

**Field Sampling Plan Addendum  
to the  
Additional Investigation  
at the  
Anoka County Riverfront Park**

**Naval Industrial Reserve  
Ordnance Plant  
Fridley, Minnesota**



**Southern Division  
Naval Facilities Engineering Command  
Contract Number N62467-94-D-0888  
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**FIELD SAMPLING PLAN ADDENDUM  
TO THE ADDITIONAL INVESTIGATION  
AT THE ANOKA COUNTY RIVERFRONT PARK**

**NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT  
FRIDLEY, MINNESOTA**

**COMPREHENSIVE LONG-TERM  
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

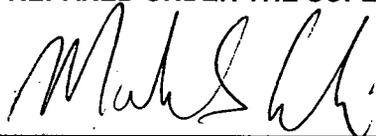
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## ACRONYMS

ACP	Anoka County Riverfront Park
AMR	Annual Monitoring Report
bgs	Below ground surface
COPC	Contaminant of Potential Concern
FID	Flame ionization detector
NIROP	Naval Industrial Reserve Ordnance Plant
OU	Operating Unit
PID	Photo Ionization Detector
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAWP	Remedial Action Work Plan
SOP	Standard operating procedure
TCL	Target Compound List
TOM	Task Order Manager
TtNUS	Tetra Tech NUS, Inc.
UDLP	United Defense Limited Partnership
USGS	United States Geological Survey
VOC	Volatile organic compound

## 1.0 INTRODUCTION

This Field Sampling Plan (FSP) summarizes the field operations and standard operating procedures (SOPs) to be conducted by Tetra Tech NUS, Inc. (TtNUS) for the additional investigation at the Naval Industrial Reserve Ordnance Plant (NIROP) and adjacent Anoka County Riverfront Park (ACP), Fridley, Minnesota. This FSP describes the scope of work for the Supplemental Containment Evaluation field investigation as previously outlined in the technical meetings held on July 8 and 9, 2003.

This FSP was prepared as an addendum to the Field Sampling Plan for the Additional Investigation at the Anoka County Riverfront Park (TtNUS, 1999) to address data gaps identified during the NIROP Partnering Team Technical Committee meetings held on July 8 and 9, 2003. A copy of the Technical Committee 'meeting notes' summarizing the subcommittee meeting can be found in Appendix A.

The investigation described herein will be performed in accordance with the Remedial Action Work Plan (RAWP) (TtNUS, 2003a). This document will however contain project-specific details (e.g., boring/well locations, investigative techniques, quality assurance/quality control issues) that have been changed or modified from the original FSP.

### 1.1 OVERVIEW OF THE INVESTIGATION

The additional investigation at the NIROP and ACP will consist of sampling unsaturated and saturated soil and groundwater in the shallow and intermediate unconsolidated aquifer(s) and related subsurface investigation activities. A total of two well borings/monitoring wells and three soil borings will be installed as part of this investigation. Two additional monitoring wells may be installed if the presence of an intermediate monitoring interval exists in soil boring SB-08 or SB-09. The borings/monitoring wells will be installed using Rotosonic or hollow stem auger techniques. Soil samples for lithologic purposes will be collected from the deepest well boring in a cluster and from the soil borings. Groundwater samples will be collected from each newly installed well at the site.

The proposed sampling locations are recommended but may be moved slightly based on specific field conditions. The actual sampling locations are contingent on the clearance of utilities/structures and will be adjusted in the field as necessary in coordination with Minnesota Department of Transportation, NIROP personnel, United Defense L.P. (UDLP) personnel, and the regulatory oversight representative (if any), as appropriate. The proposed boring and well installation is anticipated to last 1 week.

Two aquifer tests are planned to determine the flow zones for monitoring wells 11-S and 17-D. The aquifer tests follow a protocol developed by the United States Geological Survey (USGS) (2002) and previously distributed to the Partnering Team (see Appendix B). The aquifer tests are anticipated to last several weeks, depending on the level of response observed in instrument-equipped wells.

## **1.2 CONCEPTUAL SITE MODEL**

A description of the subsurface hydrogeology and extent of contamination collected to date can be found in the 2002 Annual Monitoring Report (TtNUS, 2003b).

## **1.3 OVERVIEW OF THIS FSP**

Refer to Section 1.3 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

## **1.4 PROJECT ORGANIZATION AND RESPONSIBILITIES**

Refer to Section 1.4 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

## 2.0 SAMPLE NETWORK DESIGN AND RATIONALE

### 2.1 OVERVIEW

This section describes the scope of work and supporting rationale to achieve the objectives outlined in the technical meeting memorandum (Appendix A). Specifically, data are needed to further define extent of the Contaminant of Potential Concern (COPCs) within the saturated zone. The hydraulic data, combined with existing data, will be used to further evaluate the performance of the groundwater extraction and containment system. The COPCs are identified in the RAWP.

The following sections describe key objectives used in developing the scope of work and how these objectives will be met through data collection.

### 2.2 OBJECTIVES OF THE INVESTIGATION

The following objectives have been prepared as a basis for this investigation. An attempt will be made to address each objective in this investigation.

1. **Better definition of the extent of the trichloroethylene plume in the shallow and intermediate intervals of the unconsolidated aquifer(s).** The extent of the trichloroethylene plume, as defined by the 2002 Annual Monitoring Report (AMR) needs to be better defined. In the shallow and intermediate interval, west of AT-10 and 11-S, better definition of the plume is needed.
2. **Further determination of capture zones in the vicinity of monitoring wells 11-S and 17-D.**  
Two aquifer tests are proposed to address data gaps identified in the report "Evaluation of the Capture Zone for Recovery Wells at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota" (in review). These issues were discussed at the Technical Committee review meeting held on July 8 and 9, 2003, in Minneapolis, Minnesota.
3. **Further define the lithology and refine the hydrogeologic model of this complex geological environment.**  
The new hydrogeologic model of the site includes the "funneling" of groundwater through a gap in the low permeability (silty clay) unit in the intermediate zone. One of the objectives of this work is to clarify the lithologic relationships in this area.

### 2.3 RATIONALE AND SUMMARY OF INVESTIGATION

In order to meet the three objectives, two initial well borings/monitoring wells will be installed, one in the shallow (MS-54S) and one in the intermediate aquifer (MS-54I), three soil borings [approximately 70 feet below ground surface (bgs); SB-08, SB-09, and SB-10] will be installed with an option of 2 additional "step-out" borings at each location, and two aquifer tests will be performed according to the procedures outlined in Section 7.0.

Up to three additional monitoring wells (one shallow and two intermediate) will be installed if the intermediate monitoring interval is encountered in new soil boring SB-08 or SB-09. That is, an intermediate well will be installed at SB-08 and a shallow/intermediate well cluster will be installed at SB-09 if the intermediate flow zone is present at both locations. See Table 2-1.

Table 2-1 provides a summary of the borings and wells to be installed. Table 2-2 provides a summary of the groundwater samples to be collected for chemical analysis during the next annual or semi-annual AMR groundwater sampling event. In other words, no groundwater samples will be collected during this field effort. Therefore, following approval of this FSP and installation of the new wells, RAWP modifications will be required to include the new wells. Figure 2-1 illustrates the locations of proposed soil borings and wells in the shallow and intermediate intervals.

The following section provides a brief description of how the proposed wells and borings will assist in meeting the objectives outlined in Section 2.2.

1. **Better define the extent of the plume in the shallow and intermediate intervals of the unconsolidated aquifer(s).** [Note that the well numbering system for new wells in this plan continues sequentially the convention used to identify Operating Unit (OU)-3 and ACP investigation wells. The well numbering system may need to be field adjusted in consideration of any additional wells installed between this FSP and implementation.] The following will be completed to meet this objective:

- Install/sample new well cluster MS-54 (shallow and intermediate well) located west of 13-IS in the median strip of East River Road.
- Install/sample new well cluster MS-55 (intermediate well) at soil boring SB-08 and install/sample new well cluster MS-56 (shallow and intermediate well) only if an intermediate monitoring interval is encountered (see above).

**2. Further determination of flow zones for monitoring wells 11-S and 17-D.**

The following will be completed to meet this objective:

- Monitoring water levels in 11-S while performing controlled pumping testing of shallow and intermediate aquifers is planned because the water levels in 11-S appear to move in tandem with the intermediate and deep wells in the vicinity and do not fit trends seen in the water table wells during non-pumping conditions. It is important to understand this well because it is located between pumping wells AT-8 and AT-9. The capture zone to which this well is connected can be resolved by this simple test.
- Monitoring water levels in 17-D while performing controlled pumping testing of shallow and intermediate aquifers is planned because the water level in well 17-D has not responded hydraulically as expected under pumping conditions. Because of its close proximity to AT-5B (deep pumping well), it has been expected that it would respond to pumping at AT-5B. However, 17-D has responded more in line with intermediate (versus deep) wells, indicating that this well may represent the intermediate and not the deep zone. The purpose of this test is to determine which zone this well most accurately represents.

**3. Further define the lithology and refine the hydrogeologic model of the site.**

The following will be completed to meet this objective:

- Drill initially three soil borings (SB-08, SB-09 and SB-10) to define lithology.
- Drill up to two "step-out" soil borings at each location only if the intermediate interval is not found in the initial borings.
- Locations of the "step-out" borings will be located in the field based on existing and new information and site access.

**2.3.1 Sample Network Summary**

No groundwater samples will be collected during this investigation. Table 2-2 provides a summary of the groundwater samples to be collected and submitted for fixed-base laboratory analysis during the next annual or semi-annual AMR groundwater sampling event.

### **2.3.1.1 Soil Sampling**

Soil samples will not be collected for analytical analysis as part of this investigation.

### **2.3.1.2 Groundwater Sampling**

The newly installed monitoring wells will be sampled during the next annual or semi-annual groundwater sampling event. Groundwater sampling procedures will follow those outlined in Section 4.3.3 of the RAWP (TtNUS, 2003a).

## **2.4 DECISION RULES**

This section describes logical "if...then..." statements defining the conditions that would cause the decision-maker to choose among alternative actions.

Well MS-55I will be installed if the intermediate monitoring interval is found during the drilling of SB-08. Well cluster MS-56S/I will be installed if the intermediate monitoring interval is found during the drilling of SB-09. See Figure 2-1.

Depths and lengths of the monitoring well screens installed in the intermediate interval will be determined in the field based upon drilling observations. See Section 7.4 for more information.

Well clusters MS-54, MS-55 and MS-56 will be located in the median strip along East River Road. Special well construction safety measures and any applicable permits required by the Minnesota Department of Transportation and Department of Health will be utilized in this high-traffic area.

TABLE 2-1

**SUMMARY OF PROPOSED MONITORING WELLS AND FIELD ANALYSIS  
FIELD SAMPLING PLAN ADDENDUM TO THE ADDITIONAL INVESTIGATION AT THE NIROP AND  
ANOKA COUNTY RIVERFRONT PARK  
FRIDLEY, MINNESOTA**

WELL CLUSTER (if applicable)	SOIL BORING <sup>(1)</sup> / WELL NAME	Field Analysis	
		Lithologic Classification <sup>(2)</sup>	PID Readings
MS-54	MS-54S	--	--
	MS-54I	X	X
MS-55	SB-08(Potential MS-55I) <sup>(3)</sup>	X	X
MS-56	SB-09(Potential MS-56S) <sup>(4)</sup>	--	X
	SB-09(Potential MS-56I) <sup>(4)</sup>	X	X
NA	SB-10	X	X

Notes:

S - Shallow well.

I - intermediate well.

2 Assuming that the lithology and field parameter results do not change within a well cluster, this information may only be recorded from the deepest boring at any given well cluster. Any changes between well borings within a cluster will be recorded appropriately on the boring log.

3 Well Cluster MS-55I will be installed at soil boring location if the presence of the intermediate monitoring interval is determined.

4 Well Cluster MS-56S/I will be installed at soil boring location if the presence of the intermediate monitoring interval is determined.

1 Up to two additional borings will be drilled at each of the three initial soil boring locations. These "step-out" borings will be drilled only if the intermediate interval is not found in the initial boring. Locations will be determined in the field based on existing and new information and site access. The borings, if drilled, will be numbered consecutively starting with SB-11.

TABLE 2-2

**SUMMARY OF PROPOSED GROUNDWATER SAMPLING FOR CHEMICAL ANALYSIS  
FIELD SAMPLING ADDENDUM TO THE ADDITIONAL INVESTIGATION AT THE NIROP AND  
ANOKA COUNTY RIVERFRONT PARK  
FRIDLEY, MINNESOTA**

WELL CLUSTER	WELL NAME	Sample Analysis
		TCL VOCs
MS-54	MS-54S	X
	MS-54I	X
MS-55 <sup>(1)</sup>	MS-55I	X
MS-56 <sup>(1)</sup>	MS-56S/I	X

S - Shallow well.

I - Intermediate well.

TCL - Target Compound List.

VOCs - Volatile organic compounds.

1 Well cluster will be installed if the intermediate monitoring interval is present in either SB-08 or SB-09.

**Groundwater samples will be collected during the next annual or semi-annual Annual Monitoring Report groundwater sampling event at NIROP. The proposed analyses in this table will be reflected in a Remedial Action Work Plan update to be provided following regulatory approval of this Field Sampling Plan.**



### 3.0 SAMPLE CUSTODY PROCEDURE

Soil and groundwater samples will not be collected as part of this investigation. Groundwater sampling for the new wells will occur as part of the next annual or semi-annual AMR groundwater sampling event. Sampling will conform to the approved RAWP (TtNUS, 2003a).

#### **4.0 SAMPLE CONTAINERS, SAMPLE PRESERVATION, MAXIMUM HOLDING TIME, AND VOLUME REQUIREMENTS**

Soil and groundwater samples will not be collected as part of this investigation. Groundwater sampling for the new wells will occur as part of the next annual or semi-annual AMR groundwater sampling event. Sampling will conform to the approved RAWP (TtNUS, 2003a).

## 5.0 FIELD DOCUMENTATION AND SAMPLE IDENTIFICATION SYSTEM

Soil and groundwater samples will not be collected as part of this investigation. Groundwater sampling for the new wells will occur as part of the next annual or semi-annual AMR groundwater sampling event. Sampling will conform to the approved RAWP (TINUS, 2003a).

## **6.0 DECONTAMINATION PROCEDURES**

The equipment involved in field sampling activities will be decontaminated prior to beginning work, during drilling and sampling activities, and at the completion of the project. This equipment includes drilling rigs, downhole tools, augers, and well casings and screens (if not certified clean from the manufacturer). The following sections detail personnel and equipment decontamination procedures.

Soil and groundwater samples will not be collected as part of this investigation. Groundwater sampling for the new wells will occur as part of the next annual or semi-annual AMR groundwater sampling event. Sampling will conform to the approved RAWP (TtNUS, 2003a).

### **6.1 PERSONNEL**

Refer to Section 6.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

### **6.2 EQUIPMENT**

Refer to Section 6.2 of the Additional Investigation at the NIROP and Anoka County Riverfront Park Report (TtNUS, 1999).

### **6.3 SAMPLING DEVICES**

Not applicable. See above.

### **6.4 SAMPLE BOTTLES**

Not applicable. See above.

## 7.0 FIELD METHODS

This section discusses the mobilization/demobilization activities, monitoring well installation, survey, and waste handling activities performed for the investigation at the NIROP and adjacent Anoka Park, Fridley, Minnesota.

### 7.1 MOBILIZATION/DEMOBILIZATION

Refer to Section 7.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

#### 7.1.1 Site Restoration

Refer to Section 7.1.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

### 7.2 DRILLING PROCEDURES AND EQUIPMENT

Refer to Section 7.2 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

#### 7.2.1 Rotosonic Drilling

Refer to Section 7.2.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

#### 7.2.2 Hollow Stem Auger Drilling

Refer to Section 7.2.2 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

### 7.3 SOIL SAMPLING PROCEDURES

Soil sampling will be performed to characterize the subsurface lithology only. Soil samples for analytical purposes will not be collected as part of this investigation.

### **7.3.1 Log of Drilling and Field Screening Procedures**

Refer to Section 7.3.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

### **7.3.2 Analytical Soil Sampling Procedures**

Soil samples for analytical purposes will not be collected as part of this investigation.

## **7.4 GROUNDWATER MONITORING WELL INSTALLATION**

Refer to Section 7.4 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

### **7.4.1 Well Construction**

Refer to Section 7.4.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

#### **7.4.1.1 Overburden Wells**

Refer to Section 7.4.1.1 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

#### **7.4.1.2 Monitoring Well Protective Casing**

All monitoring wells shall be completed with break-away surface construction. Refer to Section 7.4.1.3 of Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

## **7.5 WELL DEVELOPMENT**

Newly installed wells will be developed according to Section 7.5 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

## 7.6 GROUNDWATER PURGING AND SAMPLING PROCEDURES

Groundwater samples will not be collected as part of this investigation. Groundwater sampling for the new wells will occur as part of the next annual or semi-annual AMR groundwater sampling event. Sampling will conform to the approved RAWP (TtNUS, 2003a).

## 7.7 WATER-LEVEL MEASUREMENTS

Water-level measurements will be collected in these newly installed wells in accordance with procedures outlined in Section 4.3 of the RAWP (TtNUS, 2003a). Newly installed wells will also be included in future mass water-level measurements following their installation and development.

## 7.8 AQUIFER TESTING

TtNUS anticipates coordinating with other Navy contractors to conduct aquifer tests in wells 11-S and 17-D. The procedures for conducting aquifer testing at 11-S are as follows:

1. Pressure transducers would be installed in wells 11-S and 24-S and set to collect data at 15-minute intervals (See Figure 2-1). Pressure transducers should also be installed in wells MS-37S and MS-38S. The data from well MS-37S will help determine if this well is in the shallow or intermediate zone, and the data from well MS-38S will help determine if water is moving through the ridge feature. Hand measurements of water levels should be taken whenever practicable as a check on the pressure transducers.
2. All recovery wells should be online and pumping for at least 2 to 4 weeks before aquifer testing to ensure relatively stable aquifer conditions.
3. Then well AT3A should be turned off for at least 4 days.
4. Then well AT3A should be turned back on for at least the number of days that it was off.
5. Then well AT8 should be turned off for at least 4 days.
6. Then well AT8 should be turned back on for at least the number of days that it was off.

7. Then well AT9 should be turned off for at least 4 days.
8. Then well AT9 should be turned back on for at least the number of days that it was off.

It can then be assumed that if well 11-S responds to only AT3A pumping, it is in the intermediate flow system, and if it responds to only AT8 and AT9, it is in the shallow flow system.

The procedures for conducting aquifer testing at 17-D are as follows:

1. Pressure transducers would be installed in wells 17-D and 13-IS and set to collect data at 15-minute intervals. Pressure transducers should also be installed in wells 18-S, 4-IS, and 8-D. These wells all moved in tandem during the previous tests under very low gradients. Measuring the water levels during this test should help show if ground water can move vertically under low gradients in Anoka County Park. Hand measurements of water levels should be taken whenever practicable as a check on the pressure transducers.
2. All wells in the systems should be online and pumping for at least 2 to 4 weeks to ensure relatively stable aquifer conditions.
3. Then well AT5B should be turned off for at least 4 days.
4. Then well AT5B should be turned back on for at least the number of days that it was off.
5. Then well AT10 should be turned off for at least 4 days.
6. Then well AT10 should be turned back on for at least the number of days that it was off.
7. Then well AT3A should be turned off for at least 4 days.
8. Then well AT3A should be turned back on for at least the number of days that it was off.

If well 17-D responds to only AT5B pumping, it is in the deep flow system, and if it responds to only AT10 and AT3A, it is in the intermediate flow system.

## 7.9 SURVEYING

The monitoring wells and soil borings installed during this investigation will be surveyed in accordance with Section 7.9 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999). Surveying will occur at an unidentified point in the future, to ultimately be scheduled to optimize the surveyor's time on site by including survey points from other activities.

## 7.10 WASTE HANDLING

Refer to Section 7.10 of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999).

## 8.0 FIELD-RELATED QC SAMPLE PROCEDURES

Soil and groundwater samples will not be collected as part of this investigation. Groundwater sampling for the new wells will occur as part of the next annual or semi-annual AMR groundwater sampling event. Sampling will conform to the approved RAWP (TtNUS, 2003a).

## **9.0 FIELD MEASUREMENT/SCREENING**

This section identifies the field instruments and procedures to be used during the field measurement activities. The field instruments are calibrated prior to each sampling activity as detailed in the following section and their respective SOPs, contained in Appendix B of the Additional Investigation at the NIROP and Anoka County Riverfront Park report (TtNUS, 1999). The information in this section is consistent with details in the approved RAWP (TtNUS, 2003a).

### **9.1 FIELD INSTRUMENT CALIBRATION**

Field instruments to be used during this investigation include photoionization detectors (PIDs). A flame ionization detector (FID) may be substituted for a PID in this investigation. These field instruments will be calibrated as described in SOP ME-12 (PID) in the RAWP. The PIDs are calibrated with isobutylene, and the FIDs are calibrated with methane gas at a concentration of 100 ppm. As a rule, instruments will be calibrated daily prior to use, and the calibration will be checked against standards at the end of each day. For specific instructions on the calibration frequency, the acceptance criteria, and the conditions that will require more frequent recalibration, refer to the specific SOPs for each field analysis.

Calibration procedures, along with frequency of calibration, will be recorded on the field calibration form provided in Appendix D of the Remedial Action Monitoring Plan segment of the RAWP (TtNUS, 2003a).

### **9.2 FIELD MEASUREMENT PROCEDURES**

See Section B of the Quality Assurance Project Plan (QAPP) segment of the RAWP (TtNUS, 2003a).

### **9.3 FIELD SCREENING PROCEDURES**

Not applicable. No field screening is being conducted.

## **10.0 PREVENTIVE MAINTENANCE AND CORRECTIVE ACTION**

Preventive maintenance procedures are followed for each field instrument used during field activities to minimize and identify potential instrument problems. Nonconformances or conditions adverse to quality are also required to be reported immediately to the Task Order Manager (TOM) or Quality Assurance Manager (QAM). These parties, in turn, are charged with correcting and implementing appropriate corrective action as quickly as possible so that work integrity or quality of product is not compromised.

### **10.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE PROCEDURE/SCHEDULE**

See Section B of the QAPP segment of the RAWP (TtNUS, 2003a).

### **10.2 FIELD CORRECTIVE ACTION**

See Section B of the QAPP segment of the RAWP (TtNUS, 2003a).

## REFERENCES

TtNUS, 1999. Additional Investigation at the NIROP and Anoka County Riverfront Park, Naval Industrial Reserve Plant, Fridley, Minnesota. July.

TtNUS, 2003a. Remedial Action Work Plan, Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, January.

TtNUS, 2003b. 2002 Annual Monitoring Report, Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota. August.

United States Geological Survey, 2002. United States Department of the Interior, Water Resources Division, Evaluation of the Capture Zones for Recovery Wells at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota. December.

**APPENDIX A**

**MPCA BRIEF SUMMARY OF TECH  
SUBCOMMITTEE MEETING ON USGS  
CAPTURE EVALUATION**

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

SF-000

## Office Memorandum

DATE: July 14, 2003

TO: Mark Sladec - TetraNUS

FROM: John Betcher - Site Hydrogeologist

PHONE: 651-296-7821

SUBJECT: Brief Summary of Tech. Subcommittee Meeting on USGS Capture Evaluation

On July 8-9, 2003 the NIROP Technical Subcommittee meet to resolve review comments to the USGS-Hal Davis capture evaluation report. During the meeting Hal agreed to make a number of modifications to the report to address comments. It was agreed that Hal should proceed with field tests to resolve several monitoring well issues. The tests involve turning off certain pumping wells and recording the responses in selected monitoring wells near the pumping wells. The tests will resolve which aquifer zones several monitoring wells should be assigned to. The report will be modified to reflect the findings of the field tests.

The Technical Subcommittee views the USGS report as an independent evaluation of the capture effectiveness of the NIROP ground water remedy. The Technical group determined that Hal Davis had done the best possible evaluation of capture at the NIROP given the data available. The group had a relatively high degree of confidence in the capture evaluation in the shallow unconfined aquifer. The most recently installed pumping wells have improved the capture effectiveness in the shallow zone.

There was some uncertainty regarding the extent of the capture zone of AT-3A. The Navy agreed to install a nest of monitoring wells, including a shallow and intermediate well, downgradient of AT-3A to serve as "sentinel" wells to monitor the downgradient impact of AT-3A. There was not consensus regarding the high permeability area near 12-IS ("the nose") and the effect on that zone from pumping well AT-10. It was agreed that the capture zones would be dashed in the USGS report and that there was an acknowledgment that there was some uncertainty in the extent of capture.

In the deep zone there was uncertainty regarding the extent of capture of the deep plume and the impact of AT-3A on the deep zone. This uncertainty will be reflected in the report. It was observed that the levels of contamination in the deep zone were of lower concentration than the other zones. It was determined that monitoring wells classified as intermediate zone wells should continue to be assigned to the intermediate zone rather than be reassigned to the deep zone. The group could not reach consensus regarding upwelling of water from deeper to shallower zones in Anoka County Park. This issue may become important if full scale implementation of the veggie-oil technology is decided.

The group agreed that the evaluation was the best evaluation that could be done given the existing data. The group acknowledged that there was some degree of uncertainty regarding capture, particularly in the intermediate and deep aquifer zones. There was consensus that the evaluation did not warrant additional pumping at this time. There was an acknowledgement that the annual monitoring performed at the site would be reviewed on a yearly basis and that trends in downgradient contaminant levels would be used as another evaluation tool to monitor the effectiveness of capture (as decided in the DQO process). If contaminant levels downgradient of the pump out system do not decrease with time (as data becomes available to establish trends) the capture effectiveness issue will be revisited. In addition it was acknowledged that maintaining the evaluated capture zones depends on the design pumping rates being maintained.

**APPENDIX B**

**USGS DETERMINATION OF FLOW  
ZONES FOR MONITORING WELLS  
11-S AND 17-D (PUMP TEST)**

## Determination of Flow Zones for Monitoring Wells 11-S and 17-D

Two tests are proposed to address data the gaps that were identified in the report "Evaluation of the Capture Zones for Recovery Wells at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota" (in review). And they were discussed at the technical review meeting on July 8 and 9, 2003, in Minneapolis, MN.

### Well 11-S Test

This is a shallow well and is screened near the water-table. This test is recommended because the water levels in 11-S move in tandem with the intermediate and deep wells in the vicinity, and do not fit the trend seen in the water table wells during non-pumping conditions. It is important to understand this well because it is located between pumping wells AT-8 and AT-9. The flow zone that this well is connected to can be resolved by this relatively simple test. The test would be conducted as follows:

1. Pressure transducers would be installed in wells 11-S and 24-S and set to collect data at 15 minute intervals (figs. 1 and 2).

[Pressure transducers should also be installed in wells MS-37S and MS-38S. The data from well MS-37S will help determine if this well is in the shallow or intermediate zone and the data from well MS-38S will help determine if water is moving through the ridge feature.]

[Hand measurements of water levels should be taken whenever practicable as a check on the pressure transducers.]

2. All recovery wells should be online and pumping for at least 2 weeks (4 weeks would be even better) to ensure relatively stable aquifer conditions.
3. Then well AT3A should be turned off for at least 4 days.
4. Then well AT3A should be turned back on for at least the number of days that it was off.
5. Then well AT8 should be turned off for at least 4 days.
6. Then well AT8 should be turned back on for at least the number of days that it was off.
7. Then well AT9 should be turned off for at least 4 days.
8. Then well AT9 be turned back on for at least the number of days that it was off.

If well 11-S responds to only AT3A pumping then it is in the intermediate flow system, if it responds to only AT8 and AT9 then it is in the shallow flow system.

### Well 17-D Test.

Well 17-D is immediately adjacent to the deep zone recovery well AT5B. . This test is recommended because the water level in well 17-D does not fit the trend seen in the deep flow zone wells. However, it does fit the trend seen in the intermediate flow zone wells indicating that this

well may tap the intermediate flow zone and not the deep zone. The purpose of this test is to determine which zone this well screened in.

1. Pressure transducers would be installed in wells 17-D and 13-IS and set to collect data at 15 minute intervals.

[Pressure transducers should also be installed in wells 18-S, 4-IS, and 8-D. These wells all moved in tandem during the previous tests under very low gradients. Measuring the water levels during this test should help show if ground water can move vertically under low gradients in Anoka County Park.]

[Hand measurements of water levels should be taken whenever practicable as a check on the pressure transducers.]

2. All wells in the systems should be online and pumping for at least 2 weeks (4 weeks would be even better) to ensure relatively stable aquifer conditions.
3. Then well AT5B should be turned off for at least 4 days.
4. Then well AT5B should be turned back on for at least the number of days that it was off.
5. Then well AT10 should be turned off for at least 4 days.
6. Then well AT10 should be turned back on for at least the number of days that it was off.
7. Then well AT3A should be turned off for at least 4 days.
8. Then well AT3A be turned back on for at least the number of days that it was off.

If well 17-D responds to only AT5B pumping then it is in the deep flow system, if it responds to only AT10 and AT3A then it is in the intermediate flow system.

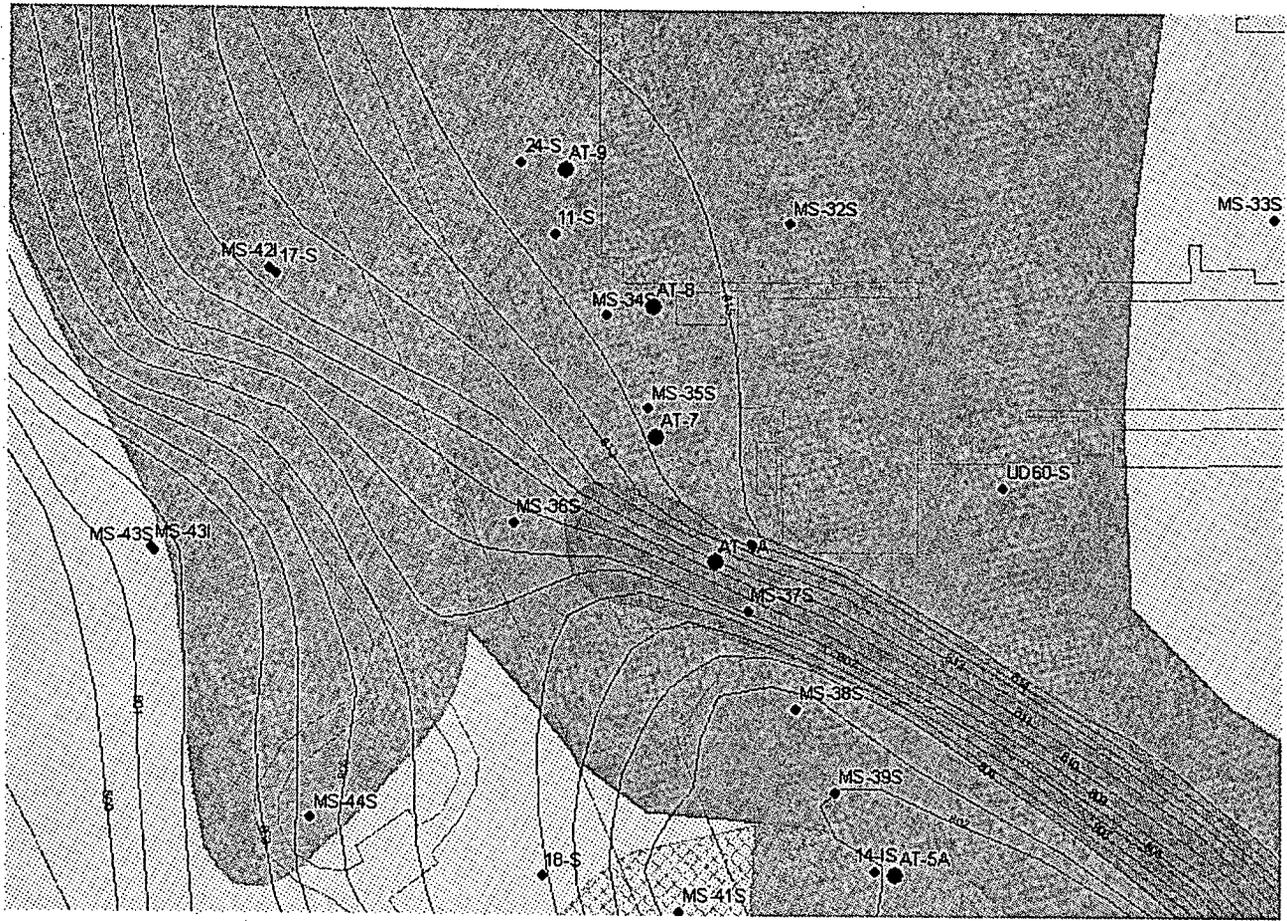


Figure 1. Location of monitoring well 11-S.

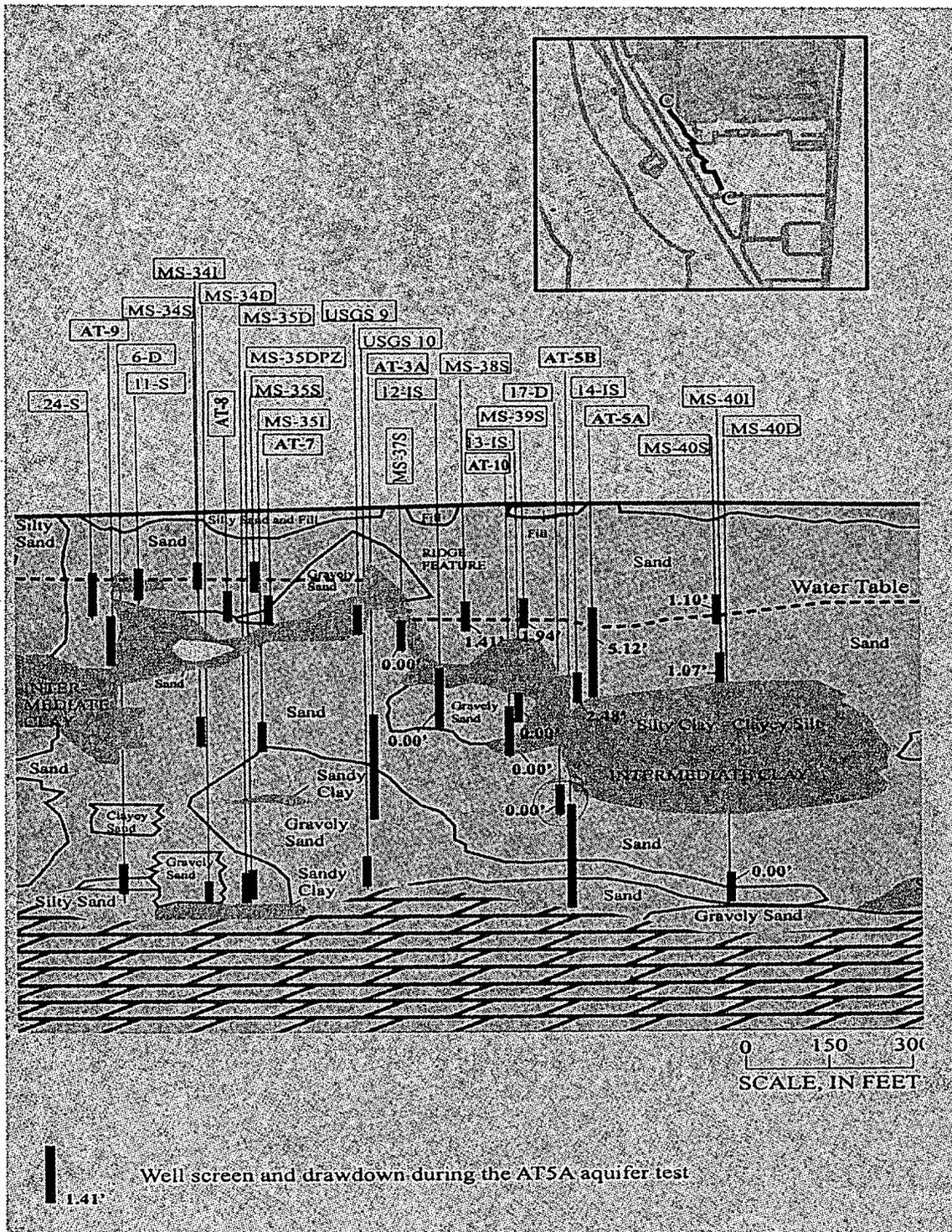


Figure 2. Cross section showing wells and lithology.

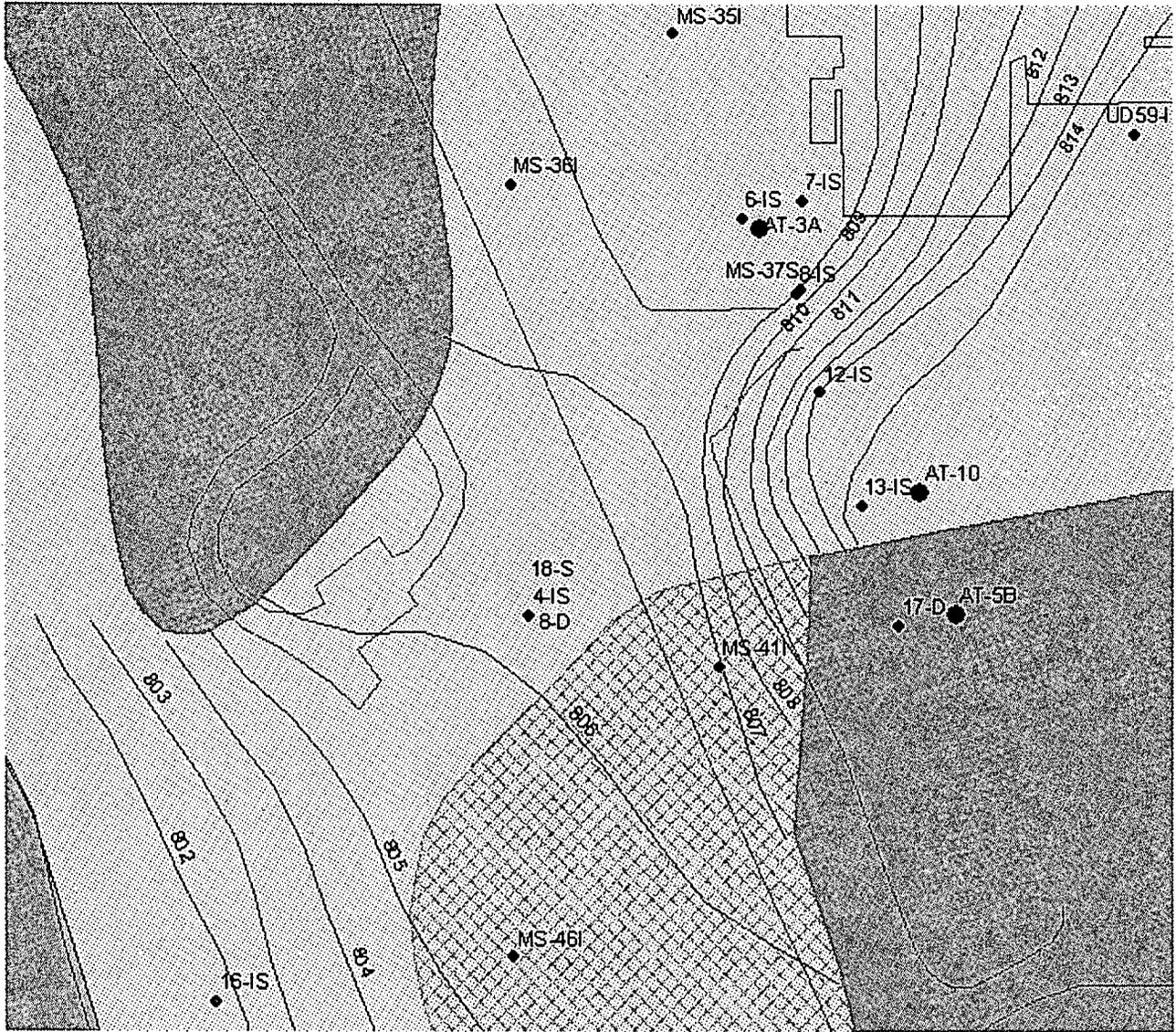


Figure 3. Location of monitoring well 17-D.

**APPENDIX C**

**RESPONSE TO COMMENTS**



**TETRA TECH NUS, INC.**

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PITT-01-4-054

January 28, 2004

Project Number 6966

Commander, Southern Division  
Naval Facilities Engineering Command  
Attn: Dan Owens, Code ES32  
2155 Eagle Drive  
North Charleston, South Carolina 29406

Reference: CLEAN CONTRACT No. N62467-94-D-0888  
Contract Task Order No. 0003

Subject: Response to Comments for Field Sampling Plan Addendum  
NIROP Fridley, Fridley, Minnesota

Dear Dan:

Please find Response to Comments for EPA and MPCA comments on the NIROP Fridley Field Sampling Plan Addendum. Hard copies of the FSP addendum will be provided shortly. Please note that the RTC requested additional borings and a well, and we have generally agreed to install these. This agreement is caveated by the requirement for Anoka County to approve all installation locations. Now that the team is agreed on the scope of the investigation, we will submit a request to Anoka County to approve this scope. We will keep the team updated on progress.

Please call with any questions.

Sincerely,

Mark Sladic P.E.  
Task Order Manager

MS/kf

Enclosure

cc: Dave Douglas, MPCA (1 copy)  
Wayne Hanson, NAVSEA (1 copy)  
Dave Seely, USEPA (1 copy)  
Richard Harris, RAB Co-Chair (1 copy)  
Tim Ruda, UDLP (1 copy)  
Rick Kuhthau, Tech Law (1 copy)



TETRA TECH NUS, INC.

Mr. Dan Owens  
Naval Facilities Engineering Command  
January 28, 2004 – Page 2

John Koehnen, Tech Law (1 copy)  
Hal Davis, USGS (1 copy)  
Venky Venkatesh, CH2MHill (1 copy)  
Paul Walz, Bay West (1 copy)  
Keith Henn, TiNUS (1 copy)  
Mark Perry/File 6966 TiNUS (unbound copy)  
Debra Wroblewski TiNUS (Cover Letter Only)

**RESPONSES TO EPA COMMENTS  
FIELD SAMPLING PLAN ADDENDUM TO THE ADDITIONAL INVESTIGATION  
AT THE ANOKA COUNTY RIVERFRONT PARK  
NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT (NIROP)**

**GENERAL COMMENTS**

1. **Comment:** The Field Sampling Plan Addendum to the Additional Investigation at Anoka County Riverfront Park (FSP Addendum) (pg. 1-1) indicates that "a copy of the Technical Committee 'meeting notes' summarizing the subcommittee meeting can be found in Appendix A." The FSP Addendum (pg. 2-1) similarly indicates that Section 2 "describes the scope of work and rationale to achieve the objectives outlined in the technical meeting memorandum (Appendix A)." However, no Appendix A is provided in the FSP Addendum, and it is not clear what technical meeting memorandum is being referred to. The FSP Addendum should be revised to include a copy of Appendix A.

**Response:** The Navy agrees. The document will be modified accordingly.

2. **Comment:** The FSP Addendum (pg. 1-2) indicates that the planned "aquifer tests follow a protocol developed by the USGS and previously distributed to the Partnering Team (see Appendix B)." However, Appendix B is not provided with the FSP Addendum, and it is not clear what United States Geological Survey (USGS) protocol is being referred to. The FSP Addendum should be revised to include a copy of Appendix B.

**Response:** The Navy agrees. The document will be modified accordingly.

3. **Comment:** Boring SB-10 has been identified as a proposed soil boring on Figure 2-1. However, except to indicate that it will be installed (pg. 2-1), no further mention of this soil boring has been provided in the text of the FSP Addendum. The FSP Addendum should discuss the purpose of the proposed boring SB-10 and indicate how if at all, the lithology identified at this boring will influence the installation of monitoring wells at the other boring locations proposed in the FSP Addendum.

**Response:** The intent of SB-10 is to collect additional lithologic data in this relatively complex geologic environment. SB-8, SB-9, and SB-10 were spread somewhat evenly across the area identified as needing additional data. Based upon the limited area for drilling due to East River Road and the utility corridor SB-10 was added to the plan. If SB-8 and SB-9 do not indicate a presence of an intermediate interval this location will be utilized for the placement of the well. This will be more clearly stated in the work plan. Also please see Navy Responses to the MPCA comments for additional information.

4. **Comment:** The objectives of the proposed investigation, as cited in the FSP Addendum (pg. 2-1), include better definition of the trichloroethylene (TCE) plume in the shallow and intermediate intervals of the unconsolidated aquifer(s) west of AT-10. The installation of monitoring well cluster MS-54 is proposed to address this objective. The proposed location of this well cluster is shown on Figure 2-1. While not clearly stated, it appears that the primary purpose of this well cluster is to better evaluate the degree of capture achieved in the hydraulic feature observed in the intermediate zone in the area of 12-IS and 13-IS. This area has frequently been referred to as the hydraulic 'nose.'

In response to an ongoing review of this FSP Addendum, Hal Davis of the USGS has suggested (in an E-mail dated October 10, 2003) moving well cluster MS-54 further north along the median of East River Road into an area associated with the flatter part of the cone of depression of extraction well

AT-3A. However, moving the well into an area more obviously controlled by AT-3A may not be helpful for evaluating capture in the area of the hydraulic nose.

When reviewing the potentiometric maps prepared by the USGS for the intermediate zone, it has been noted that these maps do not include water level data from monitoring well MS-411. In the December 2002 USGS capture zone analysis, MS-411 was moved into the deep zone. However, as discussed during the NIROP Technical Committee meeting held on July 8 and 9, 2003, it may not be appropriate to eliminate the intermediate zone at many of the locations, as was done in the USGS capture zone analysis, including at MS-411. As shown by Figure 4-8 of the 2001 AMR, if the water-level datum for the pumping scenario from MS-411 is included in the intermediate potentiometric map, the hydraulic nose feature becomes much more evident. This alternate depiction of the potentiometric surface in the intermediate zone under pumping conditions may influence the USGS's analysis of groundwater flow in this area and should be considered in future decision making.

**Response:** The Navy agrees. Placement of MS-54 is appropriate to define the "nose" emanating from the vicinity of 12-IS and 13-IS. The data collected will certainly be considered in future decision making

5. **Comment:** The FSP Addendum (pg. 2-2) indicates that the new well cluster MS-54 will be installed "only if the intermediate monitoring interval is encountered at soil boring SB-08 or SB-09." Given the heterogeneity previously observed in the lithology in this general area, limiting the installation of MS-54 only if the intermediate monitoring zone is encountered in the area of SB-09 does not appear sufficient. If the intermediate flow zone is not found initially at SB-09, additional borings should be completed in this general area to identify this zone. Otherwise, the intermediate flow zone may inadvertently be missed.

Also, the strategy of placing only one other boring some 200 feet north of SB-09 at SB-08 should be justified. Based on the current conceptual model of the site, it would seem unlikely that an intermediate flow zone would be found this far to the north. Consequently, an approach that steps out from SB-09 in smaller increments would appear more appropriate for delineating the northern extent of the intermediate zone in this area. In addition, this was the approach that was discussed in the July 2003 Technical Committee meeting.

**Response:** The Navy agrees. The work plan will be modified to allow more flexibility and in doing so will be modified to include additional potential "step-out" borings per the MPCA comment letter. The Navy has chosen a total 6 additional potential "step-out" borings (2 borings per location) instead of the MPCA suggested 9 additional borings (3 per location). This reduction from MPCA's suggestion is solely due to the limited area where wells can be installed at the site. The obvious road restrictions to the northeast and southwest of the medial strip and large utility corridor beyond the road to the northeast severely limit the available area to locate wells. These additional potential "step-out" borings will only be drilled if the intermediate interval is not found in the original borings SB-8 and SB-9.

As stated in the MPCA response letter additional 2 potential "step-out" may be utilized in the vicinity of SB-10 if the borings around SB-08 and SB-09 indicate that the intermediate interval is not present in the medial strip along East River Road.

Please note that the "decision" to install additional borings identified in MPCA's comment will be made in the field, in "near real-time", so it will not create driller "stand-by" time or more than the one mobilization planned. As stated, these borings will only be installed if needed based upon a field decision considering the suggestions by the MPCA in their comment (e.g., rough geologic cross-sections in the field).

The placement of the well cluster MS-55 (not MS-54 as is stated in the comment) will be selected based upon the data collected from these borings. Assuming the intermediate interval is present MS-54S/I will be installed without "field decision".

6. **Comment:** The FSP Addendum pg. (2-3) indicates that if both SB-08 and SB-09 "show the presence of the intermediate monitoring interval then well cluster MW-55S/I will be installed at SB-09." No rationale has been presented for this decision.

As shown on Figures 19 and 23 of the USGS Capture Zone Evaluation, the presence of an intermediate zone at SB-08 would differ significantly from that assumed during the USGS evaluation. The depiction of potentiometric contours and groundwater flow lines shown on these figures may change significantly with such a scenario. Consequently, additional analysis of probable flow paths under these conditions would appear necessary to identify appropriate monitoring well locations. The above decision rule may be based on the observed distribution of TCE in the intermediate zone. However, due to a lack of monitoring wells in this area, the distribution of TCE north of well cluster MS-36 does not appear to be well established; and previous depictions of TCE may not provide a good basis for locating additional well locations.

Based on the conceptual model for the site, the presence of the intermediate zone at SB-08 would appear unlikely. However, if the intermediate flow zone is found to be present at both locations (SB-08 and SB-09), it may be best to consider installing well clusters at both locations. SB-08 is approximately 200 feet from SB-09, and the influence of extraction well AT-3A may not extend to SB-08. The installation of a well cluster only at SB-08 would leave approximately 400 feet of the 'funnel' in the intermediate zone between SB-08 and MW-36 locations unmonitored. The rationale for choosing the final location(s) for the monitoring well cluster(s) should be clearly described and properly justified.

**Response:** Based upon the geologic information available in addition to the points made it would seem unlikely that the intermediate interval would be present at SB-08. But more importantly, because of the better than expected performance of AT-9 there does not appear to be a debate over capture in this area. On the other hand, the elevated levels of contamination at MS-34I and MS-35I have left cause for concern over the contamination present in the northern vicinity of MS-36. Thus, this area was selected as the more appropriate area for the additional well cluster.

However, the Navy is very interested in working with the EPA and MPCA in achieving closure on the hydrogeologic and contaminant distribution issues at the NIROP site. To that end, the Navy concedes that well(s) will be installed at each location if the intermediate flow zone is present at both boring locations (SB-08 and SB-09). That is, an intermediate well will be installed at SB-08 and a shallow/intermediate well cluster will be installed at SB-09 if the intermediate flow zone is present at both locations (a shallow well is not needed at the SB-08 location due to other wells located nearby). This assumes that these two clusters will be approximately 150 feet or greater apart. This will not apply if "step-out" borings are utilized (implying that the clusters will be less than 150 feet apart from one another).

**RESPONSES TO MPCA COMMENTS  
MODIFICATIONS TO "FIELD SAMPLING PLAN ADDENDUM  
TO THE ADDITIONAL INVESTIGATION  
AT THE ANOKA COUNTY RIVERFRONT PARK,"  
DATED SEPTEMBER 30, 2003**

- 1. Comment:** The rationale for SB-10 is not entirely clear. It would seem that one of the primary purposes of the borings is to better define lithology. The MPCA staff requests that a third goal of the work plan be added, i.e., to better define lithology in the study area. If there is additional clarification regarding the rationale for boring SB-10, the MPCA staff requests that the clarification be included in the work plan.

**Response:** The Navy agrees to more clearly state the objective in the work plan. The intent of proposing soil boring SB-10 is to further better define lithology at this complex geological environment. Based upon the limited area for drilling due to restrictions of East River Road and the utility corridor SB-10 was added to the plan. If SB-8 and SB-9 do not indicate a presence of an intermediate interval this location may be utilized for the placement of an intermediate monitoring well. This will be more clearly stated in the work plan. Also please see Navy Responses to the EPA comments for additional information.

- 2. Comment:** The new hydrogeologic model of the site includes the "funneling" of ground water through a gap in the low permeability (silty clay) unit in the intermediate zone. Presumably, one of the objectives of this work is to clarify the lithologic relationships in this area, i.e., to address this question, "What is the extent of the intermediate aquifer in relation to the silty clay layer?" Once this is known, locations for two nests of wells will be determined. The wells will be used to collect hydraulic head and chemistry data. The data will be used to assist in plume definition and plume capture evaluations, which is the issue raised at the Technical Subcommittee meeting regarding the United States Geological Survey (USGS) capture effectiveness report, "Evaluation of the Capture Zone for Recovery Wells at Naval Industrial Reserve Ordnance Plant, Fridley, MN - (USGS Open File Report - In Preparation," dated December 17, 2002.

**Response:** The Navy agrees. The intent of the proposed work is to further refine the hydrogeologic model of the site and to foster a better understanding of the site conditions and remedy performance by the Technical Subcommittee.

- 3. Comment:** The geology in the study area is complex due to the glacio-fluvial processes that were at work during the erosional and depositional events that created the lithologic sequence. As we have observed in the past, with this and other areas of the site (AT-2 and AT-10 areas), lithology can change greatly over short horizontal and vertical distances. The changes can profoundly influence ground water flow. A little upfront field work could avoid locating the monitoring wells in less than desirable locations. The additional upfront work can optimize the time and money spent and maximize the quality of the data to be collected. Some flexibility in the field should be built into the work plan.

The best approach for success in properly locating monitoring wells that provide the best data in glacio-fluvial sequences is to do a series of "step-out" borings at a more closely spaced interval. As data is collected from the borings in the field a cross section can be roughed out and the geology interpreted. The data is then reviewed in the field and a decision made as to the best location of the wells.

The MPCA staff requests that in the proposed MS-54S/I, SB-08 and SB-09 locations a series of up to three borings be planned for each location rather than using a single or several fixed

locations. In the case of SB-08 and SB-09, the geology may change greatly in the 200 feet between borings and the complexity of the geology may not be understood. Such rapid lithologic changes were observed between the former AT-2 and the 6-D locations. Although the specific reasoning for SB-10 is not fully articulated in the work plan it is possible that a series of borings in this location may be needed to clarify the lithology. Three borings may not be required in each location if the geology proves to be less complex; the number of borings can be determined in the field as the data is collected.

This work is an opportunity to define the northern and southern edges of the "funnel" and to better define the relationship between the silty clay layers and the extent of the intermediate aquifer. An evaluation of the data collected in the field will lead to a better decision regarding where to locate the monitoring wells so that they provide the best data for plume and capture evaluations, i.e., optimization of the well locations. The MPCA staff requests that the work plan be modified to include field flexibility and "step-out" borings to define the lithologic relationships and to locate the proposed monitoring wells.

**Response:** The Navy agrees. As stated in previous comment responses, the intent of SB-10 was to accomplish this point. However, it is understood that due to the correctly stated points by the MPCA, the work plan will be modified to allow more flexibility. The work plan will be modified to include additional potential "step-out" borings. The Navy has chosen a total 6 additional potential "step-out" borings (2 borings per location) instead of the suggested 9 additional borings (3 per location). This reduction is solely due to the limited area where wells can be installed at the site. The obvious road restrictions to the northeast and southwest of the medial strip and large utility corridor beyond the road to the northeast severely limit the available area to locate borings/wells. These additional potential "step-out" borings will only be drilled if the intermediate interval is not found in the original borings SB-8 and SB-9.

To meet the MPCA's objective, the additional 2 potential "step-out" not used in the vicinity of SB-8 and SB-9 will potentially be utilized in the vicinity of SB-10 if the borings around SB-08 and SB-09 indicate that the intermediate interval is not present in the medial strip along East River Road.

Please note that the "decision" to install additional borings identified in MPCA's comment will be made in the field, in "near real-time", so it will not create driller "stand-by" time or more than the one mobilization planned. As stated, these borings will only be installed if needed based upon a field decision considering the suggestions by the MPCA in their comment (e.g., rough geologic cross-sections in the field).

4. **Comment:** The MPCA staff requests that the Navy add the draft USGS report to the list of references. Much of the work proposed in this work plan was recommended in the report.

**Response:** The Navy agrees.

5. **Comment:** The MPCA staff will defer to Hal Davis of the USGS to review the pump test procedures outlined in the work plan.

**Response:** The Navy agrees.