HYDROGEOLOGIC EVALUATION

OF THE

COOK NUCLEAR PLANT, BRIDGMAN, MICHIGAN

Prepared for
Indiana Michigan Power Company

Prepared by
American Electric Power Service Corporation

December 1991

CCVD 12/4/91

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* Trade Mark

Introduction

A hydrogeologic study has been prepared to evaluate the potential impacts resulting from the discharge of the turbine room sump (TRS) effluent to the plant's TRS absorption pond. This report defines the aerial and vertical extent of the aquifer based upon a review of previous hydrologic studies. The baseline groundwater quality is derived from a review of the previous Dames & Moore hydrogeologic study and the upgradient observation well of the current NPDES monitoring program.

The NPDES groundwater monitoring program does indicate an increase in total dissolved solids, sulfate and sodium concentrations above baseline quality concentrations downgradient of the absorption pond. These parameters are used as key indicator parameters to determine the areal extent of influence upon the shallow aquifer resulting from the discharge to the TRS pond.

An additional hydrogeologic investigation was implemented in May 1991 to address concerns raised by the Michigan DNR that seepage from the TRS absorption pond to the underlying aquifer may have migrated off-site and potentially degraded

groundwater resources beneath adjacent properties. The investigation included the drilling of four new monitoring wells along Livingston Road (the plant's southern property boundary). The migration of the TRS effluent plume and subsequent attenuation was also evaluated by analyzing a number of groundwater samples collected by the Hydropunch sampling method. The results of this investigation indicate that the TRS plume has dispersed and/or attenuated to acceptable concentrations along Livingston Road.

Topography

The site is located within a local physiographic area known as the Grand Marais Embayment. This area, 16 miles long and with an average width of about 1 mile, lies adjacent and parallel to the shoreline of Lake Michigan in western Berrien County. The area adjacent to the beach is characterized by high sand dunes of Pleistocene and Recent origin. The area is bounded on the east by a glacial moraine which parallels the shoreline and is known as Covert Ridge. The area east of Covert Ridge is a glacial plain, with morainic ridges. (Figure No. 1).

Topographic relief within the dune area ranges from 580 ft. NGVD which is the elevation of Lake Michigan, to a high of slightly more than 800 ft. NGVD. In the southern part of the embayment, the area of high dunes extends from the lake shore to the crest of Covert Ridge. To the north, however, the belt of high dunes is separated from Covert Ridge by Thornton Valley and the Grand Marais Lakes. The higher sand dunes extend inland about 3,000 feet from the beach. The eastern portion of the site is characterized by scattered lower dunes with broader intervening flat lowlands or basins, some of which contain small shallow ponds. The crest lines of the dune ridges and the floors of the enclosed basins are essentially horizontal.

Geology

The site geology consists of a sequence of deposits comprised of a surface deposit of dune sand which overlies older beach sand which in turn is underlain by glacial lake clays, glacial till and shale bedrock. In the eastern half of the property, the beach sands are absent and the dunes rest directly on glacial lake deposits.

The dune sands are light brown to tan, poorly graded, fine to medium sands that commonly are loose at and near the surface and grade to moderately compact at depth. In the

eastern half of the site (Borings 12 and 18) the dune sands directly overlie glacial lake sediments. In this area, the upper 10 to 20 feet of lake sediments are often silty and sandy. Figure No. 1 depicts boring locations.

In the western portion of the site, the dune sands overlie beach sands which are generally coarser grained and not as uniformly graded. In places, the beach deposits contain a small percentage of fine gravel. The beach sands may be a bar-type of deposit, probably related to an old shoreline of Lake Michigan. The maximum thickness of the beach sand is about 52 feet in the southern portion of the site. In the west-central portion of the property near the lake, the beach sands generally range from about 25 to 35 feet in thickness.

Underlying the beach sands and/or the dune sands is a thick sequence of glacial lake sediments. These glacio-lacustrine deposits, which are approximately 80 to 90 feet thick, consist generally of gray silty clay and sandy clay with occasional sand and silt partings. Varve-type bedding is not typical but does occasionally occur in places. The deposits exhibit considerable variation in detailed characteristics between borings and comprise an irregularly interbedded series of sediments.

The top few inches of the lake sequence often is marked by a considerable amount of organic material which in place is concentrated in peaty layers one or two inches in thickness. The layer immediately beneath the organic soil generally contains an abundance of gastropod shells. Throughout most of the site, the upper five to ten feet of lake deposits consists of silty or sandy soil with varying amounts of dispersed organic material and decayed vegetation. At greater depth, the lake deposits consists of silty clay with occasional lenses containing coarse sand and fine gravel. Lenses of silty sand and sandy silt are also common. The deepest part of the lake sequence is commonly a clayey silt deposit.

A compact glacial till of silt and gravel with cobbles was encountered at a depth of about 118 feet in Boring 19. This stratum, is about 22 feet, is probably continuous across the site and fills in any depressions in the underlying bedrock.

Boring 19 was advanced 12 1/2 feet into the underlying bedrock. The rock was encountered at a depth of 140 feet and consists of gray, thin-bedded to fissile, calcareous shale containing thin interbeds of impure, shaley limestone. The shale is horizontally bedded and is cut by two sets of

cemented joints. One set of joints is vertical and the other set is inclined 60 degrees from the horizontal. The rock appears to correlate with the Berea-Bedford shale, a lower Mississippian formation.

Hydrogeology

Covert Ridge is a groundwater barrier as well as a watershed boundary between the glacial plain to the east and the Grand Marais Embayment to the west. Static water levels east of the ridge are generally at an elevation of 650 ft. NGVD. In contrast, static water levels west of the ridge occur generally at elevations of 580 to 610 ft. NGVD.

Test borings and water level measurements at the site indicate that the aquifer is unconfined. The aquifer is comprised of the dune sands and beach sands. This unconfined aquifer overlies low permeable glaciolacustrine clays and silts that extend to a stratum of glacial till overlying shale bedrock. The base of the shallow aquifer is delineated as the stratigraphic contact between the sandy beach deposits and the lacustine clay deposits.

The surface of the lake clays slopes upward gradually from elevations of about 555 to 560 ft. NGVD along the beach to about an elevation of 589 ft. NGVD at the location of Boring 14 in the southeast corner of the site (Figures 2, 3 and 4).

Groundwater is recharged by the infiltration of precipitation through the permeable, sandy surficial soils. The average annual precipitation for Benton Harbor Airport located approximately 12 miles from the plant, is 36.04 inches/year (Table No. 1). Surface runoff is limited to minor quantities and is restricted to the northeast and east portion of the site. Basins of interior drainage and closed depressions characterize most of the site.

Initial site investigation observed static water levels ranging from 582 to 609 ft. NGVD inside perforated plastic pipe installed in the 19 test borings (Table No. 2). A generalized potentiometric map which characterizes baseline conditions is depicted in Figure No. 5. The groundwater elevations reflect to some extent the irregular topography of the dunes and basins. The direction of groundwater flow is toward the west to Lake Michigan. Of significance, is the preferred direction of groundwater flow towards the control area of the plant site (i.e. RP Well Nos. 4, 5 and 6) indicating a discharge area from the shallow aquifer into Lake Michigan.

Short duration pumping tests were performed to determine values of permeability across the site. These pumping tests indicated that permeability values would range from 115 to 196 ft/day (4.06×10^{-2} to 6.91×10^{-2} cm/sec) assuming an aquifer thickness of 30 feet. This pump test data is referenced in Appendix No. 1.

Groundwater Quality Baseline Conditions

The baseline groundwater quality reflects the solubility of minerals present in the aquifer and the residence time of the water in contact with various minerals. An analysis of the plant's two drinking water wells in March 1972 yielded a calcium bicarbonate type water with an average total dissolved solids concentration of 390 mg/l. Chloride and sulfate concentrations of the plant's former potable supply wells are also presented in Table No. 3 and reflect concentrations similar to baseline conditions reported by the previous Dames & Moore site investigation. It is reasonable to extrapolate the analysis of the potable supply wells to establish the concentration of the dominant cations and anions (Ca, Mg, NA, HCO_3, SO_4 & Cl) in the groundwater quality baseline. Figure 6 illustrates the relationship between the dominant cations and anions for the March 1972 analysis.

The water quality of the upgradient Well No. 8 provides a contrast in water quality between groundwater upgradient of the TRS pond and groundwater that is downgradient and has been influenced by seepage from the the TRS pond.

Groundwater Monitoring Program

Two separate groundwater monitoring programs are active at the plant. The radiological protection program is comprised of 7 monitoring wells for the plant and 4 monitoring wells for the temporary steam generator storage facility. These wells are used to monitor the shallow aquifer for radiological parameters.

The NPDES groundwater monitoring program is composed of eight wells at four sites. Two wells are located at each site where one well is equipped with a submersible pump to obtain water samples and the other well to be used to observe static water levels. Four additional monitoring wells were drilled as part of this site investigation to supplement the NPDES monitoring program. Plate No. 1 lists the specifications for both the radiological protection (RP) and environmental monitoring wells. Well logs are contained in Appendix No. 2. Drawing No. CE-SK-3/25/91-2 depicts the location of the observation wells with respect to the plant's absorption pond, sanitary ponds and the plant's former potable supply wells.

The absorption pond creates a groundwater mound and superimposes a radial flow pattern from the pond center on the regional flow regime. The monthly average discharge to the absorption pond is 0.46 MGD and ranges from 0.13 MGD to 0.84 MGD (Table No. 4). Table No. 4 also lists the static water levels, TDS and SO_4 concentrations for the period of record from November 1976 to October 1990.

Drawing No. CE-SK-3/25/91-2 depicts a water table map based on static water level measurements observed on October 30, 1990 (Table No. 5). The water table map is also, in part, inferred from the ponded dune swales. The configuration of the water table is also reflective of the static water levels measured in the hollow stem augers during the Hydropunch™ sampling program for May-August, 1991.

The direction of groundwater flow was also indirectly modified by the installation of sheet piling in 1973-74 along Lake Michigan to control beach erosion. This piling was driven into the low permeable lacustrine deposits and created a barrier to ground-water flow. Ponding occurred behind this barrier and eventually spilled over the piling and flowed again to Lake Michigan. Several drains were cut in the piling in order to alleviate the ponding of groundwater.

Well hydrographs for observation wells Nos. 1A, 8, 11, and 12 are depicted in Figure No. 7. The well hydrographs depict fluctuating water levels in response to a non-uniform discharge rate, seasonal evapotranspiration, and precipitation etc. For example, field data recorded in 1983 depicts a decline in water levels and is probably due to a precipitation deficit of nearly 7 inches. A similar decline is noted for the 1988 drought.

Groundwater Quality - Operational Monitoring Program

Significant variations occur between upgradient and downgradient wells for the parameters pH, COD, TDS, Na, Cl, SO_4 and Hardness. Downgradient wells reflect a water quality similar to the water quality of the effluent discharged to the Absorption Pond.

Time dependent graphs of sulfate (SO_4) and total dissolved solids (TDS) concentrations demonstrate the influence of the absorption pond on the aquifer system. The monthly average TDS concentration of the wastewater has varied from 300 mg/l to 1100 mg/l over the period of record. Similar concentrations of total dissolved solids are observed in the downgradient observation wells Nos. 11 and 12 (Figure No.

8). The average monthly sulfate (SO_4) concentration of the wastewater has generally ranged from 100 to 330 mg/1. Similar concentrations and time dependent trends are observed in downgradient observation well Nos. 11 and 12 (Figure No 9).

Sulfate concentrations for observation well No. 8 are generally less than 50 mg/1 and show no significant departure from baseline groundwater quality conditions. Sulfate concentrations reported for baseline conditions in the Dames & Moore study ranged from 22 to 38 mg/1 SO_4.

In 1983, there was an operational change to improve the steam generation water quality by more frequent flushing and increasing the volume of makeup water. A result of this operation is a significant increase in the number of regenerations of the demineralizers. The anion beds are recharged with a caustic solution (NaOH) and the cation beds are recharged with an acidic solution (H_2SO_4). This operational change is reflected in the monitoring program by the increase in TDS, and sulfate concentrations.

The water quality of observation Well No. 1A from July, 1977 to March 1982 is very similar to baseline quality due to its location and screened interval. After March 1982, Observation Well 1A is influenced by the overflow from the

absorption pond into the remaining portion of the dune swale. This is indicated by a steady increase in sulfate concentrations (Plate No. 2). By comparison concentrations at the upgradient observation Well No. 8 have ranged from less than detection to 200 mg/l and have averaged 22.3 mg/l.

Hydropunch™ Data & New Monitoring Wells

Groundwater samples were collected via a special sampling device referred to as Hydropunch and from four new monitoring wells drilled along Livingston Road. The Hydropunch sampler is a stainless steel and Teflon™ sampling tool that is capable of collecting a representative ground water sample (approximately 500 ml) without requiring the installation of a ground water monitoring well. The Hydropunch sampler was connected to AW drill rods and driven to the desired sampling depth using a 140 lb hammer. As the tool is advanced, it remains in the closed position, which prevents soil or water from entering the Hydropunch sampling chamber (Figure No. 10).

Once the desired sampling depth is obtained, the tool is opened to the aquifer by pulling up the drill rods approximately 1.5 feet (0.46m). In the open position, ground water can flow freely into the sample chamber of the

tool (under in-situ hydrostatic pressure). When the sample chamber is full, the Hydropunch is pulled to the surface. As the tool is retracted, check valves close and trap the ground water in the sample chamber.

At the surface the sample was transferred from the Hydropunch sampler to a polyethylene sample container. The Hydropunch samples were taken at various depths (up to five discrete sample depths) across the project site to allow vertical profiling of the aquifer. The Hydropunch sampling and drilling started on May 4, 1991 and was completed on August 26, 1991. The location of the sampling sites was restricted to existing access roads and thus precluded any disturbance of the sand dunes.

Groundwater samples collected by this method were analyzed for field parameters of pH, temperature and specific conductivity by the AEP drilling crew. Select samples were analyzed for major indicator water quality parameters (TDS, sulfate & sodium). The data is contained in Appendix No. 3.

Three cross-sections were prepared to illustrate the dispersion and attenuation of the TRS absorption pond effluent. The monitoring wells were sampled for TDS, sodium and sulfate (Table No. 6) and were also included in the

evaluation of the Hydropunch data. (Figure No. 11). The minimum detection value was used as the concentration value where the data was reported as such.

The cross-sections illustrating the vertical distribution of sodium and sulfate concentrations were developed using SYSTAT/SYGRAPH 5.0, a data management and graphic computer software package. This software package was also used to illustrate the spatial distribution of sodium and sulfate concentration in plan view at various depths within the aquifer. The isopleth contours were generated using a distance weighted least squares smoothing subroutine for the cross-sections and an inverse squared distance smoothing subroutine for the plan view.

Cross-section number 1, identified as Cut #1 in Figures No. 12 and No. 13 includes HP (Hydropunch) Nos. 3, 2, 17, 13, 14 and 26 (Table No. 7). The cross-section ordinate begins at HP No. 3 (located at the TRS pond) and continues northeast away from the absorption pond approximately 2,500 feet. Figure No. 12 shows that the sulfate concentrations diminish to within drinking water standards within 800 feet of the absorption pond (sulfate standard is currently 250 mg/l). Figure No. 13 supports this finding for sodium concentrations.

Cross-section number 2, identified as Cut #2 in Figures No. 14 and No. 15 includes HP Nos. 18, 19, 20, 21, 22, 23, well Nos. 1A, HP 24 and 25 (Table No. 8). The cross-section ordinate begins at HP No. 18 (an upgradient site) and continues northwest to monitoring well 1A, then southwest to HP No. 25 (approximately 2000 feet). Figure No. 14 shows that the sulfate concentrations are within the drinking water standards within 1000 feet downgradient of monitoring well 1A. Figure No. 15 supports this finding.

Cross-section number 3, identified as Cut #3 in Figures No. 15 and No. 17 includes environmental monitoring well number 16 and HP Nos. 15, 16, 4, 8, 5, 6, 9, 10, 11, 12, 13, 14, and 26 (Table No. 9). The cross-section ordinate begins at environmental monitoring well No. 16 (an upgradient well site) and continues northwest approximately 5000 feet. Figure No. 16 shows all the sulfate concentrations to be within drinking water standards. Figures No. 16 and No. 17 do indicate, however, anomalous sources of sodium and sulfate in the vicinity of HP Nos. 4 and 8 and HP 12 upgradient of the absorption pond. However, we know of no company operations in these areas that would contribute to sodium and sulfate.

Environmental monitoring wells installed along Livingston Road, the plant boundary, show that sulfate and TDS are within drinking water standards. (Table No. 6). Therefore,

we conclude that there is no negative impact to off-site groundwater resources as a result of TRS absorption pond discharges from the Cook Nuclear Plant. Figures No. 18 through No. 27, which are plan views of the sodium and sulfate concentrations at various descending elevations, support this conclusion. The x, y (o,o) ordinate cartesian grid corresponds to the State plane coordinates of E 1,392,560 & N 178,500, without any rotation of the axis.

Potable Supply Wells

Potable supply wells are located approximately 1,400 feet north of the absorption pond. These wells serve as a source of drinking water for plant personnel and the visitor center from 1970 to 1987. (The plant is now served by municipal water from Lake Township.) Potable Well No. 2 is located downgradient of the Absorption Pond based upon the existing flow regime. Potable Well No. 1 is located about 300 feet further inland and is located near a large sand dune which may exert local groundwater mounding.

The wells were sampled two to three times a year for several parameters (Table No. 10 and No. 11). Figures No. 28 and No. 29 depict time dependent graphs of Ca, Mg, Na, HCO_3, and Cl expressed in milliequivalents per liter (meq/l). A calcium bicarbonate type water characteristic of baseline conditions is exhibited by both wells from 1976 to early

1979. In August 1979, potable Well No. 2 experienced a change in water quality to a sodium sulfate type water (Figure No. 28) and reflects the influence of the absorption pond.

Potable Well No. 1 experienced a marginal shift in water quality (Figure No. 29) and is affected by the absorption pond to a lesser degree than Well No. 2. Sulfate concentrations for Well No. 2 have occasionally exceeded the drinking water limits of 250 mg/1 and consistently exceeds the total dissolved solids limit of 500 mg/1. Well No. 1, however, does not exceed either of these limits.

Conclusions

The Cook Nuclear Plant is sited within a groundwater basin bounded by Lake Michigan to the west and Covert Ridge (a terminal end moraine) to the east. The aquifer is unconfined and is composed of beach sands overlain by sand dunes and underlain by low permeable lacustrine clays. Construction of the sheet piling and the Absorption Pond has modified existing ground-water flow directions. Discharge to absorption pond has created a groundwater mound which superimposed a radial flow pattern on the regional flow towards Lake Michigan. A significant departure from baseline conditions has been observed in the

upgradient observation Well No. 8 and is attributed to an anomalous increase in chloride concentration. The Hydropunch sampling program also detected an anomalous concentration of sodium and sulfate upgradient of the TRS pond.

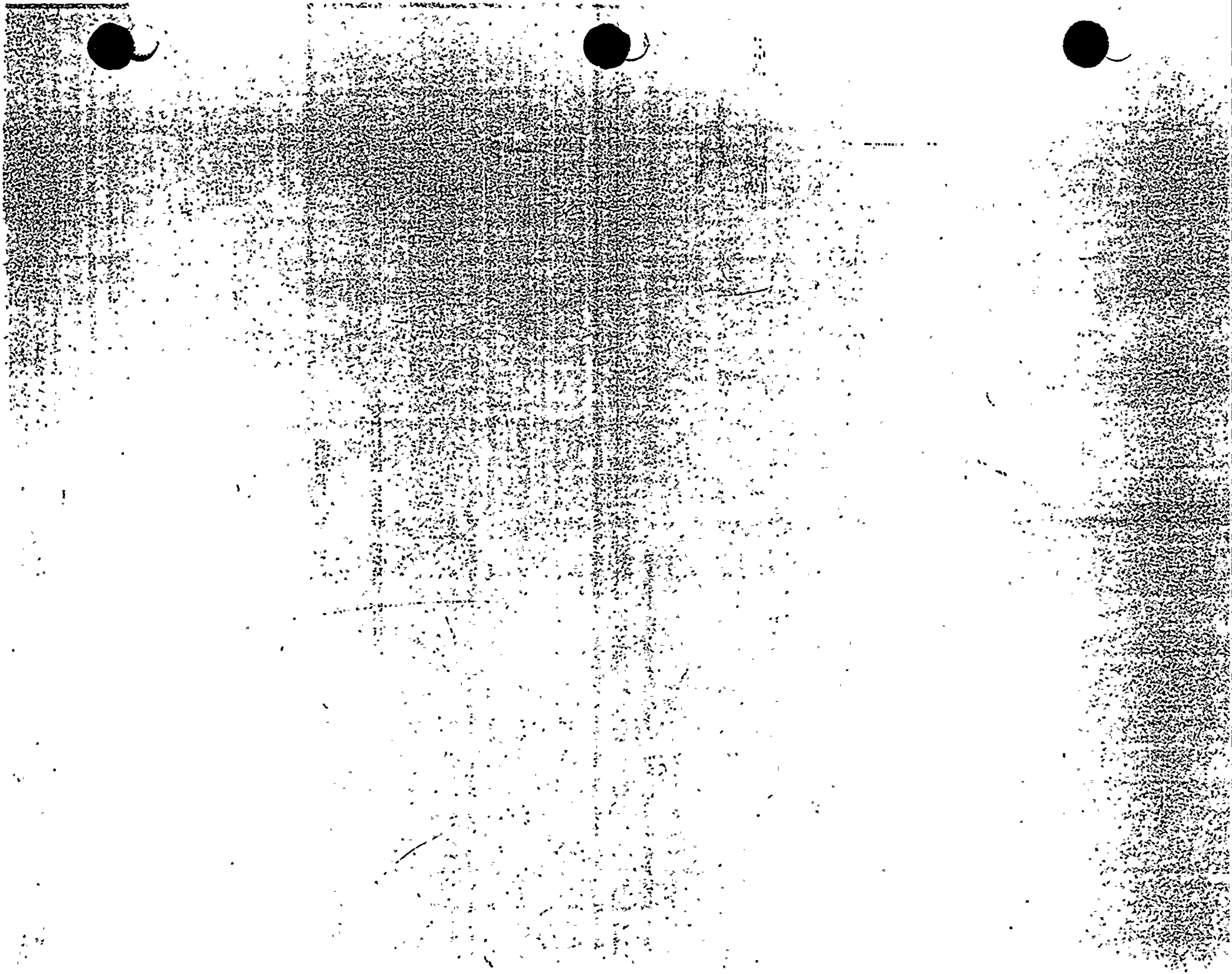
Total dissolved solids and sulfate concentrations have increased above baseline conditions downgradient of the absorption pond as a result of the effluent discharge. Similar water quality changes were observed in the plant's former potable Well No. 2 and marginal changes were observed in the former potable Well No. 1. The northern areal extent of the TRS effluent is bracketed between the plants former potable supply wells and R. P. Wells No. 1 and No. 2.

The downgradient observation Wells Nos. 11 and 12 and former potable supply Well No. 2 detect the influence of the TRS pond as groundwater flows into Lake Michigan.

The southern areal extent of the TRS pond effluent appears to be bracketed by observation Wells 1A and the recently installed monitoring wells drilled along Livingston Road. The concentration of key indicator parameters (TDS, SO_4 & Na) does indicate that the TRS pond effluent plume has migrated to Livingston Road. The plume, however, has dispersed and/or attenuated to acceptable levels based on the first round of sampling and the Hydropunch data.

Appendix No. 1

Aquifer Pump Test Data



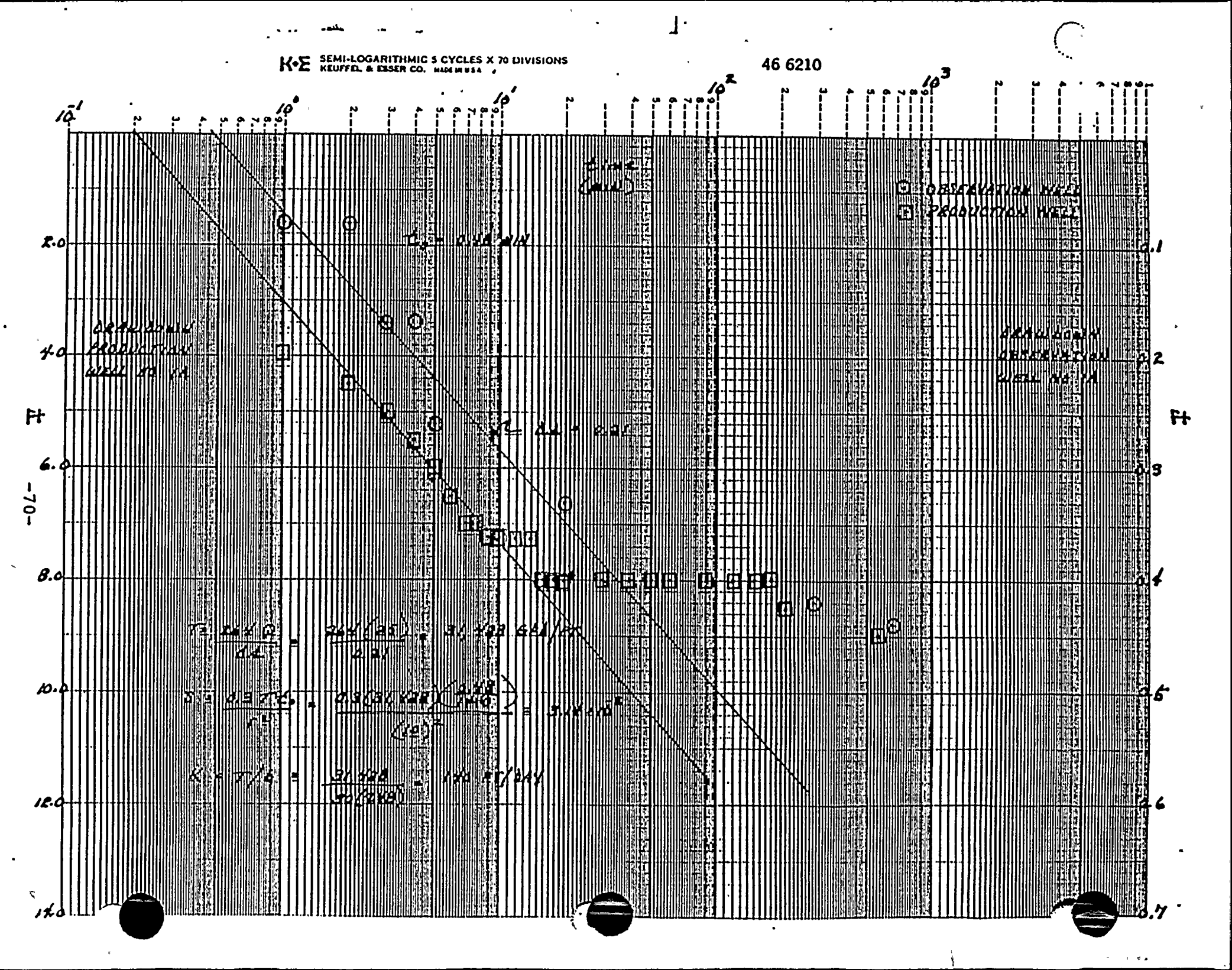
Summary of

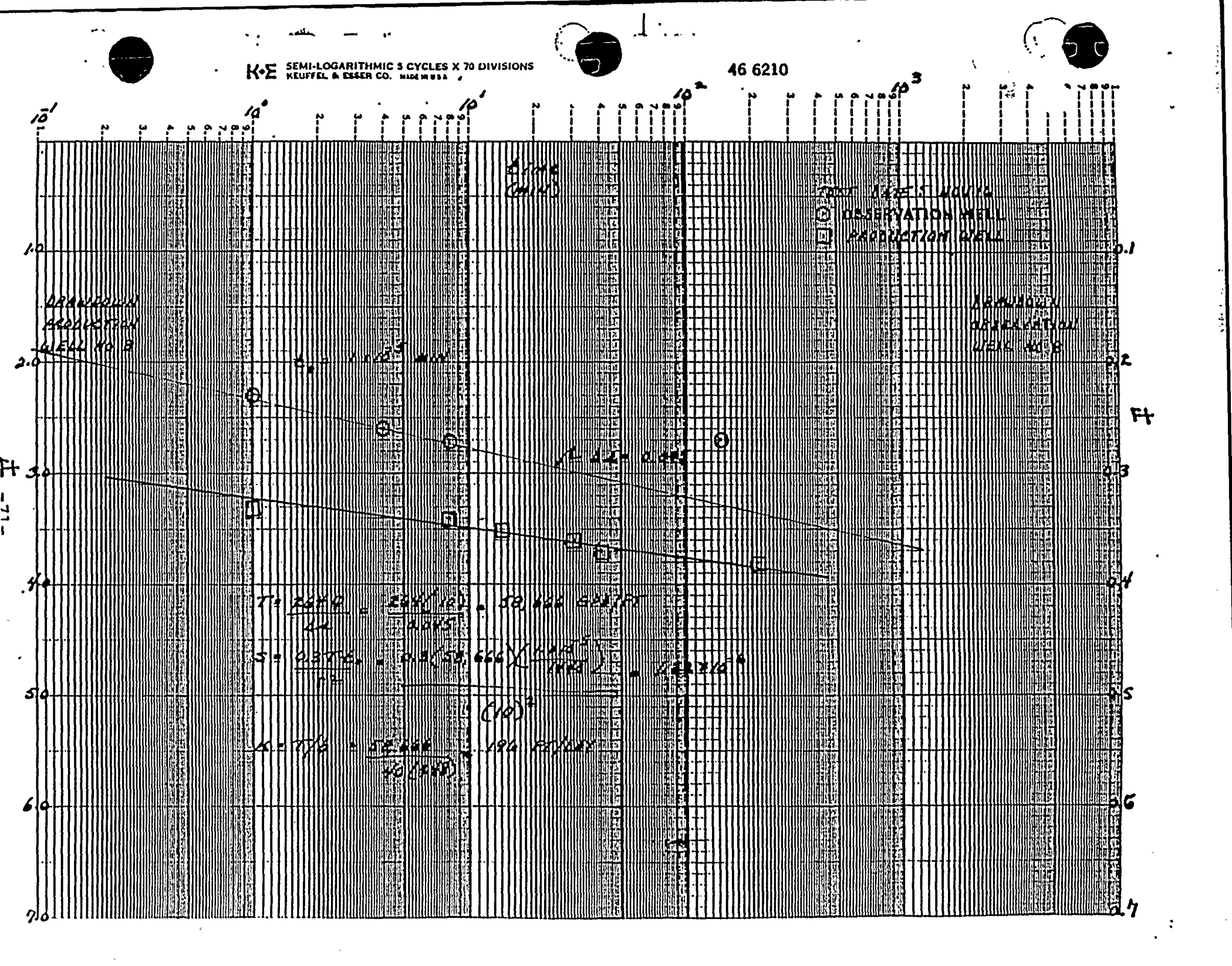
Aquifer Pump Test Data

OBS WELL No.	Q (gpm)	r (ft)	T (gpd/ft)	k (ft/day)	S	Analytical Method
8	10	10	58,666	196	1.22×10^{-6}	Jacob
1A	25	10	31,428	140	3.14×10^{-7}	Jacob
11	25	9.5	36,666	163	5.07×10^{-3}	Jacob
12	25	10	25,882	115	3.50×10^{-1}	Jacob
AVERAGE			38,160	153.5		

Notes:

1. The drawdown for each production well is plotted on semi-logarithmic paper for comparison with the drawdown observed in the respective observation well.
2. The permeability is derived from the transmissivity, T, divided by the aquifer thicknesses. The aquifer thickness at observation well No. 8 is estimated to be 40 ft. and 30 ft. for the remaining observation wells.
3. Data Source: Donald C. Cook Nuclear Plant, Annual Environmental Operating Report, 1981.


K•E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
OBSERVATION WELL
PRODUCTION WELL
DRAWDOWN
PRODUCTION WELL
DRAWDOWN
OBSERVATION WELL
ft
ft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KEUFFEL & ESSER CO.
46 6210
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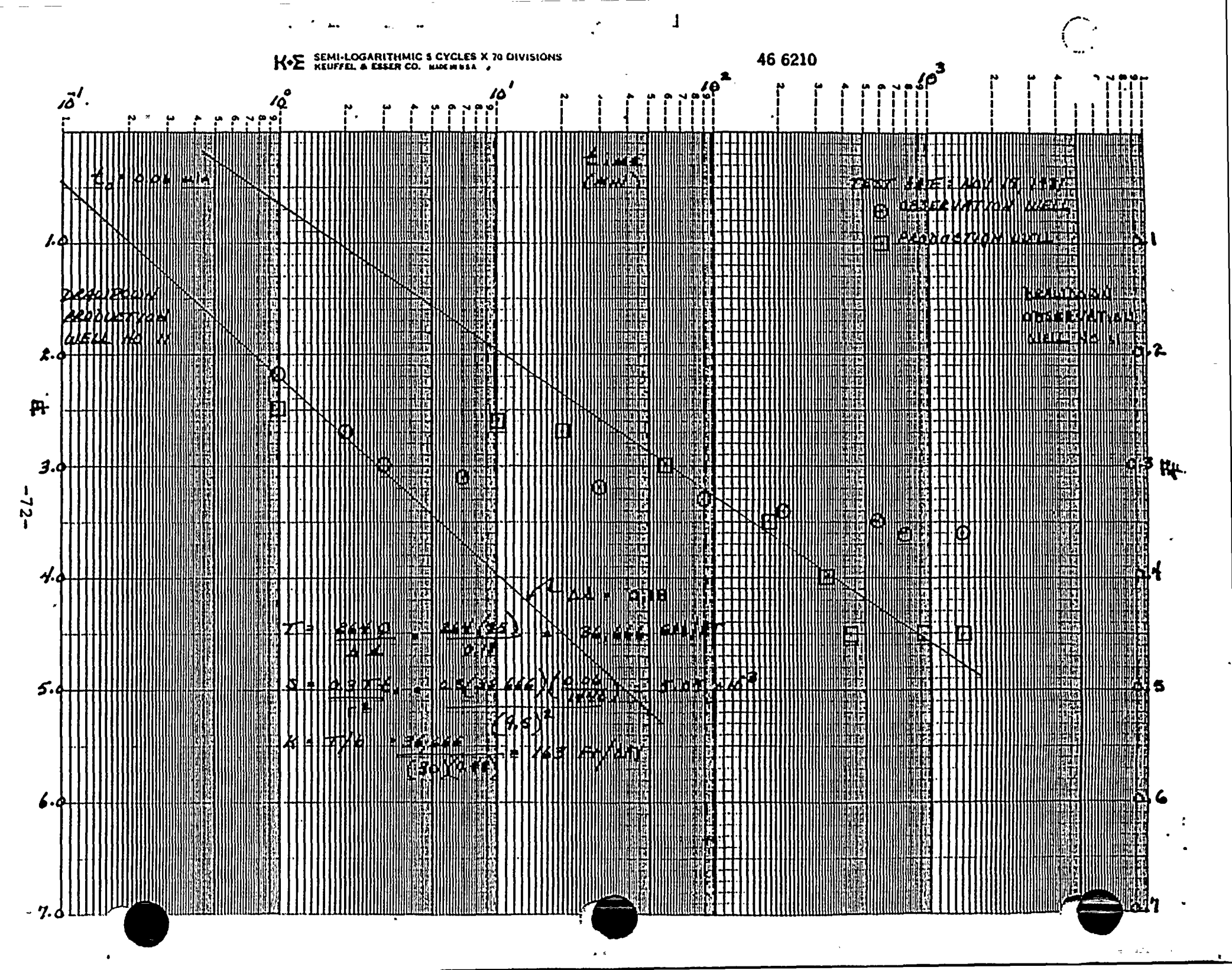
PRODUCTION WELL
DRAWDOWN
PRODUCTION
WELL NO 2
RECOVERY
OBSERVATION
WELL NO 8
Ft
- 11 -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KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
DEFLECTION REDUCTION CURVE NO. 11
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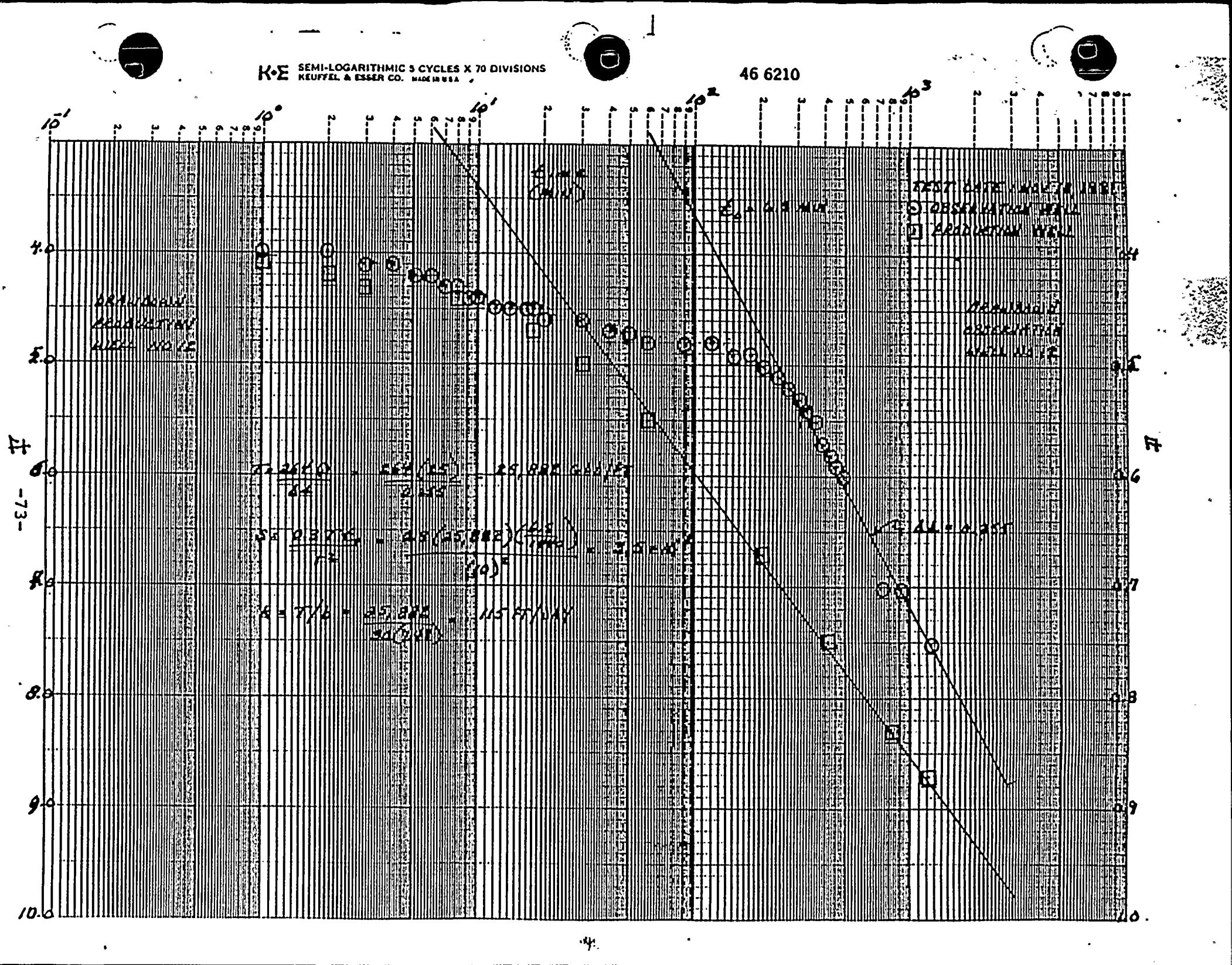
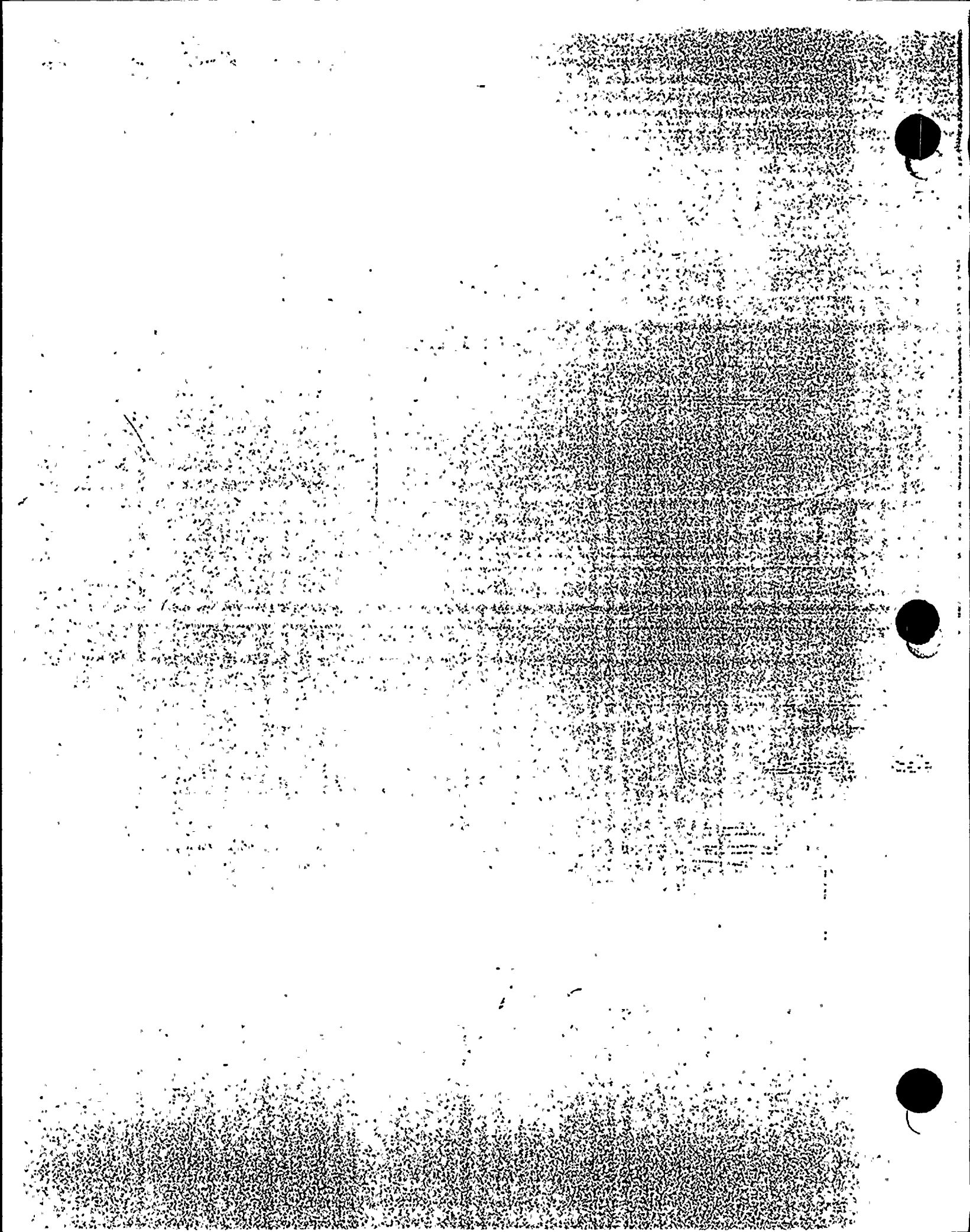

K·E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210

Appendix No. 2

Well Logs



AEP
INDIANA MICHIGAN POWER

Date March 13, 1991

Subject Lake Township Monitoring Well

MAR 15 1991

From J. E. Oetken

To J. T. Massey-Norton

The following information pertains to the Lake Township monitoring well:

Well depth:	12 feet (approximate)
Screen length:	3.5 feet
Casing diameter:	2 inches
Casing type:	Galvanized
Installation method:	Driven
Sealing method:	Bentonite
Backfill:	None

The ground and casing elevations have not been determined.

If you require any additional information in order to incorporate this well into your hydrogeologic study, feel free to call me at X1326.

c: D. M. Fitzgerald

Intra-System

PIEZOMETER INSTALLATION REPORT

Project I+M D.C. Cook Steam Generator Storage SGR-5		
Piez. Type observation well	Depth. 29.4	Riser Desc. 2" PVC
Mat'l @ Tip Sand	Sample #	Boring Dia. 4"
Method of Installation H W Casing		
Type of Grnd Protection 6" Steel Pipe set in Grout		
Grnd Elev. 621.90	Riser Elev. 634.36	Piez Tip Elev. 594.5
Filter Material Sand	from Elev. 614.50	to Elev. 594.5
Seal Material No. Seal	from Elev. —	to Elev. —
Installed By Roush - Bumgarner		
Date Installed 9-1-87	Date Tested 10-1-87	

Method of Testing Piez.

Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water

REMARKS

Valclay Grout 619.6 - 614.50

Water Elevation 604.90 9-2-87

" " 605.60 10-1-87

.01 Screen slot

No Bentowite Seal installed - Per. J.T. Massey - Norton

PIEZOMETER INSTALLATION REPORT

Project Tom D.C. Cook Steam Generator Storage SGR-4		
Piez. Type observation well	Depth.	Riser Desc. 2" pvc
Mat'l @ Tip Sand	Sample #	Boring Dia. 4"
Method of Installation HW Casing		
Type of Grnd Protection 6" steel Pipe Set in Grout		
Grnd Elev. 614.05	Riser Elev. * 616.21	Piez Tip Elev. 584.05
Filter Material Sand	from Elev. 604.05 to Elev. 584.05	
Seal Material Bentonite	from Elev. 604.55 to Elev. 604.05	
Installed By Roush - Burmeister		
Date Installed 9-2-87	Date Tested 10-1-87	

Method of Testing Piez.

Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water

REMARKS

Valclay Grout 611.65 - 604.55

Water Elevation 606.05 one (1) Hr after installation

" " 10-1-87 606.01

.01 screen. slot

* Riser elevation taken from top of steel protector

PIEZOMETER INSTALLATION REPORT

Project I-m D.C. Cook Steam Generator Storage SER-2

Piez. Type observation well	Depth.	Riser Desc. 2" PVC
Mat'l @ Tip Sand	Sample #	Boring Dia. 4"

Method of Installation HW Casing

Type of Grnd Protection 6" Steel Pipe Set in Grout

Grnd Elev. 614.82	Riser Elev. 617.32	Piez Tip Elev. 584.82

Filter Material Sand from Elev. 604.82 to Elev. 584.82

Seal Material Bentonite from Elev. 605.32 to Elev. 604.82

Installed By Roush - Bumgarner

Date Installed 8-27-87	Date Tested 10-1-87

Method of Testing Piez. Pump Test

Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water

REMARKS

Valclay Grout 612.52 - 605.32

Water Elevation 9-2-87 606.32

10" Screen Slot 10-1-87 605.78

PIEZOMETER INSTALLATION REPORT

Project Fort D.C. Cook Steam Generator Storage		S6R-1
Piez. Type observation well	Depth. 30.0	Riser Desc. 2" PVC
Mat'l @ Tip Sand	Sample #	Boring Dia. 4"
Method of Installation HW casing		
Type of Grnd Protection 6" steel pipe set in grout		
Grnd Elev. 616.46	Riser Elev. 618.18	Piez Tip Elev. 586.46
Filter Material Sand	from Elev. 606.46	to Elev. 586.46
Seal Material Bentowite	from Elev. 606.96	to Elev. 606.46
Installed By Roush-Bumgarner		
Date Installed 8-25-87	Date Tested 10-1-87	

Method of Testing Piez. Pump Test

Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water	Time	Elapsed Time	Depth to Water

REMARKS

Valclay Grout 614.16 to 606.96

.01 Screen slot

Water Elevation 8-27-87 - 607.46

" " 9-2-87 607.46

" " 10-1-87 606.54

INDIANA & MICHIGAN POWER COMPANY
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN, MICHIGAN

GROUND WATER MONITORING

6" MONITORING WELL # 1A	3" OBSERVATION WELL # 1A
LOCATION: 600' SOUTH OF INFILTRATION BASIN	LOCATION: 10' S.W. OF MONITORING WELL
WELL TOP ELEVATION: 660.74'	WELL TOP ELEVATION: 661.54'
GROUND ELEVATION: 659.5' APPROX.	GROUND ELEVATION: 660.5' APPROX.

WATER TABLE ELEVATIONS

ON	6-19-75	604.87'
ON	4-25-75	603.43'
ON	10-25-75	601.82

LOG OF GEOLOGICAL FORMATION

DESCRIPTION	THICKNESS	DEPTH TO BOTTOM
DUNE SAND	50'	50'
WATER BEARING SAND	25'	75'

INDIANA & MICHIGAN POWER COMPANY
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN, MICHIGAN

GROUND WATER MONITORING

4" MONITORING WELL # 8	2" OBSERVATION WELL # 8
LOCATION: 2400' EAST OF INFILTRATION BASIN	LOCATION: 10' S.W. OF MONITORING WELL
WELL TOP ELEVATION: 615.20'	WELL TOP ELEVATION: 615.66'
GROUND ELEVATION: 614.' APPROX.	GROUND ELEVATION: 614.5' APPROX.

WATER TABLE ELEVATIONS

ON	6-19-75	609.33'
ON	4-25-75	608.60'
ON	10-25-75	607.03'

LOG OF GEOLOGICAL FORMATION

DESCRIPTION	THICKNESS	DEPTH TO BOTTOM
TOP SOIL	1'	1'
DARK YELLOW SAND	5'	6'
LIGHT SAND	12'	18'
WATER BEARING SAND	14½'	32½'
CLAY	1'	33½'

INDIANA & MICHIGAN POWER COMPANY
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN, MICHIGAN

GROUND WATER MONITORING

6" MONITORING WELL # 11	2" OBSERVATION WELL # 11
LOCATION: 200' N.W. OF INFILTRATION BASIN	LOCATION: 10' WEST OF MONITORING WELL
WELL TOP ELEVATION: 609.47'	WELL TOP ELEVATION: 608.37'
GROUND ELEVATION 608.5' APPROX	GROUND ELEVATION: 607.5' APPROX.

WATER TABLE ELEVATIONS

ON	6-19-75	599.33'
ON	4-25-75	597.08'
ON	10-25-75	601.72'

LOG OF GEOLOGICAL FORMATION

DESCRIPTION	THICKNESS	DEPTH TO BOTTOM
DUNE SAND	16'	16'
WATER BEARING SAND	10'	26'

T.K. 6-3-

INDIANA & MICHIGAN POWER COMPANY
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN, MICHIGAN

GROUND WATER MONITORING

6" MONITORING WELL # 12	2" OBSERVATION WELL # 12
LOCATION: 700' WEST OF INFILTRATION BASIN	LOCATION: 10' SOUTH OF MONITORING WELL
WELL TOP ELEVATION: 610.45'	WELL TOP ELEVATION: 610.97'
GROUND ELEVATION: 609.5 APPROX	GROUND ELEVATION: 610.0 APPROX

WATER TABLE ELEVATIONS

ON	6-19-75	593.45'
ON	4-25-75	594.70'
ON	10-25-75	593.28'

LOG OF GEOLOGICAL FORMATION

DESCRIPTION	THICKNESS	DEPTH TO BOTTOM
GRAVEL	1'	1'
DUNE SAND	12'	13'
BLACK PEAT SAND	3'	16'
GRAVEL W/ SAND	6'	22'
SAND W/ GRAVEL	10'	32'

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

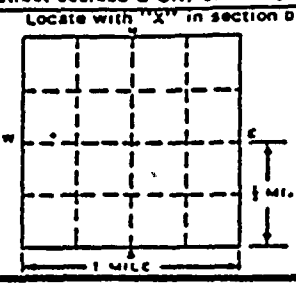
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Berrien	Lake	NW¼ NE¼ SE¼	6	6 S.	20 W.

Distance And Direction from Road Intersections

Street address & City of Well Location

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: I & M Power Co.
Address D.C. Cook Plant
Bridgman, Mi

4 WELL DEPTH: (Completed) 96 ft. Date of Completion 19 June 74

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☒ Jetted ☐ Bored ☐ ____

6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ MONITOR WELL

7 CASING: Threaded ☒ Welded ☐ Diam. 3 in. to ____ ft. Depth; ____ in. to ____ ft. Depth
Height: Above/~~Below~~ Surface 2 ft. Weight ____ lbs./ft. Drive Shoe? Yes ☒ No ☐

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Top soil	1	1
dune sand	70	71
H₂O Sand	16	87
H₂O gravel	9	96

8 SCREEN: Type: SS Dia.: 2" Slot/Gauze 80 Length 8' OA
Set between 90 ft. and 96 ft.
Fittings: neck + K packer

9 STATIC WATER LEVEL 75' ft. below land surface Appx

10 PUMPING LEVEL below land surface pneumatic testing 40+ g.p.m.
____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ____ Chlorides (Cl) ____
Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No ☐ Neat Cement ☐ Bentonite ☐ ____
Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination None (Direction) ____ Type ____
Well disinfected upon completion ☐ Yes ☐ No

15 PUMP: ☒ Not Installed
Manufacturer's Name ____
Model Number ____ HP ____ Volts ____
Length of Drop Pipe ____ ft. capacity ____ G.P.M.
Type: ☐ Submersible ☐ Jet ☐ Reciprocating

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.
Well @ Top of Hill near old 2" well pit pits MONITOR WELL # 1 (located @ S. end of I+M property)

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
George Cole & Son 0213
REGISTERED BUSINESS NAME REGISTRATION NO.
Address RR 3, Box 240 B.H
Signed Robert Cole Date 6 July 74
AUTHORIZED REPRESENTATIVE

D47d 100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. [ ] #3 [ ][ ][ ][ ][ ][ ][ ][ ][ ]

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

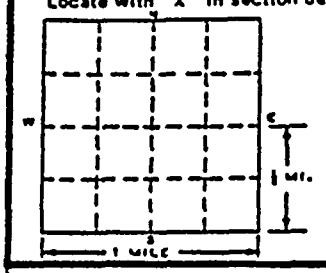
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Cass	Lake	NE¼ NW¼ SE¼	6	6 N/S.	20 E/W.

Distance And Direction from Road Intersections

Street address & City of Well Location

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: I & M Power Co.
Address Cook Plant, Bridgman, Mi

4 WELL DEPTH: (completed) 49 ft. Date of Completion 3 June 74

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug
☐ Hollow rod ☒ Jetted ☐ Bored ☐ ____

6 USE: ☐ Domestic ☐ Public Supply ☐ Industry
☐ Irrigation ☐ Air Conditioning ☐ Commercial
☒ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface 1 ft.
Diam. 2 in. to 45 ft. Depth Weight ____ lbs./ft.
____ in. to ____ ft. Depth Drive Shoe? Yes ☒ No ☐

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
fill & gravel	1	1
dune sand	19	20
H₂O sand	29	49

8 SCREEN:
Type: SS 13½ Dia.: 1¼"
Slot/Gauze 80 Length 5' OA
Set between 45 ft. and 49 ft.
Fittings: Check valve

9 STATIC WATER LEVEL
14 ft. below land surface

10 PUMPING LEVEL below land surface
plunger Hydrant 12+ g.p.m.
____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ____ Chlorides (Cl) ____
Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit
☐ Pitless Adapter ☒ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No
☐ Neat Cement ☐ Bentonite ☐ ____
Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination
____ ft. None Direction ____ Type
Well disinfected upon completion ☐ Yes ☐ No

15 PUMP: ☒ Not installed
Manufacturer's Name ____
Model Number ____ HP ____ Volts ____
Length of Drop Pipe ____ ft. capacity ____ G.P.M.
Type: ☐ Submersible ☐ Jet ☐ Reciprocating

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.
Used as test well — pulled & plugged
For Water Well #3
(2" Pilot well)

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
George Cole & Son 0213
REGISTERED BUSINESS NAME REGISTRATION NO.
Address 3946 Evergreen Lane S.H.
Signed Robert L. Cole Date 6 July 74
AUTHORIZED REPRESENTATIVE

D47d 100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. [ ]

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

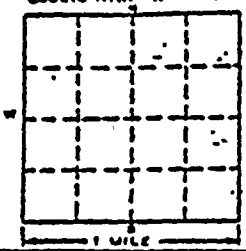
LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Berrien	Lake	NE¼ NW¼ SE¼	6	6 S	20 E/W.

Distance And Direction from Road Intersections

Street address & City of Well Location

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: I & M. Power Co
Address D.C. Cook Plant
Bridgman, Mich

4 WELL DEPTH: (completed) 47 ft. Date of Completion 20 June 74

5 ☒ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ ____

6 USE: ☐ Domestic ☒ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface 1' ft.
Diam. 6 in. to 42 ft. Depth Weight 19 lbs./ft.
___ in. to ___ ft. Depth Drive Shoe? Yes ☐ No ☒

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Top soil & gravel fill	1	1
Dune sand	19	20
Itzo sand	27	47
drinking water well #1		
(construction parking)		

USE A 2ND SHEET IF NEEDED

8 SCREEN: Type: Red Brass Dia.: 6" ID
Slot/Gauge 16 Length 5'
Set between 42 ft. and 47 ft.
Fittings: 6" riser + 6" plug bottom

9 STATIC WATER LEVEL 14 ft. below land surface

10 PUMPING LEVEL below land surface 40 ft. after 24 hrs. pumping 80 g.p.m.
___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ___ Chlorides (Cl) ___
Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No
☐ Neat Cement ☒ Bentonite ☐ ____
Depth: From 10 ft. to 0 ft.

14 Nearest Source of possible contamination None Known Type
Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not Installed
Manufacturer's Name DEMING
Model Number 2361212008 HP 5 Volts 575-3ph
Length of Drop Pipe ___ ft. capacity 30 G.P.M.
Type: ☒ Submersible 2" x 29'
☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.
ICAL Power Co.
7 Civil Works —
GPM with #1 & #2 in 74
Well Water #3

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Leonard D. Cole & Son. 0213
REGISTERED BUSINESS NAME REGISTRATION NO.
Address 3946 Evergreen Lane B. H.
Signed Robert J. Cole Date 6 July 74
AUTHORIZED REPRESENTATIVE

3474 100M (Rev. 12-68)

IMPORTANT: ...

GEOLOGICAL SURVEY SAMPLE No. [ ] #6 [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

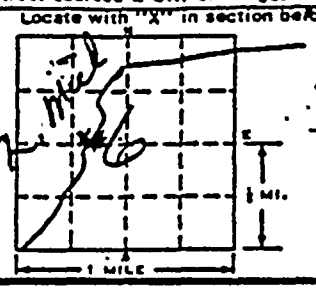
1 LOCATION OF WELL

Co	Township Name	Fraction	Section Number	Town Number	Range Number
		SE¼ SW¼ NW¼	6	6 N/S.	19 W.

Distance And Direction from Road Intersections: Along Lake Bluff @ N.W. Part of Property - Appx 95' from Lake Shore

Street Address & City of Well Location:

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: American Elec Power Co.
Address: D.C. Cook Plant, Bridgman, Michigan

4 WELL DEPTH: (completed) 93 ft. Date of Completion: 4 JAN 77

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ ____

6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well

7 CASING: Threaded ☒ Welded ☐ Diam. 6 in. to 88 ft. Depth; ____ in. to ____ ft. Depth
Height: Above/Below Surface 2' ft. Weight 19 lbs/ft. Drive Shoe? Yes ☒ No ☐

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Fill Gravel	2	2
Alluvial Sand, Brwn	70	72
Clean Gravel	1	73
H2O Sand	20	93

8 SCREEN: Type: Red Brass Dia.: 6" Nom.
Slot/Gauge 15 Length 16'-3" OA
Set between 67.94 ft. and 93 ft.
Fittings: 4 Packer - 6'-4" Sump

9 STATIC WATER LEVEL Apx 76 ft. below land surface

10 PUMPING LEVEL below land surface
Pumped 30 ft. after ____ hrs. pumping Appx g.p.m.
____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ____ Chlorides (Cl) ____
Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No ☐ Neat Cement ☐ Bentonite ☐ ____
Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination: None Close Type
Well disinfected upon completion ☐ Yes ☒ No

15 PUMP: ☒ Not Installed
Manufacturer's Name Red Jacket - Flowmotor
Model Number 6CC HP 3/4 Volts 230
Length of Drop Pipe ____ ft. Capacity 48 G.P.M.
Type: ☒ Submersible 1¼" x 91' ☐ Jet ☐ Reciprocating

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.
North C.B. Well Replaces "A" Well Was Pulled, Plugged & Back Filled. (#6 Well)

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
George E. Cole & Son C213
REGISTERED BUSINESS NAME — REGISTRATION NO.
Address: 5946 Evergreen Lane, Bridgman, Mich.
Signed ____ AUTHORIZED REPRESENTATIVE Date 10 March 77

047d 100M (Rev. 12-68)

IMPORTANT: File original and first copy with Water Supply Division, Michigan Department of Public Health, Lansing, Michigan 48914. Retain second copy for your records.

GEOLOGICAL SURVEY SAMPLE No. _____

#7

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

1 LOCATION OF WELL

County	Twp.	Fraction	Section No.	Town	Range
Berrien	Lake	¼ ¼ ¼	6	6 N/S.	19-20 E/W.

Distance And Direction from Road Intersections: 8' Drinking Water Well #1

Donald C. Cook Nuclear Power Plant

Street address & City of Well Location: Bridgman, Mich.

OWNER No. _____

3 OWNER OF WELL: Indiana & Michigan Power Company

Address: Bowling Green Sta. New York

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
dune sand	20	20
water sand	20	40
reddish gray sand	7	47
muddy sand w/ clay	4	51

4 WELL DEPTH: (Completed) 49 ft. Date of Completion: Feb 19, 1969

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ ___

6 USE: ☐ Domestic ☒ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐ _____

7 CASING: Diam. 4 in. to 39 ft. Depth; Threaded ☐ Welded ☒; ___ in. to ___ ft. Depth

Height: Above/Below surface 1 ft.; Weight ___ lbs/ft.; Drive Shoe? Yes ☒ No ☐

8 SCREEN: Type: COOK Dia.: 7⅝ OD

Slot/Gauge 11 Length 6'

Set between 39 ft. and 49 ft.

Fittings: 2-2" Neoprene Packer, 3-2" Anchor Pipe

9 STATIC WATER LEVEL 20-2 ft. below land surface

10 PUMPING LEVEL below land surface

37 ft. after 24 hrs. pumping 75 g.p.m.

___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million:

Iron (Fe) _____ Chlorides (Cl) _____

Hardness _____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 GROUTING:

Well Grouted? ☐ Yes ☒ No

Material: ☐ Neat Cement ☐ _____

Depth: From ___ ft. to ___ ft.

14 SANITARY:

Nearest Source of possible contamination: 1500 feet W Direction TANK Type

Well disinfected upon completion ☐ Yes ☐ No

15 PUMP:

Manufacturer's Name: Deming

Model Number _____ HP 3

Length of Drop Pipe 40 ft. capacity 50 G.P.M.

Type: ☒ Submersible ☐ _____ ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

Pump and Pitless adapter to be installed later — type to be used listed.

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

George B Cobb & Son — REGISTERED BUSINESS NAME

0213 — REGISTRATION NO.

Address: RR #3, Box 240 Benton Harbor

Signed: _____ AUTHORIZED REPRESENTATIVE Date: 3-24-69

D670 100M 6-66

IMPORTANT: File with deed.

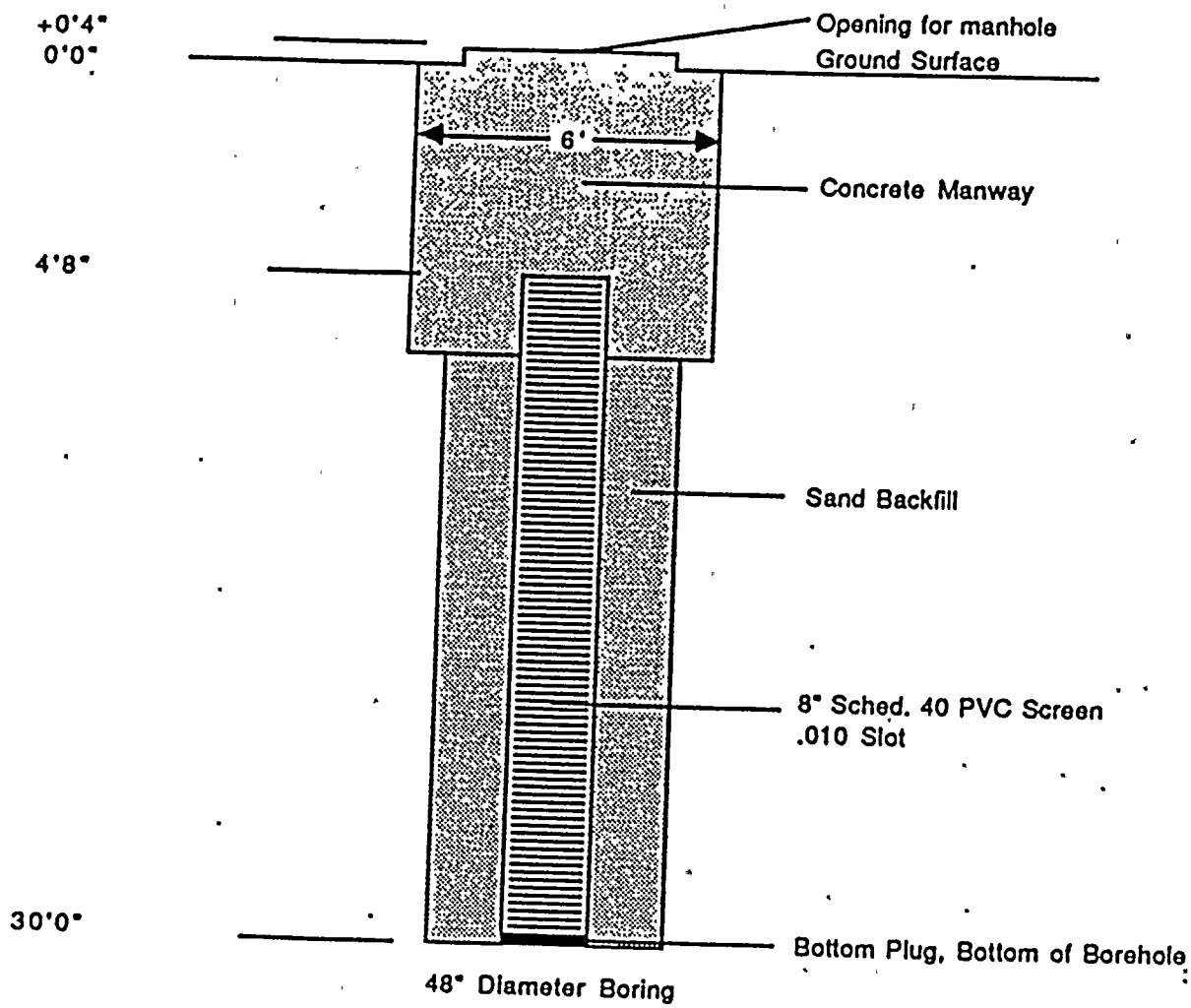
WELL OWNER COPY #1

AMERICAN
ENVIRONMENTAL
SERVICES CO., INC.

Well Detail Summary
American Electric Power
D.C. Cook Nuclear Plant
Bridgeman, Michigan
AE-964 - 7/7/89

Well Detail Summary

RW



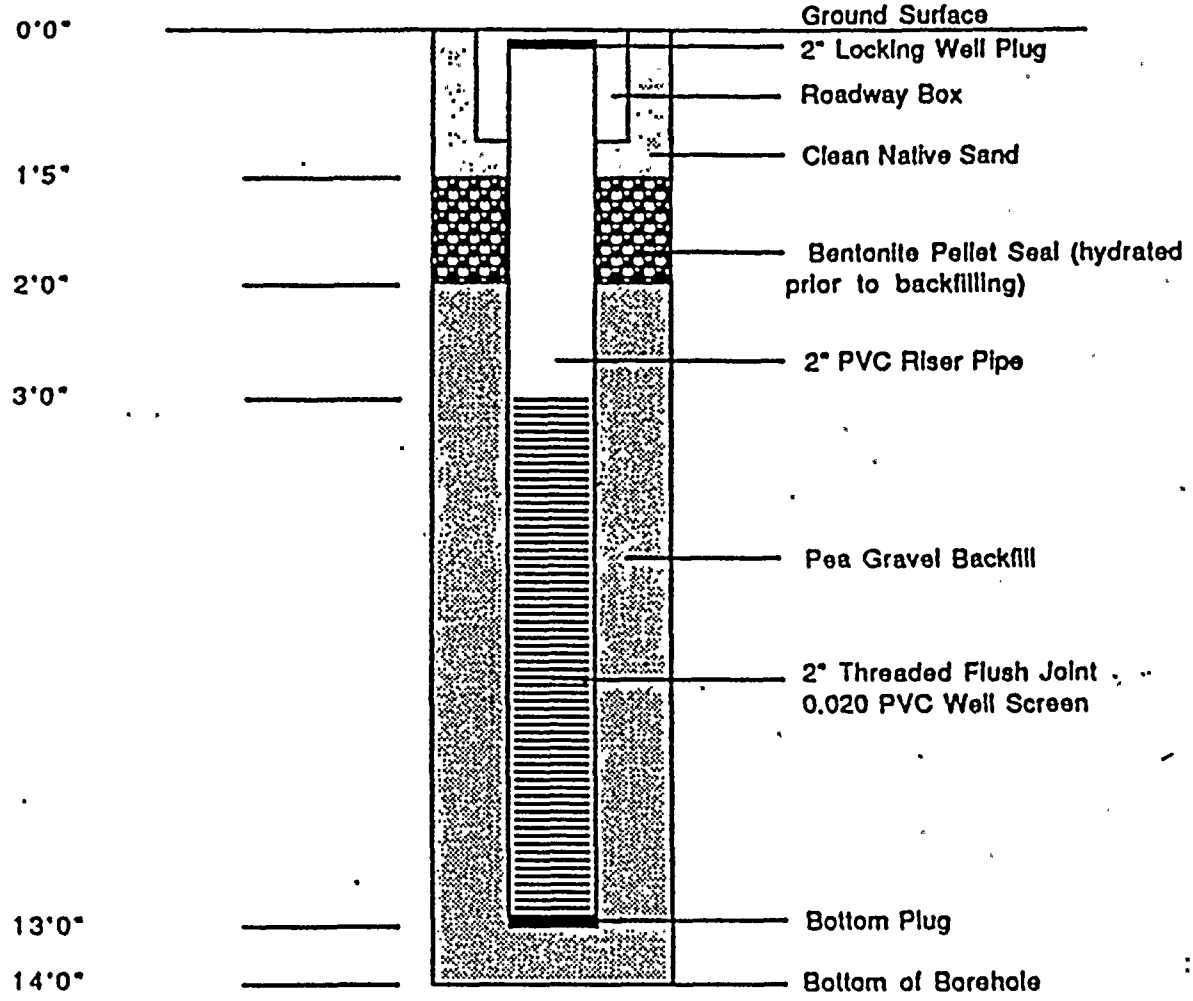
Note: Drawing Not to Scale.

AMERICAN
ENVIRONMENTAL
SERVICES CO., INC.

Well Detail Summary
American Electric Power
D.C. Cook Nuclear Plant
Bridgeman, Michigan
AE-964 - 8/6/89

Well Detail Summary

OW-3



20" Diameter Boring

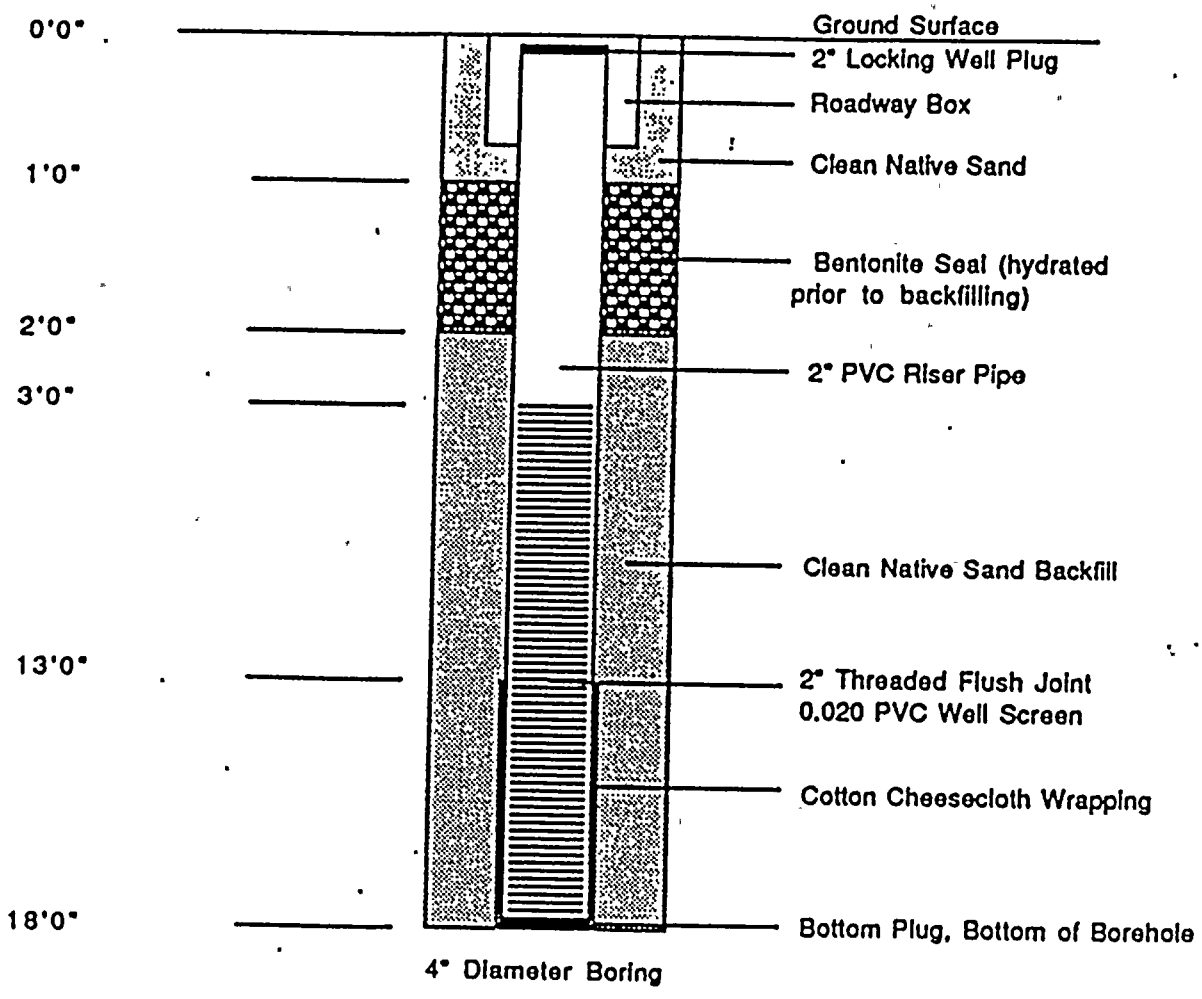
Note: Drawing Not to Scale.

AMERICAN
ENVIRONMENTAL
SERVICES CO., INC.

Well Detail Summary
American Electric Power
D.C. Cook Nuclear Plant
Bridgeman, Michigan
AE-964 - 6/6/89

Well Detail Summary

OW-2



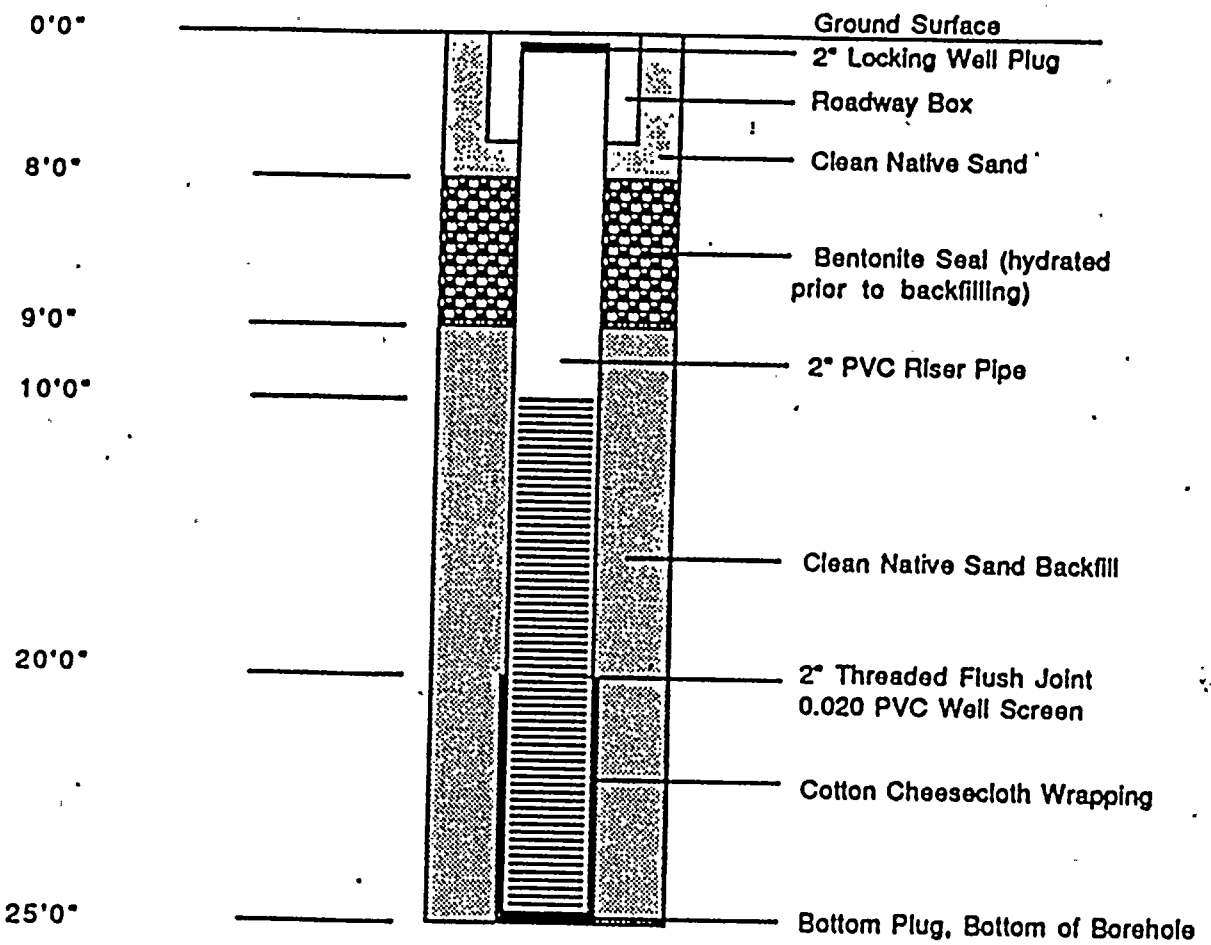
Note: Drawing Not to Scale.

AMERICAN
ENVIRONMENTAL
SERVICES CO., INC.

Well Detail Summary
American Electric Power
D.C. Cook Nuclear Plant
Bridgeman, Michigan
AE-964 - 6/6/89

Well Detail Summary

OW-1



4" Diameter Boring

Note: Drawing Not to Scale.

JOB NO. _____

COMPANY I+M D.C. Cook

PROJECT Groundwater discharge Permit

COORDINATES N. 179,215.26 & 1393,019.93

DATE _____ TIME _____

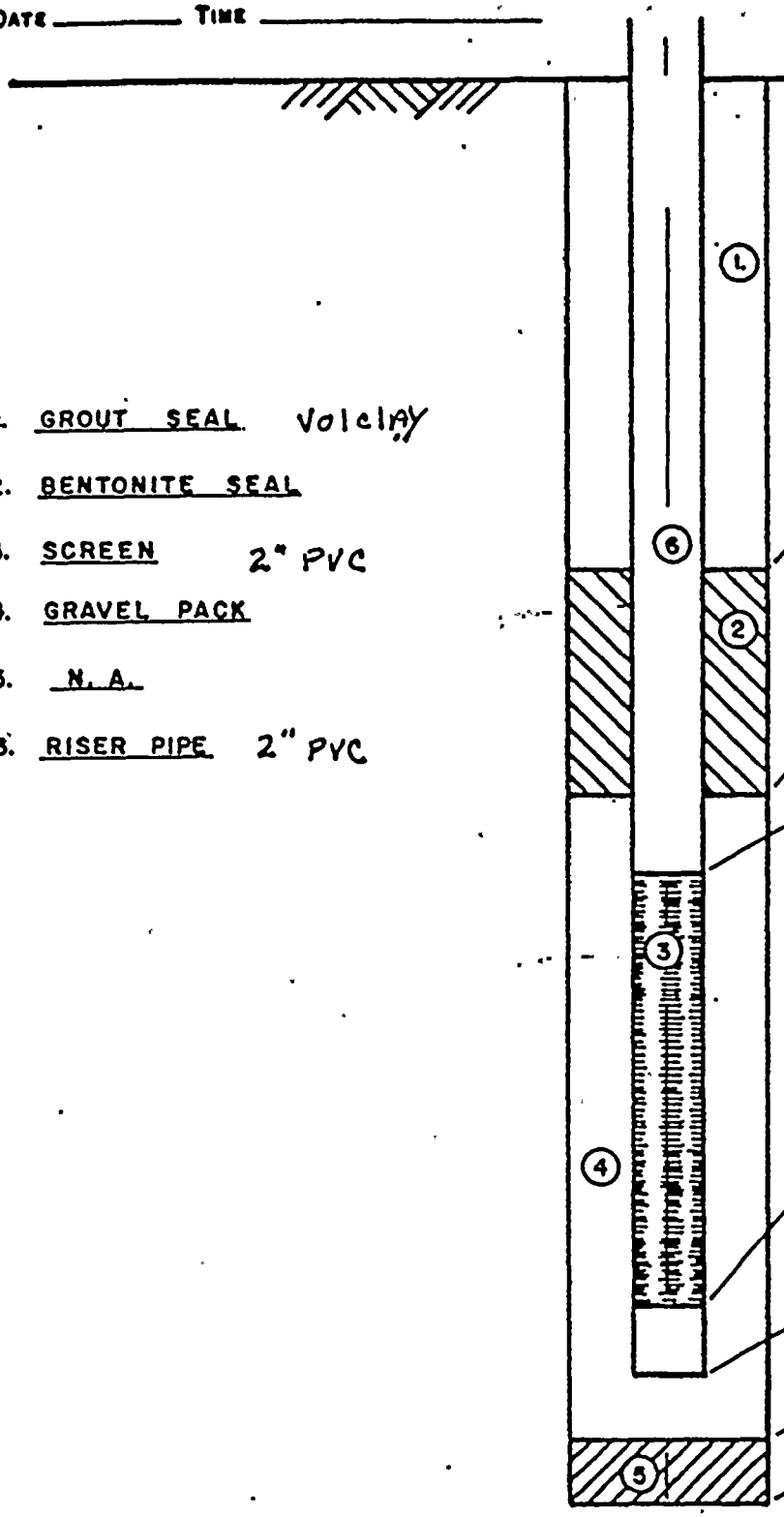
WELL CONSTRUCTION SUMMARY ELEVATIONS (ft NGVD)

WELL No. GW-13

REF. DATUM PT. 641.75

GRADE 640.12

1. GROUT SEAL Volclay
2. BENTONITE SEAL
3. SCREEN 2" PVC
4. GRAVEL PACK
5. N.A.
6. RISER PIPE 2" PVC



TOP OF BENTONITE SEAL NA

TOP OF GRAVEL PACK 590.52

TOP OF SCREEN 588.72

BOTTOM OF SCREEN 579.72

BOTTOM OF BLANK SECTION 578.72

BOTTOM OF GRAVEL PACK 578.12

BOTTOM OF BOREHOLE 578.12

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION		OBSERVATION WELL
APPROVED	DR.	CH.		
AMERICAN ELECTRIC POWER SVC. CORP.				

JOB NO. _____

COMPANY I+M D.C. Cook

PROJECT Groundwater discharge permit

COORDINATES N: 178,857.96 E 1,398,902.49

DATE _____ TIME _____

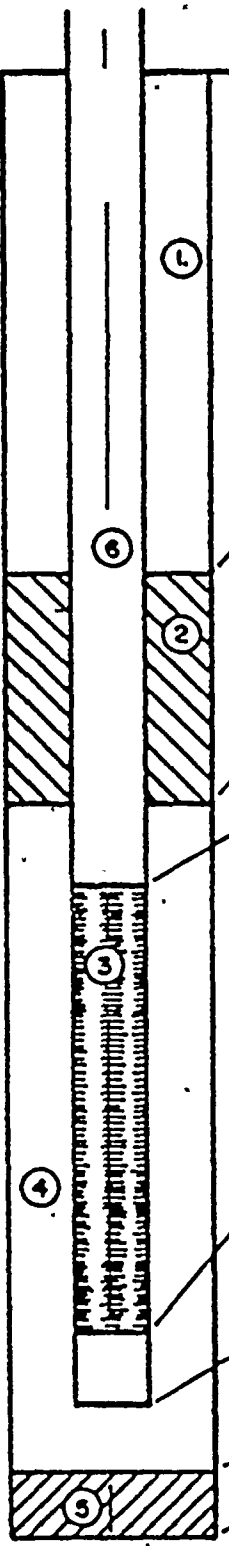
WELL CONSTRUCTION SUMMARY ELEVATIONS (ft NGVD)

WELL No. EW-1

REF. DATUM PT. 620.

GRADE 618.30

1. GROUT SEAL Volclay
2. BENTONITE SEAL
3. SCREEN 2" PVC
4. GRAVEL PACK
5. N.A.
6. RISER PIPE 2" PVC



TOP OF BENTONITE SEAL NA

TOP OF GRAVEL PACK 585.3

TOP OF SCREEN 582.7

BOTTOM OF SCREEN 573.7

BOTTOM OF BLANK SECTION 572.7

BOTTOM OF GRAVEL PACK 572.3

BOTTOM OF BOREHOLE 572.3

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION	OBSERVATION WELL
APPROVED	DR.	CH.	
AMERICAN ELECTRIC POWER SVC. CORP.			CDS-04 SH.

Job No. _____

Company I&M D.C. Cook

Project Groundwater discharge permit

Coordinates N. 178512.86 E. 1394569.77

Date _____ Time _____

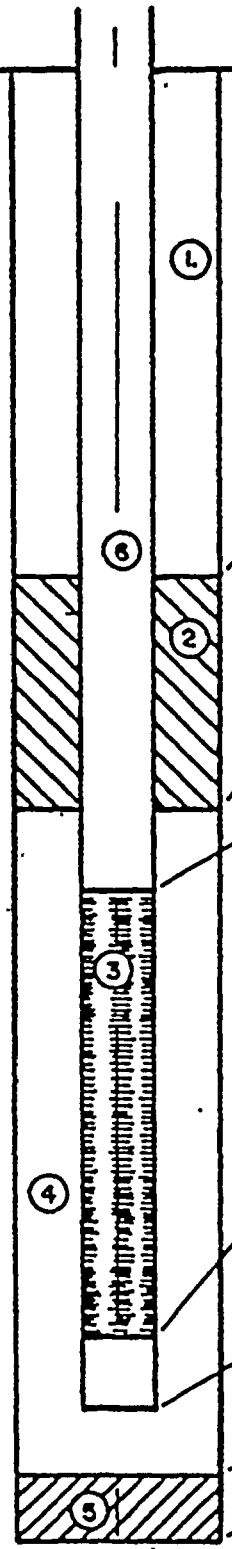
WELL CONSTRUCTION SUMMARY ELEVATIONS (ft NGVD)

WELL No. EW-15

REF. DATUM PT. 614.38

GRADE 612.38

1. GROUT SEAL Volclay
2. BENTONITE SEAL
3. SCREEN 2" PVC
4. GRAVEL PACK
5. N.A.
6. RISER PIPE 2" PVC



TOP OF BENTONITE SEAL NA

TOP OF GRAVEL PACK 591.38

TOP OF SCREEN 588.88

BOTTOM OF SCREEN 579.88

BOTTOM OF BLANK SECTION 578.88

BOTTOM OF GRAVEL PACK 578.38

BOTTOM OF BOREHOLE 578.38

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION		OBSERVATION WELL
APPROVED	DR.	CH.		
AMERICAN ELECTRIC POWER SVC. CORP.				

Job No. _____

Company T+M D.C. Cook

Project Ground water discharge permit

Coordinates N-178689.61 E-1396341.82

Date _____ Time _____

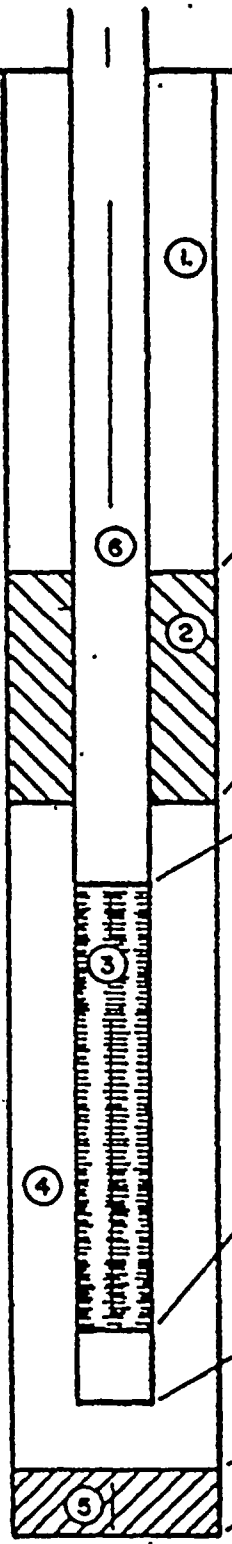
WELL CONSTRUCTION SUMMARY ELEVATIONS (ft NGVD)

WELL No. EW-1

REF. DATUM PT. 630

GRADE 628.83

1. GROUT SEAL Volclay
2. BENTONITE SEAL
3. SCREEN 2"
4. GRAVEL PACK
5. N.A.
6. RISER PIPE 2"



TOP OF BENTONITE SEAL NA

TOP OF GRAVEL PACK 603.83

TOP OF SCREEN 601.43

BOTTOM OF SCREEN 592.43

BOTTOM OF BLANK SECTION 591.43

BOTTOM OF GRAVEL PACK 590.83

BOTTOM OF BOREHOLE 590.83

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION		OBSERVATIO... WELL
APPROVED	DR.	CH.		
AMERICAN ELECTRIC POWER SVC. CORP.			CDS-04	SH.

Job No. _____

Company I+M D.C. Cook

Project Groundwater discharge permit

Coordinates N 192706.10 E 1293645.50

Date _____ Time _____

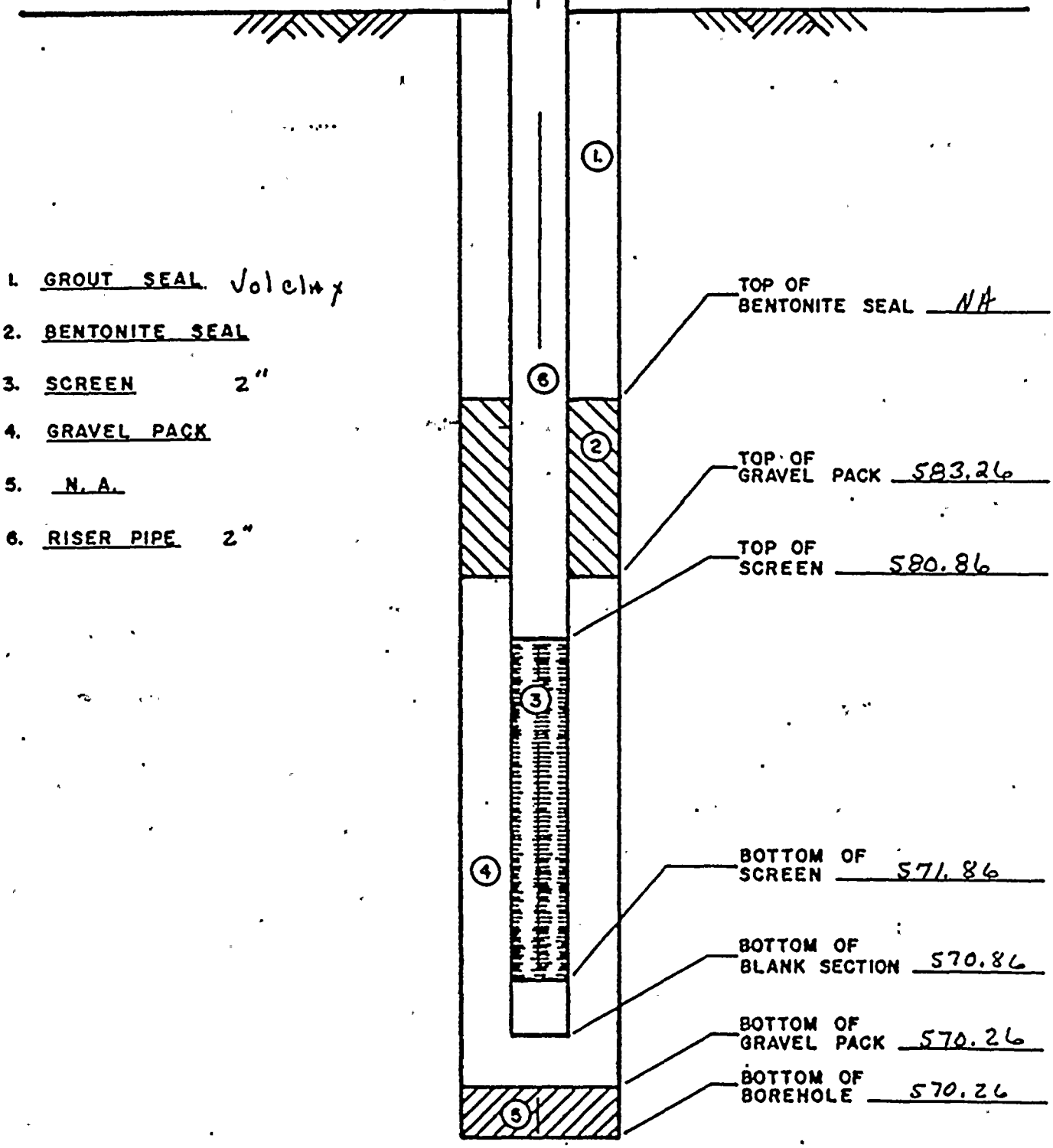
WELL CONSTRUCTION SUMMARY ELEVATIONS (ft NGVD)

WELL No. EW-17

REF. DATUM PT. _____

well cover will be installed at a later date

GRADE 651.26



1. GROUT SEAL Volclay
2. BENTONITE SEAL
3. SCREEN 2"
4. GRAVEL PACK
5. N. A.
6. RISER PIPE 2"

TOP OF BENTONITE SEAL NA

TOP OF GRAVEL PACK 583.26

TOP OF SCREEN 580.86

BOTTOM OF SCREEN 571.86

BOTTOM OF BLANK SECTION 570.86

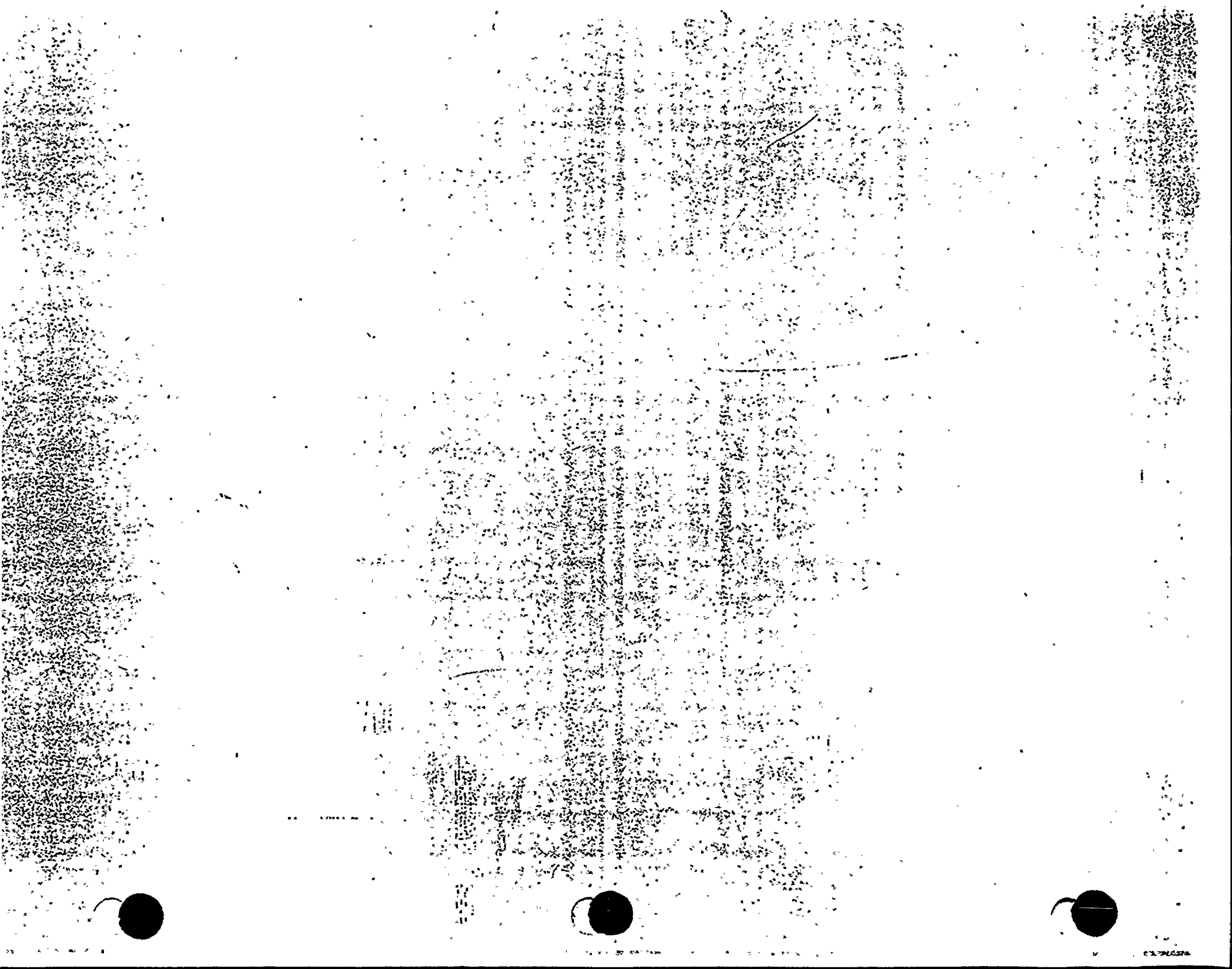
BOTTOM OF GRAVEL PACK 570.26

BOTTOM OF BOREHOLE 570.26

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION		OBSERVATION WELL
APPROVED	DR.	CH.		

Appendix 3

Hydropunch™ Data



DEPTH TO STATIC WATER LEVEL 43.0 FEET
STATIC WATER ELEVATION 607.55 FEET NGVD

BORING NO HP-2
COORDINATES:
E 1393878.22 N 180417.58
GRADE EL. 650.55 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	4.MAY.91		53.5	NO	RECOVERY							
2		10:00 AM	63.5	587.05	350	9.05	57.0	13.9	1,180	644	NA	339
3		11:07 AM	73.5	577.05	500	8.86	51.0		1,180	676	176	511
4			83.5	NO RECOVERY								

DEPTH TO STATIC WATER LEVEL 10.3 FEET
STATIC WATER ELEVATION 608.66 FEET NGVD

BORING NO HP-3
COORDINATES:
E 1393744.33 N 180326.01
GRADE EL. 618.96 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	4.MAY.91	4:30 PM	13.0	605.96	425	8.04	60.0	15.6	1,130	711	131	407
2		5:05 PM	23.0	595.96	250	7.38	62.0	16.7	1,330	NA	164	NA
3	14.MAY.91	11:45 AM	33.0	585.96	450	8.82	59.0	15.0	1,110	616	186	336
4			43.0	575.96	NO	RECOVERY						
5			53.0	565.96	NO	RECOVERY						

N.A. NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 4.6 FEET
STATIC WATER ELEVATION 610.1 FEET NGVD

BORING NO HP-4
COORDINATES:
E 1396126.89 N 180207.62
GRADE EL. 614.7 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	15.MAY.91	10:05 AM	18.0	596.70	500	7.20	58.0	14.4	410	213	18.7	5.5
2			28.0	586.70	NO	RECOVERY						
3		1:35 PM	38.0	576.70	5		74.0	23.3	NA	NA	NA	NA
4		2:35 PM	48.0	566.70	NO	RECOVERY						

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 13.8 FEET
STATIC WATER ELEVATION 604 FEET NGVD

BORING NO HP-5
COORDINATES:
E 1395709.18 N 180319.65
GRADE EL. 617 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	16.MAY.91	9:35 AM	21.3	596.17	525	6.68	52.0	11.1	600	342	11.9	18
2			26.3	591.17	NO	RECOVERY						
3			36.3	581.17	NO	RECOVERY						

DEPTH TO STATIC WATER LEVEL 13.8 FEET
STATIC WATER ELEVATION 603.62 FEET NGVD

BORING NO HP-6
COORDINATES:
E 1395705.71 N 180320.74
GRADE EL. 617.42 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	16.MAY.91		18.0	599.42	NO	RECOVERY						
2		2:57 PM	28.0	589.42	525	7.06	58.0	14.4	440	N.A.	15.8	N.A.
3			38.0	579.42	NO	RECOVERY						
4			48.0	569.42								

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 5.1 FEET
STATIC WATER ELEVATION 609.55 FEET NGVD

BORING NO HP-8
COORDINATES:
E 1396133.69 N 180206.18
GRADE EL. 614.65 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	29.MAY.91	6:30 PM	13.0	601.65	500	6.85	62.0	16.7	370	261	16.5	25
2		8:00 PM	23.0	591.65	525	7.22	58.0	14.4	384	178	24.5	10
3		8:00 AM	33.0	581.65	550	7.37	61.0	16.1	677	331	56.0	28
4			43.0	571.65	250	9.19	64.0	17.8	8,170	620	31.0	150

DEPTH TO STATIC WATER LEVEL 11.2 FEET
STATIC WATER ELEVATION 606.25 FEET NGVD

BORING NO HP-9
COORDINATES:
E 1395702.9 N 180321.4
GRADE EL. 617.45 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	30.MAY.91	1:10 PM	18.0	599.45	500	7.21	60.0	15.6	671	314	6.5	L.D.
2		2:00 PM	28.0	589.45	30	N.A.	N.A.	N.A.	N.A.	236	18.5	L.D.
3		2:45 PM	38.0	579.45	550	7.08	69.0	20.6	928	413	37.5	L.D.
4		3:50 PM	48.0	569.45	530	7.57	68.0	20.0	398	160	10.5	30

N.A. = NO ANALYSIS

L.D. = LESS THAN DETECTION LIMIT OF 5.0 mg/l

DEPTH TO STATIC WATER LEVEL 8.2 FEET
STATIC WATER ELEVATION 603.75 FEET NGVD

BORING NO HP-10
COORDINATES:
E 1395302.59 N 180447.4
GRADE EL. 611.95 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	31.MAY.91	8:45 AM	17.8	594.15	475	7.16	58.0	14.4	471	233	14.5	25
2			27.8	584.15	530	6.94	60.0	15.6	N.A.	275	30.0	33
3		10:15 AM	37.8	574.15	300	7.06	66.0	18.9	N.A.	246	19.0	23
4			47.8	564.15	400	7.53	68.0	20.0	N.A.	231	9.0	37

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 7.1 FEET
STATIC WATER ELEVATION 602.17 FEET NGVD

BORING NO HP-11
COORDINATES:
E 1394899.08 N 180591.01
GRADE EL. 609.27 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	31.MAY.91	2:30 PM	13.3	595.97	530	6.71	64.0	17.8	N.A.	218	21.0	9.4
2		3:10 PM	23.3	585.97	400	6.88	64.0	17.8	N.A.	293	10.5	14.0
3		3:50 PM	33.3	575.97	450	6.78	65.0	18.3	N.A.	214	13.0	20.0
4		5:00 PM	43.3	565.97	475	7.15	64.0	17.8	N.A.	216	8.0	32.0

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 25.7 FEET
STATIC WATER ELEVATION 603.61 FEET NGVD

BORING NO HP-12
COORDINATES:
E 1394776.78 N 180939.06
GRADE EL. 629.31 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD.	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	1.JUN.91	10:15 AM	33.1	596.21	300	6.89	58.0	14.4	N.A.	382	8.0	120
2		11:00 AM	43.1	586.21	252	7.49	61.0	16.1	N.A.	237	13.5	19
3			53.1	576.21	475	7.30	63.0	17.2	N.A.	353	29.0	40
4		1:50 PM	63.1	566.21	425	7.75	63.0	17.2	N.A.	238	25.5	30
5		2:55 PM	73.1	556.21	500	8.17	66.0	18.9	N.A.	356	26.0	36

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 26.8 FEET
STATIC WATER ELEVATION 601.30 FEET NGVD

BORING NO HP-13
COORDINATES:
E 1394668.88 N 181183.64
GRADE EL. 628.10 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	1.JUN.91	5:40 PM	33.0	595.10	500	7.54	58.0	14.4	N.A.	260	5.0	29
2		6:15 PM	43.0	585.10	500	7.26	63.0	17.2	N.A.	265	64.5	29
3	2.JUN.91	7.00 AM	53.0	575.10	500	7.67	62.0	16.7	N.A.	312	23.5	31
4		9:30 AM	63.0	565.10	325	7.61	N.A.	N.A.	309	234	18.0	31
5		10:20 AM	73.0	555.10	250	8.07	70.0	21.1	383	276	23.0	36

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 28.2 FEET
STATIC WATER ELEVATION 600.66 FEET NGVD

BORING NO HP-14
COORDINATES:
E 1394557.88 N 181595.94
GRADE EL. 628.86 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	2.JUN.91	1:35 PM	33.1	595.76	475	7.48	65.0	18.3	726	L.D.	18.0	44
2		2:40 PM	43.1	585.76	475	7.32	60.0	15.6	456	280	23.0	33
3		3.10 PM	53.1	575.76	525	7.18	64.0	17.8	604	355	23.0	24
4		4:15 PM	63.1	565.76	500	7.39	64.0	17.8	527	268	21.5	53
5		5:10 PM	73.1	555.76	250	8.23	66.0	18.9	380	214	N.A.	29

N.A. = NO ANALYSIS
L.D. = LESS THAN DETECTION LIMIT OF 1.0 mg/l

DEPTH TO STATIC WATER LEVEL 6.3 FEET
STATIC WATER ELEVATION 608.25 FEET NGVD

BORING NO HP-15
COORDINATES:
E 1396470.33 N 179438.09
GRADE EL. 614.55 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	3.JUN.91	10:10 AM	13.2	601.35	510	7.19	72.0	22.2	849	425	71.5	12
2		10:50 AM	23.2	591.35	500	7.10	65.0	18.3	994	575	23.0	12
3		11:35 AM	33.2	581.35	100	7.88	70.0	21.1	386	N.A.	69.0	N.A.
			43.2	571.35	NO	RECOVERY						

N.A. = NO ANALYSIS

DEPTH TO STATIC WATER LEVEL 17.4 FEET
STATIC WATER ELEVATION 606.14 FEET NGVD

BORING NO HP-16
COORDINATES:
E 1396369.61 N 180025.93
GRADE EL. 623.54 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	3.JUN.91	3:00 PM	23.0	600.54	510	6.80	60.0	15.6	401	272	26.5	22
2		3:35 PM	33.0	590.54	525	6.82	64.0	17.8	732	428	58.5	18
3		4:20 PM	43.0	580.54	150	7.13	65.0	18.3	575	364	N.A.	11

DEPTH TO STATIC WATER LEVEL 6.8 FEET
STATIC WATER ELEVATION 601.19 FEET NGVD

BORING NO HP-17
COORDINATES:
E 1394139.42 N 180691.70
GRADE EL. 607.99 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	11.JUN.91	9:05 AM	13.9	594.09	500	7.70	64.0	17.8	880	474	87.7	210
2		9:55 AM	23.9	584.09	510	7.62	65.0	18.3	1,160	759	133.5	400
3		10:35 AM	33.9	574.09	500	7.87	64.0	17.8	910	587	104.6	270
4		11:30 AM	43.9	564.09	500	7.45	64.0	17.8	970	642	98.4	280
5		1:45 PM	53.9	554.09	425	7.69	66.0	18.9	503	250	17.4	400

DEPTH TO STATIC WATER LEVEL 8.1 FEET
STATIC WATER ELEVATION 607.08 FEET NGVD

BORING NO HP-18
COORDINATES:
E 1394602.17 N 178806.54
GRADE EL. 615.18 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	12.JUN.91	4:00 PM	18.0	597.18	400	6.93	58.0	14.4	510	309	33.6	34
2		4:45 PM	28.0	587.18	450	6.10	60.0	15.6	536	245	27.6	36
3		5:15 PM	38.0	577.18	525	6.68	60.0	15.6	926	374	N.A.	75
4		6:00 PM	48.0	567.18	525	7.47	62.0	16.7	385	142	7.3	32

DEPTH TO STATIC WATER LEVEL 31.9 FEET
STATIC WATER ELEVATION 609.07 FEET NGVD

BORING NO HP-19
COORDINATES:
E 1394479.65 N 179226.10
GRADE EL. 640.97 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	21.AUG.91	2:30 PM	43.3	597.67	525	8.14	58.0	14.4	226	356	23	22
2		3:10 PM	53.3	587.67	425	6.97	62.0	16.7	482	288	49	48
3		4:15 PM	63.3	577.67	525	6.89	63.0	17.2	805	374	73	42
4		5:15 PM	73.3	567.67	325	8.27	64.0	17.8	390	358	39	45

DEPTH TO STATIC WATER LEVEL 17.6 FEET
STATIC WATER ELEVATION 610.16 FEET NGVD

BORING NO HP-20
COORDINATES:
E 1394389.28 N 179410.49
GRADE EL. 627.76 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	24.AUG.91	4:00 PM	23.0	604.76	450	8.27	57.0	13.9	268	126	21	28
2		4:30 PM	33.0	594.76	475	7.42	63.0	17.2	390	268	42	39
3		9:30 AM	43.0	584.76	525	8.10	60.0	15.6	662	352	94	47
4	25.AUG.91	10:15 AM	53.0	574.76	525	7.87	62.0	16.7	502	255	60	28
5		11:10 AM	63.0	564.76	450	8.27	64.0	17.8	352	254	45	41

DEPTH TO STATIC WATER LEVEL 12.3 FEET
STATIC WATER ELEVATION 605.95 FEET NGVD

BORING NO HP-21
COORDINATES:
E 1394233.26 N 179474.88
GRADE EL. 618.25 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD.	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	24.AUG.91	9:30 AM	18.0	600:25	500	8.31	60.0	15.6	211	99	30	24
2		10:30 AM	28.0	590.25	525	7.35	61.0	16.1	290	221	35	L.D.M.
3		11:30 AM	38.0	580.25	500	7.50	61.0	16.1	1,048	651	158	365
4		1:00 PM	48.0	570.25	200	7.57	66.0	18.9	658	350	N.A.	127
5		1:45 PM	58.0	560.25	30	7.55	70.0	21.1	415	N.A.	36	N.A.

N.A. = NO ANALYSIS

L.D.M. = LESS THAN DETECTION LIMIT OF 25.0 mg/l DUE TO MATRIX INTERFERENCE

DEPTH TO STATIC WATER LEVEL 4.8 FEET
STATIC WATER ELEVATION 606.98 FEET NGVD

BORING NO HP-22
COORDINATES:
E 1394130.47 N 179534.51
GRADE EL. 611.78 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	23.AUG.91	1:30 PM	13.0	598.78	525	6.63	70.0	21.1	974	653	298	289
2		2:15 PM	23.0	588.78	525	6.82	68.0	20.0	549	457	277	113
3		3:00 PM	33.0	578.78	525	7.79	66.0	18.9	764	439	98	215
4		4:30 PM	43.0	568.78	525	7.25	66.0	18.9	518	258	79	30
5		4:40 PM	53.0	558.78	500	7.76	66.0	18.9	350	199	41	40

DEPTH TO STATIC WATER LEVEL 24.2 FEET
STATIC WATER ELEVATION 596.83 FEET NGVD

BORING NO HP-23
COORDINATES:
E 1393904.27 N 179523.80
GRADE EL. 621.03 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	11.AUG.91	1:50 PM	28.1	592.93	525	6.87	58.0	14.4	460	528	160.4	206
2		3:30 PM	38.1	582.93	525	7.96	64.0	17.8	750	685	143.9	321
3		4:00 PM	48.1	572.93	525	7.95	64.0	17.8	1294	1280	224.1	698
4		5:00 PM	58.1	562.93		8.00	66.0	18.9	291	288	N.A.	23

DEPTH TO STATIC WATER LEVEL 35.8 FEET
STATIC WATER ELEVATION 604.51 FEET NGVD

BORING NO HP-24
COORDINATES:
E 1393647.95 N 197466.93
GRADE EL. 640.31 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	10.AUG.91	2:30 PM	43.3	597.01	500	8.34	60.0	15.6	767	716	121.2	318
2		4:00 PM	53.3	587.01	525	8.19	64.0	17.8	505	424	123.2	151
3		5:15 PM	63.3	577.01	530	8.19	64.0	17.8	998	889	102.3	509
4	11.AUG.91	8:50 AM	73.3	567.01	500	7.44	62.0	16.7	547	492	71.5	166
5		10:00 AM	83.3	557.01	250	7.90	64.0	17.8	268	322	N.A.	47

DEPTH TO STATIC WATER LEVEL 36.1 FEET
STATIC WATER ELEVATION 611.31 FEET NGVD

BORING NO HP-25
COORDINATES:
E 1393349.43 N 179352.10
GRADE EL. 647.41 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	9.AUG.91		43.0	604.41	NO	RECOVERY						
2		5:25 PM	51.0	596.41	500	7.70	66.0	18.9	628	304	10.4	8.3
3	10.AUG.91	9:00 AM	63.0	584.41	525	7.51	61.0	16.1	754	706	45.4	334.0
4		10:00 AM	73.0	574.41	525	7.87	62.0	16.7	384	334	28.3	114.0
5		11:00 AM	83.0	564.41	500	7.17	61.0	16.1	330	283	31.7	8.7

DEPTH TO STATIC WATER LEVEL 21.4 FEET
STATIC WATER ELEVATION 597.14 FEET NGVD

BORING NO HP-26
COORDINATES:
E 1394671.98 N 182101.75
GRADE EL. 618.54 FEET NGVD

	DATE OF SAMPLE COLLECTION	TIME	SAMPLE DEPTH FEET	SAMPLE ELEVATION FT NGVD	SAMPLE VOLUME ml	pH su	TEMPERATURE F	TEMPERATURE C	CONDUCTIVITY umho/cm	TDS mg/l	SODIUM mg/l	SULFATE mg/l
1	25.AUG.91	2:25 PM	28.0	590.54	450	7.57	65.0	18.3	448	354	29	41
2		3:00 PM	38.0	580.54	500	7.22	72.0	22.2	853	443	66	37
3		3:45 PM	48.0	570.54	500	7.20	70.0	21.1	765	414	84	25
4		4:30 PM	58.0	560.54	450	7.45	71.0	21.7	631	360	51	11

Appendix 4

Tables

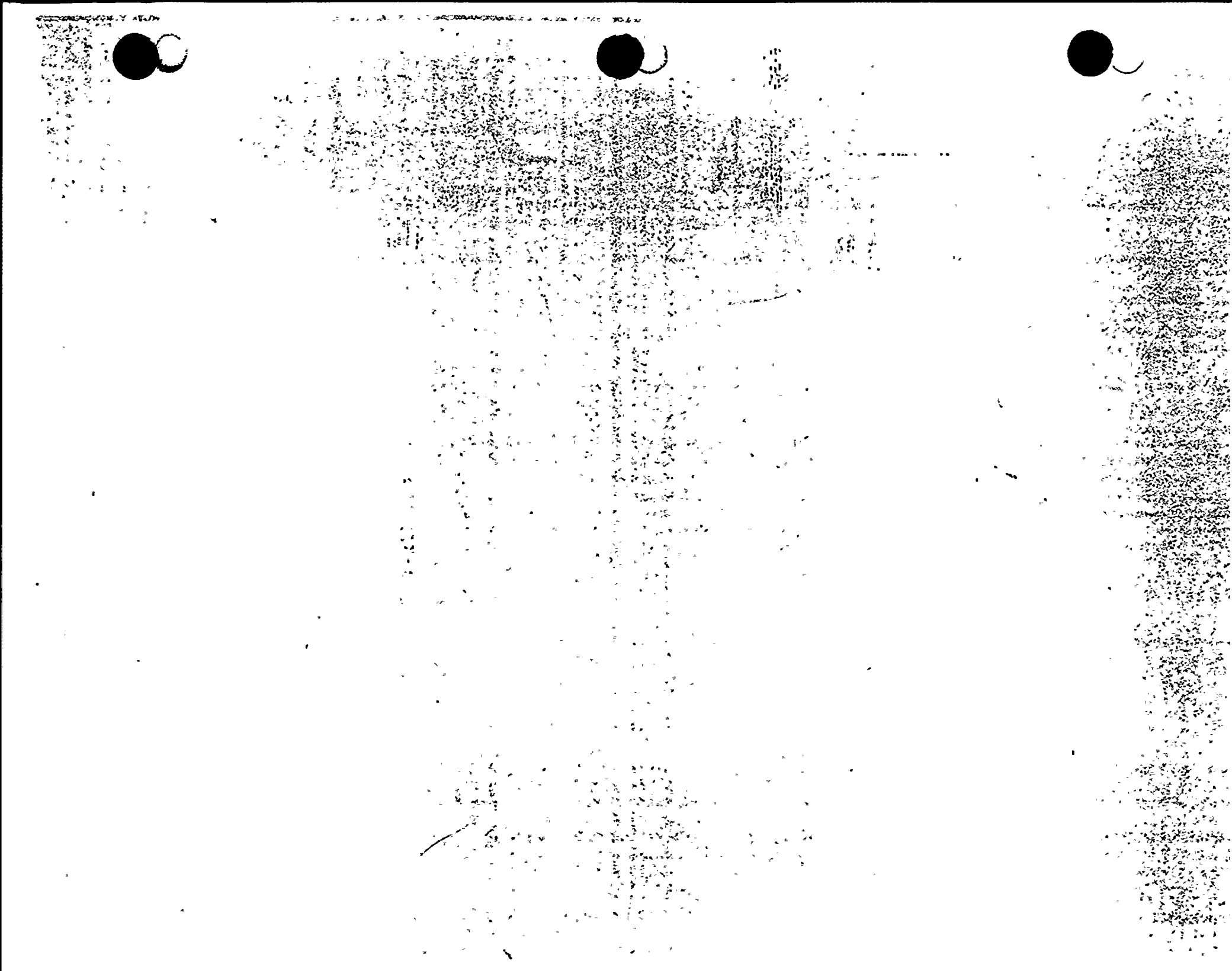


TABLE NO. 1

PRECIPITATION DATA

BENTON HARBOR AIRPORT, MICHIGAN

(inches)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
JAN	2.43	2.04	5.34	3.73	2.61	2.33	3.32	N/A	0.42	.48	N/A	.89	.64
FEB	2.14	.85	1.37	2.70	3.48	1.96	0.84	N/A	0.91	3.55	N/A	1.01	1.40
MAR	3.57	2.57	5.22	2.29	4.23	3.17	1.27	N/A	1.78	1.48	N/A	2.42	1.17
APR	3.57	4.18	4.49	5.86	5.01	2.72	3.73	3.89	2.71	4.23	.23	4.42	3.91
MAY	1.96	4.43	5.39	3.94	4.25	0.92	2.58	1.55	2.88	4.64	6.24	3.91	6.14
JUN	3.77	4.89	3.79	4.50	3.26	4.02	4.32	3.34	3.85	4.68	1.74	1.38	1.54
JUL	2.68	4.59	.89	2.34	3.06	1.54	3.93	2.56	3.36	2.01	3.60	1.33	3.46
AUG	3.33	1.65	1.79	6.21	0.61	5.11	3.35	2.18	7.10	2.40	1.81	1.67	2.44
SEP	7.00	3.41	3.48	1.56	1.74	6.88	6.91	N/A	5.81	5.08	3.36	4.46	8.44
OCT	3.27	4.04	2.29	1.19	1.78	3.47	2.69	N/A	2.71	2.88	0.98	1.92	2.92
NOV	2.67	2.48	3.72	3.78	2.36	2.58	1.48	N/A	1.41	2.28	5.15	2.68	2.46
DEC	6.04	4.82	2.27	3.64	1.45	2.85	2.83	2.98	1.64	2.37	5.90	2.98	2.37
ANNUAL	41.93	39.99	40.04	41.74	33.84	37.55	37.25	N/A	34.58	36.08	N/A	29.07	36.89
DEPART. FROM NORMAL	5.89	3.91	4.00	5.70	−2.20	1.51	1.21	N/A	−1.46	.04	N/A	−6.97	0.48

N/A = Not Available

TABLE NO. 1 CONTINUED
PRECIPITATION DATA
BENTON HARBOR AIRPORT, MICHIGAN

(Inches)

	1985	1986	1987	1988	1989	1990	1991
JAN	2.61	1.28	1.28	1.54	0.63	1.28	1.12
FEB	2.64	2.49	0.0	0.87	0.67	2.70	0.48
MAR	5.61	1.23	0.93	2.64	2.39	2.51	4.27
AP	2.61	2.47	1.59	4.22	2.49	3.87	5.35
MAY	2.62	4.76	2.46	1.67	2.20	5.84	3.67
JUN	2.59	4.88	2.46	0.15	4.73		2.17
JUL	3.84	4.87	3.22	0.99	6.94	2.94	
AUG	3.40	2.74	8.19	2.41	5.16	5.16	
SEP	1.89	9.92	2.55	2.84	3.62	5.74	
OCT	4.29	3.73	2.73	5.44	1.27	2.94	
NOV	7.15	1.21	1.80	5.92	2.16	5.16	
DEC	2.06	0.95	2.42	1.44	1.85	5.74	
ANNUAL	41.31	40.53	29.63	30.13	34.11	N/A	
DEPART. FROM NORMAL	4.90	N.A.	-6.78	-6.28	-2.30	N/A	

TABLE No. 2

BASELINE
WATER TABLE ELEVATIONS

(National Geodetic Vertical Datum 1929)

BORING NO.	SURFACE ELEVATION (feet)	GROUND WATER DEPTH (feet)	DATE	GROUND WATER ELEVATION (feet)
1	601.4	11.0	7-21-66	590.4
2	664.4	62.0	7-28-66	602.4
3	641.6	53.3	11-23-66	588.3
4	621.8	37.3	11-23-66	584.5
5	605.2	18.2	11-23-66	587.0
6	584.3	1.5	11-23-66	582.8
7	583.5	2.2	7-23-66	581.3
8	605.8	9.8	7-23-66	596.0
9	596.8	8.7	11-23-66	588.1
10	600.1	9.2	11-23-66	590.9
11	625.4	23.0	11-23-66	602.4
12	625.5	24.5	7-25-66	601.0
13	605.6	3.5	11-23-66	602.1
14	616.7	7.9	11-23-66	608.8
15	603.8	7.2	11-23-66	596.6
16	658.4	51.5	7-23-66	606.9
17	588.5	6.0	11-23-66	582.5
18	613.0	6.2	11-23-66	606.8
19	592.7	10.0	8-4-66	582.7

TABLE 3

BASELINE WATER QUALITY

(mg/l)

DAMES & MOORE SAMPLE SURVEY

SOURCE	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	Total Hard.	Total Solids	Fe
9 Wells (40-60 Ft. Deep)	12						24	10			245	306	1.2
17 Wells (60-160 Ft. Deep)	13						38	20			256	327	0.9
10 Wells (160 Ft. Deep)	13						25	17			262	307	0.5
Weighted Average	13						30	16			255	316	0.86
D.C. Cook's Potable Well No. 1 March 21, 1972	8	73	22	10	4.0	257	28	50	0.29	0.7	275	398	
Well No. 2 March 21, 1972	11.2	67	21	10	3.2	249	28	44	0.29	0.8	255	383	
Upgradient Observation Well No. 8				47			9.5	76		0.2	219.5	406	

Note: Values for observation well No. 8 are median values for period of monitoring from July 1, 1977 to December 31, 1984

TABLE NO. 4

DISCHARGE TO THE TRS POND

(AVERAGE DAILY DISCHARGE PER MONTH)

OUTFALL 374

FLOW, MGD

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
JAN		0.33		0.56	0.44	0.36	0.51	0.50	0.47	0.51	0.44	0.55	0.39	0.34	0.45	0.82
FEB		0.31	0.42	0.43	0.50	0.61	0.33	0.48	0.49	0.38	0.51	0.64	0.36	0.35	0.38	0.84
MAR		0.36	0.44	0.42	0.48	0.61	0.55	0.51	0.54	0.40	0.41	0.58	0.37	0.49	0.45	0.53
AP		0.38	0.42	0.25	0.48	0.59	0.49	0.63	0.39	0.62	0.44	0.72	0.38	0.35	0.39	0.68
MAY		0.19	0.36	0.46	0.53	0.59	0.50	0.67	0.35	0.63	0.41	0.26	0.24	0.28	0.36	0.78
JUN		0.33	0.45	0.51	0.37	0.53	0.58	0.68	0.39	0.43	0.68	0.25	0.14	0.50	0.61	0.75
JUL	0.40	0.44	0.63	0.81	0.37	0.50	0.39	0.61	0.44	0.34	0.68	0.39	0.13	0.47	0.58	0.51
AUG	0.47	0.39	0.54	0.84	0.47	0.40	0.42	0.33	0.35	0.40	0.59	0.39	0.31	0.42	0.51	
SEP	0.44	0.35	0.68	0.48	0.44	0.50	0.53	0.33	0.39	0.35	0.61	0.45	0.29	0.34	0.64	
OCT	0.42	0.33	0.62	0.45	0.44	0.42	0.48	0.40	0.38	0.42	0.57	0.60	0.28	0.27	0.71	
NOV	0.34	0.48	0.58	0.44	0.27	0.42	0.46	0.41	0.49	0.50	0.49	0.60	0.33	0.39	0.75	
DEC	0.39	0.47	0.70	0.40	0.30	0.53	0.37	0.42	0.47	0.49	0.44	0.48	0.30	0.39	0.62	

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

Table No. 4 continued

SAMPLE		WELL 1A			WELL 8			WELL 11			WELL 12		
DATE	QUARTER	SULFATE	TDS	LEVEL	SULFATE	TDS	LEVEL	SULFATE	TDS	LEVEL	SULFATE	TDS	LEVEL
11/29/76	4Q76	0	200	52.5	4.9	422	7.66	169.5	634	9.5			
2/25/77	1Q77	74.9	150	60.8	42.7	548	8	241.6	598	11.2	244.2	688	18.8
7/24/77	2Q77	1.1	176	58	1.3	496	7	29	688	9.25	32.3	680	17.75
8/19/77	3Q77	4.1	174	59.25	9.9	292	7.83	265.8	682	4.25	304.5	678	12.25
11/14/77	4Q77	8	162	59.33	9.5	604	6.83	329.2	598	9.25	283.1	570	17.75
2/11/78	1Q78	0	110	58	49.4	414	6.67	257	694	8.5	229	548	15
5/12/78	2Q78	12.4	214	57.6	0	210	6	293.8	638	7.8	307.8	618	16.8
8/11/78	3Q78	27.1	350	52	6.6	290	6	255	320	5	332	640	3.3
11/8/78	4Q78	11.5	180	54	0.8	356	7	277	716	6	265	666	12
3/6/79	1Q79(1)	0	134	59	0	464	6	247	600	4	257	624	18
3/26/79	1Q70(2)	0	244	53	0	408	6	173	556	3	234	608	12
6/25/79	2Q79	0	144	608.24	1.8	246	608.7	151	462	604.97	169	452	595.78
8/4/79	3Q79	0	176	605.74	0	272	608.2	216	428	606.17	111	478	596.95
12/4/79	4Q79	20	234	616.74	21	370	608.2	229	750	602.97	163	494	596.95
3/4/80	1Q80	0	220	604.66	0	564	608.2	248	694	602.64	301	738	592.15
6/2/80	2Q80	3	170	604.74	29	312	608.37	310	718	602.8	272	654	599.68
8/3/80	3Q80	0	308	602.24	0	488	608.7	279	786	602.85	312	698	593.95
12/2/80	4Q80	0	94	568.74	0	602	598.37	333	606	583.14	82.5	296	594.14
3/3/81	1Q81	1	186	604.54	0	358	608.58	285	700	601.85	295	688	596.53
6/2/81	2Q81	35	570	612.6	11	398	609.47	205	660	602.18	236	688	596.36
8/3/81	3Q81	98.2	292	609.1	8	364	608.72	176	410	603.73	112	422	599.23
12/10/81	4Q81	117	298	609.6	0	342	608.72	157	390	602.43	174	450	598.03
3/4/82	1Q82	28.8	81	605.6	31	412	610.72	190.9	456	602.6	221.3	434	599.53
6/2/82	2Q82(1)	170	398	610.77	24	670	609.3	170	414	599.85	152	342	596.11
7/7/82	2Q82(2)				71	334	609.81						
8/31/82	3Q82	186	420	611.6	13	272	609.47	121	444	602.93	158	454	595.53
12/7/82	4Q82	151	320	605.6	1	514	608.72	221.4	594	601.26	74	410	595.53
3/8/83	1Q83	202.5	456	606.1	18.1	780	609.7	228	546	599.43	216.5	306	597.53
6/9/83	2Q83	0	386	605.68	17.3	438	610.53	242	538	601.93	118.5	410	596.03
9/6/83	3Q83	10	268	605.5	3	566	607.95	345	422	601.68	225	504	597.78
12/6/83	4Q83	149	464	604.77	16	406	607.22	234	694	599.43	77	525	593.78
3/6/84	1Q84	269	604	606.1	200	518	609.94	209	842	599.93	239	754	595.53
6/18/84	2Q84	383	760	606.52	10	480	609.22	370	672	599.85	398	744	593.66
9/4/84	3Q84	139	620	604.93	25	350	607.3	242	1018	599.93	159	760	593.86
12/4/84	4Q84	421	900	606.43	4	454	608.3	243	1088	598.51	244	1008	593.61
3/7/85	1Q85	370	1044	606.93	2	510	610.47	405	1174	599.56	290	1150	594.2
6/14/85	2Q85	256.7	576	607.97	0	340	609.3	294	1052	601.35	364.5	882	593.7
9/3/85	3Q85	125	396	607.1	16	476	607.72	316	762	600.18	446	786	594.28
12/5/85	4Q85	388	652	608.43	32	546	609.55	349	690	600.35	366	698	594.45
3/10/86	1Q86	419	660	607.6	90	438	609.22	444	726	600.18	362	700	594.95
6/2/86	2Q86	537	888	607.6	43	700	609.14	410	876	600.35	462	786	594.03
9/3/86	3Q86	210	524	609.52	19	486	608.55	280	768	601.6	250	734	595.45

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

Table No. 4 continued

SAMPLE		WELL 1A			WELL 8			WELL 11			WELL 12		
DATE	QUARTER	SULFATE	TDS	LEVEL	SULFATE	TDS	LEVEL	SULFATE	TDS	LEVEL	SULFATE	TDS	LEVEL
12/10/86	4Q86	320	633	606	35	475	609.61	370	365	601.23	460	728	594.93
1/10/87	1Q87	440	720	606.1	49	646	603.82	440	841	596.43	390	763	592.23
5/13/87	2Q87				48	478	595.52	400	714	601.01	350	721	594.78
8/27/87	3Q87	360	677	601.6	13	430	607.42	78	280	599.23	340	658	593.23
11/23/87	4Q87	360	588	606.7	33	387	608.62	390	715	601.23	390	738	594.23
2/24/88	1Q88	380	640	608.6	8	370	614.91	1100	2250	598.53	1100	2260	598.23
6/1/88	2Q88	340	620	604.6	29	390	609.62	560	1140	588.83	400	700	593.53
9/1/88	3Q88	98	220	601.7	31	182	609.92	200	439	598.63	710	982	594.93
12/6/88	4Q88	29	175	602.6	38	273	603.92	520	722	598.63	190	361	593.03
2/16/89	1Q89	5	290	630.3	11	32	607.92	390	941	598.03	300	658	592.53
4/20/89	2Q89	18	182	603.93	16	382	607.72	800	856	596.93	580	922	589.86
8/1/89	3Q89	48	274	605.7	74	275	609.97	410	764	600.43	530	962	594.73
10/3/89	4Q89	140	58	605	15	445	608.55	520	1030	588.51	450	848	593.86
1/8/90	1Q90	420	780	605.2	13	470	609.32	470	950	598.53	390	850	593.73
4/16/90	2Q90	480	740	607.5	26	490	609.7	460	770	599.41	560	970	594.93
7/10/90	3Q90	450	750	607.7	33	460	609.61	420	790	602.38	510	880	595.95
10/24/90	4Q90	230	390	609.6	13	370	609.92	270	540	604.03	260	530	598.58

Table No. 5

Static Water levels
(measured October 26, 1990)

Well No.	Top of Casing El. (Ft. NGVD)	Depth To SWL (Ft.)	Static Water Level (Ft. NGVD)
RP 1	659.39	70.58	588.81
RP 2	627.74	30.83	596.91
RP 3	615.72	5.83	609.89
RP 4	596.73	8.42	588.31
RP 5	596.99	10.42	586.48
RP 6	596.84	7.66	589.18
RP 7	677.06	76.00	601.06
EW 1A	661.60	50.25	611.35
EW 11	608.43	4.42	604.01
EW 12	610.45	12.25	598.20
SGR 1	618.18	7.92	610.26
SGR 2	617.32	7.42	609.90
SGR 4	616.21	7.25	608.96
SGR 5	624.36	14.66	609.70

RP Radiological Protection Monitoring Well
EW Environmental Monitoring Well
SGR Steam Generator Storage Monitoring Well

Table No. 6

CONCENTRATIONS OF Na & SO4 ALONG THE COOK PLANT SITE'S SOUTHERN BORDER

ENVIRONMENTAL WELLS	STATIC ELEV. (FT NGVD)	TDS (PPM)	NA CONC. (PPM)	SO4 CONC. (PPM)
13	599.62	312	20	89
14	603.23	308	28	54
15	605.31	162	9.2	31
16	610.33	440	67.5	51

TABLE NO. 7

CUT #1: CONCENTRATIONS OF Na & SO_4 ALONG HP's 3, 2, 17, 13, 14, & 26

SAMPLE	HORIZONTAL DIST ALONG CUT #1 (FT)	GROUNDWATER STATIC ELEV (FT NGVD)	SAMPLE ELEVATION (FT NGVD)	NA CONC. (PPM)	SO4 CONC. (PPM)
HP 3	0	608.66	605.96	131	407
HP 3	0	608.66	595.96	164	.
HP 3	0	608.66	585.96	186	336
HP 2	162.234	607.55	587.05	.	339
HP 2	162.234	607.55	577.05	176	511
HP 17	540.872	601.19	594.09	87.7	210
HP 17	540.872	601.19	584.09	133.5	400
HP 17	540.872	601.19	574.09	104.6	270
HP 17	540.872	601.19	564.09	98.4	280
HP 17	540.872	601.19	554.09	17.4	400
HP 13	1263.59	601.3	595.1	5	[illegible]
HP 13	1263.59	601.3	585.1	64.5	[illegible]
HP 13	1263.59	601.3	575.1	23.5	[illegible]
HP 13	1263.59	601.3	565.1	18	31
HP 13	1263.59	601.3	555.1	23	36
HP 14	1690.57	600.66	595.76	18	44
HP 14	1690.57	600.66	585.76	23	33
HP 14	1690.57	600.66	575.76	23	24
HP 14	1690.57	600.66	565.76	21.5	5.3
HP 14	1690.57	600.66	555.76	.	29
HP 26	2209.12	597.14	590.54	29	41
HP 26	2209.12	597.14	580.54	66	37
HP 26	2209.12	597.14	570.54	84	25
HP 26	2209.12	597.14	560.54	51	11

TABLE NO. 8

CUT #2: CONCENTRATIONS OF Na & SO_4 ALONG HP's 18-23; EW 1; HP 24 & 25

SAMPLE	HORIZONTAL DIST ALONG CUT #2 (FT)	GROUNDWATER STATIC ELEV (FT NGVD)	SAMPLE ELEVATION (FT NGVD)	NA CONC. (PPM)	SO4 CONC. (PPM)
HP 18	0	607.08	597.18	33.6	34
HP 18	0	607.08	587.18	27.6	36
HP 18	0	607.08	577.18	.	75
HP 18	0	607.08	567.18	7.3	32
HP 19	437.116	609.07	597.67	23	22
HP 19	437.116	609.07	587.67	49	48
HP 19	437.116	609.07	577.67	73	42
HP 19	437.116	609.07	567.67	39	45
HP 20	642.483	610.16	604.76	21	28
HP 20	642.483	610.16	594.76	42	39
HP 20	642.483	610.16	584.76	94	47
HP 20	642.483	610.16	574.76	60	28
HP 20	642.483	610.16	564.76	45	41
HP 21	811.29	605.95	600.25	30	24
HP 21	811.29	605.95	590.25	35	25
HP 21	811.29	605.95	580.25	158	365
HP 21	811.29	605.95	570.25	.	127
HP 21	811.29	605.95	560.25	36	.
HP 22	930.109	606.98	598.78	298	289
HP 22	930.109	606.98	588.78	277	113
HP 22	930.109	606.98	578.78	98	215
HP 22	930.109	606.98	568.78	79	30
HP 22	930.109	606.98	558.78	41	40
HP 23	1156.53	596.83	592.93	160.4	206
HP 23	1156.53	596.83	582.93	143.9	321
HP 23	1156.53	596.83	572.93	224.1	698
HP 23	1156.53	596.83	562.93	.	23
EW 1	1335.36	610.77	610.77	110	420
HP 24	1631.53	604.51	597.01	121.2	318
HP 24	1631.53	604.51	587.01	123.2	151
HP 24	1631.53	604.51	577.01	102.3	509
HP 24	1631.53	604.51	567.01	71.5	166
HP 24	1631.53	604.51	557.01	...	47
HP 25	1951.41	611.31	596.41	10.4	8.3
HP 25	1951.41	611.31	584.41	45.4	334
HP 25	1951.41	611.31	574.41	28.3	114
HP 25	1951.41	611.31	564.41	31.7	8.7

TABLE NO. 9

CUT #3: CONCENTRATIONS OF Na & SO_4 ALONG EW 16; HP's 15, 16, 4, 8, 5, 6, 9-14, & 2.

SAMPLE	HORIZONTAL DIST ALONG CUT #1 (FT)	GROUNDWATER STATIC ELEV (FT NGVD)	SAMPLE ELEVATION (FT NGVD)	NA CONC. (PPM)	SO4 CONC. (PPM)
EW 16	0	610.33	610.33	67.5	51
HP 15	756.307	608.25	601.35	71.5	12
HP 15	756.307	608.25	591.35	23	11
HP 15	756.307	608.25	581.35	69	.
HP 16	1352.67	606.14	600.54	26.5	22
HP 16	1352.67	606.14	590.54	58.5	18
HP 16	1352.67	606.14	580.54	.	11
HP 4	1655.85	610.1	596.7	18.7	5.5
HP 4	1655.85	610.1	576.7	316.6	.
HP 8	1662.79	609.55	601.65	16.5	25
HP 8	1662.79	609.55	591.65	24.5	10
HP 8	1662.79	609.55	581.65	56	28
HP 8	1662.79	609.55	571.65	31	150
HP 5	2102.2	604	596.17	11.9	18
HP 6	2105.85	603.62	589.42	15.8	.
HP 9	2108.73	606.25	599.45	6.5	5
HP 9	2108.73	606.25	589.45	18.5	11
HP 9	2108.73	606.25	579.45	37.5	11
HP 9	2108.73	606.25	569.45	10.5	[redacted]
HP 10	2528.39	603.75	594.15	14.5	[redacted]
HP 10	2528.39	603.75	584.15	30	[redacted]
HP 10	2528.39	603.75	574.15	19	23
HP 10	2528.39	603.75	564.15	9	37
HP 11	2956.68	602.17	595.97	21	9.4
HP 11	2956.68	602.17	585.97	10.5	14
HP 11	2956.68	602.17	575.97	13	20
HP 11	2956.68	602.17	565.97	8	32
HP 12	3325.64	603.61	596.21	8	120
HP 12	3325.64	603.61	586.21	13.5	19
HP 12	3325.64	603.61	576.21	29	40
HP 12	3325.64	603.61	566.21	25.5	30
HP 12	3325.64	603.61	556.21	26	36
HP 13	3592.89	601.3	595.1	5	29
HP 13	3592.89	601.3	585.1	64.5	29
HP 13	3592.89	601.3	575.1	23.5	31
HP 13	3592.89	601.3	565.1	18	31
HP 13	3592.89	601.3	555.1	23	36
HP 14	4019.87	600.66	595.76	18	44
HP 14	4019.87	600.66	585.76	23	33
HP 14	4019.87	600.66	575.76	23	24
HP 14	4019.87	600.66	565.76	21.5	5.3
HP 14	4019.87	600.66	555.76	.	29
HP 26	4538.43	597.14	590.54	29	41
HP 26	4538.43	597.14	580.54	66	[redacted]
HP 26	4538.43	597.14	570.54	.84	[redacted]
HP 26	4538.43	597.14	560.54	51	[redacted]

MONITORI[illegible]TA

POTABLE SUPPLY WELL NO. 2

(mg/l)

TABLE NO. 10

DATE	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	TDS	Hard $CaCO_3$	PH	Sp. Cond. A 25°C
3/21/72	11.2	67	21.4	10	3.2	249	27.6	43.7	0.29	0.8	383	255	7.68	570
1/31/76	8.0	57	16.4	8.6	2.1	202	31.3	25.2	0.1	0.8	298	210	7.4	491
8/3/76	7.4	63	16.4	13.0	1.7	233	25.4	22.4	0.14	0.07	326	228	7.1	447
1/31/77	5.4	60	16.6	12	2.3		29		0.36	0.07	293	218		
3/16/77	7.3	57	15.9	10.4	2.6	198	29	22	0.4	2.4	300	207	6.8	386
8/1/78	7.8	65	16.9	13	2.5	199	50	25	0.34	0.0	392	232	7.1	491
1/5/79	7.0	66	16.5	12	3.3	239	30	20.6	0.2	0.0	337	232	7.3	370
8/2/79	8.7	82	18.3	76	4.1	199	195	18.7	0.4	5.6	604	280	7.4	747
2/13/80	3.6	58	18	74	2.1	190	200	17.5	0.36	1.3	566	218	7.1	625
8/5/80	8.3	57	16	56	2.4	203	130	14.9	0.34	6.0	476	208	7.5	573
2/3/81	8.2	60	14	83	2.9	147	240	19.4	0.32	1.6	578	207	7.2	743
8/3/81	7.9	62	14.6	171	5.0	139	460	40	0.1	0.18	881	215	7.0	779
12/17/81	8.3	54	15.5	105	1.5	142	305	14.6	0.1	0.37	627		7.5	695
2/1/82	7.5	62	16.1	80	3.3	187	185	18.8	0.1	0.01	539		5.9	555
5/3/82	5.7	52	14.2	115	2.0	144	320	17.9	0.13	0.03	666		6.6	753
8/3/82	9.0	45	12.9	115	2.5	145	260	18	0.11	0.17	608		6.4	610

TABLE NO. 10 CONTINUED

CONTINUED

DATE	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	TDS	Hard $CaCO_3$	pH	Sp. Cond. @ 25°C
2/8/83	8.8	44	13	75.5	1.4	156	180	13.82	0.14	0.06	424	163.6	7.6	412
5/2/83	8.9	51	14	69.1	1.3	149	195	14.82	0.17	0.10	504	-	7.3	453
8/2/83	8.1	55	17	93.9	2.6	184	205	23.93	0.15	0.17	579	205.6	7.1	481
11/11/83	7.8	59	17	44.9	0.1	208	142	22.27	ND	0.14	460	216	7.4	375
2/7/84	9.4	54	17	79.3	2.6	191.4	248	19.02	ND	ND	574	205	7.7	661
5/1/84	8.3	54	17	77.1	1.5	220	201	17.3	ND	0.08	571	204	7.2	652
8/1/84	7.1	72	19	73.1	3.1	219	180	17.0	0.20	0.01	574	258	7.8	780

* None Detected <0.1 mg/l Fl

None Detected <0.1 mg/l NO

MONITORING AREA

POTABLE SUPPLY WELL NO. 1

(mg/l)

TABLE NO. 11

DATE	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	TDS	Hard $CaCO_3$	PH	Sp. Cond. A 25°C
3/21/72	8.0	73	22.4	10	4	257.3	27.6	49.5	0.29	0.7	398	274.5	7.55	597
1/31/76	8.0	70.2	18.2	8.5	1.7	253.2	44.7	19.9	0.1	1.8	344	250	7.3	563
8/3/76	6.7	56	15.6	11.5	2.1	199.4	28.6	22	0.14	0.07	305	204	7.4	397
1/31/77	3.7	67	18.8	12.5	2.1		26		0.4	0.07	308	244		
3/16/77	8.2	66	18.5	14.3	2.7	243.5	24	30.1	0.64	0.02	350	241	7.0	445
1/31/78	10	61	19	16	2.9	236	22.5	32	0.32	0.0	334	230	7.1	465
8/1/78	10	63.5	15.8	12.1	2.3	232.3	48	23.2	0.32	0.0	344	223	7.4	385
1/6/79	7.5	64	14.9	17.5	3.3	204.2	70	36.4	0.2	0.0	361	221	7.4	392
8/1/79	7.2	78	17.9	42	3.2	226.8	114.0	17.4	0.38	5.8	457	268.5	7.2	584
2/2/80	7.1	54.	18	13	1.7	242.6	42	15.3	0.28	1.6	378	209	7.1	424
8/4/80	5.6	65	17.4	62	2.5	198.5	135	15.2	0.34	2.4	490	233	7.5	564
2/11/81	9.1	60	17	19		236	67.5	15.4	0.32	3.6	416	219	7.0	495
8/3/81	8.2	61	15.6	28.5	2.4	238	55	55	0.1	0.15	389	217	7.0	429
12/17/81	11	59	17.3	18.1	0.8	232	67.5	20	0.1	0.29	354		7.4	415
2/2/82	8.1	68	16.8	17.9	3.2	234	30	23	0.1	0.04	430		6.5	373
5/4/82	4.9	66	18.3	19.3	2.5	227	70	28	0.1	0.01	410		6.5	475
8/2/82	9.9	68	18.7	64	2.2	313	80	19	0.1	0.17	512		6.6	506

TABLE NO. 11 CONTINUED

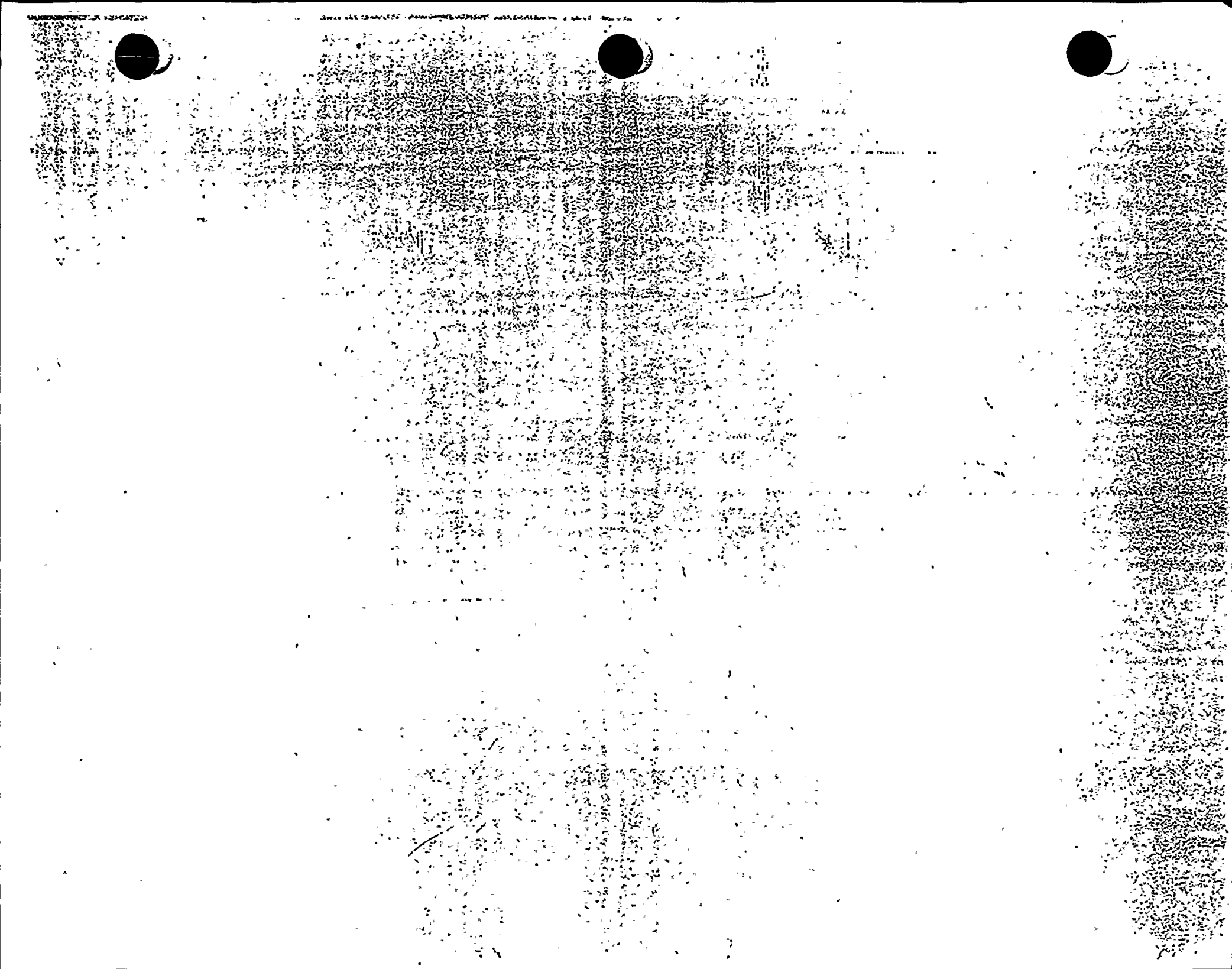
CONTINUED

Date	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	TDS	Hand $CaCO_3$	PH	Sp. Cond. @ 25°C
2/7/83	9.8	44	13.7	77.5	1.6	252	28	29.23	ND*	0.04	338	110	7.5	3.00
5/2/83	7.4	51	14.2	68.7	1.3	149	205	16.42	0.19	0.05	527	-	7.1	451
8/2/83	9.5	73	18.5	23.0	1.3	229	68	28.23	ND	0.14	426	258	6.9	358
11/11/83	9.8	60	16.7	29.2	1.4	219	92	23.23	ND	0.13	406	217	7.4	324
2/6/84	10.9	59	14.9	20.9	2.1	233	10	26.83	ND	0.28	325	207	7.5	428
4/30/84	9.5	50	15.8	20.4	1.1	234	23	35.0	ND	ND	348	190	7.0	376
7/30/84	9.4	71	15.7	16.2	22	236	17	33.7	0.20	0.03	382	241	7.7	520

* ND - None Detected < 0.1 mg/l Fl

Appendix 5

Figures



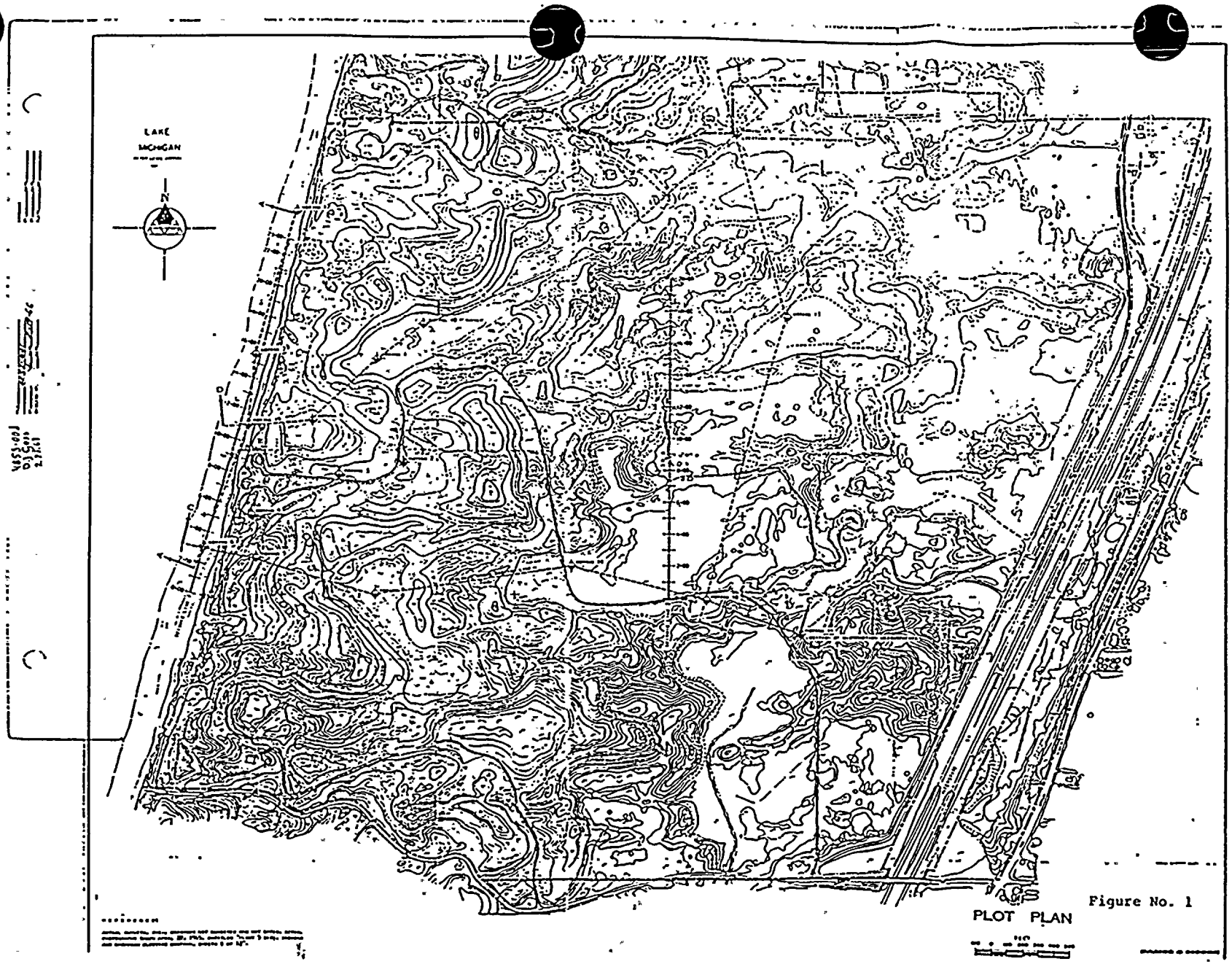
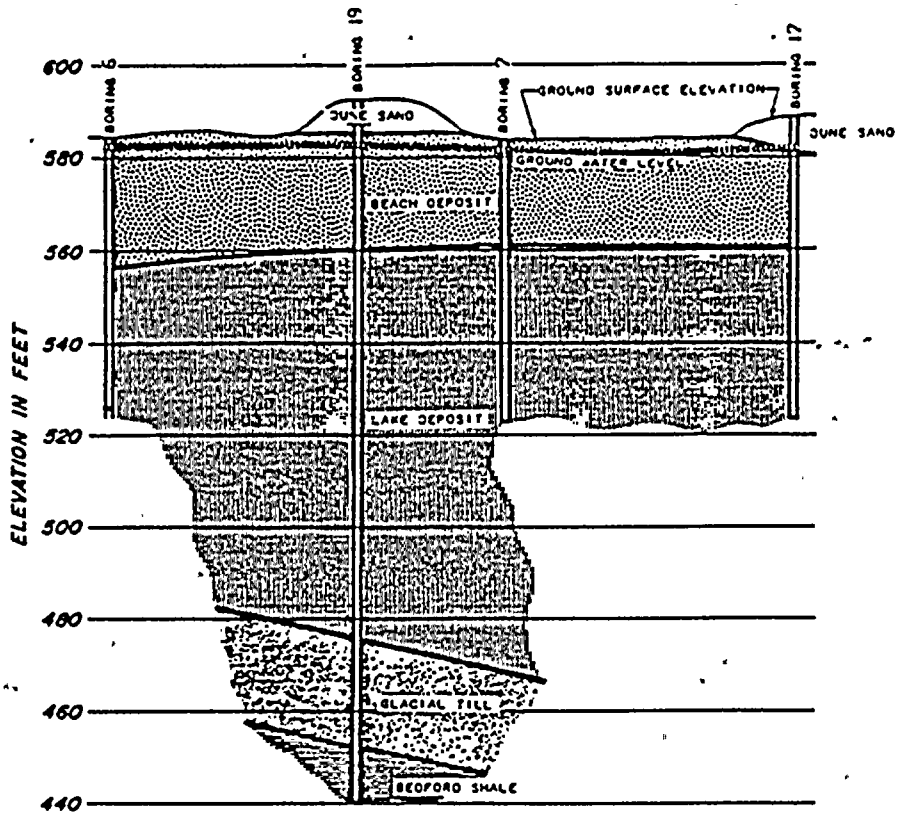
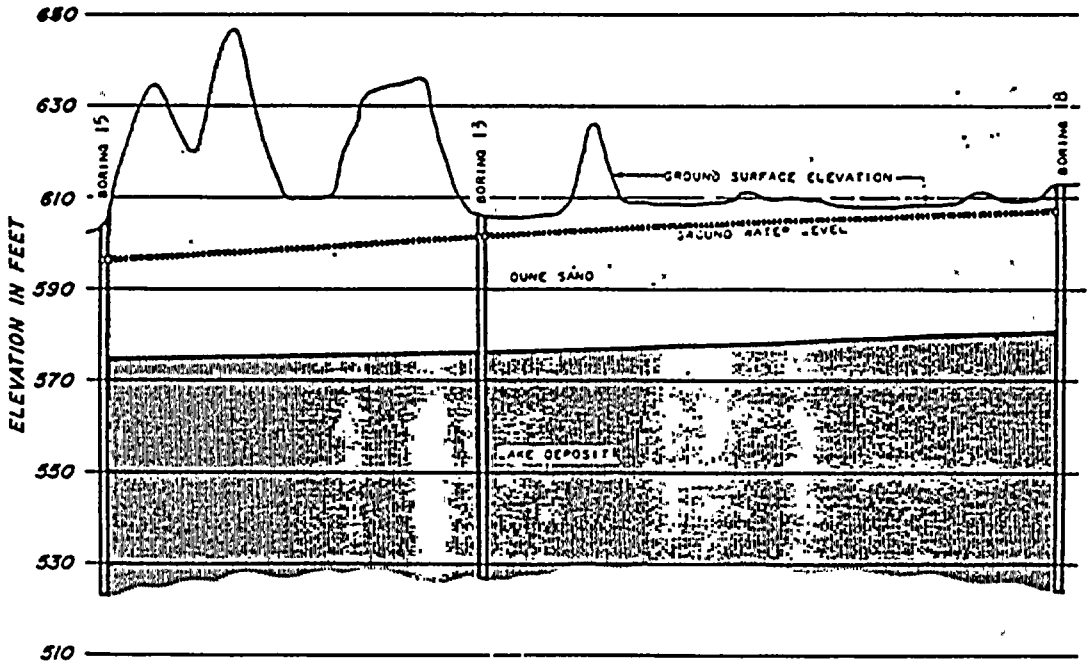


Figure No. 1



SECTION A–A



SECTION B–B

HORIZONTAL SCALE IN FEET

500 0 500 1000

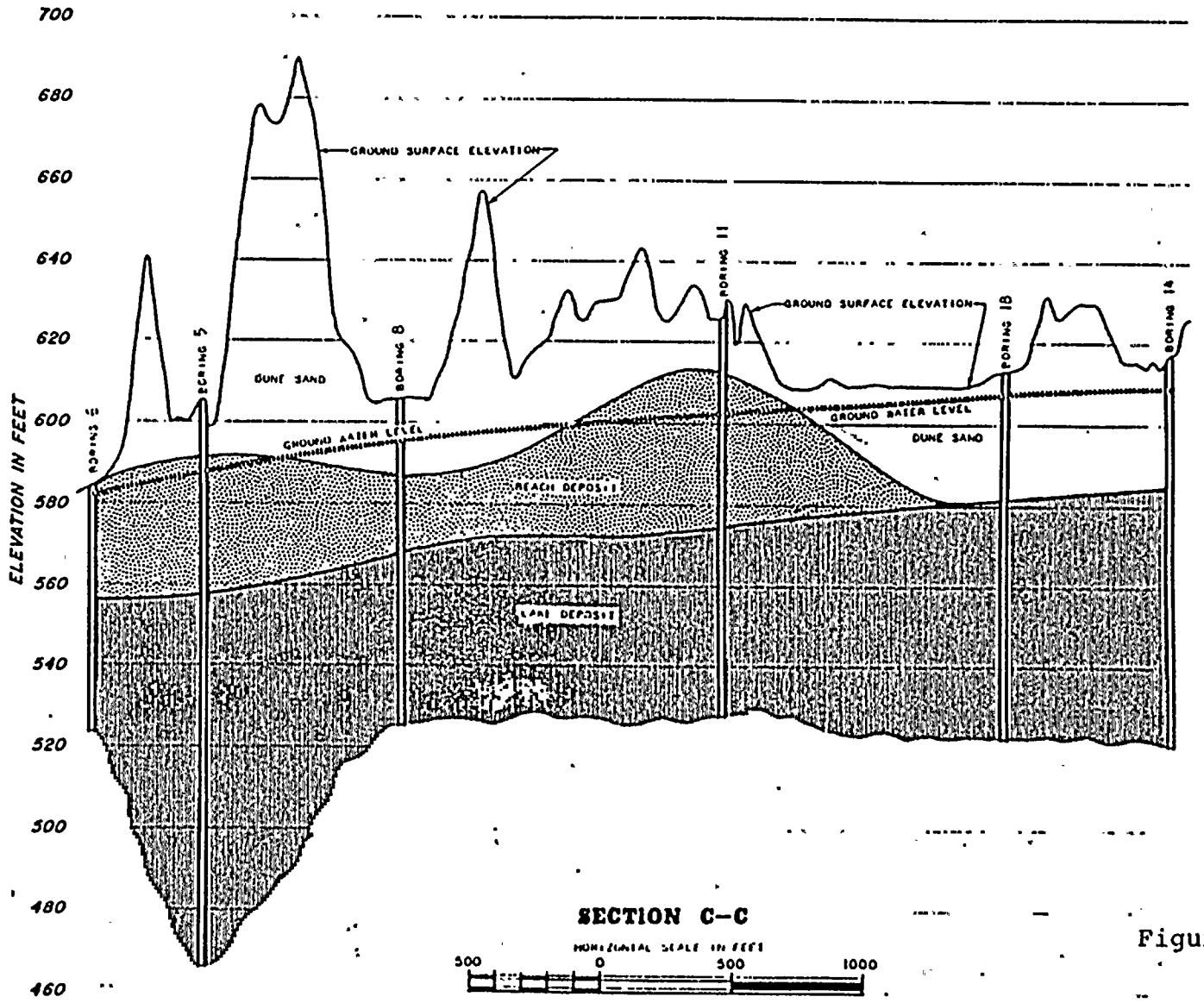
Figure No. 2

GEOLOGIC CROSS-SECTIONS

NOTE:

SUBSURFACE CONDITIONS ILLUSTRATED ABOVE WERE OBTAINED BY INTERPOLATION BETWEEN BORINGS. CONSEQUENTLY, VARIATIONS WHICH ARE NOT INDICATED BY THE CROSS-SECTION CAN BE EXPECTED BETWEEN BORING LOCATIONS.

DAMES & MOORE



NOTE:

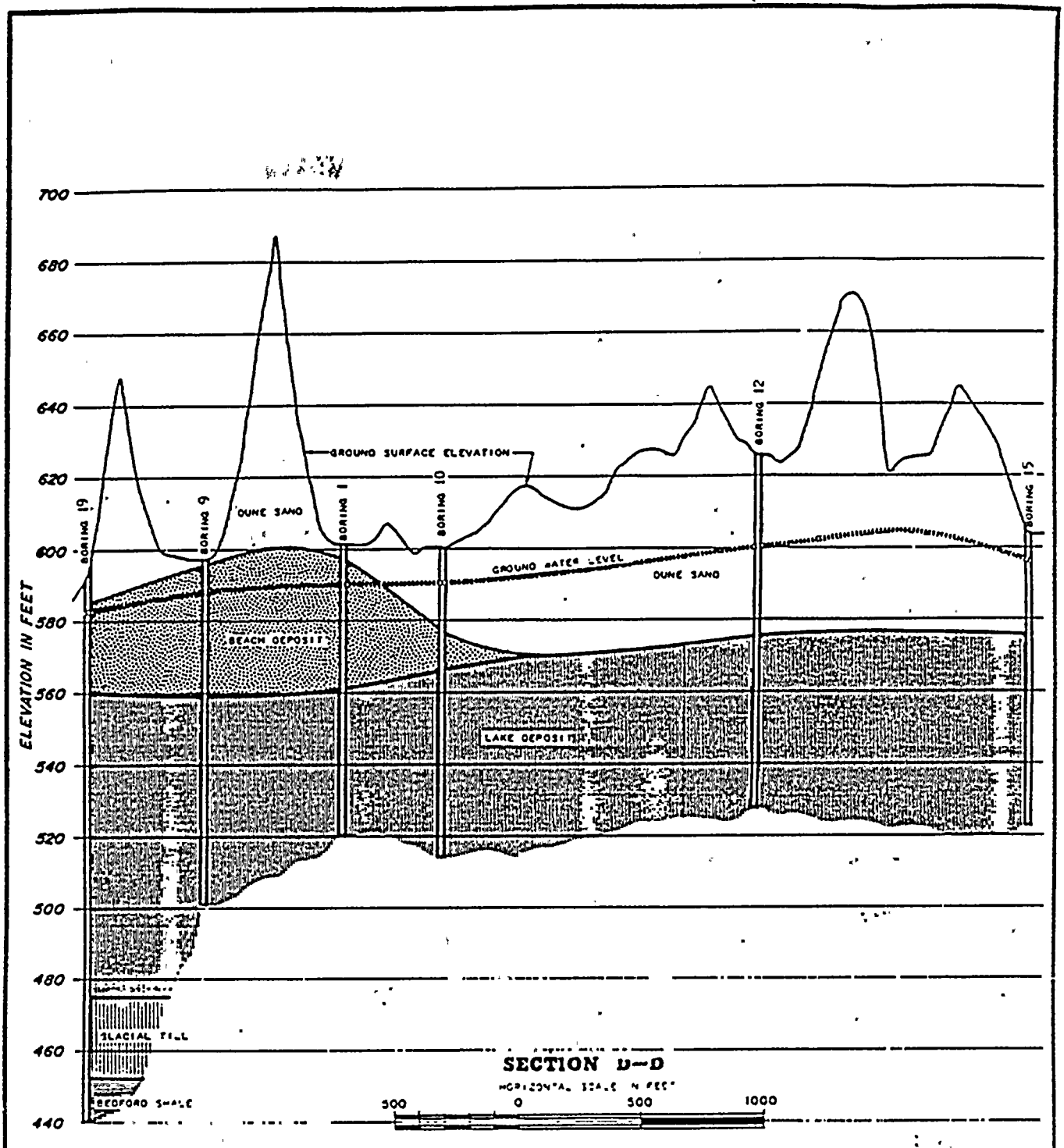
SUBSURFACE CONDITIONS ILLUSTRATED ABOVE ARE OBTAINED BY INTERPOLATION BETWEEN BORINGS. CONSEQUENTLY, VARIATIONS WHICH ARE NOT INDICATED BY THE CROSS-SECTION CAN BE EXPECTED BETWEEN BORING LOCATIONS.

Figure No. 3

GEOLOGIC CROSS-SECTION

DAMES & MOORE

PLATE IIA-10b



NOTE:

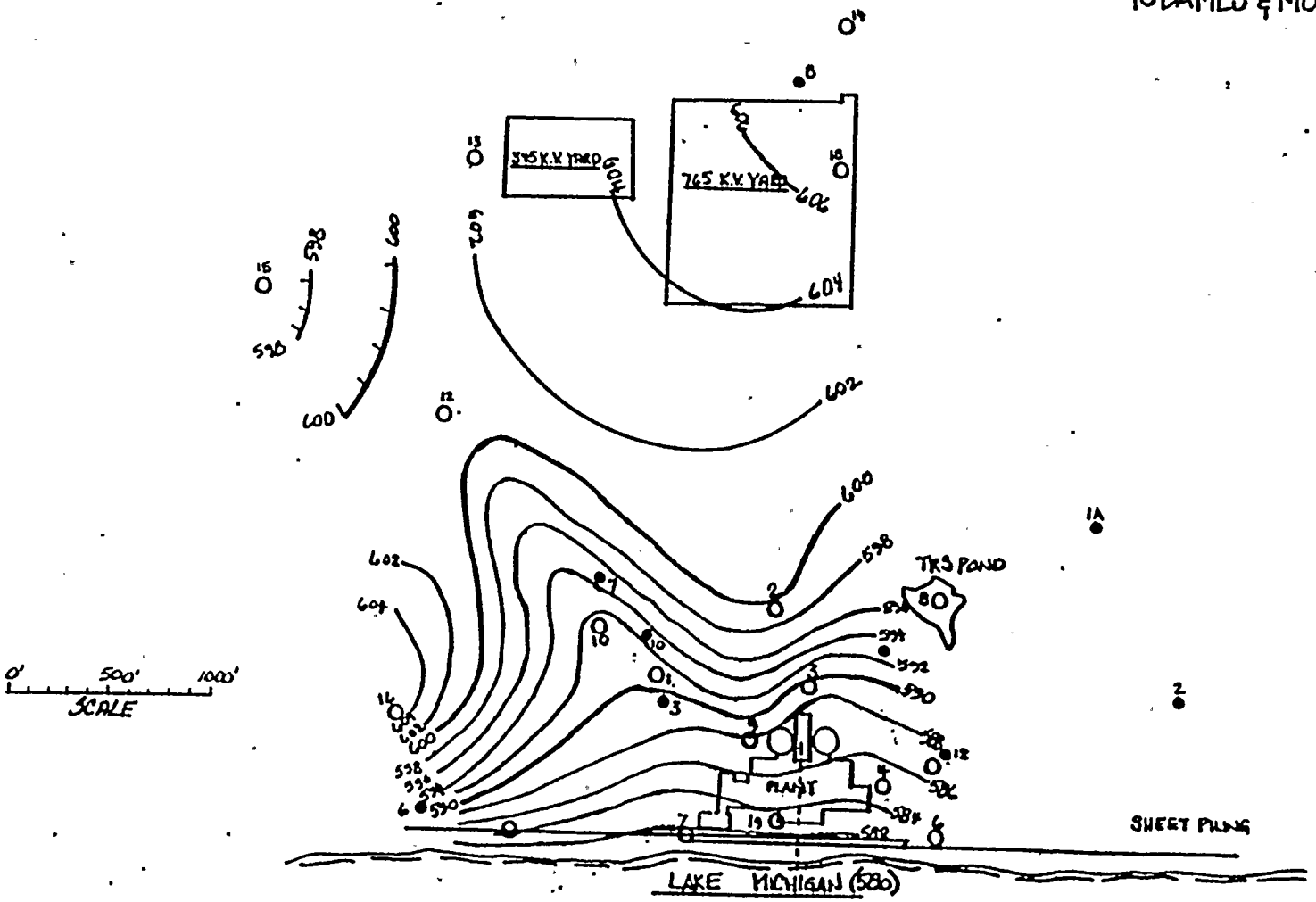
SUBSURFACE CONDITIONS ILLUSTRATED ABOVE WERE OBTAINED BY INTERPOLATION BETWEEN BORINGS. CONSEQUENTLY, VARIATIONS WHICH ARE NOT INDICATED BY THE CROSS-SECTION CAN BE EXPECTED BETWEEN BORING LOCATIONS.

GEOLOGIC CROSS-SECTION Figure No. 4

DAMES & MOORE

FIGURE 5

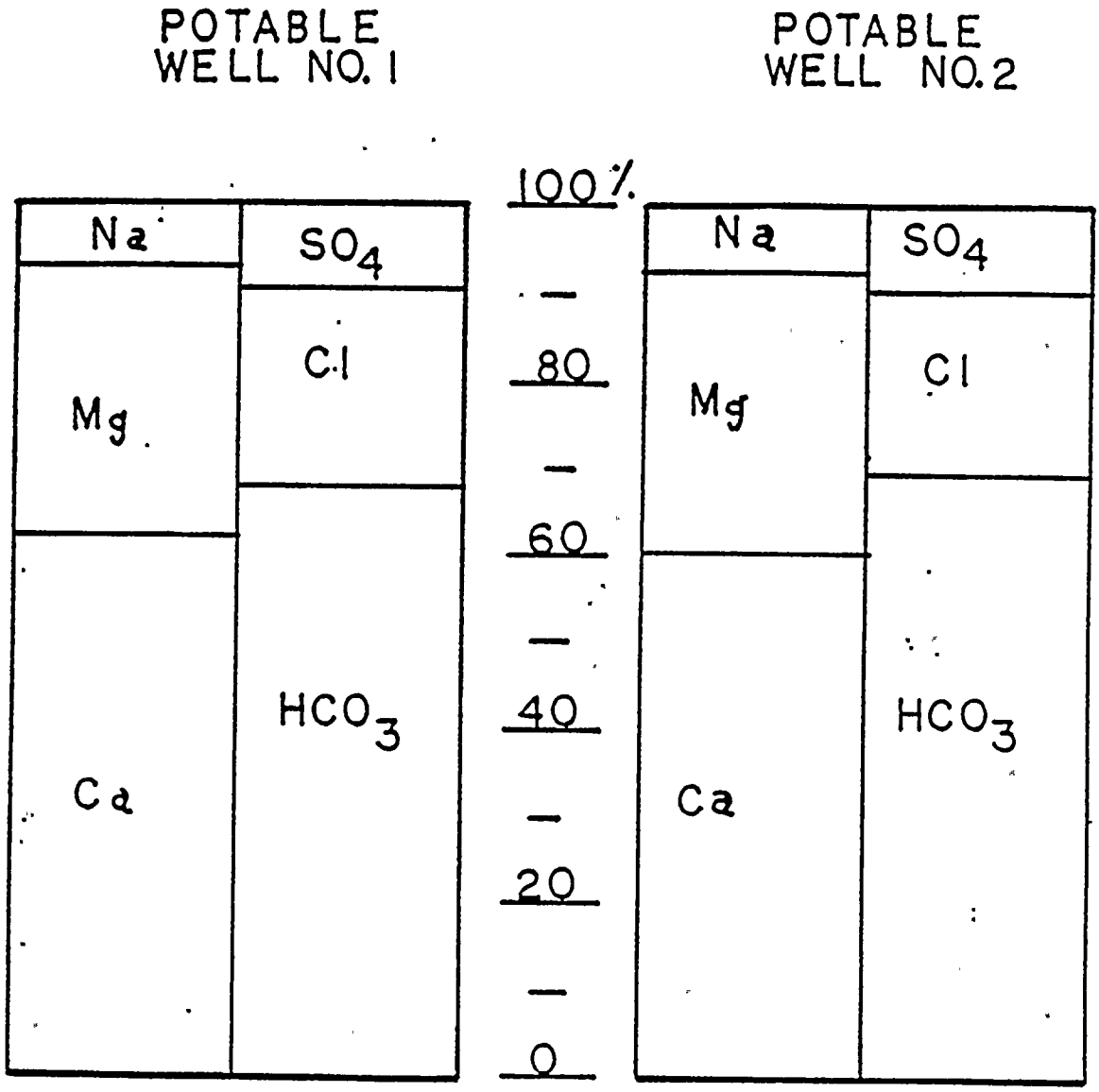
GENERALIZED PRECONSTRUCTION GROUNDWATER TABLE



Note: Obs. Wells 2, 3, 6, and 7 were discontinued after August, 1978.

Figure 6

Mass Balance of Baseline
Water Quality



NOTE: Total percentage of the ions is based on the March, 1972 analysis

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

Figure No. 7

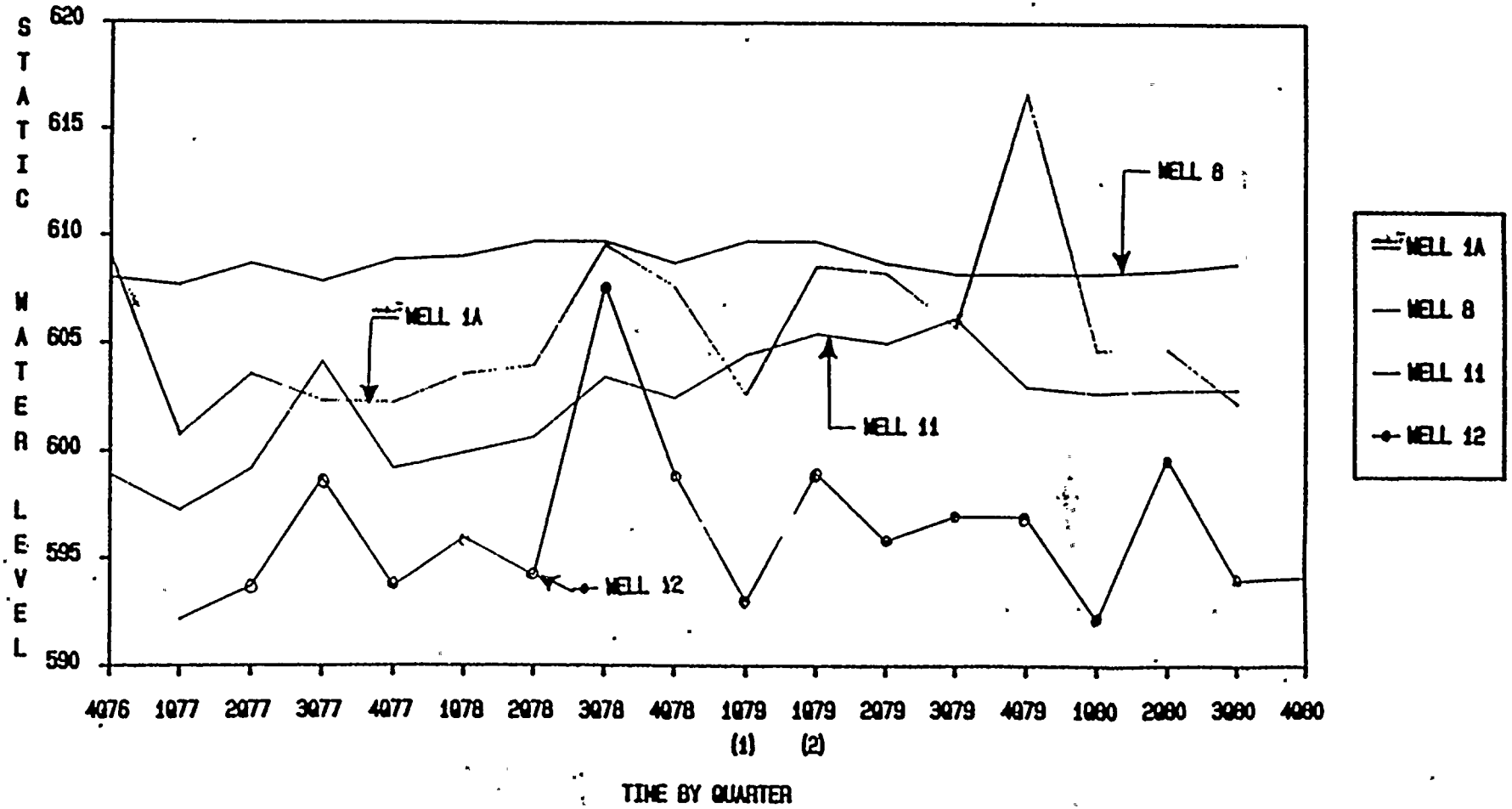


Figure No. 7
(Continued)

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

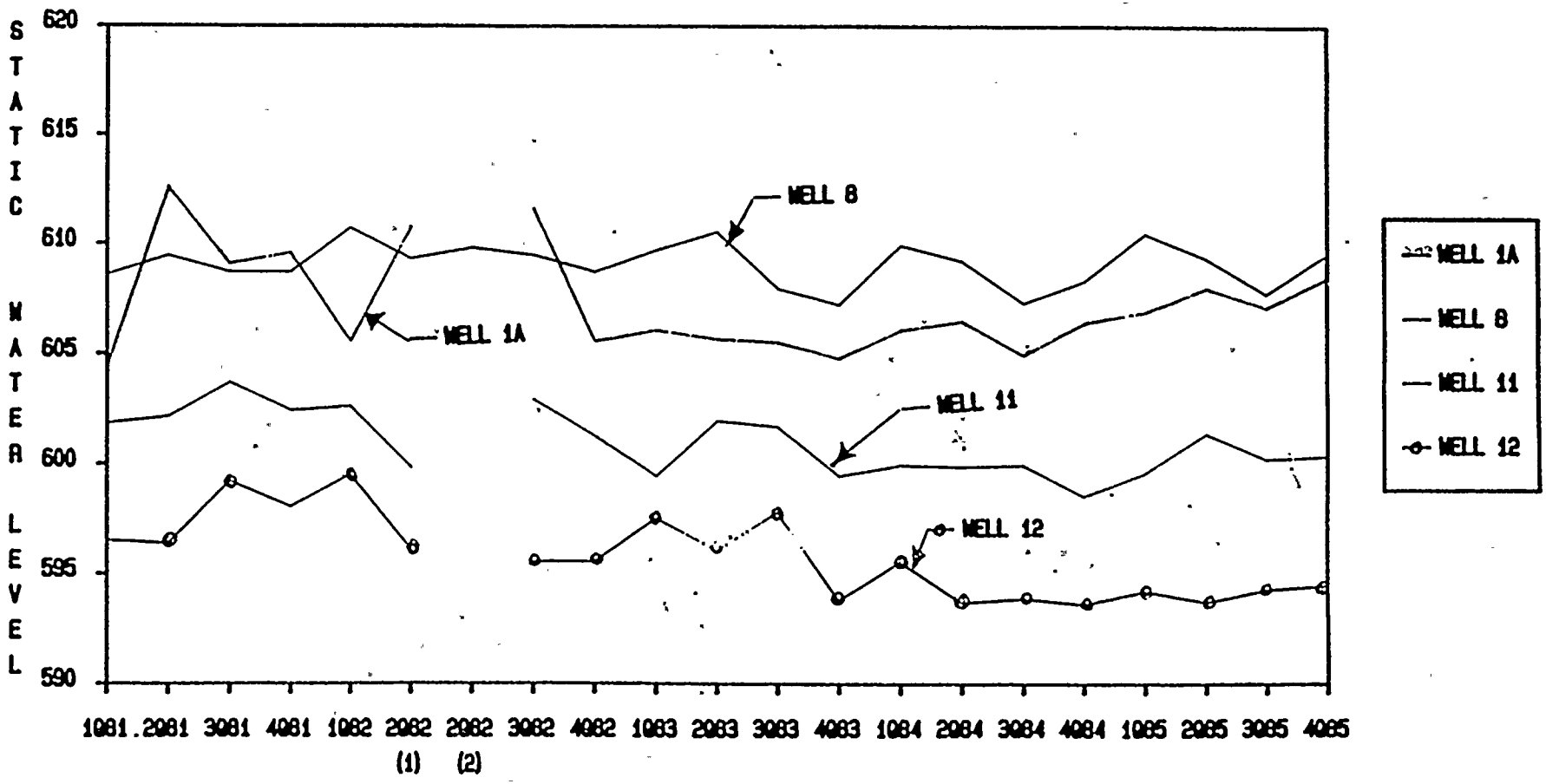


Figure No. 7
(Continued)

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

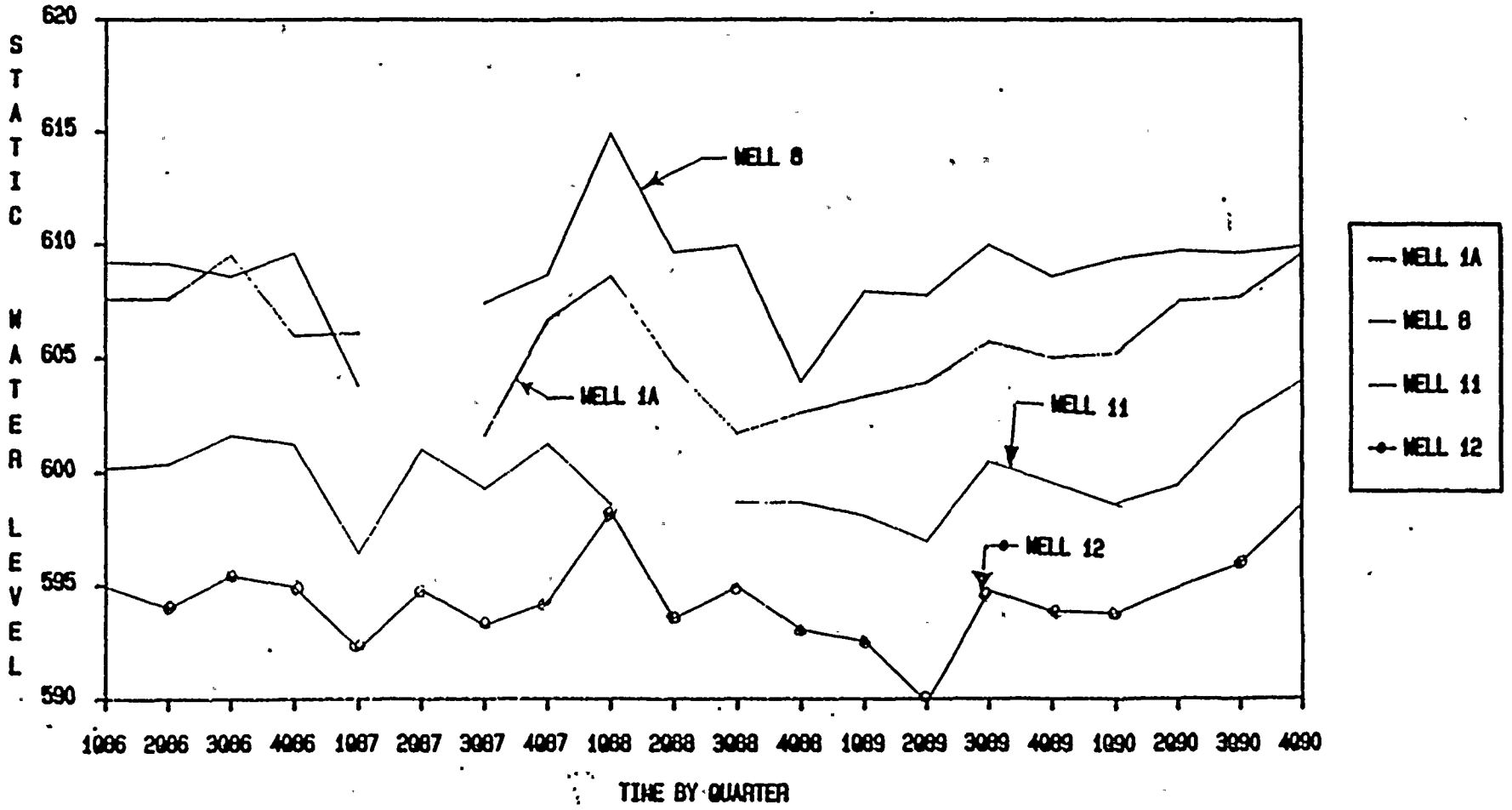


FIGURE NO. 8

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

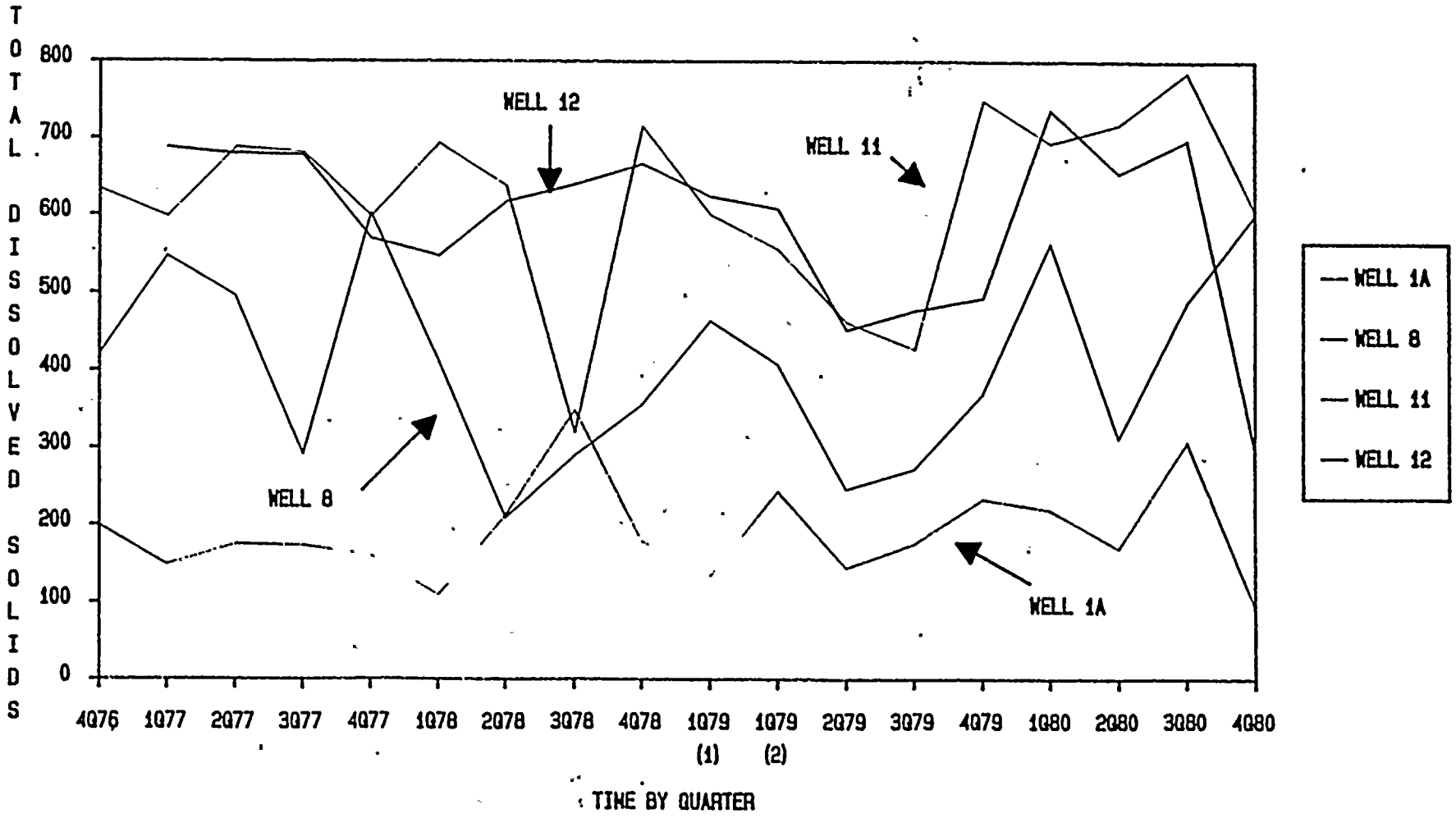


FIGURE NO. 8

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

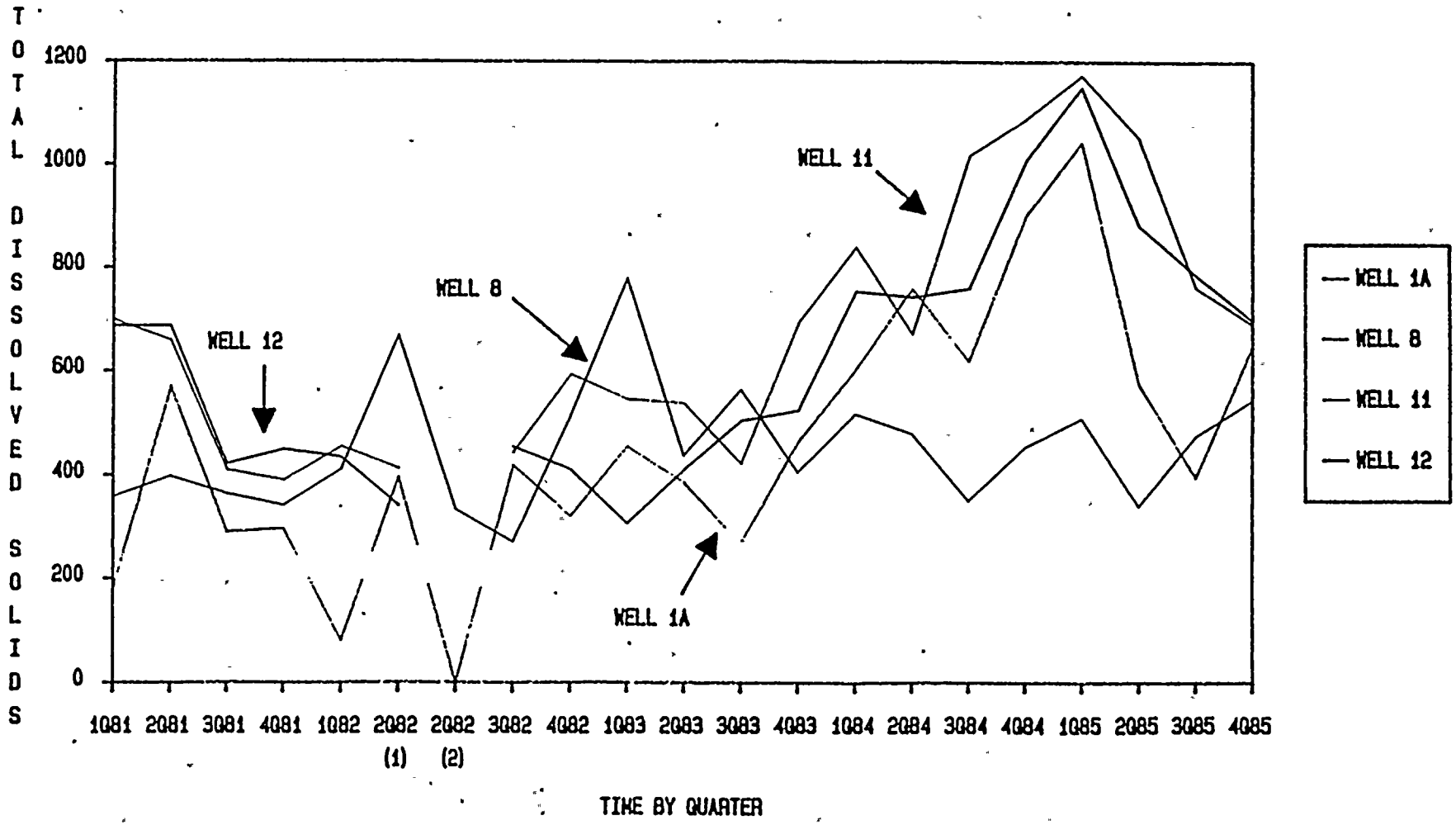


FIGURE NO. 8

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

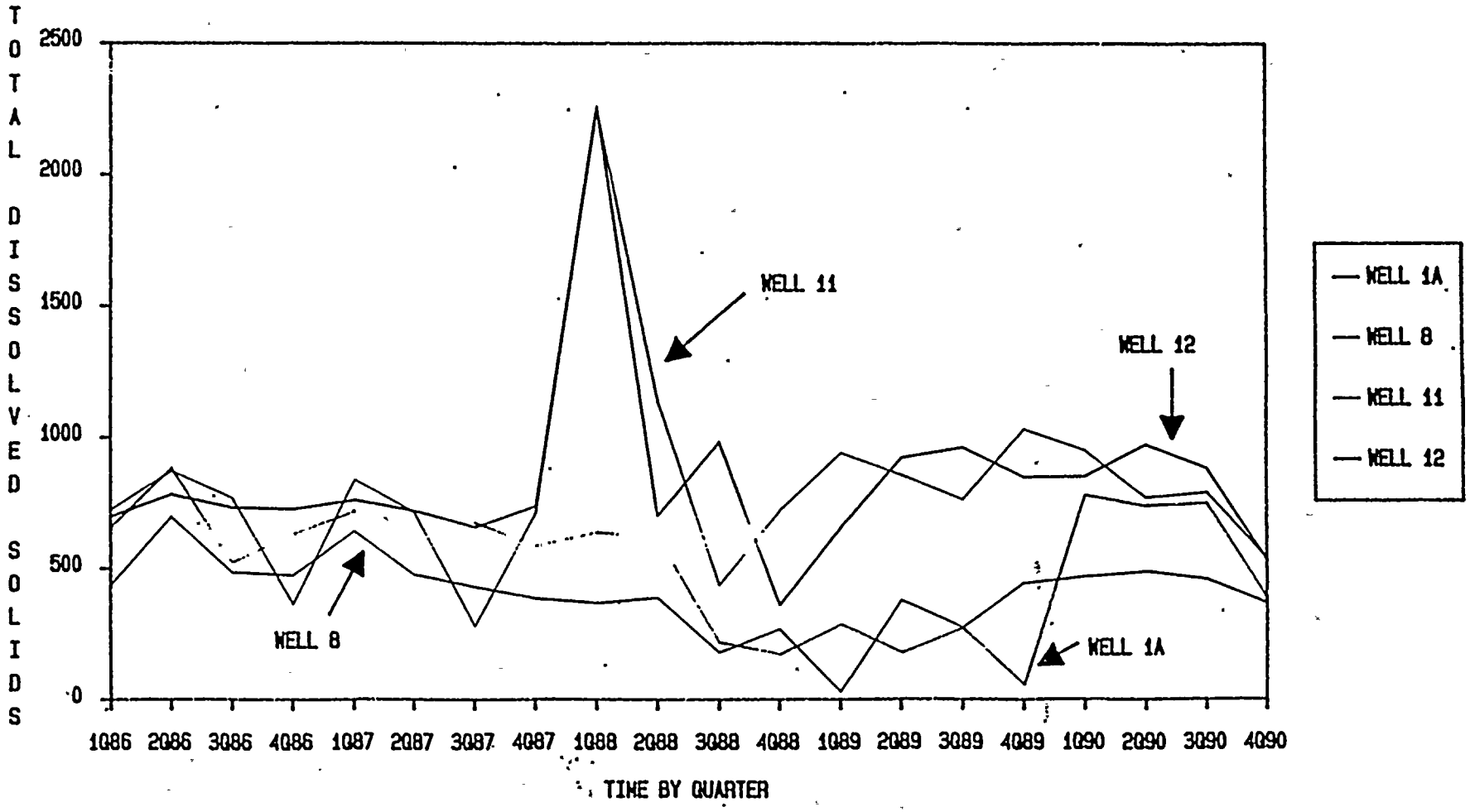


FIGURE NO. 9

DONALD C. COOK NUCLEAR PLANT GROUNDWATER DISCHARGE MONITORING

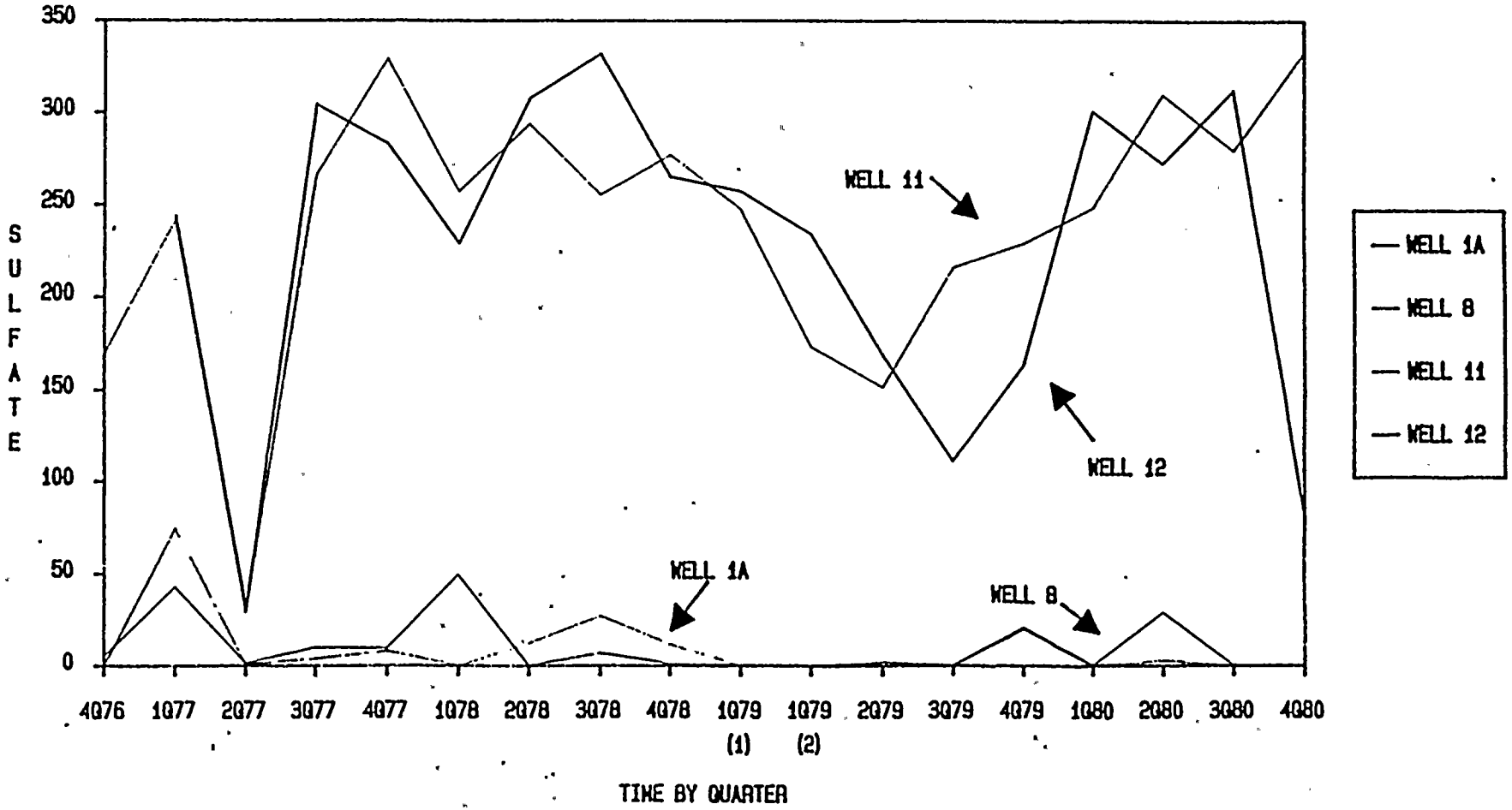


FIGURE NO. 9 CONTINUED

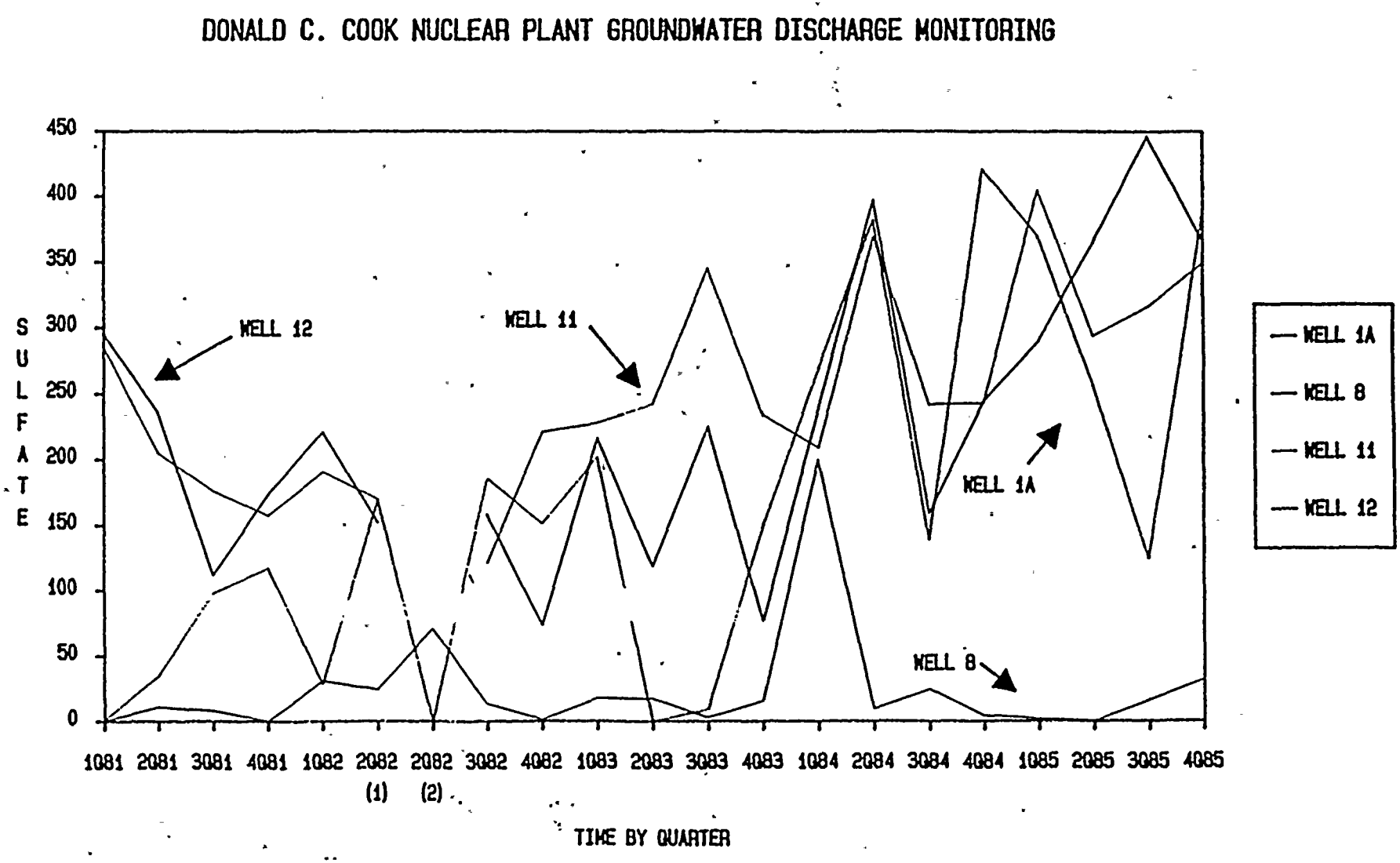


FIGURE NO. 9 CONTINUED

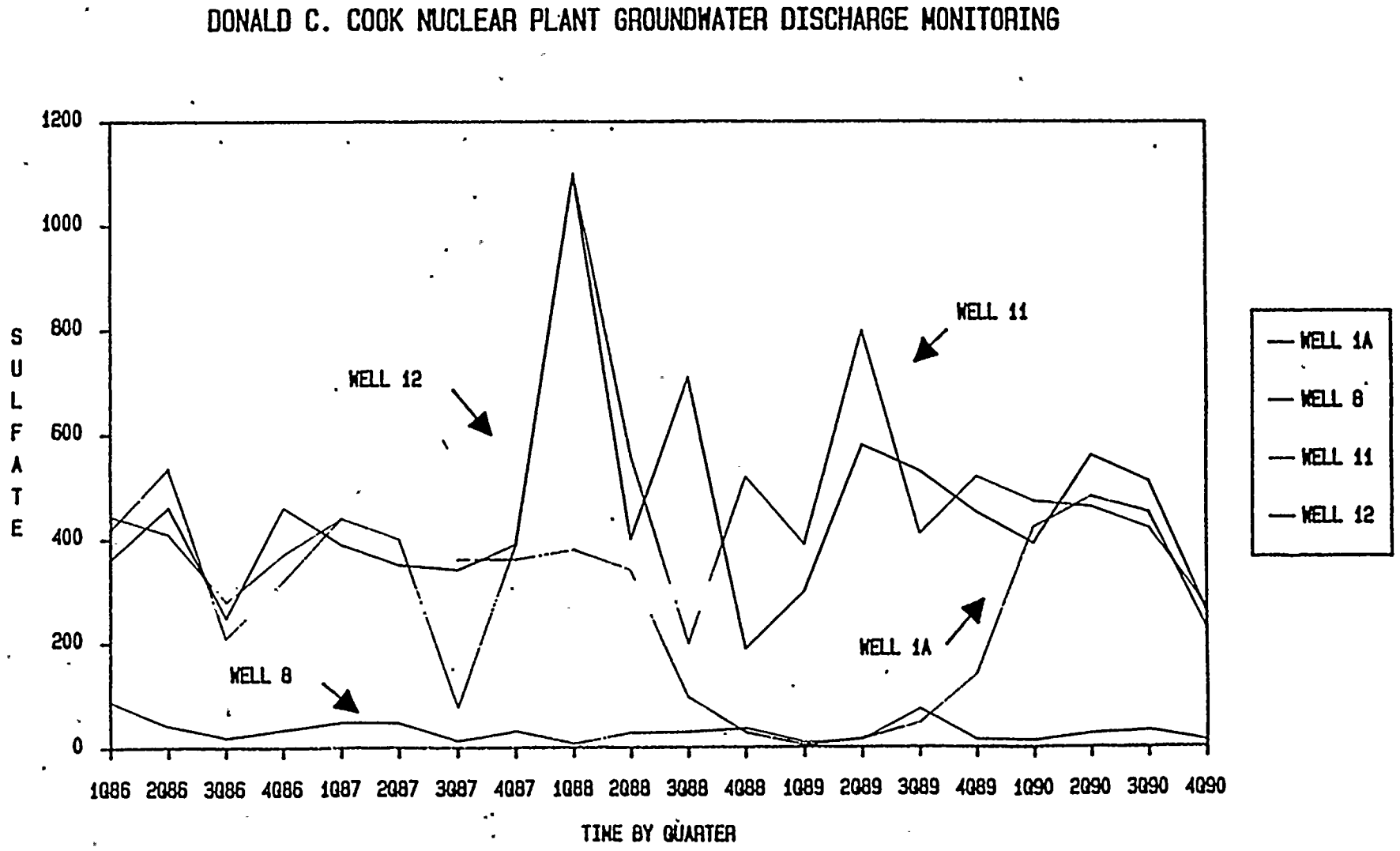
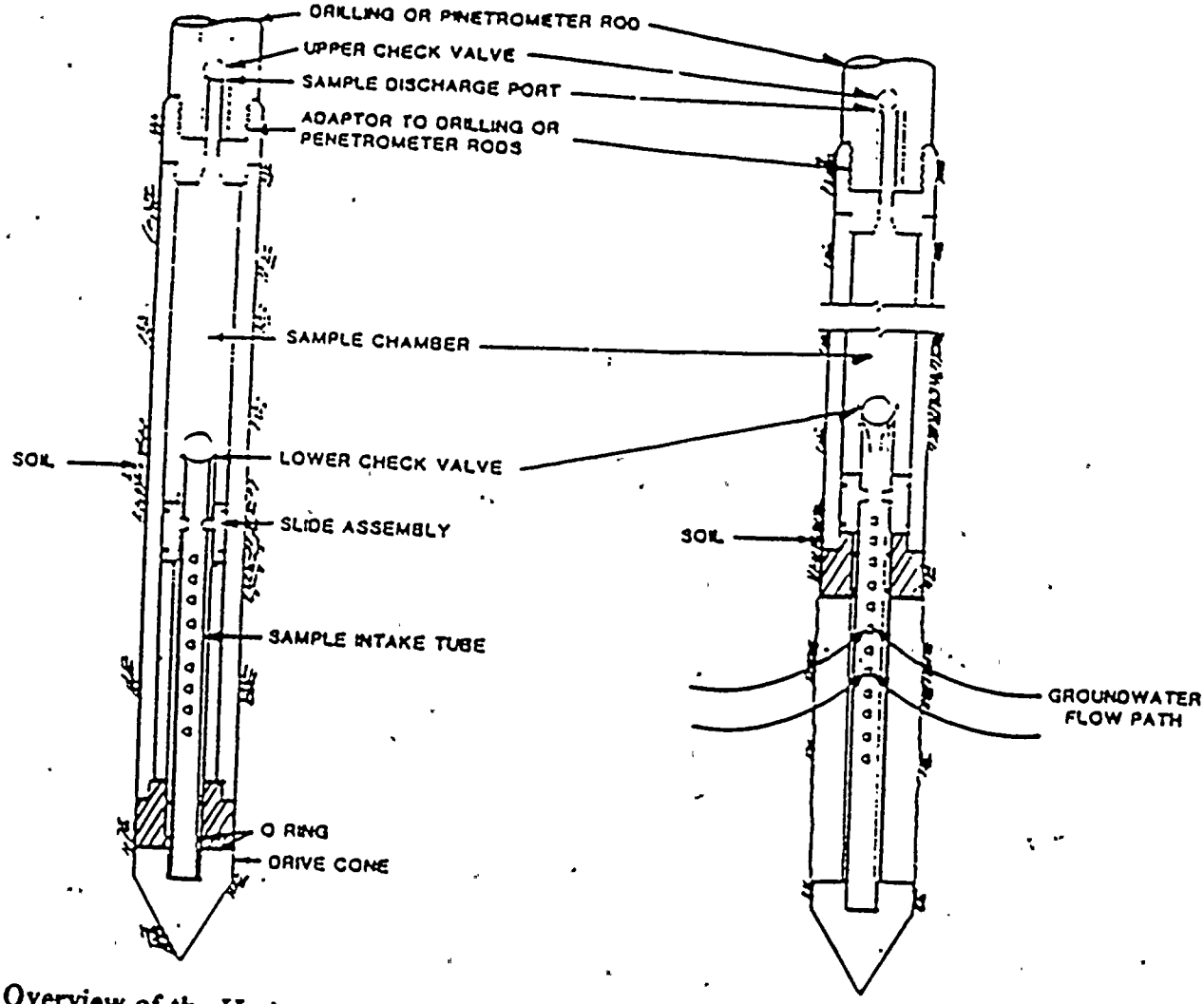


FIGURE NO. 10



Overview of the Hydropunch Components and Their Functions

Once exposed, ground water flows through the intake tube and into the sample chamber.

FIGURE NO. 11

Plan View Wells & HP

Environ. Well & HydroPunch Location (Plan View)

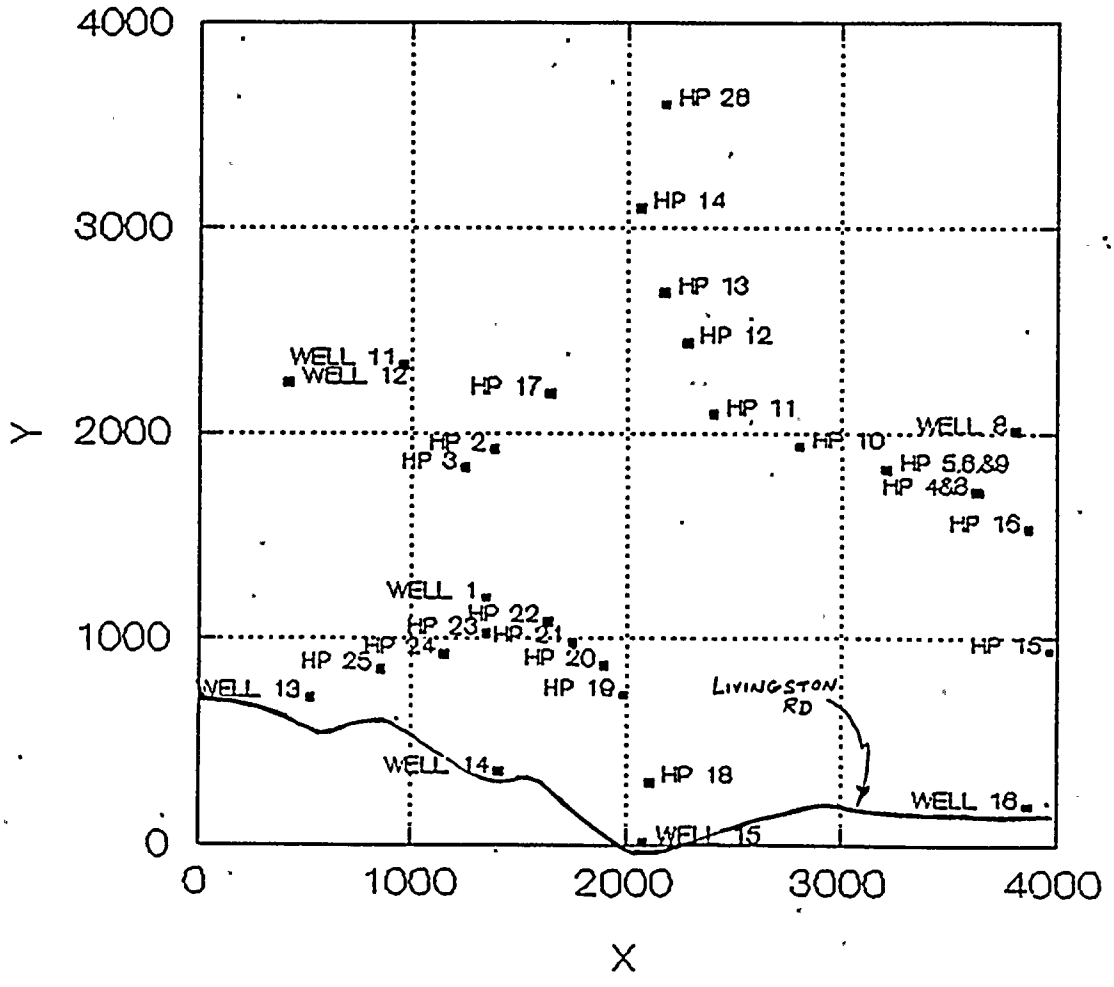


FIGURE NO. 12

#1 SO_4

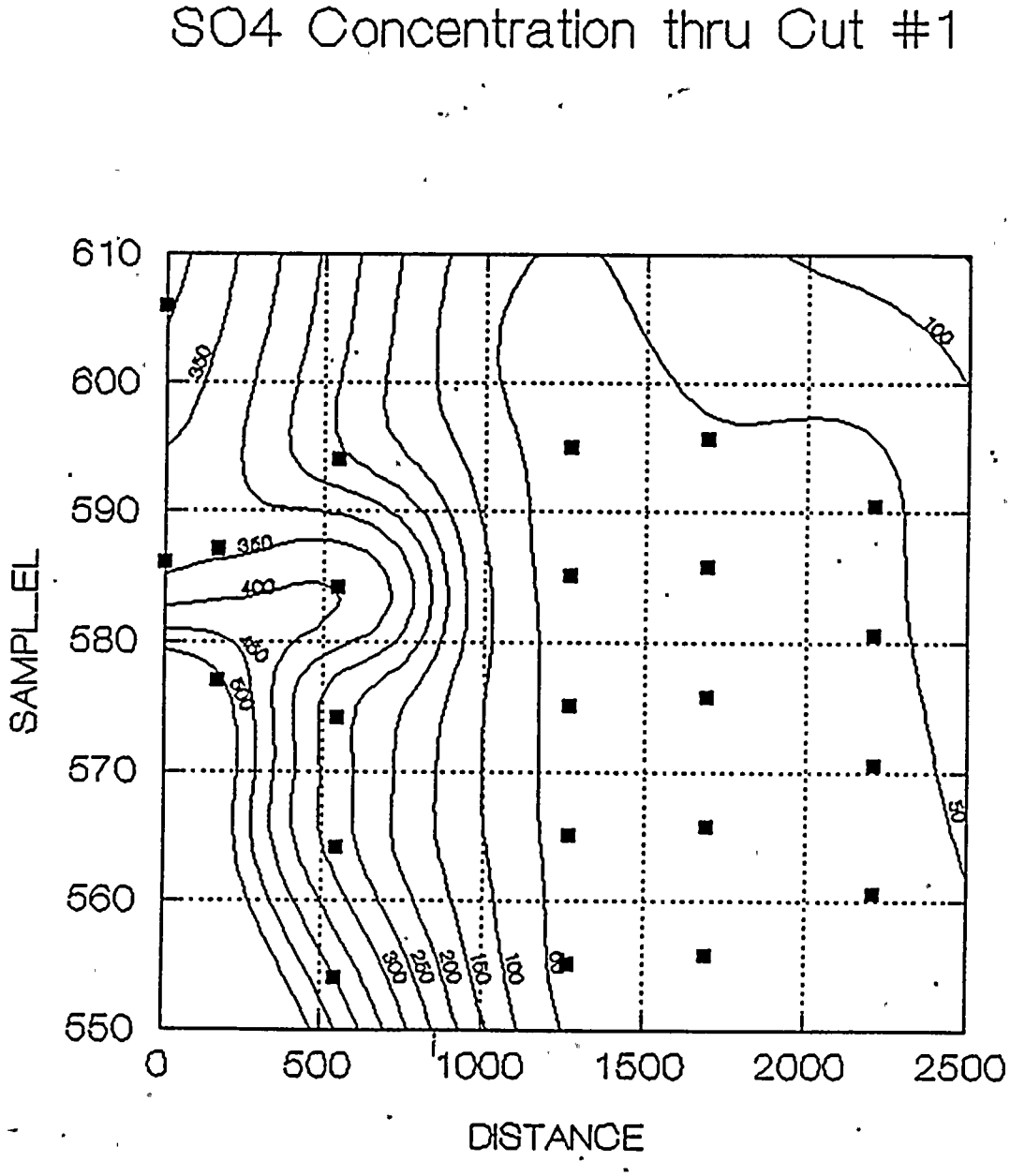


FIGURE NO. 13

#1 Na

Na Concentration thru Cut. #1

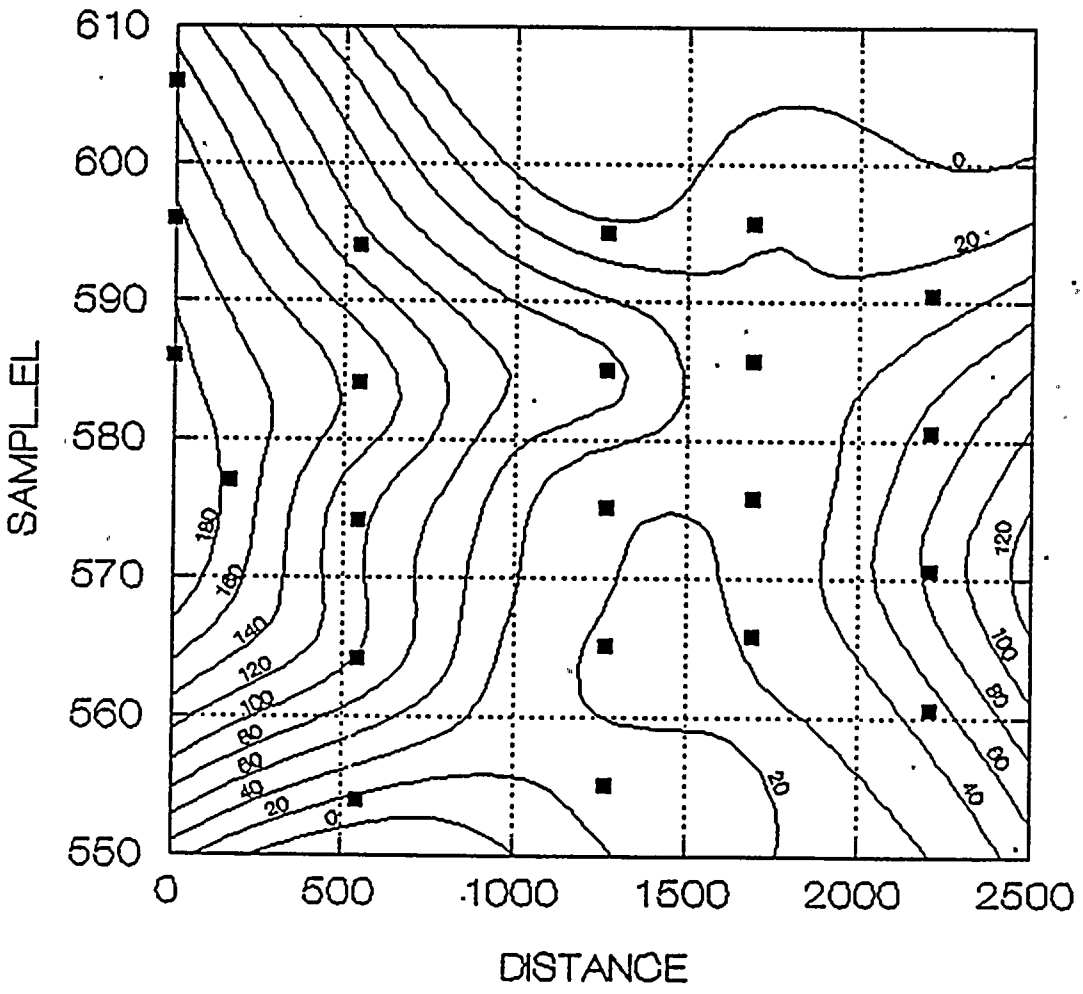


FIGURE NO. 14

#2 SO_4

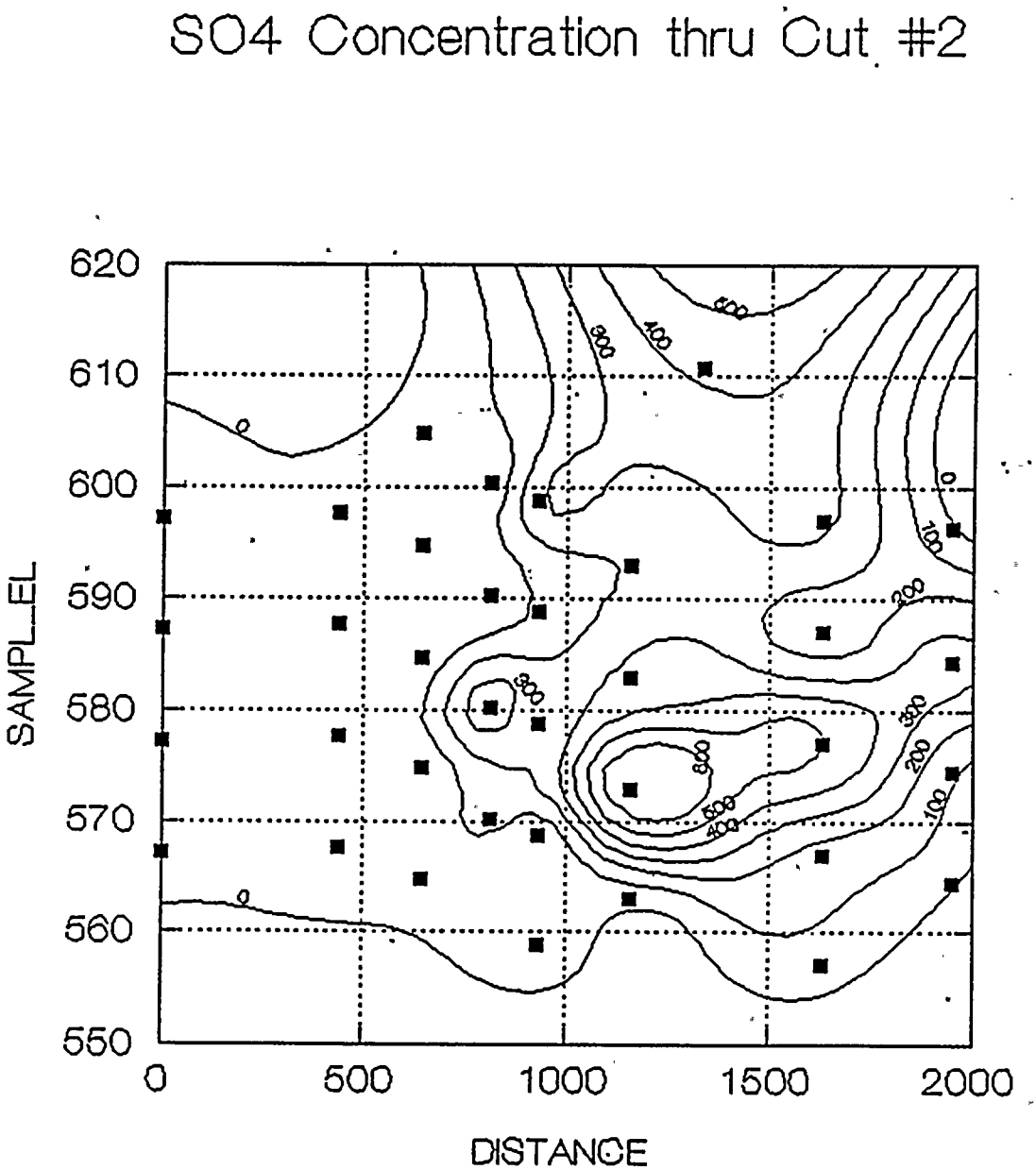


FIGURE NO. 15

#2 NA

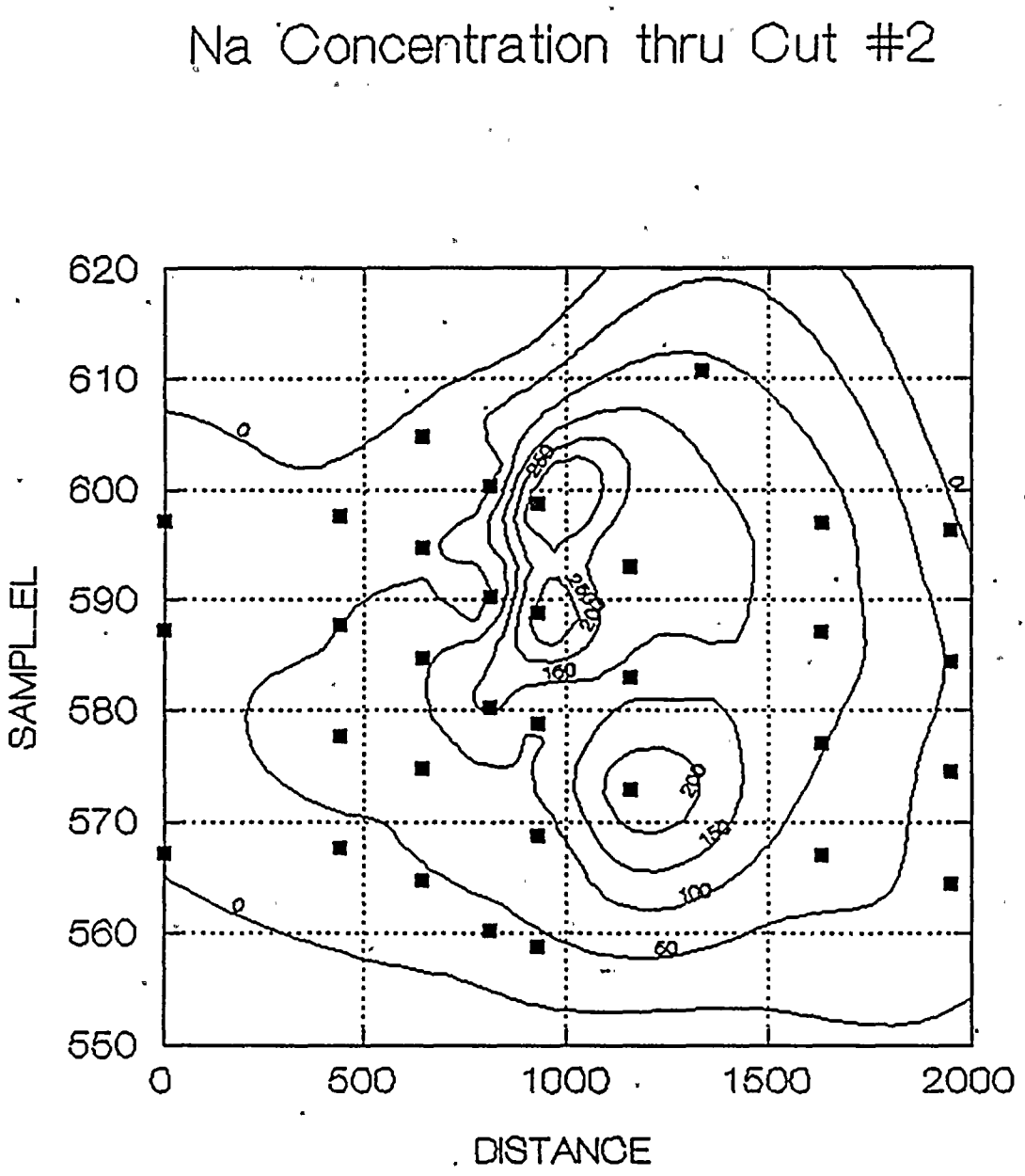


FIGURE NO. 16

#3 SO_4

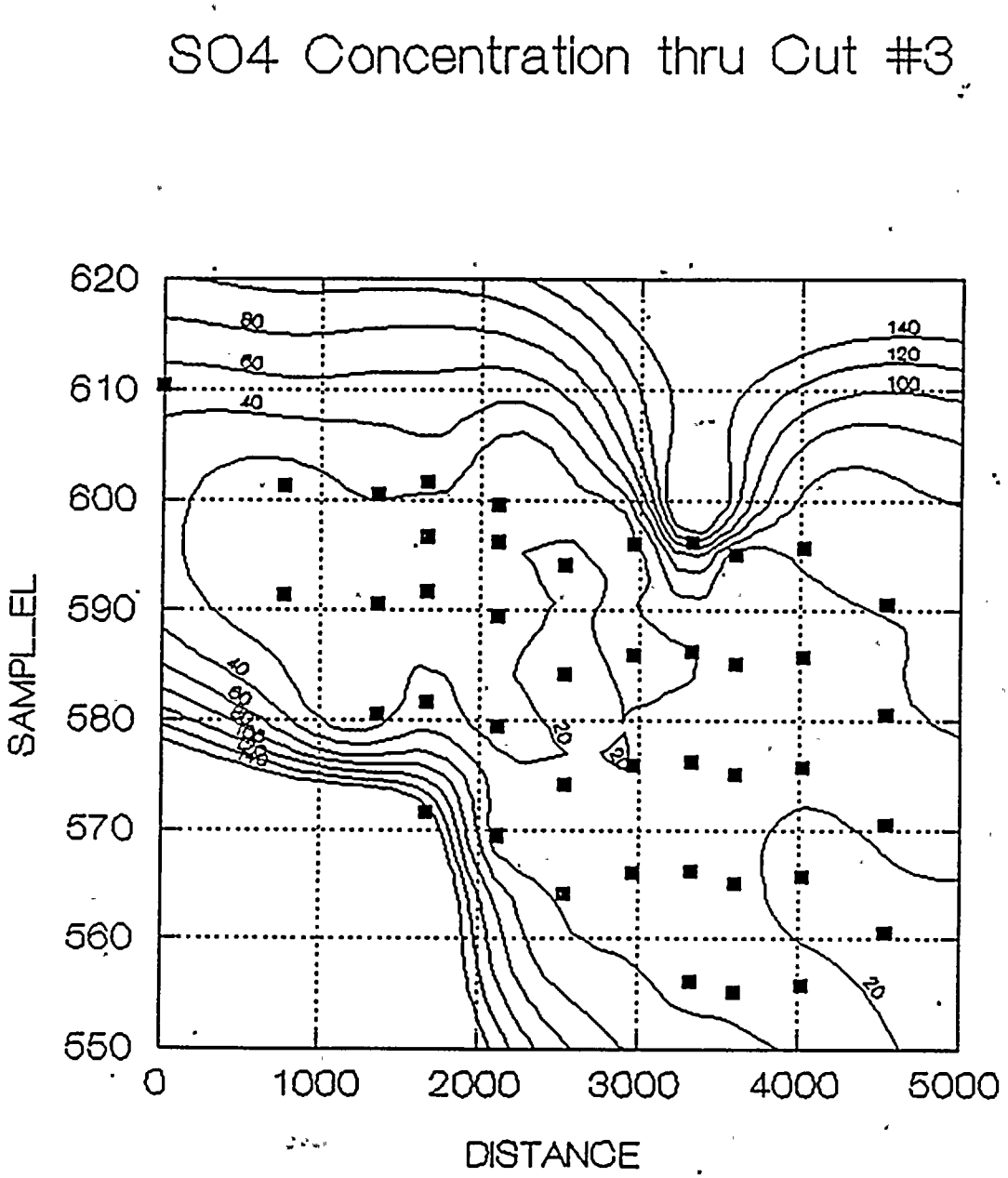


FIGURE NO. 17

#3 Na

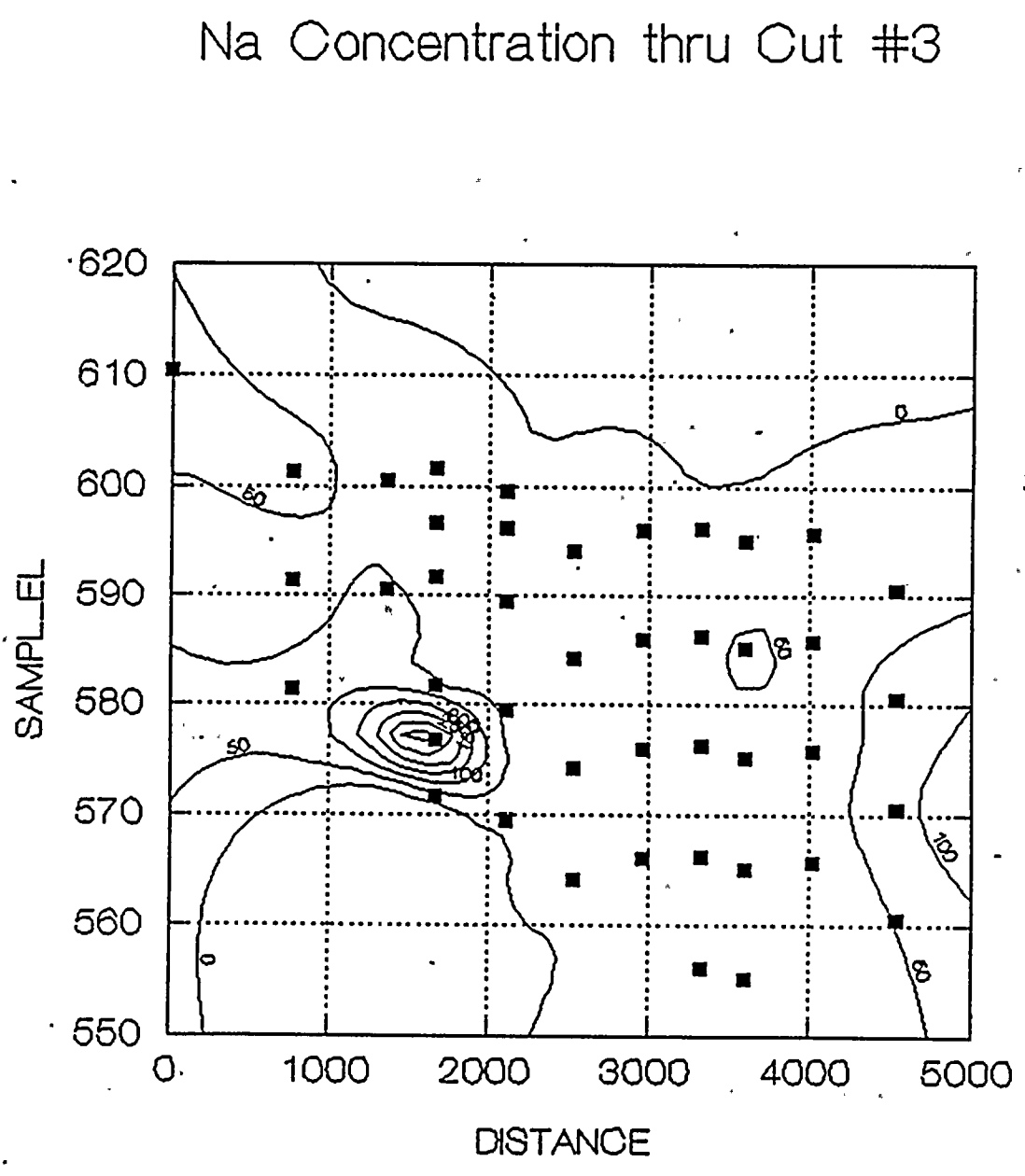


FIGURE NO. 18

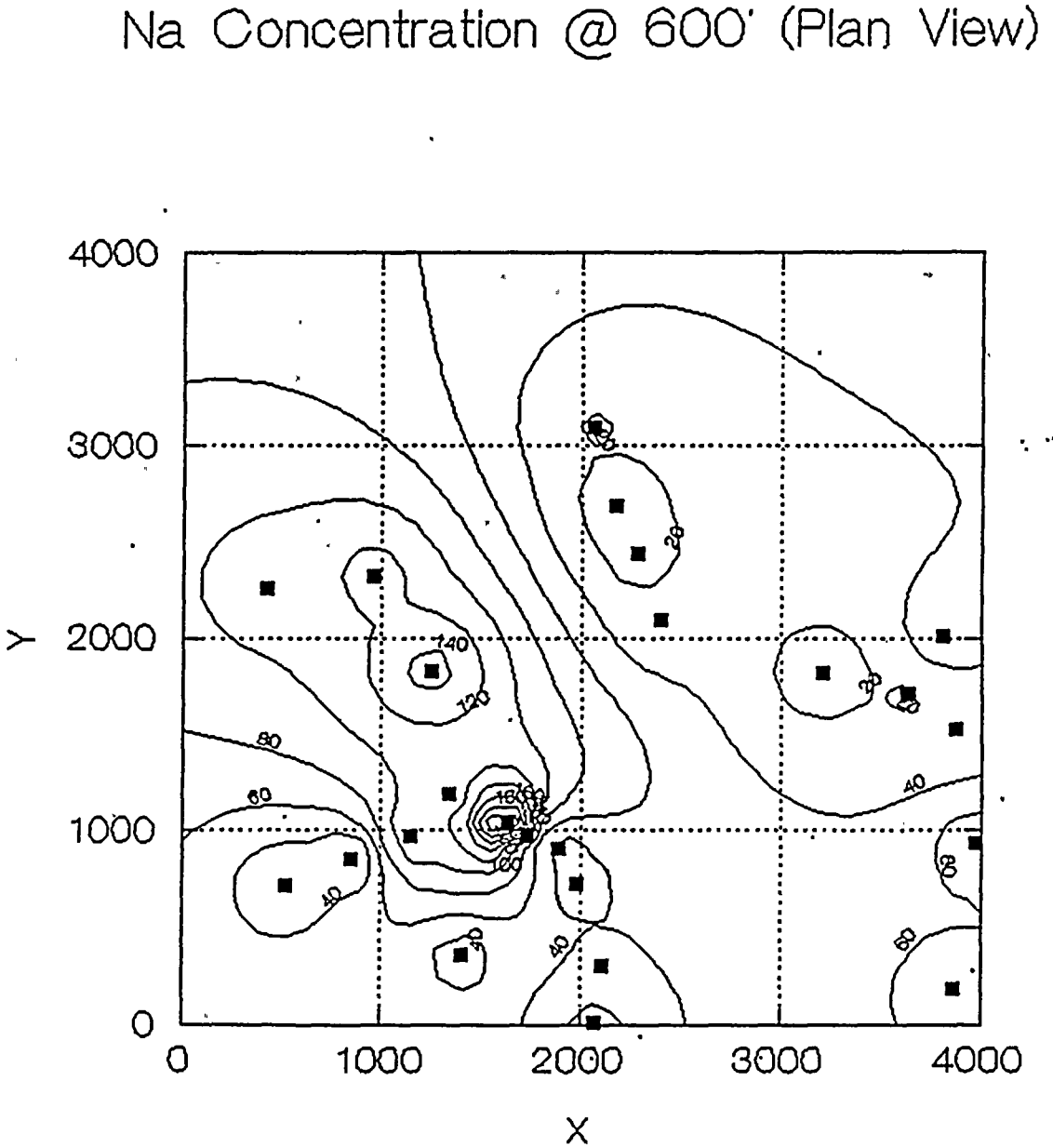

Na Concentration @ 600' (Plan View)
4000
3000
2000
1000
0
Y
0
1000
2000
3000
4000
X
140
120
80
60
40
20
40
40
40
80
80

FIGURE NO. 19

Na Concentration @ 590' (Plan View)

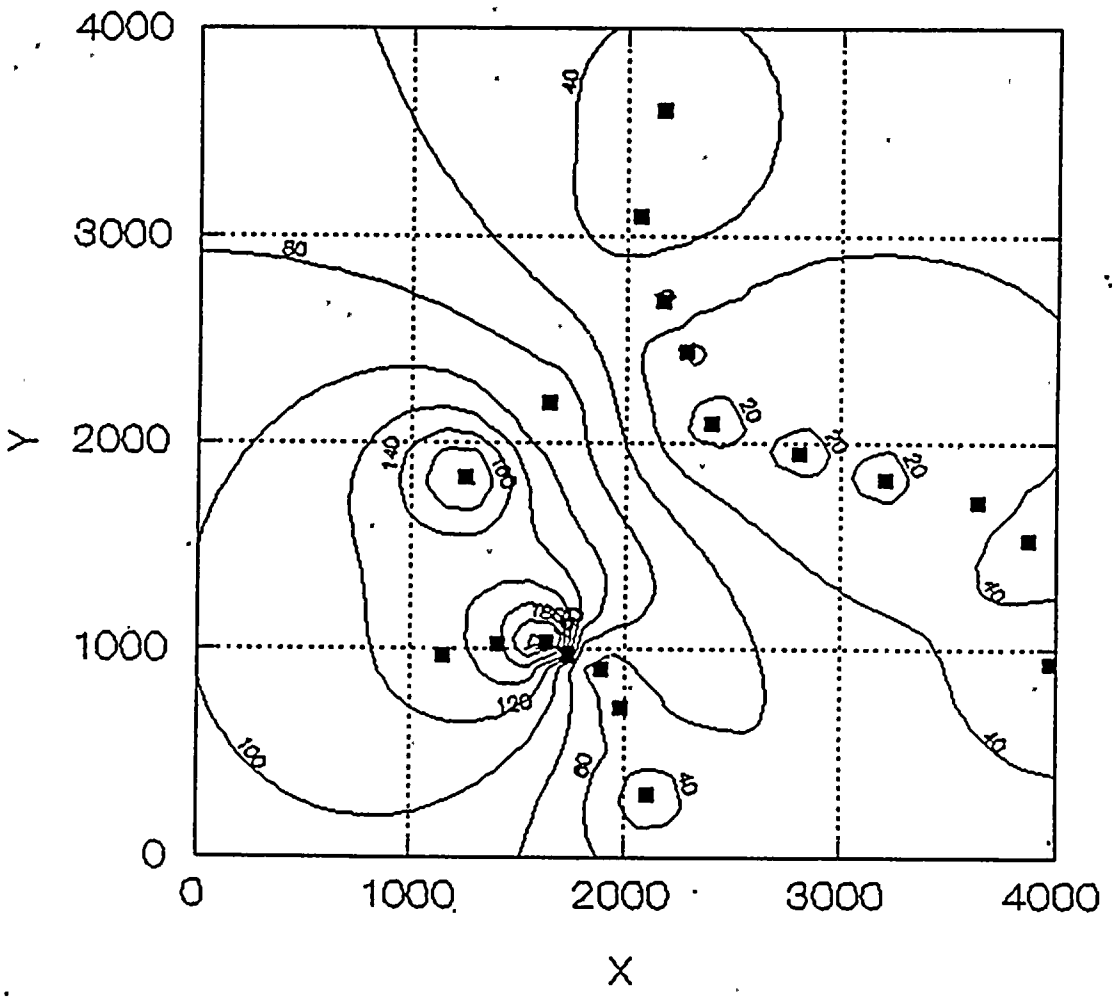


FIGURE NO. 20

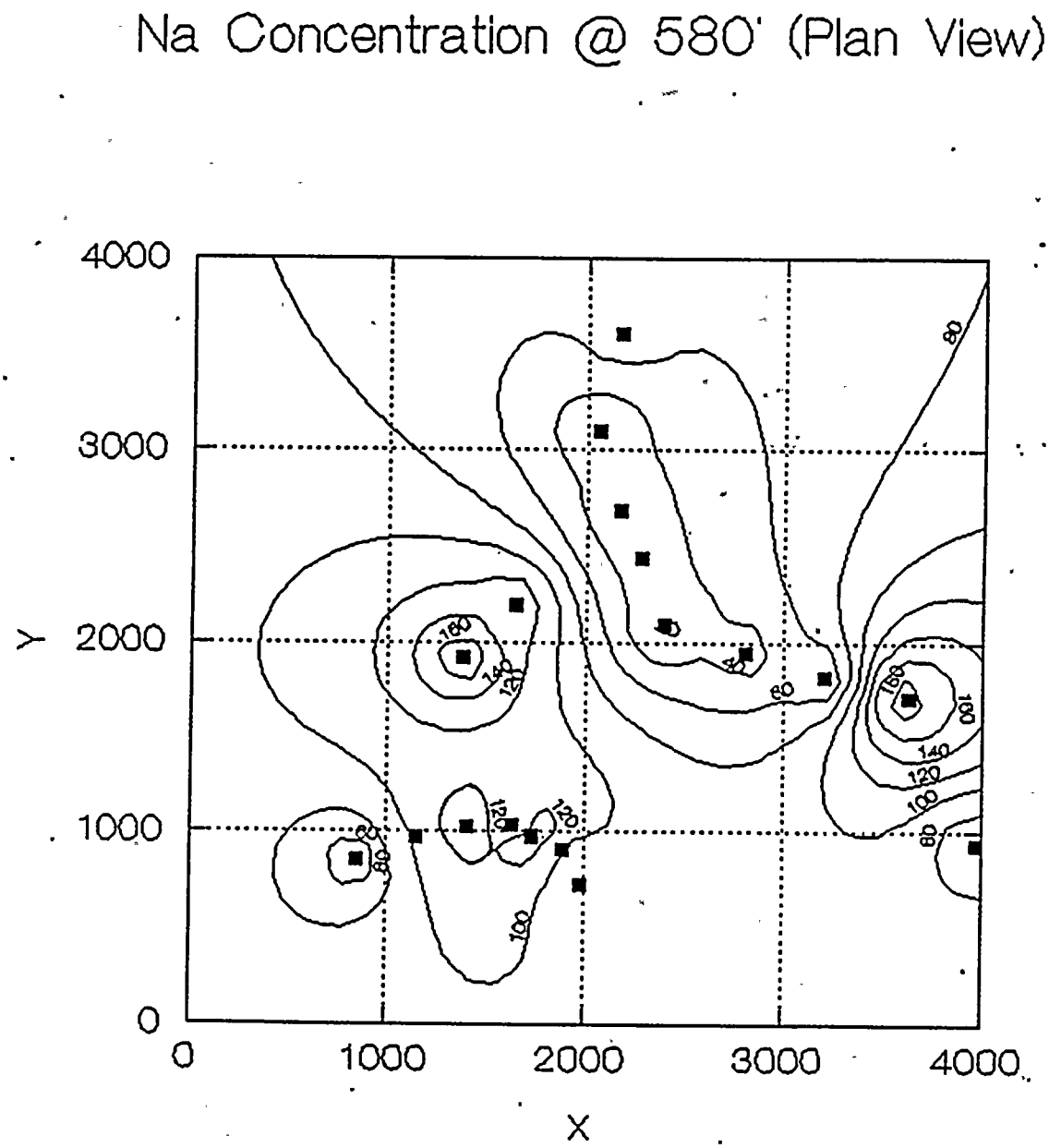

Na Concentration @ 580' (Plan View)
4000
3000
2000
1000
0
Y
0
1000
2000
3000
4000
X
80
100
120
140
160
60

FIGURE NO. 21

Na Concentration @ 570' (Plan View)

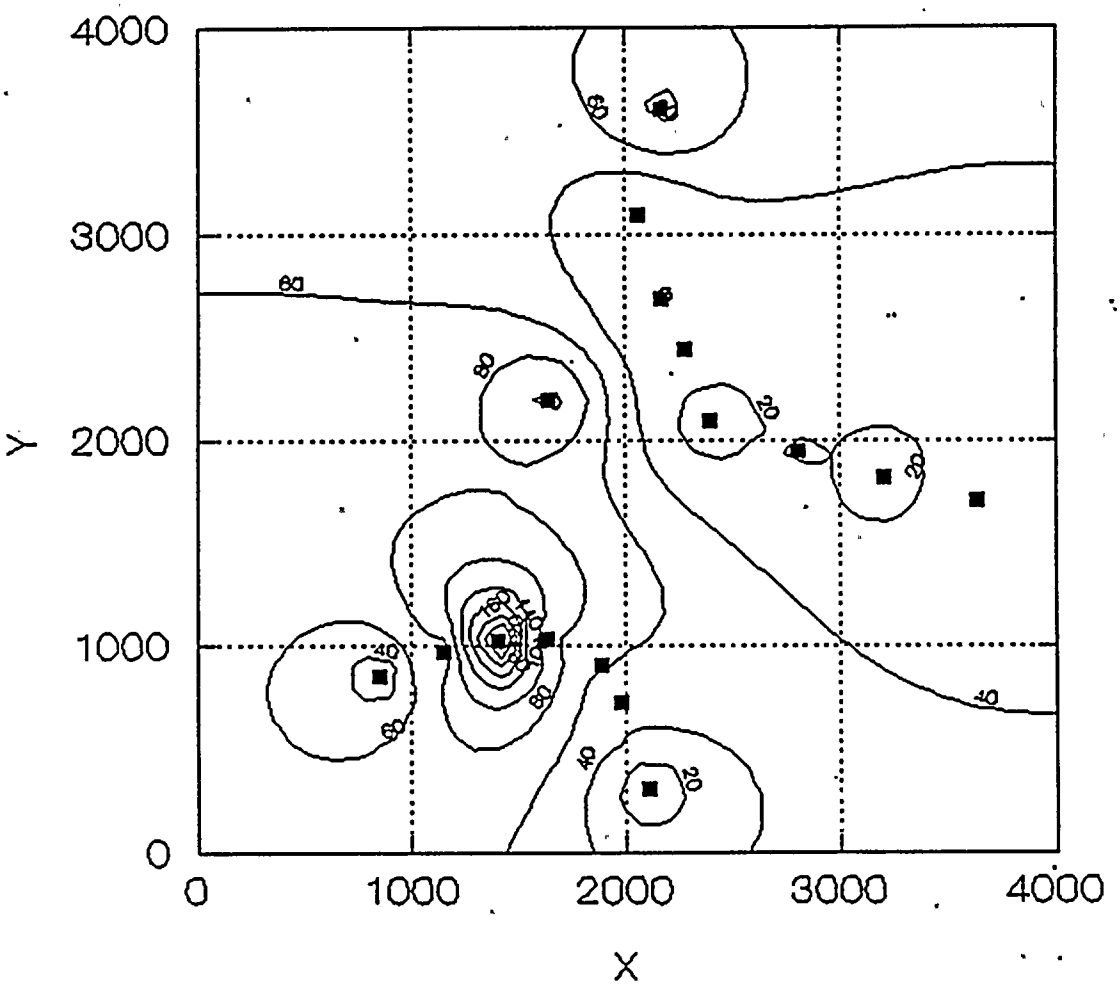


FIGURE NO. 22

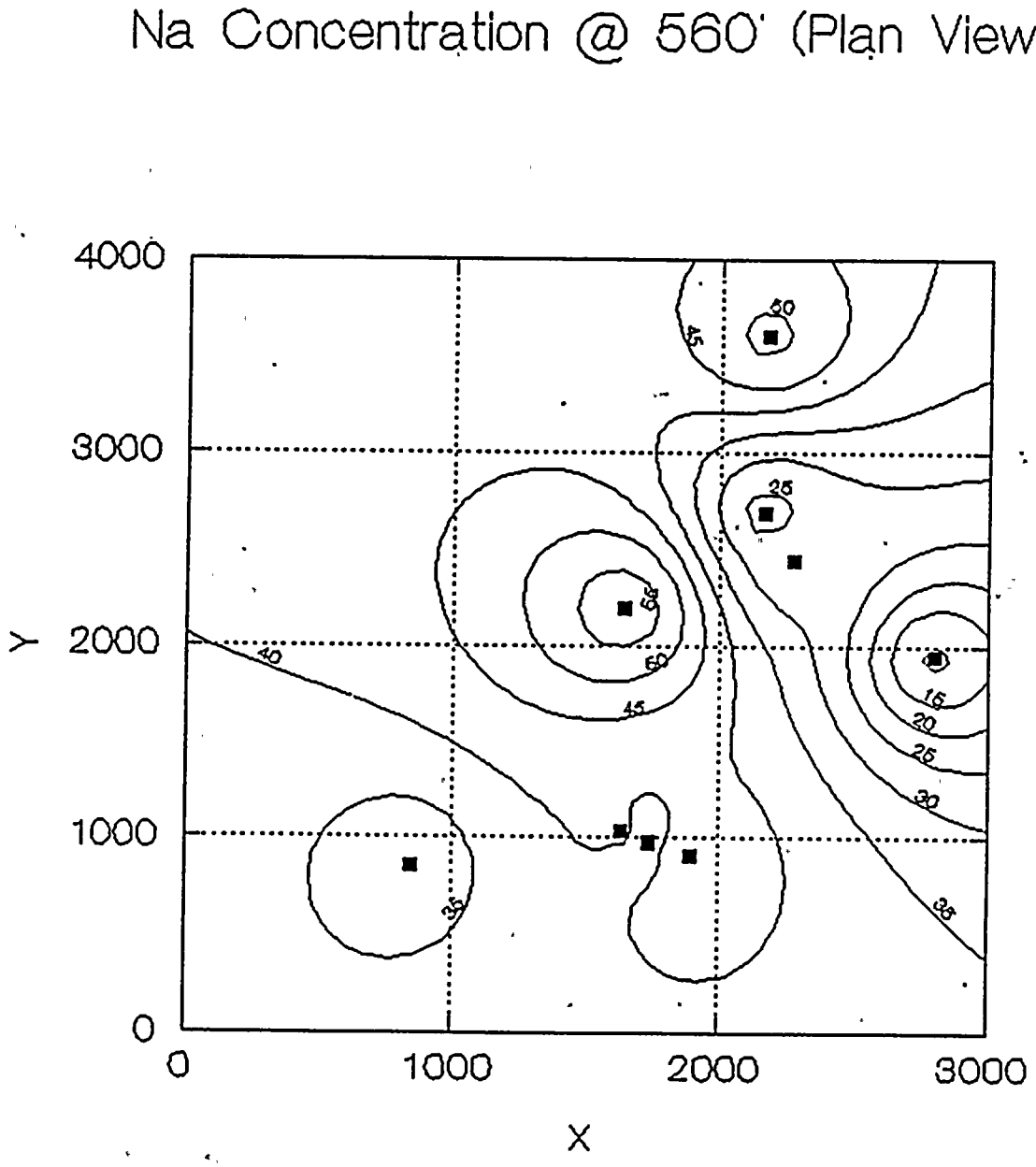

Na Concentration @ 560' (Plan View)
4000
3000
2000
1000
0
Y
0
1000
2000
3000
X
60
45
25
55
60
45
40
35
35
15
20
25
30
35

FIGURE NO. 23

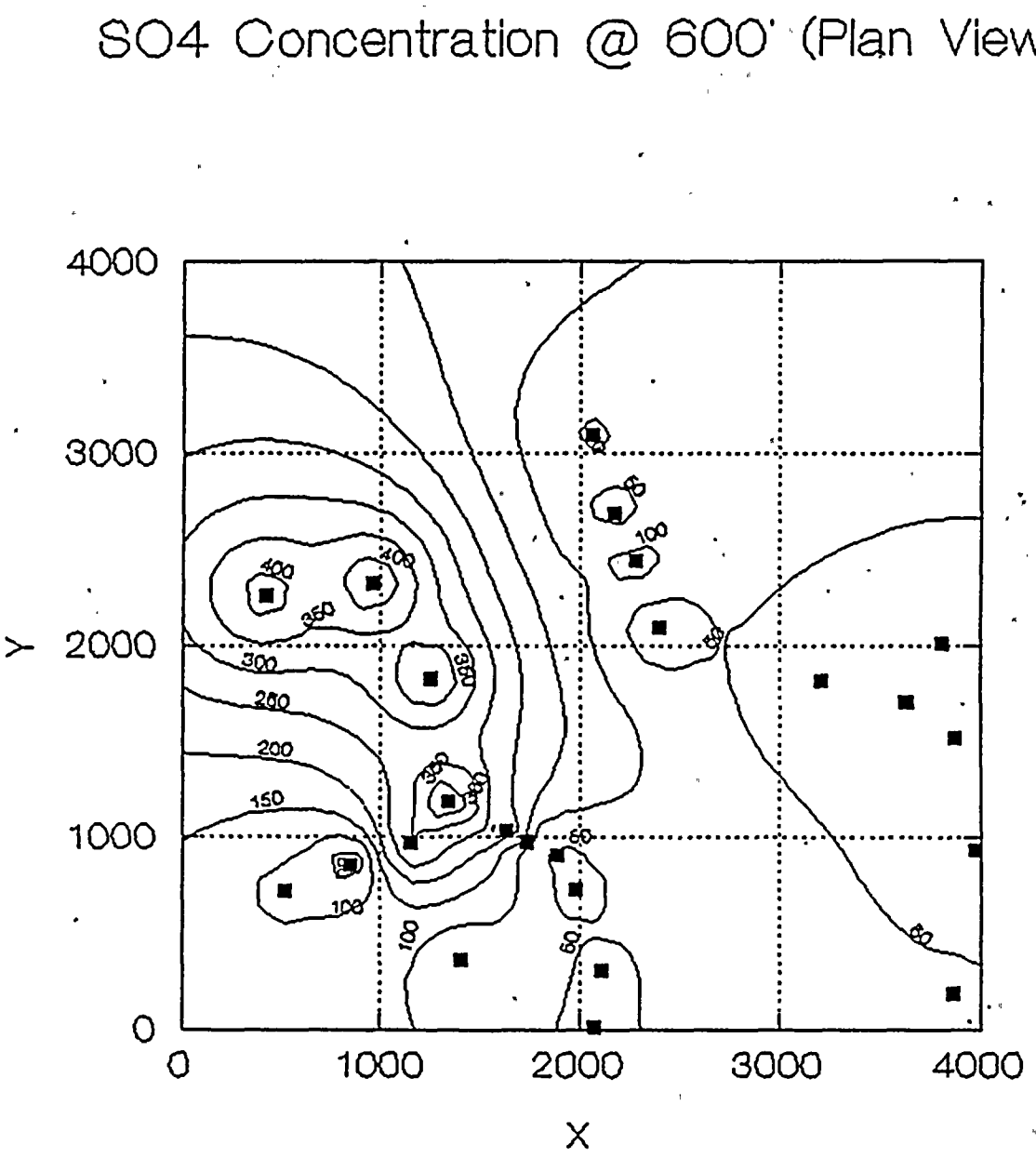

SO4 Concentration @ 600' (Plan View)
4000
3000
2000
1000
0
Y
0
1000
2000
3000
4000
X
400
350
300
200
150
100
50
60

FIGURE NO. 24

SO4 Concentration @ 590' (Plan View)

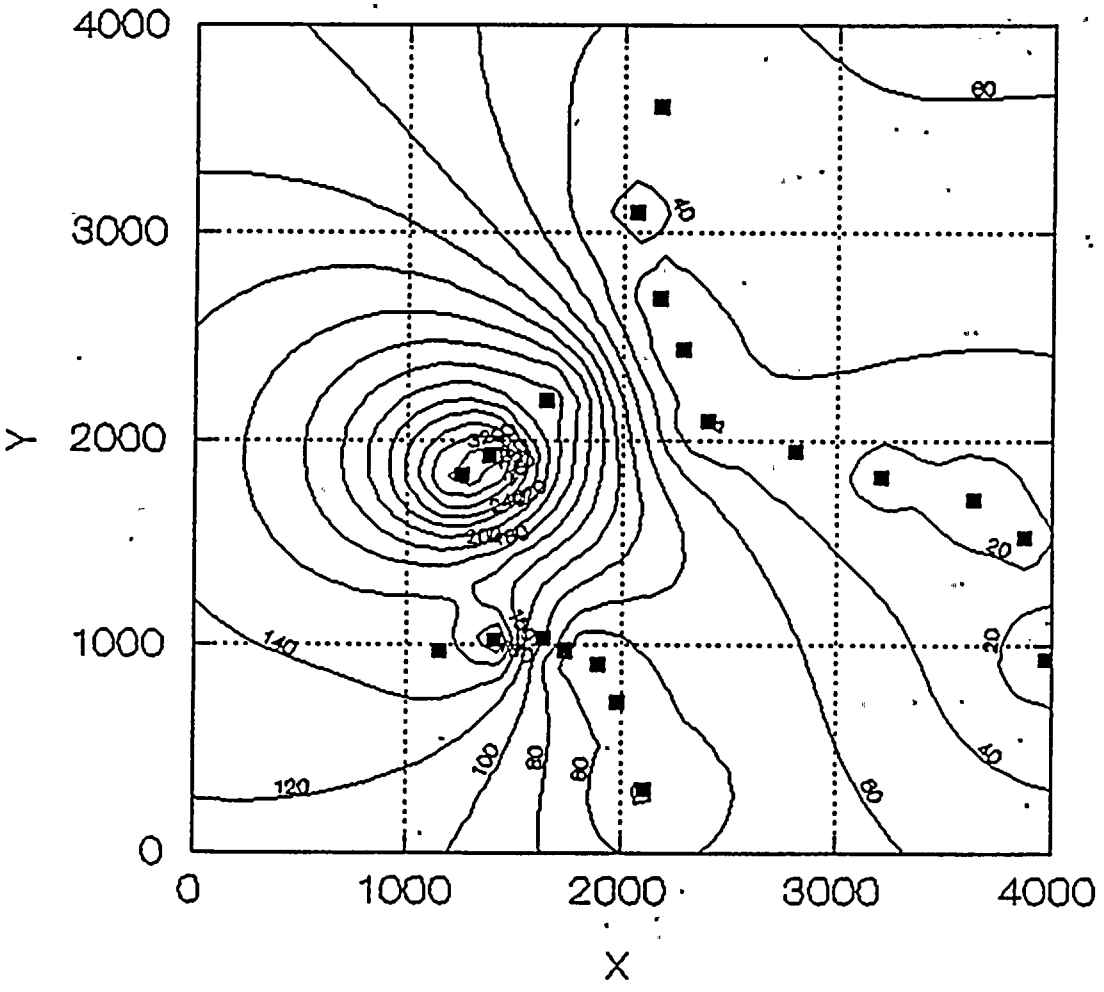


FIGURE NO. 25

SO4 Concentration @ 580' (Plan View)

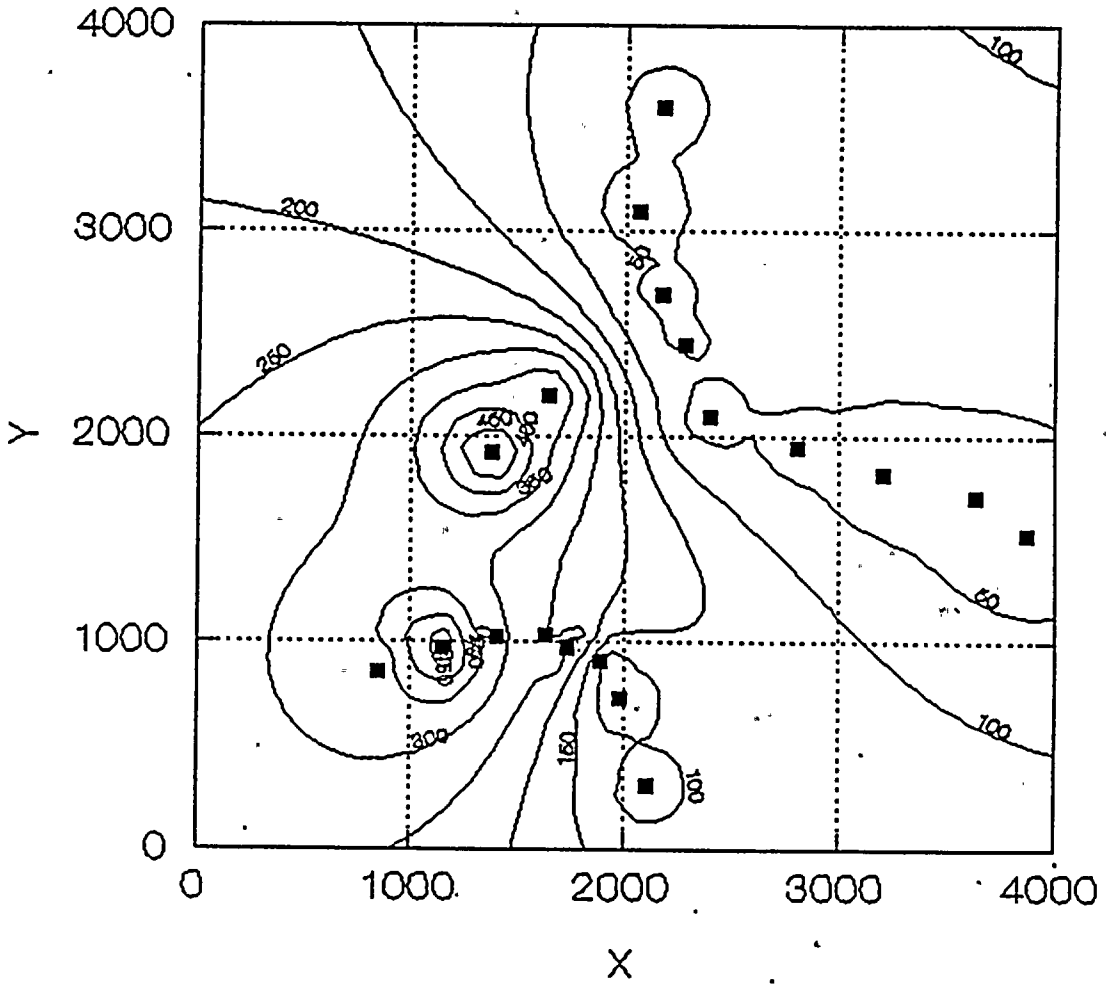


FIGURE NO. 26

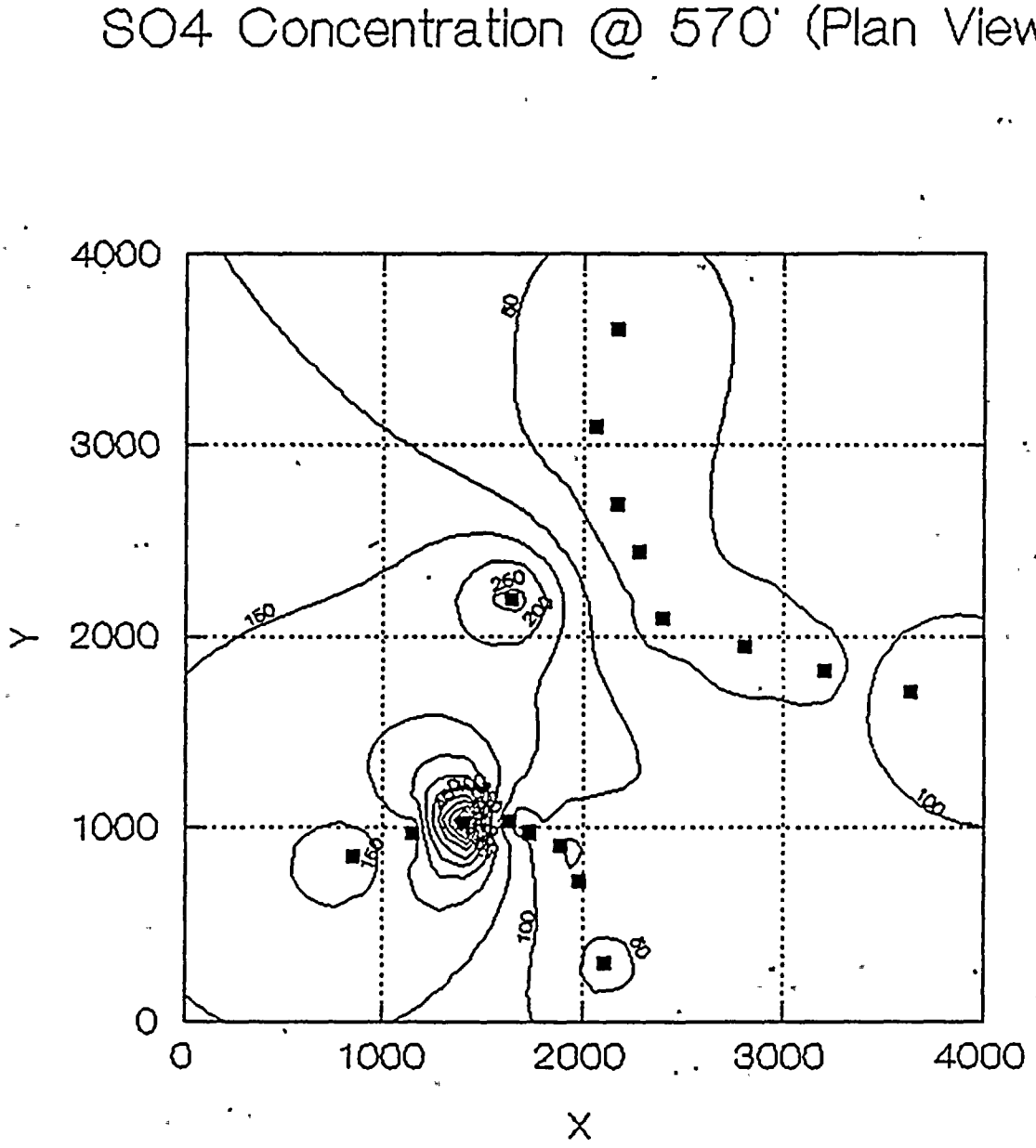

SO4 Concentration @ 570' (Plan View)
4000
3000
2000
1000
0
Y
0
1000
2000
3000
4000
X
80
150
200
250
100

FIGURE NO. 27

SO4 Concentration @ 560' (Plan View)

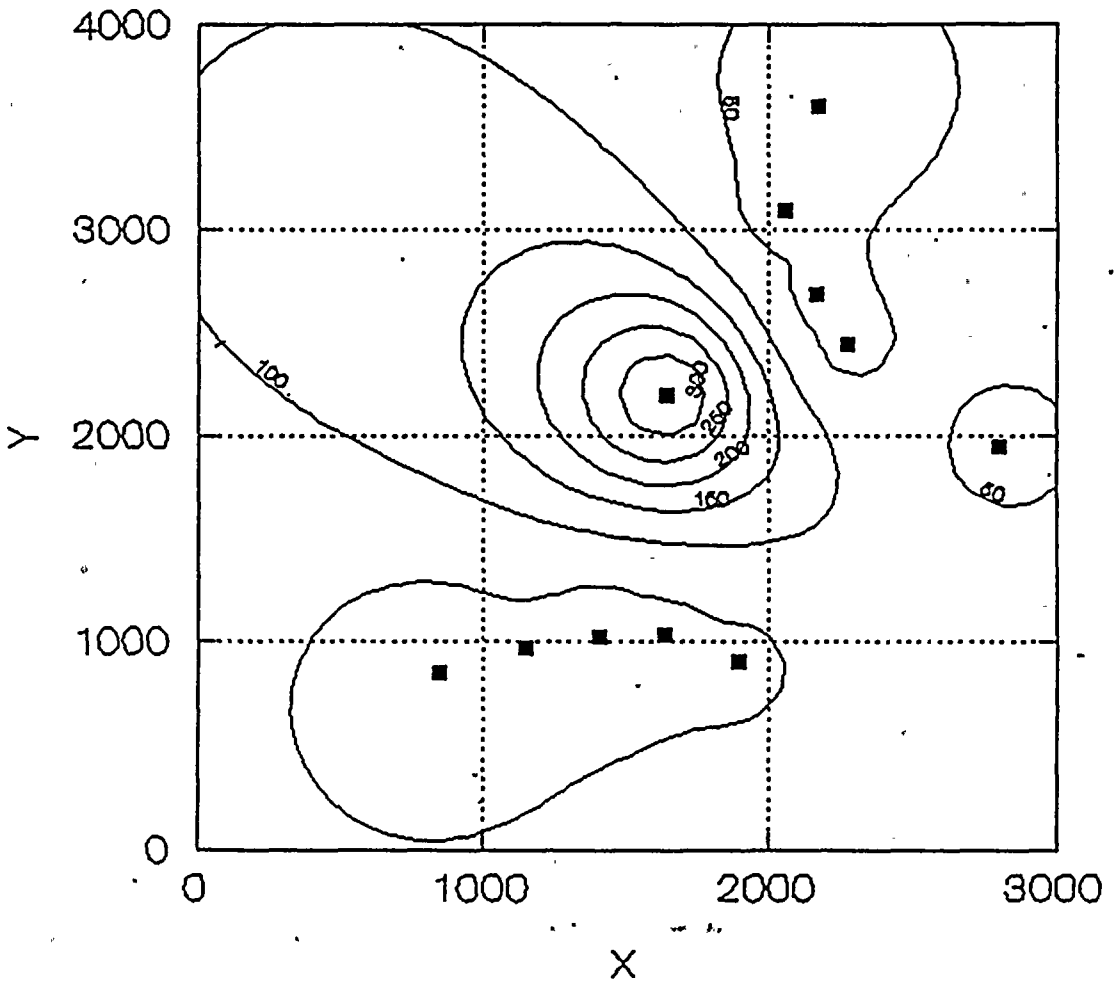


Figure No. 28
Former Potable Supply Well No. 2
Concentration of
Na, Ca, Mg, HCO_3, SO_4 & Cl

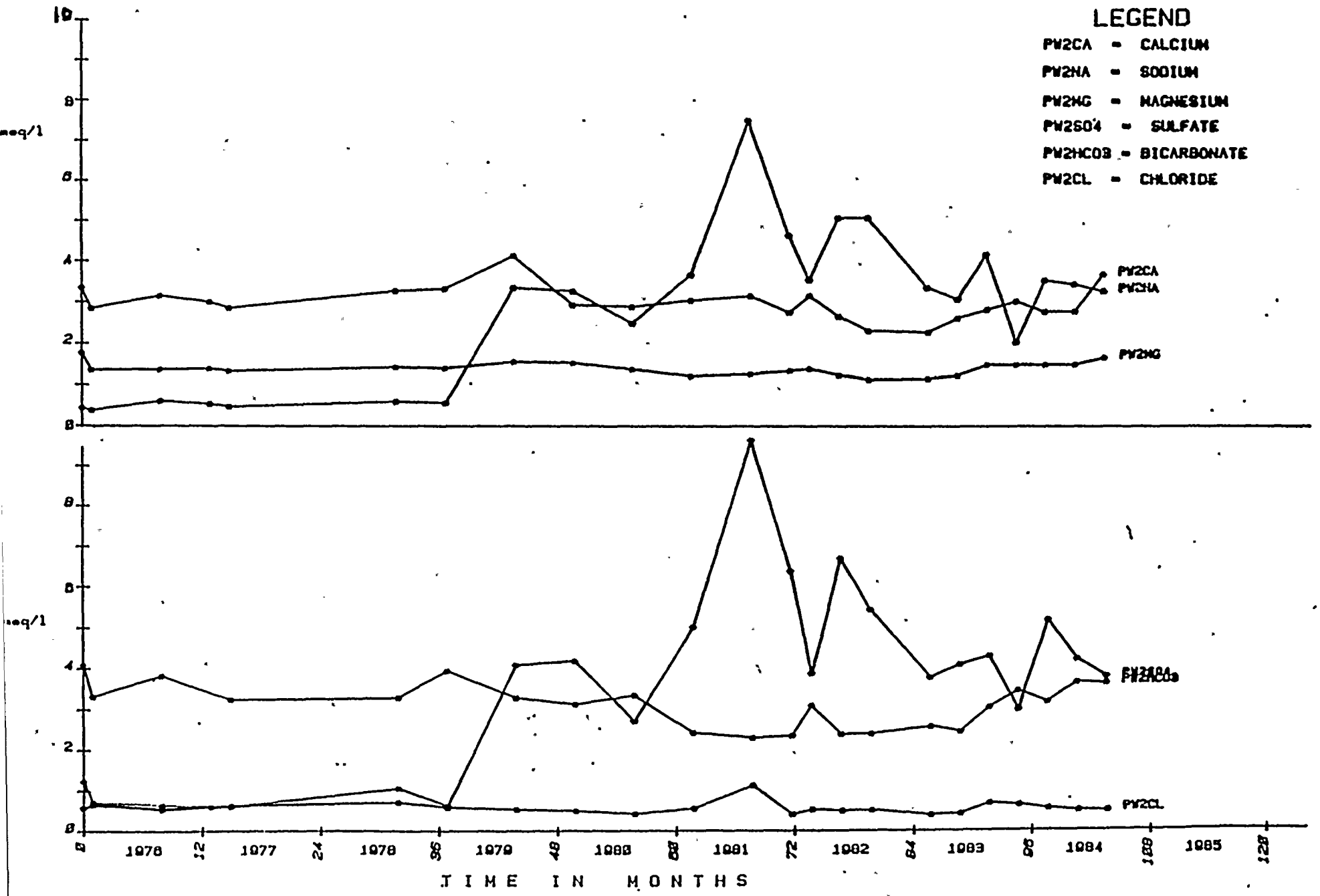


Figure No. 29
Former Potable Supply Well No. 1
Concentration of Na, Ca, Mg, HCO_3, SO_4, Cl

POTABLE WELL # 1