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SOUTH PLUME GROUNDWATER RECOVERY SYSTEM DESIGN, MONITORING, AND EVALUATION PROGRAM PLAN SYSTEM EVALUATION REPORT FOR DECEMBER 1993 THROUGH FEBRUARY 1994 - REV 1

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SOUTH PLUME GROUNDWATER RECOVERY SYSTEM DESIGN, MONITORING, and EVALUATION PROGRAM PLAN SYSTEM EVALUATION REPORT FOR DECEMBER 1993 through FEBRUARY 1994

AUGUST 1994
REVISION 1

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Under Contract DE-AC05-860R21600

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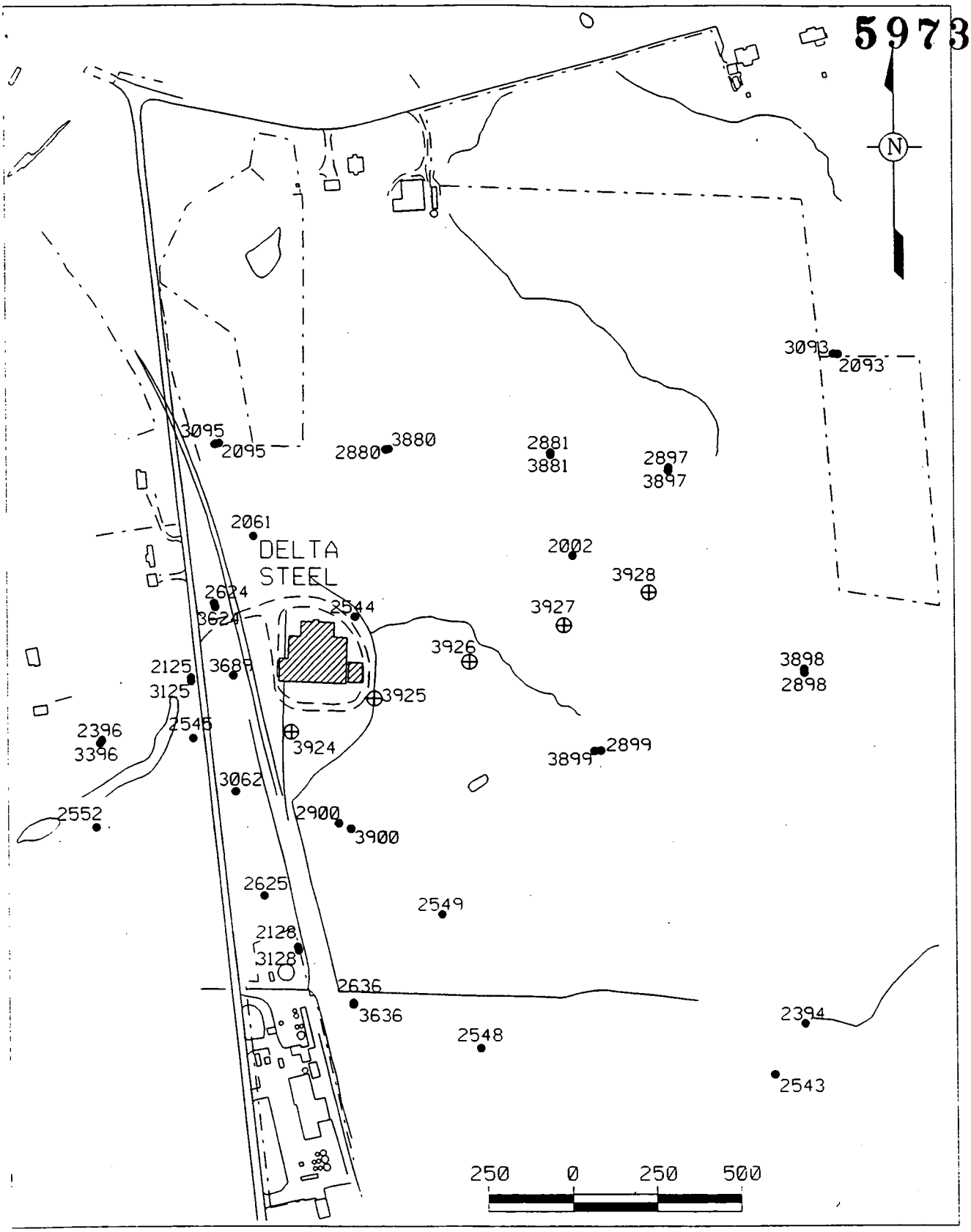
1.0 INTRODUCTION

The Design, Monitoring, and Evaluation Program Plan (DMEPP) (DOE 1993) (formerly the Operation and Maintenance Manual) was implemented to monitor and evaluate activities associated with the groundwater recovery system for the South Groundwater Contamination Plume (South Plume), Removal Action at the Fernald Environmental Management Project (FEMP) near Fernald, Ohio. Figure 1.0-1 shows the locations of the monitoring wells sampled under this program. The South Plume Removal Action (Removal Action No. 3) was implemented pursuant to the 1990 Consent Agreement between the United States Environmental Protection Agency (US EPA) and the United States Department of Energy (DOE).

This quarterly system evaluation has been prepared to meet the reporting requirements defined in the DMEPP by providing data analysis of chemical and aquifer hydraulic data in order to evaluate and assess recovery system performance. This evaluation includes establishing background chemical and hydraulic conditions for comparison with current pumping conditions and comparing them to modeled results.



DMEPP SAMPLING LOCATIONS

LEGEND:

⊕ 3927 RECOVERY WELL AND SYMBOL

• 2543 MONITORING WELL AND SYMBOL

FIGURE 1.0-1

000007

2.0 SYSTEM OPERATION

This section summarizes all available data collected for the second quarter of operation (December 1993-February 1994). Appendix A contains analytical data collected as part of the DMEPP Monitoring Program from startup of the Recovery Well Field in August 1993 through February 28, 1994. Responses to Ohio EPA comments on the May 1994 DMEPP System Evaluation Report have been incorporated in this document and are presented in Appendix B. A summary of the recovery well field operation and maintenance is summarized below for the second quarter of operation (December 1993 - February 1994):

System Operation

• December 1, 1993	Arsenic concentrations increase in several monitor wells south of the recovery well field.
• December 3, 1993	Five recovery wells are throttled back from 400 gpm to 300 gpm per recovery well in response to increasing arsenic concentrations south of the recovery well field.
• December 9, 1993	A decision is made to perform additional on-site analyses for arsenic from the five monitoring wells exhibiting increased arsenic concentrations and recovery wells 3924 and 3925.
• December 15, 1993	Monitor wells 2128, 2548, 2625, 2636, 2900, 3924 and 3925 are put on a weekly sampling schedule for arsenic.
• January 23, 1994	Recovery well field stops pumping for 11 1/2 hours due to interruption of service by Cincinnati Gas & Electric. Recovery Well No. 5 is not restarted because of a pump failure.
• January 29, 1994	A backup pump is installed in Recovery Well No. 5 and well is restarted at 8:30 am.
• February 4, 1994	Recovery Well No. 2 stops pumping due to a faulty pressure switch.
• February 7, 1994	Pressure switch is adjusted at Recovery Well No. 2 and

pump is restarted.

- February 10, 1994 — Arsenic concentrations in the wells south of the recovery well field return to pre-pumping levels

At the Storm Water Retention Basin Valve House, total flow and concentrations of total uranium are measured daily from the cumulative discharge of the recovery well field. As of February 28, 1994 a total of 459.5 million gallons of water had been pumped from the aquifer. Total uranium concentrations per day for the total discharge are shown in Figure 2.0-1. It should be noted that the total uranium value reported on September 11, 1993 of 100 ppb is not consistent with any of the other data and is considered a laboratory or sampling error. The majority of the total uranium values reported have been below 20 ppb with the exception of the first week of system operation which had concentrations around 30 ppb. As of February 28, 1994 a total of 72.13 pounds of uranium have been discharged from the recovery well system to the Great Miami River. If the assumption is made that this trend remains constant for the remainder of the year then it would be expected that after one year of operation the recovery well field would discharge to the Great Miami River a total of approximately 110 pounds of uranium (See Figure 2.0-2). The SWIFT GMA Fate and Transport Model calibrated in 1993 predicted that after the first year of operation that the recovery well field would discharge to the Great Miami River a total of 75 pounds of uranium. Based on currently available data the estimated total mass of uranium discharged through the first year of recovery field operation will fall within 32% of the model prediction.

Total Uranium in Discharge Waters

Groundwater Recovery System

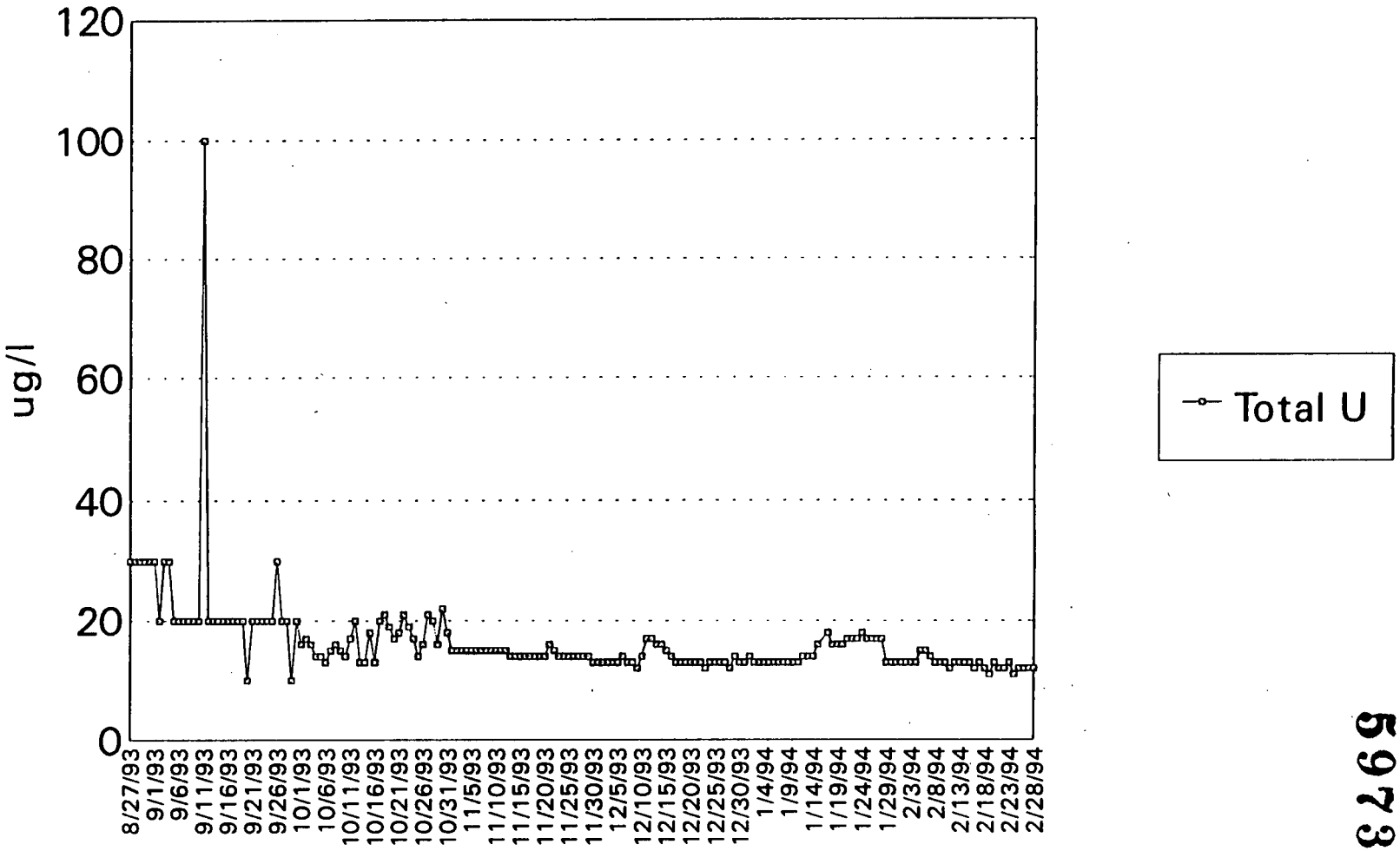


FIGURE 2.0-1

Total Uranium Discharged (LBS)
Storm Water Retention Basin

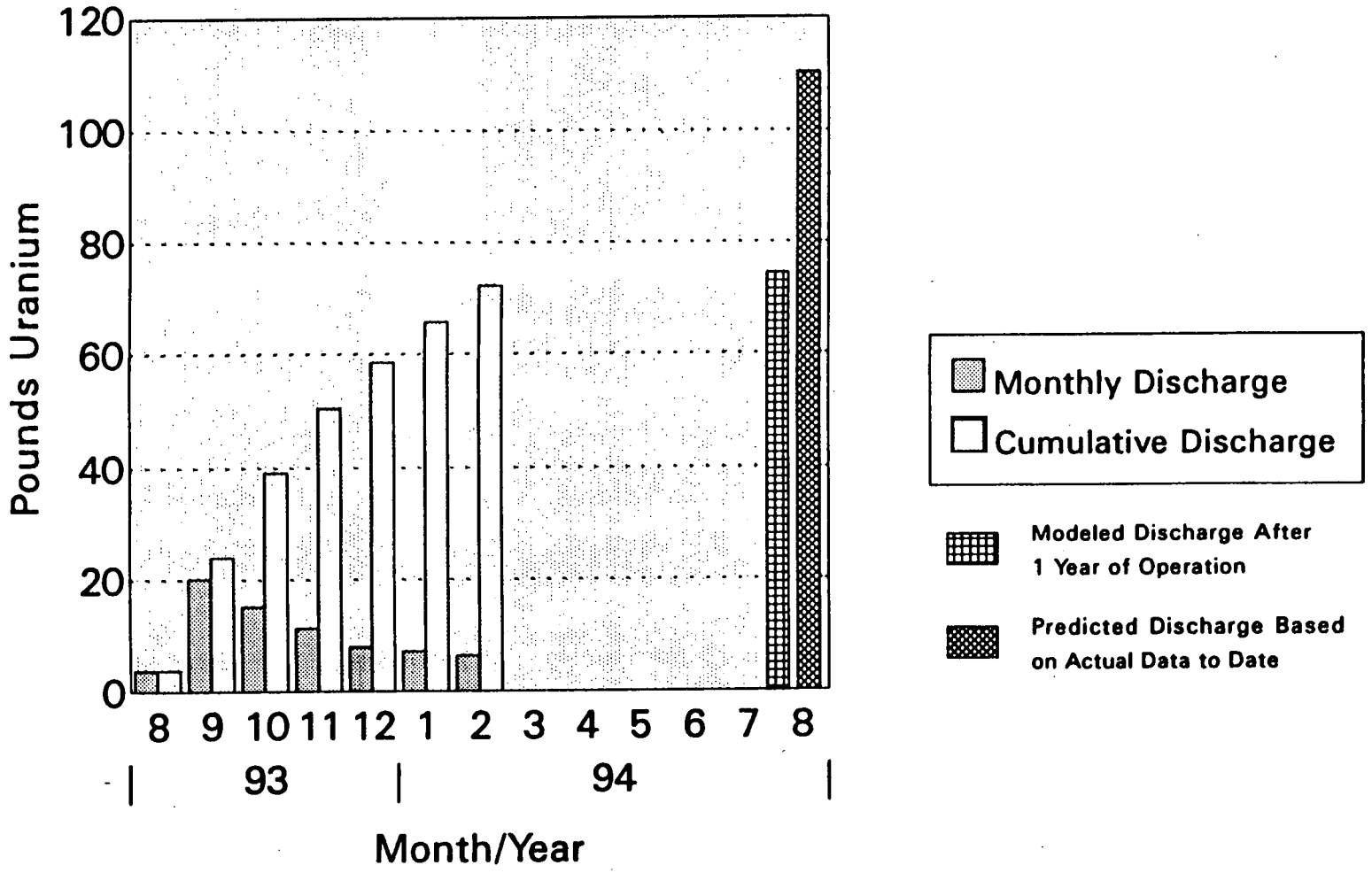


FIGURE 2.0-2

3.0 MONITORING RESULTS

This section summarizes water quality and groundwater measurements. A total of thirty-six monitoring wells are sampled for a suite of analytes including chemical constituents associated with the Paddys Run Road Site contaminant plumes. These analytes are listed in the DMEPP. Appendix A contains a summary of validated detections of the constituents sampled for under the DMEPP.

3.1 GROUNDWATER ANALYSES

Total uranium is the primary constituent of interest since the objective of the South Plume Removal Action is to prevent the further southern migration of the uranium plume. Arsenic is a constituent of concern for this program because it is a target analyte for the PRRS Plume and increasing levels of this contaminant have been detected in wells south of the recovery well field. For this reason the data presented will focus primarily on arsenic and uranium. Other analytes will be briefly discussed at the end of this section.

3.1.1 Uranium

All available validated detections of total uranium from DMEPP monitoring wells from August 27, 1993 through February 28, 1994 are presented in Appendix A. Results of the total uranium analyses shows that Recovery Well 3924 had the highest concentration of total uranium of all the recovery wells, with values ranging from 180 ppb on September 1, 1993 to 56 ppb on February 4, 1993. Figure 3.1-1 shows concentration of total uranium over time in recovery well 3924. With the exception of one anomalous reading during the first week of pumping system operation, and a slight increase of uranium in Well 3925, total uranium levels have been decreasing in the recovery wells. The other four recovery wells all had uranium concentrations less than or equal to 5 ppb. Figures 3.1-2 through 3.1-5 show uranium concentration over time for recovery wells 3925 through 3928. The overall downward trend in uranium concentrations, exhibited in the recovery wells, is reflected in the monitoring wells that initially had concentrations of uranium above background.

The monitoring well that exhibited the highest concentration of total uranium in the sampling

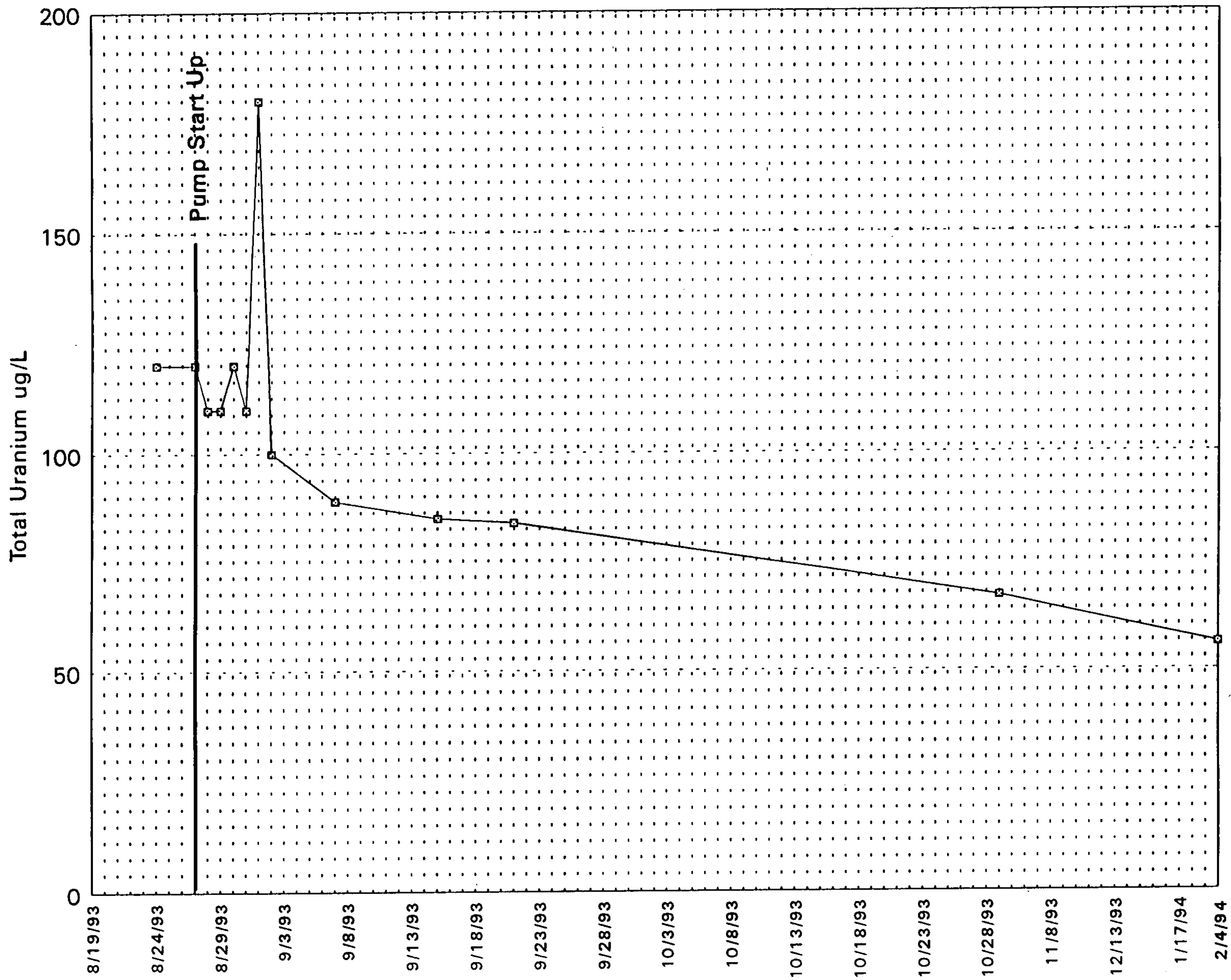


Figure 3.1-1. Total Uranium Concentrations for Recovery Well 3924

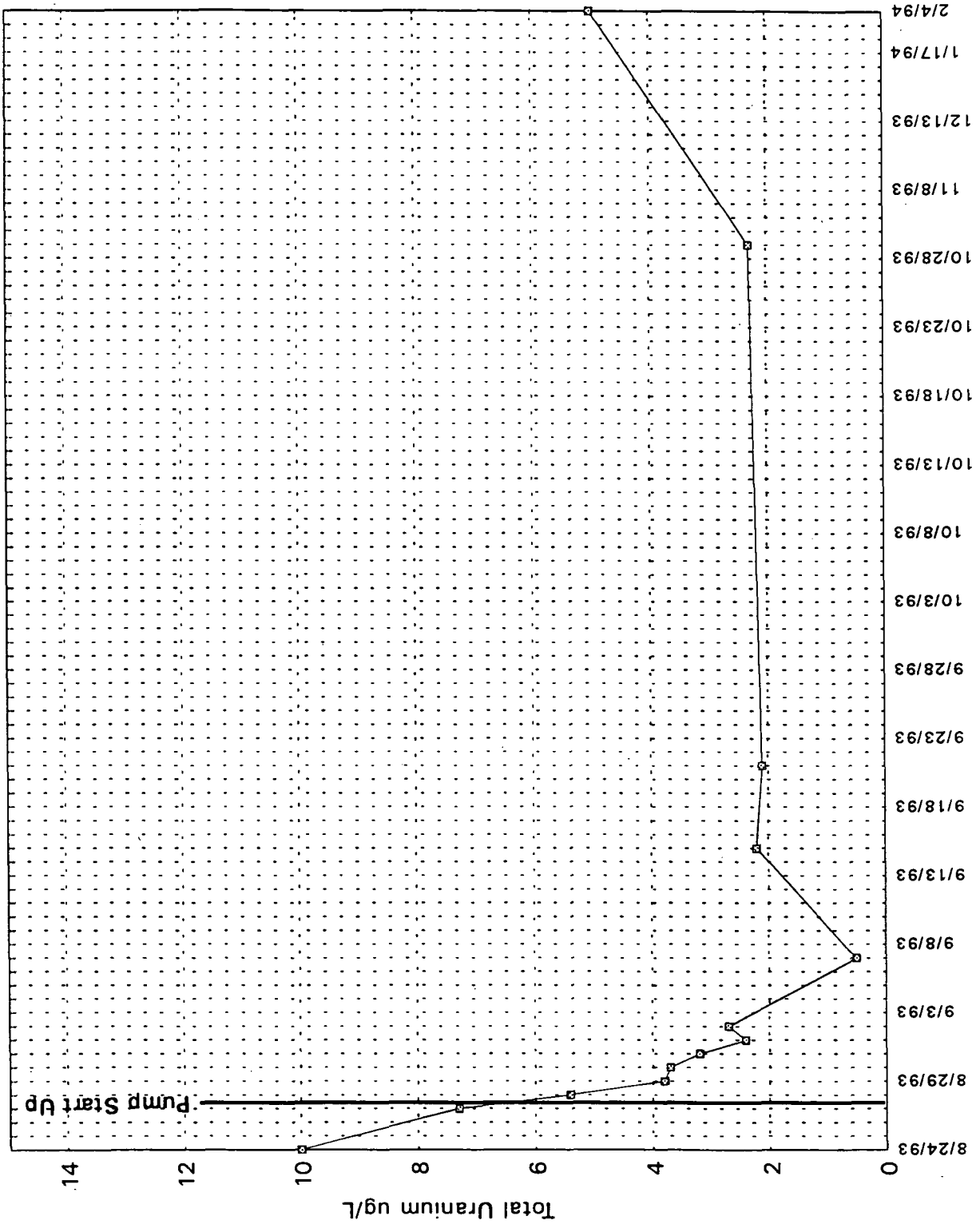


Figure 3.1-2. Total Uranium Concentrations for Recovery Well 3925

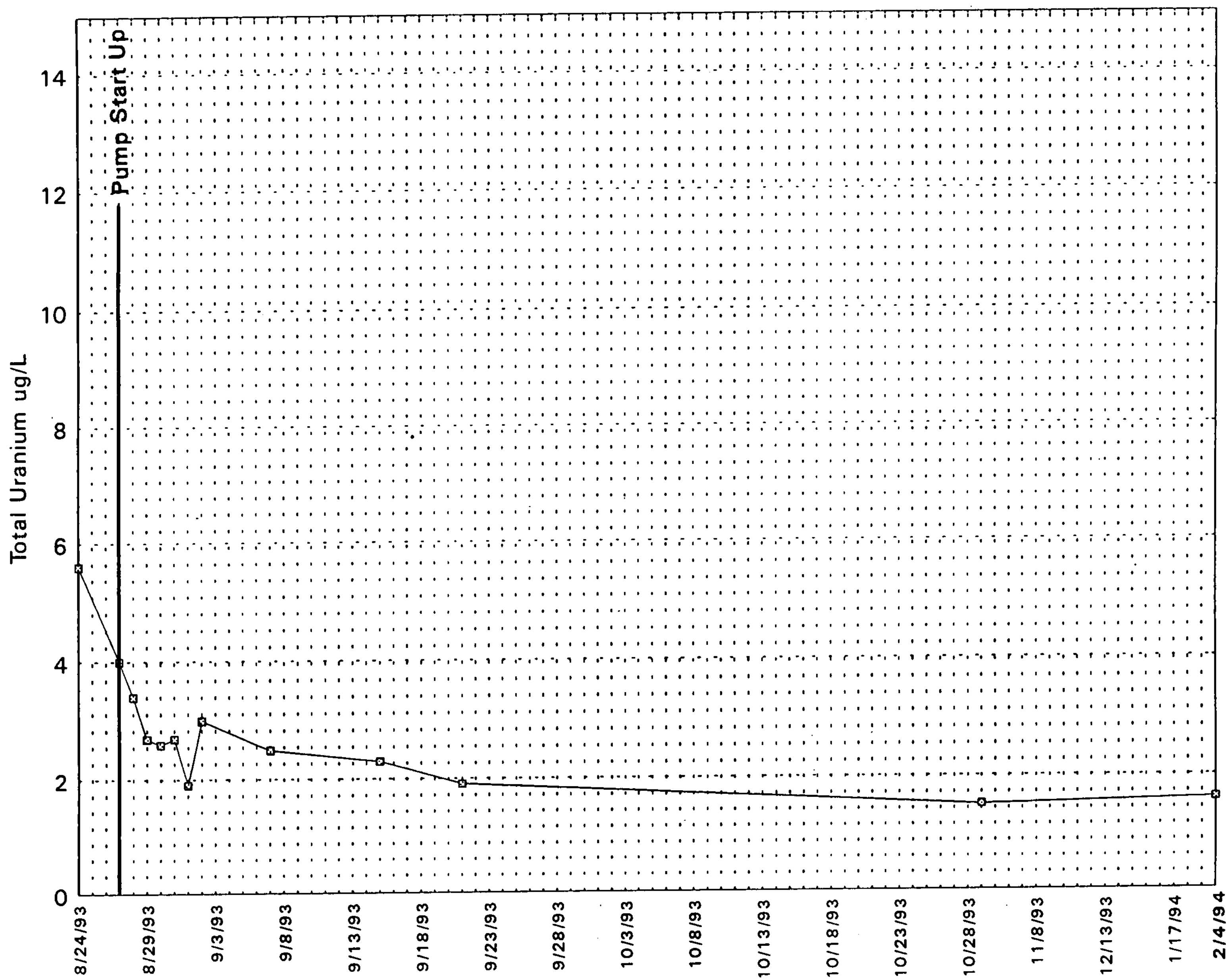


Figure 3.1-3. Total Uranium Concentrations for Recovery Well 3926

000015

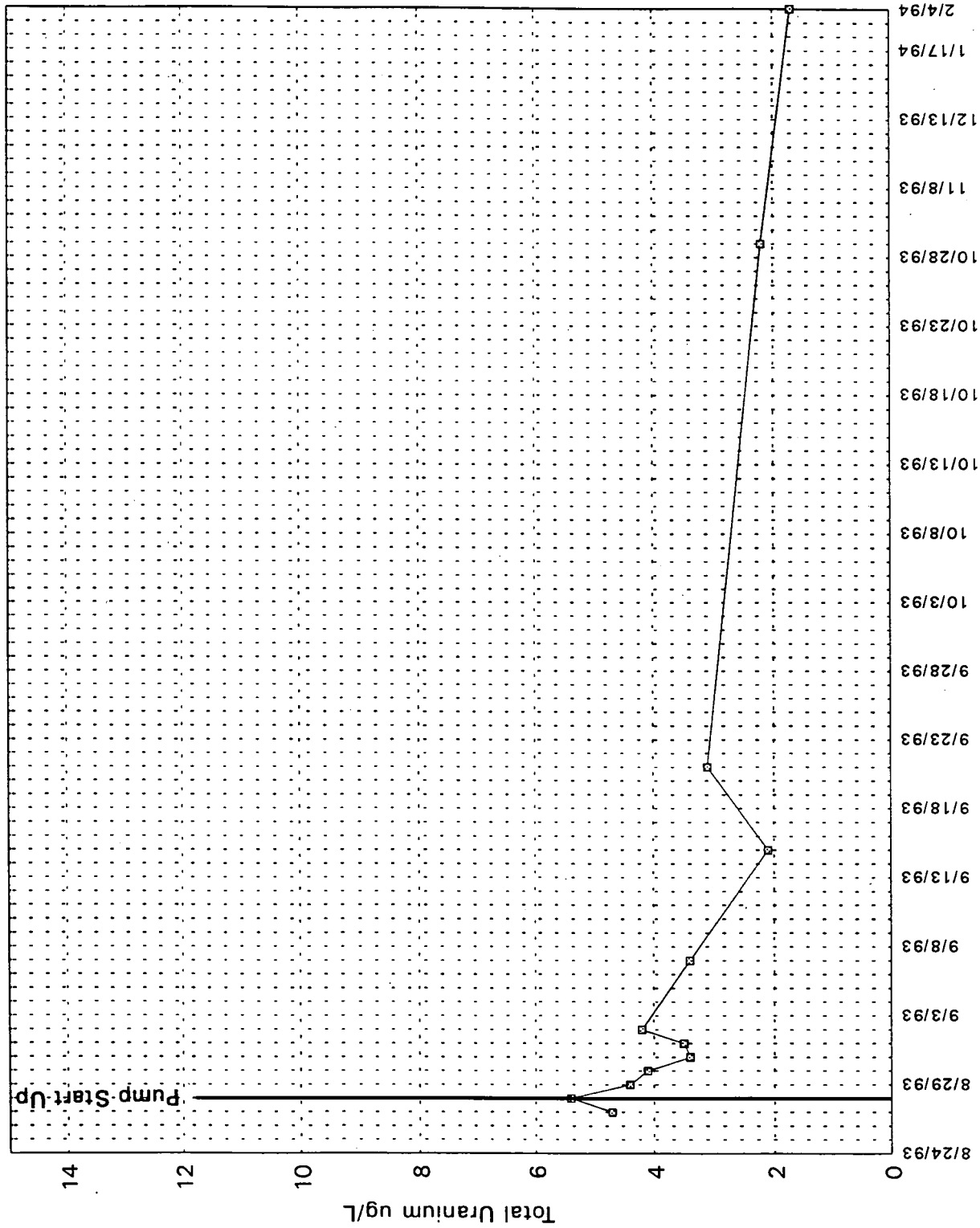


Figure 3.1-4. Total Uranium Concentrations for Recovery Well 3927

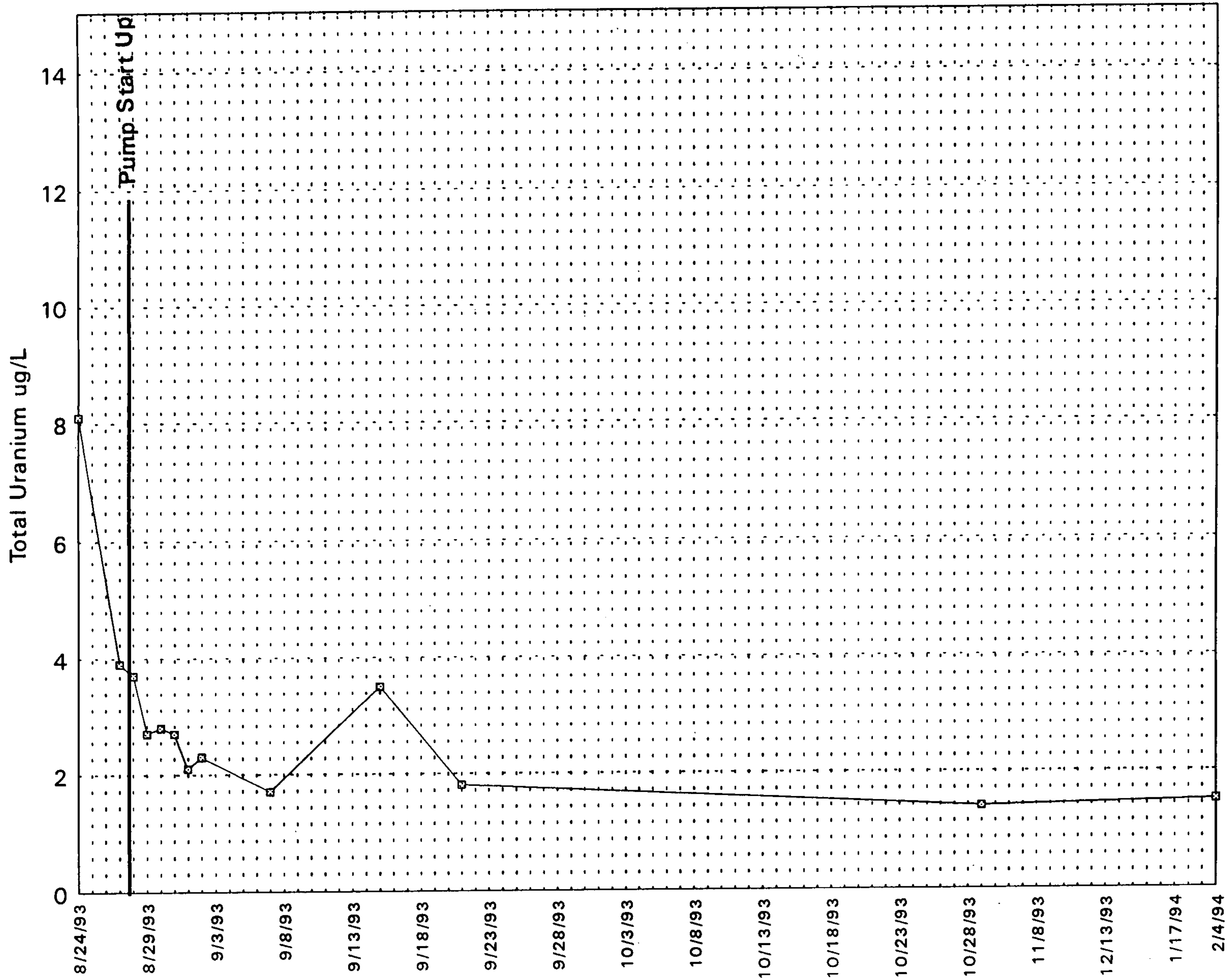


Figure 3.1-5. Total Uranium Concentrations for Recovery Well 3928

program was well 2061 with concentrations as high as 380 ppb on August 31, 1993. Figure 3.1-6 shows concentrations of total uranium over time for those wells in the DMEPP sampling program that have concentrations above 20 ppb. The uranium concentration measurement for the February sampling event of well 2061 was 230 ppb (rejected during the validation process). This well is located upgradient of the recovery well field and has shown decreasing concentrations of uranium during the first quarter of groundwater sampling. Two other monitoring wells, 2095 and 2624 exhibited total uranium above 100 ppb during the second quarter.

Well 2095 had 150 ppb of uranium on 9/16/93, and well 2624 had 100 ppb of uranium on 8/27/93. These wells are also located upgradient of the recovery well field. The majority of the remaining monitoring wells exhibit total uranium levels below 20 ppb with the exception of wells 2125, 2545 and 3125 which had values of total uranium between 20 and 100 ppb on several occasions. These wells are located west of the recovery well field but within the capture zone. Figure 3.1-7 illustrates the total uranium plume based on data collected in May, 1993 as part of the OU5 Remedial Investigation. This figure shows the location and distribution of total uranium in the aquifer prior to the recovery well start-up. A number of monitoring wells exhibited total uranium concentrations above 20 ppb prior to the starting of the recovery well system. Based on the February sampling event these wells (2125, 2061, 2624 and 3924) have shown a decrease in uranium concentrations since the last quarterly sampling round. No change in uranium concentrations could be assessed for monitor wells 2545 or 2095 because the validation process rejected the second quarter results for these wells.

3.1.2 Arsenic

On December 1, 1993, it was determined that PRRS contaminants, particularly arsenic, were increasing in five of the DMEPP wells located south of the recovery well field. The wells that exhibited an increase in arsenic were 2128, 2625, 2636, 2548 and 2900 (Figure 3.1-8). It was determined that the pumping of the recovery wells at 400 gpm was having too much influence on the flow of groundwater south of the extraction well field. The pumping rate for the recovery wells was reduced to 300 gpm at each recovery well on December 3, 1993. The 300 gpm rate was selected based on results from the step down pumping test of recovery well 3927 and

DMEPP Monitor Wells

Exhibiting Total Uranium Above 20 ppb

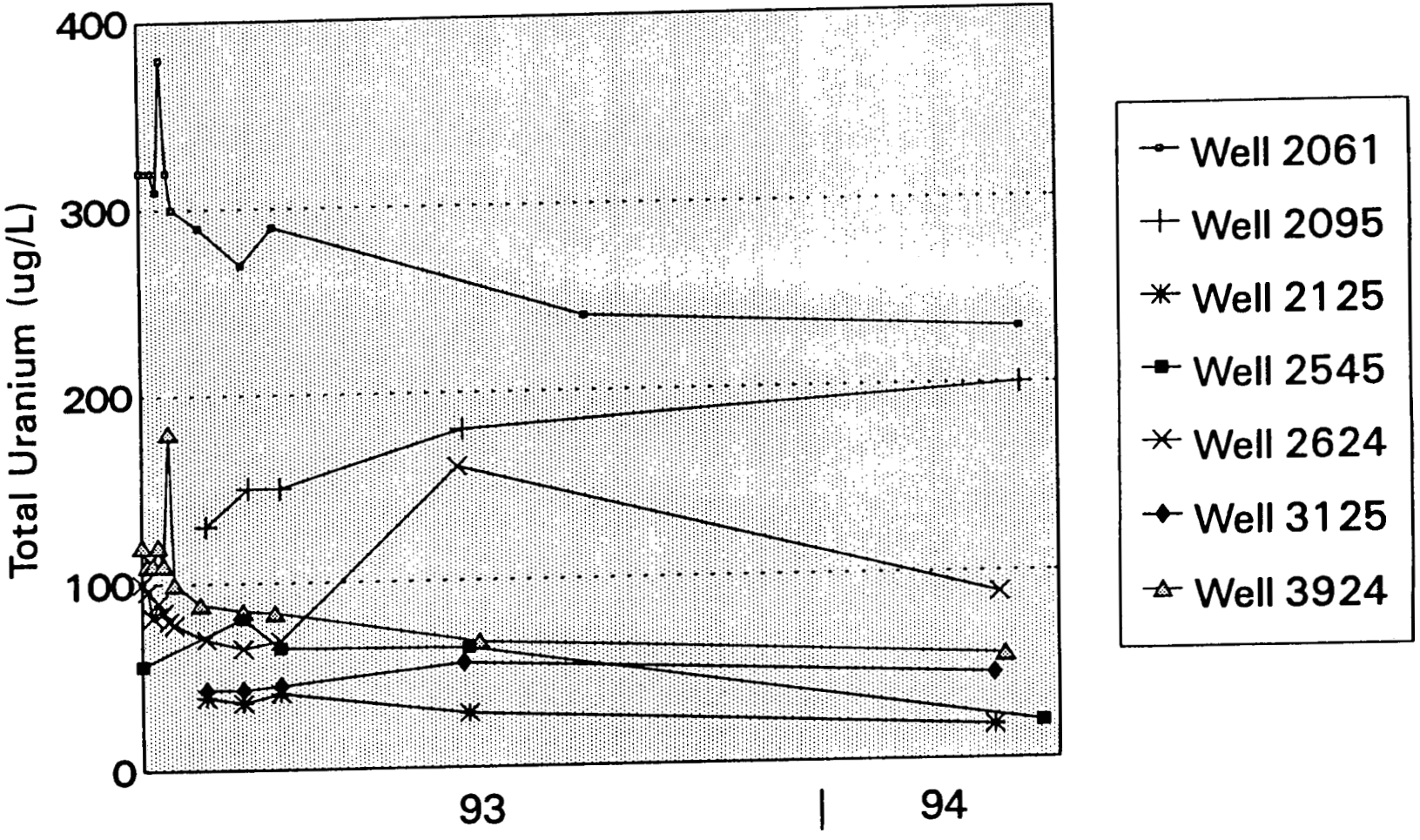
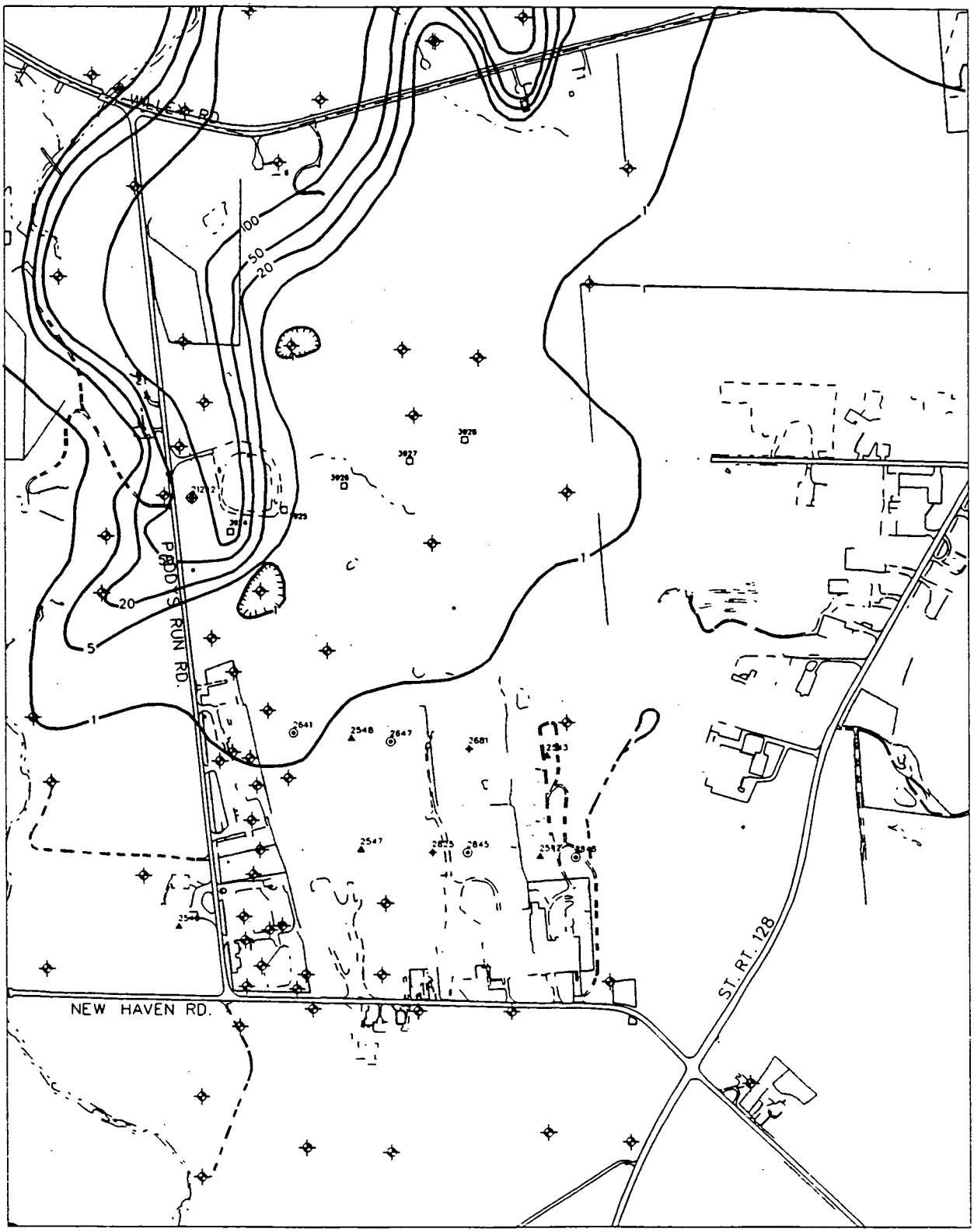


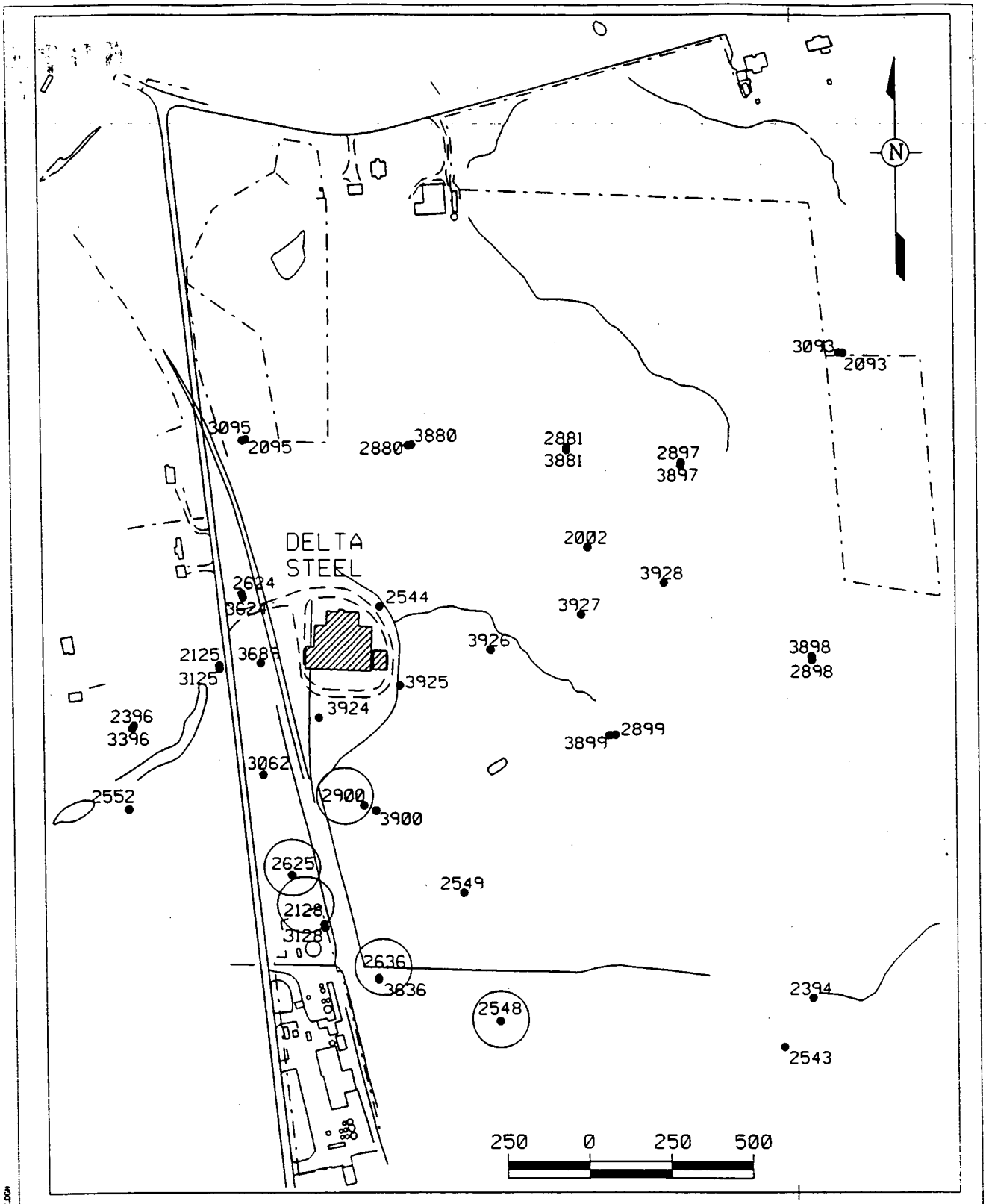
FIGURE 3.1-6



TOTAL URANIUM
TYPE 2 WELLS
MAY 1993 DATA

LEGEND:
- DENOTES VALUE LESS THAN 1 ppb
- MONITORING WELL
- RECOVERY WELL
- CONTOUR LINE (ppb)

FIGURE 3.1-7
3-9



MONITORING WELLS WITH ELEVATED ARSENIC CONCENTRATIONS

LEGEND:

2543 MONITORING WELLS WITH ELEVATED ARSENIC CONCENTRATIONS

FIGURE 3.1-8

000021

supported by groundwater modeling results. On December 9, 1993 it was decided that additional on-site analyses would be performed for arsenic from the five monitoring wells exhibiting increased arsenic concentrations. The five monitoring wells were put on a weekly sampling schedule for arsenic on December 15, 1993.

The US EPA and OEPA were notified by phone on December 3, 1993 about the increased arsenic trends south of the recovery well field and the need to throttle back the recovery wells. On December 21, 1993 a formal presentation of the arsenic data to the OEPA and US EPA was conducted. A decision was made to hold weekly conference calls with the OEPA and to provide capture zone analyses and arsenic results in a summary package by FAX to the OEPA and US EPA for discussion. Conference calls were held on January 14 and 21, 1994. After the January 21, 1994 conference call it was decided that the system had stabilized and that the weekly conference calls were no longer necessary unless significant changes occurred.

A review of water elevation data was performed to determine the effectiveness of the capture zone induced by the recovery wells, to track changes in the capture zone over time, and its effect on arsenic concentrations south of the pumping wells. A survey utilizing a Model 40L Geoflo Groundwater Flowmeter System was performed to assist in determining the effective capture of the recovery wells at the revised pumping rate. Results of the thermal flow meter survey suggested that the capture zone induced by the recovery wells being pumped at 300 gpm per recovery well was not adversely impacting flow south of the recovery well field and the effective capture of the total uranium plume at/and above 20 ppb was being achieved.

All available arsenic results are presented in Appendix A. Review of arsenic results from the on-site laboratory collected since the recovery wells were throttled back to 300 gpm on December 3, 1993 suggests that the total arsenic levels in the wells south of the pumping wells have returned to concentrations at or below their original pre-pumping concentrations. Of particular interest are wells 2128 and 2548. These wells originally exhibited a rapid increase in total arsenic levels after the recovery well pumps were first turned on. These levels reduced dramatically in both wells since the 300 gpm pumping rate was initiated and as of February 10, 1994 were at or below the analytical detection limits of 10 ppb.

3.1.3 Other Analytes

This section provides a discussion of other indicator analytes tested for under the South Plume Groundwater Recovery System Design, Monitoring, and Evaluation Program Plan. Total phosphorus, potassium, sodium, benzene, cumene (isopropyl benzene), ethylbenzene, toluene and xylene are considered to be associated with the PRRS Plume. Data is presented in Appendix A. Of the volatile organic compounds analyzed, only toluene and total xylene were detected. These constituents were only detected in well 2900. This well had concentrations of toluene of 2 ppb (4 ppb for a duplicate analysis) on February 2, 1994, and total xylene concentrations of 3 ppb on February 2, 1994. Toluene was detected in this well during the first sampling quarter at 2.4 ppb. Because of the low concentrations of volatile organic compounds (VOA's), the location of the well and the fact that no other well sampled in the program exhibited concentrations of VOA's this quarter, these detections are considered to be laboratory contaminants.

Results of sampling for total phosphorus during the first quarter of operation were consistent with pre-pumping concentrations with the exception of monitoring wells 2548, 2625 and 2900. Well 2548 had pre-pumping concentrations of total phosphorus of 1,040 to 1,500 ppb. These levels increased to 6200 ppb on 9/14/93 and 5400 ppb on 9/22/93. The second quarterly sampling round results showed concentrations of total phosphorus at 2,970 ppb. Well 2625 had one detection of 11,000 ppb on 9/8/93 that was inconsistent with a pre-pumping range of 2,120 to 4,400 ppb. The second quarterly sampling round showed concentrations of total phosphorus at 1,340 ppb. Well 2900 exhibited increased levels of total phosphorus from pre-pumping levels of 590 ppb (8/10/93) to 960 ppb (9/16/93) and 940 ppb (9/22/93). The second quarterly sampling round showed concentrations of total phosphorus at 928 ppb.

Analytical results for potassium during the first quarter were consistent with pre-pumping concentrations with the exception of wells 2128, 2548, and 2625. Well 2128 exhibited a significant increase in potassium concentrations from a pre-pumping range of 3,850 ppb to 8,100 ppb, to 16,000 ppb (9/15/93), 18,000 ppb (9/22/93) and 12,700 ppb (10/26/93). The second quarterly sampling round showed concentrations of potassium at 2200 ppb. Well 2548 also exhibited a significant increase in potassium concentrations from a pre-pumping range of 3,020

ppb to 11,900 ppb, to 13,800 ppb (9/8/93), 25,000 ppb (9/14/93), 40,000 ppb (9/22/93) and 21,000 ppb (10/27/93). The second quarterly sampling round showed concentrations of potassium at 7030 ppb. Well 2625 had one detection of 6,000 ppb on September 22, 1993 that was inconsistent with pre-pumping concentrations. The February 1, 1994 sampling round showed concentrations of potassium at 1780 ppb.

Analytical results for sodium were consistent with pre-pumping concentrations with the exception of well 2898 and 3900. Well 2898 had detections of 27,400 ppb on 10/29/93 (first quarter), and 29,200 ppb on 2/7/94 (second quarter) which were above pre-pumping concentrations for this well. Well 3900 also had detections of 10,800 ppb on 11/18/93 and 2/4/94 which were above pre-pumping concentrations for this well.

3.1.4 Statistical Analyses

Limited statistical analysis of the data was performed for this report because of the small amount of data available and the changes that were made to the pumping rate of the recovery well field. A more meaningful statistical analysis will be presented in the fourth quarterly report.

Since the main purpose of this removal action is the capture of uranium, a table was prepared and is presented in Table 3.1-1 that shows the minimum, maximum and average uranium concentrations for those monitor wells that exhibited concentrations of total uranium greater than 20 ppb at the beginning of the recovery well operation. Second quarter sample results are included for comparison. At the bottom of the table is an average of all total uranium data collected from DMEPP monitor wells from the period of January 1991 through August 26, 1993 labeled as pre - 8/27/93 (system start-up date). Also presented is an average of all total uranium data collected from DMEPP monitor wells from the period of August 28, 1993 through February 28, 1994 labeled as post - 8/27/93. A combination of these two data files is summarized at the very bottom of the table for data from all DMEPP wells from the period of January 1, 1991 through February 28, 1994 labelled All DMEPP Wells.

A review of the table shows that four of the seven monitor wells (2125, 2624, 3125 and 3924) had second quarter results that were below the average value for the entire data set for the wells.

TABLE 3.1-1 SUMMARY OF TOTAL URANIUM RANGES AND AVERAGES FOR MONITOR WELLS EXHIBITING CONCENTRATIONS ABOVE 20 PARTS PER BILLION AND AQUIFER CONCENTRATIONS PRE AND POST RECOVERY SYSTEM START-UP

	Minimum Value ppb	Maximum Value ppb	Average Value ppb	February 1994 Sample Result
MW 2061	231	380	289.3	230 R
MW 2095	52.3	201.5	131.2	200 R
MW 2125	4.2	67.4	37.1	18
MW 2545	39	106	61	20 R
MW 2624	7.5	160	86.1	7.5
MW 3125	19.3	96.2	48.5	46
MW 3924	67	180	106.7	56
Total U Pre-8/27/93	0.1	320	17.5	NA
Total U Post-8/27/93	0.1	380	28.2	NA
Total U All DMEPP Wells	0.1	380	27.3	NA

R = Analytical result rejected during validation process

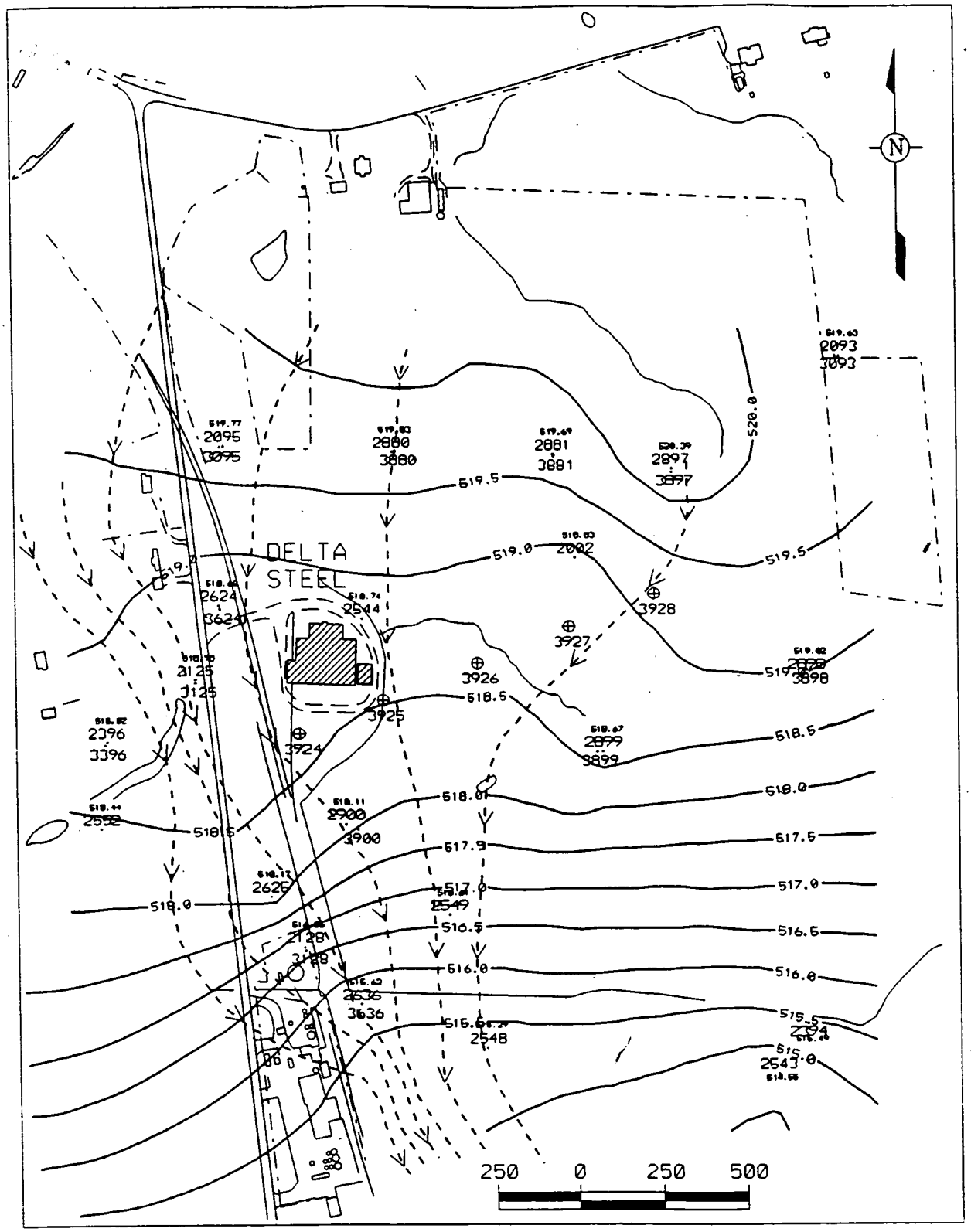
NA = Not Available. No composite water sampling was performed.

Data from the other three wells (2061, 2095 and 2545) could not be compared to the overall average because the data was rejected during the validation process.

The pre - 8/27/93, post - 8/27/93 and All DMEPP Wells data statistics were prepared to try to determine the effectiveness of uranium removal from the aquifer by the recovery well field by comparing the statistical results. The average uranium concentration was 17.5 ppb for the pre - 8/27/93 data set compared to 28.2 for the post - 8/27/93 data set. The average uranium concentration was 27.3 for the All DMEPP Wells. The fact that the average concentration of total uranium has increased after the start up of the recovery well field suggests that uranium is being captured by the recovery well system.

3.2 CAPTURE ZONE ANALYSES

Capture zone analyses have been regularly performed to assess whether or not a hydraulic barrier is being achieved, and that the impact to PRRS plumes is being minimized. The pre-pumping groundwater elevations for August 27, 1993 were used to construct a pre-pumping water table map (Figure 3.2-1). Pre-pumping groundwater flow was generally in a southerly direction with some easterly influence by groundwater mounding due to Paddys Run. At the southeast corner of the study area flow bends somewhat to the west. The capture zone of September 21, 1993 was induced by a 400 gpm pumping rate per recovery well (Figure 3.2-2). This date was selected for capture zone analysis because it had been determined that equilibrium had been reached by the system through comparison of drawdown in wells 2544 and 2624 to the natural trend observed in the aquifer at wells 2387 and 2390 (located north of Willey Road) and response to precipitation events during the same time frame (Figure 3.2-3). The capture zone was drawn utilizing estimated drawdown values for the five recovery wells because the recovery wells design does not allow for groundwater elevation measurement. Drawdown measurements are estimated at each recovery well based on the pump test performed at recovery well 3927 in May 1993. All other values used to draw the capture zone are based on actual field measurements. The flow divide for this data set runs in a west to east orientation to well 2549. The flow divide then parallels the recovery well field in a northeasterly direction. The flow divide is located along a line that passes near wells 2625, 2549 and 2898 approximately 430 feet south of the nearest recovery well (RW 3924).



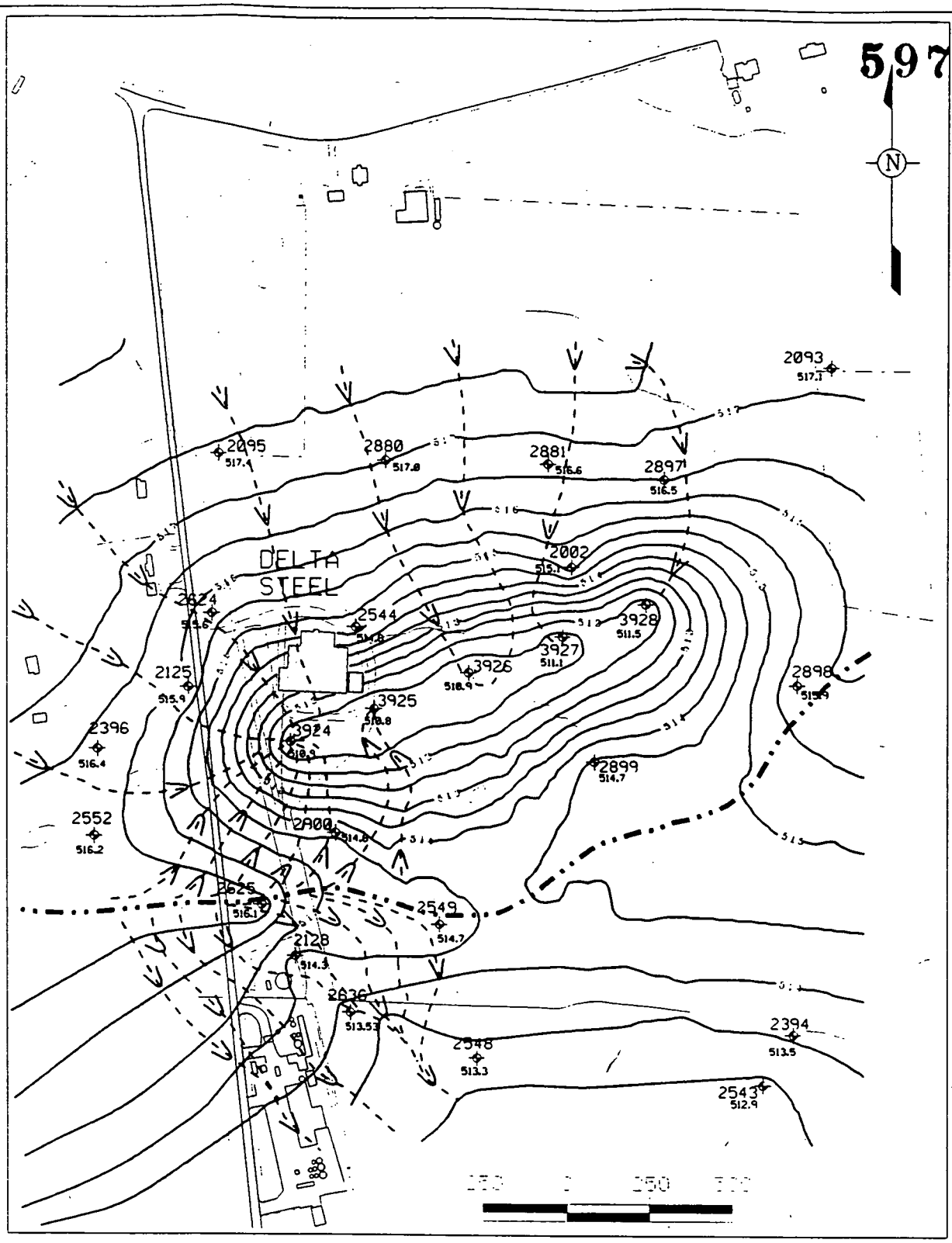
PRE-PUMPING GROUNDWATER
ELEVATIONS FOR AUGUST 27 1993

LEGEND:

- ⊕ 3926 — RECOVERY WELL NUMBER AND SYMBOL
- 2543 / 513.66 — MONITORING WELL AND ELEVATION
- ——— CONSTANT HEAD LINES
- - - - - - FLOW LINES

FIGURE 3.2-1

000027



GROUNDWATER ELEVATIONS
SEPTEMBER 21 1993
PUMPING RATE = 400gpm

LEGEND:

CONSTANT HEAD LINES
FLOW LINES
FLOW DIVIDE

FIGURE 3.2-2

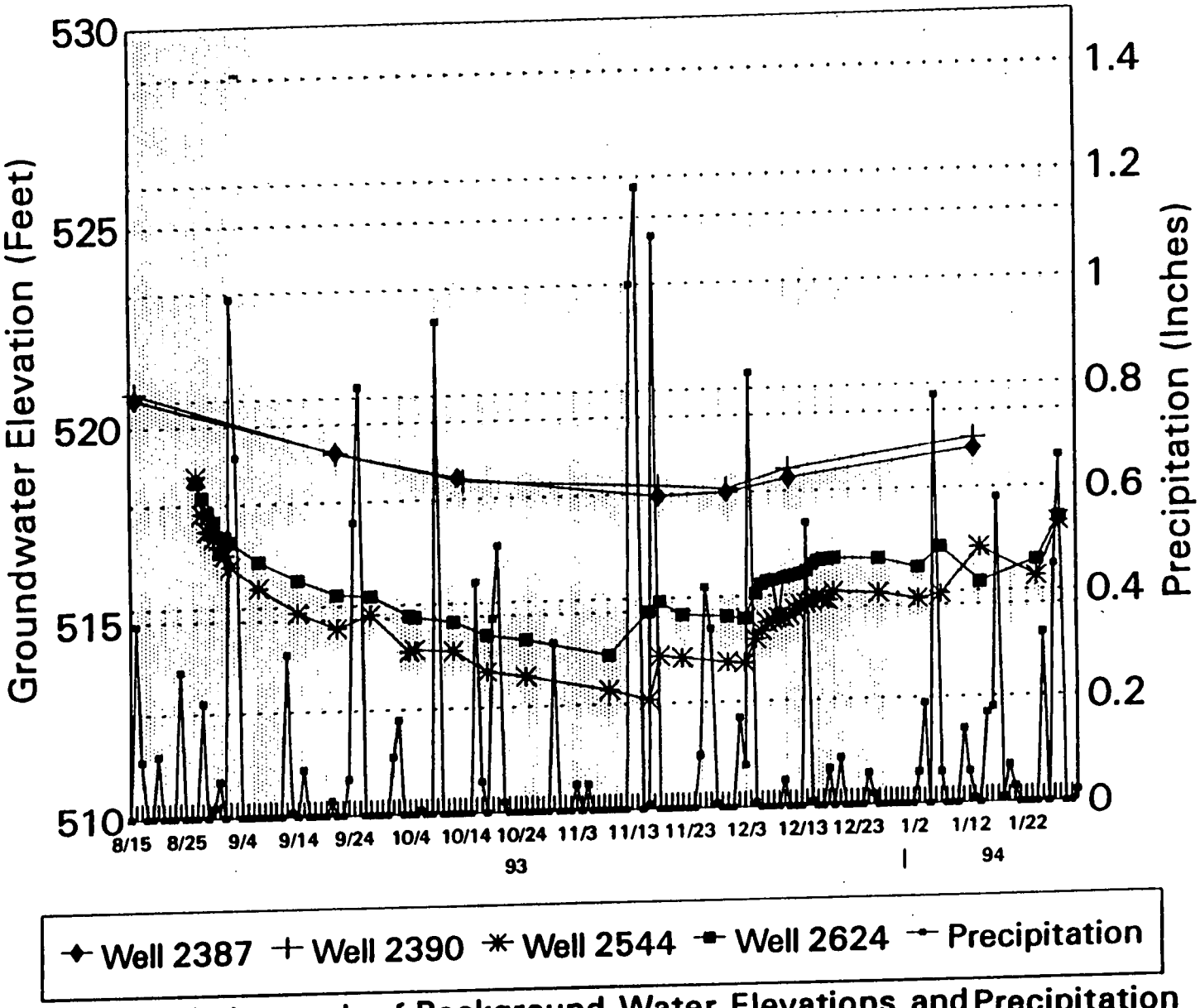
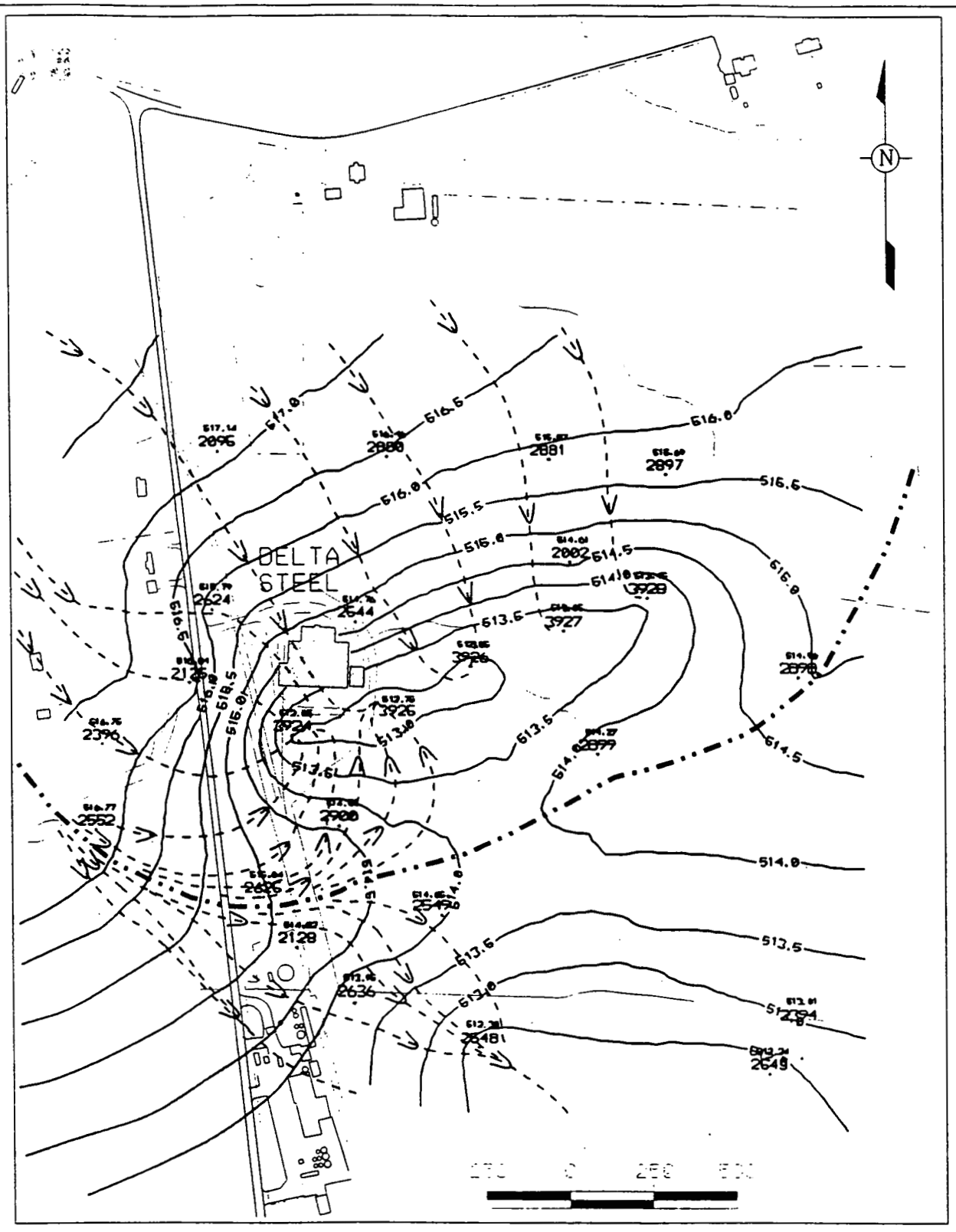


FIGURE 3.2-3 Hydrograph of Background Water Elevations and Precipitation

As noted in Section 3.1.2 of this report an increase in arsenic concentrations was noted in several of the monitoring wells south of the recovery well field. It appeared that the capture zone induced by the 400 gpm per recovery well pumping rate caused a more easterly flow path of the arsenic plume. A revised pumping rate of 300 gpm at each recovery well was implemented on December 3, 1993. A capture zone map reflecting groundwater conditions on December 10, 1993 (300 gpm/recovery well) (Figure 3.2-4) shows that the capture zone was similar to the capture zone created with the wells pumping at 400 gpm/recovery well (Figure 3.2-2). The only noticeable difference was that the western end of the flow divide line (Figure 3.2-2) was now oriented in a more northwesterly direction and that in the vicinity of the wells with increased levels of arsenic that the groundwater flow was more consistent with the groundwater flow of August 27, 1993 before recovery well start-up. Because total equilibrium had not been reached by December 10, 1993 based on hydrograph data presented in Figure 3.2-4 an additional capture zone map was generated from data collected on January 7, 1994. The January 7, 1994 capture zone map (Figure 3.2-5) shows the effective capture of the recovery well field after the aquifer had a chance to stabilize at the revised pumping rate of 300 gpm per recovery well. The result of the reduction in pumping rate is that the flow divide line moved approximately 130 feet closer to the nearest recovery well (RW 3924) to 300 feet compared to 430 feet at a pumping rate of 400 gpm per recovery well. Also wells 2128, 2548, 2625, 2636 and 2900 south of the recovery well field that previously exhibited fluctuating levels of arsenic had either returned to pre-pumping levels or near pre-pumping levels suggesting that the recovery well system was no longer adversely impacting groundwater flow in this area.

The February 11, 1994 capture zone (Figure 3.2-6) shows the effective capture of the recovery well field, based on Type 2 well data, to be almost identical to the capture zone on January 7, 1994. A second capture zone map (Figure 3.2-7) was prepared utilizing February 11, 1994 data, collected from Type 3 wells. The capture zone is very similar to the capture zone of February 11, 1994 for the Type 2 wells. The capture zone is similar west of the recovery well field. South of the recovery well field the effective capture is approximately 100 feet closer to the recovery wells while to the east of the recovery well field the effective capture is approximately 100 feet farther east than the capture determined from Type 2 well water elevations.



GROUNDWATER ELEVATIONS
DECEMBER 10 1993
PUMPING RATE = 300GPM

FIGURE 3.2-4

000031

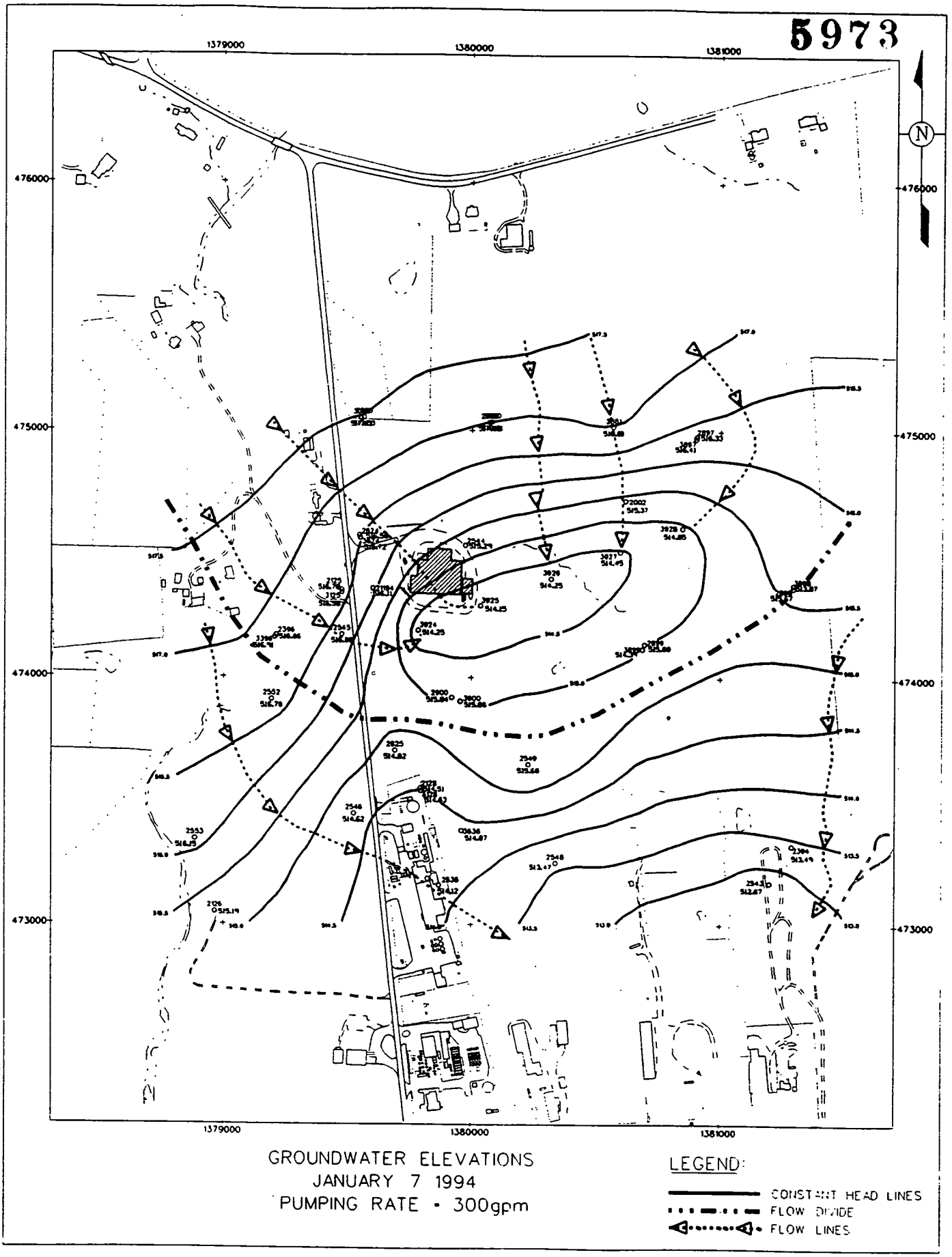
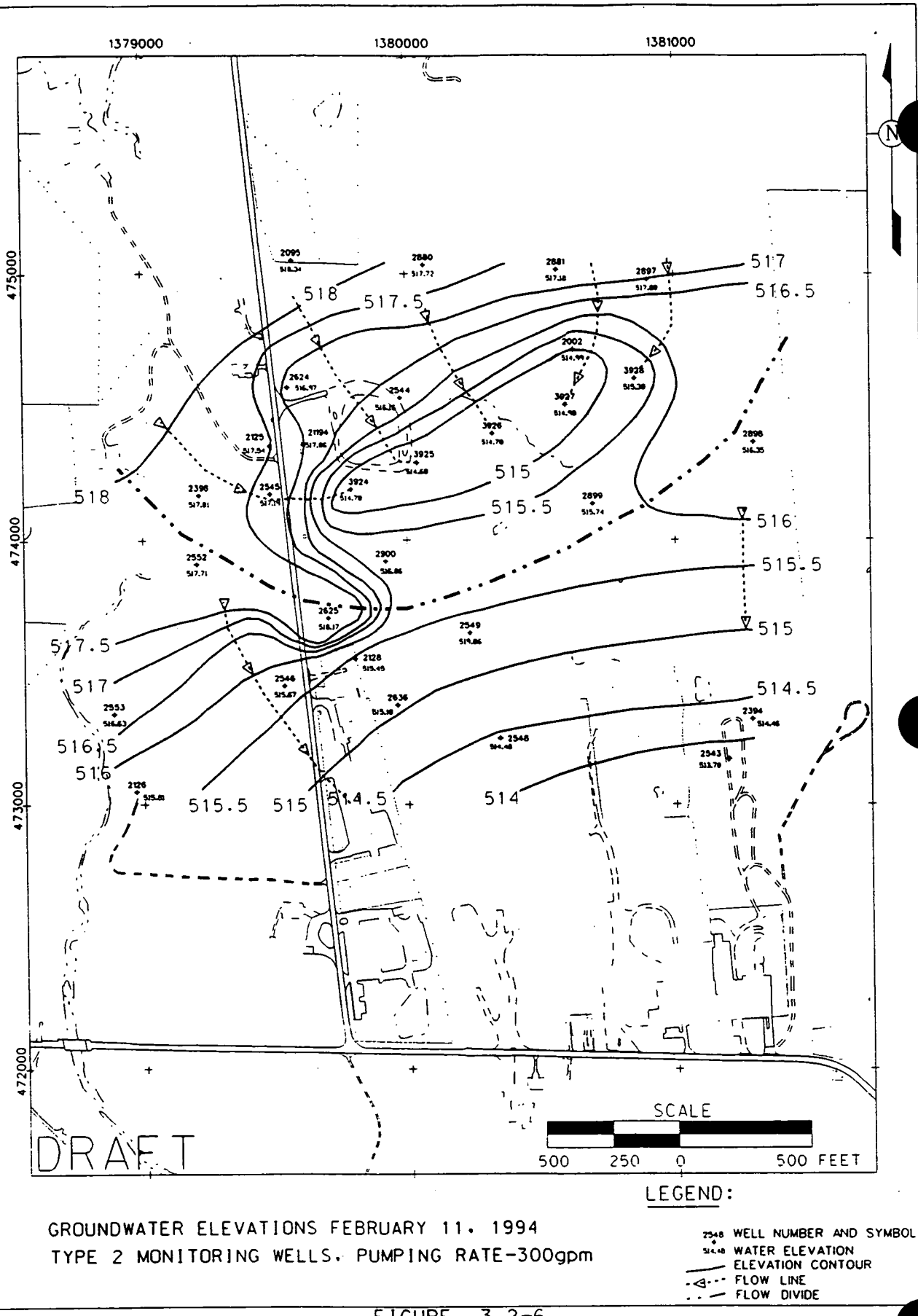
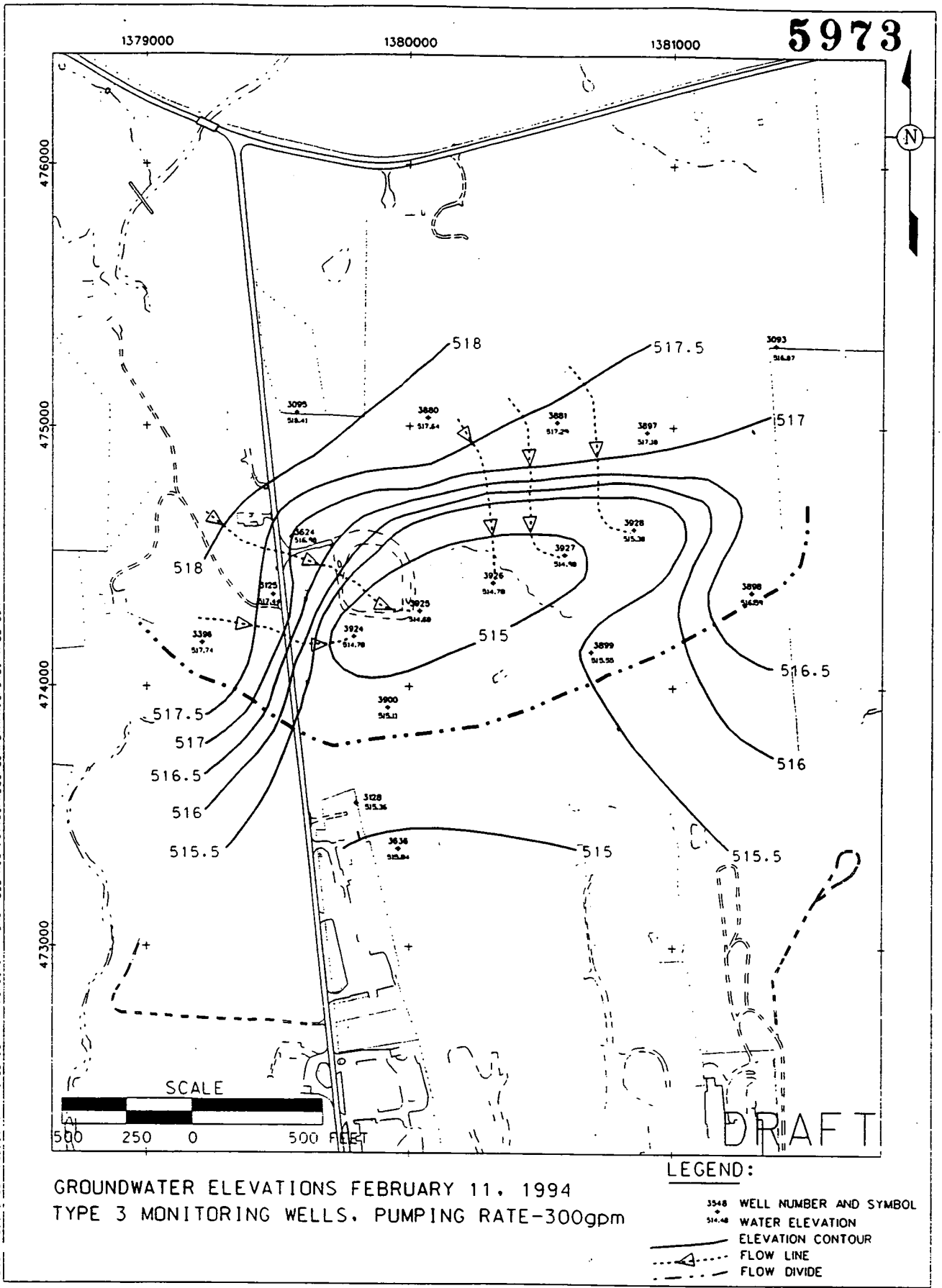

1379000
1380000
1381000
476000
475000
474000
473000
N
GROUNDWATER ELEVATIONS
JANUARY 7 1994
PUMPING RATE - 300gpm
LEGEND:
CONSTANT HEAD LINES
FLOW DIVIDE
FLOW LINES

FIGURE 3.2-5



/USR/ERNA/CRU5/DGN/MAP/HAD/DPTH/2521194.DGN FER 005 7/28/94 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE 3.2-6



GROUNDWATER ELEVATIONS FEBRUARY 11, 1994
TYPE 3 MONITORING WELLS, PUMPING RATE-300gpm

/USR/ERMA/CRUS/DGN/MAP/HOR/DPTH/351194.DGN FER CRUS 7/28/94 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE 3.2-7

The SWIFT Calibrated Model was run with a five well pumping scenario at 300 gpm. Particle tracking was performed using the flow output. Figures 3.2-8, 3.2-9 and 3.2-10 show the particle tracking runs, with wells pumping at 300 gpm per recovery well, for model layers 1, 3, and 5. These planar particle tracks are similar to actual capture analyses for Type 2 and Type 3 wells respectively as depicted in figures 3.2-6 and 3.2-7. To assess vertical capture through the aquifer, simulations were run with ST Line at each recovery well with vertical cross sections oriented north to south through model layers 1 through 6. These simulations were performed at recovery wells 1, 2, 3, 4, and 5 and are depicted in figures 3.2-11 through 3.2-15 respectively. These simulations show capture down to model layer 6.

The purpose of the recovery well field is to intercept the total uranium plume as defined by the 20 ppb isopleth. Figure 3.2-16 superimposes the 300 gpm per recovery well capture zone over the maximum extent of the total uranium plume based on a more conservative value of 5 ppb, generated from data collected in the spring of 1993. This figure indicates that the 5 ppb total uranium isopleth is within the capture zone induced by the recovery well system at a 300 gpm per recovery well pumping rate. Since particle tracking indicates capture down to model layer 6 it is assumed that complete capture of the 20 ppb uranium isopleth will occur. The fact that the aerial extent of the 20 ppb uranium isopleth at the Type 3 well interval is smaller than at the Type 2 well interval substantiates this assumption.

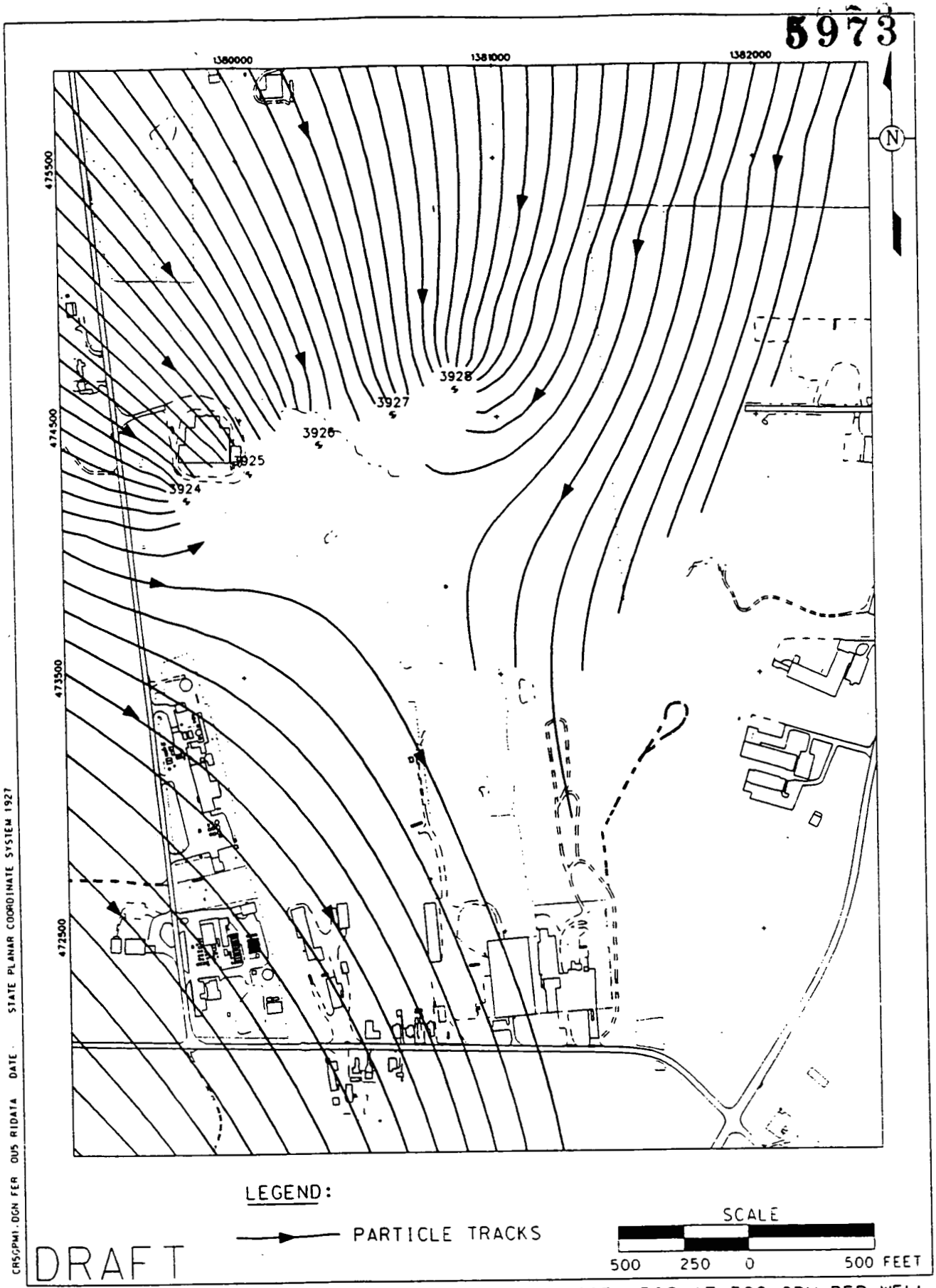


FIGURE 3.2-8. FIVE RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL ST LINE MODEL LAYER 1

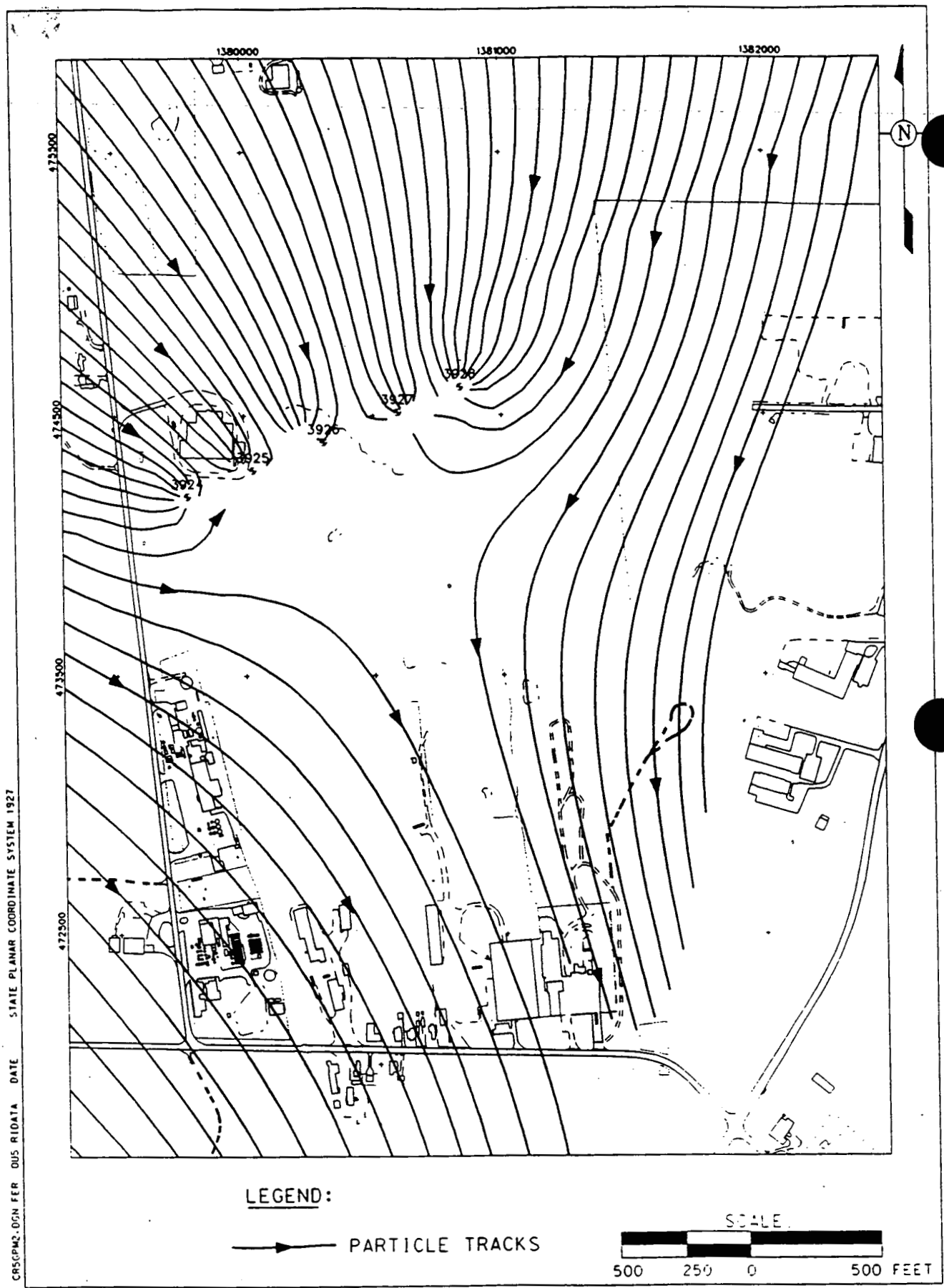


FIGURE 3.2-9. FIVE RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WE
ST LINE MODEL LAYER 2

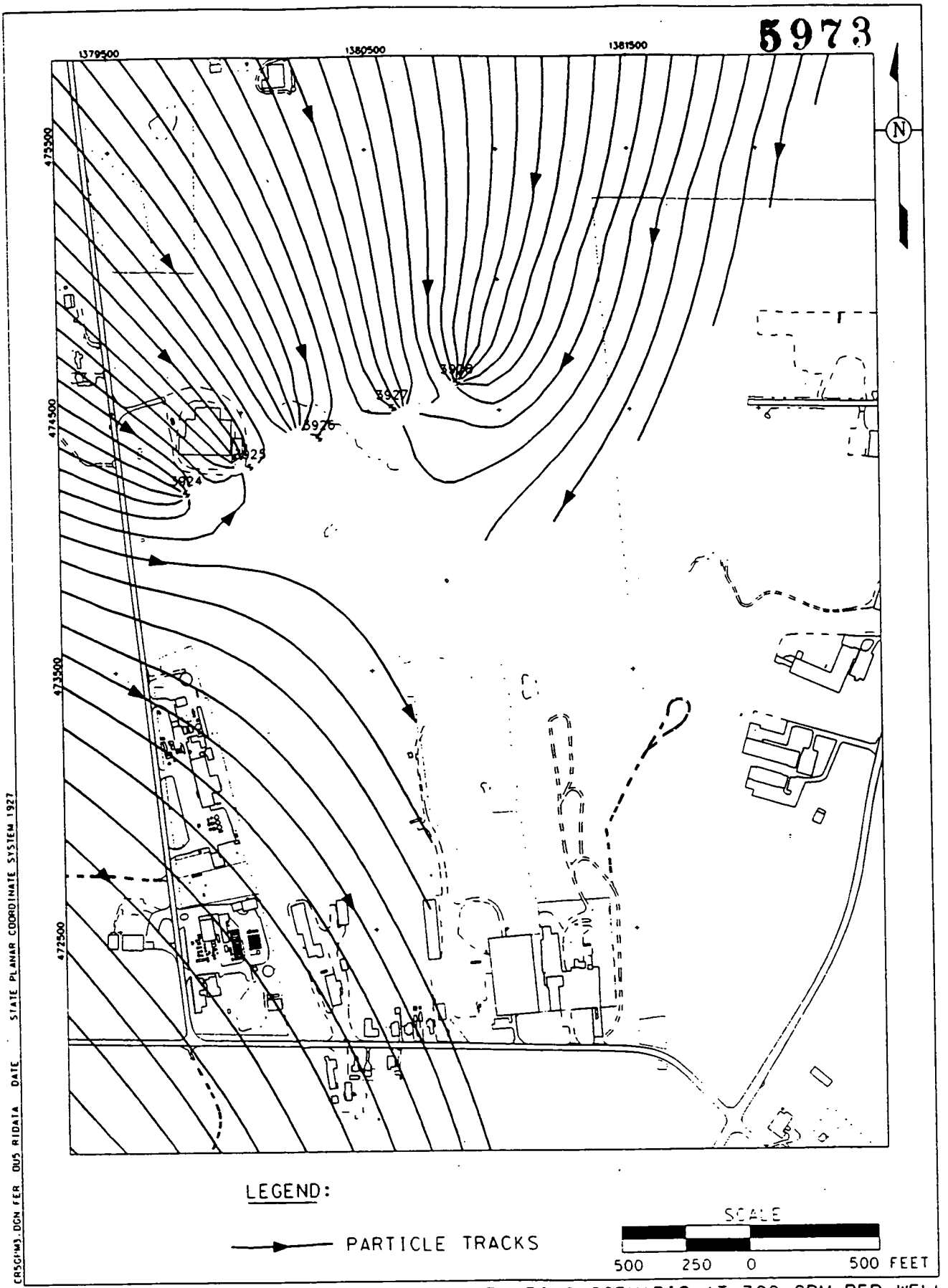
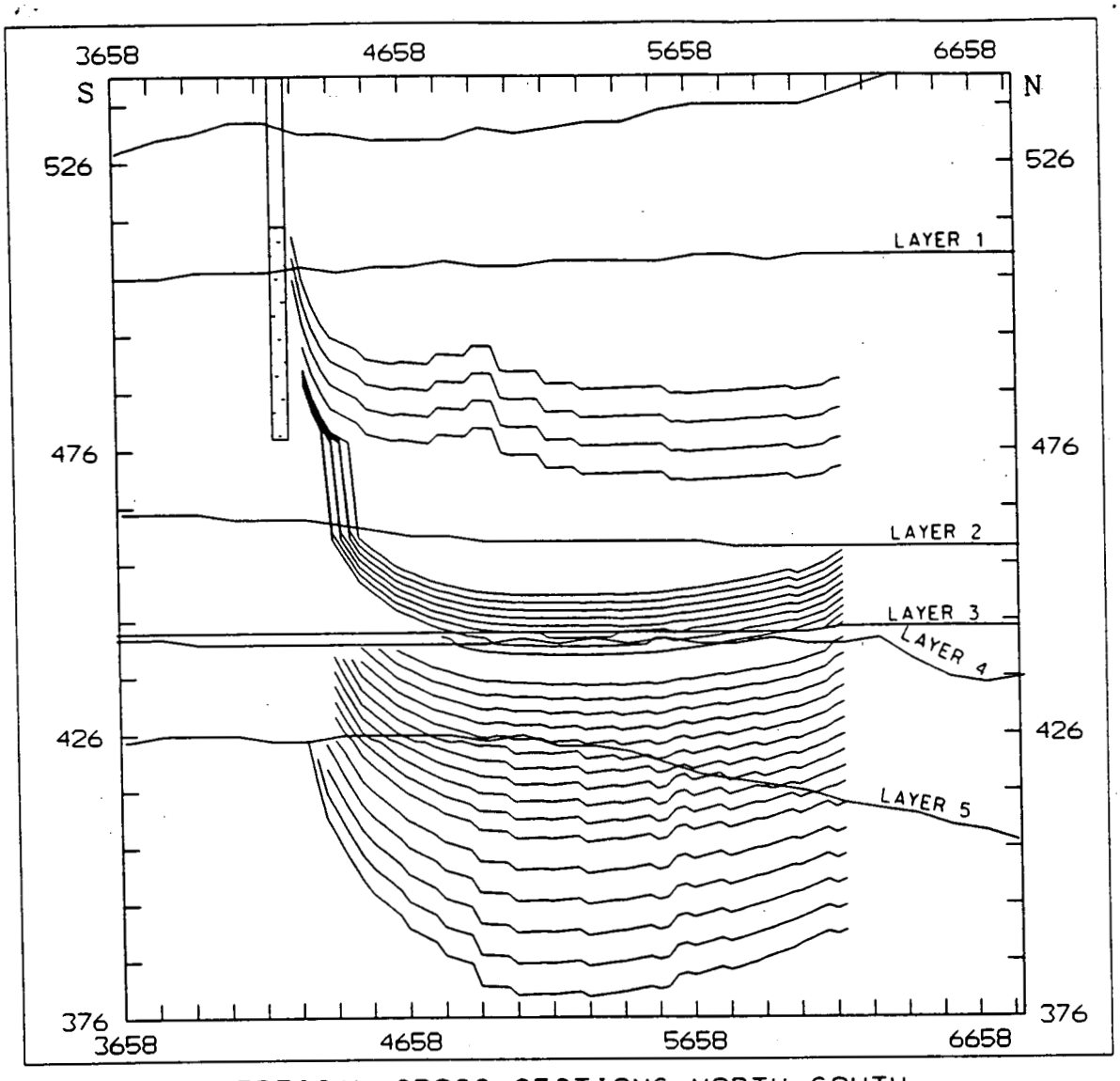
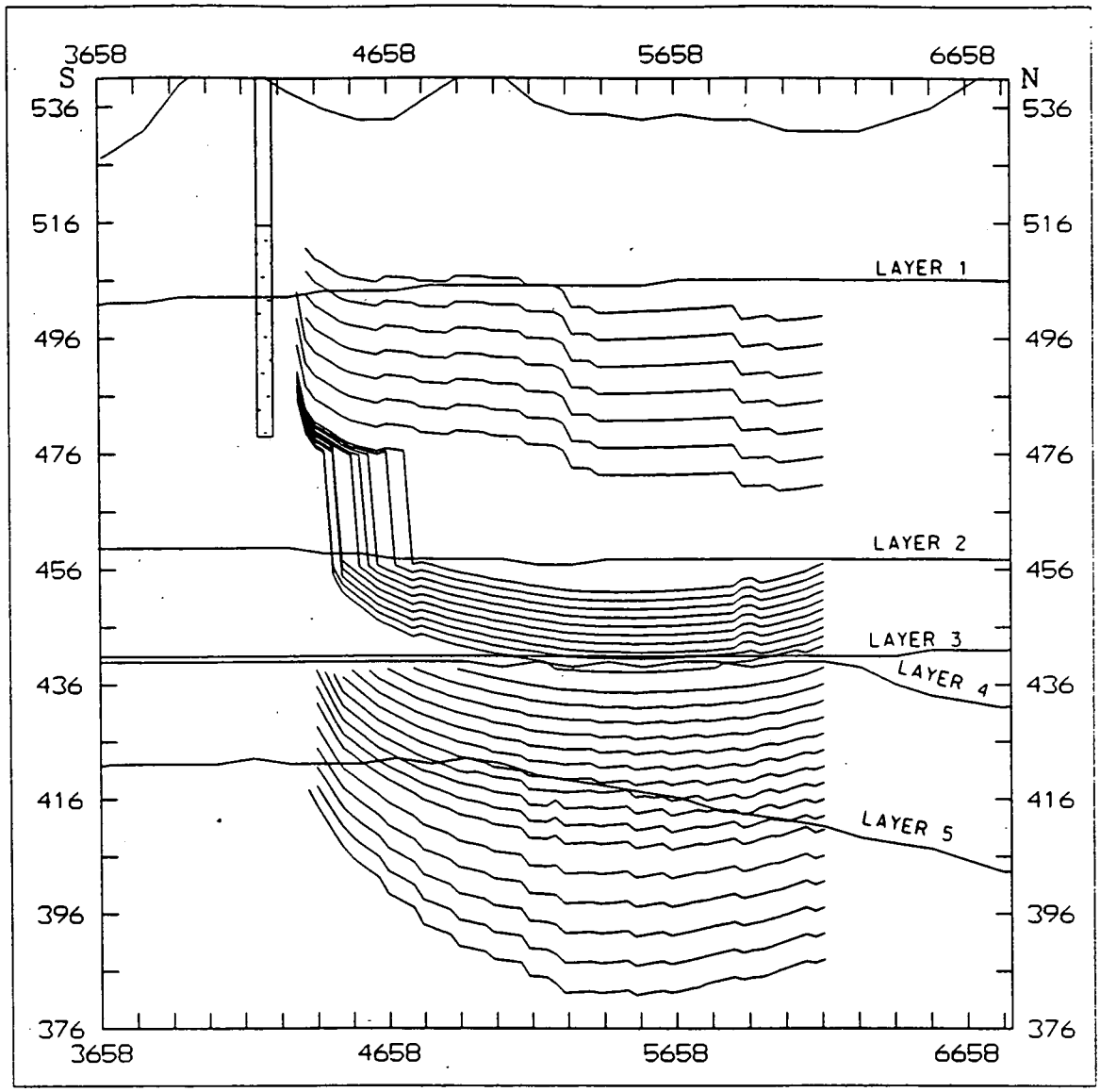


FIGURE 3.2-10. FIVE RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL ST LINE MODEL LAYER 3



VERTICAL CROSS SECTIONS NORTH-SOUTH
5 RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL
ST-LINE MODEL FOR RECOVERY WELL NO. 1

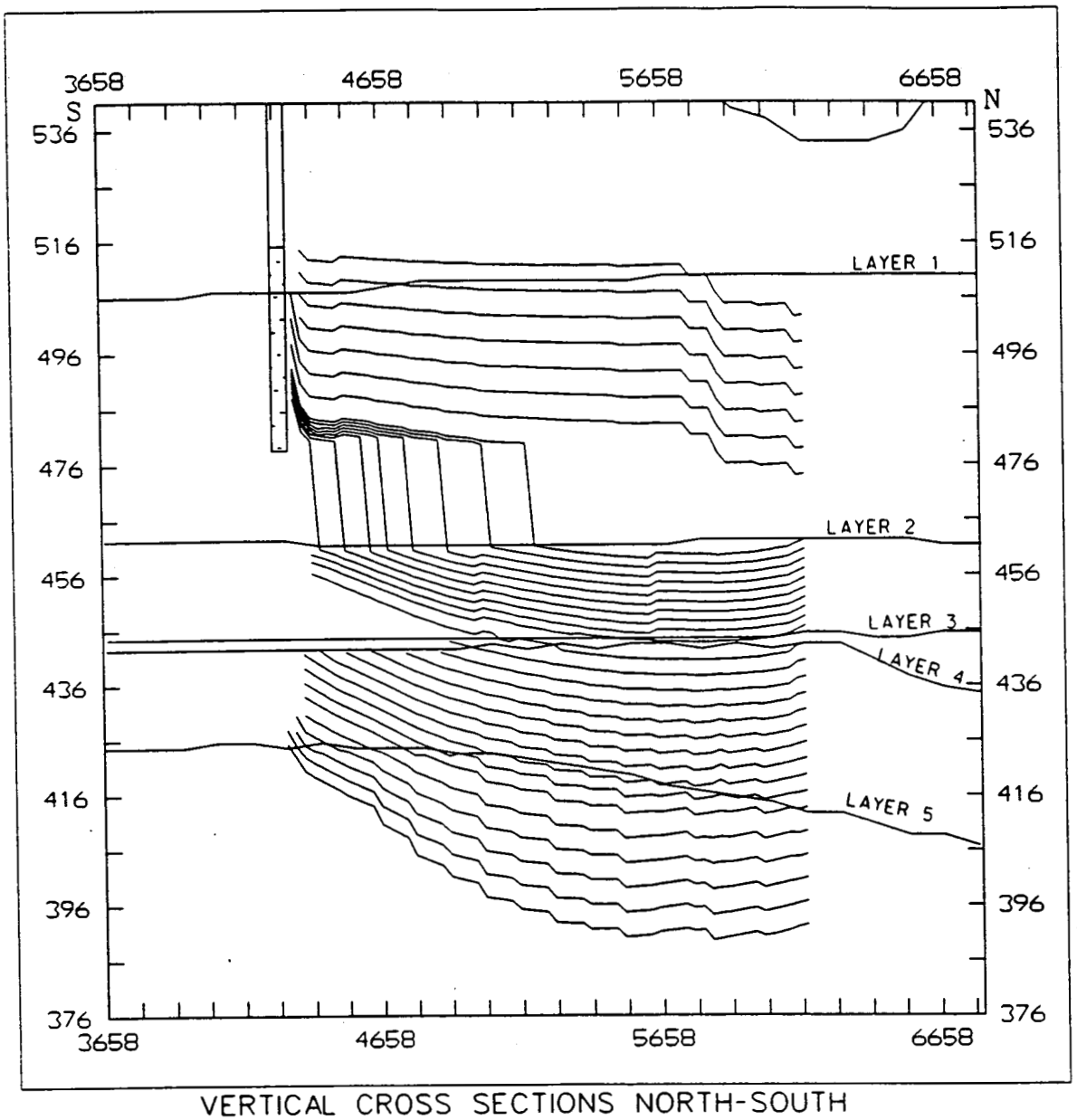
FIGURE 3.2-11



VERTICAL CROSS SECTIONS NORTH-SOUTH
5 RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL
ST-LINE MODEL FOR RECOVERY WELL NO. 2

CDL21.DGN

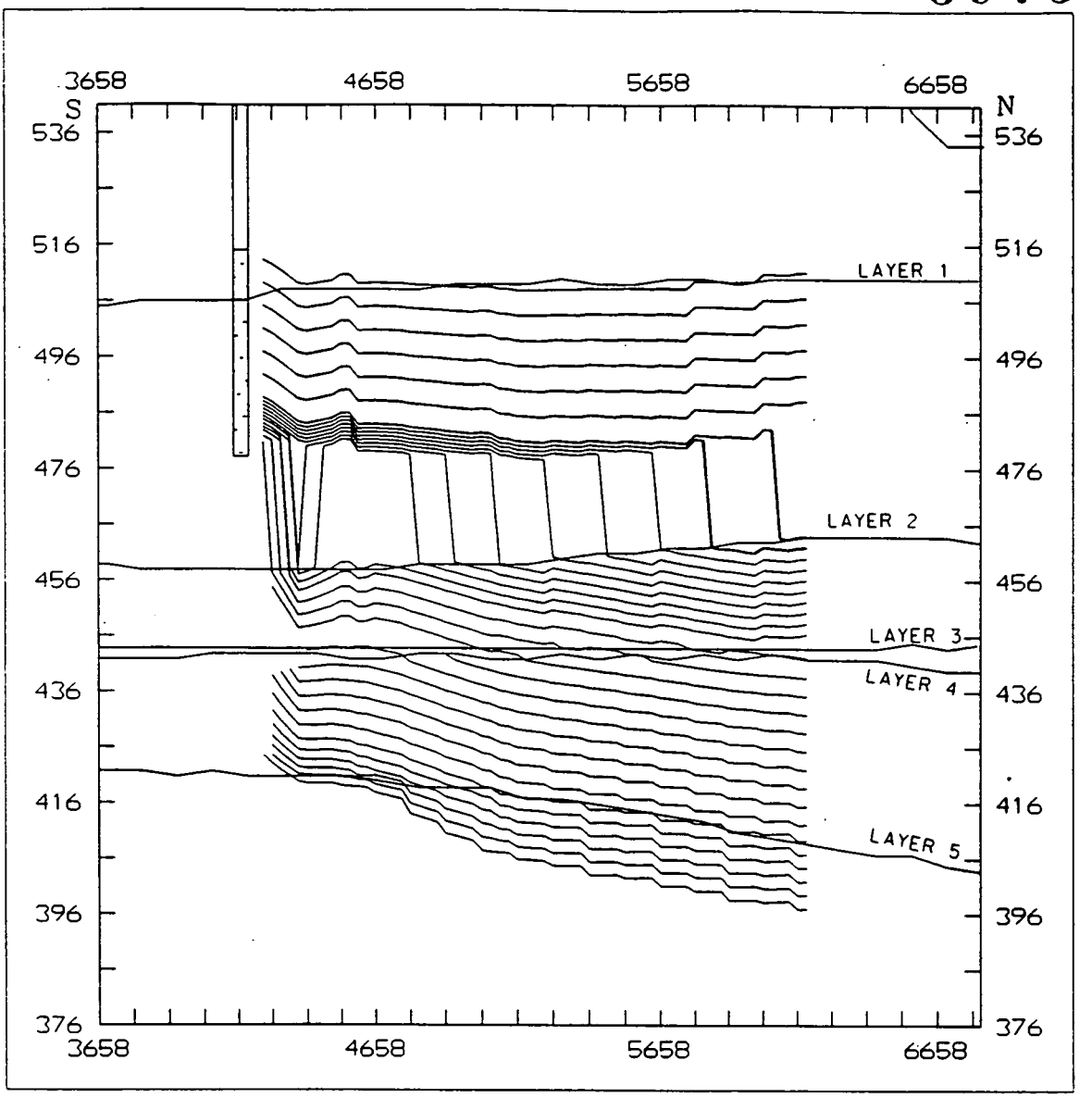
FIGURE 3.2-12



VERTICAL CROSS SECTIONS NORTH-SOUTH
5 RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL
ST-LINE MODEL FOR RECOVERY WELL NO. 3

COL23.DGN

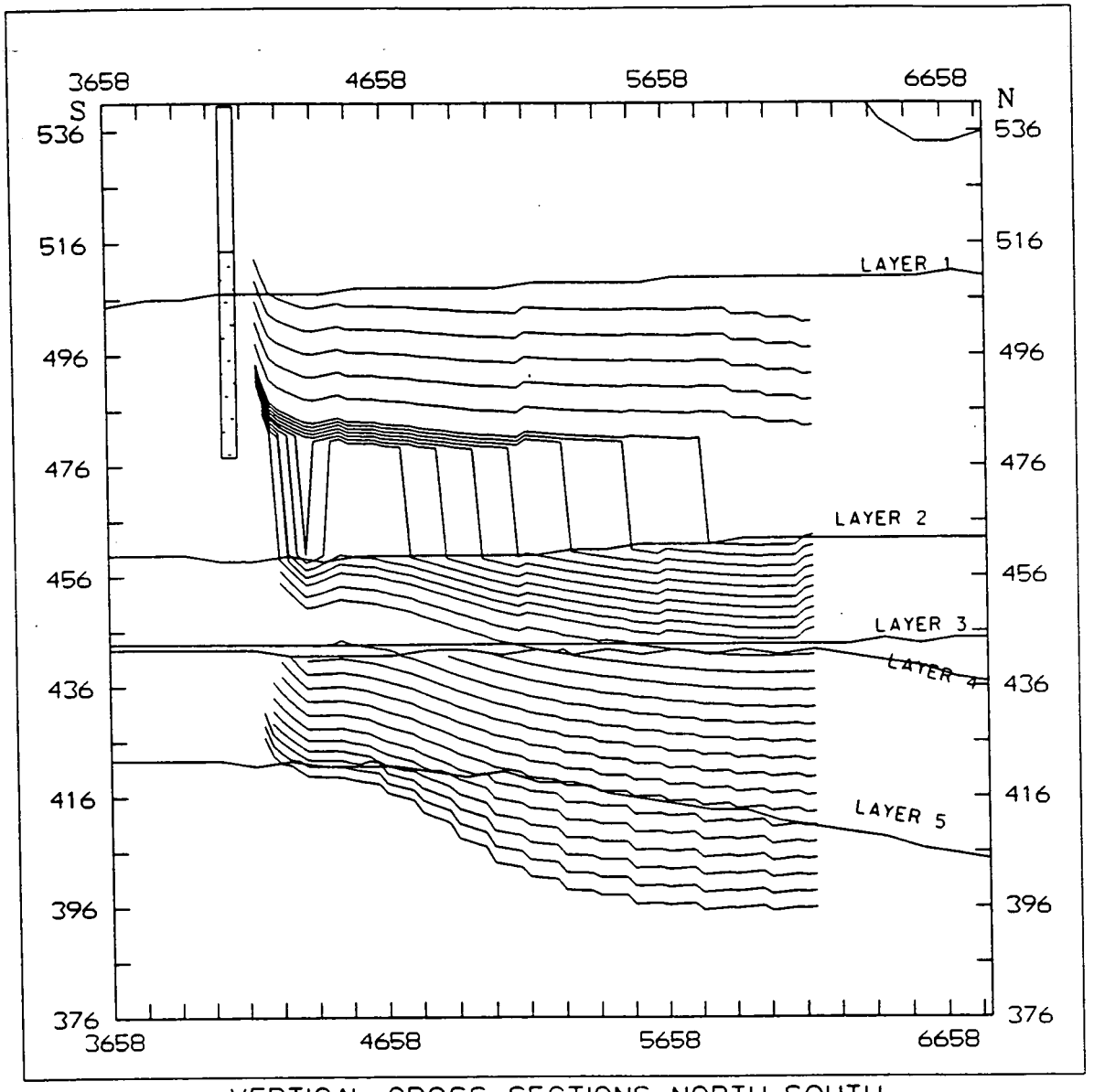
FIGURE 3.2-13



VERTICAL CROSS SECTIONS NORTH-SOUTH
5 RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL
ST-LINE MODEL FOR RECOVERY WELL NO. 4

COL28.DGN

FIGURE 3.2-14

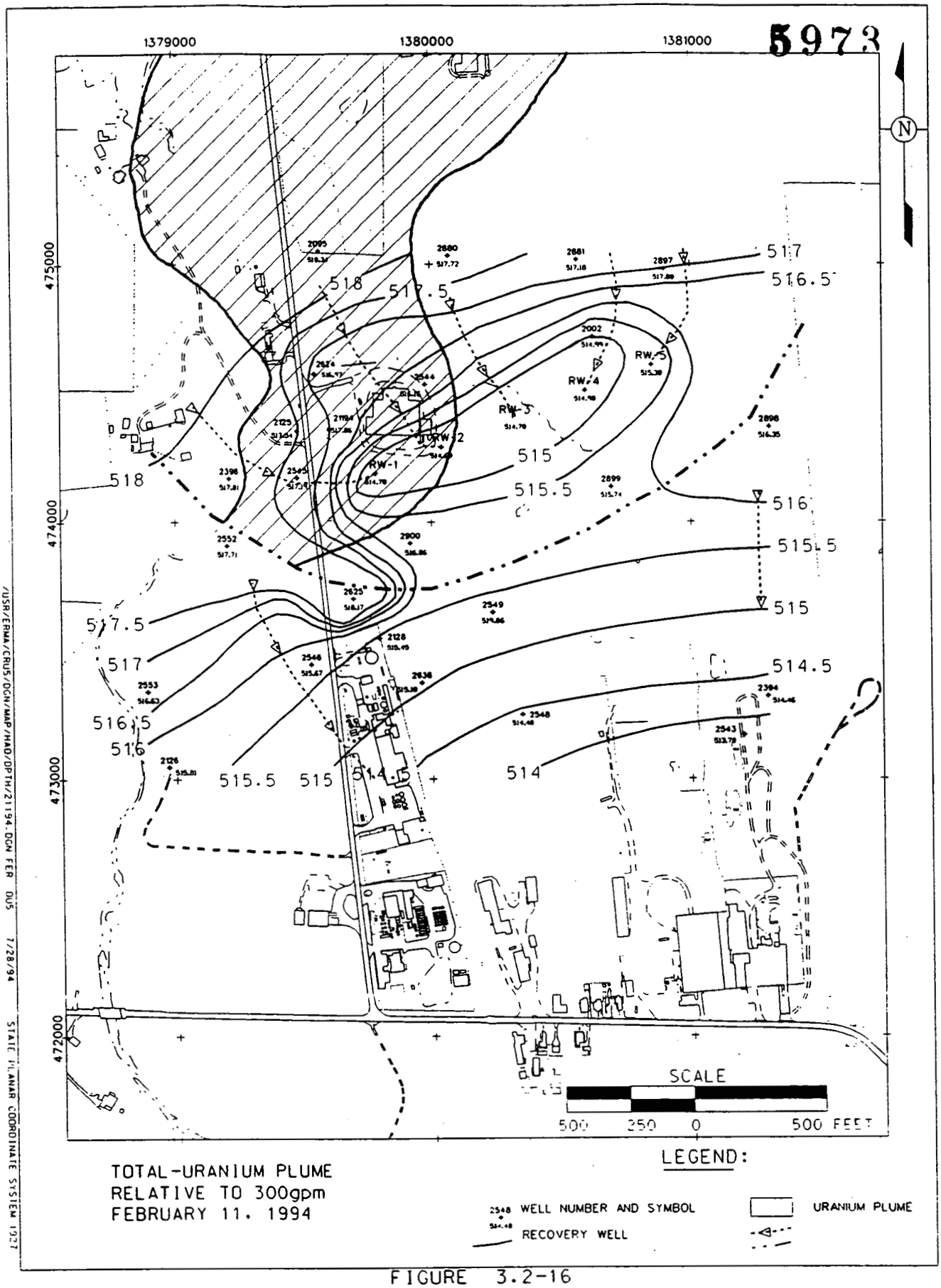


VERTICAL CROSS SECTIONS NORTH-SOUTH
5 RECOVERY WELL PUMPING SCENARIO AT 300 GPM PER WELL
ST-LINE MODEL FOR RECOVERY WELL NO. 5

COL26.DGN

DRAFT

FIGURE 3.2-15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517.5
517
516.5
516
515.5
515
514.5
514
RW-1
RW-2
RW-3
RW-4
RW-5
SCALE
500 250 0 500 FEET
LEGEND:
WELL NUMBER AND SYMBOL
RECOVERY WELL
URANIUM PLUME
TOTAL-URANIUM PLUME
RELATIVE TO 300gpm
FEBRUARY 11, 1994
/USR/ERMA/CRUS/DGN/MAP/HAD/DPTH/21194.DGN FER DUS 7/28/94 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE 3.2-16

4.0 SUMMARY

During the second quarter of operation (December 1993 - February 1994),the recovery wells were being pumped at a sufficient rate (300 gpm per recovery well) to create a hydraulic barrier to intercept the South Plume as defined by contamination above the 20 ppb total uranium isopleth. Field data and capture zone analyses indicates that the 5 ppb isopleth for total uranium is within the capture zone of the pumping system. Initial pumping of the recovery wells at the 400 gpm (per recovery well) caused increasing concentrations of arsenic in several wells south of the recovery well field. The original 400 gpm pumping rate (per recovery well) was reduced to 300 gpm (per recovery well) to reduce the pumping influence on arsenic contamination south of the recovery well field. The lower pumping rate was effective at capturing the uranium plume while not adversely impacting the migration of arsenic contamination south of the recovery well field. Quarterly arsenic sampling was increased to weekly, and a five day turn around from the on-site laboratory was initiated to better track the arsenic situation. Capture zone analyses and a flow meter survey performed south of the recovery well field indicate that the lower pumping rate is achieving removal action objectives.

Second quarter sampling results indicate that the system is operating as intended and that modeling predictions made using the SWIFT GMA Fate and Transport Model, calibrated in 1993, are similar to observed field conditions.

At this time there are no recommendations for changes or modifications to the system. Optimization for the recovery system through the use of groundwater model simulations and further data analysis is being evaluated.

REFERENCES

DOE, 1992, South Plume Removal Action Part 2-Pumping and Discharge System and Part 3-Interim Advanced Wastewater Treatment System Work Plan, Fernald Environmental Management Project, Fernald OH.

DOE, 1993, South Plume Groundwater Recovery System Design, Monitoring, and Evaluation Program Plan, Fernald Environmental Management Project, Fernald, OH.

Appendix A
Summary of Analytical Detections

Appendix B
Response to OEPA Comments
Submitted July 15, 1994
on
South Plume Groundwater Recovery System
Design, Monitoring and Evaluation Program Plan,
System Evaluation Report

Commenting Organization: Ohio EPA Commentor: GeoTrans
Section#: Pg.#: Line#: Code: M
Original Comment# 1

Comment:
Please provide horizontal coordinate and monthly hydraulic head data for the DMEPP pump and monitor wells on computer disk in ASCII format for the period between August 1993 and the present. Please also provide the data for all wells used as observation wells during the South Plume Removal Action pump test. Ideally, each computer file record should provide the well ID, x-coordinate, y-coordinate, hydraulic head in feet above MSL, and date of measurement.

Response:
Computer files are currently being compiled and will be provided as soon as they are completed.

Commenting Organization: Ohio EPA Commentor: GeoTrans
Section#: Pg.#: Line#: Code: M
Original Comment# 2

Comment:
There is no assessment of the vertical extent of the capture zone (the capture volume) in the report. Is the extent of the capture presumed to be invariate with depth? What do the data show? What does the model suggest? Why are there no hydraulic head contour maps of 3000 series well data?

Response:
Please see section 3.2 Capture Zone Analyses. This section presents hydraulic head contours for Type 3 well data compared to Type 2 well head contours. It also presents modeled particle tracks for model layers 1, 3 and 5 in planar form and vertical cross sections of particle tracks from model layer 1 through 5.

Commenting Organization: Ohio EPA Commentor: Geo Trans
Section#: Pg.#: Line#: Code: M
Original Comment# 3

Comment:
The report documents that pump wells 3926, 3927, and 3928 are well outside of the 5 ug/L total uranium plume. It appears that by continuing to pump these wells, DOE will promote the migration of uranium in a southeasterly direction, thereby expanding the uranium plume. What is the benefit of continuing to pump these wells?

Response:
See response to comment 9.

Commenting Organization: Ohio EPA Commentor: GeoTrans
Section#: Pg.#: Line#: Code: M

Original Comment# 4

Comment:
DOE should use their SWIFT model to simulate the effects of turning the pumps off sequentially in wells 3928, 3927, and 3926 beginning with the eastern most well. If the model results show unexpected negative impacts, DOE should consider turning the pumps in these wells off sequentially and monitoring the aquifer response after each well is turned off. If the desired capture zone is maintained without promoting uranium migration into relatively clean areas, why continue pumping these wells?

Response:
Various scenarios are already being modeled using SWIFT to simulate not only the shut down of recovery wells but alternate pumping scenarios as well. In response to the second half of the comment please refer to the response for comment 9.

Commenting Organization: Ohio EPA Commentor: GeoTrans
Section#: Pg.#: Line#: Code: M
Original Comment# 5

Comment:
Greater detail of simulation results should be included. The results from the simulation model are presumably from the upper most model layer. No results from the other model layers are presented. Please provide complete SWIFT input data files for both the 1989 model calibration and the 1993 model calibration including the 300 gpm extraction wells.

Response:
Please see response for comment no. 2. Concerning the request for the calibrated 1989 and 1993 SWIFT input data files please see the response to comment 1.

Commenting Organization: Ohio EPA Commentor: GeoTrans
Section#: Pg.#: Line#: Code: M
Original Comment# 6

Comment:
Were wells 3916 (model layer 4) and 3918 (model layer 6) sampled or were hydraulic heads measured in these wells during the monitoring period?

Response:
These wells were sampled and hydraulic head measurements were collected as part of the pump test activities for MW 3927. Monitor wells 3916 and 3918 were never included in the DMEPP work plan. Some additional hydraulic head measurements were collected as part of other routine monitoring programs.

Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 4.0 Pg.#: 4-1 Line#: para 3 Code: e
Original Comment# 7

Comment:
Change "263.574 million gallons per day to "263.574 million gallon."

Response:
Change has been incorporated into the second quarterly report (August 1994). See section 1.0 Introduction, paragraph three.

Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 5.3 Pg.#: 5-32 Line#: Figure 5.2-6 Code:
Original Comment# 8

Comment:
This figure implies that monitoring well 3924 is in a zone with uranium concentrations below 5 ppb. The figure needs to be revised to reflect the western component of the uranium plume.

Response:
Agreed. The footprint of the 5 ppb uranium plume has been extended to the flow divide of the capture zone to show where the recovery wells lie relative to the uranium plume. See figure 3.2-16.

Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 6.0 Pg.#: General Line#: Code:
Original Comment# 9

Comment:
Production wells 3924 and 3925 appear to be achieving the project goal of capturing ground water with uranium concentrations in excess of 20 ppb. However, production wells 3926, 3927, and 3928 are capturing ground water with concentrations far below this goal.

Based upon the information in this report, it appears that the highest concentrations of uranium are in the western portion of the capture system. Additionally, the conditions present in the aquifer system are more conducive to influencing the Paddys Run Road Site plume than originally thought. As a result, the Ohio EPA recommends the installation of at least one more capture well to the west of 3924 and the cessation of pumping in wells 3926, 3927, and 3928. The capture system should be pumped at a rate sufficient to effect capture, yet low enough to eliminate any impact on the PRRS plume. By placing the pumping wells relatively close together, the capture zone can be maximized while keeping pumping rates at a minimum.

Response:
DOE agrees that the continued use of pumping wells 3926, 3927, and 3928 needs to be evaluated. This evaluation is currently being conducted as part of the OU5 FS.

DOE is evaluating a system of pumping wells to clean up the Great Miami Aquifer that consists of 19 on-property wells and the 5 existing South Plume Extraction Wells. Each well in the pumping system effects the overall performance of the entire system. The effect of turning off one or more of these three wells needs to be evaluated in terms of the effect that is placed on the

entire system being proposed. Modeling results should be available by October and will be documented in the OU5 Feasibility Study Report which is scheduled to be submitted to the EPAs in November of 1994.

Monitoring to date indicates that the pumping of these three wells is not noticeably spreading the uranium contamination to the east, and therefore immediate action is not necessary. DOE agrees that the strategy presented in comment #4 for turning off the pumps sequentially (one-at-a-time) to determine through monitoring if the desired capture zone is being maintained is a good strategy. It will be seriously considered.

DOE would like the EPA to see the final remediation strategy for the clean up of the Great Miami Aquifer prior to turning off the pumps in one or all of these three wells. DOE would like to meet with the EPAs, once the FS groundwater modeling has been completed, to agree upon a coarse of action for the South Plume Extraction wells. If work proceeds as scheduled, this meeting can take place in early October.