59	3.1	2257.		3	10	7.40	1.3	473.						
	4	30	8.60	6.1	6661.		4	20	7.98	1.0	728.						
	0	0	.00	.0	0.		5	10	8.40	2.9	1056.						
EST SALT, TONS IN TOP M/HA					15.27						6.62						
EST. SALT, OCT. 19, 1972+					17.69						14.78						
CHANGE SINCE OCT. 19, 1972					-2.42						-8.16						
PCT. CHANGE SINCE 10-19-72					13.68						55.18						
AV. SALT IN FIRST M, 5-73					10.68						11.22						28.88

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS + FROM TABLES A-45 TO A-48
** EC VALUE FOR D-5, 70 TO 100 CM TAKEN AS 3.9 INSTEAD OF REPORTED VALUE OF 13.9 WHICH IS BELIEVED TO BE IN ERROR

TABLE A-50. ESTIMATE OF SALT IN 2 METERS OF THE SOIL PROFILE IN LEACHING PLOTS
JUNE 19,1972

SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA
C-1	1	50	7.02	14.0	25490.	D-1	1	40	6.59	15.0	21840.
	2	35	7.02	14.0	17836.		2	40	6.59	15.0	21840.
	3	20	6.80	7.0	5096.		3	10	7.18	14.5	5278.
	4	45	6.80	7.0	11466.		4	20	6.90	9.4	6243.
	5	15	7.40	10.0	5460.		5	40	7.00	7.5	10920.
	6	35	6.98	6.9	8791.		6	50	7.20	5.5	10010.
EST SALT, TONS IN 2 M					74.13						76.73
C-2	1	15	6.95	19.0	10374.	D-2	1	15	7.40	23.6	12880.
	2	45	7.09	16.6	27191.		2	30	7.45	17.9	19547.
	3	50	7.57	7.5	13650.		3	30	7.50	12.2	13327.
	4	40	7.20	7.1	10338.		4	60	7.30	6.5	14196.
	5	50	7.39	5.0	3100.		5	65	7.60	4.9	11593.
EST SALT, TONS IN 2 M					70.65						71.54
C-3	1	15	6.68	14.1	7699.	D-3	1	10	7.70	32.0	11648.
	2	10	6.50	21.0	7644.		2	5	7.40	19.0	3458.
	3	10	6.76	17.9	6516.		3	20	7.30	12.2	8882.
	4	35	7.00	17.0	21658.		4	40	6.80	6.3	9173.
	5	45	7.03	18.2	29812.		5	75	6.80	3.4	4332.
	6	30	6.68	7.0	7644.		6	90	7.40	6.6	21622.
EST SALT, TONS IN 2 M					80.97						59.11
C-4	1	15	7.20	14.5	7917.	D-4	1	20	6.80	17.4	12667.
	2	25	7.41	15.5	14105.		2	30	7.20	15.9	18455.
	3	30	7.20	17.0	18564.		3	80	6.90	9.5	27664.
	4	45	7.04	12.9	21130.		4	40	7.58	7.0	10192.
	5	25	7.40	12.0	10920.		5	30	7.60	5.8	6334.
	6	60	6.85	9.5	20748.		0	0	.00	.0	0.
EST SALT, TONS IN 2 M					93.38						75.31
C-5	1	15	7.50	16.5	9009.	D-5	1	30	6.70	13.0	14196.
	2	30	6.48	14.6	15943.		2	15	6.80	11.5	6279.
	3	30	6.90	21.6	23587.		3	50	7.58	10.2	18564.
	4	65	6.47	9.5	22477.		4	40	7.38	9.0	13104.
	5	20	7.40	11.2	8154.		5	50	7.40	6.8	12376.
	6	40	7.28	6.1	8882.		6	15	7.60	4.0	2184.
EST SALT, TONS IN 2 M					88.05						66.70
C-6	1	15	6.98	10.5	5733.	D-6	1	20	7.40	17.4	12667.
	2	50	6.98	10.5	19110.		2	55	7.40	11.0	22022.
	3	25	7.60	5.8	5278.		3	35	7.01	5.8	7389.
	4	15	7.55	5.8	9500.		4	20	7.45	7.2	5242.
	5	50	7.45	7.0	12740.		5	30	7.60	8.4	9173.
	6	15	7.40	7.0	3822.		6	40	7.01	4.5	6552.
EST SALT, TONS IN 2 M					56.18						63.04
C-7	1	15	7.18	16.5	9009.	D-7	1	30	7.29	20.5	22386.
	2	40	6.75	15.2	22131.		2	50	6.59	12.5	22750.
	3	20	6.35	14.0	10192.		3	80	7.40	7.9	23005.
	4	30	6.85	14.4	15725.		4	40	7.60	3.8	5533.
	5	95	7.70	8.4	29047.		0	0	.00	.0	0.
EST SALT, TONS IN 2 M					86.10						73.67
C-8	1	30	6.41	15.4	16817.	D-8	1	25	7.20	14.0	12740.
	2	5	7.08	13.6	2475.		2	65	7.15	12.6	29812.
	3	35	7.28	11.2	14269.		3	25	7.10	11.3	10283.
	4	5	7.09	13.9	2530.		4	10	6.70	9.2	3349.
	5	60	7.70	10.6	23150.		5	50	7.18	8.0	14560.
	6	65	7.10	4.5	10647.		6	25	7.90	5.2	4732.
EST SALT, TONS IN 2 M					69.89						75.48
OVERALL AVERAGE IN TWO M					77.42						70.20

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS

TABLE A-51. ESTIMATE OF SALT IN 2 METERS OF THE SOIL PROFILE IN LEACHING PLOTS
MAY 27-29, 1973

SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC* MMHOS	SALT KG/HA
** EC VALUE FOR D-5, 70 TO 150 CM TAKEN AS 3.9 INSTEAD OF REPORTED 13.9 MMHOS											
C-1	1	30	7.40	4.5	4914.	D-1	1	25	7.48	3.5	3185.
	2	5	6.98	4.3	783.		2	20	7.20	3.9	2839.
	3	35	7.30	6.6	8408.		3	25	7.50	3.1	2821.
	4	5	8.02	3.9	710.		4	10	7.35	3.9	1420.
	5	60	7.10	4.9	10702.		5	50	7.50	4.1	7462.
	6	65	8.10	3.2	7571.		6	25	7.28	3.7	3367.
	0	0	.00	.0	0.		7	45	7.18	4.5	7371.
EST SALT, TONS IN 2 M					33.09						28.46
C-2	1	15	7.98	1.0	546.	D-2	1	30	8.50	1.2	1310.
	2	20	8.28	2.0	1456.		2	50	8.30	1.0	1820.
	3	20	8.04	1.7	1238.		3	20	7.58	2.9	2111.
	4	30	7.40	2.2	2402.		4	60	7.58	2.9	6334.
	5	60	8.20	2.7	5897.		5	40	7.80	1.4	2038.
	6	55	7.80	3.2	6406.		0	0	.00	.0	0.
EST SALT, TONS IN 2 M					17.95						13.61
D-3	1	20	8.10	4.7	3422.	D-3	1	20	8.25	8.0	5824.
	2	50	8.50	2.2	4004.		2	55	7.80	1.3	2603.
	3	25	8.18	2.8	2548.		3	35	8.25	2.7	3440.
	4	15	8.50	2.3	1256.		4	20	8.30	1.5	1092.
	5	30	7.30	4.7	5132.		5	30	8.31	1.5	1638.
	6	15	7.67	9.1	4969.		6	40	7.70	3.7	5387.
	7	45	8.20	2.1	3440.		0	0	.00	.0	0.
EST SALT, TONS IN 2 M					24.77						19.98
C-4	1	15	8.35	1.8	983.	D-4	1	30	7.89	3.9	4259.
	2	30	7.70	1.7	1856.		2	15	6.98	3.7	2020.
	3	30	7.00	5.5	6006.		3	50	6.95	6.0	10920.
	4	65	7.60	2.3	5442.		4	40	7.40	5.8	8445.
	5	20	8.40	2.8	2038.		5	50	8.10	3.1	5642.
	6	40	7.50	2.8	4077.		6	15	8.30	4.6	2512.
EST SALT, TONS IN 2 M					20.40						33.80
C-5	1	15	8.10	3.5	1911.	D-5	1	40	8.29	2.8	4077.
	2	25	8.12	1.8	1638.		2	30	6.90	4.6	5023.
	3	30	8.31	3.7	4040.	**	3	30	6.90	3.9	4259.
	4	65	8.72	2.3	5442.	**	4	50	6.90	3.9	7098.
	5	65	7.92	3.2	7571.		5	50	7.65	6.1	11102.
EST SALT, TONS IN 2 M					20.60						31.56
C-6	1	15	8.10	.9	491.	D-6	1	10	8.20	2.1	764.
	2	10	7.50	.9	328.		2	5	7.69	2.1	382.
	3	10	8.42	1.4	510.		3	20	8.35	3.2	2330.
	4	35	7.70	1.1	1401.		4	40	8.40	4.4	6406.
	5	75	8.30	1.6	4368.		5	15	8.28	1.7	928.
	6	25	8.20	1.9	1729.		6	50	7.80	3.6	6552.
	7	30	8.55	3.3	3604.		7	60	7.28	5.1	11138.
EST SALT, TONS IN 2 M					12.43						28.50
C-7	1	15	8.48	2.9	1583.	D-7	1	15	7.19	2.3	1256.
	2	45	7.80	2.5	4095.		2	10	8.45	3.8	1383.
	3	50	8.40	1.4	2548.		3	30	7.20	5.0	5460.
	4	40	8.35	1.0	1456.		4	60	7.80	1.6	3494.
	5	20	8.50	2.9	2111.		5	30	8.02	1.3	1420.
	6	30	8.32	2.8	3058.		6	30	8.02	2.6	2939.
	0	0	.00	.0	0.		7	25	7.70	4.6	4186.
EST SALT, TONS IN 2 M					14.85						20.04
C-8	1	15	8.20	1.6	874.	D-8	1	20	7.80	1.4	1019.
	2	35	7.05	4.3	5478.		2	40	8.40	2.3	3349.
	3	20	7.59	3.1	2257.		3	10	7.40	1.3	473.
	4	45	8.60	6.1	9992.		4	20	7.98	1.0	728.
	5	15	8.18	1.8	983.		5	60	8.40	2.9	6334.
	6	35	7.90	2.9	3695.		6	50	8.40	2.9	5278.
	7	35	7.50	3.4	4332.		0	0	.00	.0	0.
EST SALT, TONS IN 2 M					27.61						17.18
OVERALL AVERAGE IN TWO M					21.46						24.14

* MAXIMUM EC FOR NON-SALINE CLASSIFICATION = 4 MMHOS
** EC VALUE FOR D-5, 70 TO 150 CM TAKEN AS 3.9 INSTEAD OF REPORTED 13.9 MMHOS

TABLE A-52. CHANGES IN ESTIMATED SALT IN TWO M OF SOIL PROFILE.

		TONS/HA		TONS/HA
SALT PRESENT JUNE 19, 1972	C-1	74.13	D-1	76.73
SALT PRESENT MAY 27, 1973		33.09		28.46
CHANGE, 6-19-72 TO 5-27-73		-41.04		-48.27
PERCENT OF SALT PRESENT 6-19-72		55.36		62.91
SALT PRESENT JUNE 19, 1972	C-2	70.65	D-2	71.54
SALT PRESENT MAY 27, 1973		17.95		13.61
CHANGE, 6-19-72 TO 5-27-73		-52.70		-57.93
PERCENT OF SALT PRESENT 6-19-72		74.59		80.98
SALT PRESENT JUNE 19, 1972	C-3	80.97	D-3	59.11
SALT PRESENT MAY 27, 1973		24.77		19.98
CHANGE, 6-19-72 TO 5-27-73		-56.20		-39.13
PERCENT OF SALT PRESENT 6-19-72		69.41		66.20
SALT PRESENT JUNE 19, 1972	C-4	93.38	D-4	75.31
SALT PRESENT MAY 27, 1973		20.40		33.80
CHANGE, 6-19-72 TO 5-27-73		-72.98		-41.51
PERCENT OF SALT PRESENT 6-19-72		78.15		55.12
SALT PRESENT JUNE 19, 1972	C-5	88.05	D-5	66.70
SALT PRESENT MAY 27, 1973		20.60		31.56
CHANGE, 6-19-72 TO 5-27-73		-67.45		-35.14
PERCENT OF SALT PRESENT 6-19-72		76.60		52.68
SALT PRESENT JUNE 19, 1972	C-6	56.18	D-6	63.04
SALT PRESENT MAY 27, 1973		12.43		28.50
CHANGE, 6-19-72 TO 5-27-73		-43.75		-34.54
PERCENT OF SALT PRESENT 6-19-72		77.87		54.79
SALT PRESENT JUNE 19, 1972	C-7	86.10	D-7	73.67
SALT PRESENT MAY 27, 1973		14.85		20.04
CHANGE, 6-19-72 TO 5-27-73		-71.25		-53.63
PERCENT OF SALT PRESENT 6-19-72		82.75		72.80
SALT PRESENT JUNE 19, 1972	C-8	69.89	D-8	75.48
SALT PRESENT MAY 27, 1973		27.61		17.18
CHANGE, 6-19-72 TO 5-27-73		-42.28		-58.30
PERCENT OF SALT PRESENT 6-19-72		60.50		77.24
OVERALL AVERAGE, JUNE 19,1972	C P	77.42	D P	70.20
OVERALL AVERAGE, MAY 27,1973		21.46		24.14
CHANGE, 6-19-72 TO 5-27-73		-55.96		-46.06
PERCENT OF SALT PRESENT 6-19-72		72.28		65.61

** BASED ON EC OF 3.9 MMHOS INSTEAD OF REPORTED 13.9 FOR D-5, N3

TABLE A-53. CHANGES IN ESTIMATED SALT IN SECOND M OF SOIL PROFILE

			TONS/HA		TONS/HA
SALT IN SECOND M	6-19-72	C-1	32.59	D-1	28.21
SALT IN SECOND M	5-27-73		13.82		15.21
CHANGE, 6-19-72 TO 5-27-73			-18.77		-13.00
PERCENT OF SALT PRESENT 6-19-72			-57.59		-46.08
SALT IN SECOND M	6-19-72	C-2	22.17	D-2	32.32
SALT IN SECOND M	5-27-73		10.83		8.37
CHANGE, 6-19-72 TO 5-27-73			-11.34		-23.95
PERCENT OF SALT PRESENT 6-19-72			-51.15		-74.10
SALT IN SECOND M	6-19-72	C-3	17.58	D-3	22.86
SALT IN SECOND M	5-27-73		14.38		9.10
CHANGE, 6-19-72 TO 5-27-73			-3.20		-13.76
PERCENT OF SALT PRESENT 6-19-72			-18.20		-60.19
SALT IN SECOND M	6-19-72	C-4	38.71	D-4	26.90
SALT IN SECOND M	5-27-73		9.46		23.55
CHANGE, 6-19-72 TO 5-27-73			-29.25		-3.35
PERCENT OF SALT PRESENT 6-19-72			-75.56		-12.45
SALT IN SECOND M	6-19-72	C-5	30.87	D-5	26.02
SALT IN SECOND M	5-27-73		10.52		18.20
CHANGE, 6-19-72 TO 5-27-73			-20.35		-7.82
PERCENT OF SALT PRESENT 6-19-72			-65.92		-30.05
SALT IN SECOND M	6-19-72	C-6	23.66	D-6	23.07
SALT IN SECOND M	5-27-73		7.84		17.07
CHANGE, 6-19-72 TO 5-27-73			-15.82		-6.00
PERCENT OF SALT PRESENT 6-19-72			-66.86		-26.01
SALT IN SECOND M	6-19-72	C-7	32.26	D-7	22.78
SALT IN SECOND M	5-27-73		7.13		9.32
CHANGE, 6-19-72 TO 5-27-73			-25.13		-13.46
PERCENT OF SALT PRESENT 6-19-72			-77.90		-59.09
SALT IN SECOND M	6-19-72	C-8	26.12	D-8	29.43
SALT IN SECOND M	5-27-73		11.89		10.56
CHANGE, 6-19-72 TO 5-27-73			-14.23		-18.87
PERCENT OF SALT PRESENT 6-19-72			-54.48		-64.12
AVERAGE SALT IN 2ND M 6-19-72		C P	28.00	D P	26.46
AVERAGE SALT IN 2ND M 5-27-73			10.78		12.92
AVG. CHANGE, 6-72 TO 5-73			-17.22		-13.54
AV. PCT. OF SALT ON 6-19-72			61.50		51.17

** BASED ON EC OF 3.9 MMHOS INSTEAD OF REPORTED 13.9 FOR D-5, N3

TABLE A-54. ESTIMATED PERCENT SALT IN SECOND M OF SOIL PROFILE

			TONS/HA		TONS/HA
SALT IN SECOND M	6-19-72	C-1	32.59	D-1	28.21
SALT IN SECOND M	5-27-73		13.82		15.21
PCT. SALT IN SECOND M	6-19-72		43.96		36.77
PCT. SALT IN SECOND M	5-27-73		41.76		53.44
SALT IN SECOND M	6-19-72	C-2	22.17	D-2	32.32
SALT IN SECOND M	5-27-73		10.83		8.37
PCT. SALT IN SECOND M	6-19-72		31.38		45.18
PCT. SALT IN SECOND M	5-27-73		60.33		61.50
SALT IN SECOND M	6-19-72	C-3	17.58	D-3	22.86
SALT IN SECOND M	5-27-73		14.38		9.10
PCT. SALT IN SECOND M	6-19-72		21.71		38.67
PCT. SALT IN SECOND M	5-27-73		58.05		45.55
SALT IN SECOND M	6-19-72	C-4	38.71	D-4	26.90
SALT IN SECOND M	5-27-73		9.46		23.55
PCT. SALT IN SECOND M	6-19-72		41.45		35.72
PCT. SALT IN SECOND M	5-27-73		46.37		69.67
SALT IN SECOND M	6-19-72	C-5	30.87	D-5	26.02
SALT IN SECOND M	5-27-73		10.52		18.20
PCT. SALT IN SECOND M	6-19-72		35.06		39.01
PCT. SALT IN SECOND M	5-27-73		51.07		57.67
SALT IN SECOND M	6-19-72	C-6	23.66	D-6	23.07
SALT IN SECOND M	5-27-73		7.84		17.07
PCT. SALT IN SECOND M	6-19-72		42.11		36.60
PCT. SALT IN SECOND M	5-27-73		63.07		59.89
SALT IN SECOND M	6-19-72	C-7	32.26	D-7	22.78
SALT IN SECOND M	5-27-73		7.13		9.32
PCT. SALT IN SECOND M	6-19-72		37.47		30.92
PCT. SALT IN SECOND M	5-27-73		48.01		46.51
SALT IN SECOND M	6-19-72	C-8	26.12	D-8	29.43
SALT IN SECOND M	5-27-73		11.89		10.56
PCT. SALT IN SECOND M	6-19-72		37.37		38.99
PCT. SALT IN SECOND M	5-27-73		43.06		61.47
AVERAGE SALT IN 2ND M	6-19-72	C P	28.00	D P	26.46
AVERAGE SALT IN 2ND M	5-27-73		10.78		12.92
AV. PCT. SALT, 2ND M	6-19-72		36.17		37.69
AV. PCT. SALT, 2ND M	5-27-73		50.23		53.52

** BASED ON EC OF 3.9 MMHOS INSTEAD OF REPORTED 13.9 FOR D-5, N3

TABLE A-55. YIELD ANALYSIS FOR LEACHING PLOT STUDY, HARVEST DATE, 5/22-23/73.

PLOT NO.	TREAT-MENT	PLOT ROWS*	SIZE AREA+	PLANTS SHOWING NORMAL DEVELOPMENT		YIELD EQUIV. AREA		PLOT YIELD TOTAL AREA	
			SQ M	M IN ROWS	EQUIV AREA	GRAMS	TONS/HA	GRAMS	TONS/HA
C-1	GYPSUM	24	16	7.77	1.295	331	2.553	1316	0.823
C-2		23	16	2.98	0.518	206	3.967	2011	1.257
D-1	DIST-	24	16	0.00	0.000	0	0.000	1083	0.677
D-2	TURBED	24	16	24.27	4.045	1083	2.677	2563	1.602
TREATMENT TOTALS AND AVERAGES++					5.858	1619	2.764	6973	1.090
C-3	GYPSUM	24	16	37.90	6.317	2483	3.931	3900	2.439
C-4		23	16	29.52	5.134	1878	3.657	3752	2.345
D-3	NOT	23	16	18.22	3.169	1490	4.730	2704	1.690
D-4	DISTURB.	24	16	16.02	2.670	599	2.240	1282	0.801
TREATMENT TOTALS AND AVERAGES					17.290	6458	3.735	11641	1.819
C-5	NO GYP-	23	16	35.24	6.129	1933	3.154	3022	1.889
C-6	SUM	23	16	50.73	8.823	3574	4.051	4131	2.582
D-5	DIST-	24	16	24.46	4.410	2181	4.946	4439	2.775
D-6	TURBED	24	16	52.02	8.670	3769	4.347	5025	3.141
TREATMENT TOTALS AND AVERAGES					28.032	11457	4.087	16618	2.597
C-7	NO GYP-	24	16	41.02	6.837	2895	4.234	3450	2.156
C-8	SUM	23	16	45.59	7.929	2636	3.324	3416	2.135
D-7	NOT	24	16	21.93	3.655	1984	5.428	3862	2.414
D-8	DISTURB.	24	16	0.00	0.000	0	0.000	1813	1.133
TREATMENT TOTALS AND AVERAGES++					18.421	7515	4.079	12541	1.960
OVERALL TOTALS AND AVERAGES++					69.601	27049	3.886	47777	1.866

* 24 ROWS = 96 METERS IN 16 SQ M PLOT.
* 23 ROWS = 92 METERS IN 16 SQ M PLOT.

+ PLOT AREA = 4 M X 4 M = 16 SQ M.
++ FOR PLOTS WITH DATA.

TABLE A-56. ESTIMATE OF SALT IN FIRST METER OF SOIL PROFILE, RICE PADDIES. BEFORE LEACHING, FEBRUARY 15-16, 1977 *

SAMPLE SITE	NO	DP CM	PH	EC MMHOS	SALT KG/HA	SAMPLE SITE	NO	DP CM	PH	EC MMHOS	SALT KG/HA
A-1	1	15	7.40	21.9	29893.	B-1	1	15	6.70	34.0	46410.
	2	20	7.20	10.2	19564.		2	15	7.22	21.0	28665.
	3	25	6.75	8.0	18200.		3	20	7.48	14.5	39585.
	4	20	7.20	3.8	6910.		4	30	7.70	6.0	16380.
	5	20	6.90	7.5	13650.		5	10	7.50	6.5	5915.
EST SALT, TONS IN TOP M/HA					87.22						136.95
A-2	1	30	7.60	22.8	62244.	B-2	1	20	7.51	20.2	47684
	2	10	7.60	14.4	13104.		2	20	7.15	11.5	28930.
	3	25	7.08	5.3	12057.		3	15	7.10	8.1	11056.
	4	20	7.50	6.3	11466.		4	45	7.40	4.6	18877.
	5	15	7.10	13.9	18973.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					117.84						99.51
A-3	1	20	7.30	6.6	15652.	B-3	1	15	6.61	19.4	26481.
	2	25	7.20	6.1	13877.		2	25	6.70	11.5	26162.
	3	30	7.28	5.8	15834.		3	30	6.90	12.1	33033.
	4	25	6.90	20.9	47547.		4	30	7.19	4.9	13104.
EST SALT, TONS IN TOP M/HA					92.91						99.78
A-4	1	15	6.80	9.0	12285.	B-4	1	30	6.70	17.5	47775.
	2	15	6.90	7.9	10783.		2	15	7.01	12.3	17199.
	3	25	7.40	3.9	8872.		3	40	7.40	6.5	23660.
	4	30	7.10	10.1	27573.		4	15	7.55	12.9	17472.
	5	15	7.00	15.0	20475.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					79.99						106.11
A-5	1	25	6.81	7.0	15929.	B-5	1	25	7.04	21.7	49367.
	2	15	6.80	5.7	7780.		2	25	7.25	7.6	17290.
	3	30	7.01	4.8	13104.		3	35	7.05	7.5	23887.
	4	15	7.05	5.3	7234.		4	15	7.18	12.5	17199.
	5	15	6.58	10.9	14878.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					58.92						107.74
A-6	1	15	6.80	13.7	18700.	B-6	1	30	6.61	18.5	50778.
	2	10	7.30	8.5	7735.		2	30	6.78	9.1	24843.
	3	25	6.91	5.4	12285.		3	25	7.59	5.0	11375.
	4	20	6.90	4.7	8554.		4	15	7.80	5.5	7507.
	5	30	6.90	4.0	10920.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					58.19						94.50
A-7	1	15	6.55	6.4	8736.	B-7	1	25	7.60	20.7	47092.
	2	30	7.15	3.9	10647.		2	30	7.10	7.0	19110.
	3	30	7.20	3.5	9555.		3	20	7.42	4.9	8918.
	4	15	6.95	2.8	3822.		4	15	7.30	9.0	12285.
	5	10	7.20	3.0	2730.		5	10	7.60	6.3	5733.
EST SALT, TONS IN TOP M/HA					35.49						93.14
A-8	1	15	6.80	12.0	16380.	B-8	1	20	7.50	17.6	32032.
	2	10	6.95	7.5	6825.		2	20	7.19	5.4	14742.
	3	25	7.30	4.9	11147.		3	20	6.93	4.9	13377.
	4	25	7.05	1.7	3867.		4	20	7.42	11.9	21658.
	5	25	7.30	3.4	7735.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					45.95						81.81
A-9	1	20	7.10	18.5	33670.	B-9	1	20	7.10	8.4	15288.
	2	20	6.80	7.7	14014.		2	25	7.18	3.5	7962.
	3	25	7.29	5.2	11830.		3	30	6.98	4.6	12558.
	4	20	7.20	3.0	5460.		4	25	7.40	6.4	14560.
	5	15	6.91	7.7	10510.		0	0	.00	.0	0.
EST SALT, TONS IN TOP M/HA					75.48						50.37
AV. SALT, TONS IN TOP M/HA					72.45						96.43

* BASED ON 1 TO 1 EXTRACTS INSTEAD OF SATURATION EXTRACTS