N91192.AR.000416
NIROP FRIDLEY
5090.3a

An Employee-Owned Company

Science Applications International Corporation

REMEDIATION PROGRAM NEEDS ASSESSMENT FOR NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA

SAIC Project 01-1408-04-9912-100

Prepared for

Southern Division
Naval Facilities Engineering Command
North Charleston, SC

Contract No.: N47408-98-C-2228

October 1998

3240 Schoolhouse Road, Middletown, Pennsylvania 17057 • (717) 944-5501 • (800) 944-6778

An Employee-Owned Company

REMEDIATION PROGRAM NEEDS ASSESSMENT FOR NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA

SAIC Project 01-1408-04-9912-100

Prepared for

Southern Division
Naval Facilities Engineering Command
North Charleston, SC

Contract No.: N47408-98-C-2228

October 1998

3240 Schoolhouse Road, Middletown, Pennsylvania 17057 • (717) 944-5501 • (800) 944-6778

REMEDIATION PROGRAM NEEDS ASSESSMENT FOR NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA

SAIC Project 01-1408-04-9912-100

Prepared for

Southern Division
Naval Facilities Engineering Command
North Charleston, SC

Contract No.: N47408-98-C-2228

Prepared by

Science Applications International Corporation
3240 Schoolhouse Road
Middletown, PA 17057
(717) 944-5501

October 1998

TABLE OF CONTENTS

Page

LIST OF ACRONYMS . . . . . Preceding Text

EXECUTIVE SUMMARY . . . . . Preceding Text

1.0 INTRODUCTION 1

1.1 Purpose and Objectives 1
1.2 Needs Assessment Approach and Presentation of Results 2
1.3 Summary of Site Conditions 2
1.4 Description of OU-1 Remedial Program 6
1.5 Current Versus Future Operations 7

2.0 BACKGROUND INFORMATION REVIEW 8

3.0 SITE EVALUATION SUMMARY 9

4.0 EVALUATION OF REMEDIATION PROGRAM 10

4.1 Approach to Remedial Program Evaluation 10
4.2 Remedial Treatment Technology 10

4.2.1 Evaluation of Technology 10

4.2.1.1 Evaluation of Existing Pump and Treat Versus Alternative Treatment Technologies 10
4.2.1.2 Hydraulic Capture and Mass Removal Efficiency 13
4.2.1.3 System Scaling and Fouling 14

4.2.2 Identification of Possible Alternatives 15

4.3 Treatment System Component Design and Configuration 17

4.3.1 Evaluation of Existing Design 17

4.3.1.1 Extraction Well System 17
4.3.1.2 Use of Existing Bypass Line to the Sanitary Sewer 20
4.3.1.3 Influent Pumping System 20
4.3.1.4 Effluent Pumping and Monitoring 21
4.3.1.5 Anti-Scaling System 22

4.3.2 Identification of Possible Alternatives 22

4.4 Treatment Systems Operations and Maintenance Functions and Cost 23

4.4.1 Preventive, Predictive, and Unscheduled Maintenance Activities 23
4.4.2 Tray Aerator Disassembly 25
4.4.3 Operation and Contractor Consistency 25
4.4.4 System Automation 25
4.4.5 Identification of Possible Alternatives 26

4.5 System Sampling and Monitoring Requirements 27

4.5.1 Evaluation of Sampling and Monitoring Requirements 27
4.5.2 Identification of Possible Alternatives 28

4.6 Wellhead Control and Monitoring 29

4.6.1 Wellhead Controls and Automation 29
4.6.2 Identification of Possible Alternatives 30

4.7 Treatment System Control and Monitoring 31

4.7.1 System Controls and Automation 31
4.7.2 SCADA Description 31
4.7.3 SCADA Location and Access 32
4.7.4 Identification of Possible Alternatives 32

4.8 Data Acquisition and Reporting 33

4.8.1 Evaluation of Current Data Acquisition and Reporting Program 33
4.8.2 Groundwater and Contaminant Capture Monitoring 34
4.8.3 Identification of Possible Alternatives 34

4.9 Future Remediation System Requirements 36

4.9.1 Future Additional Remediation Activities 36
4.9.2 Future SCADA Needs 37
4.9.3 Identification of Possible Alternatives 37

5.0 ALTERNATIVES COST REDUCTION ANALYSES 38

5.1 Approach to Cost Analysis 38
5.2 Final Cost-Saving Alternatives 40

5.2.1 Well Field Modification 40
5.2.2 Bypass to Sanitary Sewer 41
5.2.3 Gravity Discharge to Storm Sewer 42
5.2.4 Influent and Effluent Pump Upgrades 42
5.2.5 Optimize Operations and Maintenance 43
5.2.6 Streamline Sampling and Monitoring Program 43

5.2.7 Wellhead Monitoring Upgrade 44
5.2.8 SCADA Upgrade and Automated Reporting 45

5.2.8.1 SCADA Upgrade 45
5.2.8.2 Develop Automated Data Collection and Reporting System . . . 45
5.2.8.3 Perform SCADA-Supported Planned Maintenance 46

6.0 SUMMARY AND RECOMMENDATIONS 47

6.1 Summary and Ranking of Final Alternatives 47
6.2 Recommendations 47

LIST OF FIGURES

Figure 1, Conceptual Approach to Needs Assessment 3

Figure 2, NIROP Facility and Site Location Map 4

Figure 3, NIROP Facility Site Plan 5

Figure 4, Schematic Design of Phase 1 and Phase 2 Treatment Systems 18

LIST OF TABLES

Table 1, Summary of Evaluation of Remediation Program 11

Table 2, Groundwater Extraction Well Design Information 19

Table 3, Summary of Alternatives Cost Reduction Analyses 39

Table 4, Summary of Final Alternatives Evaluation and Ranking 48

LIST OF APPENDICES

Appendix A, Information Review Correspondence and Document Documentation, and Site Visit Summary Report . . . . . Following Text

Appendix B, Needs Assessment Evaluation Modules . . . . . Following Text

Appendix C, Cost Analyses Tables, Calculations, and Supporting Information . . . . . Following Text

LIST OF ACRONYMS

ASU	-	air-stripper unit
CSV	-	comma-separated variable
DBF	-	data base files
EPA	-	United States Environmental Protection Agency
GC/MS	-	gas chromatograph/mass spectroscopy
gpm	-	gallons per minute
GWTF	-	groundwater treatment facility
HAP	-	Hazardous Air Pollutants
hp	-	horsepower
LCD	-	liquid crystal display
MCES	-	Metropolitan Council of Environmental Services
MMI	-	man-machine interface
MPCA	-	Minnesota Pollution Control Agency
NA	-	Needs Assessment
NAVFAC	-	Naval Facilities Engineering Command
Navy	-	United States Navy
NIROP	-	Naval Industrial Ordnance Plant
NPDES	-	National Pollutant Discharge Elimination System
O&M	-	operations and maintenance
PLC	-	programmable logic controller
POTW	-	publicly owned treatment works
QA/QC	-	quality assurance/quality control
RI/FS	-	Remedial Investigation/Feasibility Study
ROD	-	Record of Decision
ROI	-	"return on" investment
SAIC	-	Science Applications International Corporation
SCADA	-	Supervisory Control and Data Acquisition
SVE	-	soil vapor extraction
TCE	-	trichloroethene
UDLP	-	United Defense Limited Partnership
VOC	-	volatile organic compound

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report presents the results of a Needs Assessment (NA) of the groundwater remediation program at the Naval Industrial Ordnance Plant (NIROP) located in Fridley, Minnesota. The general purpose of the NA is to assure that the remediation program is optimized with respect to performance and cost. The current Phase 1 and Phase 2 components of the NIROP remediation program were evaluated. The NA consisted of a review of available background information and data, in addition to information collected during an on-site visit to the facility. Potential cost-saving opportunities were identified, and an analysis of these was performed. The results of these activities, along with recommendations for implementing the identified cost-saving alternatives, are provided in this report.

The NIROP site, currently operated by the United Defense Limited Partnership (UDLP), is located on glacial sands and gravel overlying carbonate bedrock adjacent to the Mississippi River. Historical chemical releases have resulted in the presence of elevated concentrations of several chlorinated solvents, primarily trichloroethene (TCE), within the uppermost sand and gravel aquifer. Impacted groundwater flows off-site, eventually discharging to the Mississippi River.

The Phase 1 remedial action involves hydraulic containment and the capture of contaminant source groundwater from NIROP, and to the extent feasible, the recovery of impacted groundwater downgradient of the NIROP property. This remedial action consists of the operation of six groundwater extraction wells; the treatment of recovered water using an air-stripping system; and the discharge of treated waters to the Mississippi River.

Following a preliminary review of initial background information, a site visit was conducted to obtain additional information and a thorough understanding of site conditions. At the conclusion of the site visit, the evaluation team presented preliminary conclusions and recommendations in an exit debrief. Information was collected and summarized on a set of standardized data collection modules which were then used to complete the evaluation of the remediation program and to perform the cost analyses. Eight separate elements of the remediation program were evaluated with respect to performance, cost, and relevant other factors:

- The conclusions reached indicate that the groundwater pump-and-treat technology is the most appropriate approach for addressing this site. Conditions at the site show that the plume size is decreasing and is not expanding downgradient, and that equilibrium chemical conditions within the plume are possibly being approached. The well field management

techniques that are being employed are increasing the organic and inorganic fouling of the wells and treatment system because they are resulting in aquifer dewatering and induced high groundwater flow velocities. The data also indicate that there may be opportunity for increasing the capture efficiency of the well field.

Potential modifications to the well field and well field management program include the installation of two additional shallow extraction wells, pumping of all wells at a decreased rate, and discontinuation of pumping of extraction well AT-1A. These changes should decrease system fouling and increase well field capture efficiency.

- The results of the treatment system component design and configuration evaluation indicated that no significant deficiencies exist. However, maximum use is not being made of the existing system's control and data acquisition capability, and the remote control capability of the system is also limited. Furthermore, much of the system monitoring information is collected manually. These deficiencies prohibit effective coordination between groundwater contamination monitoring and pump-and-treat system operation which collectively result in less than optimum system operating efficiencies.

- Other system components evaluated in detail included the influent pumping system, the anti-scaling system, the air-stripping system, the effluent pumping and monitoring system, and the chemical cleaning system. Based upon this review, three possible cost-saving changes to the system configuration were identified. First, the bypass line from the extraction wells directly to the sanitary sewer can be used during future stripper system downtime. Second, the addition of a gravity storm sewer discharge line and automated controls can be added to minimize or eliminate the use of the effluent pumps. Third, the upgrade of influent and effluent pumps to incorporate variable-speed drives is also recommended. Each of theses changes will result in reduced operating costs and lower electrical power consumption.

- Operations and maintenance (O&M) activities at NIROP include preventative, predictive, and unscheduled activities. Pre-scheduling of preventative tasks and performing predictive tasks in accordance with observed system operations should provide a reduction in O&M costs. O&M costs may be further reduced through the effective utilization of the proposed upgraded Supervisory Control and Data Acquisition (SCADA) system.

- Groundwater monitoring and treatment system sampling represent a significant continuing operating cost component at the NIROP facility. Each year, approximately 133 water samples are collected for volatile organic compound (VOC) analysis by gas chromatograph/mass spectroscopy (GC/MS) methods. Historical trends of the VOC analysis from several of the wells indicate concentrations of target VOCs that are significantly below the action levels. Moreover, other wells are now known to be upgradient or cross-gradient, or provide redundant and/or unreliable data.

  Three possible cost-saving alternatives with respect to the current groundwater sampling and monitoring plan have been identified. These include reducing the number of wells being sampled, altering the sampling frequency for other monitoring wells from semiannual to annual sampling, and changing the method of analysis from the GC/MS to the less expensive GC method. These changes will result in the elimination of sampling for 8 wells and the reduction of the sampling frequency of 10 wells.

- The present manual monitoring and control of the groundwater collection system wellheads are inefficient. There is opportunity for cost savings through upgrade of wellhead equipment to allow remote monitoring and control of well pumps, and the addition of groundwater elevation and pressure sensors on collection system connective piping.

- The current treatment control system uses a supervisory computer which also serves as a limited SCADA system. The system, which has limited monitoring and data storage capability, can be easily upgraded. Provision can be made for remote access to both historical and current treatment system monitoring data and key operating functions which will result in improved operating and monitoring efficiencies and cost savings, especially if unattended operation is required in the future. Consideration should also be given to using the SCADA system to monitor and analyze system equipment performance, groundwater capture effectiveness, and VOC concentration changes over time.

- Data acquisition and reporting represents a significant cost component of the current remediation program. Most system monitoring, data acquisition and compilation, and report preparation tasks are now manually performed. Improving the existing SCADA system to provide for remote monitoring and control, increasing data storage and access capabilities, and adding software to retrieve and process data and produce automated and standardized reports will result in significant long-term efficiencies and cost savings. Benefits from this

upgrade include a lower cost for data input, a reduced potential for input errors, improved access to data from remote locations, and efficient remote response to routine alarms without the expenses of an on-site operator.

Ongoing remedial investigation and risk analyses may result in the need for further remedial action aimed at source reduction. Any resulting remediation system can be designed as stand-alone with a separate control panel and controller, or a new system could be integrated with the existing groundwater extraction system if the current treatment system SCADA is properly configured. Therefore, the treatment system control panel for the current system should be expandable to handle the additional inputs, or the system programmable logic controller (PLC) should be expandable so that it can be made to interface with additional control panels. Proper configuration of the current SCADA now would facilitate any future expansion. The value of anticipating these future SCADA needs cannot be accurately estimated; however, significant savings are likely to result.

A cost analysis was performed on all of the identified alternatives. The objectives of the cost analysis were to further quantify and refine the cost savings for each identified alternative, rank them in accordance with their cost benefit value, further evaluate the highly ranked alternatives with respect to cost to implement and cost savings, and present a set of recommendations that includes a summary of cost savings and "return on investments" (ROIs) for the highest ranked alternatives. Eight significant cost-saving alternatives were eventually evaluated in detail. These alternatives are as follows: modification of the current well field; provision of a bypass for captured water to the sanitary sewer; reconfiguration of system plumbing to allow for gravity discharge of effluent; upgrade of system influent and effluent pumps through the use of variable speed controllers; implementation of a detailed preventative and predictive maintenance program; reduction of the number and frequency of monitoring well samples collected; modification of the sample analysis analytical method; automation of the wellhead and remedial systems controls; and upgrade of the automated control, monitoring, data acquisition , and reporting capabilities of the remedial system.

The most significant cost reduction opportunities include the following: upgrading the well field results in cost reduction of as much as $75,000 per year with an ROI of less than 3 years; modifying the groundwater monitoring program has an estimated yearly value of $26,600 and an ROI of less than 1 year; and providing for gravity discharge of the effluent, upgrades of the wellhead monitoring system, and providing an improved SCADA and automated reporting capabilities each provide estimated yearly cost savings of approximately $16,000 and associated ROIs of 1 to 3 years.

The total cost savings resulting from the eight alternatives identified for the NIROP groundwater remediation program is approximately $160,000 per year and represents approximately 20 percent of the projected long-term O&M yearly costs for this facility. The value weighted ROI for the 8 alternatives is approximately 2.4 years.

It is recommended that those proposed alternatives indicating potential for the greatest cost savings be evaluated in greater detail under the next phase of this project, which should include the following activities: meet with Naval Facilities Engineering Command (NAVFAC) Southern Division and other appropriate personnel; further confirm the cost basis and assumptions used in the financial analyses; identify those alternatives to be evaluated in greater detail; conduct preliminary discussions with appropriate regulatory agencies concerning those alternatives requiring regulatory approval; perform a 30 percent engineering design for those alternatives where design is required; develop more detailed cost estimates and refine financial analysis based on firm cost and engineering design; and develop a detailed strategy and plan for implementing those alternatives confirmed to provide a significant ROI and that indicate a high potential for successful execution.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 Purpose and Objectives

Science Applications Corporation (SAIC) has completed a Needs Assessment (NA) of the groundwater remediation program at the Naval Industrial Ordnance Plant (NIROP), located in Fridley, Minnesota. This NA was performed in accordance with SAIC's contract entitled "Assessment of Groundwater Extraction System and Groundwater Treatment Facility for Optimization of Long-Term Operation and Long-Term Monitoring Performance" (Contract No. N47408-98-C-2228, dated March 19, 1998). The results of this NA are presented in this report.

The general purpose of the NA is to assure that the groundwater remediation program is optimized with respect to performance and cost. The specific objectives of the NA are as follows:

- Evaluate the present remediation technology and strategy, groundwater remediation system design, and system operations and maintenance (O&M) program with respect to performance and costs.

- Evaluate modifications to the groundwater remediation program and upgrades to the remediation system hardware and software components that may improve performance and/or reduce short-term and long-term remediation program costs.

- Make specific recommendations for change where potential modifications are shown to offer a significant financial "return on investment" (ROI), or provide other significant nonmonetary benefits.

This NA evaluates two distinct phases of the groundwater remediation program at NIROP. Phase 1, which has been ongoing since September 1992, consists of groundwater extraction and discharge of untreated water to the municipal sanitary sewer. Phase 2, which completes construction in October 1998, involves the addition of a groundwater treatment facility (GWTF), followed by discharge to surface water. The reason for completing the NA at this time is to identify cost savings and/or performance enhancement measures that could easily be incorporated into the remedial program during the final stages of construction or during the early operations phase.

1.2 Needs Assessment Approach and Presentation of Results

The NA consists of a number of tasks, the flow of which is shown in Figure 1, and the results of which are presented in this report. Available background information and data were evaluated and are summarized in Chapter 2.0. This information was used to determine the major elements of the program to be evaluated and to identify information to be collected during the on-site evaluation. Based upon the initial review of the background information, an on-site evaluation was planned and completed. The results of the site evaluation are presented in Chapter 3.0. Using the background and site visit information, the major components of the remedial program were further defined, opportunities for improvement of the major program elements identified, and a listing of potential cost-saving alternatives developed. The list of alternatives was initially screened against a set of criteria that includes technical feasibility; public and regulatory considerations; advantages and disadvantages with respect to performance; O&M and program administration; and effect on direct and indirect program costs. Alternatives deemed to be technically sound, potentially achievable, and provide possible cost savings were identified and are discussed in Chapter 4.0.

A more detailed financial analyses was performed on those cost-saving alternatives that were deemed to provide significant cost savings and/or provide performance enhancements. These results are presented in Chapter 5.0. The alternatives are then ranked based on monetary value, and with consideration of ROI. Chapter 6.0 presents cost savings and ranking of cost-saving alternatives, and provides recommendations for implementation of selected alternatives.

1.3 Summary of Site Conditions

The United States Navy (Navy) has instituted a groundwater remediation program at the NIROP facility in accordance with a 1990 Record of Decision. The 80-acre site in Fridley, Minnesota, is located in an industrial area approximately 1,000 feet from the Mississippi River (Figure 2). The NIROP portion of the site consists of approximately 35 acres of the total 80-acre site. The remaining 45 acres belong to United Defense Limited Partnership (UDLP), which also operates the entire site. The NA addresses only the Navy portion of the site which is shown in Figure 3.

Chemical releases into the groundwater have occurred in association with historical manufacturing and waste handling activities at the site. The uppermost unconsolidated aquifer contains elevated concentrations of several chlorinated solvents, with trichloroethene (TCE) being the primary constituent of concern. Groundwater containing dissolved VOCs extends southwestward beneath the adjacent public Anoka County

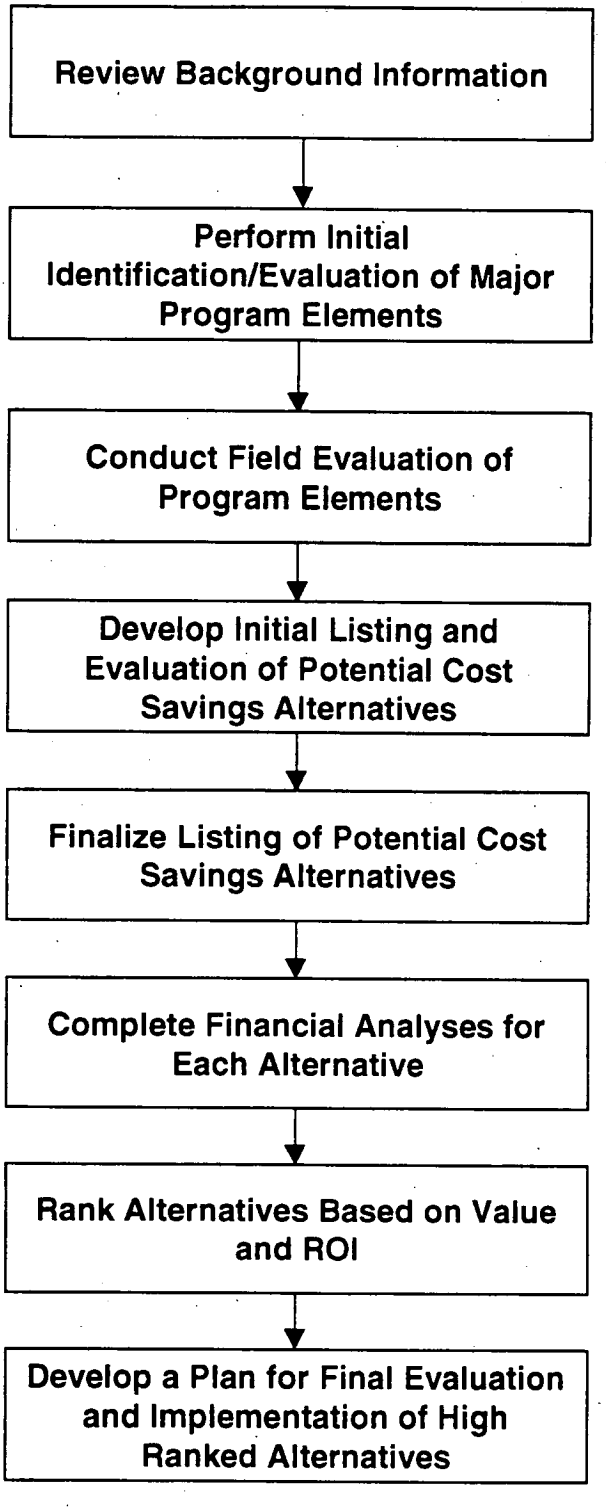
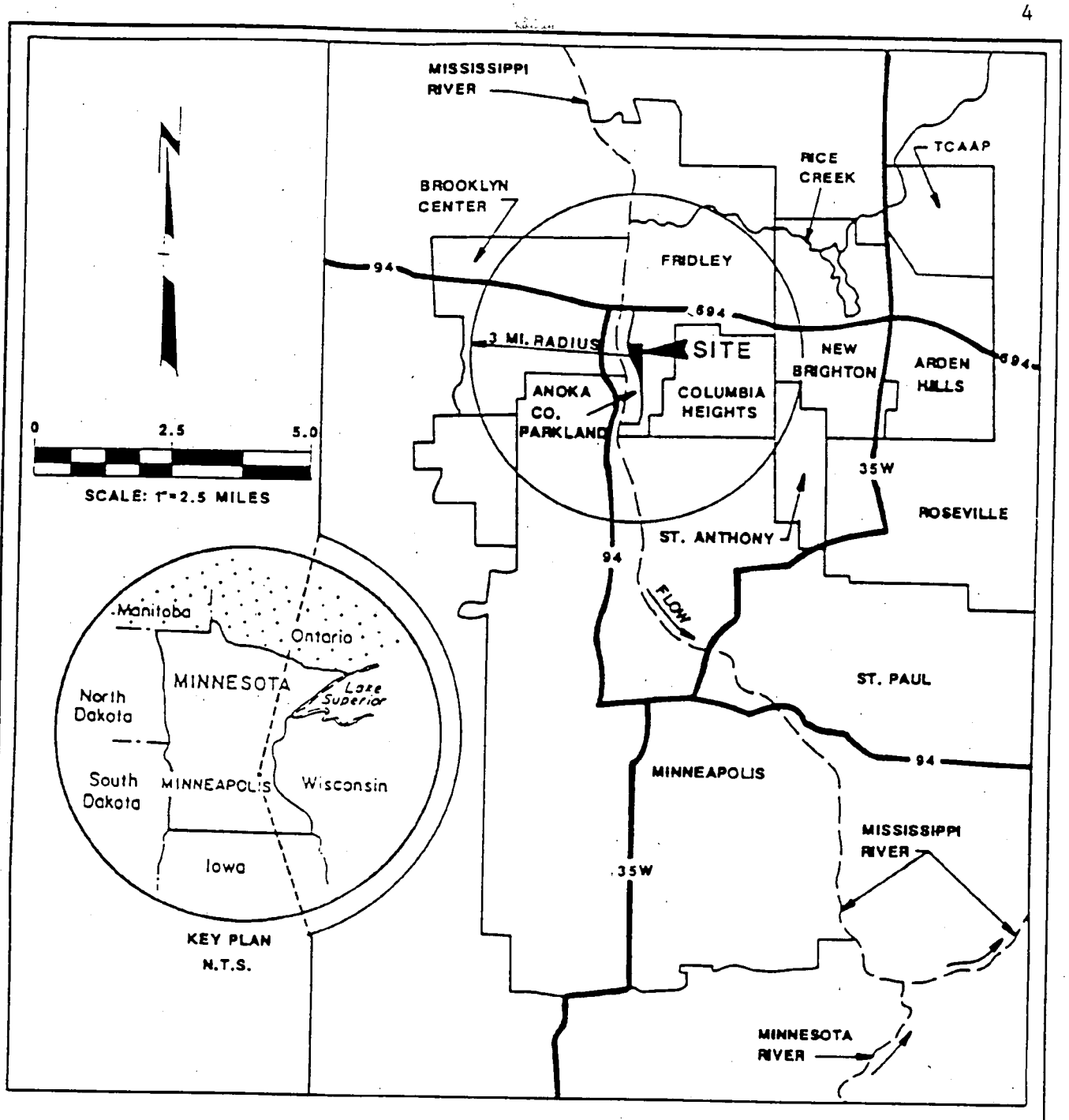


FIGURE 1 - Conc ptual Approach to Needs Ass ssm nt



(SOURCE: RMT INC. REPORT, AUGUST 1988)

FIGURE 2 - NIROP Facility and Site Location Map

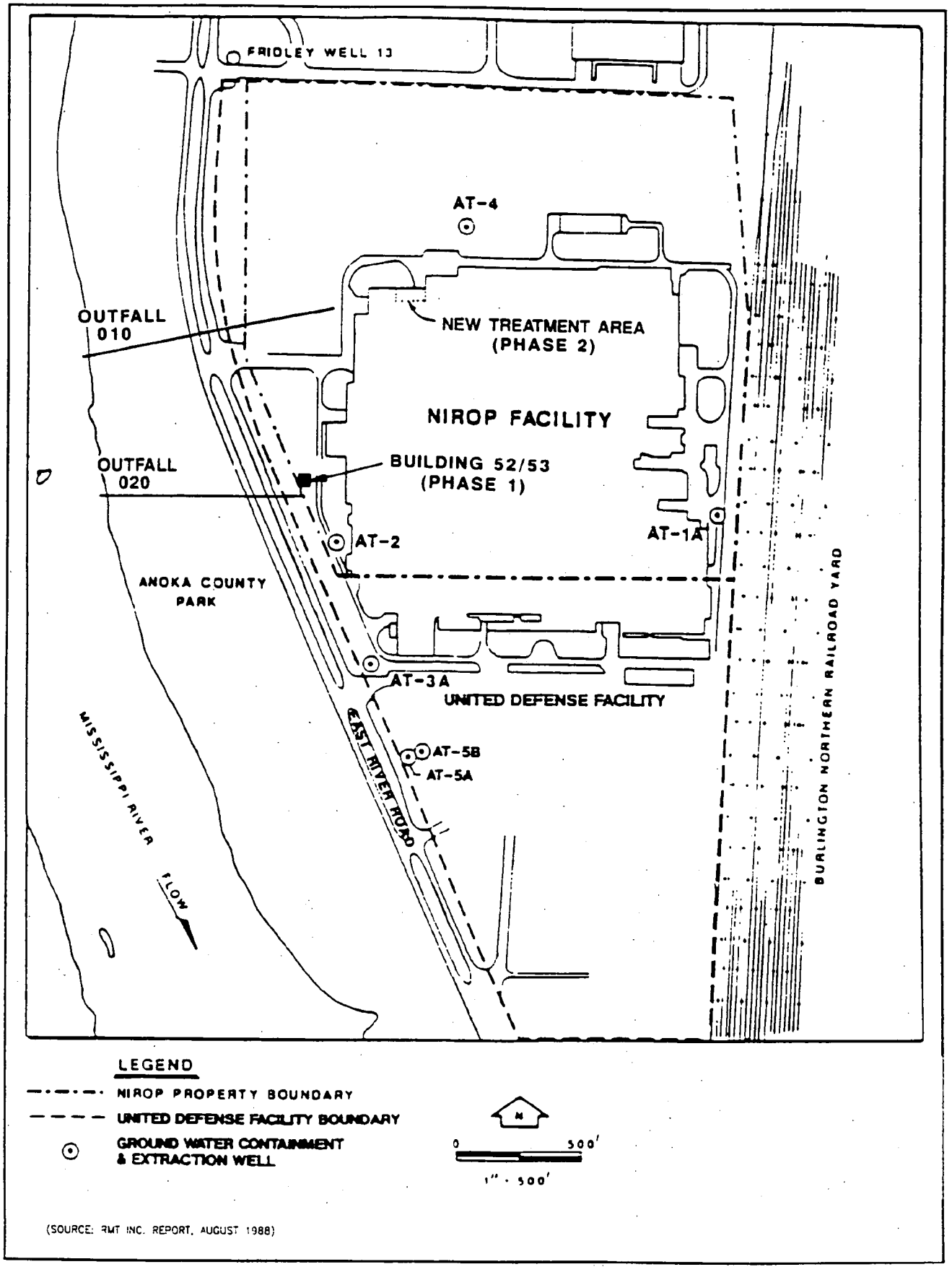


FIGURE 3 - NIROP Facility Site Plan

Park, and discharges into the Mississippi River. Risk assessment results have determined that the discharge of VOC-containing groundwater to the river presents a potential risk to the City of Minneapolis water supply intake which is located less than one mile downstream from NIROP. The current remedial action involves hydraulic containment and recovery of future migration of contaminated groundwater from NIROP and the recovery and treatment, to the extent feasible, of impacted groundwater in Anoka County Park downgradient of NIROP property.

Several sources of groundwater contamination have been identified at NIROP. Buried drums that were located outside of the main building have been removed. Additional sources are expected to remain beneath the building. A Remedial Investigation and Feasibility Study (RI/FS) for the groundwater operable unit has been completed for NIROP, and the Navy has assumed responsibility for addressing environmental impacts in accordance with these results. Additional investigations of conditions beneath the building, as well as an evaluation of residual groundwater contamination that remains in Anoka County Park, are ongoing.

Groundwater flow and discharge conditions are controlled primarily by the highly permeable nature of the upper unconsolidated aquifer deposits and the close proximity of contaminant source areas to the Mississippi River. A less permeable till layer underlies the uppermost aquifer. This layer, in conjunction with generally upward hydraulic gradients, impedes the downward migration of VOCs. As a result, the most highly impacted groundwater occurs in the uppermost portion of the aquifer and moves horizontally towards the river. Groundwater flow rates are estimated to range between 100 and 200 feet per year. This flow rate causes significant migration and concurrent dilution of impacted groundwater away from the source areas.

1.4 Description of OU-1 Remedial Program

The ROD specifies hydraulic containment and recovery of future migration of VOC-containing groundwater from NIROP. The selected remedy includes the operation of six groundwater extraction wells, with a two-phase plan for treatment and disposal of groundwater from the well system. Under Phase 1, the groundwater is being discharged to an existing sanitary sewer for treatment at the local wastewater treatment facility.

For Phase 2, a GWTF has been constructed to provide long-term groundwater treatment. The treatment system consists of a groundwater extraction and feed system, an air-stripping system comprised of four tray aerators, a chemical cleaning and anti-scale polymer injection system, and an effluent discharge system.

Treated water will be discharged through an outfall into the Mississippi River under a National Pollutant Discharge Elimination System (NPDES) discharge permit.

1.5 Current Versus Future Operations

The Phase 1 system is operated by UDLP. However, the Navy is in the process of divesting itself of the site but will retain responsibility for completing site remediation. The site, therefore, will be owned and operated by others in the near future, while the government will retain the responsibility for O&M of the site environmental remediation systems. UDLP may or may not be the future site owner-operator and may or may not operate and maintain the remediation system(s).

The scope of remediation at NIROP may also expand in the next several years. Additional suspected sources of VOCs may exist beneath the manufacturing building, and the residual groundwater contamination in Anoka County Park that is beyond the zone of influence of the existing groundwater extraction system may require further treatment. These additional areas of contamination are currently under investigation. Pending results of the ongoing investigation and risk analysis, additional soil and groundwater remediation systems may be required to address these additional areas of contamination. In the event that this does occur, the government will be responsible for operations, maintenance, and monitoring of an expanded remedial program on a site owned by others. This potential outcome will have a significant effect on the configuration of the current remediation system and its potential integration with others at the site with respect to remote operations, control, and monitoring capabilities.

2.0 BACKGROUND INFORMATION REVIEW

2.0 BACKGROUND INFORMATION REVIEW

Task 1 of the NA involved the identification and review of critical site background information. The principal documents were initially identified during a kickoff meeting teleconference on March 30, 1998, and during subsequent conversations with Mr. Scott Glass. Based on these conversations, a request for information was submitted. Copies of the request letter dated April 2, 1998, and a letter dated April 22, 1998, documenting information received, are provided in Appendix A.

During the course of the project, the draft versions of the 1997 Annual Monitoring Report, prepared by Tetra Tech NUS, and the Operations and Maintenance Manual Ground-Water Extraction and Treatment System, prepared by Morrison Knudson Corporation, were provided to SAIC.

This information was used along with other unpublished data provided by various site staff and through subsequent telephone conversations to complete the NA evaluation as presented in this report. Based on the background information review, major program elements were identified. These elements constituted the principal technologies, system design, required program tasks, and program goals having the greatest influence on program strategy and cost. This information formed the basis of the final site visit work plan which generally covered the entire scope of the remedial program, while focusing on major program cost elements. The results of the site evaluation are provided in Chapter 3.0.

3.0 SITE EVALUATION SUMMARY

3.0 SITE EVALUATION SUMMARY

SAIC conducted the site visit on April 29 and 30, 1998, following a preliminary review of the initial background information. The objectives of the site visit were to discuss the purpose of the NA project with site personnel, tour the facility to gain firsthand knowledge of site and remedial system conditions, acquire additional information and records not available during the background information review, and collect unrecorded information through interviews of on-site personnel. A significant amount of additional information and an important understanding of site conditions were acquired as a result of the site visit.

Information collected during the site visit, in addition to that contained in the background documents, was compiled onto standard data collection forms. These forms were then compiled into 14 modules which are provided in Appendix B. The information, as summarized on the modules, was used to complete the evaluation of the remediation program and to perform the analyses of the cost reduction alternatives as presented in the remainder of this report.

The evaluation team presented the preliminary conclusions and recommendations based on the work to date during the site visit exit debrief. The recommendations included expansion of the system Supervisory Control and Data Acquisition (SCADA) system to provide for future expansion and increased remote monitoring and control; changes to the system engineering design for system plumbing to the discharge point, as well as the type of motor drive used; upgrade of the system data acquisition and storage system; and attendant reporting capabilities; and modifications to the well field. The Site Visit Summary Report is provided in Appendix A.

Following the site visit, the listing of major program elements was refined, and several additional cost-saving alternatives requiring evaluation were identified. The initial evaluations of potential cost-saving alternatives for each program element are presented in the Chapter 4.0.

4.0 EVALUATION OF REMEDIATION PROGRAM

4.0 EVALUATION OF REMEDIATION PROGRAM

4.1 Approach to Remedial Program Evaluation

The NIROP remediation program is divided into eight major program elements for evaluation purposes. These elements are as follows:

- Remediation treatment technology.
- Treatment system component design and configuration.
- Treatment system O&M functions and costs.
- Ongoing sampling and monitoring.
- Treatment system equipment and controls.
- System monitoring.
- Data acquisition and reporting.
- Future remediation system.

Each element was evaluated with respect to performance, costs, and other factors, in consideration of both short-term and long-term program objectives. Where appropriate, potential opportunities for cost savings or performance improvement were identified for further analysis.

In order to facilitate the discussion that follows, a summary of the initially identified potential cost-saving alternatives for each major program element is provided as Table 1. The detailed results of the element evaluations and the cost analyses of the identified potential cost-saving alternatives are presented in the following sections of this report. Based on the results of these evaluations, many, but not all, of the initially identified alternatives were considered for further financial analysis (see Chapter 5.0). Alternatives identified for further analyses versus those not given further consideration also are summarized in Table 1.

4.2 Remedial Treatment Technology

4.2.1 Evaluation of Technology

4.2.1.1 Evaluation of Existing Pump and Treat Versus Alternative Treatment Technologies - There were no apparent major problems or deficiencies in the effectiveness of pump-and-treat technology identified at the NIROP site. Pump-and-treat technology, however, is typically more costly than other recently developed alternate technologies due to the amount of required equipment and maintenance, and

Program Element	Principle Concerns	Initially Identified Alternatives	Recommendation for Further Consideration
Remedial Treatment Technology (Pump and Treat)	• Treatment effectiveness. • Hydraulic capture effectiveness. • Mass removal efficiency. • Rate of system scaling/fouling.	• Alternative treatment technologies. • Install two additional extraction wells - reduce well pumping rates. • Discontinue pumping extraction well AT-1A.	• No; unfavorable subsurface conditions. • Yes. • Yes.
Treatment System Component Design and Configuration	• Influent pumping electrical costs. • Effluent pumping electrical costs. • Anti-scaling system chemical use.	• Short-term - bypass to sanitary sewer. • Long-term - install variable speed drives. • Gravity discharge to storm sewer. • Optimize operations and maintenance (O&M) procedures to minimize chemical use.	• Yes. • Yes • Yes. • No; uncertain return on investment (ROI).
Treatment System O&M Functions and Costs	• Unscheduled maintenance costs. • Unnecessary/inefficient maintenance. • Tray aerator disassembly. • Change in operator/contractor. • Limited remote control/system automation.	• Perform strategic predictive maintenance. • Perform Supervisory Control and Data Acquisition (SCADA)-supported planned maintenance. • Develop tray aerator maintenance plan. • Upgrade remote monitoring/control. • SCADA upgrade.	• Yes • Yes • No; uncertain ROI. • No; uncertain ROI. • Yes.
System Sampling and Monitoring	• Sampling and analyses costs.	• Reduce sampling locations. • Reduce the monitoring frequency. • Change the method of analyses.	• Yes.
Wellhead Controls and Monitoring	• Manual collection of wellhead data.	• Automate wellhead monitoring. • Replace/relocate pressure transducers.	• Yes.
Treatment System Control and Monitoring	• Manual monitoring and control requirements.	• SCADA upgrade.	• Yes.
Data Acquisition and Reporting	• Manual data manipulation and reporting.	• SCADA upgrade. • Develop standardized/automated reporting.	• Yes.
Future Remediation System Requirements	• Additional SCADA requirements.	• Provide expandable control panel and programmable logic controllers (PLCs).	• No; uncertain ROI.

TABLE 1 - Summary of Evaluation of Remediation Program

time required for completion of remediation. On the other hand, pump-and-treat is the only feasible technology for use at some sites. A general evaluation of the use of alternative technologies was performed to reevaluate the use of pump-and-treat at this site.

The groundwater pump-and-treat technology in use at NIROP is considered to be the most feasible and effective method for removing dissolved VOCs from groundwater and for controlling their off-site migration. Other possible technical approaches such as hydraulic containment barriers, reductive reaction walls, air-sparge curtains, and intrinsic or enhanced bioremediation all have limited application for eliminating off-site VOC migration under the hydrogeologic and geochemical conditions at this site. The principal limitations for these technologies for this site are as follows:

- **Hydraulic Containment Barriers** - The thickness (> 80 feet) and horizontal and vertical variability of the aquifer make the physical installation and maintenance of the barrier impractical. The ability of a barrier to effectively control the flow of the entire plume is questionable.

- **Reductive Reaction Wall** - Similar limitations exist for this technology as for hydraulic containment barriers.

- **Air Sparge Curtains** - Fouling problems inherent at this site would likely make long-term O&M very difficult and costly. The significant thickness and high physical variability of the aquifer would make effective treatment of the entire plume uncertain.

- **Intrinsic or Enhanced Bioremediation** - Current documented conditions indicate that intrinsic bioremediation alone would not be effective. The significant thickness and variability of the aquifer would make the necessary introduction and distribution of required biological amendments difficult, and the resultant effectiveness of this treatment technology would, therefore, be uncertain.

Based on these limitations, the above technologies would not likely provide practical or effective extended treatment at this site. Therefore, the use of alternative treatment technologies will not be further evaluated in this report. Air sparging and enhanced bioremediation, however, may have application for short-term source removal which may be a consideration in any future expansion of the remediation program at NIROP.

4.2.1.2 Hydraulic Capture and Mass Removal Efficiency - In general, the long-term groundwater monitoring data summarized in the 1997 Annual Monitoring Report indicate a reduction in the change over time in site-wide groundwater VOC concentrations over the past three to five years. The greatest decreases in groundwater contaminant concentrations were observed following start-up in September 1992, continued at a lower level through 1994, and with less pronounced declines more recently. The data indicate the existence of consistently lower groundwater VOC concentrations on the periphery of the diminished plume. Groundwater VOC concentrations within the plume and at the compliance boundary have decreased significantly since system start-up. Sporadic VOC concentrations observed in some of the wells within the plume are apparently due to altered groundwater flow conditions caused by the most recent installation of additional pumping wells. In general, the plume size is decreasing in horizontal extent and is not expanding downgradient.

This condition may indicate that equilibrium chemical conditions within the remaining plume are being approached where the mass of VOCs being added to the groundwater at the source areas, the amount of dilution during downgradient migration of the impacted groundwater, and the resultant chemical distribution within the remaining impacted groundwater area all are becoming relatively constant. In this case, the pump-and-treat system will provide for long-term containment, and groundwater VOC concentrations are expected to decrease more slowly in the future. As discussed in Section 4.5.1, the increasing predictability and decreasing rate of change in groundwater contaminant conditions should permit continued effective and responsible monitoring under a less intensive groundwater monitoring program.

The alternative technical approaches discussed above are effective at source removal under suitable conditions, and should be considered during subsequent source evaluations at NIROP. Source removal will significantly decrease the required time of remediation, as well as create other opportunities for alternate groundwater control technologies. If feasible, the value of source removal to the remediation program may be significant. The need for source removal is unknown, and therefore, value currently cannot be estimated. The current configuration of the groundwater contaminant plume indicates the likely existence of source areas beneath the building. Further investigations of groundwater contaminant conditions and associated source areas are ongoing. Precise location and removal of source area(s) will be an important aspect of the remaining NIROP remedial investigation.

The groundwater collection system shown in Figure 3 consists of two deeper wells (AT-3 and AT-5B) for capture of deeper groundwater and four shallower wells (AT-1A, AT-2, AT-4, and AT-5A) for capture of shallow groundwater. Site data and hydrogeologic modeling results provided in the 1997 Annual

Monitoring Report indicate inefficient capture of the impacted shallow groundwater, even during overpumping of the existing wells. Specifically, the modeling results indicate that there is a small area of groundwater located between recovery wells AT-3A and AT-5A that may not be efficiently captured. Contaminated groundwater that is not captured migrates downgradient to Anoka County Park and subsequently discharges to the Mississippi River. The data presented in the 1997 Annual Monitoring Report also indicate that aggressive pumping of deep well AT-3, which provides almost 50 percent of the current system flow, has little effect on the chemical migration in the shallow groundwater. Generally, this situation indicates that the more critical shallow groundwater recovery system is hydraulically inefficient, and the deep recovery system is ineffective for containment of the shallow groundwater flow system.

The deep and shallow groundwater recovery systems are being operated in a manner which likely enhances both inorganic and organic fouling due primarily to aquifer dewatering and high flow rates. The recommendation in the 1997 Annual Monitoring Report to install additional wells is in agreement with the recommendations presented later in this NA, although the conclusions are based on different reasoning. The addition of two shallow wells, as discussed in Section 4.2.2, would likely enhance the capture efficiency and decrease the rate of fouling of the shallow groundwater capture system. The 1997 Annual Monitoring Report recommends the reconstruction of wells AT-3 and AT-2, along with increased rates of pumping for these wells. These recommendations should be reviewed and carefully evaluated in consideration of the above discussion.

A second issue identified involves the performance of extraction well AT-1A. This extraction well was initially installed for source removal. Groundwater monitoring data indicate, however, that the concentrations in this well significantly decreased shortly after start-up in 1992 and have remained very low since that time. This well currently serves little or no purpose for either source removal or hydraulic capture and containment.

4.2.1.3 System Scaling and Fouling - Site O&M records document that scaling and fouling of well screens, pump screens, piping, and treatment equipment is a major problem at NIROP. This problem is apparently, at least in part, related to current well field management practices. The groundwater pumping system is currently removing water from the aquifer at the maximum rate. This action is standard practice for minimizing the number of pumping wells required and for achieving maximum VOC removal rates. This approach requires pumping the minimum number of wells at maximum drawdown based on aquifer characteristics and well efficiencies. Industry experience elsewhere has shown that this approach to well field management under similar environmental conditions typically increases organic and inorganic fouling

in the wells. This is as a result of dewatering and high groundwater flow velocities in the vicinity of the well bore and the introduction of additional background nutrients such as nitrogen and oxygen (biological stimulants) contained in captured groundwater, and the unnecessary capture of uncontaminated groundwater. Iron concentrations in the groundwater under non-pumping conditions are reported to be low, but apparently increase due to elevated iron solubility, related to lower redox potentials which are caused by the increased biological activity induced under current pumping conditions. This set of conditions is likely the principal cause of system fouling.

The system fouling problem is most pronounced in extraction wells AT-2 and AT-4. The reasons for this are as follows: first, well AT-2 typically has one of the highest VOC concentrations, which supports biological activity; and second, because the well screen is in an underlying layer that is less transmissive, over-pumping of the well causes significant drawdown around the well. The cascading of water within the well compounds the problem. These conditions further induce fouling and scaling and affects pumping control and groundwater elevation monitoring. The reasons for the pronounced fouling in well AT-4 are less obvious, but may be due to locally higher concentrations of iron, lime, and/or more biologically degradable constituents associated with this well.

Increased drawdown and groundwater flow velocities typically result in increased turbulent flow and decreased pressure within the aquifer and well pack. This tends to increase particulate and oxygen concentrations and decrease carbon dioxide concentrations in well influent water. Additional aeration within the well and pressure changes as the water enters the well, the well pump, and piping systems tend to promote biological activity and the precipitation of iron, as well as calcium and manganese salts. This problem is further amplified when well efficiencies are low because of improper well construction, insufficient well development, or fouling following system start-up.

4.2.2 Identification of Possible Alternatives

The existing pump-and-treat system is currently operating almost in the mode of a containment system rather than as an aggressive mass removal system. Therefore, if the VOC loading to the groundwater is being controlled more by the desorption from the soil and dissolution into the groundwater rather than being dominated by VOCs in the groundwater from the sources and subsequent groundwater flow conditions, then there are two potential system and operational alternatives that may provide cost reductions. These alternatives should increase capture effectiveness, increase mass removal efficiency, and reduce fouling. Discussion of these alternatives is as follows:

- **Install Two Additional Extraction Wells and Reduce Well Pumping Rates** - Install one well between existing extraction wells AT-5A and AT-3A and one well between existing wells AT-3A and AT-2. Decrease the rates of pumping and degree of drawdown in wells AT-5A, AT-3A, AT-4, and AT-2, along with the additional wells, to the minimum extent possible to maintain groundwater capture along the western property boundary in the impacted groundwater area. The exact locations and construction of these wells are critical and should be based on recent pumping and geophysical testing results and further analyses of current aquifer and plume conditions in this area of the site. This modification should produce the following results:

  - Increase VOC mass recovery efficiency (i.e., less water pumped for removal of a similar mass of contaminants) by 10 to 30 percent per year.

  - Reduce the system influent total iron concentrations and the rate of fouling and scaling of the wells by 10 to 30 percent per year by virtue of the reduced flow rates and attendant biological activity.

  - Lower the required cleaning frequency for well screens, pumps, and piping by 10 to 30 percent per year.

  - Lower the cost of system cleaning and polymer usage by 10 to 30 percent per year.

  - The value of reconstructing extraction well AT-2 or AT-3 could be better determined based on the results of this modified well field and pumping program.

The projected modifications and associated cost savings are reasonable estimates based on industry experience. Implementing these changes at other sites having similar environmental conditions and operational problems has been shown to yield significant positive results. Further evaluation of this alternative is necessary to more accurately determine the degree of possible improvement and cost savings. These further evaluations of the pumping well field would include the collection of non-contaminant groundwater chemistry data associated with both organic and inorganic fouling and the field evaluation of changes in these fouling-related conditions under trial reduced pumping rates. The specific data required to conduct these analyses include pH, total hardness, total and

dissolved organic carbon, dissolved oxygen, dissolved carbon dioxide, chloride, and total iron and manganese.

- **Discontinue Pumping of Extraction Well AT-1A** - Use this well for groundwater monitoring only. This modification should produce the following results:
  - Eliminate well operations energy costs.
  - Eliminate pump repair and significantly reduce well and plumbing maintenance costs.

The cost savings associated with this second alternative are self-evident. An initial financial evaluation of these well field modification alternatives is presented in Section 5.2.1.

4.3 Treatment System Component Design and Configuration

The findings from the treatment system design evaluation indicated that it is basically well designed and most components should operate effectively. Figure 4 presents a generalized design and layout of the major Phase 1 and Phase 2 system components. Cost-saving alternatives were identified for five major components and are presented in the remainder of this section.

4.3.1 Evaluation of Existing Design

4.3.1.1 Extraction Well System - The extraction well system has been operating since September 1992, and its design basis is contained in the RI report. General design parameters for the six wells in the groundwater extraction system are presented in Table 2.

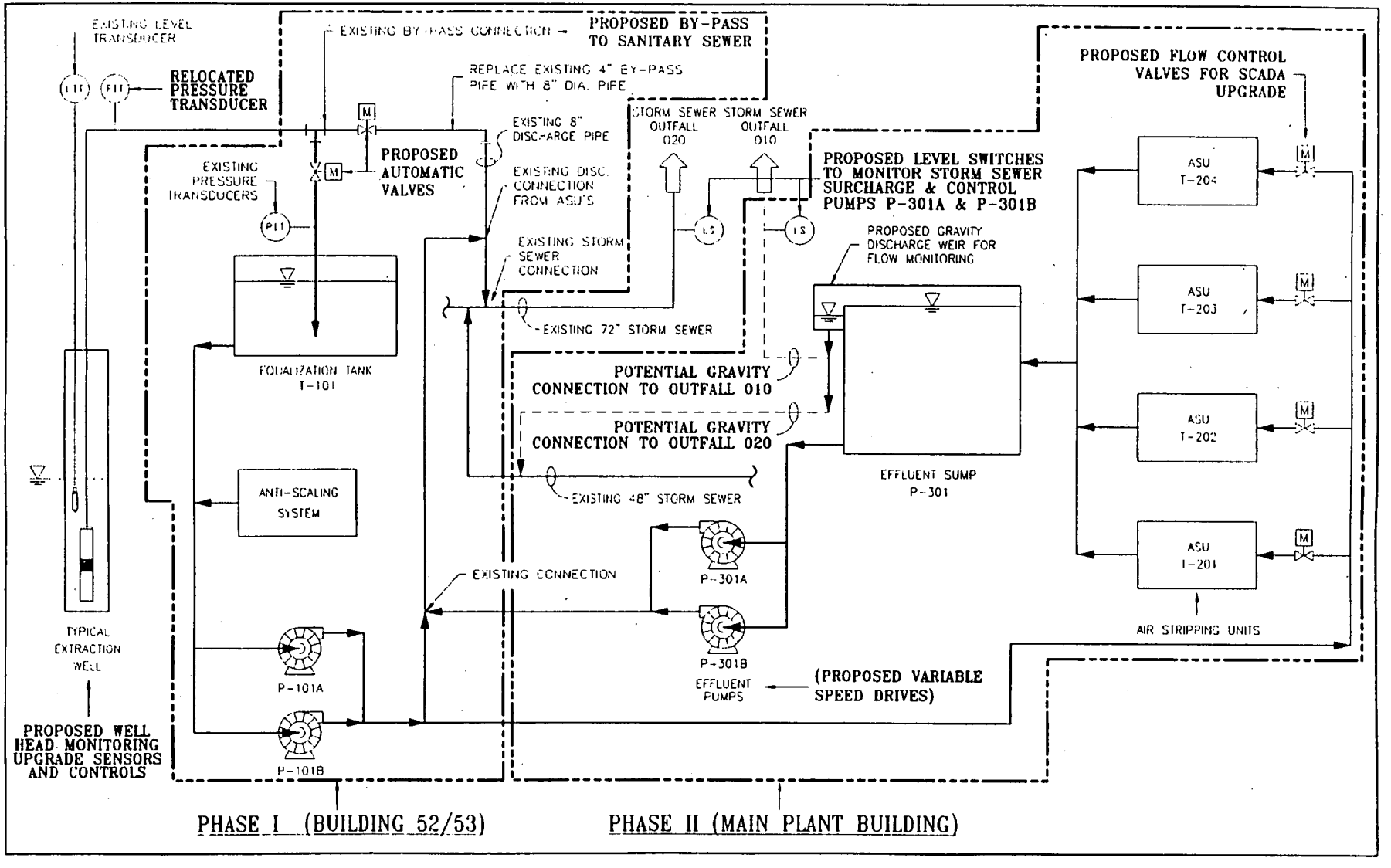


FIGURE 4 - Schematic Design of Phase I and Phase 2 Treatment Syst m

Well No.	Design Flow (gpm)	Observed Flow (gpm)	Pump Model	Comments
AT-1A	75	50	Grundfos #TSP16-5	Pump information from draft O&M Manual; 6-inch-diameter and 65 feet deep; screened interval: 44 to 64 feet; permit No. 92-6127.
AT-2	125	48	Grundfos #TSP27-3	Pump information from draft O&M Manual; 10-inch-diameter and 65 feet deep; screened interval: 35 to 65 feet; permit No. 92-6127.
AT-3A	250	242	Grundfos #TSP45-6	Pump information from draft O&M Manual; 8-inch-diameter and 130 feet deep; screened interval: 75 to 129 feet; permit No. 92-6127.
AT-4	125	43	Grundfos #TSP16-4	Pump information from draft O&M Manual; 8-inch-diameter and 47 feet deep; screened interval: 17 to 47 feet; Permit No. 92-6127.
AT-5A	150	160	Grundfos # Unknown	Screened between 36 and 66 feet below grade.
AT-5B	50	82	Grundfos # Unknown	Screened between 101 and 136 feet below grade.
gpm - gallons per minute				

TABLE 2 - Groundwater Extraction Well Design Information

Each well pump is preset to run on/off when the level of fluid in the well reaches a specified value. Flow rate is manually adjusted by the operator based on observed well production and pump cycling. Water table elevation data are collected manually; however, because of corrosion, automated water level sensors are inoperable.

Water line pressure transducers installed on each transmission line are located in Building 52/53. These pressure readings are used to assess wellhead pressure, but these readings are not representative of true wellhead pressure because of pressure losses over that distance.

Well and transmission line preventive maintenance scheduling currently requires the use of flow trend data, in conjunction with the operator's knowledge of and previous experience with the system. This approach may be satisfactory now, but will become less efficient if the system expands and is operated off-site. Upgrading the monitoring and controls of the extraction well system should improve the operator's ability to schedule maintenance of the extraction system in a more cost-effective manner. The costs and value of

upgrading the extraction well system sensors and controls are evaluated, along with other control improvements, in Section 4.6.1.

4.3.1.2 Use of Existing Bypass Line to the Sanitary Sewer - Groundwater is currently pumped by the 6 extraction well pumps to the influent equalization tank and from there to the sanitary sewer using a 30-horsepower (hp) influent pump (see Figure 4). This pump will also be used to pump water from Building 52/53 to the new treatment area. An existing bypass line will allow for direct discharge of groundwater from the extraction wells to the sanitary sewer without using the influent equalization tank or pump. This currently unutilized bypass line can be used during ASU maintenance shutdowns. This change in operation would eliminate the cost of running the influent pump during these periods. The bypass line, however, was intentionally designed to be four inches in diameter and is not capable of carrying the extracted groundwater design flow. Therefore, the line would require replacement with one capable of carrying the design flow.

4.3.1.3 Influent Pumping System - The influent pumping system is designed for pumping extracted groundwater, a distance of about 1,000 feet, from the influent equalization tank located in Building 52/53 to the air-stripping system located in the new treatment area within the building. The treated groundwater is then pumped back, using 30-hp pumps, to Building 52/53 for final discharge to the sanitary or storm sewer.

The location of the Phase 2 GWTF, to include the influent pumping system, was selected primarily to minimize new building construction costs, but also took into consideration air discharge issues relative to property line concentrations of Hazardous Air Pollutants (HAPs). Air-phase carbon adsorption would have been required if the discharge were located at Building 52/53. However, because of the location of the GWTF relative to the pumping system, significant cost is incurred in pumping the groundwater to the treatment system and then back to Building 52/53 for discharge. Typically, a 30-hp motor operating at 80 percent efficiency, 24 hours per day, 365 days per year, would cost approximately $12,000 annually to operate, assuming an energy cost of $0.05 per kilowatt per hour.

The influent pump drives are constant speed with soft-start motor starters to minimize start-up load. Flow from the pumps to the air strippers is controlled based on the water level in the equalization tank. In the automatic mode, a set-point controller adjusts a control valve in the discharge line of the pump to control discharge and maintain a preselected level in the tank. Therefore, whenever the pump is operating below its rated capacity, the system works "against itself" and more electricity is consumed than is required. The

use of variable-speed drives in place of the existing soft-start motor starters may significantly reduce power costs. This alternative will be further evaluated for potential cost savings.

4.3.1.4 Effluent Pumping and Monitoring - The effluent pumping system pumps the water from the air-stripping units back to the 020 outfall connection which is located in Building 52/53 (see Figure 4). The effluent pumps are located in the new Phase 2 treatment area. The system will consist of two pumps—one primary and one in-line standby. The equipment control system, as currently configured, will not provide for automatic alternation of the pumps. The pumps are constant speed with a soft-start motor starter. The effluent flow from the pumps is controlled by an effluent flow valve that modulates to maintain a constant level in the effluent sump. The use of a variable-speed drive in replacement of the existing constant-speed motor on the effluent pumps could significantly reduce power costs. This change will, therefore, be further evaluated for the effluent pumps, as well as the influent pumps.

A second, potential alternative relating to the effluent pumps also exists. The design drawings indicate a possible gravity connection from the Phase 2 system air-stripper unit (ASU) discharge to a storm sewer. This would have allowed for gravity discharge under an NPDES permit via outfall 010. The reason for not pursuing the gravity discharge was verbally explained to be an issue of permitting. The existing draft permit for outfall 020 required considerable time and effort to obtain, and amendment of the permit at this time would require a significant effort. However, the annual power cost alone for operating a 30-hp pump, 24 hours per day, 365 day per year, would be approximately $16,000, and elimination of the pump and pump and line maintenance could easily save an additional $7,000 per annum.

An approach to permitting outfall 010 would be to monitor and permit the groundwater discharge at a point where it leaves the effluent sump before it is combined with storm or non-contact cooling waters. The cost of separate monitoring would have to be weighed against the savings of eliminating the operating and maintenance cost of a 30-hp effluent pump.

An additional discharge alternative would be to construct a gravity discharge from the ASU effluent sump to outfall 020. A review of Drawing C-2 indicates that a 48-inch-diameter storm sewer connected to outfall 020 may run north to a point close to the location of the new treatment area. The extent of this line toward the new treatment area and its accessibility is not clear from the drawings. This alternative would include the use of automated valving to redirect the system flow back to the existing effluent pump and force main if the capacity of the storm sewer is exceeded during severe storm events. Therefore, discharge to either outfall 010 or outfall 020 would require the addition of a gravity storm sewer discharge line and

automated controls. This potential cost-saving alternative is evaluated further in later sections of this report.

4.3.1.5 Anti-Scaling System - Information in the O&M Manual indicates a potential scaling problem in the transmission pipeline from the ASUs back to Building 52/53. This is based on past experience with the decommissioned air stripper that operated previously at this site. As a result, an anti-scaling system has been installed as part of the Phase 2 program. Limited operating information for the anti-fouling system is contained in the draft O&M Manual.

The effectiveness of the anti-scaling system in preventing this line from scaling is unknown because its application point will be at the suction of the influent pumps in Building 52/53 prior to air stripping. Experience in the industry with operating similar systems indicates that residual sequesterant in the treated water at the discharge of the aerator is required to control fouling of the discharge line. The process of air stripping will likely also reduce the concentration of residual anti-fouling sequesterant in the air-stripper discharge, which could allow for further fouling in the return transmission line. The degree of fouling, therefore, will depend on actual groundwater conditions at the time of treatment, as well as with the concentration of unsequestered hardness and iron in the air-stripper discharge. In order to effectively maintain anti-scaling capability in the transmission pipe from the Phase 2 system back to Building 52/53, a higher dose of sequesterant may be required at the application location. The rate of sequesterant addition necessary to maintain this residual should be controlled through monitoring of the discharge during system start-up and operation.

Although the capital cost of the anti-scaling system is minimal, the annual cost of sequestering chemical is likely to be significant, possibly ranging from $20,000 to $40,000. System O&M procedures should be developed for monitoring influent chemistry related to fouling, and making appropriate adjustments of both well field pumping and anti-scaling system operations. The value of this monitoring program can be substantial; however it cannot be estimated and will not be addressed further at this time.

4.3.2 Identification of Possible Alternatives

A review of the design and configuration of the existing Phase 1 and planned Phase 2 remediation systems revealed the following possible cost-saving alternatives:

- **Bypass to Sanitary Sewer** - Use of the bypass line from the extraction wells to the sanitary sewer will result in a savings of $1,000 per month ($12,000 annually) in electrical

power cost by not operating the influent pump. The bypass to the sanitary sewer can be used during stripper system downtime. The design drawings indicate that check valves may not currently exist in the bypass lines. If they are needed, these valves can be purchased at minimal cost and placed between existing flanges to allow for this bypass operation.

- **Install Variable-Speed Drives** - The upgrade of influent and effluent pumps to incorporate variable-speed drives should be evaluated relative to long-term groundwater treatment needs. This upgrade should decrease electrical power usage and costs. This alternative may be relevant if actual groundwater flows average below 750 gpm over the expected life of the facility.

- **Gravity Discharge to Storm Sewer** - The addition of a gravity storm sewer discharge line to either outfall 010 or 020, along with automated controls to minimize or eliminate the use of the effluent pump should be evaluated for future implementation. The force main to Building 52/53 would remain active for emergency use during high storm sewer flow conditions to ensure continuous operation of the pump-and-treat system. Elimination of 90 percent of the run time of a single 30-hp effluent pump would result in a significant decrease in electrical power cost. Moreover, it is reasonable to assume that the pump would need to operate no more than 10 percent of the time to handle periodic high flow storm events.

Initial financial evaluations of these treatment system design and configuration alternatives are provided in Sections 5.2.2, 5.2.3, and 5.2.4.

4.4 Treatment System Operations and Maintenance Functions and Cost

4.4.1 Preventive, Predictive, and Unscheduled Maintenance Activities

O&M at NIROP include preventive, predictive, and unscheduled activities. Preventive maintenance involves standard maintenance of system components. The equipment maintenance items in the O&M Manual cover the manufacturers' requirements to maintain the equipment in continual operation or at a high percentage of full duty.

Predictive maintenance involves scheduled maintenance activities required to keep the entire system operating efficiently based on observed system performance. Examples of these tasks include periodic removal of well pumps and pump settings for inspection of down-hole equipment, cleaning of well screens, and disassembling and cleaning of aerators as necessary to maintain performance. These activities are normally performed in response to wear and tear, or physical fouling and clogging of treatment components.

Unscheduled maintenance events include activities such as change-out of a failed pump or motor, and repair of broken equipment. These events are generally the most expensive and can occur at inopportune times. This work often causes the shutdown of the treatment system to perform the repair and may involve additional labor and delays for shipment of new equipment or repair of broken equipment.

Both preventive and predictive maintenance requires annual planning to perform the necessary tasks in the most cost-effective way. There is currently no detailed preventive or predictive maintenance schedule for the Phase 2 program. Preventive tasks should be prescheduled to meet minimum manufacturers' maintenance requirements. Predictive tasks, however, need to be performed in accordance with the observed system operations and performance. Tracking of system performance should dictate exactly when predictive tasks should be completed. For example, system operational data may show that plumbing or aerator back pressure is increasing. An acid wash may be applied to decrease back pressure when it exceeds a predetermined value. Performing predictive maintenance in this manner minimizes labor, chemical, and power costs, as well as publicly owned treatment works (POTW) charges associated with system cleaning. Therefore, the development of a strategic predictive maintenance plan is identified as an important cost-saving alternative to be further evaluated.

Upgrading the SCADA system, the data collection system, and reporting functions, as discussed in greater detail elsewhere in this NA, is a second identified alternative which should further optimize maintenance activities. These system upgrades will provide the mechanism to complete long-term performance trend analysis. These system trends are the best indication of maintenance required to avoid possible system or equipment problems. Analyzing the data from the human-machine interface (HMI) units, along with operator notes of recorded information, provides the trend data that show the need for additional labor, supplies, or material to restore the system to peak efficiency. Repeating trends then become a predictive maintenance task. This is the most efficient way to adjust the maintenance schedule and to most cost-effectively complete the combination of work tasks. Performing SCADA-supported planned maintenance is a possible cost-savings alternative to be further evaluated.

4.4.2 Tray Aerator Disassembly

The tray aerators will be dissembled, cleaned, and repaired annually. The tray aerators are heavy pieces of equipment that require lifting equipment. An overhead crane is currently on-site and belongs to the site owner. The cost and future availability of the crane are unknown; therefore, outside rental may be required. The O&M contractor should provide a backup plan and cost for these tasks. Cost savings or reduction will result if disassembly of the tray aerator could be performed less frequently. This may be possible if the tray aerator maintenance plan includes an increased frequency of acid wash, increased use of sequesterant, or periodic manual cleaning of the trays through the ASU access ports as indicated by performance trends. A decrease in the iron and hardness loading, resulting from a modified well field pumping program discussed previously, will also contribute directly to the savings in this area. The actual value of this type of tray aerator maintenance plan, although potentially significant, will have to be further evaluated during system start-up and operation. Therefore, this alternative will not be further evaluated in this report.

4.4.3 Operation and Contractor Consistency

Total costs, including Naval Facilities Engineering Command (NAVFAC) administrative costs, will likely increase upon any change of O&M contractor. These increased costs can be controlled by establishing standard operating procedures and reporting formats. An increased remote monitoring and control capability will facilitate more efficient operation of the systems by off-site contractors, as well as more cost-effective oversight by the O&M contractor. This will be especially important during any change in contractor or contractor-assigned personnel. Increased system remote control and monitoring capability will result in less dependence on on-site contractors, which will ultimately help to control both direct and indirect costs. Again, the value of increased remote monitoring and control in reducing costs related to any potential change in contractor, although possibly significant, cannot be precisely estimated and, therefore, is not further evaluated in this report.

4.4.4 System Automation

A detailed description of the current and planned Phase 2 SCADA and associated HMI system is provided in Section 4.7.2. The current HMI system has the ability to record and store up to 30 days of data. The site could be monitored remotely 24 hours a day with the further upgrade and reconfiguration of the SCADA system already at the site. Labor hours spent recording system operation data are then saved. The SCADA system enables the operator or others to access and evaluate existing conditions and alarms,

review data between service trips to the site, make adjustments to flow, or turn equipment on or off. The ability to remotely evaluate and respond to a system alarm often eliminates the need for a site visit, particularly when the system condition can be addressed later during a routine visit. Some of the new SCADA systems have simulation capabilities which allow easy evaluation of various "what if" scenarios to support decision making. The SCADA also allows others to check system operating parameters and double-check the contractor or operator work without visiting the site. All of these capabilities will have particular value if the NIROP system is operated and maintained by an off-site operator. Improvement of system monitoring and control capabilities is a cost-savings alternative that is evaluated in detail in Sections 4.6 and 4.7 of this report.

4.4.5 Identification of Possible Alternatives

Significant opportunities to improve the O&M program exist and, if implemented, could result in substantial savings. These include:

- **Perform Strategic Predictive Maintenance** - Routine predictive maintenance for the six well system should be scheduled semiannually. Based on experience with maintaining similar systems elsewhere, spring and fall maintenance when weather conditions are favorable is efficient and results in reduced costs. Maintenance of the wellheads represents approximately $50,000 per year in O&M costs. These costs have not been detailed but are assumed to be high because activities are currently unplanned and are performed in response to pump failures and system clogging. Following system start-up, the predictive maintenance schedule should be adjusted, if necessary, based on performance history. Scheduled predictive maintenance, executed at opportune times based on system monitoring and trend analyses, should result in significant cost reductions.

  Piping system inspections would also be performed at this time in order to avoid any other unscheduled shutdowns during the year due to pump failure or line clogging. This will result in savings because unexpected shutdowns are significantly more expensive than planned shutdowns due to parts availability and allocation of labor resources.

- **Perform SCADA-Supported Planned Maintenance** - A detailed preventive and predictive maintenance schedule and management program should be developed, whereby information provided by an upgraded SCADA system would be used to allow additional

off-site monitoring, as well as less frequent, as-required scheduling of predictive maintenance events.

All preventive and predictive maintenance tasks should be plotted onto an annual schedule, with each piece of equipment identified for each task. This list of maintenance tasks can be fitted to the operator time on-site. The list ensures that all maintenance items are completed and that necessary supplies are on-hand. Trend analyses strategies should be considered for each predictive task and implemented, where possible, to optimize the scheduling of each task in consideration of costs. Effective preplanning and schedule adjustment in accordance with trend analysis will result in the more efficient performance of preventive and predictive tasks, while minimizing the occurrence of unscheduled tasks. For example, if the well pump systems were removed and inspected, and preventive maintenance was performed twice-yearly, as opposed to running the systems until the pumps failed, the savings could be substantial. On the other hand, there is no need to clean the aerators until scaling and fouling degrade system performance.

- **SCADA Upgrade** - SCADA system upgrade may result in significant cost reduction for the reasons discussed above; however it would also benefit the wellhead controls and monitoring, treatment system control and monitoring, and data acquisition and reporting program elements. Therefore, the SCADA upgrade is identified as one of the major potential cost-saving alternatives for this remedial program.

The cost analysis of the first two alternatives is provided in Section 5.2.5 and the third in Section 5.2.8.

4.5 System Sampling and Monitoring Requirements

4.5.1 Evaluation of Sampling and Monitoring Requirements

Water samples from the combined system discharge of the extraction wells are collected monthly, and samples from 6 extraction and 44 monitoring wells are collected semiannually. One additional well, Fridley well No. 13, is also sampled annually. Additional samples are collected for quality assurance/quality control (QA/QC) measures. A total of approximately 133 water samples are collected each year for VOC analysis for the monitoring program. Sludge samples are collected for waste characterization analyses. Additional air discharge and NPDES discharge sampling will be performed as

part of Phase 2. Expansion of the sampling and monitoring program will likely occur as future remedial systems come on-line.

All water samples are currently submitted for VOC analyses by United States Environmental Protection Agency (EPA) SW-846 8260 (Method 624). The historical monitoring results from 14 of the monitoring wells (1-I, 1-S, 2-PC, 4-D, 5-S, 8-D, 10-I, 13-D, 13-S, 15-S, 16-I, 20-S, 23-S, and 25-S) indicate that these wells consistently have concentrations of target VOCs that are significantly below the action levels. Other wells are known to be upgradient or provide redundant or unreliable data. In addition, only several of the total compounds on the gas chromatograph/mass spectroscopy (GC/MS) analyte suite are target VOCs in the groundwater and treated water samples.

4.5.2 Identification of Possible Alternatives

Sampling and analyses activities are completed in accordance with the "Remedial Action Work Plan for Groundwater Remediation - Revision 3" (1995), which has been approved by the Minnesota Pollution Control Agency (MPCA) and EPA. Any change to the sampling and analyses program will require regulatory approval. Groundwater monitoring and sampling results support the occurrence of a decreasing groundwater contaminant plume size and more predictable groundwater contaminant conditions at NIROP. In consideration of the highly predictable nature of the results from these wells, the current monitoring frequency for all analytes serves no practical purpose and could be reduced with no effect on the efficiency of capture or additional risk to potential off-site receptors. Possible alternatives to the sampling and monitoring program include the following:

- **Reduce Sampling Locations** - Reduce the number of well locations to be sampled. Redundant wells, wells producing low utility data due to improper construction, and wells shown to be remote or upgradient from the plume may possibly be eliminated. This may include sampling points 1-S, 2-PC, 9-S, 13-S, 15-S, 16-I, 23-S, and 24-S.

- **Reduce the Monitoring Frequency** - Change the monitoring frequency for monitoring wells from semiannual to annual by either sampling all of the wells yearly or by sampling 50 percent of the wells during each of two 6-month sampling periods. Wells which are cross-gradient from the plume and are not along a receptor pathway and have consistently exhibited very low or non-detectable concentrations of chemicals may possibly be sampled annually. The involved sampling points include 2-I, 2-D, 3-I, 4-D, 5-S, 10-I, 16-S, 20-S, 22-S, and 25-S.

- **Change the Method of Sample Analyses** - Change the method of analyses from SW-846 8260 (EPA Method 624) to SW-846 8010/8020 (EPA Method 601/602).

These modifications would result in the following potential cost savings:

- Reducing the number of monitoring wells sampled by eliminating the sampling of eight wells would decrease the groundwater sampling costs.

- Decreasing the frequency of sampling of 10 monitoring wells from 2 times per year to 1 time per year would decrease monitoring well purging and/or sampling costs.

- Changing the method of analyses to only a GC method would decrease analytical costs for each sample by approximately 50 percent.

Total savings from a combination of one or more of these modifications would be greater than 30 percent per year and would also result in a marginal decrease in data acquisition and reporting costs.

An initial financial evaluation of these sampling and monitoring alternatives is provided in Section 5.2.6.

4.6 Wellhead Control and Monitoring

4.6.1 Wellhead Controls and Automation

Well pumping rates for the six extraction wells are not optimized. The wells are either operated at maximum yield or manually controlled by valve positioning. The water level was previously measured at the wellhead using a level transducer with a liquid crystal display (LCD). These transducers are not operational and data on groundwater surface levels are taken manually on a weekly basis. These data, however, were not available for this evaluation. The method of analysis of these data are also unknown, as well as if any adjustments are made to the operation of the extraction and treatment system based on observed groundwater level conditions. If, however, the water level transducers were to be integrated with the SCADA system, then automated data collection, trending analysis, and thus remote monitoring and control could be achieved.

The location of the pressure transducers at the inlet to the equalization tank does not provide an accurate indication of line pressures or provide any indication of line fouling. This is because the change in head at the wellhead (not the transmission line discharge point) would have to be monitored and analyzed over time to evaluate line fouling and pump operation. The absence of pump cycling, flow, and line pressure trends prohibits the execution of a cost-effective maintenance program.

4.6.2 Identification of Possible Alternatives

Two possible cost-saving alternatives to the wellhead monitoring and control system have been identified and are as follows:

- **Replace/Relocate Pressure Transducers** - The pressure transducers mounted on the transmission piping in Building 52/53 should be relocated to replace the pressure gauges at their respective wellheads and hard wired back to the control panel to provide for remote monitoring and control. Relocation of these pressure transducers provides a better means of monitoring extraction pumps and pipe fouling by trending wellhead pressure versus well flow over time. This type of information can be used to schedule preventive maintenance of the wells and pipes on an "as-needed" basis rather than on a "fixed" schedule. The ability to perform preventive maintenance in this fashion may result in a 10 to 20 percent cost reduction in the annual budget for extraction well maintenance over the life of the system.

- **Automate Wellhead Monitoring** - Groundwater elevation monitoring, presently done manually, should be automatically conducted using a level transducer at each wellhead. The current reported cost of manual data collection is minimal due to the operating arrangement with the on-site contractor. However, hard wiring these transducers to the control room will facilitate real-time trending with an upgraded SCADA system and position the facility for potential future remote operation. This approach will be even more important if the number of wells being monitored at the site increases in the future. Another advantage of this modification is real-time access by authorized personnel, from any location at any time, and the potential for automated flow control from the extraction wells based on groundwater elevation.

An initial financial evaluation of these wellhead and system equipment controls alternatives is presented in Section 5.2.7.

4.7 Treatment System Control and Monitoring

The Phase 1 and Phase 2 treatment systems have substantial control and monitoring capability; however, it is currently used to only a limited extent, and plans for upgrade have not been finalized. Proper upgrade and configuration of the existing SCADA system would significantly increase the efficiency and decrease the costs of treatment system control and monitoring, as well as provide benefits to other aspects of the remediation program as discussed elsewhere in this report. A detailed evaluation of the existing SCADA system and opportunities for upgrade of this system are presented below.

4.7.1 System Controls and Automation

The inlet valves to the four proposed ASUs are designed for manual operation. The draft O&M Manual does not discuss operations and controls for the Phase 2 installation (ASUs, effluents systems, chemical cleaning, and sequesterant systems); however, automatic controls for ASU operations do not appear to be included in the system as designed. Some feedback controls and emergency interlocks and shutdown components exist, but no feed-forward control is included in the system design. For example, the ASU feed pump automatically operates based on equalization tank level. If the level is increasing or decreasing, a loop controller modulates control valve 101 to maintain it. There are no feed-forward controls that will put additional ASUs on-line or shut down ASUs if flow from the extraction wells increases or decreases. This may be done in part because the extraction wells themselves only run manually at close to maximum well yield. If more efficient hydraulic control of off-site VOC migration is pursued in the future based on evaluation of well yield and groundwater elevation impact, or if the current pumping system is expanded, additional automation of the treatment system components would facilitate more efficient operation in response to changing flow conditions. Moreover, if the operational status of NIROP changes and an off-site contractor is used to operate and maintain the system, additional automation, monitoring, and remote operation of critical system components will likely be needed. Upgrade and increased automation of the treatment system controls have significant potential value and are, therefore, identified as a potential cost-savings alternative.

4.7.2 SCADA Description

The current system uses a supervisory computer to provide an HMI which also serves as a limited SCADA system. The computer is a Compaq Presario 4504 with Allan Bradley RSView 32 Windows NT Version 4.0 software for control and data management and an HP LaserJet 5SE printer. Due to an apparent lack of data storage, an external memory storage system was added to download 30 days of

operating data. The external memory used is a SYQUEST - Spar Q 1.0GB backup memory. Information was not available on the type of long-term solution being pursued to store and maintain data for the Phase 2 system.

Basic operational data, stored in comma-separated variable (CSV) files or data base files (DBF) require minimal storage space. It is recommended that the RSView software be configured for collection of data in this format. An economical method of data storage is then to create daily reports and store them as independent Excel spreadsheets, which can be done in either an automated or on-demand fashion with a properly configured system.

Approximately 12 different screens, as well as the control of the new treatment area, are planned but have not been developed. The design specifications call for remote access capability to the SCADA/HMI, but this access was not installed nor described in the draft O&M Manual. Further development of the system SCADA capabilities would be an integral part of the upgrade of the system controls capability.

4.7.3 SCADA Location and Access

The SCADA/HMI is located in Building 52/53. A separate control room is included in the design for Phase 2 construction which will house the SCADA/HMI computer. There is no remote access for control or data management in the Building 52/53 system. It is not clear if remote access to these systems is planned for the Phase 2 construction; however, remote access to data and key operating functions will provide operating and monitoring efficiencies and cost savings if unattended operation is required in the future. This access could be provided on a lap-top computer with a "Runtime" version of the RSView software installed. All the levels of access, monitoring, and control would be available to the operator via modem from remote locations. Providing for mobile and remote access to the SCADA/HMI would be an integral part of the upgrade of the system control capability.

4.7.4 Identification of Possible Alternatives

The following alternative would result in substantial savings if implemented:

- **SCADA Upgrade** - Improvement of the SCADA system to provide for remote monitoring and control, additional long-term data storage, remote access, software to retrieve and process data from other electronic formats, and prepare customized reports (see Section 4.8) would provide multiple benefits. These benefits include reduced cost from

eliminating manual input of data and potential of input errors, better access to data from remote locations; and remote response to routine alarms and operating conditions without the expenses of an operator being present. An initial evaluation of the SCADA upgrade alternative is presented in Section 5.2.8.

4.8 Data Acquisition and Reporting

4.8.1 Evaluation of Current Data Acquisition and Reporting Program

Data acquisition and the preparation of regulatory reports represent a significant cost component of the current remediation program. Quarterly reports are submitted to the Metropolitan Council of Environmental Services (MCES), and an annual report is submitted to EPA and MPCA. This aspect of the remediation program will increase substantially upon initiation of Phase 2 activities due to additional monitoring/sampling, analyses, and reporting required to meet air quality and NPDES discharge reporting requirements. Therefore, upgrade of the automated data acquisition and reporting program may provide significant cost savings and is identified as a potential cost-saving opportunity.

Most system monitoring, data acquisition and compilation, and report preparation tasks for the site are currently done manually. The SCADA system software allows trend analyses for only a one-day period. Data can be collected in the system for approximately one month and then must be periodically downloaded to a permanent file. Selected data from this permanent file are then manually extracted and loaded into an Excel data base for future access and for reporting.

There are several important factors in the evaluation of the data acquisition and reporting program. First, only the pumps and equalization tank levels are currently automated. A SCADA system has recently been installed and will be brought on-line with the Phase 2 equipment. This system has good system monitoring and alarming capabilities but currently has only limited systems control and data acquisition capabilities.

A second important factor is the potential for additional data acquisition and reporting needs associated with any possible future expansion of the remediation program to address source reduction. Any expansion may further increase the scope and costs associated with data acquisition and reporting at this site. It is reasonable to project that the total scope of the data acquisition and reporting tasks at NIROP may increase by 50 to 100 percent over the next 5 years. This may increase the additional monitoring of groundwater wells within the building footprint.

A third important factor is that site divestiture may result in the selection of a future operations contractor that may not reside on-site. This monitoring and operations may be performed without the benefit of a full-time on-site contractor.

4.8.2 Groundwater and Contaminant Capture Monitoring

In addition to the processing of treatment system and extraction well data, consideration should be made to using the SCADA system to analyze the containment performance of the groundwater pumping system and impact on VOC concentrations over time. This would require the automated collection and input of monitoring well groundwater elevations, and analytical data from the sampling and analysis. This data management approach, in conjunction with a software upgrade of the SCADA system, would provide an easily accessible, single-source, centralized data base for all groundwater contamination and remediation system performance information.

4.8.3 Identification of Possible Alternatives

Two possible alternatives to the data acquisition and reporting program could be implemented that may yield benefits including significant cost savings. These alternatives are as follows:

- **SCADA Upgrade** - Expand the automated system monitoring and data collection capabilities. An evaluation and initial identification of possible alternatives for improvement and upgrade of the current and planned Phase 2 treatment system equipment controls and system monitoring capabilities are presented in Sections 4.6 and 4.7 of this report. This modification would result in the following cost savings:

  - Reduction in labor hours previously required for the collection of various information to include groundwater elevation data, system pressure and instantaneous and totalizer wellhead data, influent and effluent flow readings, temperature, flow rate and pressure at the air discharge point, and current river stage information.

  - Reduction in labor hours previously required for downloading data from a temporary file to a permanent file and the manual entry of this data into the data base.

- **Develop Standardized and Automated Reporting** - Monitoring data automatically stored in the remedial system data base can be pre-formatted for automated insertion into standardized reports. This feature would also economize the preparation of anticipated additional reporting which is repetitive in nature such as NPDES reports. This would increase the efficiency of preparing the quarterly reports to MCES and the annual reports to MPCA and EPA. All laboratory data should also be received in digital format for automatic inclusion into the program data base. This modification would result in the following cost savings:

  - Reduction in labor hours previously required for manual insertion of laboratory data into the data base and for development of supporting report information such as summary tables of flows and mass removal rates, groundwater elevation and contaminant distribution maps, and other related documentation.

  - Reduction in labor hours previously required for preparation of the standardized portions of the reports. This action does not include time for data interpretation and presentation of interpretive sections of the report which would still require preparation.

  - Reduction in necessary QA/QC time as a result of eliminating human error in data transfer.

It is reasonable to expect that implementing the above recommendations should decrease yearly data acquisition and reporting costs by as much as 50 percent. The projected changes and savings presented herein are reasonable estimates based on industry experience. The actual savings will be better estimated as future work scope needs are finalized. Further evaluation of this opportunity is necessary to more accurately determine the degree of possible improvement and cost savings. An initial financial evaluation of these data acquisition and reporting alternatives is presented in Section 5.2.9.

4.9 Future Remediation System Requirements

4.9.1 Future Additional Remediation Activities

Pending results of ongoing investigations and risk analyses, additional remediation activities may be implemented at the facility. The investigations and feasibility analyses are currently focused on two areas: 1) dissolved VOCs in off-site downgradient groundwater; and 2) soil contamination and VOC source(s) beneath the main manufacturing building.

The groundwater extraction system is presently operating at 63 percent of its maximum flow capacity, or 630 gpm. The potential exists to utilize the remaining 370 gpm for treatment of additional groundwater. This should be sufficient if the current capture system and the future system are both operated at maximum hydraulic efficiency. However, utilization of all the available capacity will require that parts of the extraction system be shut down during any routine maintenance operations which would require shutdown of any of the ASUs. The existing control panel on the Phase 2 groundwater collection system also appears to have sufficient capacity for incorporating the control modules for the additional groundwater recovery wells.

Any future remediation systems at NIROP, if necessary, may involve one or more of several in-situ or ex-situ treatment technologies. If the groundwater extraction system is expanded in the future, then one key issue may be the location of the additional groundwater extraction wells. Presently, the influent equalization tank is located in Building 52/53 and requires pumping to the air-stripping system. If any new extraction wells are installed at the site, it will not be possible to pump from these new wells directly to the air strippers because the influent tank and ASU feed pump are located in Building 52/53 and there are no provisions in the new treatment area to feed directly to the air strippers. Additionally, the anti-scaling system is also located in Building 52/53, further supporting the need to route to this location rather than directly to the ASUs. Therefore, additional multiple pumping, as presently done from the extraction well to Building 52/53, to the air strippers and finally back to Building 52/53 for discharge may be required.

Potential VOC sources located under the manufacturing building are currently being investigated. Results of ongoing investigations and risk analyses may require remedial alternatives including a soil vapor extraction (SVE), air sparging, or other in-situ remediation/source removal system. These systems can be as stand-alone with a separate control panel and controllers, or can be accessed and monitored through the groundwater extraction system SCADA if it were properly configured.

4.9.2 Future SCADA Needs

If additional groundwater remediation systems or on-site soil remediation systems are implemented, each will require additional monitoring and control. It is reasonable to expect that if the groundwater recovery system is expanded, it may require control and monitoring of pumps, groundwater elevations, and line pressures at the wellhead for any additional wells. If an SVE or air sparging system is implemented, it would likely require monitoring of at least blower operation and system pressure and/or flow. If only short-term source removal/reduction systems are implemented, however, expanded SCADA capabilities may not be justified.

4.9.3 Identification of Possible Alternatives

The control panel for the current system should be expandable to handle the additional inputs, or the system programmable logic controller (PLC) should be expandable to be able to interface with additional control panels. To provide for possible expansion at NIROP, the control panel on the Phase 2 remediation system should allow for the future control and monitoring of up to five additional wells. In addition, the PLC should be expandable to allow the future control of an additional control panel for other possible systems being considered, such as SVE, air sparging, or other in-situ technologies.

Proper configuration of the SCADA on the Phase 2 system would facilitate this future expansion. Cost savings will result through the efficient use of hardware and only a single software system. Single-point access and control and the expanded use of automated data collection and reporting capabilities would yield cost savings for the operations, maintenance, and reporting associated with any new systems similar to those potential savings for the current system. This would occur, however, at essentially no additional cost.

The potential future value of developing a SCADA now in consideration of future needs cannot be estimated. The value of this alternative will certainly increase as on-site labor costs and the scope of the remedial program increases at NIROP. In such a situation, expandable remote system control and data acquisition capabilities provide significant future cost control.

5.0 ALTERNATIVES COST REDUCTION ANALYSES

5.0 ALTERNATIVES COST REDUCTION ANALYSES

5.1 Approach to Cost Analysis

The results of the background information review and site evaluation identified alternatives that may lead to significant cost reductions. Some of these alternatives were not selected for further evaluation because implementation was not deemed feasible, or results and/or value was unable to be determined. Table 1 shows those alternatives that will not be considered for further analysis. In some cases, two or three of the initially identified alternatives were so interrelated that they were combined for final evaluation purposes. The final alternative in other cases is simply a broader or more general definition of the initially identified alternative. A summary of the results of this final alternatives evaluation is shown in Table 3 and discussed in detail in the remainder of this chapter.

The objectives of the final alternative analysis are as follows:

- Identify those alternative actions or measures that could be implemented to realize significant cost reductions. For example, well field modification is a final alternative identified to optimize contaminant mass removal and hydraulic capture, thus optimizing the effectiveness and reducing the costs of the current remedial treatment technology.

- Evaluate each alternative sufficiently to determine their applicability and to formally establish their merits and relative importance (ranking) from a cost/benefit standpoint.

- Calculate annual and life-cycle cost savings for highly ranked alternatives, including present-worth analysis of any capital investment.

- Prepare a list of recommendations, plan of implementation, and a summary of cost savings and ROIs expected to be realized from implementation of those recommendations.

The first three objectives are addressed in the remainder of this chapter. The last objective that results in the final recommendation of the NA is summarized in Chapter 6.0, along with an implementation plan.

Table 3 provides a summary of the financial analyses for the eight final alternatives evaluated. The details of the financial analyses are presented in the cost analyses tables provided in Appendix C. The estimated cost of current operations, the estimated cost of the proposed operations, and the capital cost of the

Initially Identified Alternative[1]	Final Alternative Evaluated[1]	Initial Cost	Annual Cost Savings	Life-Cycle Savings[2]	Return on Investment (years)
Install Two Additional Extraction Wells - Reduce Pumping Rates	Well Field Modification	$205,500	$ 74,610	$ 650,276	2.75
Discontinue Pumping Extraction Well AT-1A					
Use of Bypass Line	Bypass to Sanitary Sewer	$ 25,740	$ 1,850	$ -4,520	13.91
Gravity Discharge to Storm Sewer	Gravity Discharge to Storm Sewer	$ 53,820	$ 16,425	$ 134,574	3.3
Install Variable Speed Drives	Influent and Effluent Pump Upgrades	$ 50,000	$ 7,876	$ 40,337	6.3
Perform Strategic Predictive Maintenance	Optimize Operations and Maintenance	N/A	$ 2,830	$ 56,600	N/A
Reduce Sampling Locations	Streamline Sampling and Monitoring Program	$ 20,000	$ 26,600	$ 285,102	0.7
Reduce the Monitoring Frequency					
Change the Method of Analyses					
Replace/Relocate Pressure Transducers	Wellhead Monitoring Upgrade	$ 16,500	$ 15,400	$ 160,138	1.1
Automate Wellhead Monitoring					
Supervisory Control and Data Acquisition (SCADA) Upgrade	SCADA Upgrade and Automated Reporting	$ 20,000	$ 16,500	$ 169,255	1.2
Develop Automated/Standardized Reporting					
Perform SCADA Supported Planned Maintenance					
TOTAL[3]		$365,820	$160,241	$1,496,282	

N/A - Not Applicable

[1]Combining several initially identified alternatives under a single heading.
[2]Assumes a 20-year period of operations for life cycle cost estimating.
[3]Totals do not include costs or savings for use of the bypass line.

TABLE 3 - Summary of Alternatives Cost Reduction Analyses

proposed alternatives were based primarily on cost information provided in the 1997 NIROP Operations and Maintenance Cost Analyses Report or cost information for completing similar work elsewhere. When no actual cost information was available, cost estimates using conservative assumptions and general industry experience were used. The supporting assumptions and calculations are provided, along with the summary tables in Appendix C. The present worth of both the current and proposed operations is based on a facility life of 20 years and a discount factor, or value of money, of 6 percent. The potential life cycle savings then represents the difference between the calculated present worth of the current versus the proposed (including cost saving alternatives) operations.

5.2 Final Cost-Saving Alternatives

Several initial alternatives or program modifications have been identified in the evaluation of the groundwater remediation program at NIROP. The final alternatives that may offer potential significant cost reductions to the program have been selected and are discussed below.

5.2.1 Well Field Modification

Operational problems and maintenance activities related to system scaling and fouling, hydraulic capture effectiveness, and mass removal efficiency of the remediation system well field are important considerations in this program. As discussed in Section 4.2, the installation of two additional extraction wells, coupled with reduced pumping of all wells, and a discontinuance of pumping at well AT-1A are well field modifications which should address these problems and reduce program costs.

Well field modification would involve the design and installation of two wells which would involve modifying the currently approved GWTF work plan. In addition, individual well pumping rates would be reduced by an estimated 25 percent. The potential cost savings (annual and life cycle) resulting from these two alternatives, along with the associated costing assumptions, are presented in Table C-1 (Appendix C). A summary of the cost reduction analyses for this alternative is provided in Table 3. The financial analyses indicate that the cost for implementing this alternative would be approximately $205,500, whereas the annual cost savings are estimated at approximately $75,000, thus providing an ROI of 2.75 years, with yearly savings at this level for each year of operation. The potential life-cycle savings, based on an assumed 20 years of system operation, are estimated at approximately $650,000.

This modification would also provide additional excess capacity to handle future additional flow that may be required to ensure hydraulic capture of the impacted groundwater. For example, if pumping of

additional water for source removal beneath the building were ever deemed necessary, the system would have the capacity to handle these flows, thus avoiding the need for and costs of additional GWTF construction. However, the resulting cost savings which this represents cannot be estimated at this time but is believed to be significant.

5.2.2 Bypass to Sanitary Sewer

Section 4.3 discusses the use of the existing bypass line for direct discharge of pumped water to the sanitary sewer, thus eliminating the use of the 30-hp influent pump. This alternative involves the diversion of the flow to a 10-inch-diameter replacement pipe during system downtime and employs an automated valving system to redirect the flow to the normal operating mode. The details of the financial analyses are provided in Table C-2 (Appendix C). A summary of the cost reduction analyses for this alternative is presented in Table 3.

This alternative would utilize the upgraded bypass line from the extraction wells to the sanitary sewer and eliminate the need for pumping from the equalization tank to the sanitary sewer. However, the bypass line would be upgraded by the addition of wafer check valves that were not included in the original design. Additionally, the bypass line would be automated so that an operator can readily bypass the air strippers and discharge directly to the sanitary sewer when this is necessary in the future. This automation would require the addition of valve operators to the existing manual valves on each groundwater extraction well influent line. This bypass could then be used in the event that the air-stripping system is not available and groundwater must be discharged to the sanitary sewer from all or some of the extraction wells. The total cost for upgrading the bypass line and automating the valves would be approximately $25,740. The potential savings that may be realized if these valves were automatically operated on average of once per quarter for a 2-day maintenance operation and twice per annum for an emergency bypass is approximately $1,850 per year.

The financial analyses indicate that although the original capital costs would be repaid in approximately 14 years, the present worth value of the savings would be less than the present worth value of the investment, assuming 6 percent interest over 20 years. This investment is, therefore, not viable based entirely on financial considerations. An operational benefit to this alternative would be the ability to automatically control the flow from each well.

5.2.3 Gravity Discharge to Storm Sewer

Replacement of the current effluent pumping system with a gravity discharge system is an alternative that may significantly reduce costs. The potential for gravity discharge of Phase 2 water to the storm sewer is discussed in Section 4.3. The details of the financial analyses are provided in Table C-3 (Appendix C). A summary of the cost reduction analyses for this alternative is provided in Table 3.

In this alternative, the treated groundwater from the air strippers is gravity-discharged to storm sewer discharge points 010 or 020. This alternative also involves the implementation of automatic controls for operation of the effluent pumps and monitoring of storm sewer levels. Permit modifications would be required prior to implementation of this alternative; however, this process would be facilitated by the availability of effluent groundwater quality data from air-stripping operations for use with the regulator. This alternative also includes the installation of 200 linear feet of gravity line, an independent monitoring station, upgrading the PLC, and provision of field instrumentation to automatically switch outfalls if the gravity discharge sewer backs up due to an excessive storm flow.

The capital cost for this alternative would be approximately $54,000. The potential annual and life-cycle savings over continuous O&M of the existing effluent pump are approximately $16,000 and $135,000, respectively, thus providing an ROI of about 3 years.

5.2.4 Influent and Effluent Pump Upgrades

Modifying the influent and effluent pumps by replacing the existing constant-speed starters with variable-speed drives is an alternative that may significantly reduce costs through decreased use of electrical power. This alternative assumes that actual treatment system flows average 750 gpm over the lifetime of the system. The details of the financial analyses are provided in Table C-4 (Appendix C). A summary of the cost reduction analyses for this alternative is provided in Table 3.

The capital cost for this alternative is approximately $50,000. The potential annual and life-cycle savings are $7,900 and $40,000, respectively, thus providing an ROI of approximately 6 years.

5.2.5 Optimize Operations and Maintenance

In Section 4.4, three alternatives to reduce the cost of the O&M task were identified for further evaluation. The proposed modifications included the performance of strategic predictive maintenance, performance of SCADA-supported planned maintenance, and provision of upgrades to the SCADA system. Of these three alternatives, only performance of strategic preventative maintenance is considered under the final alternative to optimize O&M. The remaining two recommendations are evaluated under the final alternative of SCADA upgrade and automated reporting.

The potential cost savings (annual and life cycle) from performing strategic predictive maintenance are presented in Table C-5 (Appendix C). The specific assumptions of cost and savings are provided on the attached work sheets. A summary of the cost reduction analyses for this alternative is provided in Table 3. As presented in the costing tables, performance of biannual predictive maintenance on the pumps and settings is projected to result in a net annual savings of approximately $2,800, with estimated life-cycle savings of $56,600. As shown on the costing sheets in Appendix C, no additional capital investment is required, and actual savings may be greater than currently estimated if the number of extraction wells are increased in the future.

5.2.6 Streamline Sampling and Monitoring Program

Three alternatives to reduce the cost of the environmental sampling and monitoring program at NIROP are presented in Section 4.5: reduction of sampling locations (monitoring wells); reduction of sampling frequency; and modification of analytical method.

The three closely related alternatives are combined under the common final alternative to streamline the sampling and monitoring program. The potential cost savings (annual and life cycle) of the combination of these three alternatives are presented in Table C-6 (Appendix C). A summary of the cost reduction analyses for this alternative is provided in Table 3.

For the reduction of sampling locations alternative, cost savings result from eliminating 8 of the 44 monitoring well locations from the current groundwater sampling plan. Wells to be removed from the sampling program are those wells upgradient of or removed from the plume which exhibit historical results of VOC concentrations at non-detectable or below action levels for at least the past three years.

For the sampling frequency alternative, 10 of the monitoring wells are to be sampled annually instead of semiannually. These are wells that are located cross-gradient to the groundwater contaminant plume and which have shown non-detectable or very low contaminant concentrations over the past several sampling events. Semiannual samples would be collected from the remaining monitoring wells and from all of the groundwater extraction wells.

The analytical laboratory method for VOC analysis would be changed from EPA Method 624 (a GC/MS method) to EPA Method 601/602 (a GC method). This change in method should reduce analytical costs by approximately 50 percent for each sample analyzed.

The cost analysis data presented in Table C-7 show that the potential cost savings for implementing the above changes may be as great as $26,600 per year and $285,000 throughout the life of the program and represent an ROI of less than 1 year. The feasibility of implementing these changes would depend on obtaining regulatory approval from MPCA and EPA.

5.2.7 Wellhead Monitoring Upgrade

Section 4.6 discusses wellhead monitoring system modifications which involve replacing and relocating the pressure transducers and automating monitoring at the wellhead. The details of the financial evaluation are provided in Table C-7 (Appendix C). A summary of the cost reduction analyses for this alternative is provided in Table 3. The modification includes the hard wiring of the existing groundwater level transducers at the extraction wells, relocation of pressure transducers from the transmission lines to the extraction wells, and installation of signal cable from the transducers to the SCADA system via either Building 52/53 or the new treatment area PLCs. This alternative assumes that the existing Phase 2 construction includes sufficient spare communication cable between the PLC located in Building 52/53 and the SCADA system control room in the new treatment area to accommodate transducer signals from the collection wells located near Building 52/53. It also assumes that the underground cable installation route from the wellheads to the PLCs is readily accessible. Cost savings from this alternative result from the decrease or elimination of manual data collection and entry of data into the data base. The resultant ability to maintain the wells, pumps, sensors, and piping based on improved system performance monitoring versus a fixed time schedule would provide additional cost savings.

As shown in Table 3, the capital cost for this alternative is approximately $16,500. The potential yearly and life-cycle savings of this alternative are approximately $15,400 and $160,000, respectively; thus, the ROI is slightly over 1 year.

5.2.8 SCADA Upgrade and Automated Reporting

The SCADA system upgrade and its use in the development of automated and standardized reporting and in supporting more efficient planned maintenance are all interrelated benefits. As shown in Table 3, these three initial alternatives were combined and evaluated as SCADA upgrade and automated reporting.

5.2.8.1 SCADA Upgrade - Further enhancement of the system control, monitoring, data collection, and reporting program involves upgrade of the existing SCADA system for automated data collection and remote monitoring, along with the development of an automated data processing and standardized reporting program. The potential for upgrade of the SCADA system for system monitoring is discussed in Section 4.7. The details of the financial analyses are provided in Table C-8 (Appendix C). A summary of the cost reduction analyses for this alternative is provided in Table 3. This alternative includes reconfiguring of the RSView software in the existing system to accommodate an internal memory exceeding 30 days using CSV or DBF files. Also included is the addition of remote access and control of the SCADA system using two lap-top computers with "Runtime" versions of the RSView software installed and a tape backup to access historical data. Reduced costs would result by allowing an assessment of system alarms from remote locations, thus eliminating unnecessary operator responses to noncritical system alarms; providing more efficient, as well as remote, access to system data (lack of real-time access); elimination of manual compilation of analytical results; and decreasing labor costs associated with manual report preparation to regulatory authorities. Operational benefits are also associated with this alternative and include reduced errors of automated data entry of analytical results, single point access of data, consistent data collection methodology, consistent format of reporting over time, and lower operator/contractor changeover costs. Potential additional savings, which would be realized at no additional cost upon future expansion of the system, are not included in this analysis.

The capital cost of this alternative is approximately $20,000. The potential yearly and life-cycle savings of this alternative are approximately $16,500 and $170,000, respectively, with an ROI of slightly over 1 year.

5.2.8.2 Develop Automated Data Collection and Reporting System - The improved SCADA system will provide the capability for automated data collection and reporting. Using this system, the collected data can be loaded into a data base and appropriate data printed out in pre-formatted, standardized tables as required. This would significantly decrease the time required for data preparation in support of report generation. Analytical laboratory data should be acquired in digital form and incorporated into the remedial program data base for further analysis and for generation of monitoring data tables. Repeat

analytical functions on data such as trend analysis for contaminant mass removal, constituent ratios, and others can be preprogrammed to be generated on an as-needed basis or at some desired frequency.

The projected treatment system monitoring and reporting costs are estimated in the 1997 O&M cost analyses report as $61,680 per year. Using the improved automated system, it is reasonable to project that yearly reporting costs decrease by as much as 50 percent. Reduced reporting costs would result from the elimination of manual transfer of operating and laboratory data into the data base; labor savings from repeat generation of automated, standardized data tables, groundwater contour maps, and data trend charts; labor savings from automated, standardized text formatting; reduced QA/QC time and costs; report review and revision time; and reduced duplication and transmittal costs. Assuming a very conservative estimate of 20 percent reduction, in effect would provide an annual cost savings for reduced reporting of approximately $12,300. These savings are included along with the savings calculated for the SCADA upgrade in Table C-8 and the accompanying work sheets in Appendix C.

5.2.8.3 Perform SCADA-Supported Planned Maintenance - Performing SCADA-supported planned maintenance involves using system performance trends and current operating conditions to determine the optimum time for performing specific maintenance tasks. One example of this is to use instantaneous flow data to indicate the optimum time for the cleaning of well or pump screens. An additional example is to use the tray aerator air flow data to optimize the scheduling of acid wash events. In this manner, only the maintenance tasks that are actually necessary are performed at the optimum time.

The exact value of implementing this alternative, however, cannot be reasonably estimated because there are no existing cost data on any of the current or projected specific maintenance tasks. Additional cost savings due to SCADA-supported planned maintenance, therefore, are not included in the total cost savings calculated for SCADA upgrade and automated reporting. This indicates that the annual and life-cycle savings provided by the SCADA upgrade and automated reporting are probably very conservative.

6.0 SUMMARY AND RECOMMENDATIONS

6.0 SUMMARY AND RECOMMENDATIONS

6.1 Summary and Ranking of Final Alternatives

The NA for the NIROP groundwater remediation program identified alternatives or program modifications that can potentially significantly reduce the cost of remediation. Based on collected site information and the site inspection, 12 alternatives were initially identified for further evaluation (see Table 1). These alternatives were assembled into eight final recommendations which were then analyzed to determine their applicability and estimated cost savings, including ROI (see Table 3). A summary of the final alternatives evaluation and ranking is provided in Table 4.

The data in Table 4 show that the total potential value of the cost-savings alternatives is approximately $160,241 per year, or approximately 20 percent of the average yearly O&M costs over the 20-year life of this facility. The calculated total present worth value of these alternatives, based on 6 percent interest over a 20-year project duration, is estimated to be approximately $1,500,000 (see Table 3).

For the purposes of this NA, the proposed final alternatives were ranked according to estimated value with the No. 1 and No. 8 ranked alternatives having the highest and lowest values, respectively. Modification of the well field, streamlining of the sampling and monitoring program, SCADA upgrade and automated reporting, providing gravity discharge to the storm sewer, and the wellhead monitoring upgrade represent the most significant potential cost savings at this site. The other proposed alternatives represent lesser, but still viable, potential cost savings.

6.2 Recommendations

The proposed alternatives exhibiting the greatest potential for cost savings are recommended to be evaluated in greater detail and a plan developed for implementing them. Activities included in the further analysis and planning would involve the following:

- Meeting with NAVFAC and appropriate personnel to further confirm the costing information used to make the assumptions, and to identify those alternatives to be evaluated in greater detail.

- Conduct preliminary discussions with appropriate regulatory agencies to evaluate the regulatory and political willingness or resistance to the proposed alternatives, and to

04-9912\9912-T01.TBL

Proposed Final Alternative	Estimated Value[1]	Return on Investment (years)	Ranking of Alternatives
Well Field Modification	$ 74,610	2.7	1
Bypass to Sanitary Sewer	$ 1,850	14.1	8
Gravity Discharge to Storm Sewer	$ 16,425	3.3	4
Influent and Effluent Pump Upgrades	$ 7,876	6.3	6
Optimize Operations and Maintenance	$ 2,830	N/A	7
Streamline Sampling and Monitoring Program	$ 26,600	0.75	2
Wellhead Monitoring Upgrade	$ 15,400	1.1	5
SCADA Upgrade and Automated Reporting	$ 16,500	1.2	3
TOTAL[3]	$160,241	--	--

N/A - Not Applicable

[1]Average cost savings per year over a 20-year life cycle.
[2]Represents 20 percent of currently projected program costs totaling approximately $750,000.
[3]Total does not include bypass to sanitary sewer.

TABLE 4 - Summary of Final Alternatives Evaluation and Ranking

further evaluate any additional activities and costs associated with gaining regulatory approval.

- Perform a 30 percent engineering design for those alternatives where engineering design is required and, from a regulatory standpoint, have a high chance of successful implementation.

- Develop detailed cost estimates based on engineering design and vendor quotes.

Develop a detailed strategy and plan for implementation of those alternatives that are confirmed to provide significant ROI and show a high likelihood of successful execution.

APPENDIX A

Information Review Correspondence and Document Documentation, and Site Visit Summary Report

April 2, 1998

Mr. Scott Glass
Southern Division
Naval Facilities Engineering Command
P. O. Box 190010
North Charleston, SC 29419-9010

Re: Request for Information
Fridley, Minnesota, Needs Assessment

Dear Scott,

This letter is to summarize my understanding of the most important points of both the kickoff meeting telecon on Friday, March 27, 1998, and our subsequent telephone call of March 30, 1998. The major points summarizing these communications are as follows:

- Since construction of the treatment system will happen soon, any major issues or possible changes to the current design or remedial action work plan (RAW) will be brought to your attention immediately, rather than waiting to be presented in the final project report. This will include the identification of alternate technologies which may benefit your remediation program.

- As part of our evaluation, we will consider the possibility that responsibility for the day to day O&M could possibly change in the future.

- The possible need for system expansion to address conditions in the park area between the site and the river will be considered during the assessment.

  The needs assessment team will work with Tim Ruda, your site environmental specialist, and Mark Sladic, of TetraTech, during the compilation of background information and during the site visit, since some of the information is available only through them. I will contact both Tim and Mark directly.

- Ideally, the site visit should be scheduled for approximately two weeks after receipt of background information to give the site assessment sufficient time for review of the information and formulation of a specific on-site assessment plan. This schedule will be shortened if possible.

- In general, the background information identified on Exhibit 2 of SAIC's proposal dated March 6, 1998, will be provided for our review. Specifically this will include:

    1. Available well field design information;
    2. The Focused Facility Assessment Report and the ROD;
    3. O&M Manual;
    4. RI/FS report and Addendum;
    5. RAW and Upgrade report;
    6. Initial and most recent yearly monitoring reports (without original laboratory and QA/QC reports);
    7. Recent Modflow analyses and non-contaminant chemistry data included in monitoring reports;
    8. RI/FS reports (without full data packages) for the OU2 and OU3 source areas;
    9. RMT System Design Information including design drawings, work plan, and addendum;
    10. O&M Analyses Report of 1997;
    11. Draft of five-year O&M Summary Analyses Report;
    12. USGS seismic survey report;
    13. Summary of existing GIS structure and supporting databases; and
    14. Historical program cost information.

- You will pull together any of this information that you have for delivery to me by no later than April 7, 1998.

- For planning purposes, the background information will be reviewed and a site visit plan prepared by April 17, 1998. This schedule would result in completion of the field visit portion of the site evaluation during the week of April 20, 1998. You will plan to be present during the exit debrief portion of the field visit.

- One copy of all reports will go to you, Tim Ruda, and Richard Zuromski.

  In addition, after our telecon, I received some additional input from the SAIC project team. Would you please provide or direct me to information, or advise me if no information is available regarding the following additional points:

- A description of how the system captures and exports the initial data, and what types of analyses are performed on the data.

- Does the facility have a laboratory information management system (LIMS)?

- A description of any information systems used such as Computerized Maintenance Management System (CMMS), Process Historian, or Environmental Information Management System.

I trust that this is an accurate summary of our conversations. Please provide any additions, changes, or comments which you may have. I look forward to our continuing interaction on this project.

Truly,

Richard C. Cronce, Ph.D.
Vice President, Earth Sciences

cc: Richard Zuromski, NFESC (via email)
Michael Carsley, NFESC (via email)
Tim Ruda, UDLP (via e-mail)
Mark Sladic, TetraTech (via e-mail)
Tom Galatro, SAIC
Steve Zimmers, SAIC
Gary Jones, SAIC (via email)
J. Scott Lockhart, SAIC (via email)
Nick Trentacoste, SAIC (via email)

April 22, 1998

Mr. Scott Glass
Southern Division
Naval Facilities Engineering Command
P. O. Box 190010
North Charleston, SC 29419-9010

Re: SAIC Receipt of File Documents
Fridley, Minnesota, Needs Assessment
01-1408-04-9912-100

Dear Scott,

I have received the four boxes of documents from you, and one box of documents from Mark Sladic of Brown and Root. All of the documents listed on your accompanying letter are in order, and the documents will be handled as directed in your letter. Thank you for providing these. The review is underway in preparation for our site visit next week.

I have a call in to Pat Mosites to give him the visitor information required for the site visit, and to discuss any other visit requirements. I'll try to contact him again tomorrow.

Will provide an itinerary for the site visit by end of day on Friday.

Yours Truly,

Richard C. Cronce, Ph.D.
Vice President, Earth Sciences

cc: Tim Ruda, UDLP (via e-mail)
Mark Sladic, TetraTech (via e-mail)
Tom Galatro, SAIC
Steve Zimmers, SAIC
Gary Jones, SAIC (via email)
J. Scott Lockhart, SAIC (via email)
Nick Trentacoste, SAIC (via email)

April 7, 1998

Richard C. Cronce
SAIC/R. E. Wright
3240 Schoolhouse Rd.
Middletown, PA 17057

Note: All boxes checked
[illegible] Firmak

Subj: Request for Information, LTO/LTM Needs Assessment, NIROP Fridley MN

I am providing four boxes and one tube of information in support of the Needs Assessment. I believe I have provided the information identified in your April 2, 1998 letter with the following exceptions:

- Well field design information; Mark Sladic may have information on the original extraction/monitoring system designs if you are looking for more than what is in the FS and PP.
- Summary of existing GIS structure and supporting database; Mark Sladic/Tetra Tech constructed the GIS/DB.
- Historical program cost information: Tim Ruda should have this information.
- Tim Ruda exports data from the existing system and provides to Tetra Tech for analysis.
- Tim Ruda should be able to provide information on laboratory information management system, if it exists.

The following is a catalog of the references provided. The majority of the documents sent to you are my only copy, therefor I request you return them at your earliest convenience. I may require some of these documents be returned on short notice (primarily design/as-builts) therefor it be necessary to make copies for yourself if you are not complete with the review. I have identified these with an *. Documents identified as "copy" do not need to be returned.

Box 1:
Proposed Plan for GW Remediation, May 90 ✓
FFA/ROD. March 91/Sept 90 (extra copy) ✓
OU1 RI Report, June 87 ✓
OU1 RI Report Addendum, July 88 ✓
GWES O&M Manual, Rev 6, Dec 93 ✓

Box 2:
Evaluation of GWCS Effectiveness, July 96 ✓
1993 AMR ✓
1993 AMR Addendum ✓
WP for Improvement of GWCS Effectiveness, Jan 95 ✓
RAWP for GW Remediation. Rev 3. Nov 95 (copy) ✓

Box 3:
GW FS Report, July 93
GW FS Report Addendum, Aug 88
OU2 RI Report, Sept 93
OU2 FS Report, April 97 (extra copy)

Box 4:
WP for GWTF, Sept 97 (copy)
Interim Procedure for Collecting and Pumping GW to Sanitary Sewer, January 98 (copy)
WP for GWTF Addendum #1, March 98 (extra copy)
O&M Cost Analysis Report, Nov 97 (copy)
* Basis of Design, June 97
* Design Notes, June 97
Design Specifications, Sept 97 (copy)
* Evaluation of Treatment Process & Location Options, Feb 97
Seismic Reflection Survey, Feb 97
Initial Assessment Study, June 83 (extra copy)
11X17 copy of design drawings (copy)
Draft 5 year review, March 98 (copy)
Final Construction Cost Estimate, Sept 97 (copy)

Tube 1:
* As built drawings for Phase I GWTF construction

If you have any questions, please call me at (843) 820-5587.

Sincerely,

Scott A. Glass, P.E.

R.E. Wright Environmental, Inc.
a Subsidiary of Science Applications International Corporation
An Employee-Owned Company

June 4, 1998

Mr. Scott Glass
Southern Division
Naval Facilities Engineering Command
P. O. Box 190010
North Charleston, SC 29419-9010

Re: Site Visit Summary Report
Fridley, Minnesota, Needs Assessment
R.E. Wright Project 01-1408-04-9912-100

Dear Scott:

Science Applications International Corporation (SAIC) has conducted a site evaluation of the groundwater collection and treatment system at the Naval Industrial Ordinance Plant (NIROP) in Fridley, Minnesota. This evaluation was performed in accordance with Task 2 of SAIC's contract entitled "Assessment of Groundwater Extraction System and Groundwater Treatment Facility for Optimization of Long-Term Operation and Long-Term Monitoring Performance" (Contract No. N47408-98-C-2228, dated March 19, 1998). A summary report of this site visit is provided below.

INTRODUCTION AND OBJECTIVES

The site visit was conducted as one of the tasks included in the ongoing optimization assessment of NIROP groundwater treatment program. Site background information provided by Naval Facilities Engineering Command was reviewed in preparation for the site visit. Based on this preliminary review, a final site visit plan and agenda were submitted to Mr. Pat Mosites (SAIC letter dated April 24, 1998). The primary objectives of the site visit were as follows:

1. Discuss the objectives and importance of the project with site personnel.

2. Tour the facility to acquire firsthand knowledge of the site and system conditions.

3240 Schoolhouse Road, Middletown, Pennsylvania 17057 • Phone (717) 944-5501 • (800) 944-6778

3. Review records and information not available during the Task 1 background information review.

4. Collect unrecorded information through interviews of on-site personnel.

5. Conduct a firsthand inspection of remediation equipment and systems.

The site visit was conducted on April 29 and 30, 1998. Present during the visit were Mr. Tim Ruda (UDLP), Mr. Pat Mosites (NAFAC), and Mr. Patrick K. (Kerry) Morrow (NAVSEA). The SAIC assessment team and their respective area of expertise were of Messrs. Richard Cronce (earth sciences/remedial technologies), Thomas Galatro (engineering/electrical design), Steven Zimmers (operations and maintenance [O&M]), and Gary Jones (data management and control). The site visit generally followed the planned agenda. The results of the visit are summarized below.

INTRODUCTION AND IN-BRIEF MEETING

The in-brief meeting involved Messrs. Ruda, Mosites, and Morrow, and the SAIC evaluation team. Mr. Cronce introduced the evaluation team and presented the project objectives. The in-brief discussions are summarized as follows:

1. The Navy is in the process of divesting this site while retaining the environmental responsibilities. This situation will influence the approach to the design and operations of any on-site treatment systems. Systems should be "out of the way" of future facility operators, who may or may not be responsible for the day-to-day O&M of the system(s).

2. Mr. Ruda stated that UDLP's approach to site remediation is very practical, and that he doubted that any additional automation or data integration of the existing system would have significant value.

3. The remediation, as currently designed, is meant to address groundwater contamination associated with on-site source areas outside of the plant building. There are additional known areas of contamination, both beneath the building and off-site between NIROP and the Mississippi River. Therefore, the current remediation program will likely expand significantly in scope over the next five years.

4. The presence of high concentrations of trichloroethene (TCE) in site groundwater indicates the probable presence of free-phase TCE as dense non-aqueous phase liquid (DNAPL), which may require an extended period of groundwater remediation to mitigate.

SITE TOUR AND SYSTEM EVALUATION

Mr. Ruda provided a tour of the treatment facility and the site. The evaluation of the equipment is summarized as follows:

1. The treatment system process equipment appears well engineered.

2. Mr. Ruda indicated that the totalizing flowmeters inside of the treatment building do not match the flow rates on the computerized system control and data acquisition screens.

3. Well AT-2 is screened in clay. Dewatering of the water-bearing zone causes cascading of water in the well which accelerates system fouling.

4. Although there are groundwater level transducers at the wellheads, there is currently no means of remotely monitoring or controlling groundwater elevations in the pumping wells. Groundwater elevation sensors present in the wells are not active due to corrosion problems. Mr. Ruda indicated that control of groundwater elevations from within the treatment building would be convenient, but questioned the value of the required investment. There are no plans for this in the current engineering design.

5. One in-line flowmeter, near the equalization tank, was noted to be improperly positioned.

6. The pressure transducers for the influent lines of all of the wells are located inside of the treatment building near to the equalization tank. Therefore, these readings do not indicate pressures at the wellheads or in the lines.

7. Tank No. 2 in the treatment building is used for storage of sludge generated during system maintenance. System fouling is a major problem. System piping is periodically cleaned physically by air jetting. Well and pump screens are cleaned by periodic acid treatment, along with the regular use of a drilling contractor to pull and clean the well pumps and pump controls.

8. Use of an adjuvant is included in the engineering design, but the specifics of the need for and use of the chelator are not provided. A chelator study has been completed but was not available during the site visit. Mr. Ruda referred SAIC to Morrison and Knudson (M&K) for the complete study.

9. The Supervisory Control and Data Acquisition (SCADA) system software allows trend analyses over a one-day period. Data is stored in the system for approximately one month and then is periodically downloaded to permanent files.

10. Presently, because there was no gravity line in the original design, the system uses a 40-horsepower (hp) motor to pump untreated effluent to the sanitary sewer.

11. A SCADA system utilizing Rockwell Software RSLinx is in place and is being brought online as the equipment is installed. At the present time, only the pumps and equilazation tank levels are automated.

12. Reporting is done by Mr. Ruda using locally developed Excel spreadsheets and manually compiled numbers.

FACILITY RECORDS REVIEW

SAIC worked with Mr. Ruda to identify any facility records not obtained during the initial data gathering phase (Task 1) of the project. The operations records are maintained in hard copy, with some of the information contained in files on Mr. Ruda's desktop computer. The results of the facility records review are summarized as follows:

1. Mr. Zimmers worked with Mr. Ruda to identify and review appropriate files. Files reviewed included weekly data sheets of wellhead pressure and flow rates, and the most recent groundwater monitoring results. Mr. Ruda indicated that all administrative cost, schedule, or labor hours data are maintained by NAVFAC and is available through Mr. Scott Glass.

2. The pressure and flow rate data are collected manually and entered into an Excel data file. One point noted is that the pressure readings are taken from inside the treatment building, near the equalization tank, and therefore probably do not accurately reflect conditions at the wellhead.

3. The most recent quarterly sampling and analyses data were reviewed and found to be consistent with previous results. The monitoring data are received from the laboratory in lab report format, and then transferred manually into Excel files.

PERSONNEL INTERVIEWS

Mr. Ruda was identified as the principal source of unwritten information about the site, and was, therefore, the principal person interviewed. The interview discussions with Mr. Ruda are summarized as follows:

1. There is a suspected upgradient source of contamination associated with the Kurt Manufacturing site.

2. A site management plan exists and is available from Mr. Glass.

3. M&K are developing an O&M Manual that will be put in the form of a contract.

4. There are presently no compliance issues associated with the treatment system.

5. The state is handling the groundwater discharge to the Mississippi as a discharge point, and therefore a National Pollutant Discharge Elimination System (NPDES) permit will be required.

6. There are no emissions controls on the treatment system, and air emissions monitoring and reporting will be required.

7. The state has agreed that containment of the on-site plume has been achieved.

8. All of the cost data for the program are with Mr. Glass.

9. Mr. Ruda stated that there are no significant operational problems with the system, and that the yearly O&M costs are relatively low. Yearly costs were estimated by Mr. Ruda to be around $ 140,000, but SAIC was referred to Mr. Glass for the specific cost information.

10. The use of an environmental data management system (EDMS) was discussed and SAIC's standard evaluation form was delivered to Mr. Ruda. Mr. Ruda indicated that the scope of the remedial system alone does not seem to justify the overhead of an EDMS. Mr. Ruda agreed to complete the evaluation form return it to Mr. Jones.

EXIT DEBRIEF

The site visit concluded with an exit debrief meeting. Present at the meeting were Messrs. Ruda and Morrow, and the SAIC evaluation team. Discussions during the exit debrief meeting are summarized as follows:

1. Mr. Cronce thanked everyone for the full cooperation, support, and hospitality extended during the site visit.

2. The evaluation team presented the preliminary conclusions and recommendations based on the work to date. These included the following:

   a. Expand the SCADA system to allow for increased remote monitoring and control, and to allow for management of multiple systems.

   b. Evaluate the gravity drain system for the Building 52 equalization tank to eliminate the current transfer pump.

   c. Develop increased remedial system data storage capabilities and development of a data base to support automated, standardized reporting.

   d. Address recovery well AT-2 and consider taking this well off-line.

   e. Evaluate capture of energy costs by the use of variable frequency drives on some of the system pumps versus the current use of control valve to regulate flow.

   f. Consider installation of gravity discharge line to the storm water sewer located next to the air stripping system as part of the Stage 2 construction activities.

g. Remove recovery well 1-A from operation due to low contaminant concentrations.

3. Several action items were identified and discussed during the exit debrief. These included the following:

   a. SAIC is to contact Mr. Glass to get system construction and equipment cost information.

   b. Mr. Ruda will locate and forward well pump information to SAIC.

   c. SAIC will contact Mr. Glass for the carbon air shop drawings, pilot testing results, and submittals.

   d. SAIC will contact Mr. Glass regarding program administrative and travel costs.

   e. SAIC will contact Mr. Glass to get the instrumentation and design submittals and shop drawings.

SUMMARY

The site visit was determined by those involved to be useful, and the objectives of the site visit were achieved as summarized above. Completion of the action items, to include the collection of additional information, should provide all of the available information relevant to the completion of this project. The results of the initial information review

(Task 1), along with information collected as a result of the site visit (Task 2), will be used to complete the SmartSite planning modules, perform the performance and cost evaluation (Task 3), and prepare the final report and recommendations.

Yours truly,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Richard C. Cronce, Ph.D.
Vice President, Earth Sciences

RCC:co
cc: Tim Ruda, UDLP (via email)
Tom Galatro, SAIC
Steve Zimmers, SAIC
Gary Jones, SAIC (via email)
J. Scott Lockhart, SAIC (via email)
Nick Trentacoste, SAIC (via email)

APPENDIX B

Needs Assessment Evaluation Modules

Facility / Site Name:

Date:

Inspector:

Module Number	Subject	Word Section	Word Pages
0	Table of Contents	1	1
1	Background Information	2	2-3
2	System Summary	3	4-7
3	Labor	4	8
4	Maintenance and Repair Management	5	9-11
5	Transfer Equipment (pumps, blowers, others)	6	12-14
6	Instrumentation (inputs)	7	15
7	Control System	8	16
8	Controlling Devices (outputs)	9	17
9	SCADA and Operator Interfaces	10	18
10	Management Systems	11	19-22
11	Detailed Cost Data	12	23-24
12	Monitoring	13	25-26
13	Well and Trench Systems	14	27
14	Specific Problems/Desired Improvements	15	28
15	Configuration Management	16	29

Notes:

1. Complete definitions of terms and instructions for use can be found in the SAIC document, *SmartSite Opportunity Assessment Manual.*
2. Number the pages individually, by hand in each module. Since it is impossible to determine in advance how many pages will be used in most modules, they cannot be numbered in advance.
3. Modules 1 and 14 are designed for the whole facility, base, plant, etc. The other Modules, 2-13, are designed for individual "systems" that may be deployed at the facility. Some facilities will have several systems and the inspector will need to have several copies of these Modules. In some cases, it is not clear if there will be several systems or a single system, e.g., management systems, and the inspector will need to use judgment in where to supply "facility" summaries or "system" summaries. Module 15 is for control of changes to the forms and is not used as part of an assessment.
4. You can print pages by selecting pages in the print dialog box and specifying the pages, e.g., 3,15,12-14. You can print a Section by specifying "S" and the section number, e.g., s6, or s10, s11.
5. This MS Word file is named SmartSite Opportunity Assessment Field Forms v1.1 and was created using Windows 95-based Word 97 SR-1. Given the number of custom tables, conversions to Mac-based systems could introduce formatting errors. Even Word V6 has caused some lines to disappear.

Facility / Site Name: Naval Industrial Reserve Ordinance Plant (NIROP), Fridley, Minnesota

Date: 4/23/98

Inspector: R. Cronce

A. Facility	B. Location
NIROP: 1. Groundwater Treatment System	4800 East River Road Minneapolis, MN 54421

C. Key Contacts:

Name and Title	Address	
Scott Glass, Remediation Project Manager	Southern Division, Naval Facilities Engineering Command; P. O. Box 190010; North Charleston, SC 29419	Phone: (803) 820-5587 Fax: (803) 820-5563 E-Mail: sglass@efdsouth.navfac.navy.mil
Pat Mosites, REICC Naval Facilities Engineering	United Defense L.P. 4800 East River Road Minneapolis, MN 54421	Phone: (612) 572-6438 Fax: (612) 572-6305 E-Mail:
Tim Ruda	United Defense L.P. 4800 East River Road Minneapolis, MN 54421	Phone: (612) 572-6906 Fax: (612) 572-4901 E-Mail: tim-ruda@udlp.com
Mark Sladic	Tetra Tech 661 Anderson Drive Pittsburgh, PA 15220-2745	Phone: (412) 921-8216 Fax: (412) 921-4040 E-Mail:
Richard Zuromski	Naval Facilities Engineering Service Center; 1100 23rd Avenue; Building 1100; Port Hueneme, CA 93043-4370	Phone: (805) 982-1488 Fax: (805) 982-4304 E-Mail:

D. General Notes (Facility mission, history, risk issues, land use, political issues, etc.):

Property being divested. United Defense L.P. (UDLP) has been running site. May change. Additional on-site sources recently identified. Operations and maintenance (O&M) contract may change. Operating facility operated by UDLP. UDLP owns one portion. Public work is downgradient. Additional off-site groundwater plume to be addressed. Negotiations with regulators and public relations involved in getting the current program in place have been sensitive. Any suggested change at this point which may reopen an issue needs to be strongly justified.

83 acres

Facility / Site Name: Naval Industrial Reserve Ordinance Plant (NIROP), Fridley, Minnesota

Date: 4/23/98

Inspector: R. Cronce

E. Systems located at or operated by the facility			
System	System ID #	Location	Description
OU-1 - Phase 1			Hydraulic containment - groundwater capture and discharge to sanitary sewer; six extraction wells.
OU-1 - Phase 2			Hydraulic containment - groundwater capture, treatment, and discharge to Mississippi River; six wells; low profile strippers (four) with polymer addition.

Add additional pages as necessary

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro
System No: NA

System Name: Groundwater Extraction and Treatment

A. System Description

1. Description of stream being treated:

Contaminated groundwater from 6 recovery wells pumping at a total flow rate of approximately 750 gallons per minute (gpm). Contaminants in the groundwater include: trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and methylene chloride.

2. List treatment methods/unit operations included in the treatment train:

- Extraction wells;
- Influent pumping;
- Anti-scaling;
- Air stripping;
- Effluent pumping and monitoring; and
- Chemical cleaning.

3. Provide overall description of system (Present in text form, and attach simple flow diagram. Also provide a sketch in Question C):

Refer to attached piping and instrument drawing (P&ID). System as shown in drawing will be installed in two stages. The first stage was installed in January 1998 and is presently operating. This stage consists of the flow equalization, influent pumping, and an upgrade to the programmable logic controls (PLCs) with SCADA equipment for both stages. Stage 1 equipment is located in Building 52/53. Stage 2 consists of air strippers and an effluent sump and pumps. Also included in Stage 2 is a chemical cleaning system and a control room to permanently house the SCADA equipment along with the Stage 2 PLC. Stage 2 is scheduled for start-up in October 1998.

4. Design process rate (give units):	750 gpm
5. Annual average actual process rate (give units):	620 gpm, based on observed operations
6. Date of system start-up:	January 22, 1998
7. Expected operation life (in years from startup):	Not stated in design documents (assume 20 years).

8. List any existing problems known through past regulator inspection reports, interviews with plant operators, plant managers, etc.:

- Location of pressure sensors in recovery well piping.
- Discharge pH not monitored or recorded monthly (probable requirement for National Pollutant Discharge Elimination System [NPDES] permit.).

Discharge flow not monitored at point of discharge (probable requirement for NPDES permit.)

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro

System Name: Groundwater Extraction and Treatment

System No: NA

B. Performance (Annual Average, Year ( ): NA System under construction.

1. Influent Data Summary: For key parameters see design specification section 11302 pp. 7 & 8.

Parameter	Units	Design Value		Actual Value	
		Average	Max	Average	Max

2. Effluent Data Summary

Parameter	Units	Design Value		Actual Value	
		Average	Max	Average	Max

3. Discuss key performance issues related to the data shown above (frequency of non-compliance, variability of discharge, seasonal affects, etc.):

Extraction wells presently discharging directly without pretreatment to the local publically owned treatment works (POTW) at a unit cost per gallon discharged. System presently under construction will include a treatment system for groundwater to be discharged to the Mississippi River via existing storm sewers under a new NPDES permit.

C. Flow Diagram (optional if process flow diagram already provided):

See design drawings, P&ID, and drawing numbers:

- P&ID: ASU Feed System: NAFAC #5640516 - M-2 - Sheet 14 of 59.
- P&ID: ASU Water and Air Flow: NAFAC #5640517 - M-3 - Sheet 15 of 59.
- P&ID: Effluent Discharge and Floor Sumps: NAFAC #5640518 - M-4 - Sheet 16 of 59.
- P&ID: ASU Chemical Cleaning: NAFAC #5640519 - M-5 - Sheet 17 of 59.
- Proposed Process Flow Diagram - Anti-Scaling System. Operations and Maintenance Cost Analysis Report - NIROP Fridley, Minnesota; Unit ID Code: N91192; Contract No. N62467-93-D-1106; November 1997, Revision 0.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro

System Name: Groundwater Extraction and Treatment

System No: NA

D. Unit operation included in this system:
ID #: AT-1A, AT-2, AT-3A, AT-4, AT-5A, AT-5B

1. Unit Name:	Extraction Wells
2. Vendor	Grundfos Pumps

3. Unit Dimensions: Not available.

4. Design Criteria:

AT-1A: NA (Obs. Flow; 50.0 gpm), east of plume
AT-2: NA (Obs. Flow; 47.9 gpm), southwest of plume
AT-3A: NA (Obs. Flow; 241.8 gpm), southwest of plume
AT-4: NA (Obs. Flow; 43.0 gpm), north of plume
AT-5A: Design Rate = 150 gpm (Obs. Flow; 159.9 gpm), screened between 36 and 66 feet below grade
AT-5B: Design Rate = 50 gpm (Obs. Flow; 81.8 gpm), screened between 101 and 136 feet below grade

5. Primary control parameter(s) (flow, level, pressure drop, etc.):

All wells automatically turned on and off based on water level in well. Flow rate is manually adjusted by operator based on observed well production and cycling of pumps. Pressure drop is manually monitored at each wellhead and automatically monitored by the SCADA system for each transmission line at the inlet to the equalization tank.

6. Obvious visual problems (Odors, leaks, foaming, carryover, general housekeeping):

None. Note: The well level is measured at the wellhead using a level transducer with an LCD display at the wellhead. This instrument could be tied into the SCADA system for easier data collection, trending analysis, and automatic control. Also, the location of the pressure transducers at the inlet to the equalization tank does not provide an accurate indication of line fouling since the change in head at the wellhead not the transmission line discharge point would have to monitored and analyzed over time to evaluate line fouling and pump operation.

7. Key issues to evaluate:

- Is the system significantly overdesigned based upon current operation conditions?
  Extraction system design basis was not available for review. Cannot determine optimum pumping rates for containment of plume or groundwater yields. Modifications to extraction wells are not part of the ongoing design and construction work.

- Is the system being operated based upon fixed predetermined parameters?
  Extraction system design basis was not available for review. Cannot determine optimum pumping rates for containment of plume or groundwater yields.

- Was the system designed using proper materials of construction so that maintenance and repairs are minimized?

Materials of construction have not been reported by the system operator to be a problem. Pump specifications were not available to review and therefore an assessment of material compatibility with groundwater characteristics could not be done. Based on the lack of previous operating problems, this does not seem to be an area where additional effort would yield significant savings or operational efficiency.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro

System Name: Groundwater Extraction and Treatment

System No: NA

D. Unit operation included in this system:
ID #: Influent Pumping System (P-101A; P-101B)

1. Unit Name:	ASU - Feed Pumps
2. Vendor	

3. Unit Dimensions: Not available.

4. Design Criteria:

Flow rate: minimum - 100 gpm; average - 750 gpm at 32 pounds per square inch gauge (psig); and maximum - 1,000 gpm at 42 psig

5. Primary control parameter(s) (flow, level, pressure drop, etc.):

Level in equalization tank.

6. Obvious visual problems (Odors, leaks, foaming, carryover, general housekeeping):

None.

7. Key issues to evaluate:

- Is the system significantly overdesigned based upon current operation conditions?
  Yes; pumps run at approximately 65 percent capacity using a flow control valve on the discharge line. Pump curves (efficiency) were not available for review.

- Is the system being operated based upon fixed predetermined parameters?
  Yes.

- Was the system designed using proper materials of construction so that maintenance and repairs are minimized?
  Materials of construction have not been reported by the system operator to be a problem. Pump specifications were not available to review and therefore an assessment of material compatibility with groundwater characteristics could not be done. Based on the lack of previous operating problems, this does not seem to be an area where additional effort would yield significant savings or operational efficiency.

D. Unit operation included in this system:
ID #: No Unit ID assigned to this system at this time.

1. Unit Name:	Anti-Scaling System
2. Vendor	Not identified. Not included in report reviewed containing process flow diagram. Potential vendors include Aqua Mag, Nalco, Calgon, and BetzDearborn.

3. Unit Dimensions: Not available.

4. Design Criteria:

Prevent system scaling based on the following water quality: hardness - 580 to 725 parts per million (ppm), alkalinity - 230 to 290 ppm, iron - 1.5 to 3 ppm, manganese - 1 to 3 ppm, and magnesium - 50 to 75 ppm.

5. Primary control parameter(s) (flow, level, pressure drop, etc.):

Manual adjustment of chemical metering pump base on water chemistry information. Provisions for a scale meter are included in the design as a monitoring device only.

6. Obvious visual problems (Odors, leaks, foaming, carryover, general housekeeping):

System not yet installed.

7. Key issues to evaluate:

- Is the system significantly overdesigned based upon current operation conditions?

Cannot be determined without review of manufacturer submittals. This system was installed to backup the chemical cleaning as recommended by the air stripping manufacturer. A potential scaling problem is in the pipeline from the ASUs back to Building 52/53 for discharge. The anti-scaling system impact at preventing this line from scaling, since its application point, will be at the suction of the influent pumps prior to air stripping is not known and may be limited based on the anti-scaling chemical used. Although the capital cost of the anti-scaling system is minimal, the annual cost of chemical is significant.

- Is the system being operated based upon fixed predetermined parameters?

  System not yet installed.

- Was the system designed using proper materials of construction so that maintenance and repairs are minimized?

  Cannot be determined without review of manufacturer submittals.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro
System No: NA

System Name: Groundwater Extraction and Treatment

D. Unit operation included in this system: ID #: T-201, T-202, T-203, T-204	
1. Unit Name:	Air Stripping Units
2. Vendor	Carbonair Environmental Systems (ordered but not on-site at time of visit)
3. Unit Dimensions: Shop drawings not available for review.	

4. Design Criteria:

Refer to Section 11302 of specifications. Key constituent is TCE at 1.8 to 3.0 ppm, and other organic constituents are all less than 1 ppm total; iron at 2 to 3 ppm; total hardness at 580 to 725 ppm.

5. Primary control parameter(s) (flow, level, pressure drop, etc.):

Manually adjusted liquid flow rate. Manually adjusted air flow rate. Liquid level controls system shuts down based on high levels in ASU sumps, effluent sumps, building sumps, pipeline flushing tank, or blower failure on the ASUs or low level in the equalization tank.

6. Obvious visual problems (Odors, leaks, foaming, carryover, general housekeeping):

System not yet installed.

7. Key issues to evaluate:

- Is the system significantly overdesigned based upon current operation conditions?
  Cannot be determined without review of manufacturer submittals as required by the specification.

- Is the system being operated based upon fixed predetermined parameters?
  Not applicable at this time.

- Was the system designed using proper materials of construction so that maintenance and repairs are minimized?
  Specification required stainless steel. Cannot evaluate without review of shop drawing submittals.

D. Unit operation included in this system: ID #: P301A, P301B	
1. Unit Name:	Effluent Pumping and Monitoring System
2. Vendor	System not installed at time of visit. Shop drawings not available for review.
3. Unit Dimensions: Not available.	
4. Design Criteria: Flow rate: minimum - 100 gpm, average - 750 gpm at 36 psig; and maximum - 1,000 gpm at 34 psig	
5. Primary control parameter(s) (flow, level, pressure drop, etc.): Level in effluent sump.	
6. Obvious visual problems (Odors, leaks, foaming, carryover, general housekeeping): Not applicable; system not yet installed.	
7. Key issues to evaluate: • Is the system significantly overdesigned based upon current operation conditions? It appears that the system may be overdesigned (power consumption inefficiency) since all flow control will be by effluent control valve instead of variable speed drive (approximately 40 BHP motors) to maintain constant level in effluent sump. Also, design drawing indicates a possible gravity connection to a storm sewer which would eliminate all effluent pumping. When question was raised why this was not pursued, the reason was vague, reference to permitting issue. Need to verify reasoning why gravity discharge to river not pursued and if possible to reopen possibility with regulators after system is operational. • Is the system being operated based upon fixed predetermined parameters? Not applicable; system not installed. • Was the system designed using proper materials of construction so that maintenance and repairs are minimized? Cannot be determined without review of manufacturer submittals.	

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro
System No: NA

System Name: Groundwater Extraction and Treatment

D. Unit operation included in this system:
ID #: T-402, T-403, F-405

1. Unit Name:	Chemical Cleaning System
2. Vendor	Not applicable; system consists of tanks, valves, pumps, and filter press.

3. Unit Dimensions: Not applicable.

4. Design Criteria:

Not applicable.

5. Primary control parameter(s) (flow, level, pressure drop, etc.):

Manual with tank overflow fail-safes.

6. Obvious visual problems (Odors, leaks, foaming, carryover, general housekeeping):

Not applicable; system not yet installed.

7. Key issues to evaluate:
Effectiveness in removing scale from air strippers.

- Is the system significantly overdesigned based upon current operation conditions?

- Is the system being operated based upon fixed predetermined parameters?
  Not applicable; system not installed.

- Was the system designed using proper materials of construction so that maintenance and repairs are minimized?
  Cannot be determined without review of manufacturer submittals.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector S. Zimmers

System Name: GWTP, OU-1

System No: OU-1

A. Types of labor utilized:

Y Facility Employees	Y Contract labor	☐ Other _____
(Y) Union	Y Union	☐ Union
Y Non-union	(Y) Non-Union	☐ Non-union

B. Who is involved with operating the system?

Labor Types (list by name or classification)	Description of Duties
1. Operators Tim Ruda of UDLP	Tim Ruda performs the day-to-day operation of the on-site systems. On a weekly basis, Mr. Ruda records well data, flows, and pressures, and adjusts the system if required. The data is summarized into monthly reports with the sampling results. The well pump data is recorded by manual effort of visiting each wellhead on-site to record information onto log sheets. It is then entered into a data base at Mr. Ruda`s office.
2. Maintenance Tim Ruda of UDLP	Mr. Ruda performs minor repair and cleaning. Mr. Ruda utilizes in-house UDLP personnel for additional repairs or troubleshooting of the system and/or equipment. Major repairs (for example, pump cleanings). would be subcontracted out.
3. Engineering/Technical System design by RMT Work plan and construction by Morrison & Knudsen (M&K)	RMT designed the new system and reported the construction cost. The work plan, written by M&K, is now in the construction phase; they will also perform start-up and the first few months of operation and maintenance. M&K also recommended, proposed, and started the construction of the chemical treatment system to prevent scaling of the piping and air strippers.
4. Administrative Tim Ruda of UDLP	The site activities that Mr. Ruda performs, either himself or through subcontractors, are billed to a UDLP project or contract number; the charges are then forwarded to Southdiv (Navy). The cost for these on-site tasks were unavailable; Mr. Ruda assumed they would be approximately $140,000 per year. This amount is based on the tasks performed on the old pretreatment system before groundwater was discharged to the sanitary sewer.
5. Monitoring Tim Ruda of UDLP; also outside sampling contractor	Mr. Ruda samples the pretreatment system for compliance with sanitary sewer limits. Mr. Ruda also contracts the quarterly sampling and analysis of the groundwater monitoring wells.

MODULE 4—MAINTENANCE AND REPAIR MANAGEMENT

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: S. Zimmers

System Name: GWTP, OU-1

System No: OU-1

A. Review the system O&M manual. Note the sections it includes:

y 1. Process Flow Diagram (PFD)
y 2. Piping and Instrumentation Diagram (PID)
y 3. Equipment Specifications
* 4. Warranty information
y 5. Inspection schedule
y 6. Operating procedures
y 7. Troubleshooting diagnostics
y 8. Preventive maintenance
y 9. Predictive maintenance
y 10. Repair guidance
y 11. Spare parts required
* 12. Wellfield maintenance

Notes:

The groundwater treatment facility is under a construction phase that will decommission the former pretreatment system. That system discharged to the sanitary sewer. The new treatment system will discharge to one of the three on-site storm sewer outfalls.

Though, the new treatment system at this time has not been completed, a draft of the new treatment system O&M Manual exists to review. The manual includes the above-marked items. The items outlined below are ones with little or incomplete information.

*4. Warranty information in the draft O&M Manual contains some equipment manufacturing warranty details. The warranty of the system design and workmanship may be included in the contacts of the principals involved.

*12. Wellfield maintenance: The draft O&M Manual has details on the well pumps and motors. There is detail or procedure for pump setting, removal, or cleaning and/or redeveloping of well screens. The other issues that this operation and maintenance task will need to address are water and debris waste containment and disposal, also service equipment decontamination.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: S. Zimmers
System Name: GWTP, OU-1
System No: OU-1

B. Obtain copies of the following, if available:

- ☐ 1. Work order history
- ☐ 2. Inspection record
- ☐ 3. Alarm record
- ☐ 4. Repair record
- ☐ 5. Preventive maintenance
- ☐ 6. Compliance history
- ☐ 7. Waste disposal record
- ☐ 8. Parts inventory
- ☐ 9. Supplies inventory
- ☐ 10. Equipment list
- ☐ 11. Emergency/Immediate response actions
- ☐ 12. Tools list

Notes (Be sure to note recurrent or costly maintenance items):

The system is in the construction phase and there is no working history with the new equipment or the system process.

There is working history with a pretreatment system that is no longer in-service. This system used four of the wells now plumbed to the new system. The maintenance history on the old system included air stripping tower fouling, well pump replacement, well screen, and discharge pipe cleaning. The most notable problem was scaling. These problems have been addressed by incorporating the chemical backwash system and the polymer injection systems. The down-well equipment and screen will still require maintenance.

C. Define other maintenance duties, such as:

- ☐ 1. Cleaning/janitorial
- ☐ 2. Painting
- ☐ 3. General repair
- ☐ 4. Lawn mowing
- ☐ 5. Snow removal
- ☐ 6. Dust control
- ☐ 7. Roadway maintenance
- ☐ 8. Winterization

Notes:

The above maintenance tasks are general maintenance items that the building and grounds personnel of United Defense take care of. This work may not be accruing cost to the environmental remediation project at this time. These maintenance duties should be included in a future operations and maintenance contract.

Facility / Site Name: NIROP, Fridley, Minnesota
Date: 4/23/98
Inspector: S. Zimmers
System Name: GWTP, OU-1
System No: OU-1

D. Obtain a list of operation and maintenance problems. Query the following:

- ☐ 1. Permit compliance
- ☐ 2. Down-time
- ☐ 3. Level control
- ☐ 4. Flow control
- ☐ 5. Leakage
- ☐ 6. Clogging/fouling/scaling
- ☐ 7. Calibration
- ☐ 8. Process control
- ☐ 9. Motor performance
- ☐ 10. Valve performance
- ☐ 11. Backwash function
- ☐ 12. Filter performance
- ☐ 13. Waste generation
- ☐ 14. Contaminant removal rate
- ☐ 15. Noise/Vibration
- ☐ 16. Freeze-up
- ☐ 17. Plume containment
- ☐ 18. Performance trends vs. design
- ☐ 19. Trends of influent
- ☐ 20. Predictive maintenance procedures
- ☐ 21. SOP adequacy
- ☐ 22. Parts wear/failures
- ☐ 23. Warranty support
- ☐ 24. Energy use
- ☐ 25. Pulsing Experience
- ☐ 26.

Notes:

The system is now under construction and there is no history with equipment or the process to know of any problems. The new system incorporates new subsystem equipment to prevent the problems experienced with the old pretreatment system. The subsystems are acid washing and an anti-scaling polymer system.

E. Obtain a list of suggested improvements concerning:

- ☐ 1. SOPs
- ☐ 2. Automation
- ☐ 3. Run times
- ☐ 4. Technologies
- ☐ 5. Equipment
- ☐ 6. Information management
- ☐ 7. Alarm incidence
- ☐ 8. Program management
- ☐ 9. Monitoring procedures
- ☐ 10. Record keeping
- ☐ 11. Other (see notes)
- ☐ 12.

Notes:

The new system and equipment are, at this time, under construction. The new system has incorporated most, if not all, of the above concerns listed.

Mr. Ruda said that the treatment system under construction was designed with equipment that addressed the problems of the previous system. Mr. Ruda reviewed the design and work plans, and made suggestions to Mr. Scott Glass. The suggestions involved up-grades in equipment that Mr. Ruda had either used or preferred. Suggested improvements included more operator training on the equipment.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: S. Zimmers
System Name: GWTP, OU-1
System No: OU-1

A. Pumps

ID P-101A P-101B	Type: x centrifugal ☐ pos.displ	Driver: x Motor TEFC 30HP 460 3/0 Volts 800 RPM	Service: New feed pumps to ASU's
ID of Spare	☐ jet ☐ _____	Variable speed (n) reduced voltage starter or soft start ☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.):ITT A-C PUMP 8100 series model 300 8x6x125 key 49 1,000 gpm at 88 feet total head and 38 psi low flow limit 420 gpm at 49 psi
Total # 2(two)	☐ _____ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):

Units were placed in-service new. No operations and maintenance data.

General condition: Operating:
In-service for only a short time. Two pumps are connected in parallel and are operated bimonthly. One is in service; the other is on standby.

ID P-103	Type: x centrifugal ☐ pos. disp. displacement	Driver: ☐ Motor 3HP 460(voltage)	Service: Building 52 floor sump pump
ID of Spare	☐ jet ☐	variable speed (/n) ☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.): Weil sump pump model 1606 2.5 8" impeller
Total # 1(one)	☐ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):

Installed new. No operations and maintenance history. Data taken from O&M Manual draft copy.

General condition:

Add additional pages as necessary

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: GWTP, OU-1

Date: 4/23/98
Inspector: S. Zimmers
System No: OU-1

A. Pumps

ID	Type:	Driver:	Service: Extraction well pump
AT-1A	x centrifugal ☐ pos.displ	☐ Motor 5 HP 460(voltage) Variable speed (/n)	
ID of Spare	☐ jet ☐ _____	☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.): Grundfos 80-S50-5 design: 75 gpm at 142.3 feet Maximum head at 75 gpm is 185 feet; dead head - 230 feet
Total #	☐ _____ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):

Unknown.

General condition:

Operating as a pumping well for pretreatment system.

ID	Type:	Driver:	Service: Extraction well pump
AT-2	x centrifugal ☐ pos. disp. displacement	☐ Motor 5(hp) 460(voltage) variable speed (n)	
ID of Spare	☐ jet ☐	☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.): Grundfos 135S50-3 Design :125 gpm at 85.37 feet of head maximum head at 125 gpm is 120 feet; dead head at 160 feet
Total #	☐ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):

History unknown.

General condition:

Operating as part of old pretreatment system.

Add additional pages as necessary

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: S. Zimmers

System Name: GWTP, OU-1

System No: OU-1

A. Pumps

ID	Type:	Driver:	Service: Extraction well pump
AT-3	x centrifugal ☐ pos.displ	☐ Motor 15(hp) 460(voltage)	
ID of Spare	☐ jet ☐ _____	Variable speed (n) ☐ Air_____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.): Grundfos 225S150-6 Design: 250 GPM at 131.51 ft. of head max head at 250 GPM is 180 ft. dead head 345 ft.
Total #	☐ _____ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):
history unknown

General condition:
Operating as part of old pretreatment system

ID	Type:	Driver:	Service: Extraction well pump
AT-4	x centrifugal ☐ pos. disp. displacement	☐ Motor 5(hp) 460(voltage)	
ID of Spare	☐ jet ☐	variable speed (n) ☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.):Grundfos 80S50-4 This pump head is a modification of the standard one Design : 75 GPM at 111.71 ft. of head max head at 75 GPM of 150 ft. deadhead 180 ft.
Total #	☐ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):
history unknown

General condition:
Operating as part of old pretreatment system.

Add additional pages as necessary

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: S. Zimmers
System No: OU-1

System Name: GWTP, OU-1

A. Pumps

ID	Type:	Driver:	Service:
	☐ centrifugal ☐ pos.displ	☐ Motor _____(hp) _____(voltage)	
ID of Spare	☐ jet ☐ _____	Variable speed (y/n) ☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.):
Total #	☐ _____ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):
history unknown

General condition:

ID	Type:	Driver:	Service:
	☐ centrifugal ☐ pos. disp. displacement	☐ Motor _____(hp) _____(voltage)	
ID of Spare	☐ jet ☐	variable speed (y/n) ☐ Air _____ (press.) ☐ Steam _____ (press.)	Rating (flow rate, etc.):
Total #	☐ ☐ _____	☐ Other _____	Schematic (optional if PFD supplied):

Operating and Maintenance History: (Date, maintenance, repairs, problems):

General condition:

Add additional pages as necessary

MODULE 6—INSTRUMENTATION (Inputs)

Page ___ of ___

Facility / Site Name: NIROP, Fridley, Minnesota

Date:

Inspector

System Name:

System No:

ID	Device Type (e.g., level, flow)	Description/Service	Manufacturer & Model
	☐ Analog Transmitter:	☐ Externally Powered Voltage _____ ☐ Loop Powered ☐ Remote mounted	Scaling _____ Signal: ☐ 4-20 mA ☐ 1-5 VDC ☐ Other _____
	☐ Discrete (on/off) Voltage _____ Lightning/Surge Protection	Notes/Schematic/Mounting:	

ID	Device Type (e.g., level, flow)	Description/Service	Manufacturer & Model
	☐ Analog Transmitter:	☐ Externally Powered Voltage _____ ☐ Loop Powered ☐ Remote mounted	Scaling _____ Signal: ☐ 4-20 mA ☐ 1-5 VDC ☐ Other _____
	☐ Discrete (on/off) Voltage _____ Lightning/Surge Protection	Notes/Schematic/Mounting:	

ID	Device Type (e.g., level, flow)	Description/Service	Manufacturer & Model
	☐ Analog Transmitter:	☐ Externally Powered Voltage _____ ☐ Loop Powered ☐ Remote mounted	Scaling _____ Signal: ☐ 4-20 mA ☐ 1-5 VDC ☐ Other _____
	☐ Discrete (on/off) Voltage _____ Lightning/Surge Protection	Notes/Schematic/Mounting:	

Add additional forms if necessary

MODULE 7—CONTROL SYSTEM

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/29/98
Inspector: T. Galatro
System Name: PLC/MMI
System No: NA

Control Type: ☐ Relay ☒ PLC ☐ DCS ☐ RTU ☐ _____

Integrator: See Below
Equipment Manufacturer: See Below
Control Voltage: 115 volts, 60 HZ
Lightning/Surge Protection: Yes

Hazardous classification: Class _____

Drawing below includes:	Information includes:
☐ System	☐ I/O Diagram
☐ Control Panel ID: _____	☐ Topology
(obtain programming documentation, if applicable)	☐ Schematic
	☐ _____

Notes, drawings, photos, photo references:

Only Stage 1 installed.

System Integrator:

Systems By Design, Inc.
1588 Peltier Lake Drive
Centerville, MN 55058

Manufacturer:

Allen Bradley PLC 5/11
- 2 input cards 120 vac
- 2 output cards (dry contacts)
- 1 Analog Output card 12 bit
- 3 Isolated Analog Input Cards (16 bit)

Refer to Contract Drawings;

Sheet E-5; Building 52/53 Control Panel Layout
Sheets E-6 through E-10; Building 52.53 Control Panel - Ladder Diagrams
Sheet E-14; Treatment Area Control Panel Layout
Sheets E-15 through E-20; Groundwater Treatment Facility Control Panel Ladder Diagrams

Refer to Contract Specifications;

Section 15911: Personal Computer-Man-Machine Interface
Section 15912: PLC System/Instrumentation and Control Valves
Section 15913: Control Panels
Section 15995: Process Controls Narrative

MODULE 8 - INSTRUMENTATION (Inputs)

Page ___ f ___

Facility / Site Name: NIROP, Fridley, Minnesota

Date:

Inspector

System Name:

System No:

ID	Device Type (valve, etc.)	Description/Service:	Manufacturer & Model:
	☐ Manual Size _____	☐ Automatic ☐ Modulating ☐ On/Off ☐ Electric ☐ Pneumatic Voltage _____volts	Safety Features ☐ Explosion proof ☐ Fail-safe ☐ _____ Signal Type ☐ 4-20 mA ☐ 0-5 VDC ☐ 1-5 VDC ☐ Other_____	Feedback ☐ Visual ☐ Position Feedback ☐ Signal _____ ☐ Position indicator

Notes, schematic, mounting, etc.:

General condition:

ID	Device Type (valve, etc.)	Description/Service:	Manufacturers (Model)
	☐ Manual Size _____	☐ Automatic ☐ Modulating ☐ On/Of ☐ Electric ☐ Pneumatic Voltage _____volts	Safety Features ☐ Explosion proof ☐ Fail-safe ☐ _____ Signal Type ☐ 4-20 mA ☐ 0-5 VDC ☐ 1-5 VDC ☐ Other_____	Feedback ☐ Visual ☐ Position feedback ☐ Signal _____ ☐ Position indicator

Notes, schematic, mounting, etc.:

General condition:

Add additional forms if necessary

MODULE 9—SCADA AND OPERATOR INTERFACES

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: SCADA

Date: 4/29/98
Inspector: T. Galatro
System No: NA

Device(s):
- ☒ HMI
- ☐ Panel Interface
- ☐ Auto Dialer
- ☐ Indicator
- ☐ Recorder
- ☒ Data Logger
- ☐ Modem
- ☐ RF Modem
- ☐ Manual Task
- ☐ _____

ID:

Description/Service: Only operator interface installed is located in Building 52/53. An identical system is to be installed in the treatment area.

Manufacturer & Model:

Compac Presario
40 MB RAM

Location: Building 52/53
Treatment Area ☒ Local ☐ Remote

Software (if applicable):
Licenses: _____ Version: 4 .0 S/N: _____

RS View 32
Windows NT
Version 4.0

Notes/Diagram/Topology/Data list (obtain sample reports, if applicable):

Added external memory storage to Stage 1 system. Not sure if Phase 2 will correct this problem on a permanent basis. Used SYQUEST - Spar Q 1.0 GB backup memory.

Operator interface was not functioning properly during visit. Pointer would not allow access to control screens. Could only get copy of main screen. Other screens not accessible due to malfunction of pointer.

Features controlled by SCADA:

See specification Section 15912 for screen descriptions and functions. Could not evaluate system since MMI was not functioning properly during visit.

MODULE 10—MANAGEMENT SYSTEMS

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: GWTP; OU-1, Phase 2

Date: 4/23/98
Inspector: R. Cronce
System No: OU-1, Phase 2

A. General

Computer based systems: ☐ yes ☒ no	Network	Data Management (circle primary):	Description (include where data resides, external access, firewalls):
	☒ None ☐ Server-based ☐ Peer-to-peer ☐ Email only	☐ Custom application name: _____	SCADA-RS link stores data for up to one month. Data then downloaded to a data base. Pressure and flow data collected manually and entered into Excel data base. Manual collection/ entry of water table elevations.
PC operating Systems used:	Network OS ☒ NT ☐ NetWare ☐ Other _____ _____	☐ Access ☐ Oracle ☐ Sybase ☐ dBase/Foxpro ☒ Other: __Excel_____ ☒ Spreadsheet ☐ None	

B. Process Data

How Recorded:

☐ COTS Software _____ (system)

☐ Third party software _____ (system)

☐ Unstructured Database _____ (system)

☒ Paper

☐ None

☒ Other __Excel_____ (system)

General idea of what data is available in electronic format

Variable	Frequency				
Flow Rate	Daily				
Pressure	Daily				
Influent Chemistry	Monthly; VOCs Quarterly				
Effluent Chemistry	Monthly; VOCs Quarterly				
Sludge Chemistry	As Required for Waste Processing				
Air Emissions	To Be Determined				
Air Pressure Readings	Daily				

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98

Inspector: R. Cronce

System Name: GWTP; OU-1, Phase 2

System No: OU-1, Phase 2

C. Environmental Data

How Recorded:

☐ COTS Software _____ (system)

☐ Third party software _____ (system)

☐ Unstructured Database _____ (system)

☒ Paper

☐ None

☒ Other ___Excel_____ (system)

System:

Phase 1 - GWTP: Groundwater elevations; groundwater chemistry.

Phase 2 - GWTP: Groundwater elevations; groundwater chemistry.

What is recorded:

Phase 1 - Monitoring wells, VOCs, every six months; extraction wells, VOCs, monthly; groundwater elevations, monthly; and influent and effluent, monthly.

How used:

Phase 1 - Quarterly reports to EPA, MCES, MPCA, and RAB; annual monitoring reports.

Phase 2 - Quarterly reports to EPA, MCES, MPCA, and RAB; NPDES reporting; and air monitoring reporting.

Lab data:

Phase 1 - Groundwater chemistry data.

Phase 2 - Groundwater chemistry data, sludge data, air monitoring data, influent and effluent chemistry data, and extraction well chemistry data.

Network access:

None.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: R. Cronce

System Name: GWTP; OU-1, Phase 2

System No: OU-1, Phase 2

D. Maintenance Data

How Recorded:

☐ COTS _____ (system)	☐ Third party software _____ (system)	☐ Unstructured Database _____ (system)
☒ Paper	☐ None	☐ Other _____ (system)

What data are recorded:

☐ Work Orders	☐ Electronic	☐ Server-based
☐ Parts Usage	☐ Electronic	☐ Server-based
☐ Costs	☐ Electronic	☐ Server-based
☐ Repair (by equipment item)	☐ Electronic	☐ Server-based
☐	☐ Electronic	☐ Server-based
☐	☐ Electronic	☐ Server-based
☐	☐ Electronic	☐ Server-based

CMMS Software
(to extent known)

None

Name _____ Version _____

S/N _____ Licenses _____

Notes:

All O&M data collected on O&M logs. Information includes:

- Key maintenance and repair activities.
- Date of change-out of carbon vessels (previous Phase 1).
- Building temperature.
- Weather conditions at time of system inspections.

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: R. Cronce
System Name: GWTP; OU-1, Phase 2
System No: OU-1, Phase 2

E. Purchasing

System (SAP, etc.): Unknown	☐ Network based ☐ Data accessible by others
Purchases allocated by:	☐ Not allocated ☐ Individual system ☐ Department (includes all systems) ☒ Other __Total Project - Yearly_____

Description of what kind of information is available and the form:

There was no detailed cost information available for review. Total yearly O&M for Phase 1 estimated at $150,000 per year.

F. Cost Accounting

System (SAP, etc.): Unknown	☐ Network based ☐ Data accessible by others
Costs allocated by:	☐ Not allocated ☐ Individual system ☐ Department (includes all systems) ☒ Other __Total Project - Yearly_____

Description of what kind of information is available and the form:

UDLP does cost accounting reports to Jerry Morrow (NAVSEA). Navy has facilities service contract to cover everything.

MODULE 11—DETAILED COST DATA

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: GWTP; OU-1, Phase 2

Date: 6/22/98
Inspector: R. Cronce
System No: OU-1 - Phase 2

Cost data detail (Cost Basis Year _____1999_____):

A. Labor

Labor Category (list by labor classification)	No. of Employees	LOE (hrs/year)	Rate ($/hr) Average	Total Amount Labor Cost ($)
1. Operating				
2. Maintenance				
3. Engineering/Technical				
4. Administrative				
5. Monitoring				

Facility / Site Name: NIROP, Fridley, Minnesota
Date: 6/22/98
Inspector: R. Cronce
System Name: GWTP; OU-1, Phase 2
System No: OU-1 - Phase 2

B. Non-Labor Costs

Cost Element/Data Source	Unit Cost (give units)	Data Source	Total Annual Cost	Comments
1. Electricity:				
2. Gas:				
3. Water:				
4. Sewer:				
5. Telephone:				
6. Chemicals:				
7. Expendable Items:				
8. Personnel Supplies:				
9. Waste Disposal:				
10. Analytical Costs:				
11. Major Repairs:				
12. Regular Maintenance:				
13. Major Maintenance:				
14. Other:				

MODULE 12—MONITORING

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: GWTP; OU-1, Phase 2

Date: 6/23/98
Inspector: R. Cronce
System No: OU-1, Phase 2

A. Type

- ☒ 1. Remedial
- ☐ 2. Post-closure
- ☐ 3. Other (routine):_____

B. Device

- ☒ 1. Well(s)
- ☐ 2. Spring
- ☐ 3. Surface water
- ☐ 4. Stack
- ☐ 5. Pipe outfall
- ☒ 6. Other:__Remedial system influent, effluent, and air discharge._____

C. Media

- ☒ 1. Groundwater
- ☐ 2. Surface water-(stream or spring)
- ☒ 3. Air (Phase 2)
- ☐ 4. Storm water
- ☐ 5. Ecological
- ☐ 6. Sediment
- ☐ 7. Soil
- ☐ 8. Levels (water)
- ☒ 9. Treated wastewater effluent
- ☒ 10. Other __Sludge_____

D. Regulatory Drivers

- ☒ 1. Federal permit(s) (ROD)
- ☒ 2. State permit(s) (NPDES)
- ☐ 3. Local permits
- ☒ 4. Federal ROD
- ☒ 5. Federal consent agreement
- ☐ 6. State consent agreement
- ☐ 7. RCRA closure
- ☐ 8. RCRA corrective measures
- ☐ 9. Voluntary
- ☐ 10. State regulations
- ☒ 11. Federal regulations
- ☒ 12. Regulatory contacts:
  - ☒ a. State: __ND_____
  - ☒ b. Federal: __ND_____
  - ☐ c. Local: _____
  - ☐ d. Other: _____
- ☒. 13. Other _Restoration Advisory Board - Public Works_____

E. Sensitive Factors

- ☒ 1. Local politics (Public Works ?)
- ☒ 2. Residential population
- ☒ 3. Citizens group
- ☒ 4. River/stream
- ☒ 5. Sensitive receptors (intake of public water supply)
- ☒ 6. Ecosystems (Mississippi River)
- ☐ 7. Noise
- ☐ 8. Present land use
- ☐ 9. Future land use
- ☐ 10. Local employment
- ☐ 11. Other_____

F. Study Area

- ☒ 1. Map of locations (attached) (see report)
- ☒ 2. Monitoring boundaries
  - ☒ a. Property lines
  - ☐ b. Vapor plume
  - ☒ c. Groundwater plume
  - ☐ d. Surface water plume
  - ☒ e. Soil plume
  - ☐ f. Buildings
  - ☒ g. Neighboring properties (UDLP)
  - ☐ h. Neighboring structures
  - ☒ i. Municipal (Minneapolis water supply system intake from river)
  - ☐ j. Other:_____

G. Objectives

- ☒ 1. Regulatory compliance
- ☒ 2. Clean-up performance
- ☒ 3. Mobility monitoring
- ☐ 4. Sentinel posts
- ☐ 5. Other: _____

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: GWTP; OU-1, Phase 2

Date: 6/23/98
Inspector: R. Cronce
System No: OU-1, Phase 2

H. Frequency

- ☐ 1. Daily
- ☐ 2. Weekly
- ☒ 3. Bi-weekly (Influent/Effluent - Year 1)
- ☐ 4. Monthly
- ☐ 5. Quarterly
- ☒ 6. Semiannual (Monitoring Wells)
- ☒ 7. Other: Air sampling frequency to be developed.

I. Number of Sampling Points

- ☒ 1. Number of wells: 48 Monitoring Wells
- ☐ 2. Number of piezometers: _____
- ☒ 3. Number of surface water stations: 1
- ☐ 4. Number of springs: _____
- ☒ 5. Number of air stacks: 1
- ☒ 6. Number of treatment system taps: 6 Extraction Wells
- ☒ 7. Number of treated water outfalls: 1 Effluent
- ☒ 8. Other: Sludge - As Required

J. Field Procedures

- ☒ 1. Well purging
- ☐ 2. Micro-purging
- ☐ 3. Water treatment
- ☐ 4. Power supply
- ☐ 5. Other: _____

K. Analytical Protocols

- ☒ 1. Parameter List
- ☒ 2. Chemicals of concern
- ☒ 3. Analytical methods
- ☒ 4. QA/QC samples
- ☒ 5. Data Quality
- ☐ 6. Action levels
- ☐ 7. Incidence of exceedances
- ☐ 8. Other: _____

Notes:

Samples analyzed by SW-846 Method 8260. Evaluate _____ination of 1-I, 1-S, 2-PC, 4-D, 5-S, 8-D, 10-I, 13-I, 13-S, 15-S, 16-I, 20-S, 23-S, and 25-S.

MODULE 13—WELL AND TRENCH SYSTEMS

Facility / Site Name: NIROP, Fridley, Minnesota

System Name: GWTP; OU-1, Phase 2

Date: 6/23/98
Inspector: R. Cronce
System No: OU-1, Phase 2

A. Type of System

- ☐ 1. Soil vapor extraction
- ☐ 2. Air sparging
- ☒ 3. Groundwater extraction
- ☐ 4. Dual phase
- ☐ 5. Multi phase
- ☐ 6. Bioventing
- ☐ 7. Aquifer flushing
- ☐ 8. Monitoring only
- ☐ 9. Other: _____

B. Well Location

- ☒ 1. Site map
- ☒ 2. Scale
- ☒ 3. Utility routing
- ☒ 4. Roads/Access
- ☐ 5. Coordinates
- ☐ 6. Other Info.: _____

C. Well Types

- ☒ 1. Vertical
  Number of 6
- ☐ 2. Horizontal
  Number of _____
- ☒ 3. Extraction
- ☐ 4. Injection
- ☐ 5. Interceptor trench
  Number of _____
- ☐ 6. Other Info: _____

D. Well Construction

- ☒ 1. Individual logs
- ☒ 2. Diameters
- ☒ 3. Formation/Stratigraphy
- ☒ 4. Casing: L: _____
  M: _____
- ☒ 5. Screen: L: _____
  M: _____
- ☒ 6. Slot Size _____ in.
- ☐ 7. Borehole
- ☒ 8. Depth
- ☒ 9. Sand Pack
- ☐ 10. Other Info. _____

E. Equipment Specifications

- ☒ 1. Type of pump(s): Grundfos
- ☒ 2. Flow rates/range: 35 to 200 gpm
- ☒ 3. Type of control: Transducers in wells; control valves for flow _____
- ☐ 4. Special Equipment: _____

F. Problems

- ☐ 1. Control
- ☐ 2. Motor failures
- ☒ 3. Low yield
- ☐ 4. Cycling
- ☐ 5. Air/Emulsion
- ☒ 6. Screen Clogging
- ☒ 7. Biofouling/Iron bacteria
- ☐ 8. Other: _____
- ☐ 9. Capture attainment

Notes:

- Groundwater elevation sensors in wells deactivated due to well screen corrosion problems associated with operation.
- Extraction well AT-2 has significant fouling problem. Extraction rate is 50 percent of original and 30 percent of original design.
- Contaminant concentrations in extraction well 1-A are low. Mr. Ruda wants to consider taking off-line.

MODULE 14—SPECIFIC PROBLEMS/DESIRED IMPROVEMENTS

Facility / Site Name: NIROP, Fridley, Minnesota

Date: 4/23/98
Inspector: R. Cronce

System Name: GWTP; OU-1, Phase 2

System No: OU-1, Phase 2

The purpose of this page is to provide a single location for noting and describing the improvements to systems that are indicated by the facility personnel or inferred by the assessors during the course of this assessment. These could include fixing recurring failures, reducing a particularly high cost, site closure to accommodate future needs, or anything else that we should especially look at during the evaluation.

General Comments:	Who suggested this?
Description of desired improvement: • RA____ - Looking at again early May; reevaluate number/types of analyses. • Continuity in program. • Define data needs to support compliance; monitoring and operation.	

Specific Recommendations:	Who suggested this? Various
Description of desired improvement: • Expand SCADA system. • Evaluate gravity drain system. • Develop automated data storage and reporting capabilities. • Consider reconstruction of AT-2. • Evaluate use of variable speed drives for energy savings. • Remove extraction well AT-1 from service.	

Add additional pages as necessary

Note:
This form is not used in the field assessment.

Submit recommended changes to Gary Jones at:
Voice 619-458-2506, Fax 619-458-2735, Email jonesg@saic.com

Version	Date	Changes from prior version
1.0	12/16/97	• Original version prepared from hand-written drafts developed at 12/15-16/97 meeting. Authors: Gary Jones, Barry Langer, Randy Seavers, and Ned Wehler.
1.1	1/09/98	• Incorporated editorial changes from authors (Modules modified 6, 7, 8, 9) • Embedded TrueType fonts into file for print compatibility • Added filename field to footer • Added configuration management record • Fields now update upon printing
1.2	1/27/98	• Incorporated editorial changes from authors (modules 1, 2, 3, 4, 5, 7, 10, 11, 12, 13 and 14 modified)
		•
		•
		•
		•
		•
		•

APPENDIX C

Cost Analyses Tables, Calculations, and Supporting Information

TABLE C-1

Well Field Modification

Date Prepared: 6/26/98
Prepared by: G. Burgdorf

Project: NIROP
Alternative Name: Well Field Modification
Description of Alternative:
Revise the workplan.
Install 2 additional wells, associated controls, and plumbing.
Discontinue pumping of extraction well AT-1A.

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations		$ 497,410.00	$ 5,705,292.70	$ 422,800.00		$ 4,849,516.00	$ 74,610.00		$ 855,776.70
Maintenance			$ -			$ -	$ -		$ -
Monitoring			$ -			$ -	$ -		$ -
Adminstration	Permitting		$ -		$ 30,000.00	$ 30,000.00	$ -		$ (30,000.00)
Engineering			$ -		$ 40,500.00	$ 40,500.00	$ -		$ (40,500.00)
Analytical			$ -			$ -	$ -		$ -
Subcontract	Wells, piping, controls, installtion		$ -		$ 135,000.00	$ 135,000.00	$ -		$ (135,000.00)
Utility			$ -			$ -	$ -		$ -
Chemicals			$ -			$ -	$ -		$ -
Equipment			$ -			$ -	$ -		$ -
Materials			$ -			$ -	$ -		$ -
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
	Totals	$ 497,410.00	$ 5,705,292.70	$ 422,800.00	$ 205,500.00	$ 5,055,016.00	$ 74,610.00	2.75	$ 650,276.70

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Well Field Modification

AUTHOR RCC DATE 9/16/98 JOB NO. 9912-300

CHECKED BY _____ DATE _____ PAGE 1 of 2

Reference

Description of Alternative:

1. Install 2 additional wells, each 75 ft deep, 6 in diam stainless steel screen, carbon steel riser. Install pumps and settings with pump drives, pressure transducers, flow and pressure sensors.

2. Istall 1400 ft of Trenching with connective piping and control leads to building 52/53.

Construction Costs:

1. Install 2 wells, material and labor, @ $13,500 each — $27,000
2. Install 2 well pumps with leads — $6,000
3. Install pump riser pipe, valves, gauges, and well head assemblys on two wells — $900
4. Install 2 water level transducers - labor/equip. — $9,200
5. Trenching (4½ ft to 5 ft deep) - 1400 linear feet @ $50.00/ft — $70,000
6. Trench piping and conduit (1400 ft x $4/ft), including wire and pull boxes (1400 ft x $0.50/ft) — $6,700
7. Install 2 line pressure transducers — $2,400
8. Install 2 sonic flow meters — $6,000
9. Building modification and pipe welding — $6,400

$134,600

↓

Total Well Installation — $135,000

This document is the property of Science Applications International Corporation and is delivered on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Well Field Modification

AUTHOR RCC DATE 9/16/98 JOB NO. 9912-300

CHECKED BY _____ DATE _____ PAGE 2 of 2

Reference

Engineering Costs:

Assume 30% of construction $40,500

0.3 x 135,000 = $40,500

Revise the workplan: $30,500

Estimated Total Installation Costs - $ 205,500

Calculate Savings:

Assume: 1. Total O+M plus monitoring costs (non-lab) is ≃ $500,000/yr @ total flow of 625 gpm.

2. Flow will decrease by 165 gpm or ≃ 25 %

3. Total O+M costs will decrease by ≃ 15 %

Savings are therefore, 0.15 x $500,000/yr = $75,000/yr

This document is the property of Science Applications International Corporation and is delivered on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-2

Cost Analysis for Bypass to Sanitary Sewer

Date Prepared: 6/26/98
Prepared by: T. Galatro

Project: NIROP

Alternative Name: By-Pass to Sanitary Sewer

Description of Alternative:

Upgrade the existing bypass line to allow for direct discharge of groundwater influent to the sanitary sewer, thereby bypassing the influent pump. Bypass would be used until Phase 2 construction is complete, and during future Phase 2 system downtime.

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations	Response to emergency (2 per yr.)	$ 1,200.00	$ 13,764.00	$ -		$ -	$ 1,200.00		$ 13,764.00
Maintenance			$ -			$ -	$ -		$ -
Monitoring			$ -			$ -	$ -		$ -
Adminstration			$ -			$ -	$ -		$ -
Engineering			$ -			$ -	$ -		$ -
Analytical			$ -			$ -	$ -		$ -
Subcontract	Install ck, valves & 12 actuators		$ -		$ 23,240.00	$ 23,240.00	$ -		$ (23,240.00)
Utility	Routine & emerg. maint, on ASU's	$ 650.00	$ 7,455.50			$ -	$ 650.00		$ 7,455.50
Chemicals			$ -			$ -	$ -		$ -
Equipment			$ -			$ -	$ -		$ -
Materials	Replace 4 inch with 10 inch pipe		$ -		$ 2,500.00	$ 2,500.00	$ -		$ (2,500.00)
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
	Totals	$ 1,850.00	$ 21,219.50	$ -	$ 25,740.00	$ 25,740.00	$ 1,850.00	13.91	$ (4,520.50)

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT ALTERNATIVE ANALYSIS
USE OF BY-PASS LINE TO SANITARY SEWER

AUTHOR TJG DATE 6-22-98 JOB NO. 9912-300
REVISED CHECKED BY TJG DATE 8-18-98 PAGE 1 of

Reference

DESCRIPTION OF ALTERNATIVE

THIS ALTERNATIVE WILL AUTOMATE THE BY-PASS LINE FROM THE EXTRACTION WELLS TO THE SANITARY SEWER AND ELIMINATE THE NEED FOR PUMPING FROM THE EQUALIZATION TANK TO THE SANITARY SEWER.

1. INSTALL WAFER CHECK VALVES IN BY-PASS LINES;

COST: TOTAL COST (MAT'L, LABOR, O&P) = $340./VALVE
FOR IRON VALVES: (MEANS: #151-960-6670)

WILL REQUIRE 6 VALVES TO BE INSTALLED

340 x 6 = $2040.00 SUB-TOTAL COST = $2040.00

NOTE: IF THESE CHECK VALVES DO NOT EXIST, THEY SHOULD BE INSTALLED EVEN IF THERE IS NO PAYBACK.

2. INSTALLATION OF AUTOMATIC B.F VALVE ACTUATORS: (ON/OFF OPERATION) (TOTAL 12)

COST: MAT'L = $500.00/VALVE FOR ACT. = 6000
75.00 MOUNTING KIT = 900

SUB-CONT
MECH. = $50/hr @ 5 days x 2 men = $4000
ELECT. = $ /hr @ 5 days x 2 men = $6000
CONO./CABLE = $150/VALVE = 1800
REPROGRAMING = $2500.00 = 2500
REPL. 4" PIPE W/ 10" PIPE (MAT'L ONLY) = 2500

SUB-TOTAL COST 23,700

TOTAL #1&2 = 25,740.00

3. COST TO MANUALLY OPERATE VALVES;

a.) COST TO DISCHARGE TO SANITARY VIA E.Q. TANK;

ASSUME: ROUTINE MAINTENANCE 1 PER QUARTER FOR 2 days:

PUMP. OPERATING COST (POWER) = $33.55/day

33.55/DAY x 2 days x 4 times per year = $300/year

This document is the property of Science Applications International Corporation and is de[illegible]on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT ALTERNATIVE ANALYSIS
BY-PASS LINE

AUTHOR _____ DATE _____ JOB NO. _____
REVISED
CHECKED BY TJG DATE 8·18·98 PAGE 2 of 2

Reference

3. b.) COST TO RESPOND TO 2 EMERGENCY RESPONSES / year :

- OPERATOR COST ;

  8 hrs per call out @ 1½ SALARY = $75/hr.

  8 hrs × $75/hr × 2/yr. = $1200 / year

- Power COST

  ASSUME BY-PASS OPERATIONS FOR 5 days per INCIDENT ;

  $33.55/day × 5 days × 2/year = $350 / year

∴ TOTAL YEARLY SAVINGS WHEN SYSTEM IS ON LINE ;

$300 + $1,200 + $350 = $1850 PER YEAR

This document is the property of Science Applications International Corporation and is delivered on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-3

Cost Analysis for Gravity Discharge to Storm Sewer

Date Prepared: 6/26/98
Prepared by: T. Galatro

Project: NIROP

Alternative Name: Gravity Discharge to Storm Sewer

Description of Alternative:

Replace current effluent pumping system with a gravity discharge to outfall 010 or 020.
Modify NPDES permit, Install 200 ft. of gravity line, inititiate a new monitoring station, upgrade the PLC, and automate valving and switching.

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations			$ -			$ -	$ -		$ -
Maintenance	Pumps will remain - no savings	$ -	$ -			$ -	$ -		$ -
Monitoring			$ -			$ -	$ -		$ -
Adminstration			$ -			$ -	$ -		$ -
Engineering	Permit modification		$ -		$ 15,000.00	$ 15,000.00	$ -		$ (15,000.00)
Analytical			$ -			$ -	$ -		$ -
Subcontract	Trenching		$ -		$ 10,000.00	$ 10,000.00	$ -		$ (10,000.00)
Utility	Assume 30 HP pump (specifications)	$ 18,250.00	$ 209,327.50	$ 1,825.00		$ 20,932.75	$ 16,425.00		$ 188,394.75
Chemicals			$ -			$ -	$ -		$ -
Equipment	Install instrumented valving		$ -		$ 15,000.00	$ 15,000.00	$ -		$ (15,000.00)
Materials	Piping, tie-in, M.H, sump, etc		$ -		$ 13,820.00	$ 13,820.00	$ -		$ (13,820.00)
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
	Totals	$ 18,250.00	$ 209,327.50	$ 1,825.00	$ 53,820.00	$ 74,752.75	$ 16,425.00	3.28	$ 134,574.75

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Alternative Analysis
Gravity Discharge

AUTHOR TJG DATE 6-22-98 JOB NO. 9912-3600
REVISED CHECKED BY TJG DATE 8-18-98 PAGE 1 of 2

Reference

Description of Alternative

This alternative includes the gravity discharge of treated groundwater from the air strippers to a storm sewer located within 200 linear feet of the new treatment system location and automatic controls to monitor storm sewer flow or level and control the operation of the effluent pumps. Permit modifications will be required and it is assumed that this process will be facilitated due to the fact that effluent quality data from air stripping operations will be available for review by the regulators. This alternative would include the installation of 200 linear feet of gravity line, an independent monitoring station, upgrade to the PLC and field instrumentation to automatically switch outfalls if the gravity discharge sewer backs up due to an excessive storm flow.

1. Install of 200 L.F. from effl. sump to storm sewer manhole;
   a. Trenching - 7' wide / 6' deep = $50 / LF
      for equip. & labor - Means 12.3-110-1340
      50 x 200 (assuming trench shoring) = $10,000.00
   b. Drainage Pipe = Assume 18" ϕ corrugated metal
      16 ga - Bit. coated = $19.10 / LF
      for: mat'l and install labor NOT incl. trench/B.F.
      Means 027-164-2120
      19.10 x 200 = $3,820.00
   c. Miscell. tie-in to M.H. eff. sump & monitoring weir. = $10,000.00
   d. Automatic controls / field instrument and programming = $15,000
2. Modification to permit:
   Assuming Engineering & Admin cost = $15,000

$53,820

This document is the property of Science Applications International Corporation and is delivered on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT: GRAVITY DISCHARGE

AUTHOR: DG DATE: JOB NO.:

CHECKED BY: DATE: PAGE 2 of

Reference

3. PRESENT VS. PROJECTED COSTS

a) ASSUME PUMP WILL OPERATE 10% OF TOTAL TIME DUE TO HIGH FLOW CONDITIONS IN STORM SEWER;

40 HP PUMP; (POWER COST $0.05 / KW-hr)

(*) $KW = \frac{40HP \times 0.7457}{0.70} = 42.61$ KW-hrs

42.61 KW-hr × 24 hrs/day × $0.05/KW-hr ≅ $50 / day

CURRENT COST: $50.00 / day × (365 days / yr) = $18,250 / year

PROJECTED COST: $18,250 / yr × 0.10 = $1,825 per year

(*) NOTE:

This calculation was based on a 40 HP motor as specified in the original design documents — Based on field inspections the influent pumps installed were 30HP, the discharge pumps had not been installed but were specified as 40 HP. If 30 HP motors are also used for the discharge pump, the above calculation will change. The change to a 30HP will be within 25% of the calculated projected cost which is a reasonable degree of accuracy for this level of evaluation.

This document is the property of Science Applications International Corporation and is de... the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-4

Cost Analysis for Influent and Effluent Pump Upgrades

Date Prepared: 6/26/98
Prepared by: T. Galatro

Project: NIROP
Alternative Name: Influent and Effluent Pump Upgrades
Description of Alternative:
Install variable speed drives on 4 x 30 hp pumps

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations			$ -			$ -	$ -		$ -
Maintenance			$ -			$ -	$ -		$ -
Monitoring			$ -			$ -	$ -		$ -
Adminstration			$ -			$ -	$ -		$ -
Engineering			$ -			$ -	$ -		$ -
Analytical			$ -			$ -	$ -		$ -
Subcontract	Installation VFD's on 4 pumps		$ -		$ 50,000.00	$ 50,000.00	$ -		$ (50,000.00)
Utility	2 pumps running continuosly	$ 28,032.00	$ 321,527.04	$ 20,156.00		$ 231,189.32	$ 7,876.00		$ 90,337.72
Chemicals			$ -			$ -	$ -		$ -
Equipment			$ -			$ -	$ -		$ -
Materials			$ -			$ -	$ -		$ -
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
	Totals	$ 28,032.00	$ 321,527.04	$ 20,156.00	$ 50,000.00	$ 281,189.32	$ 7,876.00	6.35	$ 40,337.72

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company

3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Influent/Effluent Pump Upgrade

AUTHOR DG DATE 6-22-98 JOB NO.

CHECKED BY DATE PAGE 1 of 2

Reference

Description of Alternative

This alternative includes the upgrade of the existing pump drives for the influent and effluent to incorporate variable speed drives to optimize power consumption at system flows below pump design point conditions. This alternative assumes that actual treatment system flows average 750 gpm over the lifetime of the system. This alternative includes the installation of the variable speed drives in the existing motor control centers as direct replacements of the existing soft-start drives.

1.) Install of VFD's in existing MCC's.

a. Drives = $10,000 / drive × 4 = 40,000

b. Elect. sub-contractor = 10,000

$50,000.00

2.) Power consumption (VFD's):

$$BHP_{(VFD)} = \frac{750\ gpm \times 80\ TDH \times SG=1}{3960 \times 0.70} = 21.6\ BHP$$

$$KW_{(VFD)} = \frac{21.6 \times 0.7457}{0.70} = 23.01\ KW$$

23.01 KW × 24 hrs/day × $0.05/kw-hr = $27.61/day

$27.61/day × 365 days/year × 2 pumps = $20,156/year

This document is the property of Science Applications International Corporation and is de[illegible] the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT ALTERNATIVE ANALYSIS
INFLU./EFFLU. PUMP COST ANALYSIS

AUTHOR TH DATE 6-19-98 JOB NO.
CHECKED BY DATE PAGE 2 of 2

Reference

3.) INFLU./EFFLU. PUMP – POWER CONSUMPTION ESIMATE

BRAKE HP = 30 (40 BHP)

KW INPUT TO MOTOR = $\frac{\text{Pump bhp} \times 0.7457}{\text{MOTOR EFF.}}$ 1

∴ Assume motor eff = 70% (verify w/ O&M)

∴ $KW = \frac{30 \times 0.7457}{0.7} = 32.0$ KW-hrs (42.63)

@ $0.05 / KW-hr

Cost of pump operation;

32.0 KW-hr × 24 hr/day × $0.05/KW-hr =

= $38.40 per day (51.0) per pump

30 days/mon = $1152/month per pump

× 365 days/year = $14,016/yr (18615) per pump

× 2 pumps = 28,032/year (37,230)

(*) NEED TO LOOK @ PUMP CURVES TO GET RANGE OF BHP AT TYPICAL OPERATING PARAMETERS.

This document is the property of Science Applications International Corporation and is de[illegible]n the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company

3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT

AUTHOR DATE JOB NO.

CHECKED BY DATE PAGE of

Reference

REFERENCES

1 - Cameron Hydraulic Data

2. - Principals of Engineering Economy - 5th Ed. Riggs.

This document is the property of Science Applications International Corporation and is disclosed on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-5

Cost Analyses for Optimize Operations and Maintenance

Date Prepared: 6/26/98
Prepared by: T. Galatro

Project: NIROP

Alternative Name: Optimize Operations and Maintenance

Description of Alternatives:

Perform twice yearly predictive maintenance
Remove and clean wellhead assemblies
Clean/repair well screens and pumps and shock treat wells
Restart and adjust system.

PRECISE COSTING FOR CURRENT OPERATIONS ARE UNKNOWN - SEE SUPPORTING SHEETS FOR COST SAVINGS CALCULATIONS

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations			$ -			$ -	$ -		$ -
Maintenance	Remove, clean and replace well equip		$ -			$ -	$ -		$ -
Monitoring			$ -			$ -	$ -		$ -
Adminstration			$ -			$ -	$ -		$ -
Engineering			$ -			$ -	$ -		$ -
Analytical			$ -			$ -	$ -		$ -
Subcontract	Crane rental		$ -			$ -	$ -		$ -
Utility			$ -			$ -	$ -		$ -
Chemicals	Chemicals and handling equipment		$ -			$ -	$ -		$ -
Equipment	Replacement pumps		$ -			$ -	$ -		$ -
Materials	General materials		$ -			$ -	$ -		$ -
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
Totals		$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!	$ -

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT DTM - Predictive Maintenance

AUTHOR RCC DATE 8/98 JOB NO. 9912

CHECKED BY _____ DATE _____ PAGE 1 of 2

Reference

Describe Alternative: Perform predictive maintenance, twice yearly, on all pumping wells. Remove pumps and settings, surge cleaning of all wells, pump inspection, cleaning and repair of pumps, sensors, and controls. Reinstall and adjust flows. Shock treat the wells for biological fouling.

Costs of Alternative:

1. Labor -
   - Remove / reinstall pumps + piping
     2 events x $11,000/event $22,000
   - Clean + repair well screens and pumps and shock treat wells
     2 events x $1,500/event $3,000
   - Restart system and adjust
     2 events x $800/event $1,600
2. Materials - H_2O_2, flanges, gaskets, clothing, gloves, etc.
   2 events x $1,900/event $3,800
3. Crane rental - 10 days @ $400/day $4,000

Total $34,400

This document is the property of Science Applications International Corporation and is de[illegible] the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT D + M - Predictive Maintenance

AUTHOR RCC DATE JOB NO.

CHECKED BY DATE PAGE 2 of 2

Reference

Estimated Yearly Savings:

1. Assume save the cost of 1 unscheduled shutdown per year - $34,400/2 $17,200[1]
2. Save replacement of pumps and piping due to reduced fouling $5,000[2]
3. Chemical savings $2,500[3]

$24,700

4. General savings - Labor and supplies $12,530[4]

Gross Savings $37,230

Net Yearly Savings:

$37,230 - $34,400 = $2,830/yr

ROI: Since there are no actual additional investment costs, the ROI is essentially immediate.

Notes:

1. Assume cost of unscheduled event is the same as a scheduled event.
2. Assume avoidance of replacing 1 pump and accessories per year
3. Assumed decrease in chemical usage resulting from regular cleaning; assuming ≈ 10% of $25,000
4. Assuming 10% savings on residual costs of $150,000 - $24,700 = $125,300 x 0.1 = $12,530

This document is the property of Science Applications International Corporation and is disclosed in the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-6

Cost Analysis for Streamline Sampling and Monitoring Program

Date Prepared: 6/26/98
Prepared by: G. Burgdorf

Project: NIROP

Alternative Name: Streamline Sampling and Monitoring Program

Description of Alternative:

Modify ROD and gain approval of regulatory agencies.
Eliminate sampling of 8 wells, and change 10 wells from semi-annual to annual sampliing.
Change analytical method from EPA 624 to EPA 601/602

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations			$ -			$ -	$ -		$ -
Maintenance			$ -			$ -	$ -		$ -
Monitoring	Sampling of Wells	$ 40,000.00	$ 458,800.00	$ 29,600.00		$ 339,512.00	$ 10,400.00		$ 119,288.00
Adminstration			$ -		$ 20,000.00	$ 20,000.00	$ -		$ (20,000.00)
Engineering			$ -			$ -	$ -		$ -
Analytical	Reduction of sampling frequency	$ 26,600.00	$ 305,102.00	$ 10,400.00		$ 119,288.00	$ 16,200.00		$ 185,814.00
Subcontract			$ -			$ -	$ -		$ -
Utility			$ -			$ -	$ -		$ -
Chemicals			$ -			$ -	$ -		$ -
Equipment			$ -			$ -	$ -		$ -
Materials			$ -			$ -	$ -		$ -
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
	Totals	$ 66,600.00	$ 763,902.00	$ 40,000.00	$ 20,000.00	$ 478,800.00	$ 26,600.00	0.75	$ 285,102.00

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

General note: Total costs and life cycle costs are estimates only since exisiting program costs were not available.
Annual cost savings are shown for relative comparison only. Additional analysis will be required to finalize table.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Sampling and Monitoring Requirements - Program Modification

AUTHOR RCE DATE 8/18/98 JOB NO. 9912

CHECKED BY _____ DATE _____ PAGE 1 of 2

Reference

Assumptions:

8 wells eliminated which are upgradient, redundant, or poor well construction

10 wells changed from semi-annual to annual monitoring - wells which are cross-gradient and historically show low or N.D. contaminant concentrations

Change analytical method from EPA 624 to EPA 601/602

Present Costs:

50 wells sampled semi-annually with 12 system discharge samples, one public well sample, and 20% (10) QA/QC samples = 133 samples

Lab Cost: 133 samples x $200/sample = $26,600/yr

Well Sampling and Supplies

100 samples x $400/sample = $40,000/yr

Data Handling/Reporting - Costs included in data acquisition and reporting = -0-

Total Present Cost = $66,600

This document is the property of Science Applications International Corporation and is d[illegible] the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Co[illegible]on. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Sampling and Monitoring Requirements

AUTHOR RCE DATE JOB NO.

CHECKED BY DATE PAGE 2 of 2

Reference

87

Proposed Costs:

(64 samples)

- 32 wells sampled semi-annually, plus 10 wells sampled annually (10 samples), plus 12 system discharge samples, plus 1 public well, plus 20% QA/QC (17 samples) = 104 samples
- change analyses from EPA 624 ($200 ea) to EPA 601/602 ($100 ea)

Lab Costs:

104 samples x $100/sample = $10,400

Well Sampling and Supplies:

74 Well samples x $400/sample = 29,600

Total Projected Costs = $40,000

Capital Costs:

Assume $20,000 to modify the ROD and $20,000 gain regulatory approval

This document is the property of Science Applications International Corporation and is de[illegible] the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-7

Cost Analysis for Wellhead Monitoring Upgrade

Date Prepared: 6/26/98
Prepared by: T. Galatro

Project: NIROP
Alternative Name: Well Head Monitoring Upgrade
Description of Alternative:
Replace/Relocate Pressure Transducers
Automate Wellhead Monitoring

Cost Category	Description of Cost	Column 1 Est. Cost of Current Operations (Annual) Note 1	Column 2 PW of Current Operations Note 2	Column 3 Est. Cost of Proposed Operations (Annual)	Column 4 Capital Cost of Proposed Alternative	Column 5 PW of Proposed Operations Note 3	Column 6 Annual Operating Cost Savings (Col. 1 - Col. 3)	Column 7 Potential R O I (Years) (Col.4 / Col.6)	Column 8 Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations			$ -			$ -	$ -		$ -
Maintenance	Savings well pump & line cleaning	$ 5,000.00	$ 57,350.00	$ -		$ -	$ 5,000.00		$ 57,350.00
Monitoring	Manual data management	$ 10,400.00	$ 119,288.00	$ -		$ -	$ 10,400.00		$ 119,288.00
Adminstration			$ -			$ -	$ -		$ -
Engineering			$ -			$ -	$ -		$ -
Analytical			$ -			$ -	$ -		$ -
Subcontract	Instrument Installation		$ -		$ 16,500.00	$ 16,500.00	$ -		$ (16,500.00)
Utility			$ -			$ -	$ -		$ -
Chemicals			$ -			$ -	$ -		$ -
Equipment			$ -			$ -	$ -		$ -
Materials			$ -			$ -	$ -		$ -
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
Totals		$ 15,400.00	$ 176,638.00	$ -	$ 16,500.00	$ 16,500.00	$ 15,400.00	1.07	$ 160,138.00

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT Alternative Analysis
Well Head Monitoring

AUTHOR DG DATE 6-22-98 JOB NO.
CHECKED BY DATE PAGE 1 of 2

Reference

Description of Alternative

This alternative includes the hard wiring of the existing level transducers at the extraction wells, relocation of pressure transducers from the transmission lines to the extraction well and the installation of signal cable from the transducers back to the SCADA system via either the building 52/53 or in the new treatment area PLCs. This alternative assumes that the existing Phase 2 construction includes sufficient spare communication cable between the PLC located in Building 52/53 and the SCADA system control room in the new treatment area to accommodate transducer signals from the collection wells located near Building 52/53. It is also assume that the underground cable installation cost from the well heads to the PLCs is readily accessible.

The potential lifecycle saving of this alternative versus the manual data collection, manual entry and distribution of data, and maintenance of extraction pumps and transmission lines on a fixed time instead of actual process conditions

1.) Install. of Underground Cable from Wells to Controls:
(Ass. 1000 LF of UG. Cable)

a.) Trenching - 2' wide x 2' deep = $2.08/LF
for Equip & Labor. Means 12.3-110-1310
2.08 x 1000 L.F. = $2,080.00

b.) Cable/Conduit

- Conduit: 3/4" mat'l & Labor = 3.15/LF
  Means 160-205-9110 = 3,150.00
- Cable (Shielded) Copper 1/0 - 3.80/LF
  Means 161-150-0400 = 3,800.00

c.) Elect. Sub-Cont. (other le term/mounting) = 5,000.00

d.) Programming upgrade = 2500.00

= 16,500.00

This document is the property of Science Applications International Corporation and is de[illegible] the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT: Well Head Monitoring

AUTHOR _____ DATE _____ JOB NO. _____

CHECKED BY _____ DATE _____ PAGE 2 of 2

Reference

2.) Cost of ongoing operation;

a.) Data collection & entry

Labor $50/hr × 4 hrs/wk × 52 wks = $10,400/yr

b.) One less pump overhaul & line flushin per year = 5,000/yr

15,400/yr

3.) Cost Savings

PW = 15,400 × 11.47 = $176,638

4) Life cycle savings;

176,638 - 16 500 = ~~$150,000~~ $160,138

Note: Cost of proposed operations is assumed to be negligable due to automation. Other costs are included in routine O+M costs.

This document is the property of Science Applications International Corporation and is delivered on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

TABLE C-8

Cost Analysis for SCADA Upgrade and Automated Reporting

Date Prepared: 6/26/98
Prepared by: T. Galatro

Project: NIROP

Alternative Name: SCADA Upgrade and Automated Reporting

Description of Alternative:

Reconfigure existing software and add hardware to provide remote monitoring and control capability
Reconfigure RSView software for automated data collection and generation of standardized reports
Perform SCADA supported planned maintenance using increased remote monitoring, control, and reporting capabilities

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Cost Category	Description of Cost	Est. Cost of Current Operations (Annual) Note 1	PW of Current Operations Note 2	Est. Cost of Proposed Operations (Annual)	Capital Cost of Proposed Alternative	PW of Proposed Operations Note 3	Annual Operating Cost Savings (Col. 1 - Col. 3)	Potential R O I (Years) (Col.4 / Col.1)	Potential Life Cycle Savings (Col. 2 - Col. 5)
Labor									
Operations			$ -			$ -	$ -		$ -
Maintenance	Emergency Response to Alarms	$ 3,000.00	$ 34,410.00			$ -	$ 3,000.00		$ 34,410.00
Monitoring	Remote access to information	$ 1,200.00	$ 13,764.00			$ -	$ 1,200.00		$ 13,764.00
Adminstration	Automated report generation	$ 12,300.00	$ 141,081.00			$ -	$ 12,300.00		$ 141,081.00
Engineering			$ -			$ -	$ -		$ -
Analytical			$ -			$ -	$ -		$ -
Subcontract	Software, hardware, engineering		$ -		$ 20,000.00	$ 20,000.00	$ -		$ (20,000.00)
Utility			$ -			$ -	$ -		$ -
Chemicals			$ -			$ -	$ -		$ -
Equipment			$ -			$ -	$ -		$ -
Materials			$ -			$ -	$ -		$ -
Supplies			$ -			$ -	$ -		$ -
			$ -			$ -	$ -		$ -
	Totals	$ 16,500.00	$ 189,255.00	$ -	$ 20,000.00	$ 20,000.00	$ 16,500.00	1.21	$ 169,255.00

Note 1: Based on present estimated annual costs impacted by this alternative only.
Note 2: The present worth of present annual costs based on a facility life of 20 years and a discount factor of 6%(PW multiplier = 11.47).
Note 3: Capital cost of proposed alternative plus the present worth of proposed annual costs based on 20 year life and 6% discount factor(PW multiplier = 11.47).

Science Applications International Corporation
An Employee-Owned Company
3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT ALTERNATIVE ANALYSIS
SCADA UPGRADE

AUTHOR TJG DATE 6-22-98 JOB NO.
CHECKED BY DATE PAGE 1 of

Reference

DESCRIPTION OF ALTERNATIVE

This alternative includes the upgrade or reconfiguring of the RS View software in the existing system to accommodate an internal memory exceeding 30 days using comma separated variable, CSV, database files, or DBF. Also included in this alternative is the addition of remote access and control of the SCADA system using two laptop computers with runtime versions of the RS View software installed and a tape backup to access historical data. The capital cost of this alternative is approximately $20,000. The potential lifecycle savings of this alternative versus operator response to routine system alarms, manual access to system data (lack of real time access), manual compilation of analytical results and manual report preparation to regulatory authorities

Intangible benefits are also associated with this alternative, such as reduced errors of automated data entry of analytical results, single point access of data, consistent data collection methodology, and consistent format of reporting over time and changes of operating contractors.

COSTS;

1.) UPGRADE COST:

ESTIMATE ONLY $20,000 SINCE THE BASIC SOFTWARE AND HARDWARE IS CAPABLE OF DOING WHAT NEEDED WITH ONLY MINOR UPGRADES AS DESCRIBED

$20,000

COST SAVINGS;

1.) REMOTE ALARM ASSESSMENT & RESPONSE

ASSUME ELIMINATION OF 5 CALLOUTS PER YEAR; 8 HRS. / RESPONSE at 1½ TIMES SALARY.

$50/hr × 1.5 × 8 hrs × 5 responses/yr = $3000.00/yr

2.) REMOTE ACCESS BY RPM;

ASSUME 1 less TRIP per year FROM SC. TO MN;

- PLANE TICKET = $750 / RD. TRIP = 750.00
- EXPENSES = $150 / day Hotel / CAR / FOOD FOR 3 DAYS = 450.00
- TIME ON SITE IS IN OFFICE (EVENTS OUT) = 0.00

$1200.00/yr

This document is the property of Science Applications International Corporation and is on the express condition that it is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.

Science Applications International Corporation
An Employee-Owned Company

3240 Schoolhouse Road
Middletown, PA 17057
Phone: (717) 944-5501

SUBJECT: SCADA Upgrade

AUTHOR _____ DATE _____ JOB NO. _____

CHECKED BY _____ DATE _____ PAGE 2 of _____

Reference

3.) SAVINGS FROM AUTOMATED REPORT GENERATION

ASSUME 20% REDUCTION OF PRESENT Reporting COST OF $ 61,680 ≈ 12,300.00

Remote alarming - 3.000.00

Remote access by RPM - 1,200.00

TOTAL SAVINGS $16,500

NOTE: ADDITIONAL POTENTIAL COST SAVINGS RESULTING FROM SCADA SUPPORTED PLANNED MAINTENANCE NOT ESTIMATED.

This document is the property of Science Applications International Corporation and is not to be disclosed, reproduced in whole or in part, or used for manufacture by anyone other than Science Applications International Corporation. This restriction does not apply to information obtained from another source.