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ARCADIS GERAGHTY & MILLER

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ENVIRONMENTAL SERVICES

Certified Mail Receipt Z 385 952 767

Mr. David Douglas
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Subject:
Work Plan for Site Work to Complete Tasks 1 and 2
FMC Corporation Site, Fridley, Minnesota
ARCADIS Geraghty & Miller Project No. MN000428.0003

Minneapolis
27 July 2000

Contact:
David Richardson

Extension:
(612) 373.0224

Dear Mr. Douglas:

Please find enclosed the Work Plan for Site Work to Complete Tasks 1 and 2 for the FMC Site located in Fridley, Minnesota. The complete scope of work comprised by Tasks 1 and 2 is described in the work plan submitted to the Minnesota Pollution Control Agency (MPCA) on August 31, 1999. In summary, Task 1 consists of an evaluation of the monitoring well network, and Task 2 consists of an evaluation of the downgradient plume. The enclosed work plan summarizes the Task 1 activities completed to date, and outlines the site work recommended to complete Tasks 1 and 2.

The site work recommended to complete Tasks 1 and 2 consists of the following:

- Monitoring Well Installation. One well will be installed in the unconfined aquifer to fill the data gap west of RW2. The second well will be installed in the confined aquifer to replace MW29. Proposed monitoring well locations are shown on Figure 7 in the work plan.

- Aquifer Testing Phase I: Groundwater Recovery System Shutdown. Water levels will be recorded at the four recovery wells and selected monitoring wells after the system is shut down. The locations of water level measurements are shown on Figure 8 in the work plan.

- Groundwater Sampling and Analysis. While the system is down, groundwater samples will be collected for laboratory analysis from selected long-screened wells using the low-flow sampling method. During the same sampling event, groundwater samples will also be collected from selected short-screened wells. These analytical results will be used to determine whether the long-screened wells are adequate

for monitoring the downgradient plume, or whether new short-screened wells are required as suggested by the MPCA. Groundwater samples will also be collected for field analysis to assess the natural attenuation of the downgradient plume. Groundwater sampling locations are shown on Figure 9 in the work plan.

- Aquifer Testing Phase II: Pumping Test at RW4. Before the system is restarted, a 24-hour, constant-rate pumping test will be run at RW4 followed by an 8-hour recovery period. The locations of water level measurements are shown on Figure 10 in the work plan.

A schedule for completing this site work is presented on Figure 11 in the work plan. We currently plan to begin site work during the week of August 28, 2000 with the installation of the two new monitoring wells. Site work should be completed in approximately one month with the conclusion of the pumping test at RW4. The report preparation should be completed towards the end of December 2000.

We realize that this is a fairly aggressive schedule, however, we would like to hear from you before drilling begins on August 28, 2000. Please direct any questions or comments regarding the recommended site work to me at (612) 373.0224. Thank you in advance for your time.

Sincerely,

ARCADIS Geraghty & Miller, Inc.

David Richardson

David Richardson
Geologist/Civil Engineer

Copies:
Mr. Doug Hildre - United Defense, Fridley, Minnesota
Mr. Lonnie Norman - FMC Corporation, Philadelphia, Pennsylvania
Mr. James Bedessem – ARCADIS Geraghty & Miller, Tampa, Florida

Work Plan for Site Work to Complete Tasks 1 and 2

United Defense
Fridley, Minnesota

ARCADIS
GERAGHTY & MILLER

27 July 2000

PREPARED FOR

United Defense

ARCADIS GERAGHTY & MILLER

Work Plan for Site Work to Complete Tasks 1 and 2

United Defense
Fridley, Minnesota

Prepared for:
United Defense
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Fridley, Minnesota 55421

Prepared by:
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Our Ref.:
MN000428.0003

Date:
27 July 2000

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ARCADIS GERAGHTY & MILLER

Work Plan for Site Work to Complete Tasks 1 and 2

United Defense
Fridley, Minnesota

27 July 2000

Prepared by ARCADIS Geraghty & Miller, Inc.

David Richardson
Geologist/Civil Engineer

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Introduction

ARCADIS Geraghty & Miller submitted a work plan to the Minnesota Pollution Control Agency (MPCA) in August 1999 for reviewing the response action (RA) for the FMC Site located in Fridley, Minnesota. The work plan was prepared on behalf of FMC and United Defense in response to the Five-Year Review prepared for the FMC Site by the MPCA in March 1999.

In its Five-Year Review, the MPCA stated that the RA has not achieved the cleanup goals for this site following nearly thirteen years of operation. The MPCA also made several recommendations for evaluating the effectiveness of the RA. The work plan identified three primary tasks to be completed to address the MPCA's recommendations relative to the RA:

1. Evaluate the current monitoring well network.

2. Evaluate the down gradient plume not captured by the groundwater recovery system.

3. Evaluate additional methods that may enhance the performance of the existing RA to remediate source areas, and to control the site plume.

A summary of the Task 1 activities completed to date is provided in the next section. Based on this summary, site work is recommended to complete Task 1. The site work consists of installing and sampling two new monitoring wells, and sampling a combination of existing long-screened wells and nested short-screened wells.

Site work is also being recommended to begin Task 2. The site work consists of shutting down the existing groundwater recovery system, and measuring water levels at the recovery wells and at selected monitoring wells. A pumping test will also be conducted at one recovery well.

Summary of Completed Task 1 Activities

Task 1 consists of evaluating the monitoring well network based on its effectiveness to monitor the plume in both the unconfined and confined aquifers. Task 1 activities completed to date used historical groundwater data. ARCADIS Geraghty & Miller used data visualization software called the Environmental Workbench™ (EWB) to assist in this evaluation.

Existing survey data, geological data, well construction data, and groundwater data were input into the EWB to create a three dimensional (3-D) model of the site geology, well screen locations, groundwater elevations, and contaminant concentrations in both aquifers. The EWB can now be used to view the model from any desired direction and angle.

Visualization of Geology, Well Construction, and Groundwater Data

The geology of the FMC Site consists of two sand aquifers separated by a clay layer. The surface elevation of the clay layer is not constant across the FMC Site as shown in Figure 1 created using the EWB. However, there is a good correlation between Figure 1 and previous clay surface elevation contour maps developed for the FMC Site. This serves as a good check of the geologic model constructed using the EWB.

Unconfined Aquifer

The unconfined aquifer roughly exists where the clay surface elevation drops below 810 feet above mean sea level (MSL). Historically, the highest concentrations of contaminants in the unconfined aquifer have been detected in the vicinity of RW2 near the center of a depression in the clay surface. Based on the clay surface elevations shown on Figure 1, this depression has two outlets, one to the west and one to the south, where the clay surface elevation remains below 810 feet MSL.

Figure 2 shows the clay surface and groundwater elevations measured on September 30, 1999 in the unconfined aquifer using the EWB. As shown here, groundwater in the unconfined aquifer is present over a limited portion of the site and generally flows west towards the Mississippi River. However, there are no monitoring wells in the unconfined aquifer west of RW2. Therefore, it is recommended that one monitoring well be installed west of RW2 to fill this data gap.

As shown in Figure 2, the unconfined aquifer also extends south of RW2. While groundwater in the unconfined aquifer flows to the west, detectable concentrations of contaminants are also observed in the six monitoring wells in the unconfined aquifer south of RW2. However, there do not appear to be any data gaps in the unconfined aquifer south of RW2. As such, no additional monitoring wells are recommended south of RW2.

Confined Aquifer

The confined aquifer exists across the entire FMC Site although its thickness is variable. Figure 3 shows the locations of two new cross sections prepared for the

FMC Site. Figure 4 shows cross section A-A' oriented in the direction of groundwater flow from the FMC Site to the Mississippi River. Figure 5 shows cross section B-B' along the line of recovery wells in the confined aquifer. These two cross sections were needed because the previous cross sections did not show any well construction details or water level data.

The cross section on Figure 4 shows that wells screened in the confined aquifer have the same groundwater elevation regardless of screen length or screen position within the aquifer. For example, MW11 through MW14 are constructed with short screens (5 to 10 feet) positioned at various elevations within the entire thickness of the confined aquifer. Two down gradient off-site wells MW54 and MW39 are constructed with long screens (75 to 90 feet) positioned across the entire thickness of the confined aquifer. The groundwater elevations in all six of these wells are nearly identical. This means the long-screened wells properly positioned in the confined aquifer yield adequate groundwater elevation data.

The cross section on Figure 4 also shows that wells screened across more than one aquifer may not yield accurate groundwater elevation data. For example, consider the well nest comprised of MW21, MW39, and MW43. Each of these three wells is properly screened in a separate aquifer, and the groundwater elevations in each well are markedly different. In fact, the groundwater elevation increases with increasing aquifer depth. This means that a groundwater elevation measured in a well screened across two aquifers probably represents the average groundwater elevation of the two aquifers. Such groundwater elevations have limited value.

Monitoring well 29 located between RW3 and RW4 is screened across the confined aquifer and the St. Peter Sandstone (Figure 5). As such, the groundwater elevations measured at MW29 are probably not truly representative of either aquifer. As such, it is recommended that one new monitoring well be installed next to MW29 and properly screened in the confined aquifer. The new well should provide better groundwater elevation and analytical data for the confined aquifer than MW29.

Figure 6 shows the groundwater elevations measured on September 30, 1999 in the confined aquifer using the EWB. The groundwater in the confined aquifer is flowing to the west and the elevations indicate there may be a gap in the capture zone between recovery wells RW3 and RW4. However, the identified gap in the capture zone is based primarily on the groundwater elevation measured at MW-29 that, as discussed previously, may not be representative of confined aquifer conditions. This further supports the need for a new monitoring well in this location.

Evaluation of Monitoring Well Sampling Techniques

During the same time the 3-D geologic model was being developed using the EWB, new groundwater sampling techniques were evaluated for application at the FMC Site. The MPCA recommended that the down gradient long-screened wells in the confined aquifer be replaced with nested short-screened wells to better monitor the horizontal and vertical extent of the contaminant plume. While this may be necessary, new sampling technologies have recently emerged that may allow accurate characterization of the vertical extent of contaminated groundwater using the existing long-screened wells. Examples of these new technologies are:

- Passive multi-layer samplers manufactured by Johnson Screens.
- Strata samplers manufactured by Timco.
- Low-flow groundwater sampling at multiple depths.

Based on an evaluation of these new sampling techniques, low-flow groundwater sampling at multiple depths appears to be a viable and cost effective alternative for the FMC Site. Multi-level samplers also appear viable from a data reliability and validity standpoint, but they are more costly due to the time required for deployment and recovery. Dialysis or membrane samplers are generally used for sampling low permeability formations or fractured rock (Ronen et al 1987).

Low flow sampling has been evaluated and implemented as a means whereby less disturbance is induced in the well during sampling, less purge volume is required, and low-turbidity samples are produced. The overall objective of this more passive approach is to match the intake velocity of the pump with the natural groundwater flow velocity (Puls, 1993; Puls and McCarthy, 1993).

Low flow purging is conducted to minimize mixing of water in the screened interval and also mixing with stagnant water in the casing. In determining the placement of the purge pump, attention must be paid to identify higher conductivity zones in the aquifer, as placement of the purge pump in the higher conductivity zones will preferentially sample those zones. Sampling protocols have been established for low flow sampling (Barcelona et al, 1994: Puls and Barcelona, 1996). Recommended procedures include: 1) flow rates less than 0.5 L/min, 2) measure and maintain minimal or no drawdown during purging (less than 0.1m), 3) monitor water quality parameters during purging using an in-line water quality measurement device (e.g., flow-through cell) for pH, specific conductance, redox, dissolved oxygen, 4) place the sampling device to the desired interval slowly and carefully to minimize excessive

mixing of overlying water into the desired interval, and 5) take care to place the sampling device intake at the desired sampling point.

The necessity for replacing long-screened wells with nested short-screened wells and the applicability of low-flow sampling instead of installing new nested wells, if determined to be necessary, will be evaluated in the sampling program proposed below. There are several short-screened well nests currently in place at the FMC Site that are located near or upgradient of long-screened wells. Examples include the well nest comprised of MW11, MW12, MW13, and MW14 which is upgradient of MW54 and well nest comprised of MW57A and MW57B which is near MW30. However, the nested short-screened wells and long-screened wells are not often sampled on the same schedule. Therefore, these long-screened wells will be sampled at multiple depths using low-flow sampling techniques, and this will be performed concurrently with sampling at the nearby short-screened well nests to determine if the low-flow sampling gives comparable results. This data will be also be compared to historical results for the long-screened wells to determine if the traditional sampling techniques and data are representative. Thus, this sampling program will determine the necessity for discrete interval sampling and whether low-flow sampling is adequate or whether new short-screened well nests should be proposed.

Site Work Recommended for Tasks 1 and 2

Monitoring Well Installation

One new monitoring well will be installed in the unconfined aquifer between MW45 and MW37 to fill the data gap west of RW2 as shown on Figure 7. This new well will be called MW58. Prior to any drilling, the underground utilities will be located using the Gopher State One Call Service. The new monitoring well in the unconfined aquifer will be constructed similar to MW35 (see well construction log for MW35 in Appendix A) with the following exceptions. The well diameter will be 2 inches. The well screen will be stainless steel, not galvanized steel. The screen will be positioned between 25 and 45 feet below ground surface. The top of the screen must intersect the water table, and the bottom of the screen must not intersect the top of the clay layer. As such, soil sampling will be required at 5-foot intervals to verify the depth to water and the top of the clay layer.

The second new monitoring well will be installed in the confined aquifer next to MW29 (Figure 7). This new well will be called MW29A. The new well will be constructed similar to MW29 (see well construction log for MW29 in Appendix A) with the following exceptions. The well diameter will be 2 inches. The screen will be positioned between 45 and 65 feet below ground surface. The cement grout seal will

extend to a minimum depth of 40 below ground surface to ensure it is below the bottom of the clay layer. As such, soil sampling will be required at 5-foot intervals to verify the top and bottom of the clay layer.

The two new monitoring wells will be developed immediately after installation by pumping 10-15 well volumes of water from each well. The development water will be pumped into a tank located next to the new well. ARCADIS Geraghty & Miller will coordinate the sampling and disposal of the development water.

Following development, the location and elevation of the two new monitoring wells will be surveyed. The horizontal location will be surveyed relative to the MN/DOT State Plane System, South Zone NAD83. This is the same coordinate system that is used for the entire monitoring well network at the FMC Site. The elevation will be surveyed relative to the USGS benchmark established at the FMC Site. The benchmark is near Gate 16, and its elevation is 833.41 feet MSL.

Aquifer Testing Phase I: Groundwater Recovery System Shutdown

The first phase of aquifer testing will begin after the two new monitoring wells are installed. These data will be used to refine previous aquifer properties for the unconfined and confined aquifers.

The first phase of aquifer testing will consist of shutting down the groundwater recovery system, and observing the rate of water level recovery in the recovery wells and selected monitoring wells for eight hours. It is expected that the water levels in the recovery wells will return to equilibrium within eight hours of shutting the system down.

Prior to shutting the system down, the pumping rate at each recovery well will be recorded. Barometric pressure will also recorded before system shutdown, and then hourly for the next eight hours. Figure 8 shows the locations of the wells that will be used for the first phase of aquifer testing. Table 1 presents frequency of water level measurements at each well before and after the system is shut down.

Groundwater Sampling and Analysis

Following the first phase of aquifer testing, one round of groundwater samples will be collected from selected monitoring wells using the low-flow sampling method. The low-flow sampling method is described in the standard operating procedure located in Appendix B. Groundwater sampling will focus on the long-screened wells and nested short-screened wells between RW4 and the Mississippi River. Figure 9 shows the

locations of the monitoring wells that will be sampled. The sampling order and depths are presented on Table 2.

Groundwater samples will be collected and analyzed by Interpoll Laboratories, Circle Pines, Minnesota. ARCADIS Geraghty & Miller will be on-site to oversee the first day of groundwater sampling. Groundwater samples will be analyzed for volatile organic compounds (VOCs) using USEPA Method 8260. This method includes the primary contaminant (trichloroethene) and its breakdown products. An example of an Interpoll report for USEPA Method 8260 is located in Appendix C.

Equipment rinsate blanks and duplicate samples will be collected at a ten percent effort, and a trip blank will accompany each cooler of samples. Purge water will be disposed by discharging the water to the POTW. The following stabilization parameters will be measured while purging each well. The stabilization parameters will be measured using a flow cell and appropriate meter(s).

- Temperature
- Conductivity
- Dissolved oxygen
- Oxidation/reduction potential
- pH.

In addition to the stabilization parameters, the following natural attenuation parameters will be recorded during the collection of each groundwater sample. These natural attenuation parameters will be measured using field test kits:

- Iron (Fe^{2+})
- Manganese (Mn^{2+})
- Nitrate (NO_3^{2-})
- Sulfate (SO_4^{2-})
- Hydrogen sulfide (H_2S)
- Carbon dioxide (CO_2)

- Chloride (Cl^-).

Aquifer Testing Phase II: Pumping Test at RW4

The second phase of aquifer testing will begin after groundwater sampling is completed. These data will be used to refine previous aquifer properties for the confined aquifer.

The second phase of aquifer testing will consist of a 24-hour constant-rate pumping test at RW4. Groundwater will be pumped from RW4 at a rate of 50 gallons per minute (gpm) using the existing groundwater recovery system with one exception. The existing pump will not reach 50 gpm. As such, a different pump will be installed to obtain a flow rate of 50 gpm. Groundwater will not be pumped from any of the other recovery wells during this test. Pumped water will be discharged to the POTW.

AGTM or Tim?

Prior to starting the test, baseline water levels and barometric pressure will be recorded. After 24 hours of pumping at RW4, the pump will be shut down and water level recovery will be recorded for another eight hours. Figure 10 shows the locations of the wells that will be used for the second phase of aquifer testing. Table 3 presents the frequency of water level measurements at each well before, during, and after the pumping test. Barometric pressure readings will be recorded hourly for the entire 32 hours.

Data Analysis

Data analysis will consist of preparing well construction logs for the two new monitoring wells, tabulating and analyzing the pumping test data, and tabulating and analyzing the analytical data.

Report Preparation

A report will be prepared to summarize the data. It is expected that the report will include the following tables, figures, and appendices:

Tables	Figures	Appendices
Groundwater Elevations	Site Map	Well Logs
Pumping Test Results	Cross Sections	Pumping Test Data
Analytical Results	Groundwater Elevation Contours	Analytical Data
	Pumping Test Graphs	
	Isoconcentration Contours	

The body of the report will describe the methods and procedures used to collect and analyze field data, and summarize the results. If necessary, additional modifications to the groundwater recovery system or the groundwater monitoring network will be recommended.

Schedule

A schedule for implementing this scope of work is on Figure 11. Site work is scheduled to begin on August 28, 2000 with the installation of the two new monitoring wells. Site work should be completed by September 29, 2000 with the conclusion of the pumping test and recovery period at RW4. Final copies of the report should be ready for submittal by the end of December 2000.

References

Barcelona, M.J., Wehrmann, H.A., and Varljen, M.D., 1994, Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground-Water Sampling, Ground Water, v.32, No.1, pp12-22.

Puls, R.W., 1993, Use of Low Flow or Passive Sampling Techniques for Sampling Ground Water, in EPA Ground Water Sampling—A Workshop Summary, EPA/600/R-94/205, pp. 17-20.

Puls, R.W. and Barcelona, M.J., 1996, Low Flow (Minimal Drawdown) Ground-Water Sampling Procedures, Ground Water Issue, USEPA Office of Research and Development, EPA/540/S-95/504.

Puls, R.W. and McCarthy, J.F., Well Purging and Sampling, in EPA Ground Water Sampling—A Workshop Summary, EPA/600/R-94/205, pp 82-87.

Ronen, D., Magaritz, M., and Levy, I., 1987, An In-Situ Multilevel Sampler for Preventive Monitoring and Study of Hydrochemical Profiles in Aquifers, Ground Water Monitoring Review, vol. 7, no. 4, pp 69-74.

Table 1. Aquifer Testing Phase I: Frequency of Water Level Measurements
United Defense, Fridley, Minnesota

	Baseline		Recovery	
Well ID	Water Levels	Frequency	Water Levels	Frequency
RW2	X	Single	X	Log
MW36	X	Single	X	Log
MW46	X	Single	X	Log
MW47	X	Single	X	Log
RW3	X	Single	X	15 minutes
MW55B	X	Single	X	15 minutes
MW15	X	Single	X	15 minutes
MW28	X	Single	X	15 minutes
RW4	X	Single	X	15 minutes
MW56B	X	Single	X	15 minutes
MW12	X	Single	X	15 minutes
MW13	X	Single	X	15 minutes
RW5	X	Single	X	Log
MW57A	X	Single	X	Log
MW57B	X	Single	X	Log
MW30	X	Single	X	Log

Single frequency water levels will be measured with an electronic water level indicator.

Log frequency water levels will be measured with data loggers and transducers.

g:mn0428/003/workplan/wptables.xls/phaseI

Table 2. Low-Flow Groundwater Sampling: Depth of Sampling
United Defense, Fridley, Minnesota

Sampling Order	Well ID	Screen Interval (ft)	Sampling Depth (ft)
1	MW39	45-134	130
2			90
3			50
4	MW53	35.5-135	130
5			85
6			40
7	MW5	24.7-45	35
8	MW2	26-46	36
9	MW54	64.5-140	135
10			100
11			70
12	MW57A	95-100	97
13	MW57B	60-65	62
14	MW30	40-112	105
15			75
16			45
17	MW11	85-95	90
18	MW12	65-70	67
19	MW13	41-46	43
20	MW14	25-30	27
21	MW29A	45-65	55
22	MW58	25-45	35

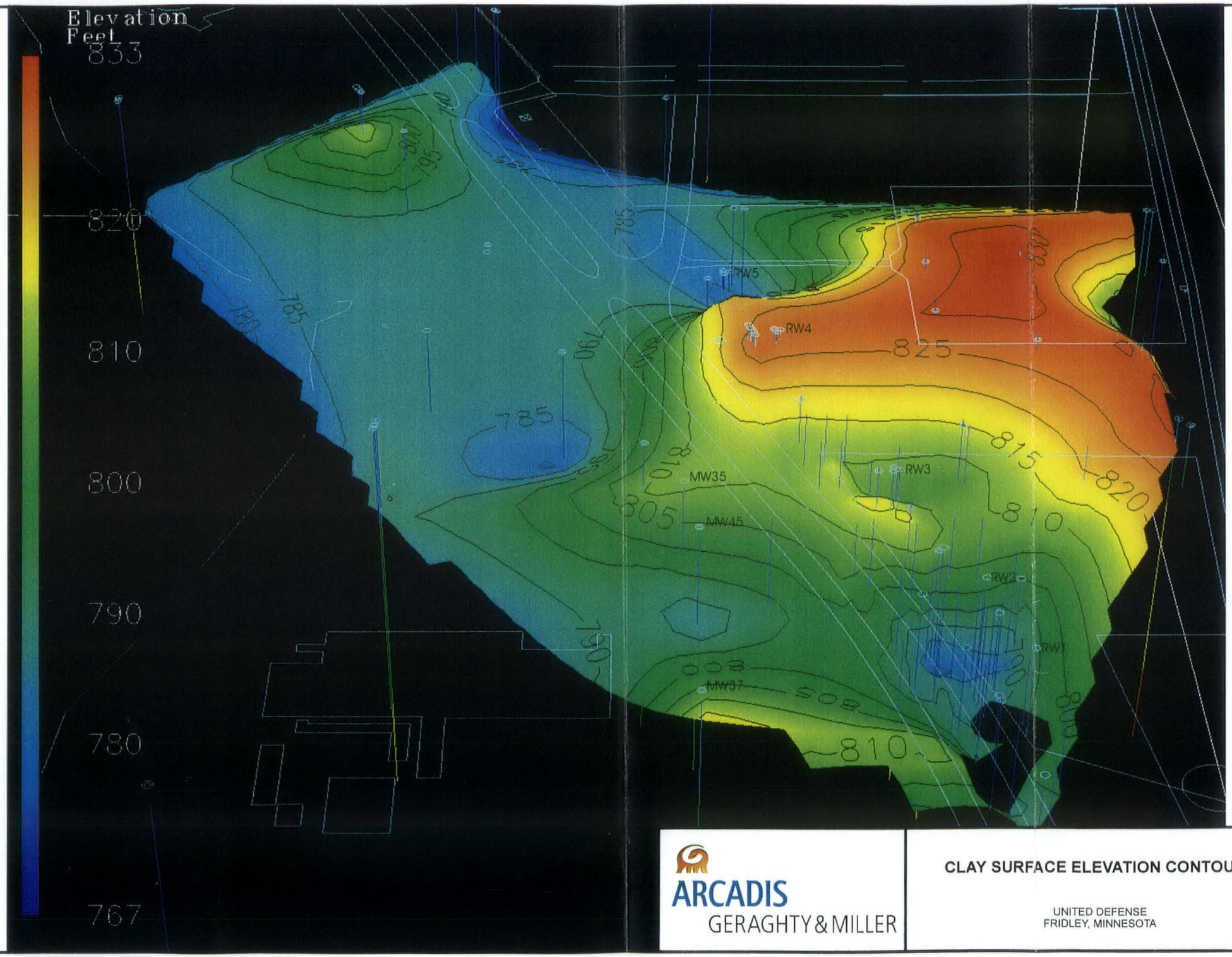
Table 3. Aquifer Testing Phase II: Frequency of Water Level Measurements
United Defense, Fridley, Minnesota

	Baseline		Pumping Test		Recovery	
Well ID	Water Levels	Frequency	Water Levels	Frequency	Water Levels	Frequency
RW4	X	Single	X	Log	X	Log
MW56B	X	Single	X	Log	X	Log
MW12	X	Single	X	Log	X	Log
MW13	X	Single	X	Log	X	Log
MW56A	X	Single	X	Single/hour	X	Single/hour
MW11	X	Single	X	Single/hour	X	Single/hour
MW14	X	Single	X	Single/hour	X	Single/hour
MW2	X	Single	X	Single/hour	X	Single/hour
MW29A	X	Single	X	Single/hour	X	Single/hour
MW30	X	Single	X	Single/hour	X	Single/hour
MW53	X	Single	X	Single/hour	X	Single/hour
MW54	X	Single	X	Single/hour	X	Single/hour

Single frequency water levels will be measured with an electronic water level indicator.

Log frequency water levels will be measured with data loggers and transducers.

g:mn0428/003/workplan/wptables.xls/phaseII



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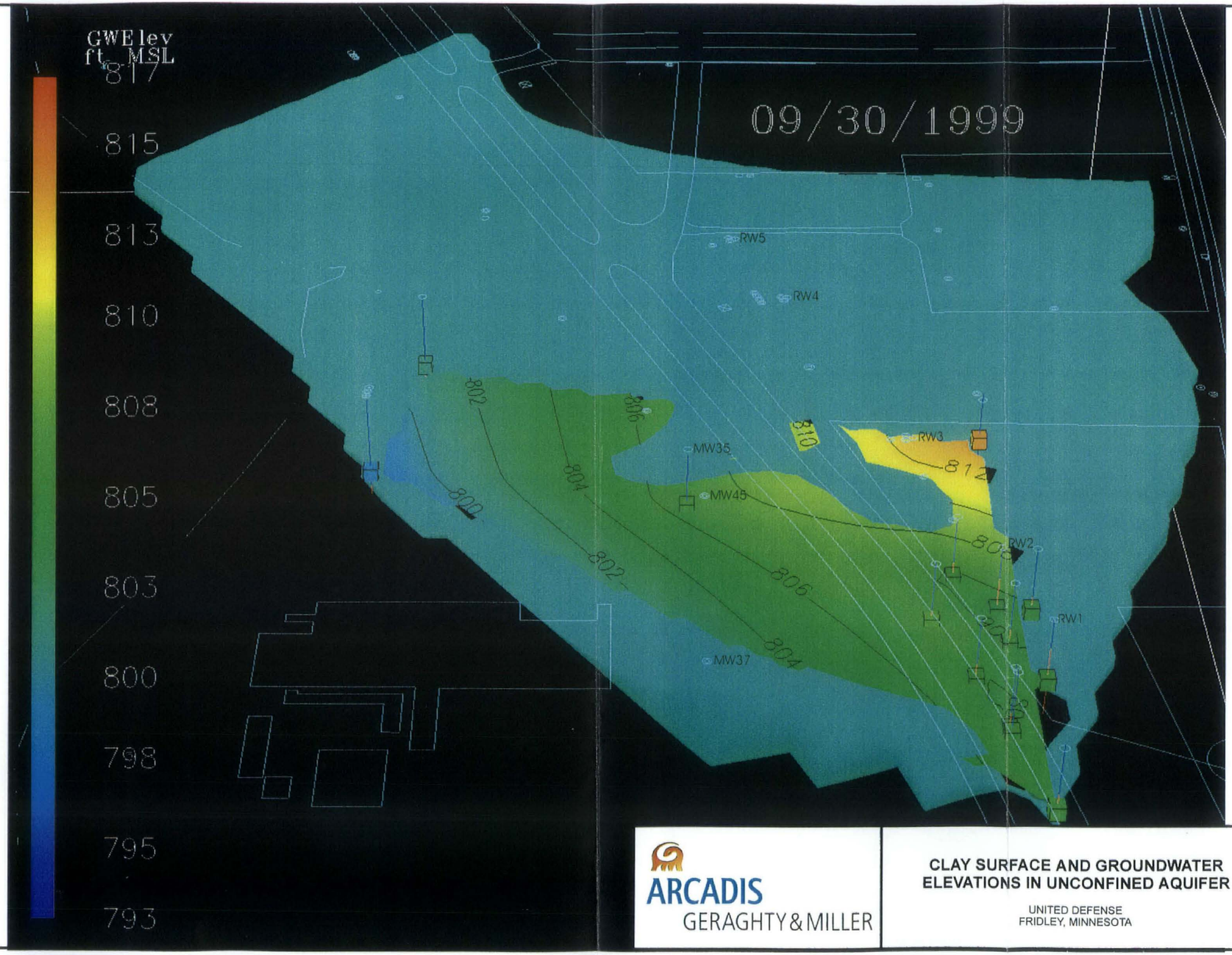
CLAY SURFACE ELEVATION CONTOURS

UNITED DEFENSE
FRIDLEY, MINNESOTA

FIGURE
1

DWG DATE: 22JAN98 | PN: G:\PROJECTS\MN0428 | FILE NO.: \003\FIGURES\ | DRAWING: FIGURE1.CDR | CHECKED: DLR | APPROVED: DLR | DRAFTER: AKA



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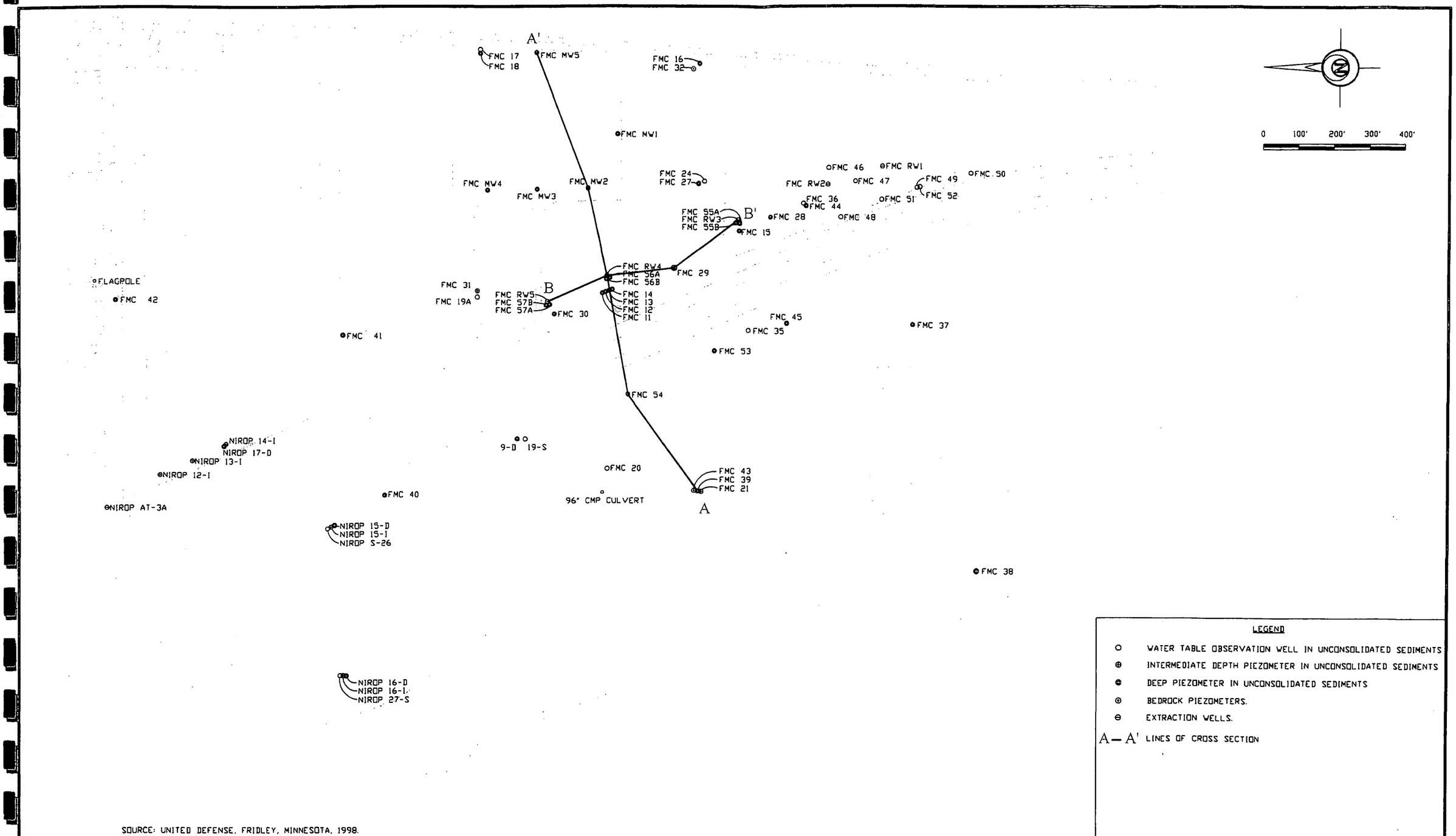
CLAY SURFACE AND GROUNDWATER ELEVATIONS IN UNCONFINED AQUIFER

UNITED DEFENSE
FRIDLEY, MINNESOTA

FIGURE
2

DWG DATE: 22JAN98 | PN: G:\PROJECTS\MN\0428 | FILE NO.: \003\FIGURES | DRAWING: FIGURE2.CDR | CHECKED: DLR | APPROVED: DLR | DRAFTER: AKA



SOURCE: UNITED DEFENSE, FRIDLEY, MINNESOTA, 1998.

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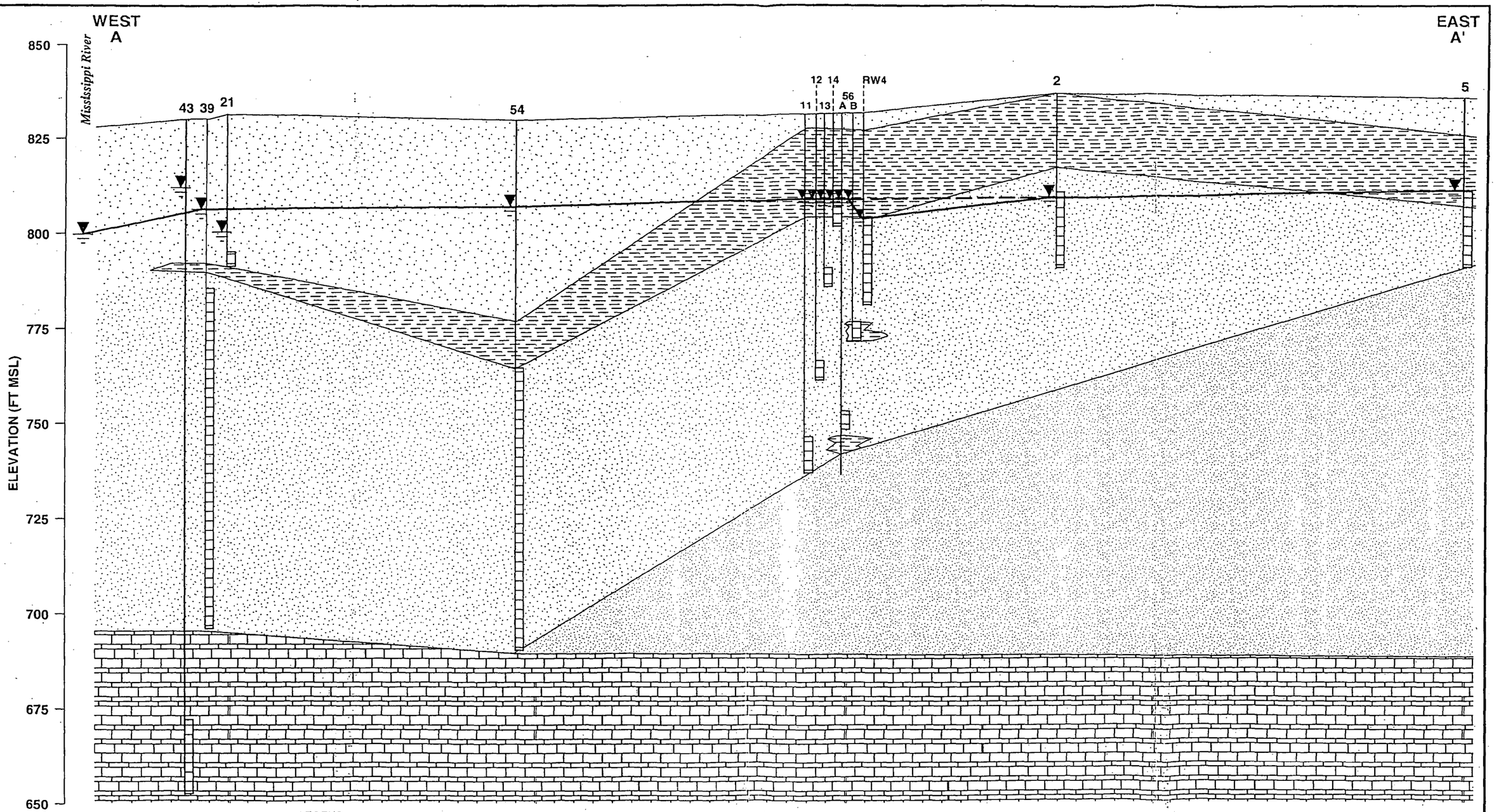
LOCATIONS OF GEOLOGIC CROSS SECTION

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	25JUL00	D. RICHARDSON	U-D\MN428-00
		LEAD DESIGN PROF.	CHECKED D. RICHARDSON
		PROJECT NUMBER	FIGURE NUMBER
		MN000428.03	3



LEGEND

- UNCONFINED SAND AQUIFER
- CLAY
- CONFINED SAND AQUIFER
- ST. PETER SANDSTONE
- PRARIE DU CHIEN LIMESTONE

GROUNDWATER ELEVATION IN SEPTEMBER 1998

SCREENED INTERVAL

0 50 100 200

APPROXIMATE HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 4X

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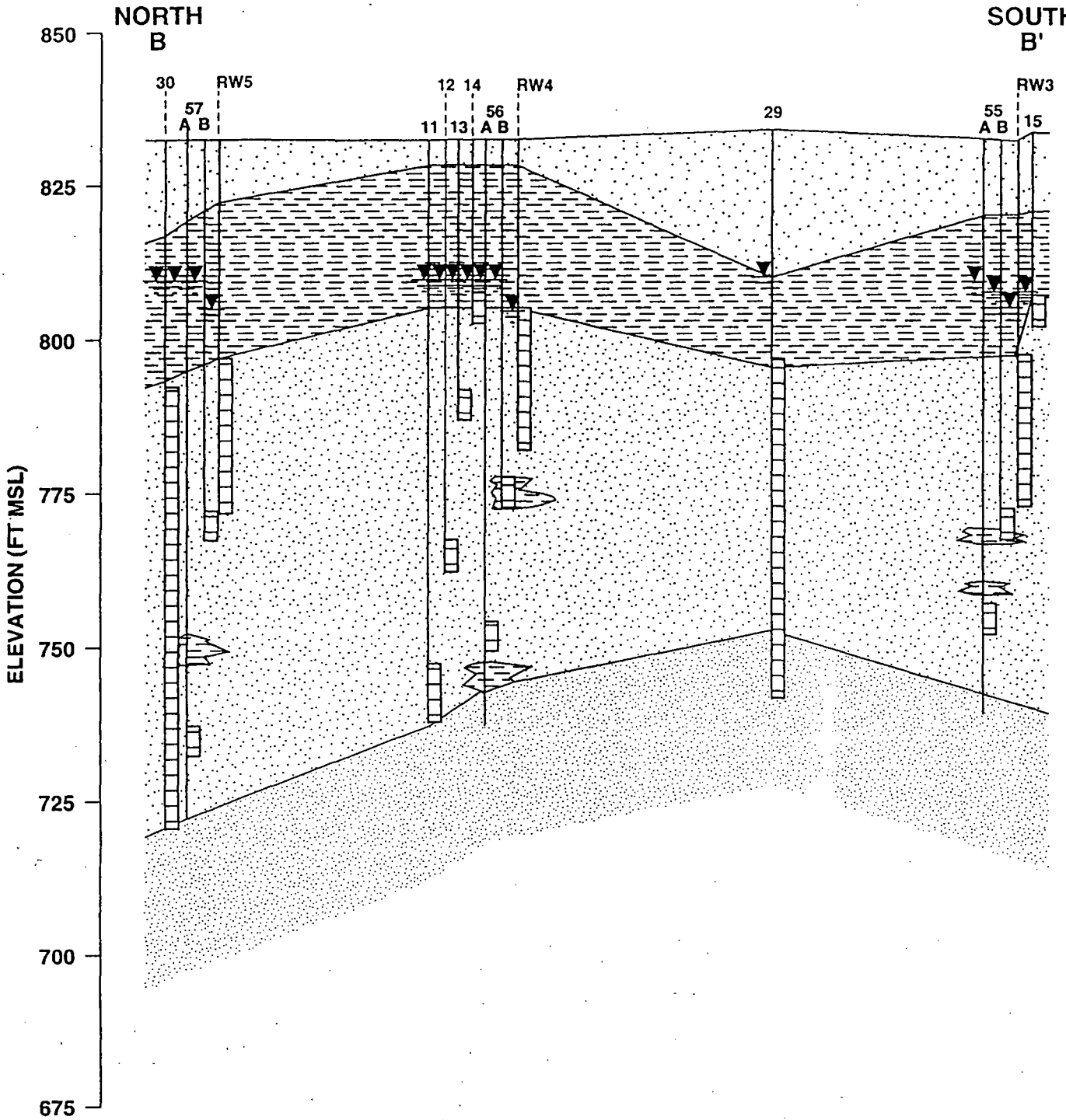
GEOLOGIC CROSS SECTION A-A'

UNITED DEFENSE
FRIDLEY, MINNESOTA

FIGURE
4

DRAFTER: ELS
APPROVED:
CHECKED: DLR
DRAWING: XSEC_AA.AI
FILE NO.: MN0421
PN: GRAPH_OHMINNEAPOLIS
DWG DATE: 10JUL00



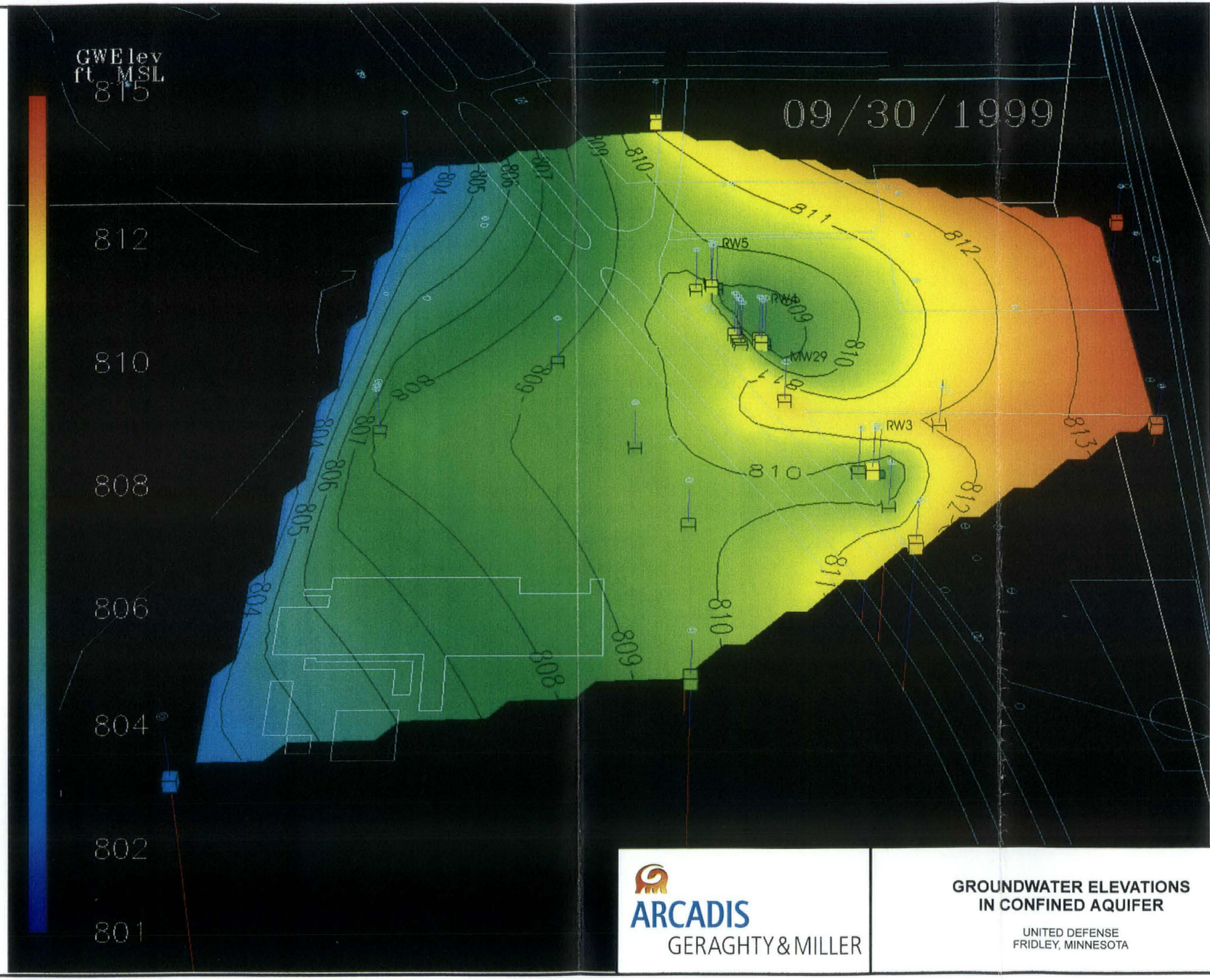
DRAFTER: ELS | APPROVED: | CHECKED: DLR | DRAWING: XSEC_BB2.AI | FILE NO.: MN0428 | PN: GRAPH_OHMINNEAPOLIS | DWG DATE: 10JUL00

ARCADIS
GERAGHTY & MILLER

GEOLOGIC CROSS SECTION B-B'

UNITED DEFENSE
FRIDLEY, MINNESOTA

FIGURE
5



ARCADIS
GERAGHTY & MILLER

GROUNDWATER ELEVATIONS IN CONFINED AQUIFER

UNITED DEFENSE
FRIDLEY, MINNESOTA

FIGURE
6

DWG DATE: 22JAN98 | PN: G:\PROJECTS\MN0428 | FILE NO.: \003\FIGURES | DRAWING: FIGURE6.CDR | CHECKED: DLR | APPROVED: DLR | DRAFTER: AKA

SOURCE: UNITED DEFENSE, FRIDLEY, MINNESOTA, 1998.

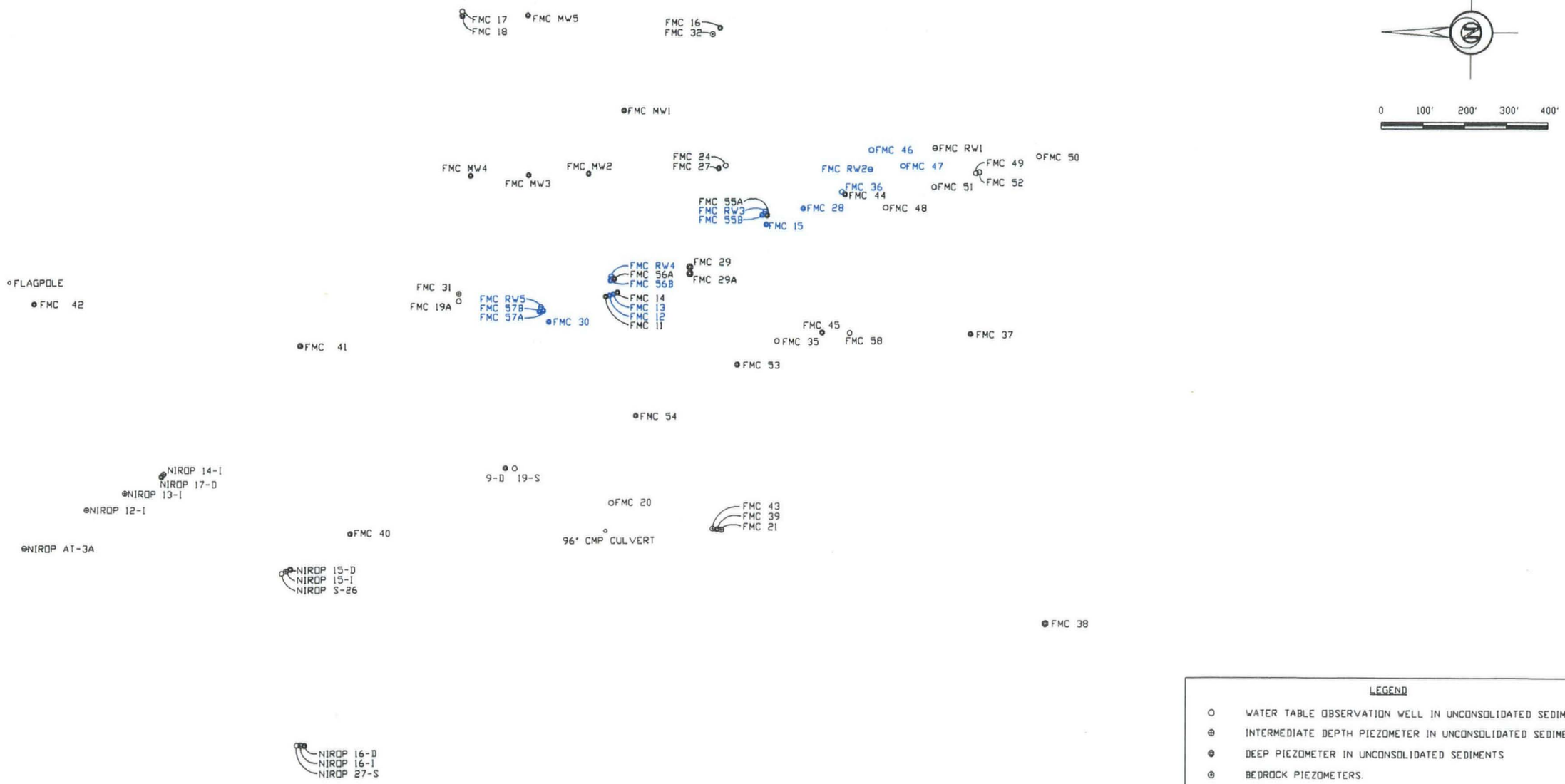
LEGEND

- ○ WATER TABLE OBSERVATION WELL IN UNCONSOLIDATED SEDIMENTS
- ⊕ INTERMEDIATE DEPTH PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ● DEEP PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ⊙ BEDROCK PIEZOMETERS.
- ⊖ EXTRACTION WELLS.

ARCADIS GERAGHTY&MILLER

PROPOSED MONITORING WELL LOCATIONS

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	25JUL00	D. RICHARDSON	U-D\MN428-00
		LEAD DESIGN PROF.	CHECKED D. RICHARDSON
		PROJECT NUMBER	FIGURE NUMBER
		MN000428.03	7



LEGEND

- ○ WATER TABLE OBSERVATION WELL IN UNCONSOLIDATED SEDIMENTS
- ⊕ INTERMEDIATE DEPTH PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ● DEEP PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ⊙ BEDROCK PIEZOMETERS.
- ⊖ EXTRACTION WELLS.

SOURCE: UNITED DEFENSE, FRIDLEY, MINNESOTA, 1998.

ARCADIS GERAGHTY&MILLER

AQUIFER TESTING PHASE I
LOCATIONS OF WATER LEVEL MEASUREMENTS

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	25JUL00	D. RICHARDSON	U-D\MN428-00
		LEAD DESIGN PROF.	CHECKED
			D. RICHARDSON
		PROJECT NUMBER	FIGURE NUMBER
		MN000428.03	8

SOURCE: UNITED DEFENSE, FRIDLEY, MINNESOTA, 1998.

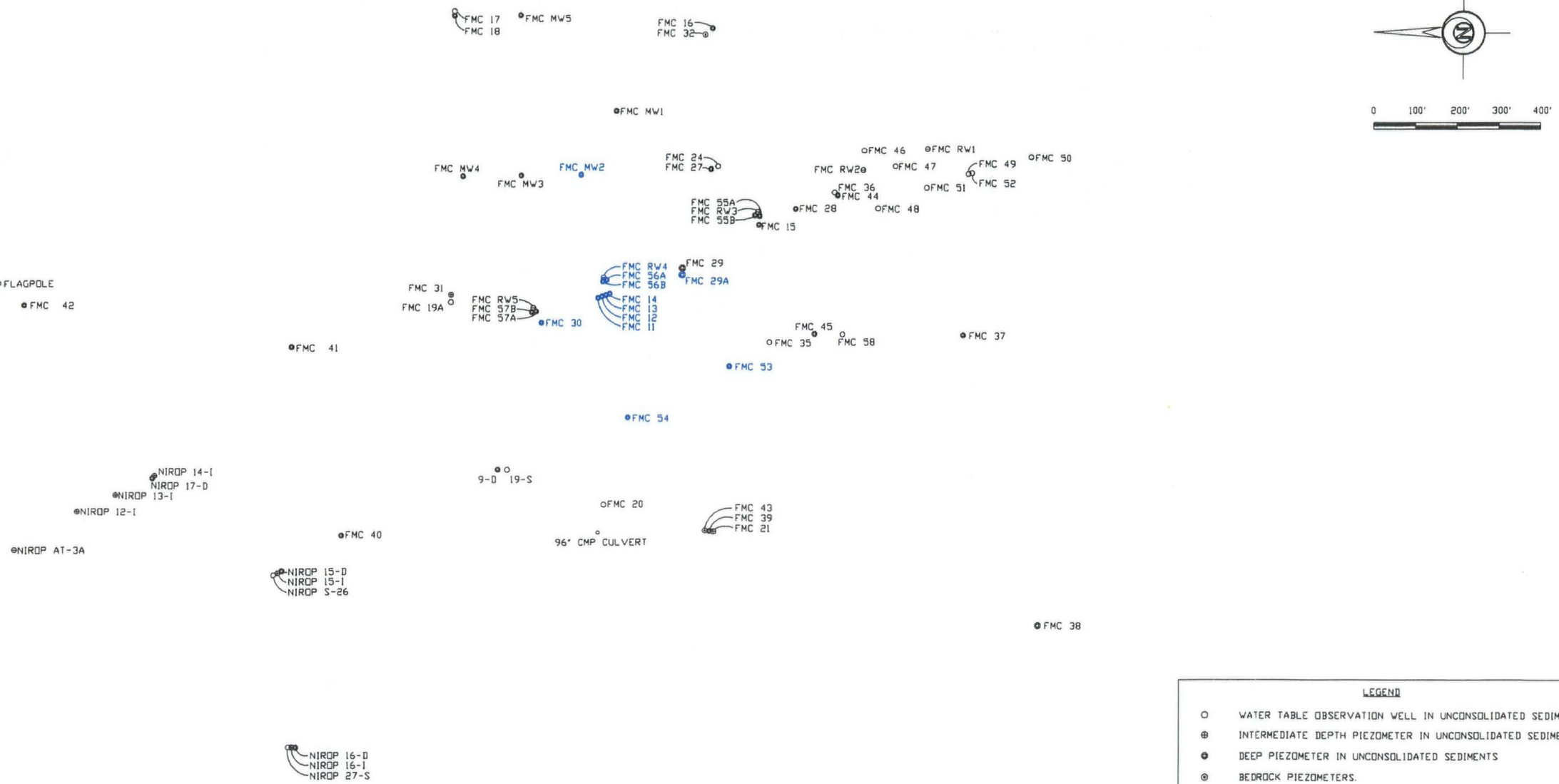
LEGEND

- ○ WATER TABLE OBSERVATION WELL IN UNCONSOLIDATED SEDIMENTS
- ⊕ INTERMEDIATE DEPTH PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ● DEEP PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ⊙ BEDROCK PIEZOMETERS.
- ⊖ EXTRACTION WELLS.

ARCADIS GERAGHTY&MILLER

LOW-FLOW GROUNDWATER SAMPLING
SAMPLING LOCATIONS

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	25JUL00	D. RICHARDSON	U-D\MN428-00
		LEAD DESIGN PROF.	CHECKED D. RICHARDSON
		PROJECT NUMBER	FIGURE NUMBER
		MN000428.03	9



SOURCE: UNITED DEFENSE, FRIDLEY, MINNESOTA, 1998.

LEGEND

- ○ WATER TABLE OBSERVATION WELL IN UNCONSOLIDATED SEDIMENTS
- ⊕ INTERMEDIATE DEPTH PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ● DEEP PIEZOMETER IN UNCONSOLIDATED SEDIMENTS
- ⊙ BEDROCK PIEZOMETERS.
- ⊖ EXTRACTION WELLS.

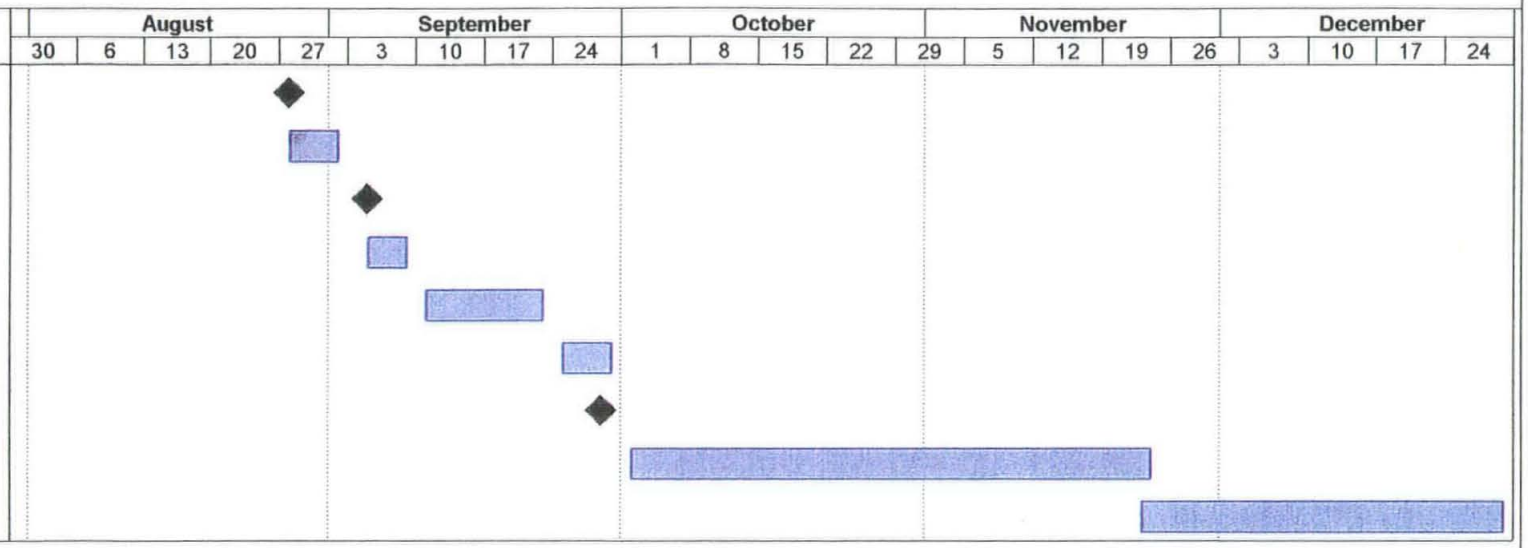
ARCADIS GERAGHTY & MILLER

AQUIFER TESTING PHASE II
LOCATIONS OF WATER LEVEL MEASUREMENTS

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	25JUL00	D. RICHARDSON	U-D\MN428-00
		LEAD DESIGN PROF.	CHECKED D. RICHARDSON
		PROJECT NUMBER	FIGURE NUMBER
		MN000428.03	10

Figure 11. Schedule for Work Plan Implementation

ID	Task Name
1	Access
2	Monitoring Well Installation
3	System Shut Down
4	Aquifer Testing Phase I
5	Groundwater Sampling
6	Aquifer Testing Phase II
7	System Restart
8	Data Analysis
9	Report Preparation



Project: wpsched.MPP
Date: Mon 7/24/00

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

Appendix A

Well Construction Logs for MN29 and MW35

30N	23W	27	SW	SE	SE

Address: FMC #29 Fridley

Distance and Direction from Road Intersections or Street Address and City of Well Location

Mark exact location of well on section grid with "X." Sketch map of well location.

N / W / E / S — 1 mile — ¼ mi.

Addition Name

Block Number

Lot Number

3. FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
silt sandy	blk	fine-med	0	0.3
sand-silty tr of gravel	red br	fine -co	.3	4.2
sand -tr of gravel	lt gray	fi-co	4.2	23.5
clay,sandy tr of gravel	dk gray	fi-co	23.5	38.5
sand-silty	fine to med & coarse		38.5	68.5
sand-gravelly	gr,brown	fi-coa	68.5	81.5
st. Peter sandstone	yel brown	shaley	81.5	87
Sandstone drills to fine grained	white lt gray		87	~~XX~~ 93

Use a second sheet, if needed

15. REMARKS, ELEVATION, SOURCE OF DATA, etc.

4. WELL DEPTH (completed): ~~XX~~ 93 ft. — Date of Completion: 10-6-82

5. ☐ Cable tool ☐ Reverse ☐ Driven ☐ Dug ☐ Hollow rod ☐ Air ☐ Bored ☐ ☒ Rotary ☐ Jetted ☐ Power Auger

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

7. CASING: ☒ Black ☐ Galv. ☐ Plastic ☐ Threaded ☐ Welded ☐ — HEIGHT: Above/Below X; Surface 2 ft.; Drive Shoe? Yes ___ No ___; 6 in. to 38 ft. — HOLE DIAM 9 in. to ___ ft.

8. SCREEN: Make Johnson; Type S.S.; Dia. 6"; Slot/Gauge 20; Length 55'; Set between 38 ft. and 93 ft.; ___ ft. and ___ ft.; Or open hole from ___ ft. to ___ ft.; FITTINGS:

9. STATIC WATER LEVEL: 20 ft. below land surface; Date Measured 10-6

10. PUMPING LEVEL (below land surface): ___ ft. after ___ hrs. pumping ___ g.p.m.

11. WELL HEAD COMPLETION: ☐ Pitless adapter, manufacturer ___ model ___; ☐ Basement offset; ☒ At least 12" above grade

12. WELL GROUTED? ☒ Yes ☐ No: ☒ Neat Cement ☐ Bentonite ☐ ___; Grout material ___ from ___ to ___ ft. Cu. Yds. ___

13. NEAREST SOURCES OF POSSIBLE CONTAMINATION: ___ feet ___ direction ___ type

Well disinfected upon completion? Yes ☐ No ☐

14. PUMP: Date Installed ___ ☐ Not installed; Manufacturer's Name ___; Model Number ___ HP ___ Volts ___; Length of drop pipe ___ ft. capacity ___ g.p.m.; Material of drop pipe ___; Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ Centrifugal ☐ ___

16. 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.

Stevens Well Co — 27194
Licensed Business Name — License No.

Address: 6240 Hwy 12 W, Maple Plain, MN

Signed: [signature] — Date: 3-31-83
Authorized Representative

John Dvorak — Date: 3-31
Name of Driller

IMPORTANT: FILE WITH DNR. WELL OWNER COPY

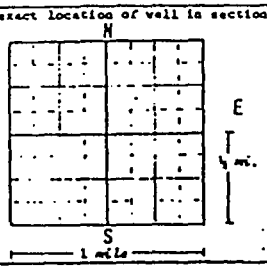
196713

1. LOCATION OF WELL:

County Name	Fraction	Section Number	Township Number	Range Number
	¼ ¼ ¼		N. or S.	E. or W.

Distance and Direction from Road Intersections or Street Address and City of Well Location

Show exact location of well in section grid with "X." Sketch map of well location.



2. FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
Sand			0	60

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

IMPORTANT: FILE WITH DEED - WELL OWNER COPY

3. PROPERTY OWNER'S NAME: FMC (Braun Engineering & Testing Inc.)
Address: 4800 N. E. River Road
Minneapolis, Minn. #3/5

4. WELL DEPTH (completed): 60' ft. Date of Completion: 1-29-83

5. 1 [ ] Cable tool 4 [ ] Reverse 7 [ ] Driven 10 [ ] Dug
2 [ ] Hollow rod 3 [ ] Air 8 [ ] Bored 11 [ ] _____
3 [X] Rotary 6 [ ] Jetted 9 [ ] Power Auger

6. USE
1 [ ] Domestic 4 [ ] Public Supply 7 [ ] Industry
2 [ ] Irrigation 5 [ ] Air Conditioning 8 [ ] Commercial
3 [ ] Test Well 6 [X] Monitoring Wells

7. CASING DIAM.
Threaded [X] 1 Welded [ ] 3
Black [X] 2 Galv. [ ] 4
4 in. to 25 ft. depth
in. to ft. depth
in. to ft. depth

HEIGHT: Above/Below
Surface ft.
Weight 10.86 lbs./ft.
Drive Shoe? Yes ___ No ___

8. SCREEN
Make Johnson
Type Galvanized Dia. 4"
Slot/Gauge 10 Length 35'
Set between 25 ft. and 60 ft.
ft. and ft.
ft. and ft.

Or open hole from ft. to ft.

FITTINGS:

9. STATIC WATER LEVEL
ft. [ ] below [ ] above land surface Date Measured

10. PUMPING LEVEL (below land surface)
ft. after hrs. pumping g.p.m.
ft. after hrs. pumping g.p.m.

11. WELL HEAD COMPLETION: None
1 [ ] Pitless adapter 2 [ ] Basement offset 3 [ ] At least 12" above grade

12. Well grouted? [X] Yes [ ] No Cu. Fds.
1 [X] Neat cement 2 [ ] Bentonite 3 [ ] _____
Depth: from ft. to ft.
from ft. to ft.

13. Nearest source of possible contamination
feet direction type
Well disinfected upon completion? Yes [ ] No [ ]

14. PUMP: None
Date Installed
[ ] Not Installed
Manufacturer's Name
Model Number HP Volts
Length of drop pipe ft. Capacity g.p.m.
Material of drop pipe
Type: 1 [ ] Submersible 3 [ ] Turbine [ ] Reciprocating
2 [ ] Jet 4 [ ] Centrifugal 5 [ ] _____

16. 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.

DON STODOLA WELL DRILLING CO., INC. 172
Licensee Name License No.

Address 15306 Highway # 7, Mtka, Minn. 55343

Signed Arnold E. Stodola Jr. Date 2-16-83
Authorized Representative

Mark Stodola
Name of Driller

7/74 30M

Appendix B

SOP No. 3.4 Low Flow Purging of a Monitoring Well Before Sampling

STANDARD OPERATING PROCEDURE NO. 3.4

LOW FLOW PURGING OF A MONITORING WELL BEFORE SAMPLING

1.0 PURPOSE

The purpose of this procedure is to provide a uniform basis for low flow purging of a monitoring well before collecting a groundwater sample. This procedure also provides quality control steps necessary for low flow purging of a monitoring well, and for ensuring continuity between field personnel.

2.0 PROCEDURES

2.1. Don appropriate PPE per HASP.

2.2. Locate and identify the well.

2.3. After measuring depth to water, measure the total depth of the well to be sampled. Calculate volume of water in the well and record it the volume on the Low Flow Groundwater Sampling Form.

2.4. Connect a clean length of tubing to the pump just above the check valve using a stainless steel clamp. Make sure the tubing will be long enough to reach the ground surface after the pump intake has been lowered to the desired depth. Lower the pump so the intake is at the appropriate depth.

2.5. Purge water from the well at 100 to 500 milliliters (ml) per minute. Flow rates will be determined using a 1,000 ml graduated cylinder and a timer. Place purge water into a 5-gallon bucket. When the bucket is full, place the purge water in a 55-gallon container located near the dischrage point for the groundwater recovery system. When the container is full or at the conclusion of a sampling event (whichever occurs first), transfer the purge water to the POTW.

2.6. Monitor the depth to water during purging using an electronic water level indicator to verify that the water level has stabilized near the static water level. After the water level is stabilized, continue to purge well until the following stabilization criteria are met or 5 well volumes have been removed:

Three successive readings within the following ranges:

pH	± 0.1 units
Temperature	± 0.5 ° C
Conductivity	± 5 %
Redox	± 20 m v
DO	± 0.5 mg/L

2.7 Clean the submersible pump, check valve, clamp, and wire leads after use at each sampling location. Use new vinyl tubing at each sampling location.

3.0 REFERENCES

3.1 Instruction Manual, Redi-Flo 2, Grundfos pump.
3.2 Forms Book — Low Flow Groundwater Sampling Form.

4.0 EXHIBITS

4.1 *Equipment List*
Submersible pump and appurtenances
Flow-through cell and appurtenances
Vinyl tubing
Steel clamps
Graduated cylinder
Timer
Generator
Extension cord
5 gallon bucket
Calculator
Low Flow Groundwater Sampling Form

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Groundwater Sampling Form

Page _____ of _____

Project/No. _____ Well _____ Date _____

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) _____

Static Water Level _____ Measured Width _____ Well Materials ____ PVC ____ ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off: _____ **Volumes Purged** _____

Centrifugal _____ **Sample Time:** _____

Submersible _____

Other _____ Bailer Type: _____ Sampled By: _____

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)

Lowflo.xls
6/22/00

Appendix C

Example of Interpoll Laboratory Report for USEPA Method 8260

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

ANALYTICAL RESULTS
FOR UNITED DEFENSE CORPORATION
PURCHASE ORDER #629862

Submitted to:

United Defense Corporation
Naval Systems Division
4800 East River Road
Minneapolis, MN 55421-1498

Attention: Tim Ruda, M375

Approved By:

David J. Schneider, Manager
Chemistry Department

Laboratory Report #12312
February 4, 1999

PROJECT SUMMARY

The following Laboratory Report contains the analytical results for two water samples submitted to Interpoll Laboratories by United Defense for United Defense's Purchase Order #629862. The samples were received on January 21, 1999 according to Interpoll Labs documented sample acceptance procedures. The samples were analyzed for the parameters requested on the United Defense Chain-of-Custody form which accompanied the sample.

Sample ID	ILI Sample #
9005a, Mpls. Intake	12312-01
9005b, GWS Total	12312-02

Results are reported on an as received basis.

Surrogates are reported as percent (%) recovery.

Surrogate	Method	Control Limits
1,2-Dichloroethane-D4	SW-846, 8260	76 - 114
Toluene-D8	SW-846, 8260	88 - 110
4-Bromofluorobenzene	SW-846, 8260	86 - 115

Footnotes:

[a]As requested by Mr. Tim Ruda of United Defense, Interpoll Laboratories analyzed the sample for the EPA Method 601/602 list of parameters by SW-846 Method 8260.

[b]Sample was diluted by a factor of 20 to accommodate the analyte concentration. Reported value represents the concentration in the original undiluted sample, i.e., instrumental result was multiplied by the dilution factor prior to reporting. Achieved detection limit is given. The target detection limit applicable to the sample may be obtained by dividing the achieved detection limit by the dilution factor.

DJS/cg
BDL = below detection limit
Invoice Enclosed

Sample Identification: 9005a, Mpls. Intake
Sample Type: Water
Laboratory Log Number: 12312-01

Interpoll Laboratories, Inc.
Laboratory Report #12312
United Defense

	Target Detection Limit (ug/L)	Analytical Result (ug/L)	Method Blank
EPA Method SW-846, 8260,*			
Preparation Date: 1/28/99			
Analysis Date: 1/28/99			
Benzene	0.30	BDL	BDL
Bromodichloromethane	0.13	BDL	BDL
Bromoform	0.30	BDL	BDL
Bromomethane	1.0	BDL	BDL
Carbon tetrachloride	0.24	BDL	BDL
Chlorobenzene	0.75	BDL	BDL
Chloroethane	1.0	BDL	BDL
2-Chloroethyl vinyl ether	25	BDL	BDL
Chloroform	0.50	BDL	BDL
Chloromethane	0.20	BDL	BDL
Dibromochloromethane	0.12	BDL	BDL
1,2-Dichlorobenzene	0.45	BDL	BDL
1,3-Dichlorobenzene	0.45	BDL	BDL
1,4-Dichlorobenzene	0.45	BDL	BDL
Dichlorodifluoromethane	0.25	BDL	BDL
1,1-Dichloroethane	0.20	BDL	BDL
1,2-Dichloroethane	0.10	BDL	BDL
1,1-Dichlorothene	0.16	BDL	BDL
cis-1,2-Dichloroethene	0.21	BDL	BDL
trans-1,2-Dichloroethene	0.10	BDL	BDL
1,2-Dichloropropane	0.16	BDL	BDL
cis-1,3-Dichloropropene	0.46	BDL	BDL
trans-1,3-Dichloropropene	0.50	BDL	BDL
Ethylbenzene	0.60	BDL	BDL
Methylene chloride	1.0	BDL	BDL
1,1,2,2-Tetrachlorethane	0.60	BDL	BDL
Tetrachlorethene	0.75	BDL	BDL
Toluene	0.75	BDL	BDL
1,1,1-Trichloroethane	0.54	BDL	BDL
1,1,2-Trichloroethane	0.20	BDL	BDL
Trichloroethene	0.50	BDL	BDL
Trichlorofluoromethane	0.20	BDL	BDL
Vinyl chloride	0.20	BDL	BDL
m/p-Xylene	0.90	BDL	BDL
o-Xylene	0.90	BDL	BDL
Surrogates:			
1,2-Dichlorethane-D4		105%	110%
Toluene-D8		100%	101%
4-Bromofluorobenzene		109%	112%

United Defense

Armament Systems Division

CHAIN OF CUSTODY RECORD

Requester	Date	Project Name	Site Description
Tim Ruda	1/21/99	629 862 / 630650	

I. FIELD DATA

Sample Number	Date	Time	Sample Location	Sample Type	Number of Containers	Remarks - Analysis Requested
9005a	1/21	~~1/21~~	Mpls Intake	Grab 12312-01	3	629862 Taken in lab building
6			GWS Total	↓ -02	3	629862
9006	1/19	15:30	Al_2O_3 - Blast	12313-01	1	
" 7		16:00	Glass Bead	12314-02	1	5 working day turnaround requested
" 8		16:30	Steel Grit - Blast	↓ 12315-03	1	
Sampler's Signature: Tim Ruda				Total Number of Containers		

II. CHAIN OF CUSTODY

Relinquished By	Date / Time	Received By	Relinquished By	Date / Time	Received By
Tim Ruda	1/21/98 / 13:15	Jeff Jensen		/	
sign		sign	sign		sign
Relinquished By	Date / Time	Received By	Relinquished By	Date / Time	Received By
	/			/	
sign		sign	sign		sign
Relinquished By	Date / Time	Received By	Relinquished By	Date / Time	Received By
	/			/	
sign		sign	sign		sign

Method of Shipment	Shipped By	Received for Laboratory	Date / Time
		??	/
		sign	sign

III Copies To	IV. Lab Supervisor	Date

VA-081.DOC Feb98

Distribution: White - Return to Requestor Yellow - Retained by Analytical Pink - Retained by Requestor

ARCADIS GERAGHTY & MILLER

ARCADIS Geraghty & Miller, Inc.
420 North Fifth Street
Suite 1035
Minneapolis
Minnesota 55401
Tel 612 339 9434
Fax 612 336 4538

ENVIRONMENTAL SERVICES

TELEFAX

To:
Mr. Doug Hildre - United Defense
Fridley, MN

Copies:
Mr. Lonnie Norman - FMC Corp.
Philadelphia, PA
Fax (215) 299.6947

FAXED

Date:
18 July 2000

Fax:
(612) 572.4901

Total pages:
3

Subject:
FMC Site - Fridley, MN

ARCADIS Geraghty & Miller Project No.:
MN000428.0003

From:
David Richardson

Extension:
(612) 373.0224

If you do not receive all pages, please call to let us know as soon as possible.

Hello - Following my conversation with Doug this morning, I have revised the schedule for implementing the work plan. Access to the Minneapolis Water Works is set as the milestone that triggers the beginning of the site work. Since we do not know the exact day this access will be obtained, the timescale was changed to a generic one (weeks and months instead of actual dates). Milestones are also included for stopping and starting the groundwater recovery system. Please feel free to call me at (612) 373.0224 if you have any questions or comments regarding the revised schedule.

Doug – The well construction logs and site maps you requested for obtaining access were mailed to you today. Please let me know if you do not receive them by the end of this week.

THIS MESSAGE IS INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY TO WHICH IT IS ADDRESSED AND MAY CONTAIN INFORMATION THAT IS PRIVILEGED, CONFIDENTIAL, AND EXEMPT FROM DISCLOSURE UNDER APPLICABLE LAW.
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Tables	Figures	Appendices
Groundwater Elevations	Site Map	Well Logs
Pumping Test Results	Cross Sections	Pumping Test Data
Analytical Results	Groundwater Elevation Contours	Analytical Data
	Pumping Test Graphs	
	Isoconcentration Contours	

The body of the report will describe the methods and procedures used to collect and analyze field data, and summarize the results. If necessary, additional modifications to the groundwater recovery system or the groundwater monitoring network will be recommended.

Schedule

A schedule for implementing this scope of work is on Figure 7. Site work is scheduled to begin with the installation of the two new monitoring wells as soon as access is obtained from the Minneapolis Water Works. After access is obtained, site work should be completed in approximately one month. After site work is complete, final copies of the report should be ready for submittal in approximately two months.

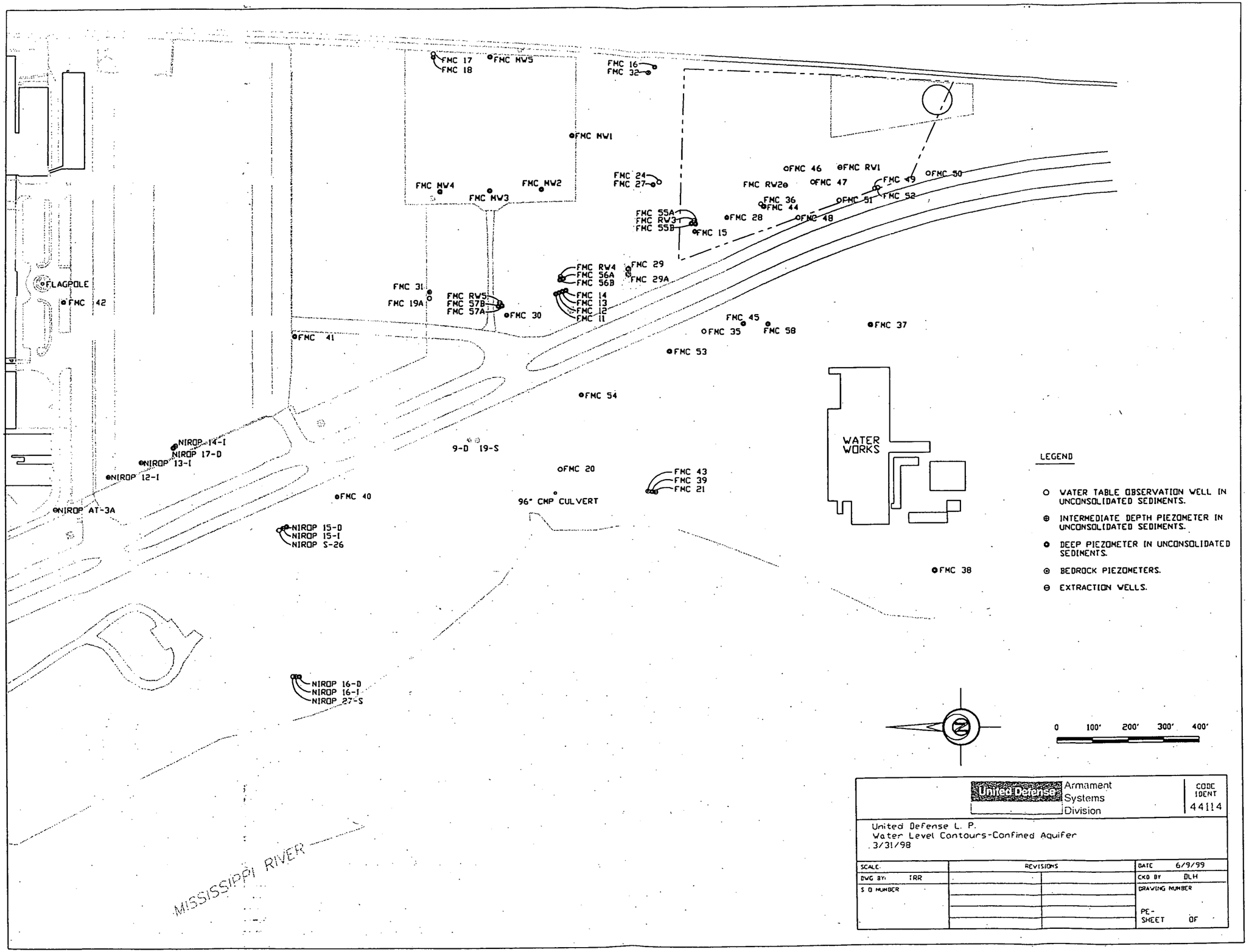
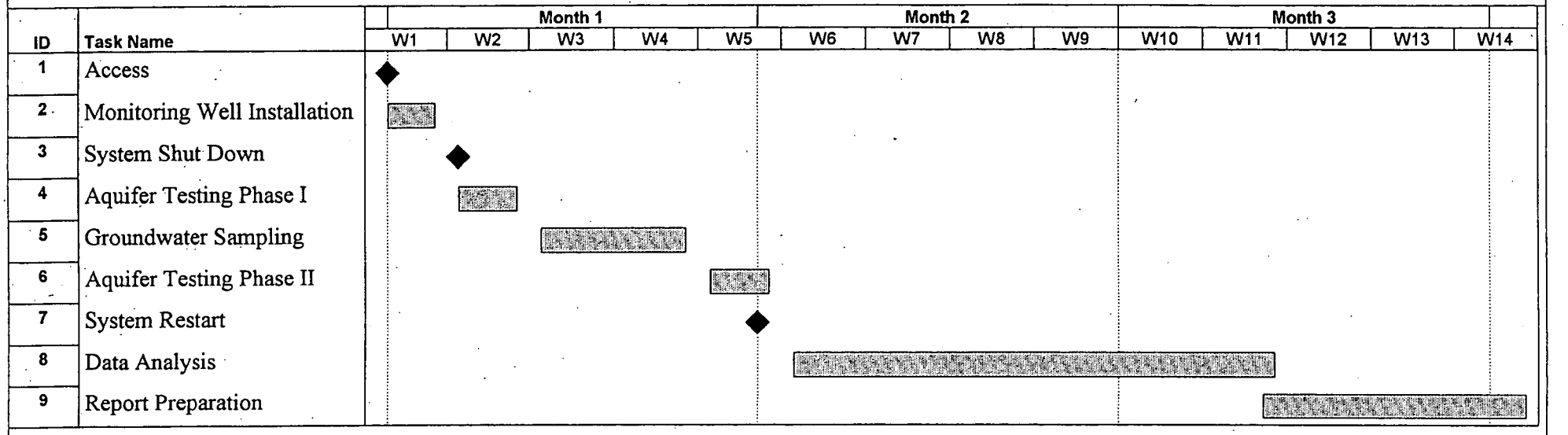

FMC 17
FMC 18
FMC MW5
FMC 16
FMC 32
FMC MW1
FMC 24
FMC 27
FMC 46
FMC RV1
FMC 47
FMC 49
FMC 50
FMC RW2
FMC 36
FMC 44
FMC 51
FMC 52
FMC MW4
FMC MW3
FMC MW2
FMC 55A
FMC RW3
FMC 55B
FMC 28
FMC 48
FMC 15
FMC RW4
FMC 56A
FMC 56B
FMC 29
FMC 29A
FLAGPOLE
FMC 42
FMC 31
FMC 19A
FMC RW5
FMC 57B
FMC 57A
FMC 30
FMC 14
FMC 13
FMC 12
FMC 11
FMC 45
FMC 35
FMC 58
FMC 37
FMC 41
FMC 53
FMC 54
WATER WORKS
NIROP 14-I
NIROP 17-D
NIROP 13-I
NIROP 12-I
9-D 19-S
FMC 20
FMC 43
FMC 39
FMC 21
96" CMP CULVERT
FMC 40
NIROP AT-3A
NIROP 15-D
NIROP 15-I
NIROP S-26
FMC 38
NIROP 16-D
NIROP 16-I
NIROP 27-S
MISSISSIPPI RIVER
LEGEND
WATER TABLE OBSERVATION WELL IN UNCONSOLIDATED SEDIMENTS.
INTERMEDIATE DEPTH PIEZOMETER IN UNCONSOLIDATED SEDIMENTS.
DEEP PIEZOMETER IN UNCONSOLIDATED SEDIMENTS.
BEDROCK PIEZOMETERS.
EXTRACTION WELLS.
0 100' 200' 300' 400'
United Defense Armament Systems Division
CODE IDENT 44114
United Defense L. P.
Water Level Contours-Confined Aquifer
3/31/98
SCALE
DWG BY: TRR
S O NUMBER
REVISIONS
DATE 6/9/99
CKD BY DLH
DRAWING NUMBER
PE-
SHEET OF

Figure 7. Schedule for Work Plan Implementation



Project: wpsched.MPP
Date: Tue 7/18/00

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress