

This section presents the detailed analysis of remedial action alternatives for IAAAP FTP groundwater, which were assembled and described in the preceding section. The detailed analysis includes a description of evaluation criteria and both individual and comparative analyses of the alternatives.

Contaminant fate and transport modeling results for each alternative are summarized in **Table 13-1**. The model-predicted extents of benzene, chloroethane, 1,1-DCE, TCE, and vinyl chloride, above PRGs in shallow groundwater for each alternative are shown on **Figures 13-1**, **13-2**, **13-3**, and **13-4**.

#### 13.1 DESCRIPTION OF EVALUATION CRITERIA

Remedial action alternatives for FTP groundwater are analyzed in detail using criteria prescribed by the NCP (40 CFR Part 300.430). Nine criteria have been developed and are described below, according to the functional classes of threshold, primary balancing, and modifying criteria:

#### Threshold Criteria

- Overall protection of human health and the environment: This criterion provides a final assessment of whether the alternative provides adequate protection of human health and the environment, focusing on how each risk and associated pathway are eliminated, reduced, or controlled. The assessment of overall protection draws from the assessments conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. This evaluation allows for consideration of whether an alternative poses any unacceptable short-term, long-term, or cross-media impacts resulting from remediation.
- Compliance with ARARs: This criterion is used to determine whether each alternative will meet the federal and state ARARs that have been identified during the RAA process. A description of ARARs is provided in Section 10. If an identified ARAR is not met by an alternative, then an evaluation on the appropriateness of a waiver should be made. A waiver could be applied in any of six circumstances identified by CERCLA (USEPA 1988b).

#### Primary Balancing Criteria

- Long-term effectiveness and permanence: This criterion addresses the risk remaining at the site after a particular remedial action has taken place and objectives have been met. The focus is on the risk posed by residuals and/or untreated wastes after the cleanup criteria have been reached. The primary considerations of this criterion are:
  - Magnitude of residual risk
  - Adequacy and reliability of long-term management controls to protect against residuals
- **Reduction of TMV:** This criterion addresses the statutory preference of CERCLA for remedial actions involving treatment that permanently and significantly reduce the TMV of principal hazardous substances or contaminants at a site. Each alternative is evaluated in terms of quantity reduced, degree of reduction, irreversibility of treatment, type and quantity of residuals remaining after treatment, and how treatment addresses the principal threat.

- **Short-term effectiveness**: This criterion addresses the short-term effectiveness of each alternative by assessing the risk to the community, workers, and environment during the construction and implementation of the remedial action and the time required to achieve the remedial objectives. Efforts to provide protection are a key factor in this determination.
- Implementability: This criterion assesses the implementability of each alternative in terms of technical feasibility, administrative feasibility, and availability of services and materials. Technical feasibility considers ease of construction and operation, reliability of technology, ease of undertaking possible additional remedial action, and monitoring. Administrative feasibility considers activities needed to coordinate with other offices and agencies (e.g., permits, rights-of-way). Availability of services and materials includes availability of treatment, storage, and disposal services; necessary equipment and specialists; services and materials; and prospective technologies.
- Cost: The cost of each alternative is developed as the sum of capital costs, O&M costs, and periodic costs. Present value is the amount of money needed in the base year to cover the future costs associated with a particular time period at a particular interest or discount rate. Present value is developed at a discount rate of 7 percent for each alternative to provide a common basis for comparing alternatives. A feasibility-level cost estimate, intended to provide an accuracy range of -30 to +50 percent of actual cost, was prepared for each alternative using USEPA guidance (USEPA 2000). The final project cost of the selected alternative will depend on actual labor and material cost, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As such, the estimates provided in this RAA should not be used for final project budgeting.

#### Modifying Criteria

- Agency Acceptance: Agency acceptance will be evaluated after agency review.
- Community Acceptance: Community acceptance will not be evaluated until public
  comments are received on the proposed plan, which follows the RAA and presents the
  proposed remedy.

#### 13.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

A detailed individual analysis of the alternatives for FTP groundwater was completed using the criteria described in **Section 13.1**. Results of these analyses are presented in **Table 13-2**. Alternative-specific analysis of compliance with ARARs or TBCs is presented in **Table 13-3**.

#### 13.3 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives were compared to each other using the criteria presented in **Section 13.1**. Results of these analyses are presented below.

#### Overall Protection of Human Health and the Environment

- Alternative 1 would not provide any protection of human health in the short term. Alternatives 2, 3, 4, and 5 use institutional and engineering controls to prevent human exposure to contaminated groundwater until it can be reduced to its PRGs through natural processes, removal and ex-situ treatment, or in-situ treatment.
- Under Alternatives 1 and 2, contaminants in groundwater would eventually be reduced to PRGs through natural processes. Alternatives 3, 4, and 5 would actively remediate contaminated groundwater through removal and ex-situ treatment or in-situ treatment, combined with MNA.

#### Compliance with ARARs

ARARs and TBCs were initially screened in **Section 10**. Key ARARs for FTP groundwater were further evaluated in this detailed analysis of alternatives (**Table 13-3**). The results of this evaluation are summarized below:

- Alternative 1 would not meet ARARs. The MCLs would eventually be met through natural processes, but no actions would be taken until then to prevent human exposure to contaminated groundwater.
- Alternatives 2, 3, 4, and 5 would meet ARARs.

#### Long-Term Effectiveness

- Under Alternatives 1 through 5, upon reduction to PRGs, residual contamination would pose no unacceptable risk.
- Alternative 1 would provide no controls. Groundwater use restrictions, a health and safety program, and groundwater monitoring would be provided under Alternatives 2, 3, 4, and 5. Alternatives 3, 4, and 5 would actively remediate the plume.
- Controls for Alternatives 2, 3, 4, and 5 are considered adequate and reliable.

#### Reduction of Toxicity, Mobility, and Volume

- Under Alternatives 1 and 2, toxicity and volume of contaminants in groundwater would be reduced slowly through natural processes.
- Under Alternatives 3, 4, and 5, toxicity and volume of contaminants in groundwater would be reduced through removal and ex-situ treatment or in-situ treatment, combined with MNA.
- Alternatives 4 and 5 would reduce the mobility of arsenic in groundwater through chemical oxidation. Alternative 3 would reduce the ability of the contaminant plumes to migrate through removal and ex-situ treatment.

#### Short-Term Effectiveness

• The modeling results indicate that Alternatives 1 and 2 would reduce contaminants in groundwater to below PRGs in shallow groundwater, in similar time frames, with

Alternatives 3, 4, and 5 being faster (**Table 13-1** and **Figures 13-1**, **13-2**, **13-3**, and **13-4**). Model-predicted time estimates are considered to be conservative and were made to assist in comparing alternatives only; actual remediation time frames are likely to vary. Estimates for each alternative are summarized as follows:

Alternative	Time (years)
1 – No Action	55
2 - MNA	55
3 – Focused Extraction/MNA	15 to 20
4 – ISCO/MNA	15 to 20
5 – Enhanced Degradation/MNA	15 to 20

- Alternative 1 would have no short-term impacts, because the site remains as is.
- For Alternatives 2, 3, 4, and 5 potential impact to the community would be low. Remedial action and sampling workers would be protected through implementation of a health and safety plan.

#### *Implementability*

- Alternative 1 has no action to implement.
- Alternatives 2, 3, 4, and 5 are technically and administratively feasible, although groundwater injection approval and field scale testing would be required under Alternatives 4 and 5 prior to full-scale implementation. Services and equipment are available for these alternatives.
- Alternative 3 would need to meet the substantive requirements of an NPDES surface water discharge permit and applicable air emission standards for hazardous air pollutants.

#### Cost

The estimated capital cost, O&M costs, periodic costs, total cost, and total present values for alternatives are summarized below and in **Table 13-2**, along with the model estimated project duration. The detailed development of these costs is presented in **Appendix O**. The total present value, using a discount rate of 7 percent, ranges from \$711,000 for Alternative 2 to \$1,228,000 for Alternative 5.

Description	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/ MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/ MNA
Total Project Duration (years)	55	55	20	20	20
Capital Cost	\$0	\$114,000	\$208,000	\$225,000	\$504,000
Total O&M Cost	\$0	\$1,849,000	\$1,037,000	\$822,000	\$822,000
Total Periodic Cost	\$0	\$113,000	\$49,000	\$105,000	\$305,000
Total Cost of Alternatives	\$0	\$2,075,000	\$1,295,000	\$1,152,000	\$1,631,000
Total Present Value of Alternative	\$0	\$711,000	\$882,000	\$773,000	\$1,228,000

### **SECTION**THIRTEEN

### **Detailed Analysis of Alternatives**

Figure 13-5 compares the total costs of Alternatives 1 through 5 graphically.

TABLE 13-1
SUMMARY OF CONTAMINANT FATE AND TRANSPORT MODELING RESULTS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

		Amount of time for plun	ne concentration to	be reduced below	•1 •
Alternative	Benzene <6 μg/L	Chloroethane <110 µg/L	TCE <30 μg/L	1,1-DCE <920 μg/L	Vinyl Chloride <2 μg/L
Alternatives 1 and 2 - No Action and MNA	15-20	35-40	5-10	<5	50-55
Alternative 3 - Focused Extraction/MNA	10-15	5-10	5-10	<5	15-20
Alternative 4 - ISCO/MNA	10-15	5-10	5-10	<5	15-20
Alternative 5 - Enhanced Degradation/MNA	10-15	5-10	5-10	<5	15-20

Notes:

< = Less than

 $\mu g/L = Micrograms per liter$ 

DCE = Dichloroethene

ISCO = In-Situ Chemical Oxidation

MNA = Monitored Natural Attenuation

TCE = Trichloroethene

VC = Vinyl Chloride

See Figures 13-1 to 13-4 for the model-predicted extent of chemicals in groundwater for each alternative.

## TABLE 13-2 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Evaluation Criterion	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA
OVERALL PROTECTION	OF HUMAN HEALTH AND TH	HE ENVIRONMENT			
Human Health Protection	None in the short term, although contaminants in groundwater would be expected to eventually decrease below PRGs (approximately 50 to 55 years).	Protects human health through institutional/engineering controls until contaminants in groundwater are reduced to below PRGs through natural attenuation (approximately 50 to 55 years).	Protects human health through institutional/engineering controls, focused plume removal and treatment, and natural attenuation until contaminants in groundwater are reduced to below PRGs (approximately 15 to 20 years).	Protects human health through institutional/engineering controls, focused in-situ treatment, and natural attenuation until contaminants in groundwater are reduced to below PRGs (approximately 15 to 20 years).	Protects human health through institutional/engineering controls, focused in-situ treatment, and natural attenuation until contaminants in groundwater are reduced to below PRGs (approximately 15 to 20 years).
Environmental Protection	Natural processes would be expected to eventually reduce contaminants in groundwater to below PRGs.	Natural processes would be expected to eventually reduce contaminants in groundwater to below PRGs. Monitoring would allow for tracking of the plume.	Would reduce groundwater contamination to below PRGs. Monitoring would allow for tracking of the plume.	Would reduce groundwater contamination to below PRGs. Monitoring would allow for tracking of the plume.	Would reduce groundwater contamination to below PRGs. Monitoring would allow for tracking of the plume.
COMPLIANCE WITH ARA	Rs				
Compliance with ARARs	Not applicable.	Would meet ARARs as evaluated in <b>Table 13-3</b> .	Would meet ARARs as evaluated in <b>Table 13-3</b> .	Would meet ARARs as evaluated in <b>Table 13-3</b> .	Would meet ARARs as evaluated in <b>Table 13-3</b> .
Appropriateness of Waivers	Not appropriate.	None would be required.	None would be required.	None would be required.	None would be required.
LONG-TERM EFFECTIVE	NESS				
Magnitude of Residual Risk	Upon reduction to the PRG (approximately 50 to 55 years), residual contamination would pose no unacceptable risk.	Upon reduction to the PRG (approximately 50 to 55 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.	Upon reduction to the PRG (approximately 15 to 20 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.	Upon reduction to the PRG (approximately 15 to 20 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.	Upon reduction to the PRG (approximately 15 to 20 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.

## TABLE 13-2 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Evaluation Criterion	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA
Adequacy and Reliability of Controls	Not applicable.	Groundwater monitoring would track the migration of contaminants. Groundwater use restrictions would prevent human exposure to contaminated groundwater.	Proposed removal and treatment options are field-proven and expected to meet long-term remedial objectives (in combination with MNA). Groundwater use restrictions would prevent human exposure to contaminated groundwater. Groundwater monitoring would track the migration of contaminants.	ISCO is field-proven and is expected to meet long-term remedial objectives (in combination with MNA). Groundwater use restrictions would prevent human exposure to contaminated groundwater. Groundwater monitoring would track the migration of contaminants.	ISCO and EB are field-proven and are expected to meet long-term remedial objectives (in combination with MNA). Groundwater use restrictions would prevent human exposure to contaminated groundwater. Groundwater monitoring would track the migration of contaminants.
REDUCTION OF TOXICITY	, MOBILITY, AND VOLUME				
Treatment Process Used	None, except for natural attenuation.	None, except for the natural attenuation processes of dispersion, biodegradation, and adsorption.	An extraction well would remove contaminated groundwater in and around SA-99-1. Extracted groundwater would be treated by air stripping. MNA would remediate the remaining areas of the plume.	ISCO would treat contaminated groundwater in and around SA-99-1. MNA would remediate the remaining areas of the plume.	ISCO would treat contaminated groundwater in and around SA-99-1. EB and MNA would remediate the remaining areas of the plume.
Reduction of TMV	Toxicity and volume of contaminants would be reduced but not documented.	Toxicity and volume of contaminants in groundwater would eventually be reduced to PRGs through natural attenuation.	Toxicity and volume of contaminants in groundwater would be reduced to PRGs through focused removal and treatment and natural attenuation.	Toxicity and volume of contaminants in groundwater would be reduced to PRGs through focused in-situ treatment and natural attenuation.	Toxicity and volume of contaminants in groundwater would be reduced to PRGs through in-situ treatment and natural attenuation.
SHORT-TERM EFFECTIVE	NESS				
Time Required to Achieve Remedial Action Objectives	Contaminants in groundwater would be reduced to PRGs in approximately 50 to 55 years but would not be documented.	Contaminants in groundwater would be reduced to PRGs in approximately 50 to 55 years.	Contaminants in groundwater would be reduced to PRGs in approximately 15 to 20 years.	Contaminants in groundwater would be reduced to PRGs in approximately 15 to 20 years.	Contaminants in groundwater would be reduced to PRGs in approximately 15 to 20 years.
Protection of Community During Remedial Action	No action taken.	Potential impact to community would be low due to the nature of activities (e.g., groundwater sampling).	Potential impact to community would be low. Access to IAAAP is restricted to the public.	Potential impact to community would be low. Access to IAAAP is restricted to the public.	Potential impact to community would be low. Access to IAAAP is restricted to the public.

### TABLE 13-2 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Evaluation Criterion	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA		
Protection of Workers During Remedial Action	Workers would need to take proper health and safety precautions during drilling and sampling activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.		
IMPLEMENTABILITY							
Ability to Construct and Operate	Not applicable.	Sampling and analysis are easily implemented.	Services and equipment are available. Sampling and analysis are easily implemented.	Services and equipment are available. Sampling and analysis are easily implemented.	Services and equipment are available. Sampling and analysis are easily implemented.		
Technical Feasibility	Not applicable.	Technology is reliable. Equipment and materials are available.	Technology is reliable. Equipment and materials are available.	Treatability tests would be used to select the most effective concentration of oxidizing agent prior to full-scale implementation.	Treatability tests would be used to select the most effective concentration of oxidizing agent the best EB substrate prior to full-scale implementation.		
COST							
Assumed Project Duration (years)	55	55	20	20	20		
Capital Cost	\$0	\$114,000	\$208,000	\$225,000	\$504,000		
Total O&M Cost	\$0	\$1,849,000	\$1,037,000	\$822,000	\$822,000		
Total Periodic Cost	\$0	\$113,000	\$49,000	\$105,000	\$305,000		
Total Cost of Alternative	\$0	\$2,075,000	\$1,295,000	\$1,152,000	\$1,631,000		
Total Present Value (7%)	\$0	\$711,000	\$882,000	\$773,000	\$1,228,000		

#### Notes:

> = Greater Than

 $ARAR = Applicable \ or \ Relevant \ and \ Appropriate \ Requirement$ 

EB = Enhanced Biodegradation

GAC = Granular Activated Carbon

IAAAP = Iowa Army Ammunition Plant

ISCO = In-Situ Chemical Oxidation

MNA = Monitored Natural Attenuation

O&M = Operation and Maintenance

PRG = Preliminary Remediation Goal

TMV = Toxicity, Mobility, and Volume

VER = Vacuum-Enhanced Recovery

		Would Alternative Comply with ARARs or TBCs?				
CITATION	DESCRIPTION	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA
			FEDERAL			
Safe Drinking Water Act, 42 USC Section 300						
40 CFR Part 141, National Primary Drinking Water Regulations and National Revised Primary Drinking Water Regulations	Establishes MCLs, which are health-based standards for specific contaminants.		Yes. Groundwater use restrictions would prevent ingestion of contaminated groundwater exceeding MCLs.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.
40 CFR Part 144, Underground Injection Control Program	Protects underground sources of drinking water by prohibiting injections that may affect water quality.	N/A	N/A	N/A	Yes. Groundwater injection approval may be required.	Yes. Groundwater injection approval may be required.
Water Pollution Control Act (Clean Water Act),	as amended, 33 USC Section 1251 et seq.					
40 CFR Part 125 National Pollutant Discharge Elimination System (NPDES) Regulations	Establishes procedures for determination of effluent limitations for discharges of pollutants to navigable waters.	N/A	N/A	Yes. Monitoring would ensure that discharged effluent is treated to acceptable levels before discharge.	N/A	N/A
40 CFR Part 131, Quality Criteria for Water Ambient Water Quality Criteria	Requires states to establish ambient water quality criteria (AWQC) for surface water based on use classifications and the criteria stated under Section 304(a) of the Clean Water Act.	N/A	N/A	Yes. Monitoring would ensure that discharged effluent is treated to acceptable levels before discharge.	N/A	N/A
Guidelines Establishing Test Procedures for the Analysis of Pollutants	Specific analytical procedures for NPDES applications and reports.	N/A	N/A	Yes. Monitoring would ensure that discharged effluent is treated to acceptable levels before discharge.	N/A	N/A
Solid Waste Disposal Act (SWDA), as amended						
40 CFR Part 260 Hazardous Waste Management Systems General (Subtitle C)	Provides definitions, general standards, and information applicable to 40 CFR Parts 260-265, 268.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 261 Identification and Listing of Hazardous Wastes (Subtitle C)	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 262 Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous waste.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 263 Standards Applicable to Transporters of Hazardous Waste	Establishes standards that apply to transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 268 Land Disposal Restrictions	Identifies hazardous wastes restricted from land disposal and treatment standards for restricted wastes and waste residuals.	N/A	N/A	N/A	N/A	N/A
Occupational Safety and Health Act, 29 USC 15						
29 CFR Part 1910 Occupational Safety and Health Standards	Regulates occupational health and safety. Requires proper precautions, equipment, and training before certain tasks are completed.	N/A	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	would be implemented to ensure worker safety and compliance with applicable requirements.
29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response	Remediation efforts must be conducted in accordance with health and safety regulations. Requires a Health and Safety Plan for remedial actions that involve potential contact with contaminated environmental media to protect workers health and prepare for any foreseeable emergencies.	N/A	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.
			FEDERAL			
29 CFR Part 1926Safety and Health Regulations for Construction	Regulates construction health and safety.	N/A	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.

			v	<b>Vould Alternative Comply with ARARs or</b>	· TBCs?	
CITATION	DESCRIPTION	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA
			FEDERAL			
Hazardous Materials Transportation Act, 49 CF	FR Parts 101, 106-107, 172-173, 178-180, 171, 173-177					
49 CFR Parts 107 and 171-177	Establishes standards applicable to transporters of hazardous materials.	N/A	N/A	N/A	Yes. Transport of bulk hydrogen peroxide would need to comply with applicable requirements.	Yes. Transport of bulk hydrogen peroxide would need to comply with applicable requirements.
Air Pollution Prevention and Control (Clean Air	r Act), 42USC 7401-7671q					
40 CFR Part 50. National Primary and Secondary Ambient Air Quality Standards	Establishes monitoring requirements for sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide and lead during excavation.	N/A	N/A	Yes. Trenching activities may generate airborne particulate matter. Proper procedures would be implemented to ensure compliance with applicable requirements.	N/A	N/A
40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants	Establishes substances considered to be hazardous air pollutants and emissions standards for those substances.	N/A	N/A	Yes. Because the total mass of contaminant removed from the sump area by the treatment system is expected to be small, it is assumed that off-gas discharged from the groundwater treatment process will meet or exceed regulatory emission standards for hazardous air pollutants. If not, additional off-gas treatment could be added.	N/A	N/A
<b>Endangered Species Act, 16 USC Section 1531 e</b>	t seq.					
50 CFR Part 17 Endangered and Threatened Wildlife and Plants 50 CFR Part 402 Interagency CooperationEndangered Species Act of 1973, as amended	Protects endangered species and the critical habitats upon which endangered species depend.	N/A	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.
Bald and Golden Eagle Protection Act, 16 USC	Section 668 et seq.			•	•	
16 USC 668 et seq.	Prohibits the taking, possession, and transportation or any bald or golden eagle, dead or alive, or any part, nest or egg.	N/A	Yes. The alternative does not involve taking, possessing or transporting eagles.	Yes. The alternative does not involve taking, possessing or transporting eagles.	Yes. The alternative does not involve taking, possessing or transporting eagles.	Yes. The alternative does not involve taking, possessing or transporting eagles.
Migratory Bird Treaty Act of 1972, 16 USC Sect	tion 703				•	, -
16 USC Section 703	Protects native migratory bird species from unregulated "take." Poisoning due to exposure at hazardous waste sites can be included under this Act.	N/A	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.
National Archaeological and Historic Preservati	on Act of 1974, 16 USC Section 469					
16 USC Section 469 36 CFR Part 65	Must recover and preserve artifacts in area where alteration of terrain threatens significant scientific, prehistoric, historical, or archaeological data.	N/A	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.
The Antiquities Act of 1906, 16 USC Section 433			<u>,                                      </u>	,	·	T
43 CFR Part 3	Provides for protection of historic and prehistoric ruins and objects on federal lands.	N/A	Yes. No historic or prehistoric ruins or objects would be threatened.	Yes. No historic or prehistoric ruins or objects would be threatened.	Yes. No historic or prehistoric ruins or objects would be threatened.	Yes. No historic or prehistoric ruins or objects would be threatened.

			v	Vould Alternative Comply with ARARs o	or TBCs?	
CITATION	DESCRIPTION	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA
			FEDERAL			
Native American Graves Protection and Repatr	riation Act, 25 USC Section 3001					
Public Law 101-601	Requires that if Native American remains or cultural items are found on federal lands, the appropriate tribe must be notified, and all activity in the area of discovery must cease for at least 30 days.	N/A	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.
			STATE			
Water Supplies, 567 IAC, Division B, Chapter 4	41					
567 IAC 41.3(455B)(1)(b) 567 IAC 41.3(455B)(5)(a) and (b) 567 IAC 41.3(455B)(6)(a)	Establishes MCLs for specific contaminants that are applicable for drinking water supplied by community water systems and for nontransient, noncommunity drinking water systems.		Yes. Groundwater use restrictions would prevent ingestion of contaminated groundwater exceeding MCLs.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.
Air Quality, 567 IAC, Title II		1				
567 IAC 23.3 (455B) Emission Standards	Establishes monitoring requirements for emission of particulates or dust from any process.	N/A	N/A	Yes. Trenching activities may generate airborne particulate matter. Proper procedures would be implemented to ensure compliance with applicable requirements.	N/A	N/A
567 IAC 28 (455B) Ambient Air Quality Standards	Establishes monitoring requirements for $PM_{10}$ and lead during excavation.	N/A	N/A	Yes. Trenching activities may generate airborne particulate matter. Proper procedures would be implemented to ensure compliance with applicable requirements.	N/A	N/A
Effluent and Pretreatment Standards, 567 IAC	, Title IV, Chapter 62				·	
567 IAC 62.1(455B)(1)	Establishes NPDES permit conditions for point source discharge of pollutants into navigable waters.	N/A	N/A	Yes.	N/A	N/A
Water Quality Standards, 567 IAC, Title IV, Cl	hapter 61				•	•
567 IAC 61.2(455B)(2) 567 IAC 61.3(455B)	Establishes an antidegradation policy for surface waters of the State of Iowa, including requirements to maintain certain flows and water quality criteria.	N/A	Yes. Would not affect surface water flows or water quality.	Yes. Following extraction and treatment with air stripping, the effluent water is expected to meet the antidegradation policy requirements.	Yes. Would not affect surface water flows or water quality.	Yes. Would not affect surface water flows or water quality.
Nonpublic Water Supply Wells, 567 IAC, Division						
567 IAC 49(455b)	Establishes uniform minimum standards and methods for well construction and reconstruction for nonpublic water supply wells.	N/A	N/A	Yes. Extraction well will not adversely affect existing water supply wells.	N/A	N/A
Criteria and Conditions for Authorizing Withd	rawal, Diversion, and Storage of Water, 567 IAC, Division C	, Chapter 52			•	•
567 IAC 52(455b)	Establishes criteria for issuance of water permits, permit conditions, and conditions for modification, cancellation, or suspension of permits. Includes special criteria for particular types of water sources such as streams and groundwater.	N/A	N/A.	Yes. A permit, or equivalent requirements thereof, may be required to extract groundwater.	S N/A.	N/A.
Wastewater Treatment and Disposal, 567 IAC,						
567 IAC 61(455b) Establishment of Water Quality Standards	state waters.	N/A	Yes. Would not affect surface water quality.			
567 IAC 62(455b) Effluent and Pretreatment Standards	Sets standards for the treatment of water prior to discharge to either waters of the state or a POTW.	N/A	N/A	Yes. Monitoring would ensure that effluent is treated to acceptable levels before discharge to surface water.	N/A	N/A

		Would Alternative Comply with ARARs or TBCs?					
CITATION	DESCRIPTION	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA	
			STATE				
	Sets construction, operation, discharge, monitoring, analytical and reporting requirements for the operation of wastewater disposal systems.	N/A	N/A	Yes. Treatment system would be designed, constructed, and operated to meet requirements.	N/A	N/A	
567 IAC 69(455b) On-Site Wastewater Treatment and Disposal Systems	Establishes rules for on-site wastewater treatment and disposal systems, including discharge restrictions and minimum distances.	N/A	N/A	Yes. Treatment system would be designed, constructed, and operated to meet requirements.	N/A	N/A	
Solid Waste Comprehensive Planning Requirement	ents, 567 IAC, Title VIII, Chapter 101						
567 IAC 101(455b, 455d) Iowa Solid Waste Management and Disposal General Requirements	Defines requirements for disposal of solid wastes.	N/A	installation would be handled and disposed	Yes. Soil cuttings from monitoring well and extraction wells would be handled and disposed of as solid waste.	installation would be handled and disposed	Yes. Soil cuttings from monitoring well installation would be handled and disposed of as solid waste.	
Hazardous Waste, 567 IAC, Title XI, Chapter 14	11						
567 IAC 141(455b)	Defines criteria for characterization and listing of RCRA hazardous waste.	N/A	N/A	N/A	N/A	N/A	
Endangered Plants and Wildlife, 571 IAC, Chap	Endangered Plants and Wildlife, 571 IAC, Chapter 77						
571 IAC 77(481b)	Protects endangered species and the critical habitats upon which endangered species depend.	N/A	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.		Yes. No critical habitat would be disturbed by remedial activities.	

ARAR = Applicable or Relevant and Appropriate Requirement AWQC = Ambient Water Quality Criteria

CFR = Code of Federal Regulations CTO = Catalytic Thermal Oxidation

IAC = Iowa Code

MCL = Maximum Contaminant Levels

N/A = Not Applicable

NPDES = National Pollutant Discharge Elimination System

PCP = Pentachlorophenol

POTW = Publicly Owned Treatment Works

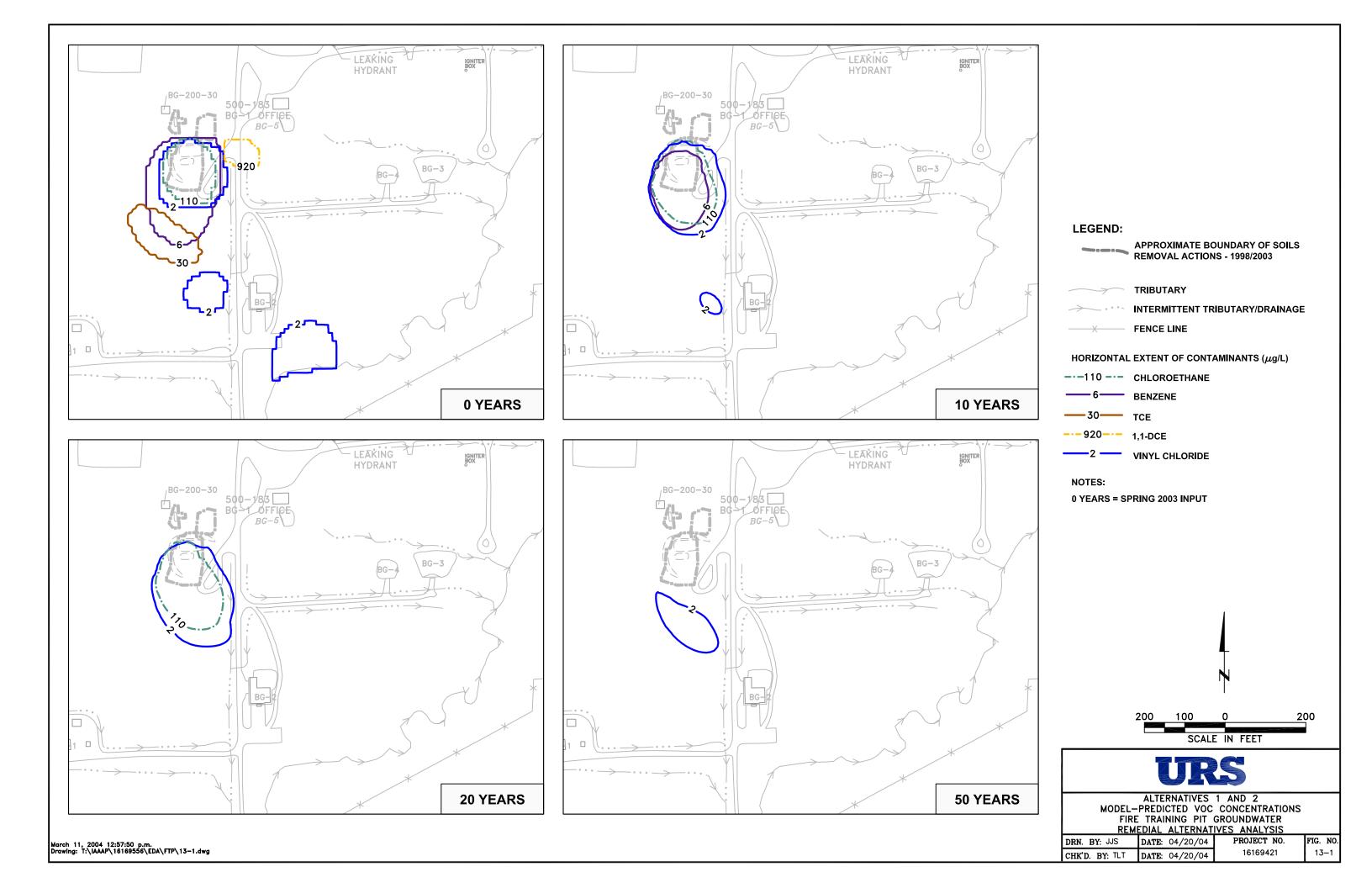
RCRA = Resource Conservation and Recovery Act

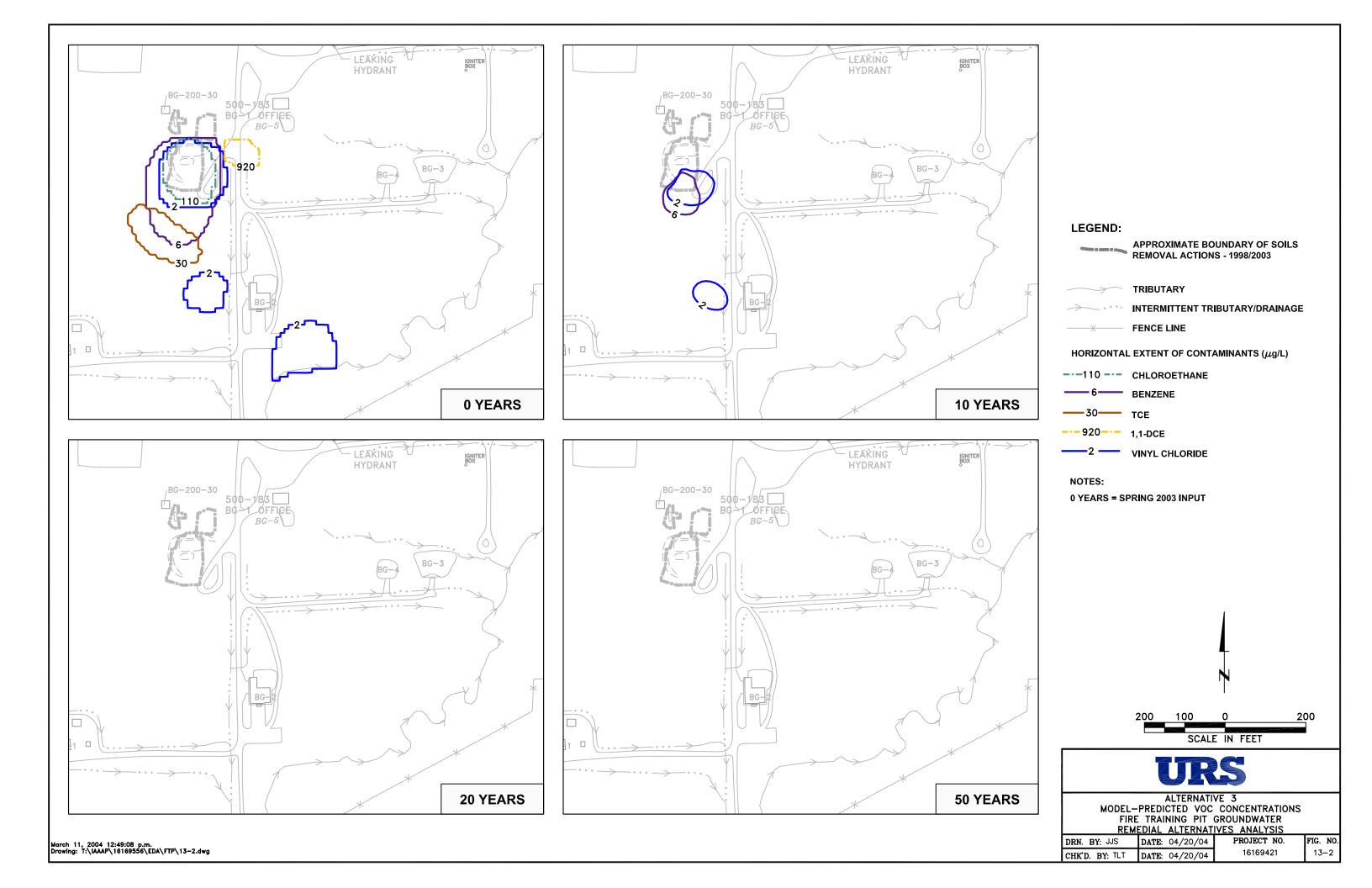
SWDA = Solid Waste Disposal Act

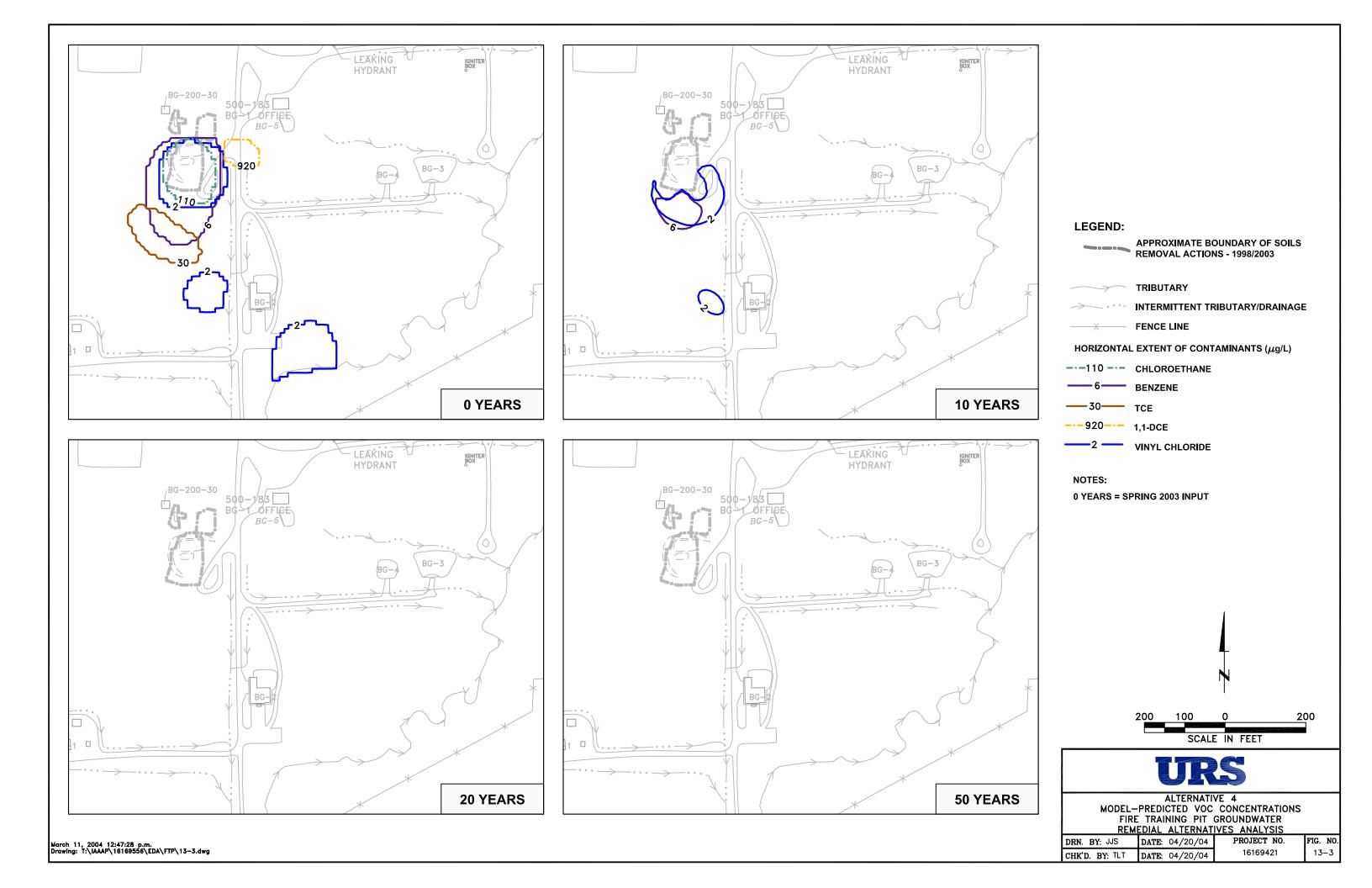
TBC = To Be Considered

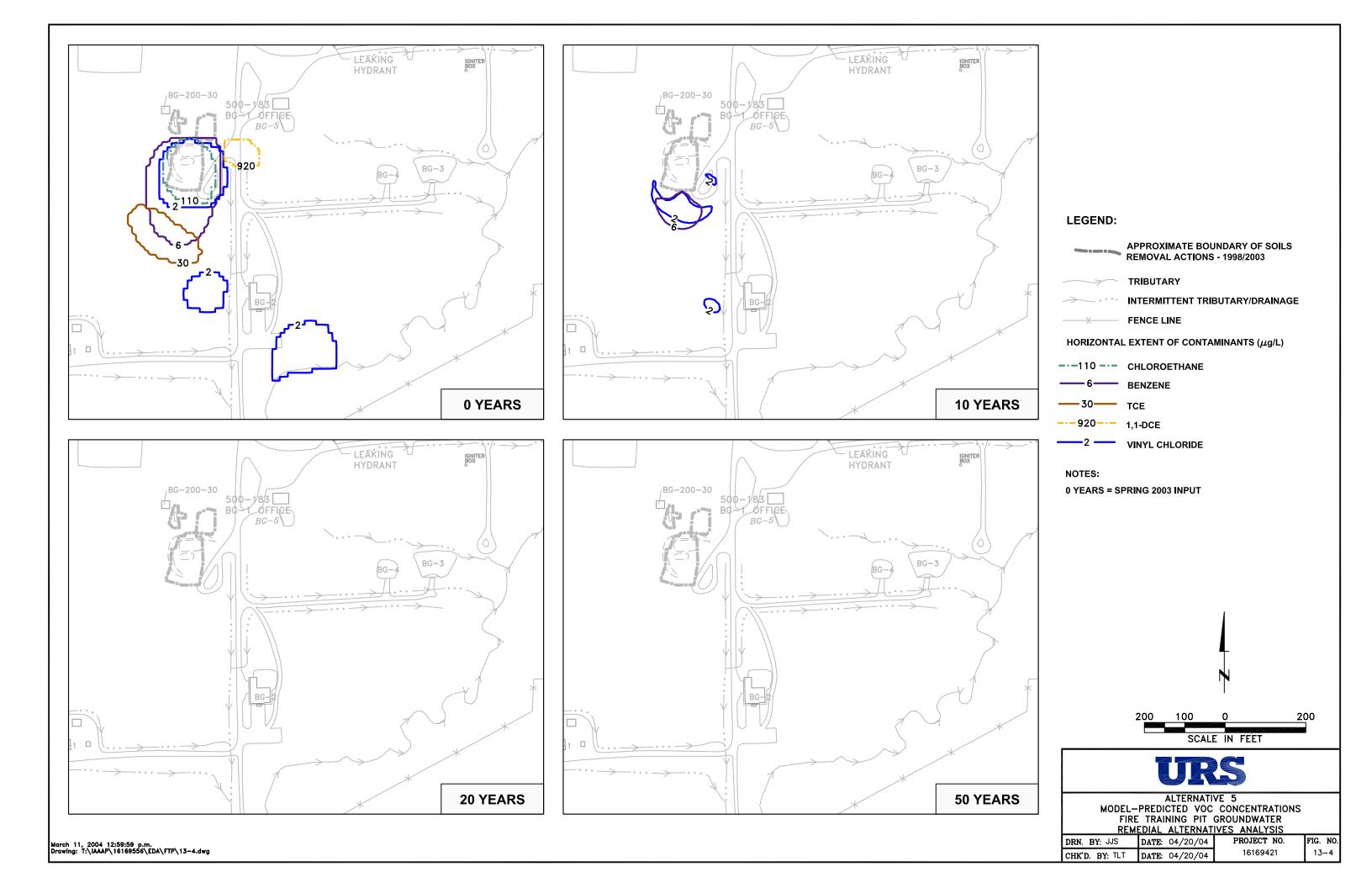
USC = United States Code

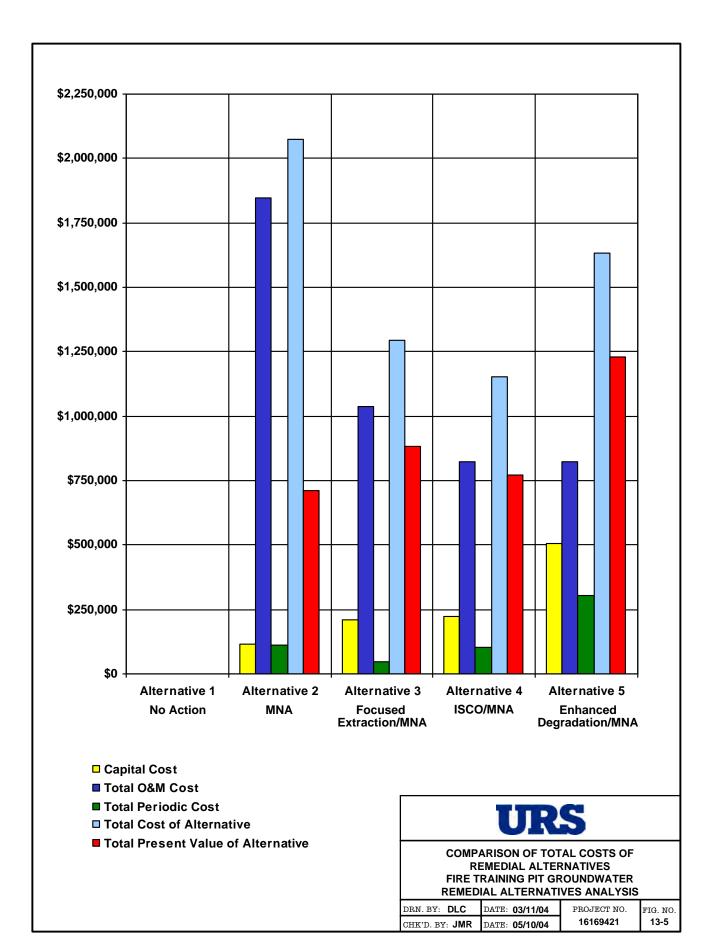
USCA = United States Code Annotated











This section discusses RAA uncertainties and assumptions and describes the remedy selection process for FTP groundwater at IAAAP, based on the detailed analysis (**Section 13**).

#### 14.1 UNCERTAINTIES AND ASSUMPTIONS

Uncertainties identified during the RAA process for FTP groundwater need to be addressed prior to final design and implementation of remedial action. In addition, certain assumptions have been made to complete RAA evaluations. Uncertainties and assumptions for FTP groundwater RAA include:

- Locations of underground utilities at FTP were estimated using as-built drawings provided to URS by IAAAP and observations made during soil removal activities. A utility locator would be used to confirm locations of underground utilities prior to remedial activities.
- Total project durations for Alternatives 2 through 5 were developed based on model-predicted time to reduce contaminant concentrations to PRGs for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride. Because the predicted durations are considered conservative, O&M costs for these alternatives may be overestimated.
- For Alternative 3, no off-gas treatment process has been developed because the total mass of contaminant removed from the sump monitoring well area by the treatment system is expected to be small (Section 11.2). It is assumed that off-gas discharged to the atmosphere from the groundwater treatment process will meet or exceed regulatory emission standards for hazardous air pollutants. It is also assumed that no additional water treatment processes, other than air stripping, would be required to reduce contaminant concentrations to below PRGs. These could be added if discharge monitoring indicates otherwise.
- For Alternative 4, the ISCO conceptual design was developed through review of technical guidance documents and case studies pertaining to ISCO. A pre-design investigation consisting of bench scale and field scale testing would be performed to determine the most effective oxidant/water mixture ratio, circulation rate, and potential supplemental Fe<sup>2+</sup> requirements prior to full-scale implementation.
- The overall effectiveness of EB depends on the ability of high-pressure injection techniques to distribute substrates into the FTP shallow till clay and glacial outwash through existing preferential pathways (i.e., sand lenses and naturally occurring micro-fractures).
- Components of Alternatives 4 and 5 may have existing patents. Costs associated with the use of patented technologies have not been included in cost estimates. Applicability of patents would need to be investigated during remedial design.

#### 14.2 REMEDY SELECTION PROCESS

The remedy selection process links the analysis of remedial action alternatives, conducted in an RI/FS (RAA), with documentation of the selected remedy in a record of decision (ROD) (USEPA 1997c). Section 121 of CERCLA established five principal requirements for the selection of remedies. Remedies must:

1. Protect human health and the environment.

### **SECTION**FOURTEEN

#### **Uncertainties and Remedy Selection Process**

- 2. Comply with ARARs unless a waiver is justified.
- 3. Be cost-effective.
- 4. Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.
- 5. Satisfy a preference for treatment as a principal element or provide an explanation in the ROD for why this preference was not met.

The nine NCP evaluation criteria (**Section 13.1**) are derived from these principal requirements as well as other important technical and policy considerations (USEPA 1997c). Therefore, a remedial action that meets the nine criteria will satisfy the principal requirements of CERCLA.

The remedy selection process consists of two steps. The first step is presentation of a preferred remedial action to the public for comment in a proposed plan. The proposed plan summarizes the preliminary conclusions as to why the preferred option appears most favorable, based on the information available and considered during the FS (RAA). Following receipt and evaluation of public comments on the proposed plan, a final decision is made and the selected remedy is documented in a ROD.

For FTP groundwater, a preferred remedial alternative is not presented in this RAA. The remedial alternatives presented in this report will be reviewed by USACE, USAEC, IAAAP, USEPA, and the Iowa Department of Natural Resources (IDNR) prior to selection of a preferred remedial alternative. Once a preferred remedial alternative has been selected, it will be presented to the public in a Proposed Plan.

The following is a brief summary of the major findings of the FTP groundwater RAA.

#### Facility and Site Background

- The FTP is located in the southwest portion of the EDA, southwest of the WBPA, and is in the Spring Creek watershed.
- The FTP was built in the early 1970s and was used for firefighting training sessions. During these training sessions, 55-gallon drums of solvents and fuels were placed in the pit, set ablaze, and extinguished by firefighters.
- Two smaller pits were located to the northwest and northeast of the main pit. The pit to the northeast was also used to burn waste solvents and fuels.
- In 1998, a major source removal action was completed which included the removal of approximately 5,200 cy of contaminated soil from the main pit.
- In May and November 2001, trenching and sampling activities delineated the two other smaller pits north of the FTP. In August 2003, a soil removal action was completed at the second and third pits.

#### RAA Data Collection Field Activities

- The RAA field activities completed in Fall 2002 and Spring 2003 focused on defining the nature and extent of contamination in the shallow and bedrock groundwater sidegradient and downgradient of the FTP.
- Field activities included a vegetation and land use survey, collection of 24 direct push groundwater samples, installation and development of eight monitoring wells, groundwater sampling at eight monitoring wells, installation of seven staff gauges (two installed near the FTP), slug testing, and surveying.

#### Physical Site Characteristics

- Surface topography at the FTP exhibits a broad, flat-to-gently sloping terrain, which slopes from the upland area near the FTP to the east and southeast toward an unnamed tributary of Spring Creek. Around the FTP area, shallow, man-made drainage ditches control and direct stormwater flow to the south and southeast toward a tributary of Spring Creek. Approximately 1,200 feet to the east of the FTP, the landscape is dissected by Spring Creek, and the topography changes to a steeply sloping terrain.
- General vegetation types and land usage in Fall 2002 included cropland, grassland, and woodland. No sensitive vegetation types or habitat for T&E species were identified near the FTP plumes.
- The FTP geologic profile consisted of a general upland glacial till plain of unconsolidated and consolidated sediments overlying bedrock. The typical subsurface geologic profile consisted of:

- <u>Shallow Weathered Glacial Till/Fill/Loess</u>: highly weathered and oxidized silty clay to sandy clay with localized sand seams. Thicknesses ranged from 34 feet near the FTP to 6 feet near the tributary of Spring Creek.
- <u>Glacial Outwash</u>: oxidized clayey sand to poorly graded sand with fine gravel. The outwash thickness ranged from 0.2 to 4.0 feet and was absent in several borings.
- <u>Bedrock</u>: fractured and weathered shale and limestone containing isolated voids, in the upper 10 to 16 feet of bedrock. Below the fractured and weathered zone, the bedrock became more competent.
- FTP hydrogeologic units included shallow groundwater (water table) and bedrock groundwater. Shallow groundwater (water table) at the FTP crossed several different geologic units in Spring 2003; therefore, shallow till wells, till/bedrock contact wells, and till/upper bedrock wells were used to interpret and describe the shallow groundwater hydrogeologic characteristics. Bedrock groundwater at the FTP was approximately 3 to 16 feet lower than the shallow groundwater in Spring 2003. This indicated that there was little or no connection between the shallow and bedrock groundwater. Upper bedrock and bedrock groundwater wells were used to interpret and describe the bedrock groundwater hydrogeologic characteristics. Hydrogeologic characteristics in Spring 2003 included:
  - <u>Shallow Groundwater (Water Table)</u>: depth to groundwater ranged from 1.8 to 9.6 feet bgs. Horizontal hydraulic gradients ranged from 0.020 to 0.085 ft/ft to the east, southeast, and south. Hydraulic conductivities in the shallow groundwater wells screened only in the glacial till ranged from 0.020 to 0.18 feet/day. Hydraulic conductivities in the shallow groundwater wells screened on top of or across the bedrock contact (typically intercepted glacial outwash sands) ranged from 0.046 to 1.7 feet/day. Estimated groundwater flow velocities ranged from 0.49 to 54 feet/year to the east, southeast, and south.
  - <u>Bedrock Groundwater</u>: depth to groundwater ranged from 7.4 to 20.3 feet bgs. Horizontal hydraulic gradients ranged from 0.028 to 0.045 ft/ft to the east. Hydraulic conductivities ranged from 0.00042 to 0.0076 feet/day. Estimated groundwater flow velocities ranged from 0.023 to 0.33 feet/year to the east.
- Several man-made drainage ditches control stormwater at the FTP and flow east, southeast, and south into an unnamed tributary of Spring Creek. This tributary converges with Spring Creek approximately 1,200 feet to the east. Staff gauges installed in Spring Creek and the tributary south of the FTP indicated that the surface water elevations were lower than the groundwater elevations in the surrounding shallow groundwater wells. These data indicated that the tributary of Spring Creek was a gaining stream along the FTP reach, and Spring Creek was a gaining stream in most of the EDA.

#### Chemical Site Characteristics/Chemicals of Potential Concern

- The primary VOCs detected in the shallow groundwater at the FTP included 1,1-DCA, 1,1-DCE, cis-1,2-DCE, 1,1,1-TCA, and TCE.
- The primary explosives compounds detected in the shallow groundwater at the FTP included 2,6-DNT, RDX, and HMX.

- The primary metals detected in the shallow groundwater at the FTP included arsenic, barium, cadmium, chromium, and selenium.
- Groundwater at the FTP was evaluated as two distinct zones during the COPCs selection for the HHRA:
  - Shallow Groundwater (0 to 34 feet bgs)
  - Bedrock Groundwater (34 to 60 feet bgs)
- Acetone, benzene, bromochloromethane, chloroethane, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, ethylbenzene, MIBK, methylene chloride, PCE, toluene, 1,1,1-TCA, 1,1,2-TCA, TCE, vinyl chloride, m,p-xylene, RDX, 2,6-DNT, and arsenic were retained as COPCs in the shallow groundwater.
- No COPCs were identified in bedrock groundwater.
- NO<sub>3</sub> was not retained as a COPC in groundwater because the maximum concentrations detected were below the risk screening value.
- No COPCs were identified in surface water.

#### Nature and Extent of Contamination

The FTP groundwater sampling results indicated the following:

- Three small explosives plumes were interpreted to be present in the shallow groundwater at the FTP. The explosives detected consisted primarily of RDX and 2,6-DNT.
- A VOC plume was interpreted to be present in the shallow groundwater, and consisted primarily of chlorinated hydrocarbons (i.e., PCE, 1,1,1-TCA, TCE, cis-1,2-DCE, 1,1-DCE, 1,2-DCA, methylene chloride, chloroethane, and vinyl chloride). 1,1-DCE was the most frequently detected VOC across the FTP site. The highest concentrations of VOCs were detected near surface drainage features and near the former fire training pit. The shallow VOC plume extends from the former fire training pit to the unnamed tributary of Spring Creek.
- No chemicals were detected in the bedrock groundwater at concentrations exceeding IAAAP regulatory standards.
- No chemicals were detected in surface water sample SCT3 above IAAAP groundwater regulatory standards.
- Arsenic was detected above the EDA background concentration in shallow groundwater from well SA-99-1. No other metals were detected in groundwater above IAAAP regulatory standards or the calculated background concentrations.
- NO<sub>3</sub> was not detected in groundwater above the IAAAP regulatory standard.

#### Contaminant Fate and Transport

• The baseline modeling results indicated that the benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plume concentrations are at their highest predicted concentrations. Most of the

VOC plume concentrations will decline below the IAAAP regulatory standards in about 15 to 25 years due to the naturally occurring processes of dispersion and degradation. The benzene plume will decline below the IAAAP regulatory standard (5  $\mu$ g/L) in about 15 to 20 years, while TCE and 1,1-DCE will take about 20 to 25 years to decline below the standard (7  $\mu$ g/L). Vinyl chloride will take about 50 to 55 years to decline below the regulatory standard (2  $\mu$ g/L). Chloroethane will be reduced to below the IAAAP regulatory standard (4.6  $\mu$ g/L) in just over 70 years.

- The baseline modeling results indicated that the VOC plumes in the high concentration areas would not be transported downgradient any significant distance away from the interpreted groundwater sources (e.g., the sump monitoring well area).
- The baseline modeling results indicated that the low concentrations of 1,1-DCE and vinyl chloride at the distal edges of the FTP VOC plume will attenuate to below IAAAP regulatory standards in less than 20 years.
- This initial natural attenuation evaluation for the FTP groundwater indicated natural attenuation processes may be significant for the FTP RDX plumes and VOCs plume. Key elements supporting natural attenuation included:
  - Shallow groundwater at sump monitoring well SA-99-1 generally exhibited reducing conditions and moderately low DO concentrations, favoring anaerobic degradation of explosives and VOCs.
  - VOC degradation products (e.g., cis-1,2-DCE, 1,1-DCE, and vinyl chloride) are present.
  - Contaminant fate and transport modeling results indicated most of the VOC plumes will degrade to below IAAAP regulatory standards within 15 to 25 years. However, the area of highest VOC concentrations (near SA-99-1) will take considerably longer to meet those levels (greater than 70 years for chloroethane).
  - RDX concentrations have remained fairly constant (and low) in FTA-99-1. RDX metabolites (e.g., MNX) were also present.
  - VOC concentrations have generally declined over time, specifically in SA-99-1, while vinyl chloride has increased over time in SA-99-1.

#### Human Health Risk Assessment

- Acetone, benzene, bromochloromethane, chloroethane, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, ethylbenzene, MIBK, methylene chloride, PCE, toluene, 1,1,1-TCA, 1,1,2-TCA, TCE, vinyl chloride, m,p-xylene, RDX, 2,6-DNT, and arsenic were retained as COPCs in the shallow groundwater. No COPCs were identified in bedrock groundwater or surface water.
- The receptor populations and exposure routes evaluated included current/future construction worker via inhalation, incidental ingestion, and dermal contact; current/future hunter/trespasser via incidental ingestion and dermal contact; and current/future commercial/industrial worker via ingestion.

- The risk assessment results indicated that the estimated total RME lifetime excess cancer risk for the construction worker (5.7x10<sup>-6</sup>) was within the USEPA target risk range of 1x10<sup>-6</sup> to 1x10<sup>-4</sup> (USEPA 1990, 1991b). The HI was 1.2.
- The risk assessment results indicated that the estimated total RME lifetime excess cancer risk for the commercial/industrial worker (1.2x10<sup>-3</sup>) was greater than the USEPA target risk range of 1x10<sup>-6</sup> to 1x10<sup>-4</sup> (USEPA 1990, 1991b). The HI was 7.1.
- Risk-based PRGs were developed for all COPCs. All were based on the commercial/industrial workers' ingestion of shallow groundwater as drinking water with the exception of toluene. The toluene risk-based PRG was based on the construction workers' inhalation of shallow groundwater.
- The risk-based PRGs for 1,1,1-TCA, acetone, bromochloromethane, cis-1,2-DCE, 2,6-DNT, ethylbenzene, MIBK, toluene, and m,p-xylene were higher than the maximum concentrations detected at the FTP.
- The following chemicals had detected concentrations at the FTP that exceeded the risk-based PRGs: 1,2-DCA, 1,1-DCE, 1,1,2-TCA, benzene, chloroethane, methylene chloride, PCE, TCE, vinyl chloride, RDX, and arsenic.

#### Remedial Action Objectives

- The following RAOs were proposed for FTP groundwater:
  - Prevent commercial/industrial worker ingestion of contaminants of concern above their PRGs in groundwater, as listed below:
    - Benzene =  $6 \mu g/L (10^{-6} \text{ risk-based PRG})$
    - 1,1,2-TCA = 6  $\mu$ g/L ( $10^{-6}$  risk-based PRG)
    - 1,2-DCA =  $5 \mu g/L (MCL)$
    - Chloroethane =  $110 \mu g/L (10^{-6} \text{ risk-based PRG})$
    - PCE =  $6 \mu g/L (10^{-6} \text{ risk-based PRG})$
    - TCE =  $30 \mu g/L (10^{-6} \text{ risk-based PRG})$
    - 1,1-DCE = 920 μg/L (HI = 1.0, risk-based PRG)
    - Vinyl Chloride =  $2 \mu g/L$  (MCL)
    - Methylene Chloride =  $44 \mu g/L (10^{-6} \text{ risk-based PRG})$
    - $RDX = 3 \mu g/L (10^{-6} \text{ risk-based PRG})$
    - Arsenic =  $40 \mu g/L$  (background UTL)

### Screening Technologies

• Following assembly, evaluation, and screening of potential remedial technologies and technology process options to satisfy the RAO, the following GRAs and process options were retained based on effectiveness, implementability, and cost:

— No Action: No Action

— Institutional Controls: Groundwater Use Restrictions, Health and Safety Program

— Engineering Controls: Groundwater Monitoring

— Removal: Excavated Sump

— In-Situ Treatment: MNA, ISCO, EB

— Ex-Situ Treatment: Air Stripping

— Disposal: Surface Water Discharge

#### **Development of Alternatives**

• Remedial action alternatives were assembled from combinations of process options and technologies that survived the screening process, to provide a range from no action to active treatments that will reduce TMV of contaminants at the site.

- Remedial alternatives developed for FTP groundwater included:
  - <u>Alternative 1 No Action</u>: No remedial action would be implemented.
  - Alternative 2 MNA: Groundwater monitoring would evaluate natural attenuation of the plume. Institutional and engineering controls would prevent human exposure to contaminated groundwater.
  - <u>Alternative 3 Focused Extraction/MNA</u>: Involves extracting contaminated groundwater from the existing sump monitoring well SA-99-1 for treatment and discharge to surface water. Alternative 3 also relies on MNA, as described for Alternative 2, to reduce the contaminant mass in portions of the FTP groundwater plume not influenced by the extraction well.
  - <u>Alternative 4 ISCO/MNA</u>: Consists of circulating a chemical oxidizing agent within the 1998 limits of excavation surrounding SA-99-1, to degrade commingled benzene and CVOCs and to immobilize arsenic in groundwater. H<sub>2</sub>O<sub>2</sub> solution entering the aquifer would combine with dissolved Fe<sup>2+</sup> and Fe<sup>2+</sup> contained in soil minerals to create a Fenton-like reagent. Alternative 4 also relies on MNA, as described for Alternative 2, to reduce the contaminant mass in portions of the FTP groundwater plume that is not affected by ISCO.
  - <u>Alternative 5 Enhanced Degradation/MNA</u>: Consists of ISCO in the SA-99-1 sump monitoring well area (as described in Alternative 4) combined with EB in surrounding areas. EB using HRC<sup>™</sup> is assumed for full-scale implementation in the CVOC plumes east and south of the sump monitoring well area to establish anaerobic conditions within the aquifer to reductively degrade CVOCs. Alternative 5 also relies on MNA, as described for Alternative 2, to reduce the contaminant mass of the FTP groundwater plume that is not affected by EB or ISCO.

#### **Uncertainties and Assumptions**

Uncertainties identified during the RAA process for FTP groundwater include the existence of contamination in soil at concentrations that could continue to migrate to groundwater, and locations of underground utilities. Alternative-specific uncertainties and assumptions include:

- Total project durations for Alternatives 2 through 5 were developed based on model-predicted time to reduce contaminant concentrations to PRGs for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride. Therefore, O&M costs for these alternatives may be overestimated.
- For Alternative 3, it is assumed that off-gas discharged to the atmosphere from the groundwater treatment process will meet or exceed regulatory emission standards for hazardous air pollutants and that no additional water treatment processes, other than air stripping, would be required to reduce contaminant concentrations to below PRGs.
- For Alternative 4, a pre-design investigation would be required to determine the most effective oxidant/water mixture ratio, circulation rate, and potential supplemental Fe<sup>2+</sup> requirements prior to full-scale implementation.
- The overall effectiveness of EB (Alternative 5) depends on the ability of high-pressure injection techniques to distribute substrates into the FTP shallow till clay and glacial outwash through existing preferential pathways (i.e., sand lenses and naturally occurring microfractures).
- Costs associated with the use of patented technologies for Alternatives 4 and 5 have not been included in cost estimates.

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DRAFT REPORT VOLUME 2 OF 2 APPENDICES

# FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

# IOWA ARMY AMMUNITION PLANT MIDDLETOWN, IOWA





Prepared for U.S. Army Corps of Engineers Omaha District

May 2004



**Direct Push Investigation Monitoring Well Installation** 

**Direct Push Investigation** 

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HTRW DRILLI	NGLOG	DISTRIC	т aha District				HOLE NUMBER
1. COMPANY NAME	<u>.                                  </u>		ING SUBCONTE				
· · · · · · · · · · · · · · · · · · ·		1					SHEET SHEETS
URS Corporation 3. PROJECT		Saber			nmental Services		1 " 5
1	4.			LOCATION	_		
Iowa AAP F.S. Data Collect 5. NAME OF DRILLER	ion			Burlingto			
1 1/	•		6.	_	TURE'S DESIGNATION	OF DRILL	
Jesse Ka	lvia	<del>-</del>			poprobe		<del>_</del>
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		maero core sau	upler 8.	HOLE LOCA			,
	115" dual	tube samples			301,166,42	a'N a	275733E
		···	9.	SURFACE E	ELEVATION		
					8.1'		
	·			DATE STAF		11. DATE	
		· · · · · · · · · · · · · · · · · · ·		10.21	OUNDWATER ENCOUN	10,6	21,07
12. OVERBURDEN THICKNESS	281	1 _					!
	<u> 38'</u>	<u>bgS</u>		<u> 34'</u>	bas during	drillin	4
13. DEPTH DRILLED INTO ROCK	d		16.	DEPTH TO		TIME AFTER DR	RILLING
	$- \varphi$				NA		
14. TOTAL DEPTH OF HOLE	201 h	. /	17.	OTHER WA	TER LEVEL MEASURE	MENTS (SPECIF	Y)
	38'b	<u> </u>			NA	_	
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDIS	TURBED	19. TOTA	AL NUMBER OF CORE	BOXES	
				<u> </u>	<del></del>		
20. SAMPLES FOR CHEMICAL ANALYSIS	voc	METALS	OTHER (S	PECIFY)	OTHER (SPECIF	OTHER	(SPECIFY) 21. TOTAL CORE
						1 —	RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (S	PECIFY)	23. SIGNATURE OF I	SPECTOR	
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ECCATION SKETCH/COM	INCIATO				SCALE:	1"= 6	$x\infty$
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11100	Spring Creek	j					,
PROJECT			<del></del>			HOLE	
Iowa AAP F.S. Data C	Collection					CTAT	ING
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HTRW DRILL	ING LOG		·		HOLE NO.
PROJECT	INSPECTOR				SHEET SHEETS
Iowa AAP F.S. Data Collection  ELEV DEPTH DESCRIPTION OF MATERIALS	FIELD SCREENIN		ANALYTICAL	BLOW-	Z OF 5
a b. c.	RESULTS d.	OR CORE BOX NO.	SAMPLE NO. f.	P. g.	h.
- Silty CLAY (CL) - very still, brown, and				İ	Topsoil/loes
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1.0 -		R= 12/32		7.0	
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3.0 -		<u> </u>			ļ .
1 - 1				7.0	[
1 4			İ		
mesome Ser most	_				<del>-</del> +
4.0 - WI gray & orange nothing, low plant trace 1001 + magenetium staining	us,			7.0/0	Till
the ing + magnetium staining	- 9	2.21			<u> </u>
<del> </del>		R=30/36			<u> </u>
50 - becomes very soft					Į.
50 - Becomes 129 211				6	Ė
]					‡
=					<u>F</u>
]	45= ND			64	Ė
[ b.o —]	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			W.4	<u> </u>
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- 1 st. CC			Ì		E
10 - becomes medium stiff			l	2.0	F
" -				4,0	E
		R=3/3/	ĺ		E
roll		' "	ŀ		F
310 becomes very soft				0.5	Ē
belomes soft - no iron staining/orange mottling				0,5	ŧ
no iron staining/ orange mothing					E
7	16 - 17				Ē
9.0	HS = ND	-		1.0	<u> </u>
1 , , , ,					Ę
- becomes med stuplastic			1		<u> </u>
10.0 =	,	34.			R = 36/36
IO.0 PROJECT		Ľ. <u>Հ.</u> , —		HOLE NO.	
Iowa AAP F.S. Data Collection	on			FTA.	DPØI

HTRW DRILLII	NG LOG	<del></del>		<u> </u>	HOLE NO. FTO-DPOI
PROJECT  LOUIS AAD E.S. Data Callaction	INSPECTOR	3			SHEET SHEETS
Iowa AAP F.S. Data Collection  ELEV DEPTH DESCRIPTION OF MATERIALS	FIELD SCREENIN				3 OF 5
a b. c.	a	OR CORE BOX NO	SAMPLE NO.	KSF	h.
SAME: Silty CLAY (CL) - 50ft, light brown of grant strange with the med	own				Till
plastic					
<u>                                   </u>		0 30/	# 0		
110-		R= 3/30	E.	1,0	
]			ĺ		
	45=ND		rea		
12.0 <u> </u>	H3 ND			110	
				,	[
=				1	
13.0 -				'	
trace wood + organics ~ 0.25"			85	0.5	<u> </u>
trace wood a organics ~ 0.25"  - becomes very stiff w/ trace concretion  - some iron staining a fine to medgin  fine to med sound w/ trace fine grave	5,	R=36/			711
fine to med sound w/ trace fine amount	et <del>el</del>	13 /36	ĺ		E
140 =	7		Sa	5.0	<u> </u>
Ē				}	<u> </u>
- 그					<u>E</u>
becomes soft a low plastic	, Va				Ė
15.0	HS : AD	<u> </u>	Ro	1.0	<u> </u>
becomes soft a low plastic  15.0 -  becomes very soft					E
			!		‡
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Ne.0 =				0.0	Ė
<u> </u>		2 3/0/			E
극		R= 36/24			-
3					. ‡
17.0 4				0.0	F
=					Ė
become week soft					<u> </u>
become they	HS=ND			1.0	Ē
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三					‡
<u></u>					E
100	15: ND	·		3,0	
PROJECT Iowa AAP F.S. Data Collection				HOLE NO.	TIPA

	HTRW DRILLII	NGIOG		<del></del>		HOLE NO.
PROJECT		INSPECTOR		<del> </del>		FTA-DPØ1
IO DEPTH	wa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	FIELD SCREENII	COVEY	ANALYTICAL	. BLOW-	4 °F 5
a. b.	c.	RESULTS d.	OR CORE BOX NO			REMARKS h.
71.0	same: 5.14 CLAY (CL) · 50ft, light be moist, low plastic some iron staining, trace fine to med sam calcite concretions & fine gravel	HOND	R. Zy			7iII
22.0						
730			R=36	Ro	9,0	
240	o.1' gravel seam Decomes gray 5. Ity (LAY (CH) high plastic 4 very stiff in some iron staining	<u>#5=ルカ</u> -	1.75" dual- tube	4-254	8.0	7111
25.0			D-34g		8.0	
260	trace sand		かを		5.6	-
]		144				<u> </u>
27.0		45=ND	Many TSTE Sampler		9.0	tube steple erusher in boring white semplings
70 -			R=34		9,0	my switch to si
210 -					(e.0	1 1 1 1 1
50.6		H5=ND			6.0	E
<u> </u>	PROJECT	11 109			HOLE NO	
<del></del>	Iowa AAP F.S. Data Collection	<del></del>			ET A	-TDP\$1

HTRV	V DRILLING LOG	<u> </u>			HOLE NO.
PROJECT  Iowa AAP F.S. Data Collection	INSPECTOR	COVEY	<del></del>	<del></del>	SHEET SHEETS
ELEV DEPTH DESCRIPTION OF MATERIA	LS FIELD SCREENI RESULTS		ANALYTICAL SAMPLE NO.	BLOW.	S S
SAME: Silty CLAY (CH).  morst, high plastic  staining, trace s	ا ا	е.	f.	S.O	Tin
310		R=361		3.0	
320				2.0	
330 —	H6= ND	macro sorc		0.0	1644 dual tube 31 eeve crushed
34.0 - Sitty SAND (SM) - med dens wet, trace fine gravel, fine t	e, light brown, to med. grame	R=1/36	Ground Water Sample FTP- DPOI-		on boring while sampling will switch to more core retrieve dual tube sleeve
36.0	145=WD		38 For VOC's Freenil3 Collected 10/22/02 T=1730		
310-		D 24/1			
	H5=ND	R= 24/4			Tempwell is
Balack Rafusal					bob. @ 380'695 @ bedrock Temp Well Installed
PROJECT  IOWA AAP F.S	S. Data Collection		F	IOLE NO.	-DPØ1

HTRW DRILLI	NG LOG	DISTRIC	т aha Distr	ict			HOLE NUMBER
1. COMPANY NAME		2. DRILL	ING SUBCO	NTRACTOR			SHEET SHEETS
URS Corporation		Saber	<del>probe,</del> Pla	ains Enviro	nmental Services		1 OF 4
3. PROJECT				4.LOCATION			
Iowa AAP F.S. Data Collec	tion			Burlington	n, Iowa		
5. NAME OF DRILLER	1 .				URE'S DESIGNATION C	F DRILL	
Jesse K				60	Probe		
7. SIZES AND TYPES OF DRILLING	A-raphs Ma	erolore Sant	oler	8. HOLE LOCA	TION ,		
AND SAMPLING EQUIPMENT				30	1145,65'N	227	6076.72'E
				9. SURFACE E	LEVATION.	<del></del> ,	3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
				6	78.2		
				10. DATE STAR	TED	11. DATE	
				10.23	.02	102	3.02
12. OVERBURDEN THICKNESS	06-11				DUNDWATER ENCOUN		
	250' b	95		NA			·
13. DEPTH DRILLED INTO ROCK	$\overline{\lambda}$			16. DEPTH TO V	WATER AND ELAPSED	TIME AFTER D	RILLING
14. TOTAL DEPTH OF HOLE	25.0' b	<u></u>		17. OTHER WA	TER LEVEL MEASURE	MENTS (SPECI	FY)
	1	J -		NA			
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDIS	STURBED	19. TOTA	L NUMBER OF CORE E	OXES	
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20. SAMPLES FOR CHEMICAL ANALYSIS	voc	METALS	OTHER	R (SPECIFY)	OTHER (SPECIFY	OTHER	R (SPECIFY) 21, TOTAL CORE RECOVERY
				_		<u> </u>	- %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER	R (SPECIFY)	23. SIGNATURE OF U	SPECIOR	/
		FTP-DPOZ			21000	-6	$-\nu$
LOCATION SKETCH/CON	MENTS			OFFICE.	SQALE: 1	"=2¢	<b>20</b> '
FTP-DI JAW-6	99-1	BG-€	● FTF DP03	2-DP02	FTP-DP22  FTP-DP06		640-
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	<b>⊕</b> JAW-61		_	Ĵ			AWK/B)
	JA	W-60		/	7 / 11		S@S@05
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Iowa AAP F.S. Data	Collection					FTP-	THAT

HTRW DRILLING LOG								
PROJECT	owa AAP F.S. Data Collection	INSPECTOR	SHEET SHEETS OF					
ELEV DEPTH	DESCRIPTION OF MATERIALS .	FIELD SCREENING RESULTS	GEOTECH AMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW	REMARKS		
a. b.	Clayer SILT(ML) - very stiff brown, moist, low to non-plastic, trace root hours 4 organics	d.	e.	f.	COUNTS COUNTS	FILL/ 70psal		
1	Silty CLAY (CL) - very stiff, brown w/ orange mottling/iron staining, trace roof hours		R=148		7.0	Lors		
1	trace drk gray mothing				4.5			
3		HS=ND			3.0			
9 -	no root hours, trace fue sand + becomes soft Becomes Sandy CLAY					711		
5	Becomes Sandy CLAY				1.0			
	becomes gray w/ orange mothers + trace calcite concretions becomes stiff	g	R=36/		110			
<b>)</b>	becomes very stiff				4.0			
4 -	becomes orange/brown w/ gray mottling 4 trace fine to coarse same				75			
1								
10 ±	trace black mothing	MSEND		,	6.0			
	PROJECT  Iowa AAP F.S. Data Collection				HOLE NO.	P-DPGZ		

HTRW DRILLIN	HOLE NO. FTP- GP 67				
PROJECT Iowa AAP F.S. Data Collection	··	SHEET SHEETS  OF 4			
ELEV DEPTH DESCRIPTION OF MATERIALS a b. c.	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	OUNTS Kar	REMARKS h.
SAME: Sandy CLAY (U) - Voy	d.	е.	f.		
SHE moist, gm w/omge,				6.0	TILL
- loupustic		12.40/		1, 5	<u> </u>
$\vdash \mu \vdash$		K-48		6.0	<u> </u>
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16 =	HSIND			5.0	<u> </u>
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= Eilty CLAY(CLD-med stiff, organge)	<del>-</del>				711
17 = Eilty CLAY (CH) - med stiff orangel brown, moist migh Hastics trace calcite concretions				4.0	<i>""</i>
trace carette and					F
becomes gray		241			E
1		K= 1/10		4.0	E
18 –		1) 148		1.0	E
gray mottling present					<u> </u>
				4 -	ŧ
19 =				9.0	F
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<b>20</b> -				900	
PROJECT  Iowa AAP F.S. Data Collection				HOLE NO.	rp-pp02

	HTRW DRILLIN	NG LOG				HOLE NO.	7
PROJECT	Iowa AAP F.S. Data Collection	INSPECTOR	over	<del></del>		SHEET SHEETS	$\exists$
ELEV DEPT	H DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS				7 7 7	$\dashv$
a. b.	-CAME: S.11- (148/CUbacus 946	d.	e.	SAMPLE NO.	FS F	h.	4
	SAME: Silts CLAY(HI)media Stiff) - mesist, orenge, / bown, unisapheshi			<i>Y///</i>		Till	Ē
-	- Water Comment of Agents of the Comment of the Com	•		Ground			ļ
	]			Water			F
2:1 -	- Silly CIAY (CI) - STOR sommer I brown	n,	ĺ	Sample	3.0		Ė
	sity CLAY (CL) - Still orange brown  moist, low plastic, trace gray mothing		<u> </u>	PTP- OPO2-			þ
-	gray morning			25			F
	4		0441	For Voci	70		Ē
22 -	some fine to need sand		R 44/	VOC'S + Fron 113	-		F
	time to me tand		1 196	Collected	i		E
	i .			10/27/02			E
23 -	3			T= 1138	10		F
-,	₫						F
	<del>-</del>				1		E
	3	1/2.50		///	1	T 0 1 /- 11 /-	þ
24 -	<u></u>	HS=ND		///	1.0	720-25'695	E
	- 1 CUTCHE HOLLOW ARMEN	7	001		1	•/3	Ē
	Sandy SILT (ML) - very soft, orange of Mrown, moist, low to mon plastice fine to med grained		R=12/				F
	fine to med grained		, ,,,	///	10		F
75-	Bechack Refusal					1 - h 0 75 1	4
	Decorate Mayora					b.o.b. @ 25 l	子
	]	•				Temp well	-
:	-				!	installed	E
							F
							ļ
•							F
_							Ė
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-							Ė
			İ	]			-
				İ			F
	PROJECT	<u> </u>			HOLE NO.	P-DPØZ	十
	Iowa AAP F.S. Data Collection				711	T T T T T T T T T T T T T T T T T T T	╛

HTRW DRILLI	NG LOG	DISTRICT Omal	na District			HOLE NUMBER
1. COMPANY NAME		2. DRILLING	SUBCONTRACTOR			SHEET SHEETS
URS Corporation		Saherne	<del>obe,</del> Plains Enviro	nmental Services		1 OF 5
3. PROJECT	<del></del> -		4.LOCATION			
Iowa AAP F.S. Data Collect	tion		Burlington	n Towa		
5. NAME OF DRILLER				URE'S DESIGNATION C	F DRILL	
1	Kalvia		1 /	Probe		
7. SIZES AND TYPES OF DRILLING						
AND SAMPLING EQUIPMENT	A-1045,71	ecroCare San	30	1096.821	1 2,25	75965.19'E
				83,7		
			10. DATE STAR	3.0C	11. DATE	3.02
12. OVERBURDEN THICKNESS	31.0'	bas		DUNDWATER ENCOUN		
13. DEPTH DRILLED INTO ROCK	1	<u>- J</u>	<del></del>	WATER AND ELAPSED	TIME AFTER DR	ILLING
14. TOTAL DEPTH OF HOLE	310'	745		TER LEVEL MEASURE	MENTS (SPECIF	η
40.050750177041.5		<u>~J~</u>		<del></del>		
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDIST	JRBED 19. TOTA	L NUMBER OF CORE E	BOXES	
20. SAMPLES FOR CHEMICAL	Voc	METALS	OTHER (SPECIFY)	OTHER (SPECIFY	) OTHER	(SPECIFY) 21. TOTAL CORE
ANALYSIS				,		RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF IN	PECTOR	
		Temphell DP03				
<del></del>	<u> </u>	1		1 miles	"-200	
(6" \$	63 The Sump) David	FTP-DP09  FTP-DP08  FTP-DP11  FTP-DP11	DP05  FTP-DP23  FTA-99-16  FTA-99-2(E	FTP-DP12	TP-DP18	P24 0/3(B) 625G05:
 	s Soring Creek		● FTP-DF	<b>220</b>		  
Tributary	Spring Creek	<b>⊕</b> M-01				
PROJECT	•		· · · · ·	· · · · ·	HOLE	
Iowa AAP F.S. Data	Collection			,	FTP-1	P03

HTRW DRILL	ING LOG				HOLE NO. FTP-DPØ3
PROJECT  Iowa AAP F.S. Data Collection	INSPECTOR \	ovey			SHEET SHEETS 2 OF 5
ELEV DEPTH DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW. GOIDUTS	REMARKS
= 5. Hy CLAY (CL) - otiff, & rown; moist, low plastic trace roothairs	I	ę.	f	80 80	Top Soil
1 -	ng l			20	Fill Locas
becomes light brown w/ black molling of wedican street		R=/48	·	1.0	
2 -				Z.0	
3 —					
				110	·
becomes very soft				-	
5 becomes stiff				φ	
Silty CLAY (CL). Stiff, moilty brown	^,	R=148		7.0.	
Silty CLAY (CL). Stiff, moist, brown lawprastic w/ send.  become 5 brown/orange w/ mothers				7.0	
8				20	
9		R.48		2.5	
PROJECT Iowa AAP F.S. Data Collection				HOLE NO.	7062

\$ \$ \$ \$ \$

	HTRW DRILLIN	NG LOG		<del></del>	<del></del> -	HOLE NO.		
PROJECT								
Iowa AAP F.S. Data Collecter Depth Description b.	RIPTION OF MATERIALS	FIELD SCREENING RESULTS		ANALYTICAL SAMPLE NO.	-BLOW COUNTS	3 OF 3		
	1) - Very stiff, bound, moist, low plastic, mothing 4 cale de + iron stawing.	d.	R=/48	f.	7.0	Till		
n					6.0			
no mottling becomes soft	<u>.</u>				5,0			
14 becomes soft		·	R=148		1,0			
16 -					4.0			
10								
17 = 5.1ty CLAY(CH)  Mast, med  Hack & area	-very stiff grange/bra to high plastic trace modeling, calcite stiff	on,			5.0	Bhallow Till		
B concretions	shift		R=148		1,5	1-		
becomes very					ø	- - - - - - - - - - - - - - - - - - -		
to becomes very	Stiff & gray w/no ece iron staining  PROJECT  IOWA AAP F.S. Data Collection		}		GO HOLE NO.	- DP63		

HTRW DRILLII	NG LOG				HOLE NO.
PROJECT  Iowa AAP F.S. Data Collection	INSPECTOR	Cover			SHEET SHEETS  OF
ELEV DEPTH DESCRIPTION OF MATERIALS a. b. c.	FIELD SCREENING RESULTS		SAMPLE NO.	SOUNTS SOUNTS	REMARKS h.
SAME	<u>d</u> .	е.	f	RS.C	TIII
21 - W trace occase withing wonstain	ing				
		R=148		4.0	
				4,0	
24 =				4.0	
16				50	
becomes orange/brown w/ grant mottling		R=36/		4.0	
1) -			Ground Water	5.0	
18			Sample FTP- OPO3- 31 for	6.0	
no mottling		1	VOC's + Freen113 Collected 10/27/02	30	÷ ÷ ÷
PROJECT Iowa AAP F.S. Data Collection			T= 1225	S.d HOLE NO. FTP -:	0044

		HTRW DRII			<u> </u>			HOLE NO. FTP - DP\$3	
PROJECT IO	wa AAP F.S. Data Colle	ction	INS	PECTOR J.C	ovey			SHEET SHEETS	
ELEV DEPTH a. b.		CRIPTION OF MATERIALS c.		FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO.		COUNTS KD	REMARKS h.	7
-	Same:			<u>u.</u>	1	1///	N-BI	TIII	
	brown, moist, for to med or	MID(SL) - Stiff, and low Plastic a + de ained. fuscul	nge/ NSC	H6=	R=36		3 <i>P</i>	Glacian Connunt Temp Well is 26-31 bgs	-  -  -
31	Belexx R	cfusa)						b.o.b.@ 31'	7
					i	†		b.o.b. @ 31'l @ bedrock Temp well installed	E
						ł		installed	ŧ
									E
									F
									ŧ
-	,								E
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		PROJECT	action				HOLE NO.	DPAS	

HTRW DRILLI	NGLOG	DISTRICT Omaha Dis	t_i_t			HOLE NUMBER	~~~~~~
1. COMPANY NAME	10 100	2. DRILLING SUBO				FTP -	SHEETS
URS Corporation		į.		nmental Services	-	1 OF	2/
3. PROJECT		G	4.LOCATION	illelitai Seivices		1	
Iowa AAP F.S. Data Collect	ion		Burlington	a. Iowa			
5. NAME OF DRILLER				URE'S DESIGNATION OF	DRILL		
Jesse Kalv				peoprobe	Track	Ra	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	A-Rods, Maci	o Core	8. HOLE LOCA				
	sampler, dua	1 tube	34	00876,60	'N ⊇a	75570.	<u> </u>
sampler			9. SURFACE E	•			
			10. DATE STAR	30,4	11. DATE	<del></del>	
				22,02		22.07	•
12, OVERBURDEN THICKNESS	-71.		15. DEPTH GRO	DUNDWATER ENCOUNTE	RED		
	27'bgs		24.	4'bas du	vina.	della	رف
13. DEPTH DRILLED INTO ROCK	<u></u>		16. DEPTH TO V	WATER AND ELAPSED TH	ME AFTER ORI	LING	
	$\mathcal{P}$			<b>V</b> A			
14. TOTAL DEPTH OF HOLE	27' b95	•	17. OTHER WA	TER LEVEL MEASUREME	ENTS (SPECIFY	)	
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED		AL NUMBER OF CORE BO	YES		
16. GEOTECHNIOAE SAMIFEES	DISTORBED	CNDISTORBED	19.1017	E NOMBER OF CORE BO.	AC3		
20. SAMPLES FOR CHEMICAL	VOC ME	TALS OTH	ER (SPECIFY)	OTHER (SPECIFY)	OTHER (	SPECIFY) 21. TO	OTAL CORE
ANALYSIS	-		· <del></del>		/ -	- RECO	OVERY %
22. DISPOSITION OF HOLE	BACKFILLED MONITOR		ER (SPECIFY)	23, SIGNATURE OF INS	ECTOR	,	
		4 FTP	-DP44D	4MST	<u> </u>		
LOCATION SKETCH/COM	IMENTS			SCALE:	"=2cc	$\mathcal{I}$	
	,,,,,,,	,		<i>V</i>		, 	
FTP-DP	01-		OFFICE				
	01 TR-3 TR-1	BG-EX	/ /	FTP-DP22		///	
	IR-5	′ <i>80-0/</i> / <b>AF</b>	ΓP-DP02				84
SA-9 (6" SI				>IETRAVVI5	<b>.</b> (o∀		
(5 0.		FTP-DP03 JAW-58	1	TEMWE(B)	J	$\sqrt{}$	
••	⊕ JAW-62	1	, /		(	7	•••
		FTP-DP05	<b>●</b> F	TP-DP06	- <u>-</u>	}	
	FTP-DE	21 JAW-59	FTP-DP23	FIP-C		4	
	<b>⊕</b> JAW-61	7	7 - 7 7		FTP-DP	200 P	
	JAW-60:		<u> </u>	7 / / / / /		ns(b): ≥SG05:	
FTP-DP	04 SEEEMVIAG	FTP-DP09	TP-DP25	FTP-DP12/////	7 )	٨	
	<u></u>	) \\		-/// <u>-/</u> /			
	FTP-DPC	8	1	8 & V 7/	P-DP18/	¥	
	P-DP07	15/-9	FTA-99-1 &	O LETTERNY	ا در	1	
\	F-DF01			O ETEMWZ	$\mathcal{O}$		
3:22.14.15	JAW-	80				FIP.	-DP16 -DP26
EMESSAW(S(B)E-7	FTP-C	P11 —		FTP-DP17	بيخر مسمر	are.	
		FTP-DP14	a (MANA)	$\sim$			
	FTP-DP10		_ <del>-</del> >^>	<b>_</b>			
	*****	1	SC:SG06	● FTP-D	P15		
	● Fip-c	P19 /	44	and the second			
	1	•	and the second second				
	نا	. <b></b>	FTP-DP	20			
*	wek.	' سور					
af.	Spring Ci 1	M-01					
Tributary	Spring Creek	,. <del> • •</del>	•				
<u> </u>		<u> </u>		<u> </u>	<u> </u>		
PROJECT				l	HOLE	· · · ·	
Iowa AAP F.S. Data (	Collection			i	FTP-T	)PØ4	

		HTRW DRILLI	NG LOG				HOLE NO. FTP-DPO4
PROJECT		<del></del>	INSPECTOR	-		···· <del>-</del>	SHEET SHEETS
ELEV DEPTH	owa AAP F.S. Data Colle	ection SCRIPTION OF MATERIALS	FIELD SCREENIN		ANALYTICAL		2 OF 4
a. b.		c.	RESULTS d.	OR CORE BOX NO.	SAMPLE NO. f.	COUNTS g	h.
	Mast, low- 4 organics	L)- stiff. drk brown plastic, trace root have	7,			3.0	Tapsoil
/ -						3.0	
2 -	becomes light	bra		P-44		4.0	
-	,	ning + orange + motteling				5,0	10246
4 -			HS= ND		-	4.0	
5 · · · · · · · · · · · · · · · · · · ·							
6	becomes light gra , ron stain.	ay w/orange motiling +		R-49/48		3.0	
7		,				3.0	
8			15=ND			3.0	- - - - - -
9 -				R= 349/18		4.0	
10		PROJECT	H5 UND			4.0	
		Iowa AAP F.S. Data Collection			8	FTP-D	Pb4

	HTRW DRILLIN	IG LOG		<del></del>		HOLE NO.
PROJECT	4	INSPECTOR	S. Cover	ſ		SHEET SHEETS
ELEV DEPTH	wa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	FIELD SCREENIN		ANALYTICAL	Bhow.	3 of 4
a. b.	· fl	RESULTS d.	OR CORE BOX NO.	SAMPLE NO. f.	COUNT'S	h.
	SAME: Silty CLAY(CL) = Sestiff light amy working moist, Ibw plass trace block mothering	ste,		///	4.0	ナル
_	trace black mothing			Ground		1
	becomes very stiff wil trace fine to me sand a fine gravel a calcute concrete	01K	R= 36/	Water Sample		
// -	7	7	\ <i>'4</i> 8	FTP.		
. =				DP04-	6.0	
	becomes stiff			for		ļ <u>‡</u>
				VOC'S		1
12 -		A5=0		Froon 113		<u> </u>
		'		Collected		
				11/05/02 T=0915		<b> </b>
				///		<u> </u>
13				///	İ	Temp well is 8-13'bgs
	becomes very soft					8-13 695
=	becomes voy soil					<u> </u>
7			0 20/			E
14 =			R=30/		0.0	<b> </b>
´ ‡	•				0.0	ŀ E
且	becomes soft					ļ ‡
=	occurs soft					l E
15					2.0	!
				ĺ	_	Į E
Ξ	becomes st.ff					Í ‡
4			1			ĺ E
16		H5=0			5.0	<b> </b>
′ =						Ī
Ē		İ		•	i	<b> </b>
‡	· · · · · · · · · · · · · · · · · · ·	i	1			l E
17 =		ļ			5.0	[
<i>'</i>	n <sub>e</sub>			]	3,0	E
E	l					‡
‡	trace		20/			E
18 -			R=30/48	ļ	4.5	‡
7		ľ	'	Ì	413	<u> </u>
<u>, E</u>	becomes heard w/ some fine to med some					<u> </u>
= 1	second veno wy some one to the					Lover T.11
19					9.0	‡
'' ‡					,	F
且						‡
‡		]				E
ν -		115= Ø			9,0	<u>_</u>
	PROJECT  Iowa AAP F.S. Data Collection	•		1	HOLE NO.	'-DRP4

	HTRW DRILLIN	G LOG		<u>.                                    </u>		HOLE NO.  FTP-DP&4
PROJECT	•	SPECTOR	0.1	· · · · · · · · · · · · · · · · · · ·		SHEET SHEETS
Iowa AAP F.S. Data Collected Description	CRIPTION OF MATERIALS	FIELD SCREENING	GEOTECH SAMPLE	ANALYTICAL	- BLOW	4 4
a. b.	с.	RESULTS d.	OR CORE BOX NO.	SAMPLE NO. f.	Per s	REMARKS h.
Sinty CLAY (CL)  low plastic,  mothling w/  Sine to me	trace prange + black calcute concretions a of sand + fine gravel				8.0	Till
22			R= 30/	7//	7.0	
Clayey SILT (M	L)-Very Stiff light graying, low Mastic, trace fine of, moist				5.5	
to med son	d, moist	H5=ND		Ground Water Sample FTP- 0P04- 27	5.0	
26 - becomes moist			R= 36/	Freenil3 Collected	0.0	
The -	cl, dance, fine to meet grained,			10/23/02 T= 0945	9,0	Clocial Outrash Tomp Woll 1s
27 - Brdran refused				///	Ra	b.o.b. @ 27 bg Bedrock Temp Well Installed.
	PROJECT  Iowa AAP F.S. Data Collection				HOLE NO.	DA.

HTRW DRILLING LO	G	DISTRICT Omaha Dist	rict			HOLE NUMBER
1. COMPANY NAME		2. DRILLING SUBCO	NTRACTOR			SHEET SHEETS
URS Corporation		S <del>abesprebe</del> , P	lains Enviro	nmental Services		1 OF 4
3. PROJECT			4.LOCATION			
Iowa AAP F.S. Data Collection			Burlington			
5. NAME OF DRILLER	. 1		1	URE'S DESIGNATION O	OF DRILL	
Jesse Kav			Gel	strobe		
7. SIZES AND TYPES OF DRILLING	Macro Ce	ore Sample	S. HOLE LOCA	MOIT		
AND SAMPLING EQUIPMENT			30	0975.05	<u>'N</u> 22	75988.40'E
			9. SURFACE E	LEVATION		
				1.5'		
			10. DATE STAF		11. DATE	
				3.0C	10.2	3.02
12. OVERBURDEN THICKNESS	0(1			DUNDWATER ENCOUN	TERED	•
23.	.O. bos		NA			
13. DEPTH DRILLED INTO ROCK			1	WATER AND ELAPSED	TIME AFTER DRI	L'LING
$oldsymbol{arphi}$			W			
14. TOTAL DEPTH OF HOLE	1/1			TER LEVEL MEASURE	MENTS (SPECIFY	)
23.0	1 695		NO-			
18. GEOTECHNICAL SAMPLES DISTURE	BED /	UNDISTURBED	19. TOTA	L NUMBER OF CORE	BOXES	•
20. SAMPLES FOR CHEMICAL VOC	METAL	S OTHE	R (SPECIFY)	OTHER (SPECIF)	OTHER (	SPECIFY) 21. TOTAL CORE
	-   -				1 -	RECOVERY %
22. DISPOSITION OF HOLE BACKFILLED			R (SPECIFY)	23. SIGNATURE OF IN	SPECTOR	
	FTP-DPC	P5		11111	ے ہے	
LOCATION SKETCH/COMMENTS				SCIATE:	<u> </u>	
LOOK TON GRETCH/COMMENTS		-		SCALE:	"~2 <del>0</del> 00'	Ī
SA-99-1 (6" SUMP) (6" SUMP)	TR-3 TR-1  TR-2  ■ FTP-DP21	FTP-DP03 JAW-58	P-DP02	FTP-DP22  PETP-W/95  TTP-DP06		6.6
	JAW-60	JAW-59	FTP-DP23	FIF	-DP13 FTP-DF	/ ·24 · //3(B) @SG05
		P-DP09	JIT-DF23	FTP-DP12/	リーン	ا
		\		///_2	///	
!	FTP-DP08		£	F F	TP-DP18	¥
<b>● FTP-DP07</b>	Y		FTA-99-1	1 / 2	-n	·
TIP-DPU/				/ O FIEMWZ	1	]
The state of the s	JAW-80	1//	( /)		)	FTP-DP16
	FTP-DP1	1 14		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		FTP-DP26 ···
		TP-DP14		FTP-DP17	t and a surrender	
		17-DP14 😈 🏙		$\nearrow$		
FTP-D	P10		<b>→</b>		DD45	
··		/	SC-SG06	→ FTP	-DP15	}
	FTP-DP19	9 /				-1
	j	4	2000			
	i - s	J	FTP-DP	20		.==
<b>4</b> _	ak J	منز بهجر	. <u> </u>			
·· S	<b>.</b>	garanti. Santa Santa				
Tributary of Spring Cre	人 <b>&amp;</b> M-	01				1
Tributan	•					```]
	<u>. ' </u>	<u> </u>		· · · · ·		1 1 1
PROJECT  Town AAPES Date Collection					HOLE	Dor

HTRW DRIL		HOLE NO.				
PROJECT Iowa AAP F.S. Data Collection	INS	PECTOR	ovey			SHEET SHEETS  OF 4
ELEV DEPTH DESCRIPTION OF MATERIALS c.		FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	A SLOW- COLINES	REMARKS h.
Silty CLAY(CL) - Stiff, brown, more love plastic, trace root has by lime stone gravel fill	st, urs	d.	e.	f.	4,0	FIII /lorss
becomes med stiffw/ trace			048,		4.5	
2 becomes very soft			K=/48		1,5	
3 -			•		0.5	
4			·			
4		K:			ø	•
becomes orange/brown			J.R.		ø	
<i>u</i> =			R=48		2.0	‡
Clayey SILT (ML) - soft, orange)  moust, burplustic, trace fine  black mothers #	brown	,	·		1.0	TIII
<b>4</b> -	4	46=			<u>ZD</u>	
9 - Silty CLAY (CH) - very otiff, orange moist, med, to high plactic, y fine to coarse sand a black most	e/brown frace hva	n,	R=36/48		7.0	
/o =					6.0	-
PROJECT Iowa AAP F.S. Data Colle	ection				HOLE NO.	P-0805

		HTRW DRILL	INC	G LOG			<del>-</del>	HOLE NO.	OF S
PROJECT	owa AAP F.S. Data Colle	ction	INSI	PECTOR J - C	ovey			SHEET OF	SHEETS
ELEV DEPTH a. b.		CRIPTION OF MATERIALS c.		FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	<del>DLOW</del> COUNTS	REMARK h.	<del>-7</del>
11 -	BAME: 5. Hy CL brown, most, trace fine to co	AY (CH) - Very 8ti ff, ora med to high plastic, aree sand & black moth	nge/ bing	, d.	R-36/	f.	6.0	TIII	
12							5.0		
13							4.0		
14					7=/H		4.0		
16	N.								
16 -	Silfy CLAY (CL gray, most,	-)-very soft, browned low plastic, trace	~- ~-					•	
17							0.0		"
R		4 high plastic (C)			748 K= 148		40		
11 -	4 trace calc	rge w/ gray moth	7				5.0		- <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del> - <del>-</del>
10		PROJECT  Iowa AAP F.S. Data Collection					S,O HOLE NO.	DPØ5	/3

	HTRW DRILLIN	IG LOG		<del></del>		HOLE NO - DP 65
PROJECT Iowa AAP F.S. Data Colle		INSPECTOR	ovey			SHEET SHEETS OF
	SCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.		COUNTS	REMARKS
SAME:		d.	е.	1///	4.0	TIII
=				Ground Water	1	
21 =				Sample FTP-	4.0	
				DP05-	9,0	
				23 For		
22 –				VOC'S + Freen 113	4.0	
				Collected 10/25/02		
				T= 1435 Duplicate FTP-0P05-0		To a Well is
13 Bedrack Refus	-1			FTP-0P05-0	<b>10</b>	Temp Well 'S 18-23 695
Decilar hora	eal.					b.o.b.@ 23'bgs set temp well w/filterpel
1						to w/ filterpech
						[ E
<u> </u>					1	[
1						ļ į
<u> </u>						
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1						Į.
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4						<u> </u>
1						
=						
						<u> </u>
3					:	Ē
	PROJECT Iowa AAP F.S. Data Collection	<u> </u>			HOLE NO.	P-DP05

HTRW DRILLI	NG LOG	DISTRICT	ha District				HOLE NUMBER FTP-DPM
1. COMPANY NAME			IG SUBCONTR	ACTOR			SHEET SHEETS
URS Corporation					mental Services		1 OF
3. PROJECT			<del></del>	OCATION	michai Scrvices		1 7
Iowa AAP F.S. Data Collec	tion		1	urlingto	1 Iou <i>t</i> a		
5. NAME OF DRILLER					URE'S DESIGNATION O	F DRILL	
	Kalvig			_	robe.		
7. SIZES AND TYPES OF DRILLING		CON Sample		OLE LOCA	TION	<del></del>	
AND SAMPLING EQUIPMENT	" FOCA , " VOC !!	CONT DOWN				7'4/ 3	276218,50'E
	<u></u>		9. 8	SURFACE E	LEVATION	1V A	4 / 6 & 1 0 , JUE
				67			
			10. 1	DATE STAR		11, DATE	
				10.23	3 17	10,23	07
12. OVERBURDEN THICKNESS			15. (	DEPTH GRO	UNDWATER ENCOUNT	TERED	
	24.0			Z3.1	645		
13, DEPTH DRILLED INTO ROCK	<u>i</u>				WATER AND ELAPSED	TIME AFTER DR	RILLING
	$\mathcal{D}$			NA			
14. TOTAL DEPTH OF HOLE	2.11		17. 0		TER LEVEL MEASURE	MENTS (SPECIF	Y)
	C4D			M)		•	
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDIST	URBED		L NUMBER OF CORE B	OXES	
<del></del>		-					
20. SAMPLES FOR CHEMICAL	voc	METALS	OTHER (SF	ECIFY)	OTHER (SPECIFY	OTHER	(SPECIFY) 21. TOTAL CORE
ANALYSIS			-				RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED 1	MONITORING WELL	OTHER (SF	ECIFY)	23. SIGNATURE OF IN	SPECTOR	/
	F	TP-DPO/					
					77		
LOCATION SKETCH/COM	MENIS				SCALE:	<b>΄≈</b> δω'	
FTP-DP	D JAW-62 D JAW-61 D JAW-61 D FTP-DP10	P-DP08 P-DP08 FTP-DP11 FTP-DP14	PDP05  FTP-D  FTP-D  SCS	P25 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	FTP-DP17	P-DP18	FTP-DP16 FTP-DP26
Tributary	<b>→</b>	<b>⊕</b> M-01					
PROJECT	<u> </u>		• • •	•	<del>' ' ' ' '</del>	HOLE	1 1 1
Iowa AAP F.S. Data (	Collection					FTP-	DPale

HTRW DRILI	LING LOG	<del></del>			FTP-DPOLO		
PROJECT  Iowa AAP F.S. Data Collection	INSPECTOR	Covey	·		SHEET SHEETS		
ELEV DEPTH DESCRIPTION OF MATERIALS b. c.	FIELD SCREENI RESULTS	NG GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	DLOW COUNTS	REMARKS		
- Silty CLAY(CL) - Stiff, brown, moist, he plastic, trace root hairs	l 4	е.	f.	3.0	Topsoi/(oss		
becomes orange/brown				3.0			
2 -		R=48		4.0			
trace gray mothing  becomes very stiff		·		5,0			
becomes soft w/ black molthing	HS=			5.0			
5	• .			1,0			
Clayer SILT (ML) med stiff to coff, and brown, moiot, trace gray + black most ul trace fine sand	uge/	R=48		2.0	Shalbu TÌU		
1 - w/ trace fine sand				1.0			
<b>4</b>			·	2.0	- :		
9		Ran.		35			
5. Ity CLAY (CH) - stiff, orange brown, moi high plastic, trace black + gray most fine to med sand, fine grave + calcute concretions	ling,	148		4.0	Snallow Till		

	HTRW [	DRILLING	LOG		-		HOLE NO. PTD-DPG6
PROJECT		<del></del>	SCTOR .	10 10 CM	<del></del>		SHEET SHEETS
Iowa AAP F.S	. Data Collection  DESCRIPTION OF MATERIALS		FIELD SCREENING		ANALYTICAL	-BLOW	3 OF 4
a. b.	c.	201122	RESULTS d	OR CORE BOX NO. e.	SAMPLE NO. f.	COUNTS	REMARKS h.
-SHME 12 mois	silty CLAY(CH)-stiff, thingh plastic, trace, mothery, fin to made of t calcute concrete	black &				''	TIII
gray	motteny, fin to med	sand, fine					
	e calcité concre p	ion s			_		
11 =				R= 48	7.0-		
]				h 48			
]			İ		8.0 —		:
12 =					8.0 -	7	
he conse	very soft						
	, , , , , , , , , , , , , , , , , , , ,		;				
=					0.5-	<b>├</b> ⇒	
13					- 10		
₫,	. 00		ĺ				
becomes	Shitt		ĺ				
, ]				R= 40/	3.0 —	<del>                                     </del>	
14 -				X= //a			
1 1	. 1			1 770			
becomes	hard						
				İ	9.0+-	<del>  &gt;</del>	
15			İ		j		/
			1				
<del></del>				]			e.
, =			ļ		9.04_	_ <del>_</del> >	· ·
16 - Decom 2	At (CI AV(N) aco Mil.	Stiff occased		,		· · ·	•
- brown,	ilty (LAY(CL) are very moist, low Plastic, to moist, low Plastic, to g, calcite concretions band	race grant			i		
mother	g calcite concretions	s & fine					-
17 - 40 Meg	·				5.0-	_ <del></del> >	
" ]					į į	ľ	
	•	Z		10/	Ì		
-		` \		1244/2	5.0-	>	
10 🗏	· · · · · · · · · · · · · · · · · · ·		·	5-148			
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a. 7		.	- 1		1 /-		<del> </del>
<u> 20 ]                                   </u>	PROJECT			Y		HOLE NO.	

	HTRW DRILLIN	NG LOG				HOLE NO.
PROJECT		INSPECTOR	Covery	,		SHEET SHEETS
ELEV DEPTI	towa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	FIELD SCREENING	GEOTECH SAMPLE			REMARKS
a b.	SAME:	RESULTS d.	OR CORE BOX NO.	SAMPLE NO.	COUNTS OPP	h.
	1 2 Mrie.				110	丁川
_	<u></u>			Ground	1	
_	thin fine grained band band			Water		
21 -	thin time grains		34	Sample FTP-	0,0	
	Clayer SILT (MI) - very soft orange brown Moist, low plastic, trace fine band	7/	R= 36	DP06-		
_	thin line graned sand sam		7 1	For	1	
	-			VOC'S	0.0	
21 -	2" med. to coarse grained sand som			Frecon 1/3		
r .	Med. to course grants, and			10/27/03	1	
				T= 1255		
Z3 -	-			//	2.0	
67	5. Hy SAND (SM) - loose, orange brown,	-				Glecial Octobra
_	Silty SAND (SM)-1005E, orange brown, wet, fine to med grained trace de	7	R=19/2	///		GALLA COPULA
			) "			L
24 -				//		Temp Wellis 19'-24' bas
	Bodiest Robus 1					1
					i	bgs, set temp well after offcetting
-		, s				well and
25 -						once
-						Ę
_						<u> </u>
4,				<u>.</u> .▶		Ė
20 -						<u>-</u>
-						Ė
-	·			,		
27 =			·	1/1	1 1	E
~ -		1 /67	11 1	$\langle g_i, H_i/H_i^3 \rangle$		E
_		. , ,	*)		. 1	· · · · · · · · · · · · · · · · · · ·
_		1 10 10 m	i san	yt vienki – i	$A_{i_1,i_2}$ .	<i>y</i> ,
28	<i>(</i>	1 1/40 100 may 100	y Mariante		7'	E
-					<i>:</i>	ŧ
		W.			Ì	<u> </u>
						<u>.                                    </u>
24						· F-
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=					j	<u> </u>
<b>5</b> 0 =					•	Ę
<u>~</u>	PROJECT		<u></u>	:	HOLE NO.	
	Iowa AAP F.S. Data Collection				FTP-	DP\$6

HTRW DRILLI	ITRW DRILLING LOG				rict			HOLE NUMBER	オコ
1. COMPANY NAME	•		2. DRILLII	NG SUBCO	NTRACTOR			SHEET SHEE	
URS Corporation						nmental Services		1 OF 4	
3. PROJECT		<del>``\</del>	Ducer	, , , ,	4.LOCATION	initeritari Bervices			
Iowa AAP F.S. Data Collec	tion				Burlington	n Towa			
5. NAME OF DRILLER.				· · · · · · · · · · · · · · · · · · ·		URE'S DESIGNATION (	OF DRILL	<del></del>	
.)esse	Kalvig				/_	eo Probe			
7. SIZES AND TYPES OF DRILLING	1A-2-1	Macrolo	~ ~	Samuele					
AND SAMPLING EQUIPMENT	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	- GILIOU			300	0738.a1 n	l aa	175618.68	<u> </u>
				-	9. SURFACE E	,			
	<del></del>	<del></del>			10. DATE STAR	80.4	11. DATE		
					10,72			77 /17	
12. OVERBURDEN THICKNESS		· · · · ·				OUNDWATER ENCOUN	TERED	77.07	
	27	bas			25.1	as due	a 1 - 1	1	
13. DEPTH DRILLED INTO ROCK	1				16. DEPTH TO	ogs durin	TIME AFTER D	RILLING	
	<i>Ø</i>				MA				
14. TOTAL DEPTH OF HOLE	27'1	295			17. OTHER WA	TER LEVEL MEASURE	MENTS (SPECI	FY)	
18. GEOTECHNICAL SAMPLES	DISTURBED	<del></del>	UNDIS.	TURBED	L	L NUMBER OF CORE	BOXES		
	SIGNORED			, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			.caeo		
20. SAMPLES FOR CHEMICAL	Voc	METALS	3	OTHE	R (SPECIFY)	OTHER (SPECIF)	) OTHE	R (SPECIFY) 21, TOTAL O	CORE
ANALYSIS								RECOVERY	Υ
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING	WELL	OTHER	R (SPECIFY)	23. SIGNATURE OF IN	SPECTOR /	7	~· %
		FTP-DP	07				1		
LOCATION OVETOURO		<u> </u>				211111			
LOCATION SKETCH/COM	MENIS					SCALE:	ょうめ		i
SA-9 (6" SI	99-1 JAW-62	TR-1   TR-2	FTP-L JAW-	DP03 -58 -DP05 V-59	FTP-DP23		-DP13 FTP-I	DP24 MW3(B) SC:SG05	E &
		j-TT	P-DP09			FTP-DP12	// IP-DP18 1	<i>&gt;</i>	
	P-DP07	FTP-DP08	7/		FTA-99-1			¥	
			إلج		77	O ETEMWA		<u>:</u>	
		JAW-80	$M_{\odot}$				)	●● FTP-DP10 FTP-DP2	6
13 P.MW8(B) -	and the second	FTP-DP11	1 '			FTP-DP17	٠.	FIP-DP2	•
·			TP-DP1	4 🗪 📰	TEE MY GE	) ^ )			
	● FTP-DP1				<b>→</b> ^>	<b>)</b>	merican in the second		i
· · · · · · · · · · · · · · · · · · ·	···-		1		SCESG06	. € FTP.	DP15		
•		● FTP-DP19	. /						
•		• Lilinolis	<b>'</b> [			are market			
		•	)		AFTE DO	20			
4	v	-	,	معتدرين	FTP-DP:	ZU			
· \_	creek	•		,», ,					]
torv of	Spring	<b>⊕</b> M-4	01. <sup>*</sup>						]
Tributary of	<b>→</b>								
	<u> </u>	J				<u> </u>			
PROJECT  Iowa AAP F.S. Data C	Collection						HOLE	DP\$7	

		HTRW DRILLIN	IG I NG			HOLE NO.
PROJE			INSPECTOR	1		SHEET SHEETS
ELEV	Io DEPTH	wa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	FIELD SCREENIN	G GEOTECH SAMPLE	ANALYTICAL SBLOW	2 of 4
a.	b.	c.	RESULTS	OR CORE BOX NO.	SAMPLE NO.	REMARKS h.
	-	Silty (LAY(CL)- Very Stiff, brown, mors) low plastic, trace organics				Top soil
,	-	becomes light brown w/ orange a gray muttling a trace from stain.	ng		#5	bees
2				Right 31/18	2,0	,
3	11.11.11.				3.0	
4			HS-ND			
6	111111111				3,0	
4		becomes brown	N.	R=18/8	3,0	
1					3.0	
જ	البيبيايية	trace wood	HS=ND		40	
9		trace calcite concretions		R=#8	50	
10		PROJECT  JOHN LAND BOOK OF THE PROJECT  IOWA AAP F.S. Data Collection			HOLE NO.	TM =

	HTRW DRILLIN	IG LOG	<del></del>			HOLE NO.
PROJECT  Iowa AAP F.S. Data Collect		INSPECTOR	ovey			SHEET SHEETS 3 OF 2/
ELEV DEPTH DESC	RIPTION OF MATERIALS c.	FIELD SCREENING RESULTS	G GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	COUNTS	REMARKS h.
- Silly CLAY(CL) Store  Town plastic  nothling  4 Give	iff - light gray moist, trace oranges black w/ fine to med same grave)	d.	R-340	f.	3,0	Till
12 -		HS=ND		<u> </u>	30	
13 -					3.0	
14 =			R=146		3,0	
15 - becomes very	stiff high plastic				4,0	T.11
16 -	)	HSZNO			4.0	-
17					4.0	
18			46, Z=48	3	4.0	
19					410	† - - - - - - -
10		145END			4.0	<u> </u>
	PROJECT  Iowa AAP F.S. Data Collection	TT. ~ 100	·		HOLE NO.	DP\$7

	HTRW DRILLIN	G LOG				HOLE NO.
PROJECT	wa AAP F.S. Data Collection	ISPECTOR	Covey		·	SHEET SHEETS OF
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENIN RESULTS		ANALYTICAL SAMPLE NO.	BLOW	REMARKS
-	SAME: S. Hy CLAY (CH) Very Stiff, light gray, moist, high plastic, frace orange mothling a fine to med send w/ fine grave!	d.	С.	£.	po	Till
21 -					4,0	
71	1/4" fure grained sand seems, gray		R3 		4.5	
73	CLAY BILT (ML) - very stiff brown to orange, moist, low to non plastic, trace fine to med sand.			Ground Water Sample	5.0	
	trace fine to med sand.	H5=ND		6TP- 0P07- 27 60r VOC'S +	6.0	
	SAND (SA) loose, brown toorange, wet, fine to med gramed			Freen113 Collectal 10/23/02 T= 1020		Glacial Outwash
=	Sandy S.H (ML)-Nesy stiff, brown to brange, w/ trace won staining, more fine to read same	-			7.0	Temp Well is
27	Barroux Refuser]					D.o.b. @ 27/bg D.o.b. @ 27/bg @ bedrack Temp well Installed
78 -						Moraneon
19						
30 =	PROJECT				Torres a	
	Iowa AAP F.S. Data Collection		· · · · · · · · · · · · · · · · · · ·		HOLE NO.	PB7

	· - · · · · · · · · · · · · · · · · · ·							
HTRW DRILLI	NG LOG	DISTRIC					HOLE NUMBER	
	140 200		ha District				FTP-DF	DE.
1. COMPANY NAME		i	NG SUBCONTR				SHEET SHE	ETS
URS Corporation 3. PROJECT		Sabory		-	nmental Services		1 OF	7
1			1	LOCATION				
Iowa AAP F.S. Data Collec	tion		E	Burlingto	n, Iowa			
5. NAME OF DRILLER  1.66E K	1-1-0		6.	_	TURE'S DESIGNATION C	F DRILL		
	-21017	<del></del>			ottobe			
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	A- Packs, Mac	rolore Son	pler 8.1	HOLE LOCA			•	,
		·		30	<u> 0792,34</u>	N 2	275831.2	ae
		····	9.	SURFACE E				
				6/	7.5			
			10.	DATE STAR		11. DATE	- /	
10.01/5001/0051/51/51/51/51					4.02		400	
12. OVERBURDEN THICKNESS	23' bg	c	15.	. 1	OUNDWATER ENCOUN	TERED		
13. DEPTH DRILLED INTO ROCK	<u> </u>	<u> </u>		NH	WATER AND ELAPSED	7045 4 5750 0		
13. DEPTH DRILLED INTO ROCK	$\phi$		110.	44		TIME AFTER D	RILLING	
14. TOTAL DEPTH OF HOLE	231 695		17.	OTHER WA	TER LEVEL MEASURE	MENTS (SPECI	FY)	
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDIS	URBED	, · · · · · · · · · · · · · · · · · · ·	AL NUMBER OF CORE E	OXES		
4 samples	_	X		1				
20. SAMPLES FOR CHEMICAL	Voc	METALS	OTHER (S	PECIFY)	OTHER (SPECIFY	) OTHER	R (SPECIFY) 21. TOTAL	
ANALYSIS	†			<del>-</del>			RECOVER	₹Y - %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (S	PECIFY)	23. SIGNATURE OF IM	SPECTOR	7	70
		ETP-DROS			// west	/		
LOCATION SKETCHICON	MENTO				COLUE 1	'' • • • •	,	
LOCATION SKETCH/COM	MINIENIS				SCALE:	, ¿900	<b>)</b> '	
ETD DO	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	<del></del>	<i>7</i> /	)FFICE		ابر بر		•••••
FTP-DP		·   [] / []		18 J. 16E				اح
		TR-2 BG-6			FTP-DP22			/
SA-9	100.1 TREE		์ <mark>⊕</mark> ÉTP-QI	PO2		market .		84
(6" SI		/ _ 570 n	DO3		SEEKW5	· (0)		
•		FTP-D			TELEMW6(B)	J 7.		
	D JAW-62	l l	Ì	1		), <sup>*</sup>	$\checkmark$	
		<del>/   </del>	\	<b>●</b> `Ę	TP-DP06	<u>,                                    </u>	}	
	● F		DP05>		FTP.	DP13	1	
	12-WAL	A Comment	-59 ● FTP	-DP23		FTP-D	P24	
	JAW-01	60			7 / 1		(WE(E) CESC05	
● FTP-DP		AWABI 🗨	€ FTP-D	P25 🛋	<u> </u>	-	/ /	
	_	FTP-DP09			FTP-DP12/	1	<i>F</i>	
					///_4	P-DP18 1		
	<del>68€</del> FI	P-pP08		、 A-99-1 ぢ <sup>()</sup> A-99-2(B)	FT REAL PROPERTY.	1-DF 18/	¥	
<b>▲</b> FT	P-DP07		<b>⊕</b> FT	A-99-2(B)		ا ہر	:	
\ \	11 -DI 07		/	/ /	O ETEMNZ			• • •
·· BIEMOT		JAW-80		//	1/1		FTP-DP1	
ESTERMAN (E) E-	and a second	FTP-DP11			FTP-DP17		- FIP-DP2	
·, [] [-] [		FTP-DP1	4 🗪 🖼	KUGE	,	والمعارض والمنطور		
	● FTP-DP10	-4	- APPRINT	<u></u>	<b>ノ</b> ン	and the same of th		
···	···->-··->-·.		Se	SG06	● FTP-I	DP15		[
	•	<u> </u>						
	•	FTP-DP19		" بغر				1
		1 b 7		200				
		1						
		لجسلح		FTP-DP2	20			
*\	nek/	لمسلم		FTP-DP2	20			
	Spring Creek	<b>9</b> 404		FTP-DP2	20			
Tributary of	Spring Creek	<b>⊕</b> M-01	**************************************	FTP-DP2	20			
Tributary of	Spring Creek	<b>⊕</b> M-01		FTP-DP2	20			
Tributary of PROJECT	Spring Creek	<b>⊕</b> M-01	· · · · ·	FTP-DP2	· · · · · · · · · · · · · · · · · · ·	, ,		

	HTRW DRILLIN	G LOG			<del>. ,</del>	HOLE NO.
PROJECT	owa AAP F.S. Data Collection	ISPECTOR J.	COVEY			SHEET SHEETS
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d		ANALYTICAL SAMPLE NO.	COUNTS	REMARKS h.
-	Sitty CLAY (cc) - Stiff, moist, deregay / black, lamp histic with organics	d.	e.	ř.	3	Keeping samples IN sleeves Sor analysis
2	Sity Clay (11) - von Stiff, maist		R=48		3	Topsui)
3	yellorin-been, louphstic w/len chains				4	
4 8	Syndy CLAY (CL) - Stiff, most, reddish brown, medintohigh plastic the grained				4	7111
			R= 48/		5	
	Becomes high plastin				4	
4	·}		Geo		4	
16 -	PROJECT		R= 48		3	
	Iowa AAP F.S. Data Collection	··-			HOLE NO.	DYOY

HTRW DRILLII	NG LOG			<del>-</del>	HOLE NO.
PROJECT  Iowa AAP F.S. Data Collection	INSPECTOR	.Covey		<del> </del>	SHEET SHEETS 3 OF 4
ELEV DEPTH DESCRIPTION OF MATERIALS a b. c.	FIELD SCREENING RESULTS		ANALYTICAL SAMPLE NO.	CO <del>UN</del> TS COUNTS	REMARKS h.
SAME: Some CLAY(CH) - Stiff, - moist, reddish brown, high plastic - fine - granieu	d	6.	£.	6	Till
12				5	
13 -				6	
Silty CLAY (CH) - Stiff, moist, reddin / valouin. Drown, high plastic		R=48 48		5	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
45 Sand		Geo	j	7	
Becomen media to low plastic				フ	
18 = Sandy (LAY(CL) - V. SHIF,		R=48	//	7	
Sandy (LAY(CL) - V. Stiff, moist, reddish-brown, nedin to our plastic, medium to fine-grain		Geo		6	
PROJECT  Iowa AAP F.S. Data Collection		- 20	//	HOLE NO.	- TIPAS

	HTRW DRILLI	NG LOG			· · · · · · · · · · · · · · · · · · ·	HOLE NO.	-DPMS
PROJECT	owa AAP F.S. Data Collection	INSPECTOR	Covey	,		SHEET OF	SHEETS
ELEV DEPTH		FIELD SCREENING RESULTS			CÉUNTS	REMARK h.	s
	SAME: Sandy CLAY CCL) - U.SHE, moist, reddlyrboun, media to	d.	е.	Ground Water	7	TIL	
21-	larplastic, media to fine -sminer		R=36	Sample FTP- DPO8- 23 for	7		
22-	Becomes Sity CLAY with Sand + Complastic		Geo	VOG'S + Freon113 Collected 10/25/02 T=0940			
23-	Wet Bertock Refusal		Geo	///		Temp Well 18'-23' 5.0.6.@	595
24	Decreck Retusa					@ bedre 4 insta Temp	alled
-							
26							
26							
21 -							† - - -
Po-							
29							
40	PROJECT						
	Iowa AAP F.S. Data Collection				FTP-	DPOP	

HTRW DRILLI	ITRW DRILLING LOG				DISTRICT Omaha District						
1. COMPANY NAME			2. DRILLIN	NG SUBCO	NTRACTOR			SHEET SHEETS			
URS Corporation						nmental Services		1 OF -			
3. PROJECT	<del></del>			240C, 11		inician bervices		1 1/			
Iowa AAP F.S. Data Collect	tion				4.LOCATION Burlington, Iowa						
5. NAME OF DRILLER	.1011					IL, IOWA TURE'S DESIGNATION C	E DOLL				
Jesse Ka	1.1.0				1		r DRILL				
		41	<del>, -</del>			oprobe		· · · · · · · · · · · · · · · · · · ·			
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	A-Rodo,	Macrore	Sant	sher	8. HOLE LOCA						
	J <u></u> .				30	<u> </u>	<u>w 2.</u>	275 993.44E			
					9. SURFACE E	1					
			<u> </u>			<u>823</u>					
					10. DATE STAF	RTED	11. DATE				
					10,2	2.02	10.	122.02			
12. OVERBURDEN THICKNESS	201	• .			15. DEPTH GR	OUNDWATER ENCOUN	TERED				
	29.5	, par	•		NA						
13. DEPTH DRILLED INTO ROCK	7				16. DEPTH TO	WATER AND ELAPSED	TIME AFTER DE	RILLING			
	$\varphi$				NA						
14. TOTAL DEPTH OF HOLE		11				ATER LEVEL MEASURE	MENTS (SPECIF	-Y)			
	29,5	bas	•	1	$N\Lambda$		•				
18. GEOTECHNICAL SAMPLES	DISTURBED	<del></del>	UNDIS	TURBED	<del></del>	AL NUMBER OF CORE E	OXES	· · · · · · · · · · · · · · · · · · ·			
<del></del>			-								
20. SAMPLES FOR CHEMICAL	Voc	METAL	s .	OTHER	R (SPECIFY)	OTHER (SPECIFY	) OTHER	(SPECIFY) 21. TOTAL CORE			
ANALYSIS		-						RECOVERY			
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING	WELL	OTHER	R (SPECIFY)	23. SIGNATURE OF N	ST CTOP	1 %			
LE BOI COMOTO TICLE		KID.D	PAST		. (0. 20)	25. SIGNATURE OF IN		·			
<del></del>		111-01	971			1/1/1/	<del>-(</del>	$\longrightarrow$			
LOCATION SKETCH/COM	MENTS					SCALE:	"=200°	1			
						/					
FTP-DF	'01 ¬ ¬	_1 11 1	// 17	<b>1</b> / '	OFFICE	'' <i>'</i> '' '					
696 JAW-6	3 - 1 m-3	11 -	1 -	Z –	/ /	● FTP-DP22		///>			
	TR-5	TR-2	$BG-\mathcal{E}_{\lambda}^{X}$	) /				64			
SA-9	9-1	<i>K.</i> 71	j	● FTF	P-DP02	( ( ( ( )	A LAND				
(6" SI	JMP)	~ /_	FTP-E	)P03		TELEMYS  TELEMYS	· (0	( 1 / ···			
8 6 7			JAW		1	- mariametro(D)s	J				
	D JAW-62		ì	j	1		Х	<del>\</del>			
			į		\ <b>•</b> `I	FTP-DP06	$\Sigma$				
	. (	FTP-DP21		-DP05	<del></del>	FTP	-DP13	]			
•	△ JAW-61	_ ↓	YAY YAY	V-59	FTP-DP23		FTP-D	P24			
\			//		/			MYE(E) 60-5605			
● FTP-DF	O. 15	W-60 BMW4/B	7		/ 	$Z = I \cap I$		© SG05			
/ TIP-DP	104 <b>W</b> max		P-DP09		P-DP25	FTP-DP12//	ff	<i></i>			
							4 1				
	658	FTP-DP08	<b>─</b> /;			J. J. S. O.F.	P-DP18 /	144			
•••	•	V 11 - D 100 -	L <i>用</i>	~	FTA-99-1	FI SERVICE SERVICES	- 1				
i ∫ Fī	P-DP07	1 1		_	FTA-99-2(E	B) O ETEMWA	لم الر				
			<del>25      </del>			A SEE MANY		ETD DD40			
- Seemen	٠.,	JAW-80	W		-//		١	FTP-DP16 FTP-DP26			
EXEMWE(B)	and the same of th	FTP-DP1	1 —			FTP-DP17	me en e	× 111-0120			
··› \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		· <b></b>	TP-DP1	4	PENNIGO.	, , ),	Sign of Same				
	● ETP PP4		1	FET		<b></b>	marine and				
··· ···	FTP-DP1	·			SCESG06	A ETD	DP15				
•••		\.	1	15	JUEGUUD	<i></i>	Pt. 12				
		FTP-DP1	9 /			veneral control of the control of th					
•••		]	1		المحترد متمهم						
••.		1	ノ		FTP-DP	20					
4	.¥	-	_								
··· \_	creen		٠					1			
of Land	Spring	<b>®</b> M	-01								
Tributary	Spring Creek										
	-/	J		• •							
PROJECT							HOLE				
Iowa AAP F.S. Data (	Collection					i	FTP-	DPd9			

	HTRW DRILLIN	G LOG				HOLE NO.
PROJECT Iowa AAP F.S. Data Collect		NSPECTOR	); Covey	,		SHEET SHEETS
	CRIPTION OF MATERIALS	FIELD SCREENING RESULTS		_	COUNTS	REMARKS h.
Sity CLAY (CL)	)-stiff brown, most ic, trace roothours cs		<u>c.</u>		4,0	Topsoil) FILL
2 -			R=ZH			
no organics		15° 6				
trace gray	a orange nothing			5.0-	5.0	Till
becomes so	74		7 400 RF/48	1.0 -	<del>-</del> 7	
]	soft w/ not mothing	Hor o		1.0-	-ラ ラ	
trace very f	ine sand	,	R= NA	0 10	<del>-</del> >	
10)	PROJECT  Iowa AAP F.S. Data Collection			1.6 -	HOLE NO.	DDAG.

HTRW DRILLING LOG HOLE NO. FTA - DP 69										
PROJECT	Iowa AAP F.S. Data Collection	ISPECTOR \(\)	Covey			SHEET SHEETS				
ELEV DEP	TH DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	G GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW COUNTS	REMARKS h.				
	- SAME: 6. Hy CLAY(CL) - SOFT, brown.	d.	е,	f	1.0	TIII				
) 	SAME: 6.Hy CLAY(CL) - 50ft, brown.  Frace gray + crange mothing moist, low plastic trace very fine sand  Trace fine sand to coarse sand + calcite concretions	4	R= 48		4.0	7.11				
12 -		HS=ND			7.0					
13 - 14 - 15 -	becomes gray w/ Iron staining + orange mothling 4 trace fine gravel		R=38,		7.0					
- 16		H5=ND			5.¢					
- 11 - -					4.0	-				
18 - -	black a crange mothering		R= 148		1.0	7,1				
19 -		W.			70	Temp Well				
20	PROJECT	MOTUD		1	4.0 1	remained Dry t				
	Iowa AAP F.S. Data Collection				FTP	-DPOP9				

	HTRW DRILLING LOG HOLENO PROP										
PROJECT	owa AAP F.S. Data Colle	etion	INSPECTOR	<u>-</u>			SHEET SHEETS OF				
ELEV DEPTH a. b.	DES	CRIPTION OF MATERIALS	FIELD SCREENIN RESULTS	G GEOTECH SAMPLE OR CORE BOX NO.		COUNTS Q	REMARKS h.				
	SAME: 5,144 ( morst, low ]	CLAY(CL) stiff, gramp > lastic, trace won black a crange racefue to course the concretions a	d.	e.	f.	4,0	Till				
21 -	sand whealer fine grave	exte concretions a				50					
zz _	,			R=40/		7.0					
73 -	becomes orang	ge./brown				7.0					
74			H5°ND			7,0					
25						1.0					
ц —	Clayey SILT (A brown, mois fine to coarse	1L) - Very Stiff orangel t, low plastic, trace sand a fine gravel	_	R38/	Ground Water Sample FTP- DP09- 30	7.0					
Z7 -		,	Ho'ND		Fren 113 Collected 1 Dlaslos	1,0	1 1 1 1 1 1 1 1				
29				R=18/18	T=1205	le io					
79		)- medium dense, orang	व		<u>//</u>	104	Chacial Outrast Temp Wellis 25-29.5'bss				
3 <sub>U</sub>	Bedook Refusal	PROJECT				HOLE NO.	Brook 27,5 Ebedrock Temp well installed				
		Iowa AAP F.S. Data Collection					-DP\$9				

HTRW DRILLI	ITRW DRILLING LOG				DISTRICT Omaha District			HOLE NUMBER
1. COMPANY NAME			ļ	ING SUBCON	····			SHEET SHEETS
URS Corporation		1	ţ			nmental Services		1 OF 3
3. PROJECT			O	<del>2000</del> , 2.	4.LOCATION	IIIICIIai Doi 1202	<del></del>	1
Iowa AAP F.S. Data Collect	tion			,	Burlington	in Iouza		
5. NAME OF DRILLER						JII, 10 WA TURE'S DESIGNATION C	OF DRILL	
Sesse Halv	118			!	_	probe	// 5	
7. SIZES AND TYPES OF DRILLING		lacro Core			8. HOLE LOCA			<del>-</del>
AND SAMPLING EQUIPMENT	A-KOAS, I	acrocone	<u>- Dan</u>		30	00571.341	N 22	75717,97'E
					9. SURFACE E	•		
<u> </u>						669.9	·	
					10. DATE STAR		11. DATE	איי נו איים
						2002		20.77
12. OVERBURDEN THICKNESS	18	b95			15. DEPTH GRO	ROUNDWATER ENCOUN	TERED	
13. DEPTH DRILLED INTO ROCK						WATER AND ELAPSED	TIME AFTER DE	RILLING
14. TOTAL DEPTH OF HOLE	4. TOTAL DEPTH OF HOLE /8 1675				17. OTHER WA	ATER LEVEL MEASURE	MENTS (SPECIF	FY)
18. GEOTECHNICAL SAMPLES	DISTURBED		UNDIS	STURBED		AL NUMBER OF CORE E	30XES	
20. SAMPLES FOR CHEMICAL	Voc	METAL	-	OTHE	R (SPECIFY)	OTHER (SPECIFY	^ I OTHER	R (SPECIFY) 21. TOTAL CORE
20. SAMPLES FOR CHEMICAL ANALYSIS		***************************************	_5	J	((SPEC),	Unitary Co. L.	<del></del>	RECOVERY
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING		OTHE	R (SPECIFY)	23. SIGNATURE OF IM	LATOR C	7
22. DISPOSITION OF HOLE	DAOIN ILL	FTP-DP1		<u> </u>	(OPEON I,	23. SIGNATURE OF	SPECIOR	
		FIFUIR	<u> </u>	Ь		11/1000		
LOCATION SKETCH/COM			·	•••••	of <b>y</b> ice	&CALE: 1	"= <del>2</del> 00'	· /
FTP-DP JAW-63 SA-9 (6" SU	3 TR-5		BG−€X ■ FTP-E JAW-	DP03	2-DP02	FTP-DP22		
 ● FTP-DP	P04 <b>% S</b>	AW-60	TP-DP09	W-59- <b>⊕</b> FT		) FTP-DP12	FTP-DP18	DP24 WW3(B) SC:SG05
● FT	P-DP07	JAW-80 FTP-DP1			FTA-99-1 (FTA-99-2(B		N	FTP-DP16 FTP-DP26 ···
			FTP-DP1	14 🌑 🗃	ELKWA .	<b>*</b>		
	FTP-DP10	0		_ <del>_</del>	<b>→</b> ^_	<b>∕</b>	para area	
••	··· <del>·</del>		1	S	SC≟SG06	FTP-	-DP15	
		● FTP-DP19	i9 /		*			
<b></b>		!	1					•
••			ر		FTP-DP	20		•••
*	zek.			30				
··	- ing Cre-	Λ <u>.</u> :		~				•••
Tributary of	Spring Creek	<b>⊕</b> M-	<b>-01</b>					•••
PROJECT	<del></del>	<del>)</del>	· · ·	<del></del>	<del>'</del>	<del></del>	HOLE	1 1 1 1
Iowa AAP F.S. Data (	Collection						FTP-D	PID

HTRW DRIL	LIN	G LOG	· · · · · · · · · · · · · · · · · · ·	<u>-</u>		HOLENO.
PROJECT  Iowa AAP F.S. Data Collection		SPECTOR	ovey			SHEET SHEETS  2 OF 3
ELEV DEPTH DESCRIPTION OF MATERIALS a. b. c.		FIELD SCREENING		ANALYTICAL SAMPLE NO.	COUNTS	REMARKS
5.14 CLAY (CL)-soft, brown, mo low plastic, trace root have	96t, 5 4	d.	е.	f.	2.0	Topsoil
becomes light brown					2.0	
Z trace calcite concretions & very stiff	bewn	es	R=448		7,0	Shallow Till
becomes hered a gray w/ ron stains  becomes very stiff	ing				9.0+	
4 -		Н5=ф	1		7,0	
becomes stiff					9,0	
1			1 4W		90	
4 -			R-48		4.0	- - - - - - - -
					4.0	
becauses very stiff to hard w/o	oranze	H5=\$			6.0	T.II
9			R=42/	,	8,0	
10					6.0	
PROJECT Iowa AAP F.S. Data Colle	ection				HOLE NO.	TPIO

HTRW DRILLING LOG										
PROJECT	wa AAP F.S. Data Collection	NSPECTOR [	ovey			SHEET SHEETS  3 OF 3				
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS		ANALYTICAL SAMPLE NO.	COUNTS FS C	REMARKS h.				
-	SAME: Sity CLAY(CL) - very stiff, group w/ ron staining, moist, low plastic, trace calcite, concretions + orange mothery	d.	е.	f.	6.0	Till				
<i>                                     </i>					5.0					
12		H5=Ø			5.0					
13	No mattery present ELA Clayer BILT (ML) - medium stiff, gray, Moist, low plasta				2.0					
14	SAND (6P)- brown loose, wet, med to coarse sond, trace silt			Ground Water Sample FTP- OP10-	9.0					
16	Clayey SILT (ML) - hard, brown to orange nuclest, low to non plastic trace calcite concreptions & I fine to coarse sound	H6=Ф		18 for VOC's From 113 Collected 10/23/02						
11				T= 1100	80					
/8 <del> </del>	Bedrock refusul	⊮≎ф		//,		Temp Wellis 13'-18' bgs bo.b. @ 8'63				
19						Temp sdell Matalled				
20						E				
	PROJECT  Iowa AAP F.S. Data Collection	<u></u>			HOLE NO.	DPID				

HTRW DRILLI	ITRW DRILLING LOG			rict		HOLE NUMBER				
1. COMPANY NAME		2. DF	RILLING SUBCO	NTRACTOR			SHEET SHEETS			
URS Corporation		-Sed	<del>corposbo</del> , Pl	lains Enviro	nmental Services		1 of 3			
3. PROJECT				4.LOCATION						
Iowa AAP F.S. Data Collec	tion			Burlingto	n, Iowa					
5. NAME OF DRILLER	1/ 1			6. MANUFACT	TURE'S DESIGNATION O	F DRILL				
Jesse	= Kalvi9			Geotrole						
7. SIZES AND TYPES OF DRILLING	A- Keds,	Macro Con	Sample	8. HOLE LOCA	ATION					
AND SAMPLING EQUIPMENT				1 3	00679.31	/ <sub>A</sub> / a	275 839.27'2	<b>F</b>		
				9. SURFACE E	LEVATION					
				1 6	71.7					
				10. DATE STAF	RTED	11. DATE				
				10,2	4.02	10,24	1.02			
12. OVERBURDEN THICKNESS	<u> </u>				OUNDWATER ENCOUNT	ERED				
	20'695									
13. DEPTH DRILLED INTO ROCK		,		16. DEPTH TO	WATER AND ELAPSED	TIME AFTER DR	ILLING			
	P			M						
14. TOTAL DEPTH OF HOLE	211				TER LEVEL MEASUREN	ENTS (SPECIF)	n			
	LO by:	<u> </u>		NA				ı		
18. GEOTECHNICAL SAMPLES	DISTURBED	UI	NDISTURBED	19. TOTA	AL NUMBER OF CORE B	OXES				
								_		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHE	R (SPECIFY)	OTHER (SPECIFY)	OTHER	(SPECIFY) 21. TOTAL COR	₹E		
ANALYSIS			-			-	RECOVERY	%		
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WEL	L OTHE	R (SPECIFY)	23. SIGNATURE OF INS	PECTOR				
		ETP-DPI	Pu	iled .	Just	7_				
LOCATION SKETCH/COM	MENTS		<b>V</b>	,	SCALE:	">200°		П		
FTP-DP	9-1 IMP) DAW-62 DAW-61	FTP-DP21 FTP-DP3 FTP-DP19 FTP-DP19	P-DP03 W-58 TP-DP05 AW-59 1	FTP-DP23	FTP-DP17	P-DP18				
PROJECT		· · · · · · · · · · · · · · · · · · ·		· · ·		HOLE		1		
Iowa AAP F.S. Data G	Collection					FTP-T	DPH .	ŀ		

Town AAP FS Date Collection  Town AAP FS Date Collection  Securities of Securities of Manager of Securities of Manager of		HTRW DRILLIN	IG LOG			·	HOLE NO.
Decomes gray woman monthing  1 becomes process will be committed the process of t	PROJECT Io	· · · · · · · · · · · · · · · · · · ·	INSPECTOR	Cover			SHEET SHEETS
Change SILT/AL) - very plastic, trace most how to sear plastic, trace not hours a organics  1 becomes brown with booms withing  2 becomes pround with booms withing  5.0  5.149 CLAY(Ca) Still, gray most of low plastic, trace oration withing  1 black mothing present  8 becomes need plastic  8 trace fine speed  10  3.0	ELEV DEPTH	DESCRIPTION OF MATERIALS	RESULTS	GEOTECH SAMPLE	SAMPLE NO.		REMARKS
becomes brown w/ H bows withing  1 becomes gray w/ many mothing  1 becomes gray w/ many mothing  2 black mothing present  3 black mothing present  4 becomes med plastic  4 trace fine going  10 3.0	-		e d.	c	f.		15
becomes gray who many mothing  5. Hy CLAY (Can) Still gram morst withing  6 Sitty CLAY (Can) Still gram morst withing  7 brack mothing present  8 becomes med plastic  8 trace fine gound  10  3.0	, <u>-</u>	becames It boown to gray w/ mange				4.0	
becomes gray whomey mothing  5. Hy CLAY (CLA) - Still, gray morst in low plastic, trace orange matting  4. Discours need plastic  4. Leave fine said  10. 10/ 3.0	1	becomes brown w/ It brown mottling		R= 48/		5.0	
becomes gray who many most in the state of any most ing the state of a	<b>7</b>			l-and the	. /	40	
5. Hy CLAY (CL) Still, gran, morst ing low plastic, trace orange nothing black mothing present  8 becomes med plastic  4 trace fine said  10  3.0  R.40/ 3.0	4 -	the same will be	3			40	
Sity CLAY (CLa) - Still gray moisting  Till  Black motting present  Becomes med plastic  A trace fine sand  10  3.0  3.0		occomes gray who make munning					
Sity CLAY (CL) - Still gray moisting  Till  black mothing present  Sity CLAY (CL) - Still gray moisting  Till  Black mothing present  Sity CLAY (CL) - Still gray moisting  Till  Black mothing present  Sity CLAY (CL) - Still gray moisting  Till gray moisting  Till gray moisting  Til	5		**************************************	, in the second	<b>,</b>	4.0	
becomes med plastic  becomes med plastic  brace fine bound  3.0  3.0  3.0	4	Sity CLAY (CL)-Still gray moist	<b>1</b>	RATH		3.0	Till
becomes med plastic  trace fine sound  3.0  3.0	<b>1</b>	black motting premat		in the second se	ø	30	,
becomes med plastic  trace fine bound  3.0  3.0	8			w.v.	*	3.0	90 (1)
Jo = 3.0	1				1	•	<u>.</u>
DOUBLE A MALENCO	4	becomes med plastic		148	3.0		
Iowa AAP & S. Data Collection HOLE NO. FTP. DPI\	lo -	N. Serte		d.			
				9 10 10		HOLE NO.	P=DP11

	HOLE NO.					
PROJECT IO	wa AAP F.S. Data Collection	INSPECTOR 4	WEY			SHEET SHEETS
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.		OOUNTES FS.F	REMARKS h.
-	SAME: Sitt CLAY-(CL) Stiff, moist,	d.	e	<u>f.</u>	TapT	Till
	oranges grow, louplastic, wisher					1
<sub>  </sub>	I" med to coorse sand seam				3,0	‡ ‡
	no black mothing trace calcine concretions					h= [
_	trace calcine concretions				70	7.11
13 -					10	†
13	becomes low plastic	·	ķ		70	- -
-			2.34			
14	becomes orange brown w/no mothling		1) %		7.0	1
	. &:	*				-
15					5.0	
	· · · · · · · · · · · · · · · · · · ·	3 <b>4</b> (				ľ
				//		installed
10	SIL ALANCAL HAR AL OC				<u> </u>	Chad to drill
-	Silty CLAY (CL) - Very Stiff orange) brown, moist, low plastic,			Ground Water		DOT WAY
=	Trace calcite concretyons a		<b>\</b> .	Sample FTP-		while restrilling got to depth of zo bgs,
11 =	nued to course sand			DP11-	6.0	12 installed well
, ]				for Explosives		offset + got
=			~ 18/	+ VOC'S		descrete sample
18 =	1" fine grained soul seam		K= /48	From 113		-
4	y and grant of the			Collected 10/24/02		<u> </u>
				T= 0935		<u> </u>
17	4" for to course sand seam	1			4.0	E
극	1. 1 <del></del>		ļ			<u> </u>
w	Balrax Rofusal			///	9.0	Temp Wall is 15-20'695
	PROJECT  Iowa AAP F.S. Data Collection		- <u> </u>		HOLE NO.	16-D611

À

HTRW DRILLI	NG LOG	DISTRICT	DISTRICT Omaha District			HOLE NUMBER		
1. COMPANY NAME	110 200		SUBCONTRACTOR	<del></del>		FTP-DPIZ		
1						05 /		
URS Corporation 3. PROJECT		Sacospa	be, Plains Enviro	illiental Services		1 0 4		
Iowa AAP F.S. Data Collec	tion		4.LOCATION	n Iouro				
5. NAME OF DRILLER	HOU		Burlingto	II, IUWA TURE'S DESIGNATION C	DE DRILL			
Lesse Kalvi	a			PROBE	N DIVICE			
7. SIZES AND TYPES OF DRILLING		10 Core Sau				*		
AND SAMPLING EQUIPMENT	Arkack , I Vac	10 Core Dav				(22500		
	<u> </u>		9. SURFACE I	<u>0866.41 A</u>	<u> </u>	6235,00E		
				26,8				
			10. DATE STAF	RIED	11. DATE			
		<del></del>	10,2		İ	7 07		
12. OVERBURDEN THICKNESS	<u></u>	<del>.</del>		OUNDWATER ENCOUN	TERED	2.02		
The state of the s	23'	bas	114	·				
13. DEPTH DRILLED INTO ROCK		-93	16. DEPTH TO	WATER AND ELAPSED	TIME AFTER DRI	ILLING		
	$\varnothing$		N					
14. TOTAL DEPTH OF HOLE	TOTAL DEPTH OF HOLE 23 1				MENTS (SPECIF)	0		
	N	<b>,</b>	•					
18, GEOTECHNICAL SAMPLES	DISTURBED	UNDISTU	RBED 19. TOTA	AL NUMBER OF CORE E	BOXES			
<del></del> ,		_						
20. SAMPLES FOR CHEMICAL	Voc	METALS	OTHER (SPECIFY)	OTHER (SPECIFY	) OTHER	(SPECIFY) 21. TOTAL CORE		
ANALYSIS					/ -	RECOVERY %		
22. DISPOSITION OF HOLE	<del></del>	IONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF	SPECTOR			
	F	P-DPIZ		Mult	7 -			
LOCATION SKETCH/COM	MENTS			SCALE:	1, 2, 2, 2, 2, 2	. /		
LOCATION SKETCH/COM	IIVIEIVIO			QCALE.	1,500			
FTP-DF	n1 — /	1	Of Pice		أيمر سر			
				● FTP-DP22		// <b>/</b>		
	IR-5	IR-2 FG-EX						
SA-9	9-1		● FTP-DP02	( secretariale	A STATE OF THE STA			
(6" SI	JMP)	FTP-DP	03	STEMWORK:	A (0)	<b>1</b> / ···		
	Ð	JAW-58	3	2-11 11 11.	Jr	Y / /		
	<b>⊕</b> JAW-62	¥ 1	$\sim$ $\sim$ $\sim$ $\sim$ $\sim$	(7) / P	); <`\	7		
606		TO DOG FTP-D		TP-DP06	4	)		
••	•	TP-DP21 JAW		FTP	-DP13 FTP-DF	<u>, , , , , , , , , , , , , , , , , , , </u>		
	◆ JAW-61	<b>Y</b>			O ETPAN	Minimum and a second se		
	JAW-	60		$\mathcal{J} = \mathcal{J} + \mathcal{J} + \mathcal{J}$	<b>₽</b> .§	es605		
● FTP-DF	04	FTP-DP09	• FTP-DP25	FTP-DP12	1/ )	﴿		
					4 6			
	##® FT	P-DP08		ST SEE SEE ST	P-DP18/	· ·		
<b></b>	• • • • • • • • • • • • • • • • • • • •		FTA-99-1			•		
● FI	P-DP07		FTA-99-2(E	O LE LEMWZ		;		
	<b>_</b>	JAW-80		/ // \		FTP-DP16		
EPEMWA		FTP-DP11			,	FTP-DP26 ···		
EXCEMINATE OF		_•		FTP-DP17	بعر مستمدي			
		FTP-DP14	● EREMYA	$\nearrow$		•••		
\	FTP-DP10	/			DD45			
		1	SC SG06	→ FIP.	DP15			
	•	FTP-DP19	_	and the second s				
		1 1	200			•		
••		i	● FTP-DF	20		,,		
4	-a.K.	*	. go			i		
- \	Soring Cree	<b>A</b>				•••		
A -initary of	Spring Creek	<b>⊕</b> M-01						
Illing					_			
PROJECT			<u> </u>	<del>`                                    </del>	Acre			
Iowa AAP F.S. Data	Collection				18 TR E	TP-DPIZ		
IOWA TIAL T.D. Data	CONCOUNT				1 10 1	.,		

	HTRW DRILLING LOG  HOLE NO. FTP-DP 12										
PROJECT	ī	NSPECTOR	C 2.1			SHEET SHEETS	┪				
ELEV DEPT	Iowa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS / / //2	FIELD SCREENING		ANALYTICAL	<b>BE€</b> W	2 OF 4					
a. b.	and the second s	RESULTS d	OR CORE BOX NO.	SAMPLE NO. f.	KS F	h.	4				
	= silty CLAY(CL)-oths, brown,				2.0	Topson	Ē				
-	moist low plastic, trace root hours + organics					Loess	<u> </u>				
	54-2-7-7-7-3-7-7-7-7-7-7-7-7-7-7-7-7-7-7-7			ļ		ļ	E				
] ) -	- Clayey SILT (ML) - Very stiff, brown, more low plastic, trace root haves	<del> </del>			6.0		E				
	low Plastic, trace root haves						ŧ				
-	<u> </u>		. 48				F				
	=		h=143		7.0		Ė				
7 -			1 71		1 10		-				
	4	}					F				
	]					E TIII	Ē				
9 -	<u> </u>				6.0		ŧ				
3 -	I made dianog momenta				(4.0		F				
_	trace orange motherly	1				:	E				
	1 500 mes 5000	116.55					Ė				
4 -	<u>-</u>	H5=ND			4.0	- -	E				
•	3				1		Ē				
_							F				
	Decomes med still				2.0		Ę				
<b></b> 5 -	<del>-</del>				10		F				
	3						ŧ				
	=		B				F				
)			R/R		30		Ė				
L -			1/48		270		F				
	1						E				
	Trace fine sand		İ				E				
7 -	3						ļ.				
!	1				1,0		E				
	;						<u>E</u>				
	]						<u> </u>				
7 -	-	45=ND			2.0		E_				
ν .	1 11 1 with a						Ė				
	trace black nothing				ł		<u> </u>				
:	<u>'</u>						F				
9 -	1		a Unl		2.0		_				
-	XIL, MAY (CIN - hard have to some the	_	R=36/		+	9.11. 711	ŧ				
	moist, high partie, trace calcite		1 198		[,	Dullow Till	<u> </u>				
10	3.14, CLAY (CH)-hard, brown to grange moist, high plastic, trace calcite concretions fore to ned sands black mothing				6.0	j	Ė				
<i>.</i>	PROJECT				HOLE NO.	(1) TO 10	-				
	Iowa AAP F.S. Data Collection				FTP	DP1Z					

HTRW DRILLING LOG										
PROJECT	INSPECTOR	Povey			SHEET SHEETS					
Iowa AAP F.S. Data Collection  ELEV DEPTH DESCRIPTION OF MATERIALS a b. c.	FIELD SCREEN	<del></del>	ANALYTICAL SAMPLE NO.	BLOW COUNTS	3 OF 4 REMARKS					
SAME: Sity CLAY (CHS-hard, brown mostly change fine to ned sand a ble mostly CLAY (CH)-Hard brown orange moist high place trace cateste concrete fine to med sand.	to	R= 36/8	f.	6.0	Till Shallow Till					
12 - =	HEEND			9.0	-					
no mottling		R= 148		8.0						
15 grey, black 4 orange modling				90	T.11					
becomes gray w/ orange moltales	H5=ND			9.0						
11 - 1			;	8.0	^ -					
no notten		R=36/48		8.0	-  -  -  -  -  -  -					
19 -				0.0						
20 =	H5= ND			0.0						
PROJECT  Iowa AAP F.S. Data Collect	tion_			HOLE NO.	DP12					

HTRW DRILLING LOG HOLE NO. FYP-BPYZ									
PROJECT	INSPECTOR A	COVEY			SHEET SHEETS				
Iowa AAP F.S. Data Collection  ELEV DEPTH DESCRIPTION OF MATERIALS	FIELD SCREENING	GEOTECH SAMPLE		<del>√BLO</del> ₩	REMARKS				
a b. c.	RESULTS d.	OR CORE BOX NO	SAMPLE NO.	COUNTS X-E	h.				
Clayed SILT (ML) - Very Stiff brown / orange, moist, low plastic, trace	e.		//	50	T111				
med fine to course sud.			Ground	İ					
- 1" Seam Course gravel	ļ		Sample FTD-						
21 - Silty SAND (SM) Med dense, brown	20/		0012-		Glacial Ostually				
21 = silty SAND (SM) Med dense, brown orange, moist, fine to coarse grand trace clay 4' fine gravel	week	536/	tor	;	Clacial col mass				
		R= 18e	Explosives						
72 =			Voc's		1				
			Freen 113 Collected						
- Claney SILT (ML) - very Stiff brown las	ange		10/a5/02 T= 1125						
Clayey SILT(ML) - very stiff, brown for movest, low plastic, trace fine to a	east KS=ND		///		Temp Well's 18'-23' bgs				
23 - Barrow Refusal	N-3-100		///		18-23 bgs				
= 15cardt Keissi		j			b.o.b. @ 231 b				
					Temp well				
<u> </u>					installed				
<b>-</b>									
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PROJECT				TOT TAKE					
Iowa AAP F.S. Data Collection	1			FTP-	DP/Z				

HTRW DRILLI	TRW DRILLING LOG			:t		HOLE NUMBER 13				
1. COMPANY NAME		2. DF	RILLING SUBCONT	RACTOR			SHEET SHEETS			
URS Corporation		اهای	herrake Plai	ns Enviro	nmental Services		1 OF 3			
3. PROJECT				LOCATION			1			
Iowa AAP F.S. Data Collec	tion			Burlingto	n Iowa					
5. NAME OF DRILLER	CLOIL COL	· · · · · · · · · · · · · · · · · · ·		6. MANUFACTURE'S DESIGNATION OF DRILL						
1/ 1/ 1	: A		i i		BROBE					
7. SIZES AND TYPES OF DRILLING	PAlado 1	Lacia Arria	C 47 4C 5	HOLE LOCA						
AND SAMPLING EQUIPMENT	711	lacon core	Simper 19		3009	79 -11	1 2276375,23E			
	1,2"			. SURFACE E		79.51 N	44/63/3,435			
· · · · · · · · · · · · · · · · · · ·										
······································				669,9'						
			]"	D. DATE STAF		11. DATE				
<u></u>	····				20.2		122.02			
12. OVERBURDEN THICKNESS	11	, , , , , , , , , , , , , , , , , , ,	11	5. DEPTH GR	OUNDWATER ENCOUN	TERED				
	10	bgs		<u> </u>			·			
13. DEPTH DRILLED INTO ROCK	$\mathcal{A}$		[16		WATER AND ELAPSED	TIME AFTER DR	ILLING			
	$\underline{\hspace{1cm}} \underline{\hspace{1cm}}  \underline{\hspace{1cm}} \hspace$		M	·						
14. TOTAL DEPTH OF HOLE	11.1		1		ATER LEVEL MEASURE	MENTS (SPECIF	γ)			
	lle' i	pgs		M	<u> </u>					
18. GEOTECHNICAL SAMPLES	DISTURBED	Ü	NDISTURBED	19. TOT/	AL NUMBER OF CORE E	OXES				
***************************************			<del></del>							
20. SAMPLES FOR CHEMICAL	Voc	METALS	OTHER	SPECIFY)	OTHER (SPECIFY	) OTHER	(SPECIFY) 21. TOTAL CORE			
ANALYSIS							RECOVERY %			
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING	LL OTHER	SPECIFY)	23, SIGNATURE OF IN	SPECTOR /				
		FTP-DP 13			1 SH	4-1-				
	J	111 0.00	- I.		- Jany					
LOCATION SKETCH/COM	MENTS				SCALE:	<i>"^20</i> 0	•			
				OFFICE .						
696 JAW-6	99-1	J.		DP02	FTP-DP22  FTP-DP06					
• FTP-DF	⊕ JAW-61	AW-60	JAW-59 ● F	P-DP23		-DP13 FTP-D				
		FTP-D	P09		FTP-DP12/	ll /				
/	and a				//// <b>_</b> _	P-DP18 1	•••			
	(after	FTP-DP08	}	TA-99-1€ TA-99-2(B	S JOSEPH PROPERTY	F-DF 10/	γ			
<b>A</b> F1	P-DP07		•	TA-99-1≈ TA-99-2(B	. 1 1 . 1 . 1 . 1 . 1 . 1 . 1 . 1 . 1 .	m	•••			
\	11 -DI VI			77	O ETEMVZ		) ••••			
HEMMI )		JAW-80	Ų.		~// <b>/</b> ~ \		FTP-DP16			
ESTERMINE (B)		FTP-DP11	_	1 /	<u> </u>	2	FTP-DP26 ···			
		. 🏎 📜	DD44 📤 🚃		FTP-DP17	and the second second	,			
			DP14 🔷 🛅		$\sim$	ar annual Harris				
··· · · · · · · · · · · · · · · · · ·	FTP-DP1	0		<b></b> >			•••			
-			/ Sõ	SG06	● FTP-	DP15				
		● FTP-DP19 /	·				•••			
••		1		***	et Total					
		}	.4	FTP-DP	20					
	4.	مجسلوس		P LIK-DP	<b>2</b> U		•••			
\	~reek									
A of	Spring C' 1	`								
Tributary	Spring Creek									
Y	-	<b>j</b>	_			_				
PROJECT			<del>,</del>	• • •	<del>` ' '</del> ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	HOLE	13			
Iowa AAP F.S. Data	Callection					CO.TX	13 Sefixe			
IOWA AME F.S. Data	COLICCHOIL					111 0	-07			

HTRW DRILLING LOG  HOLE NO. 13 FTP-DP										
PROJECT IO	wa AAP F.S. Data Collection	INSPECTOR	VEY		SHEET SHEETS  OF 3					
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENIN RESULTS	G GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.		REMARKS h.				
-	Silty CLAY(CL) - Stiff, brown, moist, low plactic, track soot hours		e	f.	PP	Top Soil				
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Clayer SILT (ML)-Very Stiff, light brown, moist, low plastic				4.0	1000 Fill				
7 -			R=48		5.0					
3					5.0					
4		45: ND			7.0	<u> </u>				
5					4.0					
4	becomes orange/brown w/ black mothers		P=148		5.0					
1					4.0					
&l.		HS= ND			4.0					
9 1	imedone rubble seam ~ 1"		R=49	Reb	3.0					
10	·			` .	5.0	-				
	PROJECT  Iowa AAP F.S. Data Collection				HOLE NO.	OPISALC				

		HTRW DR	ILLIN	G LOG			·	HOLE NO.	2
PROJECT	owa AAP F.S. Data Collec	tion	INS	SPECTOR	COVEY			SHEET SHEETS	7
ELEV DEPTH a. b.		RIPTION OF MATERIALS c.		FIELD SCREENING RESULTS		ANALYTICAL SAMPLE NO.	BLOW COLDITS	REMARKS h.	$\neg$
	Cof Claney SILT	(ML) - very stiff, or tic, black modifi	angelbrow	d	е.	f.	PP	Fill	$\dashv$
_	1,		J						-
-	Silty CLAY (CH)	Ting, trace calcute	y moist,		1 401			Shallow Till	-
11 -	or wage mou	Trace carcité	? concretur	<b>1</b> 5,	15 /r		60		-
-	]				190				
· -									ł
-				115-110			5.0	1	F
12 -				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				† '	Ī
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13 -									ŧ
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И —			ŀ		R= 48		2.0		F
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1								1 8 6	ŧ
15							70		
′ =	Silfy SAND(SM)	1- 1005e, orangelk	torce.					Glacial Octuasa	F
	MOIST, time 40	- 1005e, orange /k	1.200						F
7	Cital			N/a ID			1,0	Temp Wellis	F
16 -	Bedrail Refus			1K=ND			7,0	ramained Dry	丰
1	DESTACT MISS	<b>.</b> 4						@ bedrock	生
-			İ	ļ				Temp well installed @	Ė
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		PROJECT  Iowa AAP F.S. Data C	Collection				HOLE NO.	PHO AC	

HTRW DRILLING LOG	DISTRICT Omaha Distr	rict	HOLE NUMBER FTP-DP14				
1. COMPANY NAME	2. DRILLING SUBCO	NTRACTOR	SHEET SHEETS				
URS Corporation	Salamorebe, Pl	ains Environmental Services	1 OF 7				
3. PROJECT		4.LOCATION					
Iowa AAP F.S. Data Collection		Burlington, Iowa					
5. NAME OF DRILLER		6. MANUFACTURE'S DESIGNATION OF DRILL					
Jesse Kalvia		GeoProbe					
7. SIZES AND TYPES OF DRILLING A-Rod, Macro Core	<u> </u>	8. HOLE LOCATION					
AND SAMPLING EQUIPMENT	Jampier		1171 21 5				
·		3006/3.92 N 227	8076,36 E				
		658,3'					
		10.23.02 10.	23.02				
12. OVERBURDEN THICKNESS 9.0'		15. DEPTH GROUNDWATER ENCOUNTERED					
		7.3 bas					
13. DEPTH DRILLED INTO ROCK		16. DEPTH TO WATER AND ELAPSED TIME AFTER DR	RILLING				
4 TOTAL DESTRICTION 5							
14. TOTAL DEPTH OF HOLE  Ab' be		17. OTHER WATER LEVEL MEASUREMENTS (SPECIF	Υ)				
IN COS							
18. GEOTECHNICAL SAMPLES DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES					
20. SAMPLES FOR CHEMICAL VOC METAL ANALYSIS 2 JP. 1 104			(SPECIFY) 21. TOTAL CORE RECOVERY				
3. more half		nes zildmbers,	RECOVERY %				
22. DISPOSITION OF HOLE BACKFILLED MONITORIN	G WELL OTHER	R (SPECIFY) 23. SIGNATURE OF INSPECTOR					
	20.00	n santile					
LOCATION OVETOUROOMMENTO	•	double 14					
LOCATION SKETCH/COMMENTS		&CALE: 1"-206"					
		OFFICE / / / /					
FTP-DP01 TR-3 TR-1	الكان						
	BG-6√) /	FTP-DP22	///./				
IR-5		P-DP02	1 9 86				
SA-99-1	<b>—</b> / <b>—</b> "	STEPHEN (A)					
· (6" SUMP)	FTP-DP03	■ EXEMINAÇIBE →	1//				
	JAW-58 \	1 /////	Y / /				
<b>⊕</b> JAW-62			1				
	FTP-DP05	FTP-DP06	•				
● FTP-DP21		FTP-DP13	1				
A JAW-61		<u> </u>					
JAW-60!	. //.		W3(B): CESC05:				
FTP-DP04	· • FT	/ / / / · · · · · · · · · · · · ·	/ G=2(B)(3)				
	P-DP09	P-DP25 FTP-DP12//	^ ::				
	11	///////					
FTP-PP08	1	FTA-99-16 PTP-DP181	¥				
**	5/2	FTA-99-16 FTA-99-2(B)					
● FTP-DP07		FTA-99-2(B)					
JAW-80	-	//// <del>//</del>	FTP-DP16				
- SERVINGE	14 V4		FTP-DP26 ···				
and a second sec		● FTP-DP17					
	TP-DP14 🗬 🖫						
FTP-DP10		<b>→</b>					
· · · · · · · · · · · · · · · · · · ·	1 - 8	€SG06 FTP-DP15					
	/		•••				
● FTP-DP1	<sup>y</sup>		1				
	7						
·	<b>,</b>	● FTP-DP20					
* All All All All All All All All All Al			Į.				
Continu Creed							
of Spring O	-01						
Tributary of Spring Creek			· ]				
		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					
PROJECT		HOLE	., i				
Iowa AAP F.S. Data Collection		FTP-DP	14				

	HTRW DRILLIN	IG LOG			<del></del>	HOLE NO.
PROJECT	1	INSDECTOR	Covey			SHEET SHEETS
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS			2 PLOW	REMARKS
	5. 14. CLAY(CL) - very stiff, brown, moist, low plastic, trace soot hours torganics	d	е	f	5.0	Top soil Locus / Fill
(	becomes dark brown to black				4.0	
2 -			Rais		6.0	
3 -					5.0	
4		140. ND.			3.0	
	Trace orange mothing + fine to med. sand				20	
5			38,			
	becomes yellowsh brown a soft 3" Soundy SII (MI) seam w/fine to med smo	j	K:480	Water Sample FTP- DP14-	1,0	weathered 611
1	Clayed GILT (ML) - very soft, y ellowish-brown, moistalow plastic, trace fine to head. sand, trace salcite concretions		1	tor Explosives VOC'S	ø	-
4	Silty SAND (SM) very bose, yellowish lorown. with him to med. sand !	H5: ND		Freon 113 Collected 10/23/02 T=0833	Z.O	
•	Lune dek brown		.,			screen pointis
4	Bedrak Refusal	H5= ND	R 72		-	5.0'-9.0 bis bio.b. @ 9.0
10 =						
	PROJECT  Iowa AAP F.S. Data Collection				FTP - T	7214

HTRW DRILLI	NG LOG	DISTR	DISTRICT Omaha District				HOLE NUMBER FTP-DP15			
1. COMPANY NAME		2. DRII	LLING SUBCON	TRACTOR		<del>.</del>	SHEET SHEETS			
URS Corporation					montal for thes		1 <sup>OF</sup> 3			
3. PROJECT				4.LOCATION						
Iowa AAP F.S. Data Collect	tion			Burlington, Iowa						
5. NAME OF DRILLER	HOIL				URE'S DESIGNATION (	E DRILL				
Ton F	DOLFOLI					DI BIGEE				
7. SIZES AND TYPES OF DRILLING				Crop						
AND SAMPLING EQUIPMENT	A-Rada, Ma	acrolone Sun	pher	8. HOLE LOCATION 300548.50'N 2276366.76'E						
	<del></del>	<del></del>	!	9. SURFACE ELEVATION						
		<del></del>		<u>665</u>		,				
				0. DATE STAR		11. DATE				
					9.02		19.02			
12. OVERBURDEN THICKNESS	1-	۰ ۵'	1		DUNDWATER ENCOUN	TERED				
		2.0'		NA						
13. DEPTH DRILLED INTO ROCK	DEPTH DRILLED INTO ROCK					TIME AFTER DR	ILLING			
14. TOTAL DEPTH OF HOLE	4. TOTAL DEPTH OF HOLE 13.0' bg 5				TER LEVEL MEASURE	MENTS (SPECIF	γ)			
18. GEOTECHNICAL SAMPLES DISTURBED UNDIST				<del></del> _	L NUMBER OF CORE	BOXES				
				NA						
20. SAMPLES FOR CHEMICAL	voc	METALS	OTHER	(SPECIFY)	OTHER (SPECIF)	) OTHER	(SPECIFY) 21. TOTAL CORE			
ANALYSIS			_			. /	RECOVERY			
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER	(SPECIFY)	23. SIGNATURE OF IN	SPECTOR	- %			
		FTP-DAS-13			1114					
	1	[   P-0AG-   ]			2/100					
LOCATION SKETCH/COM	IMENTS				SCALE:	"=200	)' /			
			;;	OFFICE	-;;;-	:				
SA (6" SI	D JAW-62  → JAW-61	FIP-DP21	● FTP P-DP03 W-58	-DP02 TP-DP23	TP-DP06	-DP13 FTP-D	P24			
● FTP-DF	204 <b>%</b> 🖼	W-60 FTP-DP	09 FTF	P-DP25	FTP-DP12		CESC05:			
	-688	FTP-DP08				TP-DP18				
	£.m	7 7 7 7	~	FTA-99-12 FTA-99-2(B	A FEET LEER P	1	<u>}</u>			
● FI	TP-DP07			FTA-99-2(B	e fewy	m d				
				///	THE REMINE		FTP-DP16			
ERROR	ار	JAW-80				)	FTP-DP26 ···			
THE SELLING THE PARTY OF THE PA	armer and a second	FTP-DP11 "	-		FTP-DP17	ترسي	**			
		FTP-D	P14 🗪 🖼	MANAGE .	~ )	, <b>4</b> , - , - , - , - , - , - , - , - , - , -	·			
	● FTP-DP10			<del></del>	<b>ノ</b>					
···-		-, <u>                                    </u>	S	CESG06	. <b>♠</b> FTP	-DP15	•			
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•••		● FTP-DP19		,*	and the second s		1			
		• • •		·-·						
		كوسلد		● FTP-DP20						
*	_eK									
	Tributary of Spring Creek  M-01*						144			
hutary of	Shims Low	M-01 °								
) Tribu	7	;					i			
PROJECT				1 1	<del>' ' ' '</del> ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	HOLE				
Iowa AAP F.S. Data (	Collection					PTP-[	DE			
IOWA FIFTH T.D. Dala (	<b>JOHICCHOIL</b>					שישיש	<i>/i i</i> ∨ 1			

HTRW DRILLING LOG											
PROJE	CT CT		INSPECTOR .	Λ			FTP-DP(5				
ET EV	Іо рерти	wa AAP F.S. Data Collection	J FIELD SCREENING	Covey  GEOTECH SAMPLE	ANALYTICAL	DIOM	SHEET SHEETS 2 OF 3				
a	b.	DESCRIPTION OF MATERIALS c.	RESULTS	OR CORE BOX NO.	SAMPLE NO. f.	eousts O	REMARKS h.				
	111111	5.14 CLAY (CL) - soft, brown, moist, low plastic, trace organics of root hours				2.0	Top Soil				
<u> </u>	11111					2.0	weathered				
Z		orange/ brown, merst, low to med plastic trace five to coarse sound a fine good	e	R=60/		60	Tin				
3	1111					6.0					
4						6.5					
5			H5-70			(a.O					
le	1111						- - - - - - -				
7	Ludin										
4	111111111										
9							- - - - - - - - - - - - - - - - - - -				
<i>H</i>			/				<u> </u>				
<i>1</i> √ 		PROJECT Iowa AAP F.S. Data Collection	<u> </u>		I	HOLE NO.	DP15				

	HTRW DRILLING LOG HOLE NO. PTP-DP15										
PROJE			INSPECTOR				SHEET SHEETS				
ELEV	Io DEPTH	WA AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	FIELD SCREENIN		ANALYTICAL	BLOW	3 of 3				
a	ь.	c.	RESULTS d.	OR CORE BOX NO.	SAMPLE NO. f.	COUNTS DO	REMARKS h.				
	=	SAME:				``	TIII				
	_	_				ł	<u> </u>				
	-	I" fine sand seam		1			[ E				
}				34			<u> </u>				
	Ξ			125 /40		j	<b> </b>				
				1,1,1,76			<u> </u>				
17	, _	some sand very most to wet Limestone		]			Clacial Octuary				
,,		Limestone					Glacial Outrash F Bedrock				
	$\exists$				:		ļ <u></u>				
							Tempwellis =				
13	-		H5=0	<u> </u>			Temp Wellis 8-13 bgs Remained pry				
	=						bo.b.@ 18 bg.				
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		PROJECT				IOLE NO	<u> </u>				
		Iowa AAP F.S. Data Collection				FTP.	DP15				

HTRW DRILLING LOG	DISTRICT				HOLE NUMBER		
	Omaha Dist	<del> </del>			FTP-DP16		
	2. DRILLING SUBCO				SHEET SHEETS		
URS Corporation 3. PROJECT	Saberprobe, Pa		nmental Services		1 <sup>OF</sup> 3		
		4.LOCATION	-				
Iowa AAP F.S. Data Collection  5. NAME OF DRILLER		Burlingto	n, 10Wa URE'S DESIGNATION (	DE DOUL			
Tom PAYTON			_	OF DRILL			
		8. HOLE LOCATION					
7. SIZES AND TYPES OF DRILLING APRILS MACTO CORE	Sampler	}		'N 2a	176642,12'E		
		9. SURFACE E	LEVATION ,				
			65,7				
		10. DATE STAR		11. DATE	-		
<u> </u>		11.20.		11.70	0.07		
12. OVERBURDEN THICKNESS  / S. 2 'b	બ	15. DEPTH GRO	OUNDWATER ENCOUN	ITERED			
13. DEPTH DRILLED INTO ROCK		16. DEPTH TO	WATER AND ELAPSED	TIME AFTER DRI	LUNG		
14. TOTAL DEPTH OF HOLE	a5		TER LEVEL MEASURE	MENTS (SPECIFY	)		
18. GEOTECHNICAL SAMPLES DISTURBED	UNDISTURBED	l l	AL NUMBER OF CORE E	BOXES			
20. SAMPLES FOR CHEMICAL VOC METAL	S OTHER	R (SPECIFY)	UA OTHER (SPECIFY	OTUED 4	SPECIEN IN TOTAL COST		
ANALYSIS VOC METAL	- OTHER	· (OF EOIFT)	OTHER (SPECIFY	OTHER (	SPECIFY) 21. TOTAL CORE RECOVERY		
22. DISPOSITION OF HOLE BACKFILLED MONITORING	WELL OTHER	R (SPECIFY)		1	7 - %		
FTP-DPIG-1		(JOPEOIPT)	23. SIGNATURE OF IM	SPECTOR	'		
LOCATION SKETCH/COMMENTS	, ,		SCALE		$\longrightarrow$		
FTP-DP01 — DP4 1k-s TR-1		OFFICE	S¢ALE:	"=200°			
SA-99-1 (6" SUMP)	FTP-DP03 JAW-58	P-DP02	FTP-DP22  JELEMWS  TP-DP06	7.0	64		
	JAN-59-	FTP-DP23	FTP-DP12	FTP-DP	24 73(B) 25G05		
● FTP-DP07		FTA-99-12 FTA-99-2(B		rP-DP18	 FTP-DP16		
FTP-DP1			FTP-DP17		FTP-DP26		
FTP-DP10	1	SCESG06	● FTP-	DP15			
● FTP-DP19	9 🗸		and the second				
-	)	FTP-DP	20				
Tributary of Spring Creek	المستور المستور المستور						
Tributary of Spring M-	-01						
PROJECT	<u> </u>	<u>i., i</u>	· · · · · · · · · · · · · · · · · · ·	HOLE			
Iowa AAP F.S. Data Collection					DPILE		

HTRW DRILLING LOG										
PROJECT		INSPECTOR	7 .		_	SHEET SHEETS				
	owa AAP F.S. Data Collection	FIELD SCREENING	OVEY GEOTECH SAMPLE	T	T-111	2 of 3				
ELEV DEPTH a. b.	с.	RESULTS	OR CORE BOX NO.	ANALYTICAL SAMPLE NO. f.	COUNTS DEP	REMARKS h.				
	Silty CLAY (CL) - stiff, brown, moist, low plastic, trace organics a root have	s			4.0	Top SOIL				
-	L'occomes light brown + very stiff			<u> </u>	ĺ	Loess				
i . :					1.					
' =	trace iron staining + black mottling a gray mottling	1			6.0	ĺ				
	gray mottling									
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2 -					7.0					
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			17-100			ļ <u></u>				
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3 –					6.0					
=						l E				
					5.0					
4 -				İ		[				
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	becomes stiff		}							
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7						<u> </u>				
10 <u> </u>						<u> </u>				
	PROJECT  Iowa AAP F.S. Data Collection			Ī	HOLE NO. FTP - D	P16				

The course of th	HTRW DRILLING LOG HOLE NO. FTP-DPK										
BEST SHOP CLAY (CLAY (CLAYARD) - orange brown  SHOP SHIPS SHOP CLAY (CLAYARD) - orange brown  To correspond  11 - becomes stiff  12 - becomes grapish - brown  13 - becomes grapish - brown  14 - 2.0  15 - without clay in planting sund sund  16 - without clay in well-well angular  18 - without clay in well-well angular  18 - without clay in well-well angular  19 - without clay in well-well angular  19 - without clay in well-well angular  10 - without clay in well-well angular  11 - without clay in well-well angular  12 - without clay in well-well angular  19 - without clay in well-well angular  10 - well-well scan  10 - well-well scan  11 - without clay in well-well angular  12 - without clay in well-well angular  13 - without clay in well-well angular  14 - well-well-well-well-well-well-well-we	1	Ţ		1 ( )			SHEET SHEETS				
Source Sity City (City (City (City)) And orange from the Course State  11 - becomes stiff  12 - becomes grayish - brown  13 - becomes grayish - brown  14 - 20  15 - without ching a spranger survey with the course state of the course state of the course state of the course of the co	ELEV DEPTH	DESCRIPTION OF MATERIALS		G GEOTECH SAMPLE			REMARKS				
11 — becomes grapish - brown  12 — becomes grapish - brown  13 — becomes grapish - brown  Sound, silt (MC) soft grapish become,  nights, low playing any granned search  15 — Witnesday & bedrock  21 fine sound seam  10 Tong Well's  10 10-15 205  Remained by  Double 152 by  Photorical  10  10  10  10  10  10  10  10  10  1	-	Ī ,	orpun d			$+$ $\rho \rho$					
14 becomes grapish - brown  14 2.0  2.0  2.0  3.0  3.0  3.0  3.0  3.0	11 —	becomes stiff				4.0					
becomes grapish-brown  13 becomes grapish-brown  Sound, Sitt (MK) Soft grapish-brown  Mything claims to washing anyther  15 white claims to washing anyther  1. mestoric bedrock	·	* * .									
becomes grayish - brown  14  2.0  2.0  15  Social State (MC) Soft, grayish - brown, may of four plastic fine agricular with race clam, a weathered angular transfers bearbook.  10 - 15 2/65  Remained Dry banb. @ 15.2/65  Plantac (2)  11  12  13  14  10	12					4.0					
14  Second State (MC) Soft, grayist-brown, may still (MC) soft agrand show the clam a weathered angular through the clam a weathered angular through the shock to	·			R=60/		60					
Sandy Stit (MC) soft grayist-brown, wight, low plastic Sim t grained sand with ac clay a weathered angular  15 Time sand seam  10 10-15-658 Remained by Dash @ 15.7-679 @ backrac (	13	becomes grapish-brown		1. 160		3.0					
Sandy Stit (MC) soft grayist-brown, wight, low plastic Sim t grained sand with ac clay a weathered angular  15 Time sand seam  10 10-15-658 Remained by Dash @ 15.7-679 @ backrac (						10					
10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	' -	Sandir Sell				2.0					
10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	15	Sandy Silt (MC) Soft, grafish-brown, might, low plastic, five the trained sand weathered angular limestone bedrock	H5-0			1.0	Temp Well's				
17 — 18 — 1							b.ab.@ 15.2'bg)				
19	16										
19	1										
19				:							
19	18										
<u>10</u>							<u> </u>				
	14						<u> </u>				
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	10 ]	·									

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HTRW DRILLI	NC LOC	DISTRICT					HOLE NUMBER
	ING LOG		ha Distr			BFTP-DP17	
1. COMPANY NAME		1		NTRACTOR			SHEET SHEETS
URS Corporation 3. PROJECT		Salvenp	<del>robe</del> , Pl	7	nmental Services	<del></del>	1 OF 2
	#:			4.LOCATION	τ.		
Iowa AAP F.S. Data Collect 5. NAME OF DRILLER	ion			Burlington	n, Iowa URE'S DESIGNATION O		
	1/ .1			1 .	_	F DRILL	
7. SIZES AND TYPES OF DRILLING	Kalvig	A		8. HOLE LOCA	OPROBE		
AND SAMPLING EQUIPMENT	A-Rod Macro	Core Sor	pler		=		
	<u> </u>			0.0005405.5	<u>300641.48</u>	N 23	76248.81'E
		<del></del>		9. SURFACE E			
	<del></del>			10. DATE STAR	656.9	14. 047	<del> </del>
	<del></del>					11. DATE	- 07
12. OVERBURDEN THICKNESS				15 DEDTU CD	2307 DUNDWATER ENCOUNT		3.02
· ·	6.0' ba	c		NA	DONDWATER ENCOUN	IERED	
13. DEPTH DRILLED INTO ROCK	<u> </u>	12			WATER AND ELAPSED	TIME AETED DO	11 1 10/0
10. DEI III BRICEED IIVIO ROCK		MD	WATER AND ELAPSED	HINE AFTER DR	ILLING		
14. TOTAL DEPTH OF HOLE	4 TOTAL DEPTH OF HOLE					MENTS (SPECIF	^
(10 bas				M	TEN ELVEL MEASOREM	NEIVIO (OFEOIF	''
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDIST	URBED		AL NUMBER OF CORE B	OYES	
_		_		10.701.	eriomber of cone b	O/CO	
20. SAMPLES FOR CHEMICAL	VOC	METALS	OTHER	R (SPECIFY)	OTHER (SPECIFY)	OTHER	(SPECIFY) 21. TOTAL CORE
ANALYSIS					/	. /	RECOVERY
22. DISPOSITION OF HOLE	BACKFILLED MONE	TORING WELL	OTHER	R (SPECIFY)	23. SIGNATURE OF IN	SECTOR	<b>/</b>   %
	FTP-	DP17			//m/n		$\sim$
	<u> </u>	0.11			- July		
LOCATION SKETCH/COM	MENTS				SCALE: \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	'200'	
FTP-DF	104		~	OFFICE		ン - ル	
690 JAW-6			ļ/	OFFICE	<b>A</b>		///>
	TR-2	EG-EX	) /		FTP-DP22		//\./
SA-9	19-18-5		_ FTI	P-DP02			64.
(6" Si			_	}• <b>≯</b> ••	>JEPWV5	. (6)	
<b>`</b>		FTP-D JAW-			THE HANGER	7	
•••	<b>⊕</b> JAW-62	.11	•	No.	11/1/	y 7.	٠٠ · · · · · · · · · · · · · · · · · ·
		₩.		\ <b>•</b> `•	TP-DP06	$\langle \rangle$	Ţ
	FTP.	UPZIZE	<u>DP05</u>	<del>-&gt;</del>	FTP	-DP13	/ "
	A JAW-61	JAV	-29	FTP-DP23		FTP-D	P24 ***
	JAW-60	116		1			Wayay
● FTP-DF		UBY •		P-DP25 🗻	2 / / / /		escos ·
1/\(\)	· ·	FTP-DP09		1 -DF25	FTP-DP12/	<i>11</i> /	·-
						$\mathbb{Z}_{-}$ $\mathbb{Z}_{-}$	
	<sup>666</sup> FTP-	P08-		1	a gradual P	'P-DP18/	2
	P-DP07			FTA-99-1		_	
	P-DPU/		_	F 1A-99-2(D	e france		
	<b>J</b> À	W-80			1//\square\		FTP-DP16
31:3/(\/ya_	FŢF	P-DP11 —					FTP-DP26
					FTP-DP17		·
		FTP-DP1			$\nearrow$	are and the second	
	FTP-DP10			<b>→</b>	- ( <u>*</u>		
		1	15	SCESG06	€ FTP-	DP15	
	<b>● ř</b> įŕ	P-DP19 /			and the same same		-1
••(	j	# ◀		معتمده سرر			
• • • •	•			FTP-DP	20		}
*	المرسم K				-		
\	a wing Cree's						
of	Spring Creek	<b>∂</b> M-01					
Tributary	→ ~ ~ · · · · · · · · · · · · · · · · ·						[
	<u> </u>	<u> </u>	<u>i i</u>	<u>i i</u>	<u> </u>	<u> </u>	
PROJECT		-				HOLE	
Iowa AAP F.S. Data C	Collection					FTP-D	P17

		· · · · · · · · · · · · · · · · · · ·	HTRW DRILLI	NI/	3100				HOLE NO.	
PROJECT				<del></del>	PECTOR ,		· ·	-	HOLE NO.  FTP.DPI  SHEET SHEET	
	Іо ЕРТН	wa AAP F.S. Data Collecti		<u>Т</u>	FIELD SCREENING	GEOTECH SAMPLE	E ANALYTICAL	BLOW	2 % 3	
	b.		IPTION OF MATERIALS c.		RESULTS d.	OR CORE BOX NO			REMARKS h.	
ļ	=	silty clay(cc)	- Stiff, brown, man	5ŧ,				3.5	Topsocl	
	_	low plastic	, trace root hour	5					Fill	Į
	=							1 ,		ŀ
1								3.0		F
	-	become dark	brown to black	-				1		Ī
ĺ	Τ	SILT (ML) - STIFF	dark brown to black lastic , trace . ron sto	E,		, E	[//	1		Ė
		moisi, iou p	MASTIC PLACE MAN STE		9	B. 45	///	3.0		þ
L	=					17-48				E
	╡						Ground Water			E
	$\exists$						Sample FTP-			Ė
3	且		,				DP17-	1.0		F
<b>,</b>	=					1	60r			F
	4	41 1.7/11		_			Explosives			
_	=	Clayey SILI (ML)-	very stiff, drk brown was plastic, trace fine	6			VOC'S	1,5	Till	F
4	크	to mad sand	public, made fine	ŀ	HS=NO		+		+	E
	4	10 May 201 00					Fren 113 Collected	6.0		E
	긬						10/25/02			E
	Ė					21/	T=1303			F
5	+	Silty CLAY (CL)-1	very stuff, yellowish - buc	en		R= 24/		5.0		F
	=	moist, low plass	very stiff, yellowish - biod tic, trace fine to coa aucil	rse		,				Ė
	日	sand + time gr	2041	1						E
Ŀ	1					At.	///	40	Temp Well is	F
Ų	4	Bedeck Refusal				1746			b.o.b. @ 6.0'E	
	4								@ bedrock	r E
	=			1					Temp well installed	Ė
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8.	$\exists$			-		<del> </del>			†	F
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9.	4								-	Ė
•	=					160				F
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10	=									ŧ
10		p	PROJECT					HOLE NO.		+
			Iowa AAP F.S. Data Collection					FTP -	DP17	

HTRW DRILLI	NCLOC	DISTRICT				HOLE NUMBER
	ING LOG	Omaha Dist				FTP-DP18
1. COMPANY NAME		2. DRILLING SUBC				SHEET SHEETS
URS Corporation 3. PROJECT		Saberprobe, F		nmental Services		1 0 2
Iowa AAP F.S. Data Collect	tion		4.LOCATION	T		
5. NAME OF DRILLER	,1011		Burlingto	II., 10WA TURE'S DESIGNATION C	E DRILL	
Jesse H	alvia			20 PROBE	· OTTLE	
7. SIZES AND TYPES OF DRILLING	A-rock Macro C	0~ 5	8. HOLE LOCA	ATION	<del></del>	
AND SAMPLING EQUIPMENT	A TOUR PLACES C	ore Jampie	3	00805.641	4/ 22	76393.57'E
	<u> </u>	<del></del>	9. SURFACE E		<u>v a.o.</u>	78373,3 / C
			1 66	51.0		
			10. DATE STAF	RTED	11. DATE	
			10.2	3.02	16,	23.02
12. OVERBURDEN THICKNESS	lm' i		15. DEPTH GR	OUNDWATER ENCOUN	TERED	
	10 bas		NA			
13. DEPTH DRILLED INTO ROCK	$\lambda$		I .	WATER AND ELAPSED	TIME AFTER DR	ILLING
	$\underline{\hspace{1cm}}^{\hspace{1cm} \psi}$	<del></del>	NV			
14. TOTAL DEPTH OF HOLE	10' b95			ATER LEVEL MEASURE	MENTS (SPECIF)	n
18. GEOTECHNICAL SAMPLES		UNDISTURBED	NO	AL AUDITO OF COSTS	00750	
10, GEOTECHNICAL SAIVIPLES	DISTURBED	ONDISTORBED	19. 1017	AL NUMBER OF CORE 8	OXES	
20. SAMPLES FOR CHEMICAL	VOC MET	ALS OTHE	R (SPECIFY)	OTHER (SPECIFY	OTHER	(SPECIFY) 21. TOTAL CORE
ANALYSIS		37115			7	RECOVERY
22. DISPOSITION OF HOLE	BACKFILLED MONITORII	NG WELL OTHE	R (SPECIFY)	23. SIGNATURE OF IN	STECTOR /	/ - %
	FIP-1			////		
	<u> </u>	,,,,				
LOCATION SKETCH/COM	MENTS			SCALE: "	'=200'	
FTP-DF	201—		OFFICE"	<del></del>		
690 JAW-6		4 Y -	/ / /	● FTP-DP22		///>
	TR-5	$f_{BG-\epsilon}(0)$		F1F-0F22		
SA-9	19-1	●FT	P-DP02		- Jak	
(6° SI	JMP)	FTP-DP03		ETEMWS	<b>∡</b> (◌)	( / /
• • •	E	JAW-58	1	2 Miles	Jr 💥	$\mathcal{Y} / \mathcal{Z}$
	<b>⊕</b> JAW-62	i i	` \ \ \ \ \ \ \ \ \ \ \ .		Å.	7
68.5	FTP-DP	FTP-DP05.		FTP-DP06	<del>-</del>	
•••	· 11 -	1.4144 50-	FTP-DP23	FTP	-DP13	<u>,                                    </u>
	⊕ JAW-61		/		FTP-DI	Colores and the Colores
● FTP-DF	JAW-60 !		<u> </u>	$\mathcal{F} = \mathcal{F} \mathcal{F} \mathcal{F}$		œseos ·
/( ) <b>Trip-br</b>		TP-DP09	TP-DP25	FTP-DP12/	$\mathcal{H}$	﴿
		M			V 1	
	FTP-DP08	15		FT	P-DP18	
	'D DD07		FTA-99-18		_	
	P-DP07		F I A-99-2(B	"/ OFFERNA	MU.	
	JÁW-8	0		(//\square\)	ł	FTP-DP16
ETERNYS (E)	FTP-DP	11 —			لإ	FTP-DP26
·/ [] [-] [		FTP-DP14		FTP-DP17	i a romano de la comita de la comita de la comita de la comita de la comita de la comita de la comita de la co	
	● FTP-DP10		EREWARTS		A CONTRACTOR OF THE PARTY OF TH	
• '••	··· → ··· → ··		SCESG06	, ● FTP-	NP15	
•	<u>\ii</u>	/	0.020.000		DI 13	1
	● FTP-DP	19 /	بور			
-	<b>↓</b> (1) • · ·	7	- Standard (2007)			
- 4	سلح	<b>,</b>	FTP-DP	20		
. 7	Spring Creek					
of the second	Spring O A	W-01				•••
Tributary	→ J V I	<b>v</b> i				
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PROJECT			<del> · · · · · ·</del> · · · · · · ·	T	HOLE	<del></del>
Ioum AAPES Data C	Vallaction				-TO . Di	ו סר

Descriptions AAFES Data Collection  Town AAFES Data Collec		HTRW DRILLIN	NG LOG	<del></del>		<del>-</del>	HOLE NO.	$\neg$
Decomes yellowish-brown a very still  Clayer Sult (MC) - stiff, bown most, low plastic, trace root hairs  Decomes yellowish-brown a very still  Sity Clay(CL) - yellowery of the yellowing brown, most, low plastic, trace from standing a gray wolling how plastic, trace from standing a gray wolling to complete brown most, low plastic, trace from the plastic plastic, trace from standing brown most, low plastic, trace from the plastic plastic, trace said scarce with the plastic plastic, trace said scarce with the plastic plastic, trace said scarce with the plastic plastic, trace said scarce with the plastic plastic, trace said scarce with the plastic plastic plastic.  Sity Clay(Cla) - stiff, crange/prown, most low plastic, trace black roothing a room standing plastic pl	ROJECT	AADEG DA GIII d		<u> </u>	· · · · · · · · · · · · · · · · · · ·		SHEET SHEETS	ᅱ
Clarge Silt (ML) - Stiff, brown, morst, low plastic, trace root hairs  1 becomes yellowish brown a very stiff  2 becomes yellowish brown a very stiff  3.5  1 10255  1 5.0  2 5.144 (CLAY(CL) - yellowery 6 thirt, yellowed brown, morst, low plastic, frace con  Staining a gray wolflage  4 5.144 (Clayer Silt Two) - very stiff  6 5.144 (CLAY(CL)) - 6tiff orange forman, morst  1 biff plastic, trace gray morting  Trace black mothling a room slawing  1 fill are so carried carried  1 fill are to carri	EV DEPTI		FIELD SCREENING	GEOTECH SAMPLE				-
2 becomes yellowed brown a very stiff  3.5  6 ity CLAY(CL) - yellowery stiff, yellowed brown, most boundary of the face from Staining a gray wolflage the state form the face from the face from the face for the face for the face f	а. Б.	-Classification Conference		e.	t.	PP	h.	4
2 becomes yellowed brown a very stiff  3.5  6 ity CLAY(CL) - yellowery stiff, yellowed brown, most boundary of the face from Staining a gray wolflage the state form the face from the face from the face for the face for the face f		The plastic trace not haves			3.0 -	+->		ŧ
2 becomes yellowish brown a very stiff  3.0 - 7  Sitty CLAY(CL) - yellowery stiff yellowsh brown most, low plastic, freeze non Staining a gray wolflang.  4 Sity Clay (Silt Call) - very stiff orange brown most, low plastic.  4 Trace black northing a room staining white pastic trace black northing a room staining alphase to assar and staining a room staining white pastic trace black northing a room staining a roo	_				ļ	1	1111	ł
Decomes yellowish brown a very still  Sity CLAY(CL) - yellowery still, yellowsh brown, more, low plastic, trace non Staining a gray withing  Wo 7.0  Sity Chayey Silt (ML) - very stiff, orange/brown, most that fine early process, show plastic, trace fine early process, show plastic, trace fine early process, show plastic, trace black mothing a row staining trace black mothing a row staining within to answer same  Sity Sant (Sine to answer same)  Sity Sant (Sin) - chaymach book argues/from though fine to make for same staining solutions, show the same same same same same same same sam		<u></u>			3.5	<del>&gt;</del>		Ī
Decomes yellowish brown a very still  Sity CLAY(CL) - yellowery still, yellowsh brown, more, low plastic, trace non Staining a gray withing  Wo 7.0  Sity Chayey Silt (ML) - very stiff, orange/brown, most that fine early process, show plastic, trace fine early process, show plastic, trace fine early process, show plastic, trace black mothing a row staining trace black mothing a row staining within to answer same  Sity Sant (Sine to answer same)  Sity Sant (Sin) - chaymach book argues/from though fine to make for same staining solutions, show the same same same same same same same sam	1 -	3						İ
Decomes yellowish brown a very still  Sity CLAY(CL) - yellowery still, yellowsh brown, more, low plastic, trace non Staining a gray withing  Wo 7.0  Sity Chayey Silt (ML) - very stiff, orange/brown, most that fine early process, show plastic, trace fine early process, show plastic, trace fine early process, show plastic, trace black mothing a row staining trace black mothing a row staining within to answer same  Sity Sant (Sine to answer same)  Sity Sant (Sin) - chaymach book argues/from though fine to make for same staining solutions, show the same same same same same same same sam		3				}	İ	F
Decomes yellowish brown a very still  Sity CLAY(CL) - yellowery still, yellowsh brown, more, low plastic, trace non Staining a gray withing  Wo 7.0  Sity Chayey Silt (ML) - very stiff, orange/brown, most that fine early process, show plastic, trace fine early process, show plastic, trace fine early process, show plastic, trace black mothing a row staining trace black mothing a row staining within to answer same  Sity Sant (Sine to answer same)  Sity Sant (Sin) - chaymach book argues/from though fine to make for same staining solutions, show the same same same same same same same sam	_	4			1 2-			Ē
Sity CLAY(CL) - yelle very 5th 1, yellows, borown, most, low plactic, frace non  Standing a gray well-long  Who 7.0  Standing brown most, low plactic, trace from subject of trace fine cond, sease.  Why CLAY(CH) - Stiff, orange/brown, most high factic, trace gray mosting trace black mostling a rome standing trace black mostling a rome standing when the conditions a rome standing with the conditions are standing to the conditions of the conditions are standing to the conditions of the conditions are standing to the conditions of the conditions are standing to the conditions of the co	_	الله الله الله		04	5.0 -	-		F
Sity CLAY(CL) - yelle very 5th 1, yellows, borown, most, low plactic, frace non  Standing a gray well-long  Who 7.0  Standing brown most, low plactic, trace from subject of trace fine cond, sease.  Why CLAY(CH) - Stiff, orange/brown, most high factic, trace gray mosting trace black mostling a rome standing trace black mostling a rome standing when the conditions a rome standing with the conditions are standing to the conditions of the conditions are standing to the conditions of the conditions are standing to the conditions of the conditions are standing to the conditions of the co	1 -	becomes yellowish-brown a very 5711		K 7/48			-,	-
Sity Clayer SILTURE) - very staff.  Oranaeth brown morst, low plactic.  Trace Pine sould, trace  Water  Sample  Frace black modbing a rown sharing  Whine to covered source  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  worst, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Reserved.				1 1			loess	Ė
Sity Clayer SILTURE) - very staff.  Oranaeth brown morst, low plactic.  Trace Pine sould, trace  Water  Sample  Frace black modbing a rown sharing  Whine to covered source  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  worst, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Reserved.								F
Sity Clayer SILTURE) - very staff.  Oranaeth brown morst, low plactic.  Trace Pine sould, trace  Water  Sample  Frace black modbing a rown sharing  Whine to covered source  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  worst, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Reserved.		(1) (1) (1) (1) (1) (1)	<u>,</u>					_[
Sity Clayer SILTURE) - very staff.  Oranaeth brown morst, low plactic.  Trace Pine sould, trace  Water  Sample  Frace black modbing a rown sharing  Whine to covered source  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  worst, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Reserved.	7 -	brown most law state love on	<b>34</b> -		7.0	<del>                                     </del>	Till	<u>_</u>
Sity Clayer SILTURE) - very staff.  Oranaeth brown morst, low plactic.  Trace Pine sould, trace  Water  Sample  Frace black modbing a rown sharing  Whine to covered source  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  worst, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Bockook (effect)  Control  Temp Vell is  Sity SAND(SM) - sammed home, arguer frame  whose, fine to mid granual trace clay  Reserved.	•	Staining a gray mothers					, , ,	E
6. Hey Clayer SILT (AL) - very stiff.  Oranges brown mors, low plactic.  Track Fine sand, stage.  8.5  Silty CLAY(CA) - Stiff, orange/brown, more lawy plactic, trace gray more lawy.  Trace black modeling a rown slawing place with the avaired same lay look of same same.  Notice of same same same.  Silty SAND(SM) - same same.  Silty SAND(SM) - same same same.  Silty SAND(SM) - same same same.  Silty SAND(SM) - same same same.  Silty SAND(SM) - same same same.  Silty SAND(SM) - same same same.  Silty SAND(SM) - sa	-							Ė
Sity Chayey Silt(M) - very stiff orange brown morst, low plastic.  Track Fine sould, strate  4 Sity Child (M) - Stiff, orange/brown, most large plastic, trace gray making  trace black mothing a rown shawing  Trace black mothing a rown shawing  Trace black mothing a rown shawing  Water Sample  Fine  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Opin-  Sity SAND(SN) - satimath bose, orange/pass  Most Sity SAND(SN) - satimath bose, orange/pass  North Pass to hild granted trace class  Opin-  Opi	u _:		H5"			7.0	1	þ
Sity SAND (SM) - SAND (SM) - SAND GRAND AND SAND (SM) - SAND (SM) - SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND (SM) - SAND GRAND AND SAND (SM) - SAND GRAND AND SAND (SM) - SAND GRAND AND SAND (SM) - SAND GRAND AND SAND (SM) - SAND GRAND AND SAND (SM) - SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND AND SAND GRAND GRAND AND SAND GRAND	٦ .	-		·		8.0		E
Sity CLAY (CA) - Stiff, orange I brown, most with plactic, trace gray mobiling  trace black mobiling a room stammy  Wilding to coarse season  Notice to coarse season  Sity SAND (SM) - self, mash bose, orange I brown unorst, fine to med grand trace clay  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil	_		<b>↓</b>		-		.;	ŧ
Sity CLAY (CA) - Stiff, orange I brown, most with plactic, trace gray mobiling  trace black mobiling a room stammy  Wilding to coarse season  Notice to coarse season  Sity SAND (SM) - self, mash bose, orange I brown unorst, fine to med grand trace clay  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil	=	buty Clayer SILT CAL) - Very Stiff						E
Sity CLAY (CA) - Stiff, orange I brown, most with plactic, trace gray mobiling  trace black mobiling a room stammy  Wilding to coarse season  Notice to coarse season  Sity SAND (SM) - self, mash bose, orange I brown unorst, fine to med grand trace clay  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil  Bestock refusil	K _	Trace Pine sand becase	1			90		ŧ
Sity SAND(SM) - Satisficated frace clay to be shown of the same of	<b>J</b> -				///	7 8,0		E
Bilty CLAY (CLA) - Striff, orange/prown, most trace black modifing a room stawing  Water Sample FTP- 0P18- 4.0  For Explosives VOC'S Freenil3 Collected 5.0  Iolas/oa T=1205  Temp Vel7 is Silty SAND(SM) - Saft, much bose, orange/pomm nuoist, Pune to mid granted trace clay Boshock refuse  Bechock refuse				la		1		Ė
Bilty CLAY (CLA) - Striff, orange prown, most things placetic, trace gray modeling  trace black modeling a room stawary  Water  10  10  10  10  10  10  10  10  10  1	=			149				F
Sity SAND (SM) - Self-mach bose, cognet band nearly frace clay for the same to make trace clay and trace clay for the same to make trace clay and trace clay and trace clay being to be same trace clay being to be same trace clay being to be same trace clay being to be same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay being the same trace clay and trace clay being the same trace clay being	<i>u</i> =	4 4/45	1	15-140		3.0		Ė
Billy SAND (SM) - SAND AND AND AND AND AND AND AND AND AND		Bity CLAY (CA) - Stiff, orange/brown, mo	57		Word	ļ		ŧ
Billy SAND (SM) - Superior Stange / Bases  Temp Weit is  Temp Weit is  Temp Weit is  Silly SAND (SM) - Superior Stange / Bases  Note that to make granded trace class  Becker (efusion)  Becker	_	plastie, trace girly monthly			Sample			E
Go Explosines VOC'S Freen 113 Collected 5.0  10/as/oz T=1205  Temp Wel7 is Silty SAND (SM) - SAND (SM)	-	trace black mothing a iron stamm			FTP-		·	ŧ
G. HS: Explosives VOC'S Freen 113 Collected 5.0  10/as/oz T=1205  Temp Wel7 is Sity SAND(SM) - Self-mach boxe, organge/bann values, fame to mad granded trace clay one ist, fame to mad granded trace clay Bellett  Replication of the self-wall install trace clay one ist, fame to make granded trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall install trace clay one is the self-wall trace clay o	٦ -	White to coarse some		1	10	4.0		E
G  H5:  Voc's Freen 113 Collected 5.0  10/as/o2 T=1205  Sity SAND(SM)-6-4- mech bose, engage/bans nuoist, fine to nick grand trace clay Bockers refused  Beckers refused  Declarate process  PROJECT  PRO	_	,	1		t-or Explosives			Ė
G  Silty SAND(SM) - Soft, much bose, propage/bose, unorst, fund to mid granded trace class Guevil outsing Guevil outsing bob. C. o. bob. C. lo bos. Grand trace class bob. C. o. bob. C. lo bos. Temp well in state to make the same of the contract of the co					-4-			E
10   Silty SAND (SM) - Self-mach bose, signge/bosen, resist, fine to mid grand trace clay be believed.  Below refused.  Temp Well is  S'-10' by S Gueria prime  To be be 10' by S Gueria prime  To be be 10' by S Gueria prime  To be be 10' by S Gueria prime  To be be 10' by S To be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be be 10' by S To be 10' b								Ē
Temp Well is  Silty SAND (SM) - Soft, much bose organge/bann, nioist, I may to mid granted trace clay  Bestrock refused	લ <u> </u>	, :	Ho.		\$10.00	3.0		F
3. Hy SAND (SM) - Soft, much bose organical trace clay  Bestrock refused  Bestrock r	7			].	10/25/02			E
Bilty SAND (SM) - Soft, much bose, orange/bound, nicist, fine to mid granted trace clay to be a bob @ 10 bgs.  Bestrock refused  Bestrock				ľ	////		:	F
Bilty SAND (SM) - Soft, much bose, orange/bound, nicist, fine to mid granted trace clay to be a bob @ 10 bgs.  Bestrock refused  Bestrock					///	ا . ا ،		F
Bestock refused   Booker   Boo	۹ 📑	Α.		24/1	///	4.0		F
Bestock refused   Booker   Boo	=			1/29	//			F
Bestrock refused HOL / Coll 50.6. Coll 1951		Silty SAND (SM) - Soft, much loose, organge/brown	<b>.</b>	7		-	1 cmp Well is	F
	ות ב	moist , the to med grand trace clay	16-			2.0	Guein outras	Ė,
	• ٧		11100	L	///	HOLENO		74

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HTRW DRILL	ING LOG	C	Ostrict Omaha Dist	rict			HOLE NUMBER
1, COMPANY NAME		2.	DRILLING SUBCO	NTRACTOR			SHEET SHEETS
URS Corporation		1 :	Saberprobe Pl	ains Enviro	nmental Services		1 OF 3
3. PROJECT				4.LOCATION			1
Iowa AAP F.S. Data Collect	ction			Burlingto	n Iowa		
5. NAME OF DRILLER	Zuon			6 MANUEACT	II, IOWA TURE'S DESIGNATION C	E DRILL	
	100					OF DRILL	
	lvig			(200	Probe		
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	A-Roots, M	aciofore:	Sampler	8. HOLE LOCA			
AND SAME CING EQUIPMENT				30	00500,11	′N aa	75851.04'E
		_		9. SURFACE E	ELEVATION /		
				1 6	65,1		
				10. DATE STAF	RTED	11, DATE	<del></del>
			<del></del>	10,24		1	24.02
12. OVERBURDEN THICKNESS					OUNDWATER ENCOUN	1010	24.00
12. CYERBURDEN THICKNESS	14'L					TERED	
	14 be			N	<del></del>		
13. DEPTH DRILLED INTO ROCK	$\mathcal{A}$				WATER AND ELAPSED	TIME AFTER DE	RILLING
	4			NF			
14. TOTAL DEPTH OF HOLE	(1.11)			17. OTHER WA	TER LEVEL MEASURE	MENTS (SPECIF	γ)
	14 09	9		M	•		
18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED		AL NUMBER OF CORE E	IOXES	<del></del>
<del></del>		_				•	
20. SAMPLES FOR CHEMICAL	voc	METALS	OTHE	R (SPECIFY)	OTHER (SPECIFY	ОТНЕВ	(SPECIFY) 21. TOTAL CORE
ANALYSIS	1			- 101 - 011 1/	J. CHILLIAN LOW.	UINER	RECOVERY
						1	- %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING V		R (SPECIFY)	23. SIGNATURE OF IN	SPECTOR /	
	1	FTP-DP/	9		400	L -	
LOCATION OVETOLICO	MENTO				/		
LOCATION SKETCH/COM	MMEN 18				SCALE:	"=200s"	-
● FTP-DF	JAW-62	FTP-DP08 FTP-DP08 FTP-DP11 FTF	FTP-DP03 JAW-58  FTP-DP05 JAW-59 FT DP09  FTD	TP-DP23	FTP-DP12	P-DP187	
·•		<u>\</u>	/	<b>SECUTO</b>	FIP-I	ar 13	
	•	FTP-DP19	/	٠ بر	. second and a		]
•		! ! 1	}				•
•		لرجا		FTP-DP2	20		
4	ak	. استوسر		_			
·- (	Cree's						
of var	Spring 之 人	<b>⊕</b> M-01	l <sup>,*</sup>				
Tributary	→ \						
	Spring Creek	j					
PROJECT		<del></del>	· · · ·	<del>''</del>	<del></del>	HOLE	
Iowa AAP F.S. Data	Collection					FP-I	P19

	HTRW DRILLI	NG	LOG				HOLE NO.
PROJECT	wa AAP F.S. Data Collection	INSPECT	ror (	COVEY			SHEET SHEETS
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS  c.	FIE	LD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	COUNTS	REMARKS h.
-	Silty CLAYCCL) - Stiff, brown, ma low plastic, trace root hours praphics becomes gray w/ orange moth no organics		đ.	е.	f.	2.0	TOP SOIL LOSS
, -				101		4.0	
2 -	trace calcite concretions becomes very stiff			R= 48		6.0	
3	I" fine to med sand seam no root hairs					8.0	^.
4 -	no root hairs		_			80	
5	when to mad to high plastic, trace calcite concretions - finer sand	4				4,5	TILL
6			äs Vie	P.42/	a)	4.0	
1	3.1ty CLAY(CL) - very stiff, gray, no bu placence, trace calcine concrete 4 fine send a arange mothing - becomes orange/prown u/ gray mothing	37 27 S		ingun ti		5.0	
7						40%	
9	Chyty \$167 (114) - very soft orange wrown wil gray mothing, moss, low plastic, trace fine to me found a coloite concretions			R= 49		0.0	
10						60	
	PROJECT  Iowa AAP F.S. Data Collection					HOLE NO.	DPIG

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HTRW DRILLING	G LOG				HOLE NO. FTD-DP19
	SPECTOR	J. Covey	/		SHEET SHEETS  3 OF 3
ELEV DEPTH DESCRIPTION OF MATERIALS a b. c.	FIELD SCREENING RESULTS		ANALYTICAL	-DLOW COUNTS	REMARKS
SAME:	d	е.	//	pp	7111
			Ground		1
		dal	Water Sample FTP-		
// <del>-</del> ]		40/ R:/48	FTP- DP/9-	5.0	
			for		
<u> </u>			VOC'S Freon113		
12 =			Collected		
			10/25/02		7
moust, and to high plastic, trace			T=0905		
fine to med sound a gray mothly  13 - 1" med to coarse sand searce		B=24/			
		1/24	// ,	9.0	
I" med to coarse sand seam			//		Glacial Outnath
, =			//	6.0	Toma Wall in
14 Balus Robers	- <del></del>			0.0	6.0.b. @ 14 bas
		te y			@ bedrock
]		·			@ bedrock Installed Temp well
					Temp well
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PROJECT Iowa AAP F.S. Data Collection	<u></u>	<u></u>	1	HOLE NO.	-DP19

HTRW DRILLI	NG LOG		DISTRICT	ha Distr	rict			HOLE NUMBER
1. COMPANY NAME			2. DRILLIN	1G SUBCO	NTRACTOR			SHEET SHEETS
URS Corporation			Saberp	robe, Pl	ains Enviror	nmental Services		1 OF 4 35-10
3. PROJECT					4.LOCATION			
Iowa AAP F.S. Data Collec	tion				Burlington			· · · · · · · · · · · · · · · · · · ·
5. NAME OF DRILLER	2					URE'S DESIGNATION C	F DRILL	
	PAYTON	11 A				Probe		
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	A-Rods, 1	Macio Co	re 5	ample	B. HOLE LOCA	TION	41 20	
	1				9. SURFACE E	OUTA 1, A /	N ZZ	76145.78'E
						70.6		
	<del> </del>				10. DATE STAR		11. DATE	
					11.70	102	11.	10,02
12. OVERBURDEN THICKNESS		( )				OUNDWATER ENCOUN	TERED	<u></u>
	23	bes .			NA			
13. DEPTH DRILLED INTO ROCK	<u> </u>					WATER AND ELAPSED	TIME AFTER DE	RILLING
	$\psi$				NA			
14. TOTAL DEPTH OF HOLE	121	\- a <			_	ITER LEVEL MEASURE	MENTS (SPECIF	Ŋ
10 OFOTE((1) 10 1) 0 1 1 1 1 1	$L_{0}$	1962	141=15	7.0055	<u></u>	AL ALIMADED OF COST	OVEC	
18. GEOTECHNICAL SAMPLES	DISTURBED	J	UNDIS	TURBED	19. TOTA	AL NUMBER OF CORE E	OXES	
20. SAMPLES FOR CHEMICAL	Voc	METAL	s	OTHE	R (SPECIFY)	OTHER (SPECIFY	OTHER	(SPECIFY) 21. TOTAL CORE
ANALYSIS	700	INC. I'AL		- 01112	C(O) COII 1/	OTTLER (GI LON		RECOVERY
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING	WELL	OTHER	R (SPECIFY)	23. SIGNATURE OF IN	SPECTOR	*
22.0101 00111011 01 11022		\ \sqrt{\sqrt{\color{1000000000000000000000000000000000000			<u> </u>	110		
		_ ~				72		
LOCATION SKETCH/COM	MENTS					SCALE:	" >200	<b>)</b>
,	99-1 SUMP)	TR-1	BG-EX ■ FTP-I JAW	DP03	P-DP02	FTP-DP22		
• FTP-D	7TP-DP07	JAW-80	TP-DP0S	g-•F	FTP-DP25 FTA-99-16 FTA-99-2(6	FTP-DP12	TP-DP18	FTP-DP16 FTP-DP26
	Spring Creek	● FTP-DP	<i>f</i>	: :	FTP-DF		-DP15 HOLE	    
Iowa AAP F.S. Data	Collection						FTP-	DPZO

	HTRW DRILLIN	G LOG		<del></del>		HOLE NO.
PROJECT	wa AAP F.S. Data Collection	SPECTOR \	OVEY GEOTECHEANDLE			SHEET SHEETS
ELEV DEPTH a. b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	COUNTS COUNTS	REMARKS
-	Silty CLAY (CL) - Stiff, brown, moist, low plastice, trace organics a root hours	d.	е.	f.	7.0	Top So. 1
<i>1</i>   11   11   11   11   11   11   11	becomes orange brown a very Stiff w/ trace iron staning + black + gray mottling				5.0	Loess
7			R=69		le.O	
3	bee trace fine to med sand 4				4.0	TILL
4 _	,				le.0	
5		H5-0			5.0	
6						
1						
1						
8 -						
4						
10						
	PROJECT  Iowa AAP F.S. Data Collection	<del></del>			HOLE NO.	20

		HTRW DRILLIN	IG L OG	-		<del>-</del> ·	HOLE NO.
PROJE	CT		NSPECTOR		<del>-</del>		FTP-DPZO SHEET SHEETS
<u> </u>		wa AAP F.S. Data Collection	FIELD SCREENING	GEOTECH SAMPLE	<del>\</del>	T Provi	3 of <b>8</b> 4
ELEV ELEV	DEPTH b.	DESCRIPTION OF MATERIALS c.	RESULTS d.	OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	COUNTS Pro	REMARKS h.
		SAME:	<u> </u>	e	<u> </u>	6.0	T:11
	_					•	Till
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1	( —					5.0	<b> </b>
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	3						ļ
);	1. –					6.0	[
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	且		_				
	Ⅎ	Clayey SILT(ML) - Stiff, orange/brown, moist, low plastic, trace fine to coarse sand a fine gravel					į
1.4	, ‡	moist, low plastic, trace fine to		l		]	ļ <u></u>
13	' 긬	coarse sand a fine gravel				3.0	<u> </u>
	4						<u> </u>
	ㅋ						<u> </u>
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15	∮]					3.0	<u> </u>
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20	]		/		/ /		Ē
<u> </u>		PROJECT	<u>/</u>			HOLE NO.	<u>_</u>
		Iowa AAP F.S. Data Collection			1	HOLE NO.	PZO

	HTRW DRILLIN	IG I OG			· · · ·	HOLE NO.
PROJECT		NSPECTOR				FTP-DRZO SHEET SHEETS
	Iowa AAP F.S. Data Collection		G GEOTECH SAMPLE	Lavine	T	4 OF 4
ELEV DEPT. a. b.	c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	COUNTS DP	REMARKS h.
_	- Clayey SILT (ML) - very staff, light brown moist, low to non-plastic, tree angular limes tone of fine band.		<u> </u>	Ground Water Sample		weathered snake/Till
Z) -			230/	Sample FTP- DP20- 23 For		
ZZ -			R= 36	Fren 113 Collected 11/21/02		
		11.5 × 3		T= 1515		Tamp Wellis
23 - -	Lime Stone Bodexk Refusal	45-0		///		Temp Well is 18-23' 625 b.o.b.@ 23' bgs bedrack
24 -						
75 -						
26 -						,
27 -						
78 -	·					
29						
<u>-</u> 30 -	PROJECT			H	IOLE NO.	

HTRW DRILLII	NG LOG		DISTRIC	т aha Distri	ict			HOLE NU	MBER P-DP21
1. COMPANY NAME				NG SUBCON				SHEET	SHEETS
URS Corporation			Saber	ercbe, Pla	ins Enviror	mental Services		1	OF 4
3. PROJECT					4.LOCATION				
Iowa AAP F.S. Data Collect	io <b>n</b>			1	Burlingtor	n, Iowa			
5. NAME OF DRILLER	1				6. MANUFACT	URE'S DESIGNATION O	F DRILL		
Jetse 1	halvig.				Stot	FOBE			
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	A-Rads,	Macrolo	<u>re 5a</u>	mpler	8. HOLE LOCA		_		
AND SAMPLING EQUIPMENT					<u> 30</u>	0981.84	'N aa	7584	3,51'E
	<del></del>				9. SURFACE E	/			I
					6 8	33,7	44.0475		
· · · · · · · · · · · · · · · · · · ·					10.24		11. DATE	4.00	
12. OVERBURDEN THICKNESS						DUNDWATER ENCOUNT		4,00	
	30'b	rest Vere		- 1	JA				,
13. DEPTH DRILLED INTO ROCK	/			<del> </del>		WATER AND ELAPSED	TIME AFTER D	RILLING	
	$\phi$			1	M	•			
14. TOTAL DEPTH OF HOLE	0-11	- A				TER LEVEL MEASURE	MENTS (SPECI	FY)	
	30' k	90			M	<u> </u>			
18. GEOTECHNICAL SAMPLES	DISTURBED		UNDIS	TURBED	19. TOTA	L NUMBER OF CORE B	OXES		
<del></del>									
20. SAMPLES FOR CHEMICAL ANALYSIS	voc	METAL	s	OTHER	(SPECIFY)	OTHER (SPECIFY)	OTHE	R (SPECIFY)	21. TOTAL CORE RECOVERY
<del></del>	PACKER I ED	MONITORING	-	077.50	(ODEOIDA		_/		- %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING		OTHER	(SPECIFY)	23. SIGNATURÉ OF INS	SPECTOR		/
		FTP-DF	12			4010	$\sim$ C $^{-}$		
LOCATION SKETCH/COM	MENTS					SCALE:	'~200	<b>,</b> '	
FTP-DPC		IR-1		7	OFFICE				
696 JAW- <u>63</u>			) BG−6X	5 /	/ //	FTP-DP22			
SA-99	R-5	$U/H^{-1}$	B4-0/(_	FTP	-DP02			and the second	J 64
(6" SU		~// _	S ETD D	-		→ETEMW5	. (o		
			FTP-D JAW-		1	D SETEMW6(B)	J		
¨'	D JAW-62	/	Ì	. 1	,		X.	$\checkmark$	•••
686	The same of the sa		FTP.	-DP05	● F	TP-DP06	١	1	
		FTP-DP21			TP-DP23	FIP-	DP13		
	<b>⊕</b> JAW-61	1//		•	7		FTP-C	P24	
	JA	W-60		/	ŕ	7 / / / / /		NW3(B) GESG05	
● FTP-DP(	4	EMWA(B)	P-DP09	● FTF	P-DP25 ●1	FTP-DP12	i/i	<b>)</b>	
			_//_				/ /		
	666	FTP-DP08-			/ 18	FTI	P-DP187		• • •
	0.000	<b>Y</b> ]			FTA-99-1 ( <sup>©</sup> FTA-99-2(B)		_	*	
	P-DP07		اللجم	- 1	14-99-2(0)	<b>O</b> FEMALE	70		]
	4	<b>JAW-80</b>				1//>\\			FTP-DP16
FIRMWS(B) -		FTP-DP1	1 ~			FTP-DP17		as a series of	FTP-DP26
	···	<u>^</u> /_F	TP-DP1	4 🗪 🎫	AMWAL .	, . II-JE1/	a Herrican Commence		
	● FTP-DP10				<del>,                                    </del>	<b>ノ</b> ン	o marin		
	••—	• !	1	_ 5	C:SG06	, ● FTP-t	)P15		***
•		● FŢP-DP1	a /						
•		- 'Y [""	4			-			
			)	4	FTP-DP2	20			i
*	aK	وسلوس	_	Sandyon or account of	J	<del></del>			
. \	Spring Cree'	: 		per l					
. Tributary of	Dhina C	<b>⊕</b> M-	-01						
Tributary of	-	;							1
PROJECT	1 1 1	<u> </u>	•	<del>_''</del> _	<del>'</del>	<del>' ' ' ' '</del> '	HOLE	• • •	
							FIP-		1

ł	HTRW DRILL	ING LOC	<del></del>		FTP-DP2
PROJECT	Iowa AAP F.S. Data Collection	INSPECTOR 5	COVEY		SHEET SHEETS 7 OF
ELEV DEPT		FIELD SCREEN RESULTS	ING GEOTECH SAMPLE OR CORE BOX NO.		REMARKS h.
_	Claney SILT (ML) - very stiff brown, moist, low plastic, train root hours + organics becomes light brown to gray orange mottling	ite 1 w/	е.	8	5.0 Fill
2 -	orange nottling		R=148	7.	
<b>5</b> –	6 trace black moltling			6	.0
4 –		H5= NI		Z	2.0
5 -				0.	5
<i>u</i> –	becomes orange/brown		R= 42/	<b>@</b>	5
1 -				2.	0
4 -	And the second s	HSTUD		2.	0
10		39	P- 24/		
4.5	PROJECT  Iowa AAP F.S. Data Collecti			HOLE	TP-DPZI

HTRW DRILLING LOG									
PROJECT	INSPECTOR				FTP-DPZ I				
Iowa AAP F.S. Data Collection  ELEV DEPTH DESCRIPTION OF MATERIALS	3 % 4								
a b. DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS d.	G GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	COUNTS PY	REMARKS h.				
trace fine to coarse sand		R= 148		4,0	7711				
12 =	H5=ND			4,0					
	/ .				Not Enough Sample				
13 -		. 10							
14 =		R= 10/ 48			∵ ⊗ke				
16									
14 -					not enough				
17 - 1					not enough sample				
18		R= 4/8			- - - - - - - -				
19									
اه ا				HOLE NO.					

HTRW DRILLING LOG									
PROJECT	INSPECTOR	C	<del> </del>		FTP-DP21 SHEETS OF				
Iowa AAP F.S. Data Collection  ELEV DEPTH DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	G GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW	7 0. 4				
a b. c.	d.	e.	f.	R	h.	Ŀ			
21 Silty CLAY (CH) - Very Stiff, light brown to gray, moist, med to high plastic, trace orange a black mostling		R=148		4.0	TILL				
23				4.0					
becomes orange/brown				4.0					
27			Ground Water Sample FTP- OP21- 30						
trace fine to med sand, 4 fine gravel		1.	for VOC'S Freen 113 Collected 10/25/02 T=1020	2.00		<del>-</del>			
29 - Backage (chison		K-36e		4.0	Tempwellis as'-30'bis	<del>-</del>			
PROJECT		<u></u> <u>_</u> <u>_</u>		HOLE NO.	b.o.b. @ 30 bas	nel			
Iowa AAP F.S. Data Collection				FTP-	DPZI				

	DISTRICT		· · · · · · · · · · · · · · · · · · ·	F
HTRW DRILLING LOG	Omaha Distr	.i.a		HOLE NUMBER
			7.	FTP-DYCC
1. COMPANY NAME	2. DRILLING SUBCO			SHEET SHEETS
URS Corporation	Saberprobe, Pl	aino Environmental Services	<u></u>	1 OF 3
3. PROJECT		4.LOCATION		····
Iowa AAP F.S. Data Collection		Burlington, Iowa		
5. NAME OF DRILLER		6. MANUEACTURE'S DESIGNATION O	F DRILL	
Tom Payton		Geotrone		
7. SIZES AND TYPES OF DRILLING A - Road - Macro (	an Sourles	8. HOLE LOCATION		
AND SAMPLING EQUIPMENT	erc zwysier	301202 (0'	4/ 22	176297.39 €
<del> </del>		9. SURFACE ELEVATION	/V a.o	x /027/.37E
	·	672,1		
		10. DATE STARTED	11. DATE	
		11.20.07		-7
43 OVERDUDEN TUGUNEGO			11.20	.00
12. OVERBURDEN THICKNESS 19.5' by S		15. DEPTH GROUNDWATER ENCOUNT		./
		18,5 bg 3 durin	reg dril	ling
13. DEPTH DRILLED INTO ROCK		16. DEPTH TO WATER AND ELAPSED	TUME AFTER DRIL	LING /
7		MI		
14. TOTAL DEPTH OF HOLE 19.5 b95	-	17. OTHER WATER LEVEL MEASUREA	MENTS (SPECIFY	)
19,5 695		/VI}		
18. GEOTECHNICAL SAMPLES DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE B	OXES	
20. SAMPLES FOR CHEMICAL VOC META	LS OTHER	(SPECIFY) OTHER (SPECIFY)	OTHER (	SPECIFY) 21. TOTAL CORE
ANALYSIS	-		/ -	RECOVERY
22. DISPOSITION OF HOLE BACKFILLED MONITORIN	G WELL OTHER	R (SPECIFY) 23. SIGNATURE OF INS	PECTOR	%
<b>√</b>		11 1111		
N. N. N. N. N. N. N. N. N. N. N. N. N. N		771011		//
LOCATION SKETCH/COMMENTS	*	SCALE: /	=200°	
FTP-DP01 — IR-1	// <b>//</b> /	OFFICE /		
JAW-63 TR-3 TR-2	4 st	FTP-DP22		
	$BG-\delta$	200		64
SA-99-1	O FIF	-DP02	$ \ell \sim$	
(6" SUMP)	FTP-DP03	TEMW6(B)	X(2) 🚜	1 /
E .	JAW-58		J	$\forall \land \land \land $
<b>₽</b> JAW-62 /		- 1 (7 (1 P)	Υ,	₹ ''' <b> </b>
688	FTP-DP05	● FTP-DP06	<u> </u>	}
FTP-DP21	6	TO DOGO FTP-	DP13	/ 1
	1	TP-DP23	FTP-DP	
JAW-60!	. //	/ / / / / / / / / / / / / / / / / / / /	E SE	V3(B)
● FTP-DP04		P-DP25 ETP.DP12	= 56	£SG05:
	P-DP09	P-DP25 FTP-DP12	17 <b>)</b>	`
	ŢŢ		/ /	
FTP-DP08		FTA-99-16 <sup>th</sup> Feet Least FT	P-DP18 /	
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\			. 1	
● FTP-DP07		FTA-99-2(B)	71	
	1	/// //	~	FTP-DP16 ···
JAW-80 FTP-DP1	14 VL	-///// <b>/</b>		FTP-DP26
arresistration / :	14	● FTP-DP17		
	FTP-DP14 🗬 🔯		Haran Market	
FTP-DP10	_	<b>*</b>	e reco	
· · · · · · · · · · · · · · · · · · ·		ŒSG06 ● FTP-I	DP15	***
- <u>\il</u>	/			
● FTP-DP1	) H	and the second second		
· · · · · · · · · · · · · · · · · · ·	7			•
·· i	<b>,</b>	● <sup>×</sup> FTP-DP20		
Tributary of Spring Creek				
- Creed				
of Spring O	I-01 <sup>^</sup>			
Tribu				
	<u>i i i</u>	<u>i i i i i i i i i i i i i i i i i i i </u>	<u>; ; ;</u>	i i <u>    i    i     i                   </u>
PROJECT			HOLE	
Iowa AAP F.S. Data Collection			ETD-D	722

HTRW DRILLING LOG  HOLE NO.  FTP-DPZZ									
PROJECT	IN	SPECTOR	Covey			SHEET SHEETS  OF 3			
ELEV DEPTH	1	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BEOW	REMARKS			
a b.	- Sulty CLAY (CL) - wery soft has an	d.	e.	f.	COUSTS VSV	h.			
	Moist, low lastic trace				<b>p</b>	Fill			
	Moist, low plastic, trace organics a root hours								
-	- v				1 4	ļ			
					P				
_	·					1			
1	heromes and them as well have								
ι .	becomes orange brown w/ trace fine to coarse same				Φ	TILL -			
-	+								
:	becomes very 61,ff								
3 -					5,0	F			
<u>:</u>									
-						l E			
4 -					5.0	<u> </u>			
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5 -		45=0			4.0	<u> </u>			
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10	PROJECT LOUIS A A D E S. Data Callaction	1			HOLE NO.	DPZZ			
	Iowa AAP F.S. Data Collection				-14-1	UYCC			

HTRW DRILLING LOG  HOLE NO. FTP - DPZZ								
PROJECT	Iowa AAP F.S. Data Collec	<del></del>	INSPECTOR	1. Cover	 1		SHEET SHEETS  3 OF 2	
ELEV DEPT		CRIPTION OF MATERIALS c.	FIELD SCREENIN RESULTS		ANALYTICAL SAMPLE NO.	BLOW COUNTS Y F	REMARKS h.	
	Sitty CLAY (CL moist, low	)-Stiff, brown orange plastic, trace for sand taray mother ry stiff	e,	е,	f.	4.0	Till	
11 -	becomes ve	Sand taray mothly stiff	ng			8.0		
12 -				(0)		8.0		
- 13 -				Rivo		8,0		
- 14 -	becomes =	51.42				4,0		
- 15 -			H5=0			4.0		
-								
16 -					Ground			
17 _					Water Sample FTP- OP22- 20			
18 -					For VOC'S Freen113 Collected			
19	<del></del>	very soft, brown, we wet astic, trace fine to		R=12/12	11/21/02 T=1615	φ		
20 =	trace angular  Bestock Refu			1		ø	Temp Well is 15'-19.5' 625 D.o.b. @ 19.5'693 C bedrock	
رد	1	PROJECT Iowa AAP F.S. Data Collection		<u> </u>		HOLE NO.	-DPZZ	

HTRW DRILLI	NGLOG		ткист Omaha Distric				HOLE NUMBER
<del></del>	10 200				<del></del>		1-TV-DD23
1. COMPANY NAME			RILLING SUBCONT				SHEET SHEETS
URS Corporation 3. PROJECT	·····				montal Services	·	1 1 5 7
Iowa AAP F.S. Data Collect	<b>.:</b>			LOCATION	-		
5. NAME OF DRILLER	.1011			Burlington	n, Iowa URE'S DESIGNATION	05.00"	
Jon PA	1501		J°	_		OF DRILL	
7. SIZES AND TYPES OF DRILLING		11 4	7 11 10		Probe		
AND SAMPLING EQUIPMENT	A-140015	MacroCore	Sample 8	HOLE LOCA		-1.	
	<u> </u>			30	0963.93	N 23	276105.72'E
				SURFACE E	/		
					<u> 77.4                                   </u>		
	· · · · · · · · · · · · · · · · · · ·			DATE STAR	0.01	11. DATE	9.01
42.07(202)1005117110141502							0.00
12. OVERBURDEN THICKNESS	25'bgs	•			DUNDWATER ENCOU		
12 DEDT LDS# 5D NTO DOOK	$\frac{2}{2}$	>		21.0	DAS AUFINA WATER AND ELAPSE	arilling	<u> </u>
13. DEPTH DRILLED INTO ROCK	$\mathscr{A}$		116	_	WATER AND ELAPSE	IIME AFTER D	KILLING
14. TOTAL DEPTH OF HOLE		<del></del>	-	$\mathcal{N}_{\mathcal{A}}$	TED LEVEL MEADURE	MENTO (ODE	
IT. TOTAL DEPTH OF HOLE	25 bas		1"	OTHERWA A	TER LEVEL MEASURE	MENTS (SPECIF	- <b>T</b> )
18. GEOTECHNICAL SAMPLES	DISTURBED	<del></del>	NDISTURBED	<u>_</u>	AL NUMBER OF CORE	POVEC	
M-	DISTORBED	'		19. 1014	TOWIDER OF CORE	DUXE2	
20. SAMPLES FOR CHEMICAL	voc	METALS	OTHER (	SPECIFY	OTHER (SPECIF	Y) OTHER	R (SPECIFY) 21. TOTAL CORE
ANALYSIS						.,	RECOVERY
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WE	LL OTHER (S	SPECIFY	23. SIGNATURE OF I	ACTOR A	<u> </u>
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LOCATION SKETCH/COM	MENTS				SCALE:	"=200	
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!	IR-5			DP02			66.
SA-9 (6" SL		~ /		·	>HELPHANNS	(4)	
(6 30	,mr)		TP-DP03 AW-58		ETEMW6(B)		^ <i>1</i>
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•	D JAW-62	<u> </u>		. F	TP-DP06	4	1
183		FTP-DP21	FTP-DP05	<del>&gt;</del>	فيها المرام ومستحب واورو	P-DP13	"
••	A JAW-61		JAW-59 FT	P-DP23		FTP-D	)P24
		.w-60!	1	,			MVS(E)
● FTP-DP	-04 <b>3</b>	EMWA(B)	A 570	-DP25	7 / / / /		CESCOS
	<b></b>	Y FTP-D	P09	-DP25	FTP-DP12/	W.	<i>〉</i>
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	****	FTP-DP08		- A	S grif ger 9,5	TP-DP187	,,
-		<b>Y</b> ] 与	<u>/</u> €	TA-99-1	. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
	P-DP07			I A-99-2(B	O TEMWA		
	4	D JAW-80	Ŋ :			\	FTP-DP16
	autorio de la companya della companya della companya de la companya de la companya della company	FTP-DP11	<u></u>			,	FTP-DP26
		<b>→</b>		(	FTP-DP17	مستسيست والمستان	7
		dr	DP14 <b>●             </b>		$\nearrow$	and the second second	·
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			1 56	SG06	FIF	-DP15	
	(	● FTP-DP19 /		-6	and the second		,
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		الحال		FTP-DP	20		
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Tributa	Spring Creek	;					1
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PROJECT						HOLE	
Iowa AAP F.S. Data C	collection					I	2-0072

HTRW DRILLING LOG  PROJECT  IOWA AAP F.S. Data Collection  ELEV DEPTH a DESCRIPTION OF MATERIALS C. SHEET C. SHEET C. SHEET C. STITY CLAY (CL) - VETY Stiff, light brown, Worlst, low plastic, trace root wars.  SITY CLAY (CL) - VETY Stiff, light brown, L. SIOW FILL  BLOW SAMPLE NO. COUNTS REMARK OR COE BOX NO. I. SAMPLE NO. I. SAMPLE NO. I. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. II. SAMPLE NO. III. SAMPLE NO	4 (s
Silty CLAY (CL) - Very stiff, light brown, worst, low plastic, trace root hours.  Silty CLAY (CL) - Very stiff, light brown, Sample No. Counts L. Silty CLAY (CL) - Very stiff, light brown, Sometimes of the counts	KS .
worst, low plastic, trace root hours.	
becomes stiff	
Decomes Stiff	‡ - - -
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PROJECT HOLE NO.  Iowa AAP F.S. Data Collection FTP-DPZS	

HTRW DRILLING LOG	FTP-DP23
PROJECT  Iowa AAP F.S. Data Collection  INSPECTOR  J. Covey	SHEET SHEETS  3 OF 4
ELEV DEPTH DESCRIPTION OF MATERIALS FIELD SCREENING GEOTÉCH SAMPLE ANALYTICAL OR CORE BOX NO. SAMPLE NO. OR CORE BOX NO. SAMPLE NO.	BLOW REMARKS
S. Hy CLAY (CL) - stiff orange/brown, noist, low plastic trace fine to coarse sand of fine grave a gray mothling  3.0	P TILL
12 = 1" seam w/ some grave!  Rico 3.0	>
becomes very stiff	7
H = 5.0-1-	7
16 = 45-0 6.0 -i	
	.0
becomes stiff	
19 = bec 2 20 = 2	
	FTP-DP23

HTRW DRILLI	NG LOG				HOLE NO.
PROJECT  Iowa AAP F.S. Data Collection	INSPECTOR	Covey			SHEET SHEETS
ELEV DEPTH DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS			DLOW-	REMARKS
a b. c.	d.	e.	f.	PP	h.
- SAME: - w/ some fine sand				1 2.0	TIII
1 1 20 1 20 1					
				120	
21 = 5.1ty SAND(SM) loose orange/ brown, moved wet, fine to med grained wet, fine to			Ground Water	3.0	
brown, march wet, fine to			Sample		
The state of		1001	FTP- OP23- 25 For	<b> </b> ,	
27 - S. Ity CLAY(CL) - very stoff	_	10-%	25	6.0	
21 = 5.1+1/CLAY(CL)- Very Staff orange brown, moist, bus plassic, fine to course same	,	K 760	Explosives	,	
plaistic, fine to course sure	√	1	VOC'S		
]			Freonis	6.0	
13			Collected 11/21/02		
]			T= 1545		
		İ	11/22/02	90+	
1 24 =			T= 1315 Duplicate	ł	1
]			10 (voc's)	1	
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PROJECT  Iowa AAP F.S. Data Collection				HOLE NO.	-DP23

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HTRW DRILLI	NGLOG	DISTRICT	• ,			HOLE NUMBER	
	NO LOG	Omaha Distr				FIN-DY	24
1. COMPANY NAME		2. DRILLING SUBCO				SHEET :	SHEETS
URS Corporation 3. PROJECT		Saberprobe, Pl	ains Environme	ntal Services		1	2_
Iowa AAP F.S. Data Collec	tia		4.LOCATION				
5 NAME OF DRILLER			Burlington, Ic	) wa 'S DESIGNATION OF E		· · · · · · · · · · · · · · · · · · ·	
To I	aylon		I		JRILL		
7. SIZES AND TYPES OF DRILLING	1911		8. HOLE LOCATION	robl		<del></del>	
AND SAMPLING EQUIPMENT	4 rad, Macrol ore	Sampler					,
		<del></del>	9. SURFACE ELEV	138,78'N	<u>aa 70</u>	<u> </u>	1 E
		<del></del>		_			
			10. DATE STARTED	1,53'	1. DATE		
			11.20.0	7.	11.20	07	
12. OVERBURDEN THICKNESS	<del></del>	··		OWATER ENCOUNTER	MI W	100	
				293 Sus		Land 11 10	2
13. DEPTH DRILLED INTO ROCK	F . 1 +	110	16. DEPTH TO WATE	ERAND ELAPSED TIM	AE AEDED DOIL	INC.	<del>/</del>
	(D) / 1 1945	42(	10.02. 11.1011.	IN THE CENT CED THE	TE AIGEN DRIE	LING /	
14. TOTAL DEPTH OF HOLE	- 1 /		17. OTHER WATER	LEVEL MEASUREME	NTS (SPECIEY	<del> </del>	
	7.0' bas				MIO (OF LOR 1)	•	
18. GEOTECHNICAL SAMPLES	DISTURBED J	UNDISTURBED	19. TOTAL NU	MBER OF CORE BOX	(ES		
			10.1011.211	mozit or objection			
20. SAMPLES FOR CHEMICAL	VOC META	LS OTHER	R (SPECIFY)	OTHER (SPECIFY)	OTHER (S	SPECIFY 21 TO	TAL CORE
ANALYSIS				1		RECO	VERY
22. DISPOSITION OF HOLE	BACKFILLED MONITORIN	IG WELL OTHER	R (SPECIFY) 23.	SIGNATORE OF INSPI	ECTOR		%
·				11:104			
LOCATION OVETONICO				24 W.J.			
LOCATION SKETCH/COM	IMENIS			SCALE: "	'مهد-		
FTP-DI	204		OFPICE /	······	· · · · · · · · · · · · · · · · · · ·		
		// Lg/	OFFICE /	•			<b>/</b>
	TR-2	BG-6X) /		FTP-DP22			
SA-	10-1 Reg_16-0		P-QP02		Julius Julius	// }	64.
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		FTP-DP03 JAW-58	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	EIEMW6(B)	$\mathcal{N} \cdots \nearrow_{\mathcal{N}}$	<b>\</b> / /	
	⊕ JAW-62			$X \subseteq I / X$		1	••
			€ FTP-	DP06 \ \\	<u>.</u>	ſ	
	FTP-DP2	FTP-DP05	<del>}</del>	FTP-D	P13	]	
	A JAW-61	- 0711-03-	FTP-DP23		FTP-DP	24	
·• ( )	JAW-60	1	/ )			(B(B)	
● FTP-DI		FI	P-DP25	/.// /	= 50	<b>25605</b>	
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	P-DP07	5	FTA-99-16 5 FTA-99-2(B)		ا جر	ſ	
			777	O ETEMWA	'()	1	
	JAW-80	• //		//\rightarrow\formall_1		● FTP-	DP16
SIZMVIS(B) -	FTP-DP	11		7 7 C	٠٠.	FTP-	DP26
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••	i	<i>.</i>	● FTP-DP20				
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PROJECT		<u> </u>		<del></del>	<u> </u>	<u>i i .</u>	
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Iowa AAP F.S. Data C	Collection			<b>š</b>	ETD-	カレフノノ	1

HTRW DRILLING LOG  HOLE NO. FTP-DP24									
PROJECT	owa AAP F.S. Data Colle		INSPECTOR	Lovey			SHEET SHEETS	1	
ELEV DEPTH a. b.	1	CUON  CRIPTION OF MATERIALS  c.	FIELD SCREENING RESULTS	G GEOTECH SAMPLE OR CORE BOX NO.			REMARKS	+	
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		estamment + black		101			Till	Ė	
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7 -					Ground			F	
					Sample FTP-			E	
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4 -					For Explosive	}		F	
					VOG'S	1		F	
-			H5-0		Freen113			E	
5 -			H-S-U		Collected	3.6		E	
-					T=1350			E	
-	wet			081	11/24/03		Charlana	F	
6 <del>-</del>	Clargey SILT /2	reathered shale		1/2/0	//		weathered	Ł	
	white	reathered shale,		1,1 10			weathered bedrock	Ė	
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		PROJECT Iowa AAP F.S. Data Collection				HOLE NO.	D- DP24		

HTRW DRILLING LOG	DISTRICT	• ,		HOLE NUMBER		
······································	Omaha Distr			PIP-DP25		
1. COMPANY NAME	2. DRILLING SUBCO					
URS Corporation						
3. PROJECT		4.LOCATION				
Iowa AAP F.S. Data Collection		Burlington, Iowa				
5. NAME OF DRILLER		6. MANUFACTURE'S DESIGNATION O	F DRILL			
Tom Paryton		Geotrobe				
7. SIZES AND TYPES OF DRILLING A. Rods, Macrola	re Sampler	8. HOLE LOCATION		-		
AND SAMPLING EQUIPMENT		300876,76	N 227	6084.78'E		
		9. SURFACE ELEVATION	•			
		674,9				
		10. DATE STARTED	11. DATE			
		11,20,06	11.20.	50		
12. OVERBURDEN THICKNESS		15. DEPTH GROUNDWATER ENCOUNT	TERED	/		
20 by		20' bas durin 16. DEPTH TO WATER AND ELAPSED	ra dri	lling		
13. DEPTH DRILLED INTO ROCK			ME AFTER DRILL	ING		
Ψ		NA		•		
14. TOTAL DEPTH OF HOLE		17. OTHER WATER LEVEL MEASUREM	MENTS (SPECIFY)			
22 1295		Mt				
18. GEOTECHNICAL SAMPLES DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE B	OXES			
20. SAMPLES FOR CHEMICAL VOC META	LS OTHER	(SPECIFY) OTHER (SPECIFY)	) OTHER (S			
ANALYSIS			, , -	RECOVERY %		
22. DISPOSITION OF HOLE BACKFILLED MONITORIN	IG WELL OTHER	(SPECIFY) 23. SIGNATURE OF IN	FEGTOR	· · · · · · · · · · · · · · · · · · ·		
X		4.11/2	1-1	$\prec$		
LOCATION SKETCH/COMMENTS	-	SOLIE				
LOCATION GRETCH/COMMENTS		SCALE:	"~200'			
FTP-DP01	// <b>[</b> 4//	OFFICE /	بر السر			
JAW-63 - TR-3 TR-3	9 7	● FTP-DP22		// <b>/</b>		
IR-5 IR-2	BG-E			64		
SA-99-1	● FTF	-DP02		/ / / · · · · · · · · · · · · · · · · ·		
(6" SUMP)	FTP-DP03	• HEMWEB	<b>∞</b> (⊙)(	1 /		
E .	<b>JAW-58</b>	1 Fillian	) <del>~</del> ~	Y / /		
⊕ JAW-62	1	1 (7/1/27)	χ	7		
	FTP-DP05	FTP-DP06	4			
FTP-DP2	E	TP-DP23	-DP13	/		
		7 - 1 - 1	FTP-DP2			
JAW-60	< 77 ×	/ ///		sens ···		
FTP-DP04	<b>_</b> • FT	P-DP25 FTP-DP12	11 -5			
	TP-DP09		// <b>/</b>			
OF DEED DOOR			P-DP18 1	·= •		
FTP-DP08	カール ニン			¥		
● FTP-DP07		FTA-99-1(B) C FTEMWA	~ 1			
	<del></del>		<u> </u>			
JAW-80		-// <i>//</i> / ****	j.	FTP-DP16 FTP-DP26		
FTP-DP	11 —	● FTP-DP17		7 111-5120		
	FTP-DP14		a Herman			
● FTP-DP10			parameter of the second second second second second second second second second second second second second se			
***************************************		©SG06 ● FTP-	DP15	·		
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● FTP-DP	ia /	***		i		
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··.	<b>,</b>	● FTP-DP20				
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of Spring Civit	A-01 <sup>*</sup>			1		
Tributary of Spring Creek	n-v I					
PROJECT		1 1 1 1 1 1 1	HOLE			
Iowa AAP F.S. Data Collection		,	-TD- DI	22-		

<u> </u>	HTRW DRILLIN	IG LOG				HOLE NO.
PROJECT	1	NSDECTOR	<b>\</b>			SHEET SHEETS  OF 4
ELEV DEPT a. b.		FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	COUNTS	REMARKS
	- Silty CLAY (CL) · Stiff brown, moist, low plastic, trace root hours a organics	l a	е.	f.	P P	Top Soil
_					3.0	'
	becomes orange/brown					F
١ -	4	1			3.0	[ <u> </u>
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-	<u> </u>				, _	
2 -	<u>-</u>		0.1.01		4.0	_
	3		R=60/		<u> </u>	ļ <u>‡</u>
_	becomes very stiff		· \ /(al)		5.0	
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	PROJECT Iowa AAP F.S. Data Collection		······································		HOLE NO.	)P25

	HTRW DRILLIN	GLOG				HOLE NO.
PROJECT		ISPECTOR .				FTP-DP25
Iowa AAP F.S. Data Co		FIELD SCREENING	GEOTECH SAMPLE	- Lavaranna ar	1	3 of 4
a. b.	e. vey 5tiff	RESULTS	OR CORE BOX NO.			REMARKS h.
	(CH)-hard orange/boxon la plastic, trace fine sand a gray matting es hard  with orange mothers			12	8.0	TILL
	range/brain w/gray		R=1001		810	
13 -	J				8.0	
14					8.0	
15 -					80	
17						
18 -				Ground Water Sample		
19 =				FTP- DP25- 22 tor Explosives VOC'S		~e :
10				Freen 113 Collected 11/22/02 T= 1335 T= 1545		
	PROJECT			ברני	HOLE NO.	
	Iowa AAP F.S. Data Collection				FTP-1	UY75

	HTRW DRILLII	VG L OG				HOLE NO.
PROJECT		INSPECTOR		1		SHEET SHEETS
ELEV DEPTH	wa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	FIELD SCREENING	G GEOTECH SAMPLE		BLOW	H OF H
a b.	SASilty SAND(SM)-loose, orange/brown	RESULTS d.	OR CORE BOX NO.	f.	COUNTS	h.
] =	SASilty SAND(SM)-1005E, orange/brown wet, fine grained			Ouplicate 11 (vocs)		7111
-	Clargey SILT (ML) - very stiff, orange brown, moist, low plastic, trace fine to coarse sound	7		<b>*</b>		
21 =	fine to coarse some			(Freen 113)		
21 -					7.0	
-						
				Y / /	7.	Temp Well's
27-	Bedrek refusul		<del> </del>	-/-	7,0	17-22 625
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	PROJECT			1	HOLE NO.	
	Iowa AAP F.S. Data Collection				FTP-	DP25

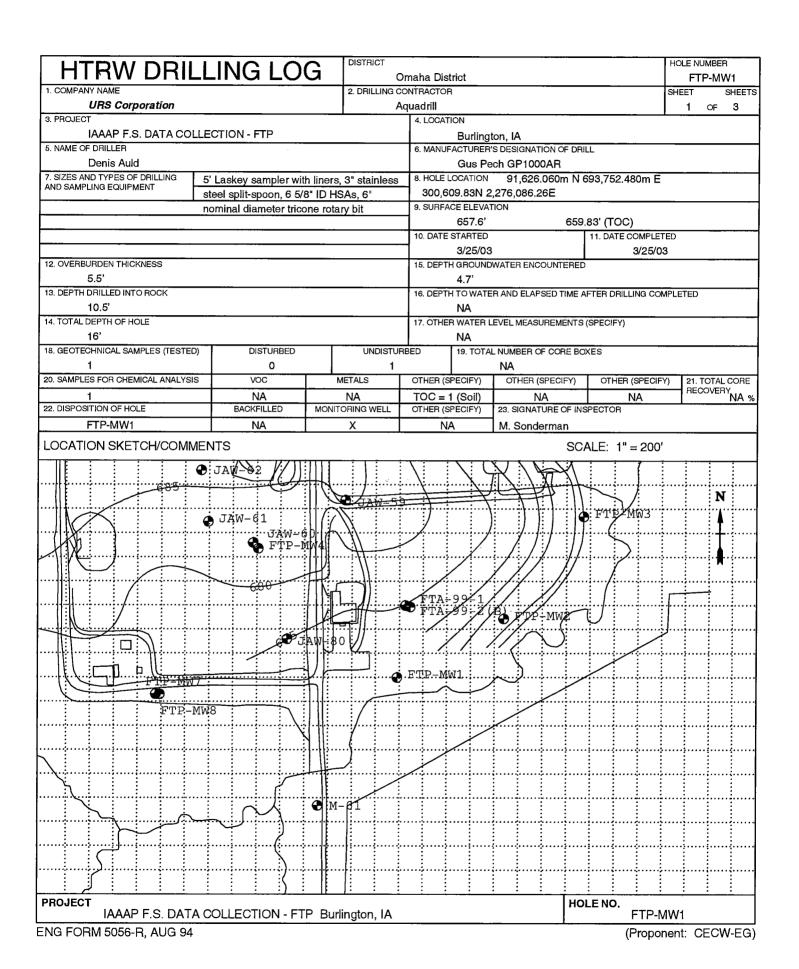
HTRW DRILLI	NG LOG	DIS		ict		* .	HOLE NUMBER
1. COMPANY NAME							SHEET SHEETS
URS Corporation		1			nmental Services		05
3. PROJECT		1 00	ourprood, 11	· · · · · · · · · · · · · · · · · · ·	internal per vices	<del>-</del>	7
Iowa AAP F.S. Data Collec	tion				n Iowa		
5. NAME OF DRILLER						OF DRILL	<del></del>
	MEANY NAME  2 DRILLING SUBCONTRACTOR  SHEET  JAKAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  A LOCATION  SAAP F.S. Data Collection  SAAP F.S. Data Collection  ME OF DRILLING  SAAP F.S. Data Collection  A LOCATION  SAAP F.S. Data Collection  SAAP F.S. Data Collection  A LOCATION  SAAP F.S. Data Collection  SAAP F.S. Data Collection  A LOCATION  SAAP F.S. Data Collection  SAAP F.S. Data Collection  SAAP F.S. Data Collection  A HOLE LOCATION  3006 86, 27 /N 22766 / 7  3006 8						
	1 1 5 1 11	<u> </u>				<del>-</del>	
AND SAMPLING EQUIPMENT	4 - Kent, 4	flight AL	igerz			44 22	766 1712
				3 OUD5405.5	00686, a 1	<u> </u>	16611.1d E
		<del> </del>		_	^ '		
						T	
							- 07
40.04500100511711014150					<del></del>		-5.00
12. OVERBURDEN THICKNESS	الدر			τ 4	DUNDWATER ENCOU	NTERED	
				<u> </u>			<del></del>
13. DEPTH DRILLED INTO ROCK	9'		j	16. DEPTH TO	WATER AND ELAPSEI <b>1</b>	O TIME AFTER D	RILLING
		<del></del>		<u> </u>	<u> </u>	<u> </u>	
14. TOTAL DEPTH OF HOLE	131 h-	4	Ì	17. OTHER WA	TER LEVEL MEASUR	EMENTS (SPECI	FY)
		<u> </u>				·	
18. GEOTECHNICAL SAMPLES	DISTURBED '	·   UI	*DISTURBED		AL NUMBER OF CORE	BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	Voc	METALS	OTHER	(SPECIFY)	OTHER (SPECIF	Y) OTHER	
ANALTSIS					1	. / -	RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WEI	L OTHER	(SPECIFY)	23. SIGNATURE OF	ISPECTOR .	/
	į į	$\searrow$	1		Lill to	## C	
LOCATION SKETCHICON	AMENTO	7			Shut I		
LOCATION SKETCH/COM	MINIENIS				SCALE: 1.	-200	
FTP_N	P01—			ATTOTAL .		<i>'''</i>	
			<u> </u>	GFFICE	/		<b>\</b>
		TR-2 FG-	-eX) /		FTP-DP22		///
	版 <b>写</b> _IE-5	$U/A^{-2}$		P-DP02			64
\$	(	~/	1	<b>}•→•••</b>	>EEEMWS	Co	
				/	ELEMINE(B)		へ <b>!</b>
• • • •	A LAW CO		\	1			<b>\</b>
605	D JAVI-02		\	<u> </u>	TP-DP06	$\mathcal{H}$	1
				<u></u>	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		
•••\	- 1414.04		JAW-59	TP-DP23	TO THE		) A
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		W-60		/	$V = I \cap I$		SCESCOS
	-04		Pna FT	P-DP25	FTP-DP12	- //	<i>\</i>
			\\\ \\		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	11 1	
	<del>-686</del>	ETP DOO	<b>7</b> !			TP-DP18 1	:
	•		Ji 🗻	FTA-99-15		7	¥
<b>●</b> F1	「P-DP07			FTA-99-2(B		7	,
					BIBMAN		
	<b>ب</b> ر	JAW-80	Í.			)	FTP-DP16
ELEMNIB(B)	area market	FTP-DP11	_		FTP-DP17		FTP-DP26 ···
-/ L-/L -/L>		→ FTP-		Particial	) I I -DE I/	34	·•-
	♠ FTP_DP10		- Table		$\mathcal{I}$	,	
·· ->··->·		. !	- E	escene -	A 570	LDD45	·•-
•		<u> </u>			<b>—</b> 1 1F	- <b>-</b>	
	•	FTP-DP19		٠٤٠			
•		! 1		January Januar			·
•		i/	.7	● <sup>2</sup> FTP-DP	20		]
*	-aK	-	-				
• 💆 .	Spring Cles		-				
- hutary of	Shina C	<b>● M-</b> 01					İ
Juna	spring Creek						
		<u> </u>					
PROJECT						HOLE	2-777/2
Iowa AAP F.S. Data (	'ollection					レフレ	1-11/1/2

		HTRW DRILLII	N	GLOG				HOLE NO.
PROJE			-	PECTOR	Λ			FTP-DPUD SHEET SHEETS
	DEPTH	wa AAP F.S. Data Collection  DESCRIPTION OF MATERIALS	_	FIELD SCREENING	GEOTECH SAMPLE	ANALYTICAL	BLOW	2 of 4 REMARKS
a	ъ.	c.		RESULTS d	OR CORE BOX NO.	SAMPLE NO. f.	COUNTS g.	REMARKS h.
	=	Silty CLAY (CL) - brown, med Stiff, moist, low plastic						See
		my tooks i, to a play site	_				1	FTP-DP16
١,	∄							For
'	=							FTP-DP/6 for description of materials
			ļ			<del>!</del>		0, 1, -1, -1,
	=				}	Í		!
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	긬							<u> </u>
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ì	目							<u> </u>
	4						ĺ	Ė
10	=							ŧ
0		PROJECT	_				HOLENO	<u> </u>
		Iowa AAP F.S. Data Collection					HOLE NO.	D26

		HTRW DR	RILLIN	G LOG		<del></del>		HOLE NO.
PROJECT IOV	wa AAP F.S. Data Collec	tion	IN	SPECTOR ,	Covey	/		SHEET SHEETS
ELEV DEPTH a. b.		RIPTION OF MATERIALS c.		FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW	REMARKS h.
11 11 11 11 11 11 11 11 11 11 11 11 11				d.	е.	f	R.	SEEFTPDPK fordescription of materials
17								
13 -								
15 -	Linustone	ed Shada						Bedrock
\( \lambda = \frac{1}{11} \rightarrow \frac{1}								
19								
10		PROJECT  Iowa AAP F.S. Data C	Collection				HOLE NO.	DP-210

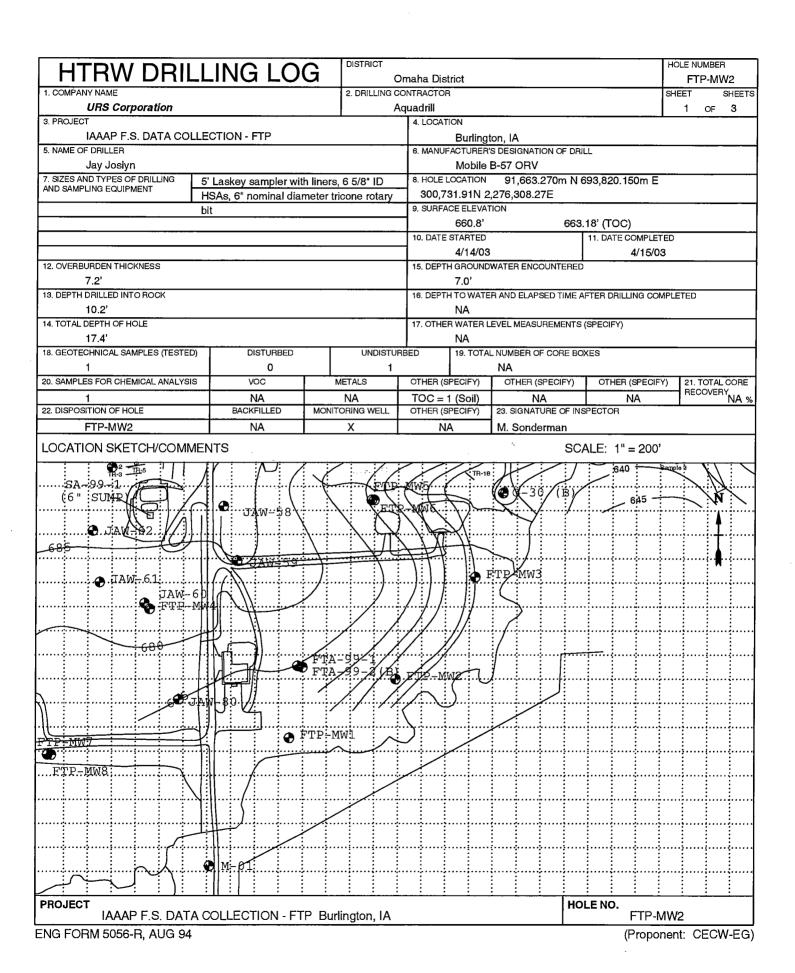
		HTRW DR	ILLIN	G LOG	<del></del>		<del> </del>	HOLE NO.
PROJECT	wa AAP F.S. Data Colle	ection	INS	SPECTOR J	Covey			SHEET SHEETS  OF 2
ELEV DEPTH a. b.		SCRIPTION OF MATERIALS	I	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW	REMARKS
71 -	BAME'	с.		d.	е.	Ground Water Sample FTP- OP26- 23 For Explosives VOC'S Freen113 Collected	R.	h.
73				-,		11/a5/0a T= 1000 11/a6/0a T=0945		Temp Well is 18'-23' 695 b.o.b. @ 23' bgs
24								
75								
24-								
17								
28 -								
30								
		PROJECT  Iowa AAP F.S. Data Co	ollection			I	HOLE NO.	OP HO

**Monitoring Well Installation** 



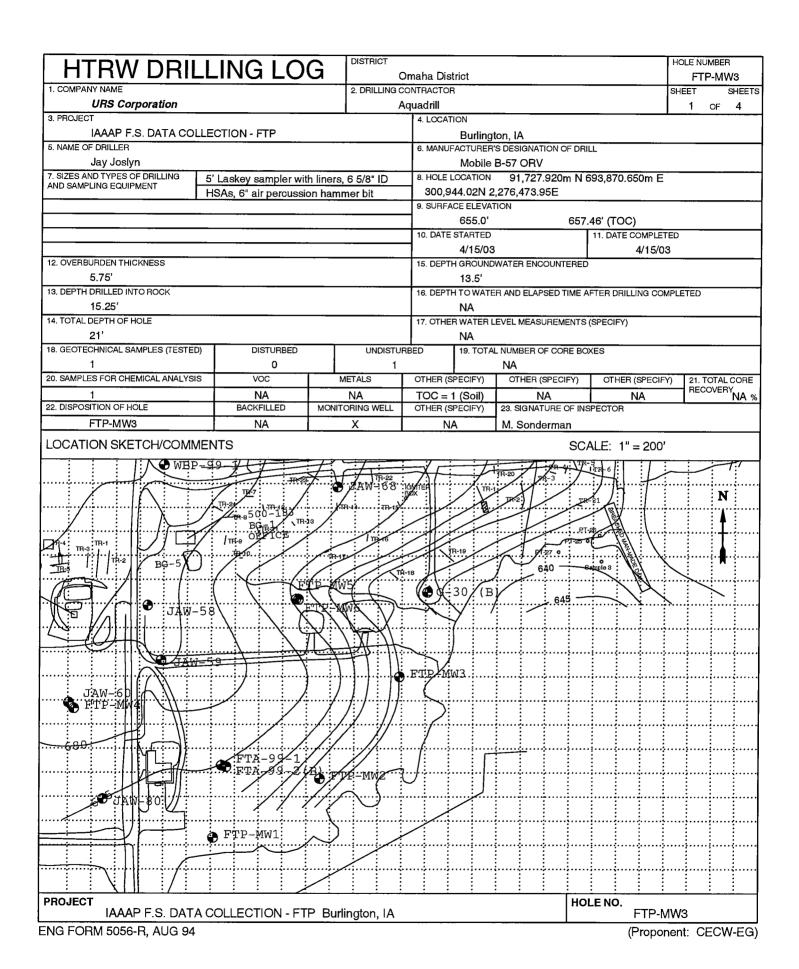
		D. (ILL)  10 L00	(CONTINUATIO	N SHEET)					FTP-MW1
DJECT	IAAAP I	io. Dana October 1 11	INSPECTOR						SHEET SHI
- 1	Burlingt	on, iA	M. Sonde		DIE !	ANALYTICAL	· .	Т	2 OF 3
LEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX		SAMPLE NO.	BLOW COUNT		REMARKS
(a)	(b)	(c)	(d)	(e)		<b>(f)</b>	(g)		(h)
657.6	0 =	Sandy CLAY (CL) - Soft, moist, brown and dark brown, low plastic, fine-graine Sand, with organics	d					Glacial Ti	II
		Sand, with organics	<u> </u>						
								BG = Bad	ekaround
656.6	1 -		İ					1	athing Zone
000.0	٠							R = Reco	
- 1								T = Time	•
	_	With iron staining	BG & BZ			Ì			
	=		PID = 0						
655.6	2					1			
							NA		
}	_	Becomes dark brown to black							
İ	$\exists$								
654.6	3_							ļ	
ŀ	$\exists$					İ			
	=	Docomos dark arey blook and arey							
	$\equiv$	Becomes dark gray-black and gray mottled, low to medium plastic							
653.6	4	•							
053.0	*=				///	TOC =			
				Geo		1,6			
	<b>.</b> ∃							T = 0950	
<del> </del>	¥ =						Laskey	▼ ATD	
652.6	5							R = 55/58	
ĺ	$\equiv$								
	=								e at 5.5' bgs.
	≕	LIMESTONE - Light gray, weathered		}			1	Bedrock	
651.6	6			F	丑			Drilled out rock.	with augers to
	$\exists$			ļ	$\Box$			TOOK.	
	=			-					
					工				
650.6	, 🗆			-	$\dashv$				
0.000	′∃				$\neg$	1		Advanced	augers to 7.0'
	=			-				bgs. Ther	switched to air
	$\exists$			<u> </u>				rotary. Air pressu	re = 75 psi
				ļ.	$\dashv$	-		Rig hydrau	ılic pressure =
649.6	88			}				600-700 Ib	os.
	$\exists$			F					
	$\exists$			F	Д				
	ヸ			Ė	$\Box$		1		
648.6	9_=			È	$\Box$				
	$\exists$			-			ļ		
ļ	=			F	$\exists$				
	$\exists$			-	$\dashv$				
	<b>1</b> ,∃						•		
347.6   <b>JECT</b>	10		1				HOLENO	<del></del>	<del></del>
	ΙΔΔΔΕ	F.S. DATA COLLECTION - FTP Burlin	acton IA				HOLE NO	FTP-N	N 8 / 4

DJECT		<del></del>	CONTINUATION	·			·	FTP-MW1	
JJECI	IAAAP I Burlingt	.o. Data occidental	M. Sonde	rman				SHEET SH	
	Dannige	on, iza	FIELD SCREENING		ANALYTICAL		Τ	3 OF 3	_
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.			REMARKS	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	[	(h)	
647.6	10 —	SAME: LIMESTONE - Light gray, weathered					Bedrock		
	=	weathered			1		Logged fr	om cuttings	
	-		1	ļ <del>                                    </del>			•		
	=								
646.6	11	Becomes weathered, with brown Clay			<b> </b>				
					]		Drilling be	ecomes easier.	
	=				1				
	=			<u> </u>					
	=				į i				
645.6	12			<del>  -   -</del>					
i	=								
	=								
	=			<del>                                     </del>					
	=								
644.6	13	Becomes Shaley, gray to dark gray, sof	t,	<b> </b>		i	Cuttings of	go from wet to	
	=	dry					complete	y dry.	
	=			<u> </u>					
643.6	14								
	7								
	$\exists$								
	l . <u>.</u> =								
642.6	15			<del>                                     </del>					
					}	ĺ			
ļ									
İ			1				Screened	interval for	
641.6	16_						FTP-MW1 bgs.	l is 5.5' to 15.5'	
041.0	10							16.0' bgs	-
ŀ							D.O.D. @	10.0 bgs	
İ			1						
	_				ļ				
640.6	17				İ				
0.0.0	□ '' □			[ ]					
	' =								
	二		]						
639.6	18								
	日				ĺ				
	二		}						
	$\exists$					1			
638.6	19								
	$\exists$					ļ			
	$\exists$		1						
İ	$\equiv$								
637.6	20 🗏								
DJECT				<del></del>		HOLE NO			_
	IAAAF	PF.S. DATA COLLECTION - FTP Burlir	naton IA				FTP-N	лW1	

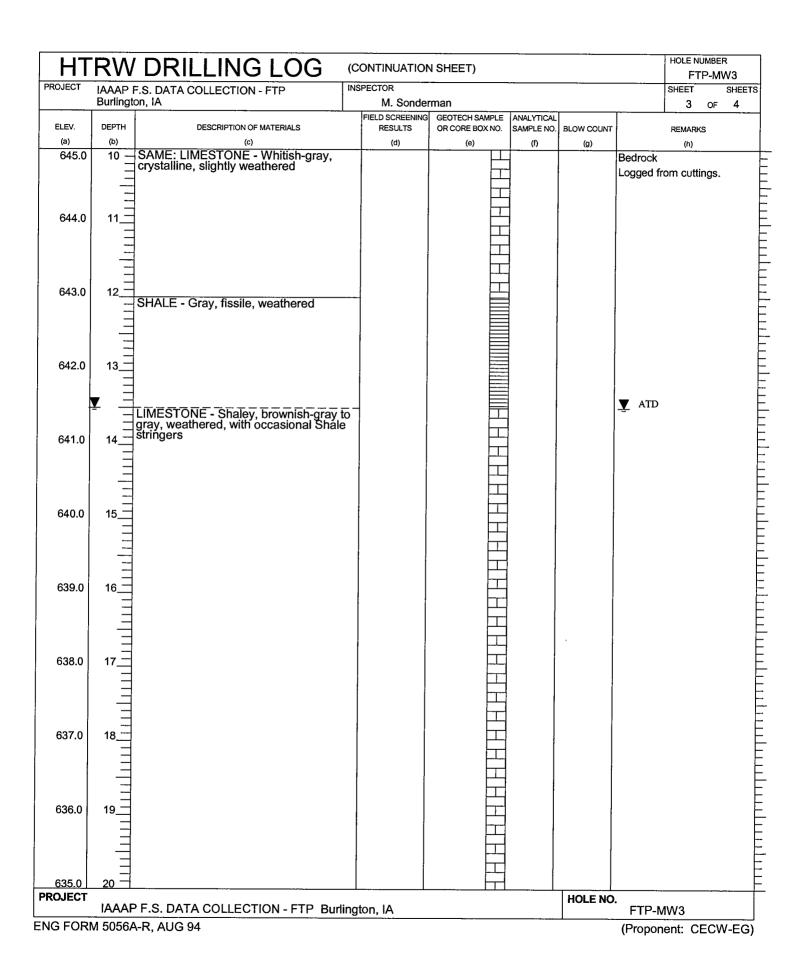


HI	RW	DRILLING LOG (	CONTINUATIO	N SHEET)				HOLE NUMB	
OJECT	IAAAP F Burlingte	.s. DATA COLLECTION -1 IF	ISPECTOR M. Sonde	rmon				SHEET	SHEET
		JI, IA	FIELD SCREENING		ANALYTICAL	<u> </u>		2 OF	= 4
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.	BLOW COUNT		REMARKS	
(a) 660.8	(b) —	Silty CLAY (CL) - Stiff moist dark	(d)	(e)	(f)	(g) 2ksf	Topsoil	(h)	
000.0	"=	Silty CLAY (CL) - Stiff, moist, dark brown, low plastic, with Sand and	1			2001	Topson		
	_	organics							
							R = Reco	Wen.	
659.8	1_		}				T = Time		
						2ksf	BG = Bac	kground athing Zone	
							HS = Hea	d Space	
			BG/FID = 0 BZ = ND				FID = Fla Detector	me lonization	on
658.8	2 =		HS = ND				Detector		
	$\exists$	Silty CLAY (CL) - Medium stiff, moist, dark brown with faint gray mottling, low plastic, with Sand					Shallow V	Veathered (	Glacial
	∃	plastic, with Sand					' '''		
657.8	3								
	=					o			
	$\exists$					2ksf			
	$\exists$								
656.8	4_	Gray mottling more pronounced							
	$\exists$	,							
	$\exists$					2ksf			
	$\exists$					ZKO			
655.8	5_	With iron staining	1			Laskey	R=55/60		
	$\exists$	with horr staining				2ksf			
	⊣								
	$\exists$								
GE 4 0	_ <u>_</u>		BZ = ND HS = ND						
654.8	⁰⊟		113 - 110		TOC =	2ksf			
İ	$\exists$				0.28				
	크			Geo		1.5ksf	T = 1638		
	_ =						R = 27/27		
653.8		Becomes wet, with Sand, coarse-grained	ı			Laskov	▼ ATD 4714/03 st	annad at	
	=	<u>Limestone pieces</u> LIMESTONE - Whitish-gray, highly					bedrock.		
	=	weathered					4/15/03 re	sumed drilli cone rotary	ing wash
	∃						Bedrock	wife rotary	wasii.
652.8	88	With fossil fragments							
	크						Logged fro	om cuttings	
	3								
	∃								
651.8	, =								
	$\exists$								
	$\exists$								
	$\exists$								
650.0	1, ∃								
<u>650,8  </u> OJECT	10 🗂		1	V///	LL	HOLE NO	 }.		
	IAAAF	F.S. DATA COLLECTION - FTP Burlin	gton, IA			I TOLL 140	,. FTP-N	/IW2	

		DRILLING LOG	(CONTINUATIO	N SHEET)				FTP-MW2
OJECT	IAAAP Burlingt	F.S. DATA COLLECTION - FTP on, IA	INSPECTOR M. Sonde	rman				SHEET SHE
	Ĭ .		FIELD SCREENING	GEOTECH SAMPLE	ANALYTICAL			L
ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.	BLOW COUNT	Ì	REMARKS
650.8	10 —	(c) SAMF: LIMESTONE - Whitish-gray	(d)	(e)	(f)	(g)	Bedrock	(h)
000.0	"=	SAME: LIMESTONE - Whitish-gray, highly weathered			]		ı	rom cuttings
	_				j .		Logged	om cattings
649.8	11							
					1 1			
ĺ	=		İ					
					]			
648.8	12 =		ł	<del>                                     </del>				
040.0	12			F				
	=							
}				-1-			Driller not	ted easier drilling.
	_	Thin Shale seam						
647.8	13	Becomes bluish-gray, weathered		<del>                                     </del>			Driller not	tes harder drilling.
646.8	14							
1					1			
045.0	4. =		1					
645.8	15							
	=			-				
	$\exists$							
-					Ì			
644.8	16		i					
	$\exists$				}	}		
	$\exists$			<del>  </del>				
	=			Fig.				
643.8	17 =			H	İ		Screened	Interval for 2 is 6.9' to 16.9'
l	$\exists$						bgs.	. 13 0.3 10 10.3
	4						0056	
	$\exists$						B.O.B. @	17.4' bgs
642.8	18_					[		
	·~=					1		
	$\exists$							
	ᆿ				1	1		
	, <del>,</del> =							
641.8	19			]				
	$\exists$							
Ī	$\exists$			i	İ	İ		
640.8	20 =					_		
DJECT	ΙΛΛΛΓ	DES DATA COLLECTION ETP D	lington IA	-		HOLE NO		414/0
		P.F.S. DATA COLLECTION - FTP Bur A-R, AUG 94	iingion, IA			1	FTP-N	/IVV2



HT	RW	DRILLING LOG ©	ONTINUATION	SHEET)				HOLE NUMBER FTP-MW3
OJECT			SPECTOR	· · · · · · · · · · · · · · · · · · ·				SHEET SHEE
	Burlingto	.o. DATA COLLECTION - 1 II	M. Sonder	man				2 OF 4
			FIELD SCREENING		ANALYTICAL			
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.			REMARKS
(a) 655.0	(b) 0 —	Silty CLAY (CL) - Medium etiff, moiet	(d)	(e)	(f)	(g)	Tonell	(h)
055.0	٦∃	Silty CLAY (CL) - Medium stiff, moist, brown to dark brown, low plastic, with Sand and organics				1.5ksf	Topsoil	
		Sand and organics					R = Reco	WO 77 (
							T = Time	
0540	⊿∃						BG = Bad	ckground
654.0	' <del>-</del>				1		BZ = Brea HS = Hea	athing Zone
l	$\exists$		1			5ksf	no – nea	au Space
	=	CLAY (CH) - Stiff, brownish-gray and	1		1		  Shallow \	Weathered Glacial
- 1		CLAY (CH) - Stiff, brownish-gray and dark brown mottled, high plastic, with Sand and iron nodules	BG = 0	==	1		Till	veathered Glacian
653.0	2 =	Sand and iron nodules	BZ = 0 HS = 0	==	<u> </u>		ļ	
055.0	-		'''		}			
	$\exists$			==	1	3ksf		
	$\exists$				<u> </u>		1	
	コ			==	]			
652.0	₃ ≓			= =	<u> </u>			
302.0	<b>~</b> =			==	]	j		
1	コ		j	     	]	014		
	$\dashv$					3ksf		
	⊣							
651.0	4 =		•		1			
00 1.0	- '=	Becomes yellowish-brown to brown and gray mottled	ĺ	1	TOC =			4
	⊣	gray mottled		0	0.23			
1	$\dashv$		]	Geo		5ksf		
	$\exists$			==			T = 1320	
650.0	5_					Laskey	R=60/60	
	$\exists$			  				
	크					9ksf 9ksf		
	=	SHALE - Gray, fissile, highly weathered					R = 9/9	
		LIMESTONE - Whitish-gray highly			}	<u> </u>	Bedrock	
649.0	6	weathered		F				
							Logged from	om cuttings.
	$\exists$							
	⇉							
648.0	7_			F.				
	コ							
	7			┝┸┑				
	$\exists$							
	_ =		İ					
647.0	8_			F	İ			
	$\exists$							
	$\equiv$							
	$\exists$							
040.0	$\Box$		ŀ					
646.0	9-∃!	Becomes Crystalline, slightly weathered to unweathered						
	3	io unweainered		<del> </del>				
	$\exists$							
	Ⅎ			二二		-		
645.0	10							
OJECT	10 1					HOLE NO		
	IAAAF	F.S. DATA COLLECTION - FTP Burling	ıton, IA			I TOLE NO	'. FTP-N	MW3

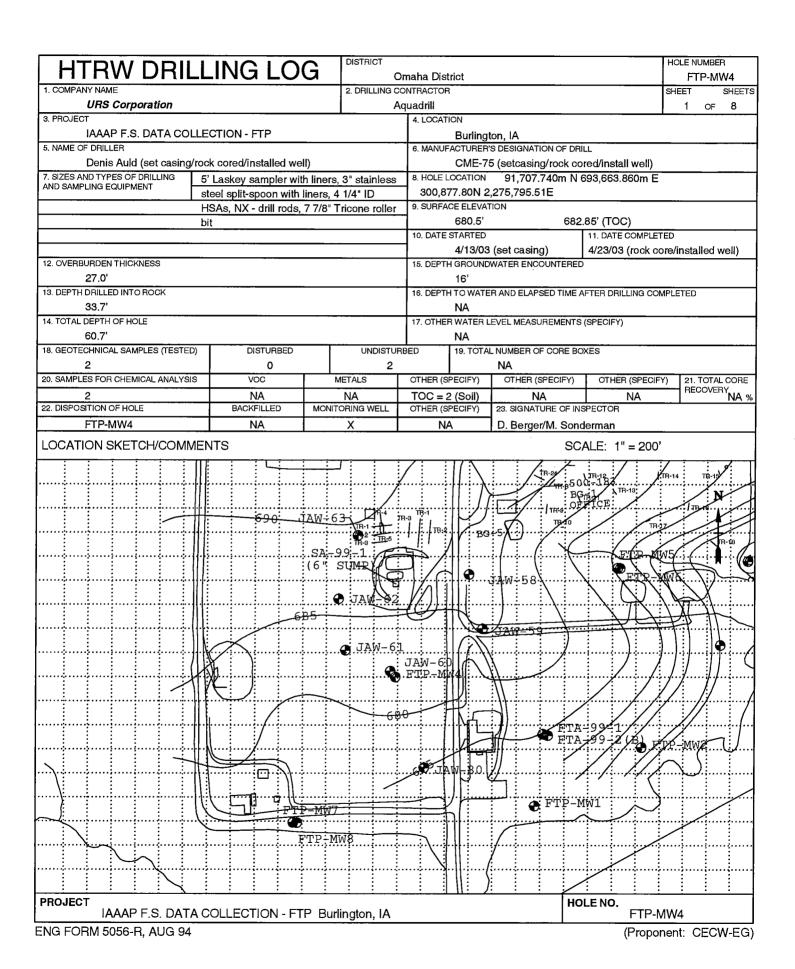


НТ	RW	DRILLING LOG	(C(	MOITAUNITNC	N SHEET)					HOLE NUM	
PROJECT	IAAAP I	S. DATA COLLECTION - FTP		PECTOR	<del></del>		FTP-MW3				
	Burlingto	on, IA		M. Sonder FIELD SCREENING		PLE				<b>4</b> 0	F 4
ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS		RESULTS (d)	OR CORE BOX (e)	NO.	SAMPLE NO. (f)	BLOW COUNT (g)		REMARKS (h)	
635.0	20	SAME: LIMESTONE - Shaley, brownis	h-	(d)	(e)		()	(8)	Bedrock	(11)	
		gray to gray, weathered								om cutting	
	_								Screened	interval fo 3 is 10.5' to	r 20.5'
604.0	=			i					bgs.	, is 10.5 k	20.5
634.0	21	-		-					B.O.B. @	21.0' bgs	
									_	-	
	_										
622.0	, I										
633.0	22										
630.0	23			İ							
632.0	∠3 —										
631.0	24_										
631.0	24		١								
	$\exists$										
								i			
	<u>,                                    </u>										
630.0	25										
	$\exists$										
	=										
629.0	26										
	=										
	$\exists$										
	=										
628.0	27_										
	=			İ							
	$\exists$			İ							
	=										
627.0	28_										
	$\exists$							İ			
	$\exists$										
	$\exists$										
626.0	29										
	$\exists$										
	크										
	$\exists$										
625.0	30 -									<u> </u>	
PROJECT	ΙΔΑΔΙ	P F.S. DATA COLLECTION - FTP Burli	ina	ton. IA				HOLE NO	). FTP-1	лW3	
		Briting College of the Bull	9						1		

(Proponent: CECW-EG)

HTRW W/GFX G:\GINTW\IAAAP\FTP\FTP.GPJ APR\_03.GDT 9/17/2003 10:22:41 AM

ENG FORM 5056A-R, AUG 94



DJECT	_	DRILLING LOG		ONTINUATION					FTP-	
JJECT	IAAAP Burlingt	F.S. DATA COLLECTION - FTP	INS	PECTOR D. Berger		SHEET	SHE			
	Durning:	OI, IA	_!	FIELD SCREENING	M. Sonderman	ANALYTICAL	7		2 0	F 8
ĒLEV.	DEPTH	DESCRIPTION OF MATERIALS		RESULTS	OR CORE BOX NO.	SAMPLE NO.	BLOW COUNT		REMARKS	
(a)	(b)	(c)		(d)	(e)	(f)	(g)		(h)	
680.5	0 =	Silty CLAY (CL) - Stiff, moist, dark bro to black, low plastic, with organics	own				4ksf	Topsoil		
	=	lo black, low plastic, with digariles								
	_					1		1		
								•		
679.5	1									
	=	Silty CLAY (CL) - Stiff moist brown v	with				3ksf			
	_	Silty CLAY (CL) - Stiff, moist, brown v black mottling and iron staining, low	771611					Loess		
	[ =	plastic		HS = ND						
678.5	2 -									
0.0.0	-=									
							3ksf			
	=									
	=					]				
677.5	3									
	=		ļ	İ		[				
İ			ĺ			' I	3ksf			
				,						
070 5	. =		i	İ		ı				
676.5	⁴⊟									
			İ				2ksf			
				1						
675.5	5 -		İ				Laskev	R=60/60		
			Ī	1			2ksf			
	$\exists$									
	$\exists$									
			ļ	ł		ļ				
674.5	6		1			ĺ				
	$\exists$						2ksf			
			i							
	=			HS = ND						
673.5	7 =					l				
0.0.0	· '=		- 1				}			
	$\exists$	Silty CLAY (CL) - Stiff, moist, orangish	า-	ļ			4ksf	Shallow W	eathered G	Slacial
İ	$\exists$	Silty CLAY (CL) - Stiff, moist, orangish brown with orange mottling and iron staining, medium plastic, with Sand					]	Till		
	$\exists$	g, piacus, mai caild					ĺ			
672.5	8									
	$\exists$						İ			
	=						4ksf			
	$\exists$						ļ			
874 5	٦									
671.5	<b>9</b> ⊟					-				
	ᆿ									
	크			ļ			7ksf			
1	=	Becomes very stiff grow lominor		İ			i			
370.5	10	Becomes very stiff, gray laminar mottling, with more Sand	]			1	Laskey <sup>{</sup>	R=60/60		
JECT							HOLE NO			
	IAAAF	F.S. DATA COLLECTION - FTP Bur	rlingt	on, IA			1	FTP-M	W4	

HT	RW	DRILLING LOG ©	ONTINUATION	SHEET)				HOLE NUMBER	
DJECT		11.15	SPECTOR	=:,					
50201	Burlingt	1.0. DATA GOLLEGIION - 1 II		M. Sonderman				FTP-MW4 SHEET SHE 3 OF 8  REMARKS (h) OW Weathered Glacial by Weathered  OW Glacial Till  OW Glacial Till  OW Glacial Till	
			FIELD SCREENING	GEOTECH SAMPLE	ANALYTICAL	Ī	T	O -	<del>-</del> -
LEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.	BLOW COUNT		REMARKS	
(a)	(b)	(c)	(d)	(e)	(f)	(g)			
670.5	10 _	SAME: Silty CLAY (CL) - Stiff, moist, orangish-brown with orange and gray laminar mottling and iron staining,				2ksf		Veathered Gla	acial
	=	laminar mottling and iron staining.		<i>///</i>			Till		
	_	medium plastic, with Sand	]						
	_	1	•						
669.5	11						Highly We	eathered	
	_		]			2ksf			
	_					Z.NOI			
	_	Becomes low to medium plastic, with less Sand and mottling	HS = ND						
	_								
668.5	12						}		
						4ksf			
	_		1						
667.5	13								
	_	i							
	=				1	4ksf			
	_				<b>a</b> 1				
	_								
666.5	14	December 1			1				
		Becomes very stiff, low to medium plastic, with more Sand and laminar gray							
		mottling	]						
i	_					7ksf			
	=	Silty CLAY (CH) - Very stiff, moist, gray					Shallow G	lacial Till	
665.5	15	Silty CLAY (CH) - Very stiff, moist, gray with dark gray and orange mottling, high plastic, with Sand					R=60/60		
	=	plastic, with Sand	Í			6			
	=	Becomes Stiff							
			ľ			10			
	=	With less Sand		- ///	1				
664.5	▼ 16			Geo	<del></del>		▼ ATD		
	_				TOC = 0.08				
						13			
	$\exists$	·	HS = ND		1 I				
669 5	<b>⊿</b> ,∃				1 I	18 00	R=24/24		
663.5	17_	With orange laminar mottling and Sand	1	<i>\(\)</i>	<del>  -  </del>	6ksf	1/2-7		
ļ	$\exists$					0690			
	_=								
			ļ			<u>.</u> .			
662.5	18					6ksf			
002.0	'°⊣								
	$\exists$								
		Sandy CLAY (CL) - Verv stiff, moist, grav					Shallow G	acial Till	
	$\exists$	with orange and dark gray mottling,					JIIIIII G	Solut III	
661.5	19	Sandy CLAY (CL) - Very stiff, moist, gray with orange and dark gray mottling, medium to high plastic, medium- to coarse-grained Sand							
.51.5	'*-	granios Caria	1	<i>\\\\\</i>		7ksf			
	$\exists$			<i>\\\\\</i>					
	=		İ			Okat			
60.5	20 =					8ksf Laskev	R=36/36		
JECT				<i>\\//</i>	L	HOLE NO		<del>.</del>	****
	ΙΛΛΛΙ	F.S. DATA COLLECTION - FTP Burling	ton IA			I NOLE NO	TO M	A\A/A	

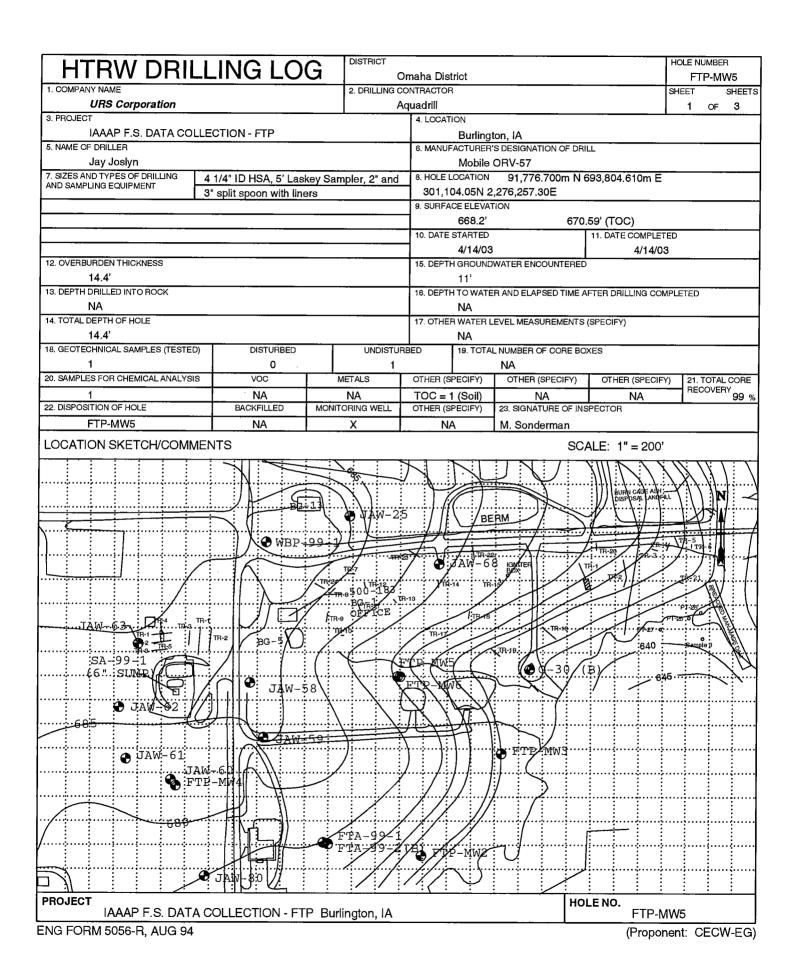
HI	RW	DRILLING LOG	(CONTINUATIO	N SHEET)				HOLE NUMBER FTP-MW4	ļ
DJECT	IAAAP	F.S. DATA COLLECTION - FTP	INSPECTOR					SHEET SH	IEET
	Burlingt	on, IA	D. Bergei	/M. Sonderman	ANALYTICAL		1	4 OF	3
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.		BLOW COUNT		REMARKS	
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)	
660.5	20 =	SAME: Sandy CLAY (CL) - Very stiff, moist, gray with orange and dark gray mottling, medium to high plastic, medium- to coarse-grained Sand				7ksf	Shallow GI	acial Till	
659.5	21	With less Sand				5ksf			
658.5	22	Becomes stiff, low to medium plastic							
						3ksf	:		
657.5	23	Becomes orangish-brown with grav				3ksf			
656.5	24	Becomes orangish-brown with gray mottling and Sand				JK51			
		Becomes medium stiff				2ksf	D-00/00		
655.5	25		HS = ND			7 12	R=60/60		
654.5	26			Geo	TOC=	12			
		Clayey Sand (SC) - Dense, wet, orangish-brown, coarse-grained, with Limestone cobbles			0.05		Sampler ref Limestone of Glacial Out R = 21/21	cobble	
653.5	27	LIMESTONE					Driller notes Laskey sam at 27.0' bgs Bedrock	s resistance to apler and auge	rs
652.5	28								
651.5	29					ļ	Refusal to a	luger at 29.2'	
							bgs. Switch wash bore. Logged from	ned to rotary	
650.5	30 =								
OJECT		PF.S. DATA COLLECTION - FTP Bur				HOLE NO	<b>)</b> .		

ΗΙ	KVV	$^\prime$ DRILLING LOG $^\circ$	OITAUNITNO	N SHEET)				FTP-M	1W4
OJECT	IAAAP	F.S. DATA COLLECTION - FTP INS	SPECTOR					SHEET	SHEE
	Burlingt	on, IA		/M. Sonderman	1			5 OF	. 8
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW COUNT		REMARKS	
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)	
650.5	30 _	SAME: LIMESTONE					Bedrock		
	=								
	_				<u> </u>				
	_				4				
649.5	31				]				
					1		İ		
	_		ĺ	-	1				
1	=				1				
648.5	32 =		!		1				
0.0.0					1				
	=				]				
İ	_				1				
	=								
647.5	33								
	Ξ				]				
i	=				] [				
646.5	34 -								
040.5	34 <u> </u>				HS = Head Space BZ = Breathing Zone MB = Mechanical Brea SO = Spin Out R = Recovery RQD = Rock Quality Designation				
	i <b>∃</b>					BZ = Brea	thing Zone		
1 =								ak	
	Ξ						R = Recov	verv	
645.5	35	With Shale					RQD = Rc	ck Quality	
	=			<del></del>			Designation	on	
	=								
	_								
	=								
644.5	36								
	=	With less Shale			İ				
	_					İ			
ł	=			<u> </u>			Stopped d	rilling on 4/1	13/03
643.5	37_			F F			casing to	37.1' bgs.	Jubie
	$\equiv$						4/23/03 re	amed out 0.	4' and
	Ⅎ						started co	edrock  S = Head Space Z = Breathing Zone B = Mechanical Break O = Spin Out = Recovery QD = Rock Quality esignation  copped drilling on 4/13/03 37.1' bgs. Set 6" doublesing to 37.1' bgs. 23/03 reamed out 0.4' all arted coring at 37.5' bgs  un = 5.5' = 5.3' QD = 77%	bgs.
	=	Siliceous, bluish-gray, with small (<1 mm) pyrite concretions, abundant chert							
		mm) pyrite concretions, abundant chert		ļIII,					
642.5	38	Thin Shale stringer with crinoids highly					Dun - 5 5		
	$\exists$	Thin Shale stringer with crinoids, highly fractured, fracture surfaces dark stained					Run = 5.5° R = 5.3'		
	크	Becomes Shaley, dark gray					RQD = 77	%	
	$\exists$	, , ,		BOX # 1			МВ		
641.5	39			H					
	$\dashv$	SHALE - Dark gray, soft, fractured,							
	$\exists$	Slightly fissile, highly weathered LIMESTONE - Shaley, medium gray, with some chert			1	,			
	$\exists$	LIMES I ONE - Shaley, medium gray, with some chert		}	l		MB		
		John Griore		円			so		
640.5	40					1	<del></del>		
OJECT	14441	P F.S. DATA COLLECTION - FTP Burling				HOLE NO	). FTP-N		

ΗI	RW	$^{\prime}$ DRILLING LOG $^{-}$	CONTINUATION	NSHEET)					ľ	MBER P-MV	
JECT	IAAAP	S. DATA COLLECTION - FTP	NSPECTOR					•	SHEET	;	SHEE
· · · · · · · · · · · · · · · · · · ·	Burlingt	on, IA		M. Sonderm		I	,	1	6	OF	_8_
.EV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAN		ANALYTICAL SAMPLE NO.	BLOW COUNT	İ	REMARKS	3	
(a)	(b)	(c)	(d)	(e)		(f)	(g)	}	(h)		
640.5	40 —	SAME: LIMESTONE - Shaley, medium			Ш			Bedrock			
		gray, with some chert									
	_				-			so			
	=										
339.5	41		BZ = ND					•			
	_				1						
				BOX # 1							
	_	Baseman Chaley light brown and gray						МВ			
	=	Becomes Shaley, light brown and gray, partially crystalline, with healed vertical fractures, isolated vugs up to several mm, very small clear crystals in vugs			H						
338.5	42	fracturés, isolated vugs up to several			<u> </u>						
	Ξ	Moderately Fractured									
	_	moderatory i ractarea			Н						
	_				П						
37.5	43 =										
337.3	43		-		Ή						
	=		•								
	_	With some pyrite and healed vertical									
	=	fractures			Н						
36.5	44	Recomes Shaley, aray and blue-aray			Ш						
	_	Becomes Shaley, gray and blue-gray, with chert, fracture surfaces weathered						МВ			
	=				H			Run = 5.0	ŗ		
	_		BZ = ND		$\Box$			R = 4.9'			
ľ	=				$\vdash$			RQD = 83	3%		
35.5	45				$\Box$			D D			
	=				Ш			Box Breal	<		
	=	With little to no Shale		BOX # 2							
	$\equiv$	Becomes bluish-gray, with chert			$\Box$						
2045	40	becomes bidish-gray, with offert			Ħ						
34.5	46					-					
i	=				Ш						
	_	Fracture surfaces weathered, dark stained			Ш						
	_	Staniod			H						
33.5	47				F						
					Ħ			Box Break	•		
	$\equiv$					-					
					円						
		Highly fractured, fracture surfaces			囯						
32.5	48	Highly fractured, fracture surfaces weathered, dark stained	ļ		H						
	=				H						
İ	=	With thin block Chalay notings of			H						
	=	With thin black Shaley partings at fractures			버			Dun = 5 0	,		
	$\exists$	··· ··- ··· ·· ·· · · · · · · · · · · ·		DOV#5	Щ			Run = 5.0 R = 5.0'			
31.5	49			BOX # 2	ш			RQD = 80	%		
	Ξ				$\vdash \vdash \vdash$						
	$\exists$										
					凵						
30.5	50				Н						
	JU						HOLE NO				

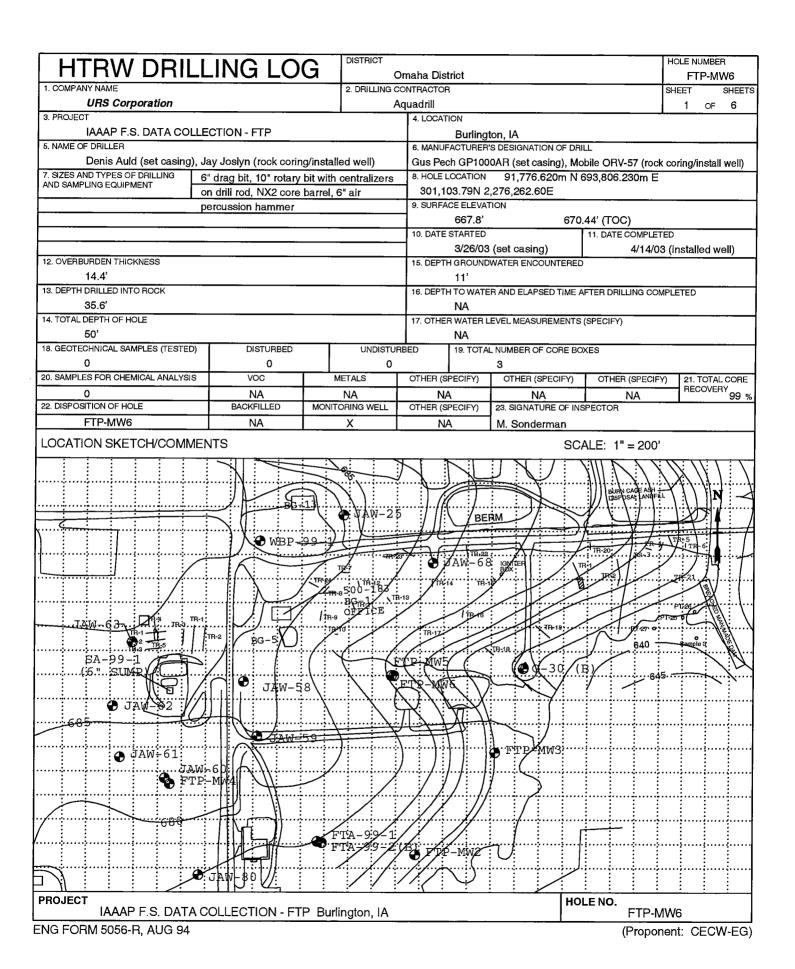
JECT		S. DATA COLLECTION - I TF	NSPECTOR D. Berger	M. Sonderm	an				SHEET 7		HEET 8
	Burlingto	on, IA	FIELD SCREENING			ANALYTICAL		<u> </u>			
EV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX		SAMPLE NO.	BLOW COUNT		REMARKS	3	
(a)	(b)	(c)	(d)	(e)		(f)	(g)		(h)		
630.5	50 =	SAME: LIMESTONE - Bluish-gray						Bedrock			
İ	=							]			
	_										
					$\mathbf{H}$			MB			
629.5	51		BZ = ND			]					
	=				Ħ						
]	=			BOX#2							
	_				$\Box$						
	=				上	<u> </u>		1			
628.5	52				$\vdash$						
	=					]					
l	_				Ľ	1		Box Break	,		
	_				$\vdash$			Box Break			
627.5	53 =				Д			DOX DICA	•		
020					工						
	Ξ				$\vdash$	1					
		With numerous yugs filled with calcite									
	_	With numerous vugs filled with calcite crystals, and chert	1			1					
626.5	54	Becomes bluish-gray, moderately fractured, unweathered with chert			-			Run = 5.0	•		
ŀ	=	fractured, unweathered with chert						R = 4.8'	0/		
	=				ш	1		RQD = 84	70		
			BZ = ND		-	1					
	=				F	1		мв			
625.5	55	Becomes dark blue				1		2			
	_	Becomes Shaley			$\vdash$	-					
	_	SHALE - Black, fractured, fissile, slightly	<del>,  </del>	BOX#3							
	=	weathered	<u></u>		F	1		МВ			
624.5	56 <sup>—</sup>	LIMESTONE - Siliceous, Shaley, blue- gray and gray				1					
024.5	30			İ	-	1	1				
	=					1		Box Break	(		
	_					1	1				
	_	SHALE - Black, soft, fissile, slightly weathered									
623.5	57 <u> </u>	weathered						мв			
	=		1								
	=	1									
	=	1	İ	1		1					
	=		-								
622.5	58	]	-	<del> </del>		1		Box Breat	(		
			_			1		so			
		LIMESTONE - Shaley, Siliceous, dark gray and brownish-gray			L	1		so			
	=	gray and brownshingray			$\mu$	1					
621.5	59_	1	1	BOX#3	I	1		Box Breal	(		
JZ 1.J		Becomes lighter in color			上	1	1				
	=	]			-	-		Run = 2.7	4		
		]				1		R = 2.5'			
	=	]		]		1		RQD = 85	5%		
620.5	60 =				Ш		<u> </u>	<u> </u>			
OJECT	IAAA						HOLE N	<b>O</b> . FTP-			

НТ	HTRW DRILLING LOG (CONTINUATION SHEET)  ECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA  INSPECTOR D. Berger/M. Sonderman										
PROJECT		.o. Bank oolleonon in		/M Sonderma	an.		•		SHEET 8 OF	SHEETS 8	
ELEV.	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)		PLE	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT		REMARKS (h)		
620.5	60 —	SAME: LIMESTONE - Shaley, Siliceous, dark gray and brownish-gray	BZ = ND	(0)				on 4/23/0	coring at 60.7		
619.5	61							B.O.B. @ Screened FTP-MW- bgs.	60.7 bgs interval for 4 is 49.1' to 5	9.1'	
618.5	62										
617.5	63										
616.5	64										
615.5	65 <u> </u>										
614.5	66										
613.5	67										
612.5	68										
611.5	69										
610.5 PROJECT	70 =	P F.S. DATA COLLECTION - FTP Burlin	gton, IA				HOLE NO	). FTP-		W EC)	



HT	RW	$^{\prime}$ DRILLING LOG $^{\circ}$	ONTINUATION	N SHEET)				HOLE NUMBER FTP-MW5
JECT			SPECTOR					SHEET SHE
	Burlingt	on, IA	M. Sonde	rman				2 of 3
	DEDTU	DESCRIPTION OF MATERIAL O	FIELD SCREENING		ANALYTICAL			·
LEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS	RESULTS (d)	OR CORE BOX NO.	SAMPLE NO.			REMARKS
668.2	0 —	l ean CLAY (CL-ML) - Medium stiff	(0)	(e)	(f)	(g) 1ksf	Topsoil	(h)
000.2		Lean CLAY (CL-ML) - Medium stiff, moist, dark brown, low plastic with				IKSI	Opson	
	_	organics						
	=	•						
cc <del>z</del> c	=							
667.2	1—	Becomes brown to yellowish-brown with	i				R = Reco	nverv
		organics				1.5ksf	T = Time	e e e e e e e e e e e e e e e e e e e
	_						BG = Ba	ckground
	$\exists$		BG/PID = 0				BZ = Bre	athing Zone
666.2	<u>,</u> Ξ		BZ = 0 HS = ND				HS = Hea	au Space n-detect
000.2	2		110 - 110				PID = Ph	oto Ionization
	=	Grades to medium plastic			1	3ksf	Detector	
1					<b>1</b>	JAGI		
	⇉	Sandy CLAY (CL) - Very stiff, moist.	1				Shallow \	Weathered Glacia
665.2	3_=	yellowish-brown and gray mottled,				į	Till	realisted Glacic
000.2	শ্ব	Sandy CLAY (CL) - Very stiff, moist, yellowish-brown and gray mottled, medium to high plastic, fine-grained Sand with iron staining			]			
	$\exists$	Cana war non staming						
			i i			4ksf		
	=							
664.2	, 🗆							
004,2	*=			<i>\\\\\</i>	1			
ŀ	=			<i>\(\)</i>	1			
	_				1	5ksf		
	=						T = 1020	
663.2	5 🗆					Laskey	R=60/60	
000.2	~=					5		
	=							
	一二			<i>\(\(\)</i>		7		
	=		HS = ND			•		
662.2	6 □							
	<b>~</b> =							
	$\exists$					_		
	ㅋ	i				8		
	日			<i>\\\\\</i>			T = 1025	
661.2	7 🗏		<u> </u>				R=17/24	
ľ	$\exists$					6ksf		
	∃	Becomes medium plastic						
	$\exists$	5000moo modium piaotio						
	$\exists$							
660.2	8_=		HS = ND					
	$\exists$	,	ווט – ואט					
	$\exists$					Altaf		
	$\exists$					4ksf		
-	ᆿ							
559.2	9							
	$\exists$							
	Ⅎ							
	$\exists$		l					
	$\exists$		l				T = 1030	
558.2	10 —	Becomes soft					R=30/36	
JECT	1000	DES DATA COLLECTION ETD DOMING	uton IA			HOLE NO	). ETD:	N 4\ A / E
	IMMAH	PF.S. DATA COLLECTION - FTP Burling	μοπ, IA			1	FTP-	CVVIVI

HT	RW	DRILLING LOG	(CONTINUATIO	N SHEET)				HOLE NU	MBER P-MW5	
PROJECT		F.S. DATA COLLECTION - FTP	INSPECTOR M. Sonde	rman				SHEET 3		EETS
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	<u> </u>	ANALYTICAL SAMPLE NO.	BLOW COUNT	!	REMARKS	·	
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)		
658.2	10 =	SAME: Sandy CLAY (CL) - Soft, moist, yellowish-brown and gray mottled, medium plastic, fine-grained Sand with iron staining				3	Shallow V Till	Veathere	d Glacia	al
657.2	▼ 11 <u></u>	Becomes wet			TQC =		▼ ATD			
	Ξ			Geo	0.6	3				
656.2	12						T = 1038 R=21/24			
						1ksf				
	1		HS = ND							
655.2	13					0.5ksf				
654.0	14						Screened FTP-MW bgs.			
654.2	14	Becomes Clayey SAND (SC) - With pieces of Limestone					T = 1042 R=29/29		• • •	
							B.O.B. @	14.4 bgs	3	
653.2	15 									
	16									
652.2	16									
	=									į
651.2	17									
	=									
650.2	18									
649.2	19									-
648.2	20									
PROJECT		P F.S. DATA COLLECTION - FTP Burli	ington, IA		 	HOLE NO	). FTP-I	MW5		



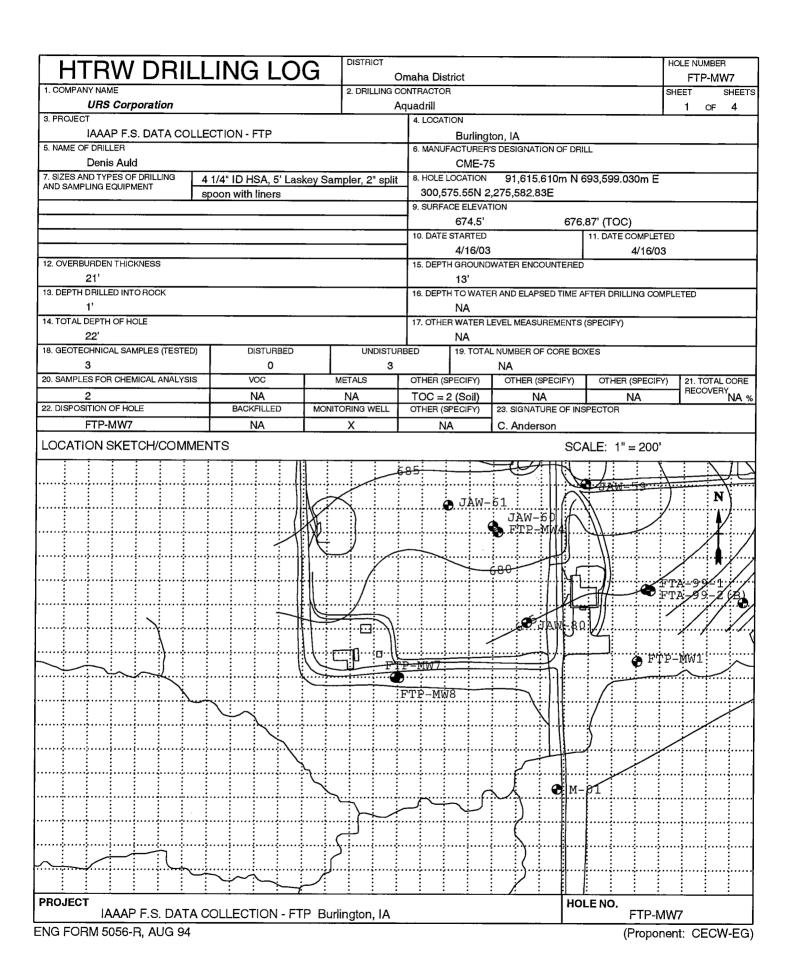
П	KVV	$^\prime$ DRILLING LOG $^{\circ}$	OITAUNITAO	N SHEET)				HOLE NUMBER
JECT			SPECTOR	<u> </u>				FTP-MW6
	Burlingt	on, IA	M. Sonde	rman				2 of 6
LEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL	BLOW COUNT		PENADIO
(a)	(b)	(c)	(d)	(e)	(f)	(g)	ĺ	REMARKS (h)
667.8	0 -		\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	100	<del>  "</del>	(9)	Topsoil	
1	_	moist, dark brown, low plastic with organics					1	
	=	organios					Overburd	en sampled in poring FTP-MW5.
	_		1			ı	ladjacom	50/11/g 1 11 -14/445.
666.8	1_	Becomes brown to yellowish-brown with						
	=	organics	1				R = Reco	very
	=	,					BG = Bac	karound
							BZ = Brea	thing Zone
665.8							HS = Hea	d Space -detect
000.0	2						PID = Pho	to lonization
		Grades to medium plastic			<b>1</b> [		Detector	
ł								
	=	Sandy CLAY (CL) - Very stiff, moist, yellowish-brown and gray mottled, medium to high plastic, fine-grained Sand with iron staining	1					/eathered Glacial
664.8	3_=	yellowish-brown and gray mottled, Imedium to high plastic, fine-grained					Till	
i	$\exists$	Sand with iron staining	1					
	$\exists$							
					ĺ			
663.8	4							
ļ	$\exists$							
	=					ļ	T = 1020	
662.8	5 ☐		[ ]		İ		1 - 1020	
002.0	~ <u>~</u>							
	$\equiv$		ļ					
	_							
	コ							
661.8	6							
	⇉							
	_=							
	$\exists$						T = 4005	
660.8	<b>,</b> $\exists$						T = 1025	
0.00	′⊟							
1	コ	Recemes modium plantic				ł		
	크	Becomes medium plastic			1	İ		
	$\exists$					ļ		
659.8	8							
	$\exists$							
-	$\exists$					1		
	$\neg$				İ			
,_,	$\exists$							
558.8	9_				ļ			
	$\exists$							
	크							
	ゴ					-	Γ = 1030	
557.8	10	Becomes soft				İ		
JECT						HOLE NO		
	IAAAF	F.S. DATA COLLECTION - FTP Burling	iton IA				FTP-M	IME

ПΙ		DRILLING LOG «	CONTINUATION	OTILLT)				FTP-MW6
DJECT		.o. DATA GOLLLOTTON - 1 11	ISPECTOR					SHEET SHE
	Burlingt	on, IA	M. Sonder		Y			3 OF 6
LEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS		ANALYTICAL	DI 01:: 0::::		
(a)	(b)			OR CORE BOX NO.	SAMPLE NO.		1	REMARKS
657.8	10 —	SAME: Sandy CLAV (CL) - Soft moist	(d)	(e)	(f)	(g)	Ch allau V	(h)
0.10	] '0 =	SAME: Sandy CLAY (CL) - Soft, moist, yellowish-brown and gray mottled, medium plastic, fine-grained Sand with	1 1			ı	Shallow V	Veathered Glacia
	=	medium plastic, fine-grained Sand with						en sampled in
		iron staining	1				adjacent l	boring FTP-MW5
	_ =						İ	
656.8	<u>▼</u> 11	Becomes wet					▼ ATD	
	=	Decomes wet	1				ļ	
	] =							
	[ <del>-</del>							
_	_						T = 1038	
655.8	12							
ĺ								
	_				ĺ		1	
	=							
	=						]	
654.8	13						1	
	_							
					ł			
							1	
653.8	14	Becomes Clavey SAND (SC) - With	1		İ		]	
		Becomes Clayey SAND (SC) - With pieces of Limestone	1				T = 1042	
		LIMEOTONE III II						
}		LIMESTONE - Light gray, fossiliferous, slightly weathered	1	$\vdash \Box$	Ì		Bedrock	
	$\exists$	Singing weathered					Logged fro	om cuttings.
652.8	15			H	]			
	∃				ľ			ed bit is catching
ĺ	Ⅎ	With brown, medium plastic, Clay with rock chips, fracture zone from 15.2' to 16.5' bgs		<del> -</del>			on fracture	€.
	$\exists$	16.5' bgs		口				
	∃	Ŭ			Ì			
651.8	16							
	$\exists$		BG/PID =					
	$\equiv$		ND ND		İ			
			BZ = ND				Driller net	nd and of fractions
	$\exists$			<del>                                      </del>			zone at 16	ed end of fracture i.5' bas.
350.8	17			岸	ľ			
	$\exists$			<del>  </del>				
	$\exists$			口				
	$\exists$			H				
1	$\exists$			戸				
649.8	18							
]	_				ľ			
	$\exists$			田				
	$\exists$		ļ l		]			
	$\exists$							
348.8	19_			<del>  </del>			May be we	athered Shale.
	크	Hit fracture zone at about 19' bgs, with dark gray Clay	] [	□□			-	
			<u> </u>	H	[			
-	$\exists$	Back into solid rock, becomes gray	D7 - ND	戸		ļ		
	コ		BZ = ND			1		
47.8	20 🗏			口				
JECT	-:		<u> </u>			HOLE NO		
	ΙΛΛΛΕ	F.S. DATA COLLECTION - FTP Burling				,10	FTP-M	

111	1 / 4 /	DRILLING LOG	(CONTINUATIO	V SI ILLI)					FTP-MW	6
OJECT		.S. DATA COLLECTION - FTF	NSPECTOR M. Canda							HEET
	Burlingt	on, IA	M. Sonde		DIE JAN	IALYTICAL		<del> </del>	4 OF	6
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX		MPLE NO.	BLOW COUNT		REMARKS	
(a)	(b)	(c)	(d)	(e)		(f)	(g)	!	(h)	
647.8	20 -	SAME: LIMESTONE - Calcareous, gray hard, fine-grained, slightly weathered	/,		Щ			Bedrock		
İ	=	nard, fine-grained, slightly weathered								
	_				$\Box$					
	_									
646.8	21				H					
	=	SHALE- Dark gray, soft, fissile, highly	$\dashv$		邑					
	=	weathered	D7 - ND							
	_	LIMESTONE - Light bluish-gray to gray unweathered	BZ = ND		Н			1		
	=	unweathered			Щ					
645.8	22									
	=				H			MB = Med  SO = Spir	chanical Break	
	=							RQD = R	ock Quality	
	_					İ		Designati	on	
	=				Щ			FID = Fla  Detector	me lonization	
644.8	23							Detector		
	_	SHALE - Gray, soft, blocky, highly	-			l				
İ	_	weathered				ŀ				
	=	LIMESTONE - Gray, unweathered with thin Shale stringers			Щ					
643.8	24	um Shale sunigers			$\Box$					
043.0	24			!	$\dashv$	- 1		Stopped o	Irilling on 3/26/	03
	=				7			Set 6" dou	uble casing at	٠٠.
								24.5' bgs.		
l	=			-	4	İ		4/13/03 re	sumed drilling. ck coring at 24	E1
642.8	25_	Devenous on broads assistant		]	工			bas with N	ck coning at 24 IX2 wireline	.o
		Bryozoan on break surface		ŀ				system.		
	$\equiv$				$\overline{}$			МВ		
	=			ļ				MD		
	$\exists$			ŀ				MB		
641.8	26_				$\Box$			90		
i	$\exists$			t		- 1		so		
ľ		SHALE - Dark gray, very soft, blocky,	BZ = ND with FID					MB		
		highly weathered I IMESTONE - Gray with calcite		F	干			MB		
	=	LIMESTONE - Gray, with calcite deposits (calcite crystal), and thin calcite healed vertical fractures below	•		$\exists$			MB		
640.8	27	healed vertical fractures below		t		ŀ		МВ		
	=			BOX #1						
				<b>[</b>	コ			_		
	=			E	$\Box$			Run = $6.2^{\circ}$ R = $5.7^{\circ}$	i	
	=			F	$\dashv$			R = 5.7 $RQD = 65$	%	
639.8	28	,	·	ļ	$\rightrightarrows$			. ,		
į	=			}		J				
		SHALE - Dark gray, very soft, fissile,	-  !			J				
	$\exists$	highly weathered	BZ = ND					мв		
620.0	$\dashv$		BZ - ND		$\equiv$				ck core from 2	8.6
638.8	29		_					to 29.1' bg		•
	$\exists$	LIMESTONE - Shaley, Siliceous, light		F	7		ļ			
	$\exists$	gray and brownish-gray interbeds, slightly weathered		ļ	耳					
	Ⅎ	<b>5</b> ,		-	$\dashv$					
637.8	30			-	干					
OJECT	30		_1	<u> </u>			HOLE NO	 )		
	1 4 4 4 1	F.S. DATA COLLECTION - FTP Burlin					I LOCKE INC	,. FTP-N		

		DRILLING LOG ©								-MW6	
ROJECT	IAAAP i Burlingt	1.0. DATA OOLLLOTION - I II	SPECTOR M. Sonde	rman					SHEET 5	SHI OF 6	EET:
		511, 174	FIELD SCREENING	GEOTECH SAM		ANALYTICAL		· · · · · ·		Or U	
ELEV.	DEPTH (b)	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX	(NO.		BLOW COUNT		REMARKS		
637.8	30 —	SAME: LIMESTONE - Shaley, Siliceous.	(d)	(e)		(f)	(9)	Bedrock	(h)		
		SAME: LIMESTONE - Shaley, Siliceous, light gray and brownish-gray interbeds, with horizontal fracture surfaces and a healed vertical fracture, slightly weathered	BZ = ND					Bearook			
636.8	31	Becomes light bluish-gray, crystalline, moderately fractured, unweathered with horizontal stylolites End of stylolites					į	Fracture s black to d to 35.5' be	ark gray t		
635.8	32										
634.8	33										
633.8	34	-	BZ = ND								
632.8	35	Becomes Siliceous, Shaley, with small vugs		DOV#0				Box Break	ί.		
631.8	36	End of Shaley zone Becomes bluish-gray, crystalline, no vugs  Becomes Shaley, brownish-gray, small		BOX # 2							
630.8	$\exists$	sulfide nodule Becomes Siliceous						Box Break			
629.8	38							мв			
628.8	39	Vertical fracture healed with calcite						Box Break			
	=	Grades to bluish-gray SHALE - Black, fissile, weathered LIMESTONE - Light gray, slightly						MB MB			
627.8	40 =	weathered		:	Ш						

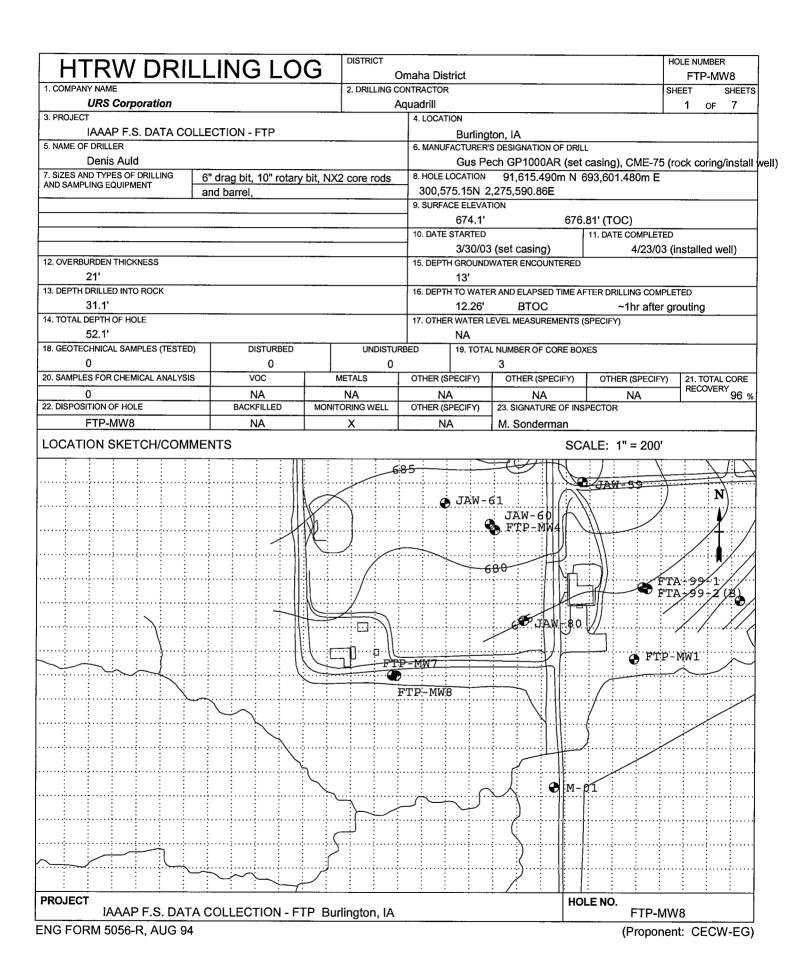
HII	RW	$^{\prime}$ DRILLING LOG $^{\circ}$	OITAUNITNO	N SHEET)				HOLE NUM FTP-	BER MW6	
		1.0. DATA GOLLLOTTON - 1 TI	SPECTOR		· · · ·			SHEET	SHE	ETS
——-	Burlingt	on, IA	M. Sonder		= [400000000		1	6 0	)F 6	
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMP OR CORE BOX N			ŀ	REMARKS		
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)		
627.8	40 _	Becomes Shaley with black Shaley	Α	-	<b>Ⅱ</b>		Bedrock			
İ	_	interbeds SHALE: Black, fissile, weathered	BZ = ND				МВ			
	_	LIMESTONE - Shaley, grading to light			4		МВ			
	=	gray			口					
626.8	41	Becomes crystalline, unweathered			I					
	=	-			귄					
				<u>-</u>	$\exists$					
	=						Run = 9.2	•		
625.8	42 -						R = 9.1' RQD = 99	10%		
025.0	42	SHALE - Dark gray to black, medium soft, fissile, unweathered to slightly weathered, with calcareous clasts						, ,0		
	_	weathered, with calcareous clasts					МВ			
	_		[				мв			
							Box Break			
624.8	43						Box Break	-		
	_		i i							
	=	Increasing carbonate contents		' <u> </u>			Numerous			
	_	_	BZ=ND	F			occured b core box.	y trying to	tit into	
	_	LIMESTONE - Shaley, light gray and gray, isolated 1-2 mm diameter vugs		<u> </u>			MB			
623.8	44	gray, recraised it a rinin diameter rege		-	니		Box Break	(		
	$\equiv$				Ц		Box Break			
	_	Some chert					DOX DIEAR	•		•
	=	Somo short		<u> </u> -	$\dashv$					
622.8	45			F	Ħ					
022.0	<del>-</del> 3				<u> </u>		Reamed h	ole to 45.3	3' bas.	
	=	SHALE - Black, fissile, unweathered	1	BOX#3			мв			
İ			ŀ							
	$\equiv$	LIMESTONE - Shaley, gray to dark gray, partly crystalline, small pyrite concretions	]				мв			
621.8	46	partly crystalline, small pyrite concretions				1	Screened			
l	⇒			<u>-</u>			FTP-MW6 bgs.	is 34.8' to	44.8	
ŀ	=	CLIAIT Disale finally convertibered	1	<u> </u>	=					
	$\exists$	SHALE - Black, fissile, unweathered					Many box to 47.2' bg		m 46.4	ţ.
	ㅋ						10 47.2 00			
620.8	4/-				=					
	Ⅎ			E	<b>=</b>					
	크			E	╡					
	$\exists$	LIMECTONE Obstantantial			릠					
619.8	48 =	LIMESTONE - Shaley, brownish-gray, unweathered								
	Ξ	•		-	닉					
	$\exists$	SHALE - Black, fissile, unweathered to					МВ			
	$\exists$	slightly weathered					1410			
	Ⅎ									
618.8	49	With 4 5 mm longth will an distant	]		<b>=</b>					
	$\exists$	With 1-5 mm length pyrite nodules					Stopped robgs.	ock coring	at 50.0	)'
	╡	With interbedded carbonate seams					Box Break			
	$\exists$	with interpeduce carbonate seams		E	₫	]	SO			
					=		Missing bo			ł
617.0					_	, ,	BUB W	50 0' hac		i
617.8 ROJECT	50 -				<b>=</b>	HOLE NO	B.O.B. @	50.0' bgs_		_



HT	RW	$^\prime$ DRILLING LOG $^{\circ}$	ONTINUATION	N SHEET)				HOLE NUMBER	
DJECT		· · · · · · · · · · · · · · · · · · ·	PECTOR				<u>.</u>		SHE
	Burlingt		C. Anders	o <b>n</b>				2 OF	4
ELEV.	DEPTH	DESCRIPTION OF MATERIAL C	FIELD SCREENING		ANALYTICAL				
(a)	(b)	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.	_	ļ	REMARKS	
674.5	0 —	Silty CLAY (CL) - Very stiff, moist, brown	(d)	(e)	(f)	(g) 5ksf	Fill	(h)	
074.0		Silty CLAY (CL) - Very stiff, moist, brown and gray mottled with black, low to medium plastic, with iron staining, black organics, and crushed round Gravel				OKSI	Fill		
	_	medium plastic, with iron staining, black			i		D D		
	_	jorganics, and crushed round Gravei					R = Recov	ery thing Zone	
					1		HS = Head	d Space	
673.5	1					6ksf	ND = Non-	detect	
	_		UC 0 0						
	_	Silty CLAY (CL) Stiff majet block law	HS = 0.0 ppm						
- 1	_	Silty CLAY (CL) - Stiff, moist, black, low to medium plastic, with organics	BZ = 0.0				Topsoil		
	_	, , , , , , , , , , , , , , , , , , ,	ppm			4ksf			
672.5	2					4791	1		
	=								
	_	Silty CLAY (CL) - Stiff, moist, reddish- brown and gray mottled, medium to high					Shallow W	eathered Gla	cia
	_	brown and gray mottled, medium to high plastic		<i>\(\/\)</i>			Till		
l,	_	plastic				3ksf			
671.5	3								
	=								
	_								
						4ksf			
1	$\Box$						D-40/40		
670.5	4				·		R=48/48		
ļ	⊣	Becomes gray with reddish-brown			ĺ	4ksf			
İ	듸								
	_								
	$\exists$								
669.5	5						:		
	$\equiv$	_			ļ	4ksf			
					ŀ	11101			
	=		HS = 0.0						
			ppm		ļ				
668.5	6		BZ = 0.0						
	コ		ppm						
	$\exists$					3ksf			
	$\exists$	Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand					Shallow W	eathered Gla	cial
	$\exists$	with Sand	ĺ				Till		
667.5	7_		[		}				
1	$\exists$								
	=		İ			3ksf			
	$\exists$								
İ	$\exists$		Į						
666.5	8_								
	コ				1				
	=								
	コ	ļ	İ			4ksf			
	コ		l		}		D-00/00		
65.5	9	ļ			L	Lackey	R=60/60		
						3			
	コ								
	コ		<u> </u>		TOC =	5			
	コ		HS = 0.0	Geo	TOC = 0.05				
664.5	10		ppm						
<b>JECT</b>	1000	DES DATA COLLECTION FTD Bowley	tom IA			HOLE NO	). ETD ::		
	_ IAAAF	P.F.S. DATA COLLECTION - FTP Burling A-R, AUG 94	ion, iA				FTP-M	VV /	

HT	JAAAP	F.S. DATA COLLECTION - FTP	INSP	PECTOR						SHEET	P-MW7 SHE
	Burling			C. Anders	on					_	of 4
LEV.	DEPTH	DESCRIPTION OF MATERIALS	- I	FIELD SCREENING RESULTS	GEOTECH SAI		ANALYTICAL SAMPLE NO.	DI OM 001 "-	]	DELLARIO	
(a)	(b)	(c)		(d)	(e)	K NO.	(f)	BLOW COUNT (g)	İ	REMARKS (h)	
664.5	10 -	SAME: Silty CLAY (CL) - Stiff, moist	:,	BZ = 0.0				(9)	Shallow \		d Glacia
	=	SAME: Silty CLAY (CL) - Stiff, moist gray with reddish-brown, low to medi plastic, with Sand	íum	ppm	Geo		TOC = 0.05		Till		u
	1 =	piastic, with Sand				-{///		7			
	=								!		
663.5	11_		_						R=20/24		
	=							6ksf			
	=			-							
	l =		ĺ				1				
662.5	40 -							6ksf	!		
002.5	12		}	HS = 0.0							
	_			ppm BZ = 0.0							
				ppm					·		
661.5	<b>▼</b> 13_	0.2' seam of gray fine-grained Sand	(dry)						▼ ATD		
	=	With Sand						7ksf	_		
	=										
		Encountered water		1							
660.5	14	Sandy CLAY (CL) - Soft, moist to we reddish-brown, low plastic, fine-grain Sand with iron stains	et,					1ksf	R=36/36		
000.5	14	Sand with iron stains	ieu				F		Shallow V	Veathered	i Glacia
			}	İ					Till	Caulcicu	Olacia
ĺ											
659.5	15		-					1ksf			
	=										
Ì				HS = 0.0 ppm							
	=			BZ = 0.0							
SEO E	16			ppm				2ksf			
658.5	16	Highly weathered					ł				
į.	=										
}		Becomes medium stiff									
	$\equiv$	becomes medium sun						3ksf			
657.5	17										
	⊣			ĺ			1				
	=										
	$\exists$							4ksf			
556.5	18_							Laskey	R=48/48		
0.00.0	'°⊣	Chert nodule inclusions at 18' bgs	-				-	20			
		_					1				
- 1	=	Becomes wet		-	<del></del>		TOC =	8			
	$\exists$			HS = 0.0			TOC = 0.05				
555.5	19			ppm BZ = 0.0	Geo		İ				
1	コ			ppm							
	コ						1	12			
	目			<u> </u>							
EAF	20 =	Chert nodule inclusions at 20' bgs		1				>50 S2	R=20/24		
354.5   NECT	20 -	Chart housing inclusions at 20 bys					l_				
JEUI	ΙΔΔΔΙ	F.S. DATA COLLECTION - FTP Bu		IA				HOLE NO	FTP-N		

HT	RW	DRILLING LOG (	CONTINUATIO	N SHEET)					HOLE NUMB		7
PROJECT		F.S. DATA COLLECTION - FTP	SPECTOR C. Anders	son					SHEET 4 OF	SHEETS	;
	<u>_</u>		FIELD SCREENING		4PLE	ANALYTICAL		Υ			┨
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX		SAMPLE NO.			REMARKS		1
(a)	(b)	(c)	(d)	(e)		(f)	(g)	İ	(h)		1
654.5	20 —	SAME: Sandy CLAY (CL) - Medium stiff, wet, reddish-brown, low plastic, fine-		ľ				Shallow V	Veathered (	Slacial	F
	_	] wet, reddish-brown, low plastic, fine-  grained Sand						Till			F
			4					<u> </u>			E
	=	Clayey SAND (SC) - Loose, wet, reddish-brown, medium- to fine-grained, with Clay and Gravel	HS = 0.0	Geo	2.5			Glacial O	utwash		F
653.5	21	with Clay and Gravel	ppm								þ
000.0		LIMESTONE - Fractured, weathered, with Clay and Sand	-  BZ = 0.0				NA	Bedrock			E
1	=	with Clay and Sand	ppm		Н						E
1		, , , , , , , , , , , , , , , , , , ,			片						L
	_	Limestone - Bedrock			<del>                                      </del>						Ь
652.5	22 =			•	工		Laskev	R=24/24			
052.5	22				-		Luchtoy		22.0' bgs		ŧ
	_							D.O.D. W	22.0 bys		F
	_										F
	_								interval for		F
									7 is 11.0' to	21.0'	F
651.5	23		1					bgs.			F
	_	•									F
	_				Ιİ						F
	_		1								F
1	_										F
650.5	24										F
	=		1								E
	_										E
	=										F
	=										E
649.5	25										E
	⇒										E
	$\exists$				<b>i</b> [						E
	コ										E
	$\exists$										E
648.5	26_										E
	$\exists$				1						Е
	$\exists$		1								E
	=										F
	Ⅎ										E
647.5	27					i					F
	$\equiv$		1			ĺ	1				E
	$\exists$										Ē
	$\exists$										E
	$\exists$										F
646.5	28_					İ	ļ				F
	$\exists$						İ				F
]	7										F
	ㅋ		j l								F
	∃						l			ì	F
645.5	29						ĺ				F
											$\overline{}$
	$\exists$			ļ		l					_
			<u> </u>								_
	コ										_
644.5	30 📑										Ξ
PROJECT					1	<u> </u>	HOLE NO	١.			_
	<u> IAAA</u> F	P.F.S. DATA COLLECTION - FTP Burling	gton, IA		_			FTP-N	/IW7		
ENG FOR	M 5056	4-R, AUG 94						(Propor	ent: CEC	W-FG)	



JECT		DRILLING LOG (CF.S. DATA COLLECTION - FTP	ISPECTOR					FTP-MW8
	Burlingt	.0. 5/1// 0022201014   11	M. Sonder					2 OF 7
LEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO.	ANALYTICAL SAMPLE NO.	BLOW COUNT		REMARKS
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)
674.1	0 =	Silty CLAY (CL) - Very stiff, moist, brown and gray mottled with black, low to medium					Geologic	descriptions of
	<u> </u>	Silty CLAY (CL) - Very stiff, moist, brown and gray mottled with black, low to medium plastic, with iron staining, black organics, and crushed round Gravel					0.0' to 21	and remarks from .0' bgs are based
		3,2,5					on sampl	es collected from boring FTP-MW7
673.1	1						Fill	boiling if IP-WW
	=							
		Silty CLAY (CL) - Stiff, moist, black, low to	-				Topodi	
	=	Silty CLAY (CL) - Stiff, moist, black, low to medium plastic, with organics					Topsoil	
672.1	2_							
		Silty CLAY (CL) - Stiff, moist, reddish-brown and gray mottled, medium to high plastic	]					Veathered Glacia
		5					Till	
671.1	3							
	$\exists$							
Ì	$\exists$							
670.1	4							
	$\exists$	Becomes gray with reddish-brown						
	크							
669.1	5				]	į		
ļ	=							
	$\exists$					ĺ	l	
668.1	$\exists$							
500.1	ν							
	$\exists$		]					
		Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with	]			i	Shallow W Till	eathered Glacia
667.1	7	Sand					. 111	
	΄∃		ļĺ					
	$\Rightarrow$		]					
			]					
66.1	8_							
	$\exists$				}			
	三							
	$\exists$							
65.1	9							
	$\exists$				-			
	ヨ							
						1		
64.1	10 =						<u>_</u>	
JECT	ΙΔΔΔΕ	F.S. DATA COLLECTION - FTP Burling				HOLE NO	FTP-N	

		DRILLING LOG						FTP-MW8
OJECT	IAAAP Burlingt	I.O. DATA COLLECTION - I II	INSPECTOR					SHEET SHE
	- Darmigt	on, 173	M. Sonde		ANALYTICAL			3 of 7
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO.	SAMPLE NO.			REMARKS
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)
664.1	10 _	SAME: Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic,		l ///			Geologic	descriptions of
	_	with Sand	ŀ	l ///			materials 0.0' to 21	and remarks from .0' bgs are based
				l ///			on sampl	es collected from
000.4	] ,, =		1	l ///			adjacent	boring FTP-MW7 Veathered Glacia
663.1	11_						Till	veathered Glacia
	=							
	_							
662.1	12		Ì					
	$\equiv$		İ					
			ļ					
	_							
	_ =	0.21 soom of grov fine ground Cond (dm)			}			
661.1	<u> </u>	0.2' seam of gray fine-grained Sand (dry)					▼ ATD	
		With Sand						
	_				İ			
	_	Encountered water	_					
660.1	14 =	Sandy CLAY (CL) - Soft, moist to wet, reddish-brown, low plastic, fine-grained Sand with iron stains	ı   i				Shallow V Till	Veathered Glacia
	· · · <del>-</del>	with iron stains					1111	
İ								
					İ			
659.1	15				]	}		
	=				ĺ			
	$\exists$							
ĺ	$\exists$				}			
658.1	16							
030.1	16	Highly weathered						
	$\exists$				Ì			
		Becomes medium stiff				j		
		becomes mediam sun	İ					
657.1	17							
	$\exists$							
	ㅋ				İ			
	$\exists$					}		
656.1	<b>₄</b> ,∃		1			ĺ		
050.1	18	Chert nodule inclusions at 18' bgs						
	二	Becomes wet						
	$\exists$							
655.1	19_					ĺ		
	Ⅎ				1			
	=							
	ᆿ				1			
	. =	Chert nodule inclusions at 20' bgs	1					
654.1   DJECT	20 🗆	Oner nodule moldaions at 20 bys				1101 = 115		
MEGI	ΙΛΛΛΕ	F.S. DATA COLLECTION - FTP Burlin				HOLE NO	FTP-N	

ΗT	RW	$^{\prime}$ DRILLING LOG $^{\circ}$	ONTINUATION	N SHEET)				HOLE NUMI	MW8
DJECT	IAAAP I	F.S. DATA COLLECTION - FTP INS	SPECTOR					SHEET	SHEE
1	Burlingto	on, IA	M. Sonder		ANALYTICAL		1	4 0	F 7
LEV.	DEPTH	DESCRIPTION OF MATERIALS	RESULTS	OR CORE BOX NO				REMARKS	
(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)	
654.1	20	SAME: Sandy CLAY (CL) - Medium stiff, wet, reddish-brown, low plastic, fine-					Glacial Ti		
	=	grained Sand						description and remar	
		Clayey SAND (SC) - Loose, wet,	1				0.0' to 21	.0' bgs are	based
	=	Clayey SAND (SC) - Loose, wet, reddish-brown, medium- to fine-grained, with Clay and Gravel		傷	퇿		on sampl	es collecte boring FTF	d from
653.1	21	LIMESTONE - Light gray to whitish-gray,	-		<u>:  </u>		Glacial O	utwash	-101447.
	=	weathered Light gray to Whiten gray,		F	7		Bedrock	ا ما فاد د د ما الله	4011
	_		1		╛			rilling with tary bit at 2	
	=			H	-	•	bgs. Pull	down pres	sure
652.1	<sub>22</sub> =	Becomes less weathered			7		gauge at		
002.1							Logged fr	om cutting	s.
1	=			-	-				
ŀ									
	=								
651.1	23_		ľ						
	=						R = Reco	very chanical Br	eak
	_				-			ock Quality	
	=						Designati		
650.1	24								
	$\equiv$			H	-				
				P					
649.1	25			Ь					
043.1		More weathered and fractured with		F	4		Drilling be	comes ea	sier.
	=	brown, medium plastic Clay							
	$\exists$			<u> </u>					
	$\equiv$		}		-				
648.1	26			口	1				
	$\exists$								
	$\exists$			H	-				
	$\exists$				]			ed much h	arder
<b>.</b> .	∃			Ľ			drilling.		
647.1	27 📑	Becomes bluish-gray		H	-				
	$\exists$			口	7				
i	크				╡		Stopped of	Irilling on 3 5" steel dou	/30/03, ible
	=	Recomes highly fractured and highly	ļ	—— <u></u>	ქ		casing at	27.7' bgs.	
646.1	28_=	Becomes highly fractured and highly weathered		F	-		4/22/03 st	arted rock	
	$\exists$				╡		pressure	30 psi dov at 27.7' bg:	vnward s.
	$\equiv$						,	·· ~9	
	_	Clay filled fractures and voids		П	-				
1	=			BOX#1 🗆	]				
645.1	29	SHALE Growto dark grow soft highly			<u> </u>		Duc = 4 4	E!	
-	二	SHALE - Gray to dark gray, soft, highly fractured, fissile, highly weathered to			∄ !		Run = 4.4 R = 3.7'	<b>o</b> .	
ŀ	=	mostly Clay			∄		R = 3.7 $RQD = 22$	%	
	$\equiv$				<b>∄</b>		. (QD - 22	70	
644.1	30 =	0.2' Limestone seam			<b>∄</b>	1			
			1	<u> </u>	<b>⊸</b> 1				

ELEX. DEPTH DESCRIPTION OF INVESTMALS (RESULTS OF COORDES ON NO. AMPLE DESCRIPTION OF MATERIALS (RESULTS OF COORDES ON NO. AMPLE DESCRIPTION OF MATERIALS (RESULTS OF COORDES ON NO. AMPLE DESCRIPTION OF MATERIALS (RESULTS OF COORDES ON NO. AMPLE DESCRIPTION OF MATERIALS (RESULTS OF COORDES ON NO. AMPLE DESCRIPTION OF	OJECT		.o. DATA GOLLLOTTON - 1 11	SPECTOR M. Sondo						SHEET	SHEE
ELEV. DEPTH DESCRIPTION MATERIALS  (i) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		ouringt	UII, IA			MPLE T	ANALYTICAL		T	5 (	OF 7
SAME: SHALE - Gray to olive-gray, soft, highly fractured, slightly fissile, highly weathered  843.1 31 Becomes slightly Calcareous, slightly harder  844.1 32 Grades to Shaley LIMESTONE  LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured, unweathered except along fracture diameter  841.1 33 Becomes light reddish-brown and medium gray  85.4 Becomes light reddish-brown and medium gray  86.3 Becomes light reddish-brown and medium gray  87.0 Becomes light reddish-brown and medium gray  88.4 Becomes light reddish-brown and medium gray  89.4 Becomes light reddish-brown and medium gray  89.4 Becomes light reddish-brown and medium gray  80.4 I Drillers picked up 470 gallons of water.  80.4 I Drillers picked up 470 gallons of water.  80.4 I Drillers picked up 470 gallons of water.  80.4 I Drillers picked up 470 gallons of water.  80.5 I Run = 0.55' R = 0.45' R = 0.45' R = 4.45' R	ELEV.	DEPTH	DESCRIPTION OF MATERIALS					BLOW COUNT	l	REMARKS	
Becomes light reddish-brown and medium gray  Back and a stringer Becomes light gray, some styolites  Box # 1  Box # 2  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 4  Box # 3  Box # 4  Box # 3  B			(c)		(e)		(f)	(g)		(h)	
Secomes slightly Calcareous, slightly  Backers	644.1	30	SAME: SHALE - Gray to olive-gray, soft,						Bedrock		
Becomes slightly Calcareous, slightly harder  Becomes slightly Calcareous, slightly harder  Becomes slightly Calcareous, slightly harder  Becomes slightly Calcareous, slightly BZ FID = ND BOX # 1  Hole started taking water  MB  MB  MB  Run = 5.0' R = 5.0' RQD = 86%  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 1  Box # 2  Box # 3.0' RQD = 86%  Box # 3.0' RQD = 86%  Box # 3.0' RQD = 86%  Box # 3.0' RQD = 86%  Box # 3.0' RQD = 86%  Box # 4  Box # 4  Box # 3.0' RQD = 86%  Box # 4  Box # 5  Box # 6  Box # 6  Box # 6  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6		_	Inigniy fractured, slightly fissile, nignly Iweathered								
642.1 32 Grades to Shaley LIMESTONE  LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured, and diameter  641.1 33  Becomes light reddish-brown and medium gray  Becomes light reddish-brown and medium gray  FiD = ND  BOX # 1  BOX # 2  BOX # 3  BOX # 3  BOX # 3  BOX # 4  BOX # 4  BOX # 3  BOX # 3  BOX # 4  BOX # 3  BOX # 4  BOX # 3  BOX # 3  BOX # 4  BOX # 3  BOX # 4  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  BOX # 3  B		=									
642.1 32 Grades to Shaley LIMESTONE  IIMESTONE - Shaley, Siliceous, medium gray, moderately fractured, unweathered adameter  641.1 33.  640.1 34 Becomes light reddish-brown and medium gray  Fracture surfaces very weathered  638.1 36 Fracture surfaces very weathered  638.1 37 Dys. Shale Stringer  Becomes light gray, some stybiltes  636.1 38 Becomes light gray, some stybiltes  637.1 37 Becomes light gray, some stybiltes  638.1 39 Moderately fractured  Massum = 5.0'  R = 5.0'  RQD = 86%  Drillers picked up 470  gallons of water.  Run = 0.45'  No rock core recovery fracture surfaces weathered.  BOX # 2 III BOX # 2 III BOX # 37.6' io 37.6'			Becomes slightly Calcareous, slightly	BZ					Hole start	ed taking	water
642.1 32 Grades to Shaley LIMESTONE LIMESTONE LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured, unweathered except along fracture surfaces very weathered  641.1 33 Becomes light reddish-brown and medium gray  Fracture surfaces very weathered  638.1 36 Becomes light reddish-brown and medium gray  Fracture surfaces very weathered  637.1 37 Becomes light gray, some styolites  636.1 38 Becomes light gray, some styolites  637.1 37 Becomes light gray, some styolites  638.1 38 Becomes light gray, some styolites  638.1 38 Becomes light gray, some styolites  638.1 39 Moderately fractured  MB  MB  Run = 5.0' RQD = 86%  BOX # 1  Drillers picked up 470 gallons of vater.  Run = 0.45' No rock core recovery from 37.8' to 37.7' bgs.  Run = 4.45' RQD = 72%  All observed fracture surfaces weathered.	643.1	31	narder	FID = ND	BOX # 1	$\equiv$			I lole start	eu taking	water.
LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured unyeathered doxed accept along fracture diameter  Becomes light reddish-brown and medium gray  Becomes light reddish-brown and medium gray  Box # 1  Box # 2  Box # 2  Box # 3  Box # 2  Box # 3  Box # 4  Box # 3  Box # 3  Box # 3  Box # 4  Box # 3  Box # 4  Box # 4  Box # 5  Box # 5  Box # 5  Box # 5  Box # 6  Box # 6  Box # 6  Box # 7  Box # 6  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box #		_			_ • • • • • •	$\blacksquare$					
HIMESTONE - Shaley, Siliceous, medium gray, moderately fractured unyesthread except along fracture uniether uniet		_				Ħ					
LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured unyeathered doxed accept along fracture diameter  Becomes light reddish-brown and medium gray  Becomes light reddish-brown and medium gray  Box # 1  Box # 2  Box # 2  Box # 3  Box # 2  Box # 3  Box # 4  Box # 3  Box # 3  Box # 3  Box # 4  Box # 3  Box # 4  Box # 4  Box # 5  Box # 5  Box # 5  Box # 5  Box # 6  Box # 6  Box # 6  Box # 7  Box # 6  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box #		_							Ì		
LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured unyeathered doxed accept along fracture diameter  Becomes light reddish-brown and medium gray  Becomes light reddish-brown and medium gray  Box # 1  Box # 2  Box # 2  Box # 3  Box # 2  Box # 3  Box # 4  Box # 3  Box # 3  Box # 3  Box # 4  Box # 3  Box # 4  Box # 4  Box # 5  Box # 5  Box # 5  Box # 5  Box # 6  Box # 6  Box # 6  Box # 7  Box # 6  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box # 6  Box # 7  Box #		=									
Becomes light reddish-brown and medium gray  Fracture surfaces very weathered  639.1 35  639.1 37  637.1 37  638.1 38  MB  Becomes light gray, some styolites  638.1 38  Becomes light gray, some styolites  638.1 38  Becomes light gray, some styolites  Box # 2  Box # 2  Box # 3  Box # 4  Box	642.1	32	Grades to Shalev LIMESTONE								
641.1 33 Becomes light reddish-brown and medium gray  BZ FID = ND  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #2  BOX #3  BOX #4  BOX	l	=	LIMESTONE - Shalev. Siliceous.						МВ		
641.1 33 Becomes light reddish-brown and medium gray  BZ FID = ND  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #2  BOX #2  BOX #2  BOX #2  BOX #2  BOX #2  BOX #2  BOX #3  BOX #4  BOX		=	medium gray, moderately fractured,	[		$\square$					
641.1 33 Becomes light reddish-brown and medium gray  BZ FID = ND  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #1  BOX #2  BOX #2  BOX #2  BOX #2  BOX #2  BOX #2  BOX #2  BOX #3  BOX #4  BOX		=	unweathered except along tracture	]		H					
Becomes light reddish-brown and medium gray  BZ FID = ND  BZ FID = ND  BZ FID = ND  BX FID = ND  BX FID = ND  BX FID = ND  BX # 1  BX FID = ND  BX F		=	diameter			H					
Becomes light reddish-brown and medium gray  Fracture surfaces very weathered  BZ FID = ND  BX FID = ND  BX RQD = 86%  BOX # 1  Drillers picked up 470 gallons of water.  BY Run = 5.0' RQD = 86%  BOX # 2  Drillers picked up 470 gallons of water.  Run = 0.55' R = 0.45' No rock core recovery fro 37.6' to 37.7' bgs.  BOX # 2  BOX # 2  All observed fracture surfaces weathered.	641.1	. 33				口			мв		
Becomes light reddish-brown and medium gray  BZ FID = ND  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 1  BOX # 2  BOX # 2  BOX # 2  BOX # 34  BOX # 2  BOX # 34  BOX # 34  BOX # 34  BOX # 34  BOX # 34  BOX # 35  BOX # 35  BOX # 35  BOX # 37  BOX # 3		_									
Box # 1  Box # 2  Box # 2  Box # 2  Box # 3  Box # 4  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 3  Box # 4  Box # 4  Box # 4  Box		=							Run = 5.0	•	
639.1 35   Fracture surfaces very weathered   BOX # 1   Drillers picked up 470 gallons of water.		_				Ħ			R = 5.0'		
639.1 35   BOX # 1   BOX # 1   BOX # 1   BOX # 1   BOX # 2   Box # 2   Box # 3   Box # 3   Box # 4   Box # 4   Box # 5   Box # 635.1   Box # 2   Box # 2   Box # 3   Box # 4   Box # 5   Box # 635.1   Box # 2   Box # 2   Box # 2   Box # 3   Box # 4   Box # 5   Box # 635.1   Box # 2   Box # 3   Box # 4   Box # 5   Box # 635.1   Box # 635.1   Box # 635.1   Box # 635.1   Box # 7   Box # 8   Box # 9		=	medium grav						RQD = 86	5%	
639.1 35	640.1	34	9,	ן רוט – ואט							
639.1 35		=		1		Ш					
639.1 35		_				$\vdash$					
Fracture surfaces very weathered  Drillers picked up 470 gallons of water.  O.2' Shale Stringer  Becomes light gray, some styolites  Becomes light gray, some styolites  BOX # 2  BOX # 2  BOX # 2  All observed fracture surfaces weathered.					BOX # 1	岸					
Fracture surfaces very weathered  Drillers picked up 470 gallons of water.  O.2' Shale Stringer  Becomes light gray, some styolites  Becomes light gray, some styolites  BOX # 2  BOX # 2  BOX # 2  All observed fracture surfaces weathered.		_ =				H					
638.1 36	639.1	35		]			ļ				
638.1 36		_									
638.1 36 Drillers picked up 470 gallons of water.  82						H					
Drillers picked up 470 gallons of water.  8un = 0.55' R = 0.45' No rock core recovery fro 37.6' to 37.7' bgs.  8un = 4.45' R = 4.45' R = 4.45' RQD = 72%  All observed fracture surfaces weathered.		=	Fracture surfaces very weathered			口					
Drillers picked up 470 gallons of water.  8un = 0.55' R = 0.45' No rock core recovery fro 37.6' to 37.7' bgs.  8un = 4.45' R = 4.45' R = 4.45' RQD = 72%  All observed fracture surfaces weathered.	639 1	26 -				Ш					
G37.1 37	030.1	30		1		Щ					
G37.1 37											
G37.1 37						H					
G37.1 37	İ	$\exists$				H			Della 1	ماد ما درو	70
636.1 Becomes light gray, some styolites  Becomes light gray, some styolites  Box # 2  Box # 2  Moderately fractured  Box # 2  All observed fracture surfaces weathered.	637.1	37		]		H	1		gallons of	⊮eu up 4. water	, u
Becomes light gray, some styolites  803.1  8		_		l		Щ			J		
Becomes light gray, some styolites  803.1  8		$\equiv$				Щ			Run = 0.5	5'	
636.1 38 BOX # 2 BOX # 2 Run = 4.45' R = 4.45' RQD = 72%  All observed fracture surfaces weathered.			0.2' Shale Stringer			田			R = 0.45'	_	
636.1 38			Becomes light gray, some stvolites			H			No rock co	ore recove	ry from
635.1 39 Moderately fractured  BOX # 2 R = 4.45' RQD = 72%  All observed fracture surfaces weathered.	636.1	38	5 5.1.y, 115 cyc	]			ļ		31.0° to 37	./ pgs.	
635.1 39 Moderately fractured  BOX # 2 R = 4.45' RQD = 72%  All observed fracture surfaces weathered.		=				$\Box$	ł				
635.1 39 Moderately fractured    BOX # 2   R = 4.45'   RQD = 72%	ļ	=		[		H			Run = 4.4	5'	
635.1 39 Moderately fractured  All observed fracture surfaces weathered.		=			BOX # 2	口			R = 4.45'		
Moderately fractured  All observed fracture surfaces weathered.		=				Ш			<b>RQD = 72</b>	%	
All observed fracture surfaces weathered.	635.1	39	Moderately fractured			$\square$					
surfaces weathered.		二	woderately nactured						All obcor	nd fractive	
634.1 40		=				$\vdash \vdash \vdash$					
		$\exists$				口	ļ				•
		.,∃									
OJECT HOLE NO.	634.1   <b>OJECT</b>			1				HOLENO	`		

	1 X A A	DRILLING LOG	(CONTINUATIO	•					FTP-MW8
ROJECT		1.0. DATA GOLLLOTTON - 1 II	NSPECTOR			7.7			SHEET SHE
	Burling	on, IA	M. Sonde						6 of 7
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAM OR CORE BOX		ANALYTICAL SAMPLE NO.	BLOW COUNT		REMARKS
(a)	(b)	(c)	(d)	(e)	.,,.	(f)	(g)		(h)
634.1	40 -	SAME: LIMESTONE - Light gray	<del>  ``</del> -	-	П	.,	(8)	Bedrock	
					$\vdash$				
		Becomes Shaley	BZ						
633.1	41_		FID = ND	DOV # 0	$\perp$				
	=	Very fractured chert layer, some fracture surfaces stained dark	e	BOX#2				1	
	_	Becomes bluish-gray, little to no Shale							
İ		je o o moo zhanon gray, maio to mo onalo			$\vdash$				
	=					i		İ	
632.1	42_	December light areas and as allows areas			Н				
İ		Becomes light gray and medium gray, some Shale, abundant chert			Щ	}			
	=			•					nachanical breaks ' to 42.5' bgs.
	_				Ш			Run = 5.0	, 10 42.3 bys.
004.4	40 =							R = 5.0'	
631.1	43							RQD = 91	%
	=				H				
-	_				H			Box Break	ς
ĺ	=				口				
630.1	44 =		BZ FID = ND		$\vdash$				
300.1			FID - ND		Ħ	Ì			
		Fracture surfaces slightly weathered						МВ	
		Fracture surfaces slightly weathered			Ш				
ļ	_			BOX # 2	口				
629.1	45_				Н			MB	
	=	Shale content increasing							
	=		1 [		H			Box Break	•
ĺ					Н			DOX DICAN	•
	=				Щ	İ			
628.1	46							MB	
İ	=					ŀ			
	=	Becomes blue-gray				ĺ			
	$\equiv$				口				
627.1	47	Fracture surfaces weathered and dark stained	]		Н				
027.1	4/				Щ	Î			
	$\equiv$	Becomes very Shaley and gray to black		<del></del>	口			МВ	
	$\dashv$								
	$\dashv$	SHALE - Black to dork are: finalla	-				}		
626.1	48_=	SHALE - Black to dark gray, fissile, moderately fractured, weathered					İ		
1		· · · · · · · · · · · · · · · · · · ·				İ		Multiple m	echanical breaks
	$\equiv$						ļ	from 47.8'	to 48.6' bgs.
	-=			BOX # 3			ſ	Run = 5.0'	
ĺ	$\exists$					ŀ		Ruii – 5.0 R = 4.9'	
625.1	49							RQD = 94°	%
-	7	IMESTONE Philab areas	-		Ħ		[		
	コ	LIMESTONE - Bluish-gray				[			
	コ				Щ		į		
201	=	Becomes Shaley, Siliceous, brownish-			$\Box$	1			
624.1	50	gray to dark graý	1		Щ				
DJECT		F.S. DATA COLLECTION - FTP Burlin					HOLE NO		

	RW	DRILLING LOG	(CO	OITAUNITM	SHEET)					HOLE NUMBE	
ROJECT		S. DATA COLLECTION - FTP	INSP	ECTOR M. Sonder	man					SHEET 7 OF	SHEE
ELEV.	DEPTH	DESCRIPTION OF MATERIALS	_1. F	TELD SCREENING RESULTS		IPLE NO	ANALYTICAL	BLOW COUNT		REMARKS	<del>'</del>
(a)	(b)	(c)		(d)	(e)	,,,	(f)	(g)		(h)	
624.1	50 —	SAME: LIMESTONE - Shaley, Siliced brownish-gray to dark gray	ous,			尸			Bedrock		
		Vertical fractures	İ			F					
	=	vortical fractures		BZ							
623.1	51 <u> </u>			FID = ND	BOX#3	厂					
						$\blacksquare$			Cored to :	52.1' bgs. o 52.1' bgs.	
	=					$\Box$				ck core fror	
622.1	52_					H			to 52.1" be	js.	
	=								B.O.B. @	52.1' bgs	
									Screened	interval for	-4 41
									bgs.	is 41.1' to !	51.1
621.1	53										
ŀ	Ξ										
	_=										
	$\exists$										
620.1	54										
ĺ	$\exists$										
ł	크										
ŀ	Ξ		İ								
619.1	55										
	$\exists$						1				
	∃										
618.1	56		ľ								
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	=		İ								
	$\exists$										
617.1	57				į						
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ľ	$\exists$										
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616.1	58										
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615.1	E0 =										
015.1	59										
	∃										
	=			İ							
614.1	60 =										
OJECT							<u></u>	HOLE NO			
	IAAAF	P.F.S. DATA COLLECTION - FTP Bui	ırlingto	n. IA				1	FTP-N	tws	

TABLE B-1
SUMMARY OF GEOTECHNICAL PARAMETER RESULTS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Well/						Geo	otechnical	Paramete	ers					
Sample Type and W Sample Number	Sample Depth (ft bgs)	Unified Soil Classification	Water Content (%)	Dry Unit Weight (pcf)	Volumetric Water Content	Dry Bulk Density (g/cc)	Specific Gravity (g/cc)	Porosity (%)	% Passing No. 200 Sieve	Grain Size Figure No. (Appendix B)	Liquid Limit (%)	Plastic Limit (%)	TOC (% dry basis)	Notes
FTP Direct Push	Geotechnic	al Analys	is											
FTP-DP08	9.0	СН	18	104	0.30	1.67	2.639	37	58		53	21		
FTP-DP08	16.0	CH	22	106	0.38	1.70	2.667	36	80		66	23		
FTP-DP08	20.0	CL	17	113	0.31	1.81	2.660	32	68		42	18		
FTP-DP08	23.0	CL	16	123	0.32	1.97	2.653	26	71		33	17		
FTP Monitoring	Well Geote	chnical A	nalysis											
FTP-MW1	4.6	CL	23	103	0.38	1.64	2.577	36	57		44	17	1.6	
FTP-MW2	6.5	CL	22	104	0.36	1.67	2.611	36	75		36	18	0.28	
FTP-MW3 (B)	5.0	CH	22	102	0.37	1.63	2.611	38	73		51	20	0.23	
FTP-MW4 (B)	16.5	CH	24	103	0.40	1.65	2.639	37	78		64	20	0.08	
FTP-MW4 (B)	26.5	CL	17	116	0.32	1.85	2.646	30	60		32	17	0.05	
FTP-MW5	12.0	CL	19	113	0.34	1.81	2.564	30	52		32	17	0.06	
FTP-MW7	10.5	СН	23	102	0.38	1.64	2.558	36	82		62	18	0.05	
FTP-MW7	19.5	CL	16	119	0.31	1.90	2.577	26	61		29	17	0.05	
FTP-MW7	21.0	SC	12	125	0.24	2.01	2.611	23	32	1	27	15		

### Notes:

-- = Not Analyzed

% = Percent

bgs = Below Ground Surface

ft = Foot or Feet

g/cc = Grams per Cubic Centimeter

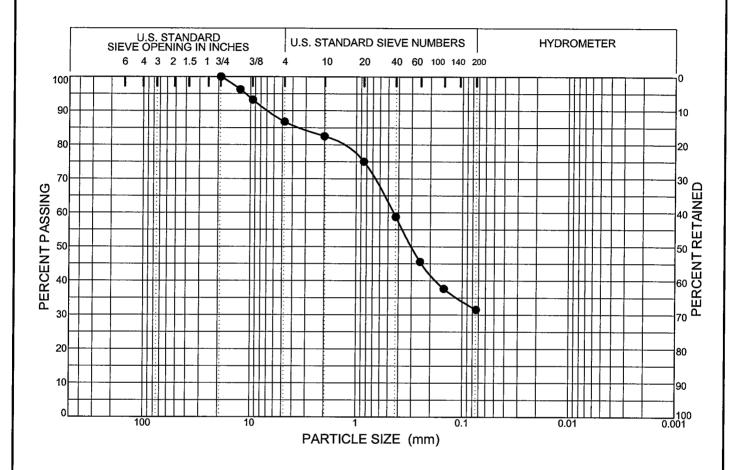
Harza = Montgomery Watson Harza

pcf = Pounds per cubic foot

TOC = Total Organic Carbon

URS = URS Group, Inc.

COBBLES	GRA	WEL		SAND	)	SILT OR CLAY
CODDLLO	coarse	fine	coarse	medium	fine	SILI OR GLAY



Boring Number	Depth (feet)	Symbol	LL	Pi	Description
FTPMW7	21.0	•	27	12	Clayey SAND (SC) - Brown, fine - grained

Checked by:

PARTICLE SIZE DISTRIBUTION CURVES

Figure No. 1

Project: IAAAP 6 SITE FS DATA COLLECTION

Burlington, Iowa

Project Number: 16169428



Direct Push – Groundwater

Monitoring Well – Soil (Total Organic Carbon)

Monitoring Well – Groundwater

**Direct Push – Groundwater** 

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP01-38 DATE/TIME COLLECTED: 10/22/02 1730 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 7 TAT 3 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container Preservative **Analysis Requested** (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 38.0 Time Started: N/A Depth to Water (ft BGS): 15.9 Time Completed: N/A Water Column Length: 22.1 PID/FID Measurements Volume of Water in Well (liters): 6.9 Background: 0.0 ppmPurge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (µS/cm) (NTU's) (°C) Oxygen (mg/L) (mV) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION **Model** Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 33' - 38' Screen Interval = 31.1 NTUs Turbidity of Sample =

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP02-25 DATE/TIME COLLECTED: 10/27/02 1138 PERSONNEL: CA SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: NO YES DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: Well Depth (ft. BGS): 10/27 25.0 Time Started: 1123 Depth to Water (ft BGS): 15.5 Time Completed: 1135 Water Column Length: 9.5 PID/FID Measurements Volume of Water in Well (liters): 2.8 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 1.5 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 20' - 25' 550 NTUs Turbidity of Sample =

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP03-31 DATE/TIME COLLECTED: 10/27/02 1225 PERSONNEL: CA SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 7 TAT 3 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: 10/27 Well Depth (ft. BGS): 31.0 Time Started: 1215 Depth to Water (ft BGS): 17.3 Time Completed: 1220 Water Column Length: 13.7 PID/FID Measurements Volume of Water in Well (liters): 4.1 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 2.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Water Redox Turbidity Purge Purged (liters) (µS/cm) (NTU's) (°C) Oxygen (mg/L) (mV) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 26' - 31' Turbidity of Sample = 52.7 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP04-13 DATE/TIME COLLECTED: 11/05/02 0915 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO **DUPLICATE SAMPLE NO.** MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (2) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 13.0 Time Started: N/A Depth to Water (ft BGS): 10.1 Time Completed: N/A Water Column Length: 2.9 PID/FID Measurements Volume of Water in Well (liters): 0.9 Background: $0.0 \; ppm$ Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 8' - 13' Turbidity of Sample = 110 NTUs

#### GENERAL INFORMATION PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP04-27 DATE/TIME COLLECTED: 10/23/02 0945 PERSONNEL: RC SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE OA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: NO YES DUPLICATE SAMPLE NO. MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon I13 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 27.0 Time Started: N/A Depth to Water (ft BGS): I1.4 Time Completed: Water Column Length: N/A 15.6 Volume of Water in Well (liters): PID/FID Measurements 4.9 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: Amount Purged (liters): 0.0 0.0 ppm Head Space: 0.0 ppm FIELD MEASUREMENTS Time pН Temperature Conductivity Amount Dissolved Redox Turbidity Water Purge Purged (liters) (µS/cm) (°C) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 22' - 27' Screen Interval = Turbidity of Sample = 51.2 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP05-23 DATE/TIME COLLECTED: 10/25/02 1435 PERSONNEL: RC SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. FTP-DP05-00 @ 1500 MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative Analysis Requested** (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 23.0 Time Started: N/A Depth to Water (ft BGS): 21.5 Time Completed: N/A Water Column Length: 1.5 PID/FID Measurements Volume of Water in Well (liters): 0.5 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 18' - 23' Turbidity of Sample = 89.1 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP06-24 DATE/TIME COLLECTED: 10/27/02 1255 PERSONNEL: CA SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 7 TAT 3 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: 10/27 Well Depth (ft. BGS): 24.0 Time Started: 1250 Depth to Water (ft BGS): 19.3 Time Completed: 1255 Water Column Length: 4.7 PID/FID Measurements Volume of Water in Well (liters): 1.4 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: Level of Drawdown (ft. BTOC): 0.0 ppm N/A Amount Purged (liters): Well Head: 0.0 ppm 0.5 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (µS/cm) Oxygen (mg/L) (NTU's) (°C) (mV) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 19' - 24' Screen Interval = Turbidity of Sample = N/A

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP07-27 DATE/TIME COLLECTED: 10/23/02 1020 PERSONNEL: RC SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO **DUPLICATE SAMPLE NO.** MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: Well Depth (ft. BGS): N/A 27.0 Time Started: N/A Depth to Water (ft BGS): 15.7 Time Completed: N/A Water Column Length: 11.3 PID/FID Measurements Volume of Water in Well (liters): 3.5 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pΗ Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION **Model** Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 22' - 27' Turbidity of Sample = 64.2 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP08-23 DATE/TIME COLLECTED: 10/25/02 0940 PERSONNEL: RC SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT **7 TAT** SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 70.0 Time Started: N/A Depth to Water (ft BGS): N/A Time Completed: N/A Water Column Length: N/A PID/FID Measurements Volume of Water in Well (liters): N/A Background: 2.4 ppm Purge Rate (liters/min): N/A Breathing Zone: 2.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 1.9 ppm Amount Purged (liters): 0.0 Head Space: 2.3 ppm FIELD MEASUREMENTS Time Amount pΗ Temperature Conductivity Dissolved Redox **Turbidity** Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 18' - 23' Turbidity of Sample = 33.1 NTUs

GENERAL INFORMATIO	)N							
PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201								•
SITE NAME: IAAAP FS	Data Collection			WELL NO.	FTP-DP09-30	)		
DATE/TIME COLLECTED	. 10	/23/02	1205	DEDCONNEL.	DC DM			
SAMPLE METHOD:		Pump / Bailer	1205	_ PERSONNEL:	KC, BM	·		
SAMPLE MEDIA:	Groundwater			<del>_</del>				
SAMPLE STATUS:	3 TAT	7 TAT	7 .					
SAMPLE QA SPLIT:	YES	NO	SPL	IT SAMPLE NO.				
SAMPLE QC DUPLICATE		NO						
MS/MSD REQUESTED	YES	NO MS/MSD SAMPLE NO.						
SAMPLE CONTAINERS,	PRESERVATIV	ES, ANALYSI	<u> </u>	· · · · · · · · · · · · · · · · · · ·				
Sample Container	Preservative		Analysis Req	uested				
(3) 40 mL VOA	AC HCI		Voletile Oree	nia Commonada (S	2260D)   E	112		
(2) 1 L Glass Amber	4C, HCL 4C		Explosives (8	nic Compounds (8	200B) + Fre0	n 115		<del> </del>
E) I E Glass Milled			Explosives (8	JJUJ T IVINA				
WELL PURGING DATA							<del></del>	
Date:	N/A	_	Well	Depth (ft. BGS):		30	.0	
Time Started:	N/A			Water (ft BGS):	- 1	19	.3	_
Time Completed:	N/A	Water Column Length: 10.7						
PID/FID Measurements		v	Volume of Water in Well (liters): 3.3					
Background:	0.0 ppm	Purge Rate (liters/min): N/A						
Breathing Zone:	0.0 ppm	Level of Drawdown (ft. BTOC): N/A						
Well Head:	0.0 ppm	Amount Purged (liters): 0.0				0		
Head Space:	0.0 ppm	_		-	· · · · · ·			
FIELD MEASUREMENTS					<del></del> ·		<del></del>	
Time Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
Purged (lite	rs)	(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate
		<u> </u>						
	┤ "_	113	r			, ,		
	_	ield N	leasu	remer	its N	/A [		
-			n.		٠,			
			-				<u>-</u>	
L								
FIELD EQUIPMENT AND	CALIBRATION	N	-		·· <u>,</u>			
FIELD EQUIPMENT AND		N odel	-			Calibration		
FIELD EQUIPMENT AND Photoionization Detector		<u>odel</u>		Calibration Verif	ication Daily	Calibration		
	<u>M</u>	odel SeV		Calibration Verif		Calibration		
Photoionization Detector	MiniRAE 10.0	odel 6eV ro				Calibration		
Photoionization Detector FID (1-50,000 ppm)	MiniRAE 10.0 Photovac Mic Slope Indicate	odel 6eV ro				Calibration		
Photoionization Detector FID (1-50,000 ppm) Water Level Probe  GENERAL COMMENTS Well Diameter =	MiniRAE 10.0 Photovac Mic Slope Indicate	odel 6eV ro				Calibration		
Photoionization Detector FID (1-50,000 ppm) Water Level Probe  GENERAL COMMENTS Well Diameter = Screen Interval =	MiniRAE 10.0 Photovac Mic Slope Indicate  1" 25' - 30'	odel 6eV ro				Calibration		
Photoionization Detector FID (1-50,000 ppm) Water Level Probe  GENERAL COMMENTS Well Diameter =	MiniRAE 10.0 Photovac Mic Slope Indicate	odel 6eV ro				Calibration		
Photoionization Detector FID (1-50,000 ppm) Water Level Probe  GENERAL COMMENTS Well Diameter = Screen Interval =	MiniRAE 10.0 Photovac Mic Slope Indicate  1" 25' - 30'	odel 6eV ro				Calibration		

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP10-18 DATE/TIME COLLECTED: 10/23/02 1100 PERSONNEL: RC SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 18.0 Time Started: N/A Depth to Water (ft BGS): 10.4 Time Completed: N/A Water Column Length: 7.6 PID/FID Measurements Volume of Water in Well (liters): 2.3 Background: N/A 0.0 ppm Purge Rate (liters/min): Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: N/A Amount Purged (liters): 0.0 Head Space: N/A FIELD MEASUREMENTS Time Amount pΗ Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model **Calibration** Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 13' - 18' Turbidity of Sample = 81.0 NTUs

	•								
PROJ. NAME	: Iowa Army	Ammunition Pl	ant		PROJECT NO.	16169421.00	201		
SITE NAME:	IAAAP FS D	ata Collection			WELL NO. 1	FTP-DP11-20	)		
DATE/TIME	COLLECTED:	10/	24/02	0935	PERSONNEL: .	IC			
SAMPLE ME	THOD:	Peristaltic 1	Pump / Bailer				1. 1		
SAMPLE ME	DIA.	Groundwater							
SAMPLE STA		3 TAT	7 TAT	7					
SAMPLE QA		YES	NO	CDI	T SAMPLE NO.				
_	DUPLICATE:	YES	NO	-	E SAMPLE NO				
_	PREQUESTED YES NO MS/MSD SAMPLE NO.								
SAMPLE CO	NTAINERS, PI	RESERVATIV	ES, ANALYSI	s					
Sample Contain	iner	Preservative		Analysis Requ	ıested				
(3) 40 mL VO	A	AC HCI		Volotila O	aia Cammanada (9	260D)   E	112		
(3) 40 mL VO (2) 1 L Glass A		4C, HCL 4C	<del></del>	Explosives (83	nic Compounds (8)	200B) + Fre0	п 115		
(2) I L Glass F	MILLON .	<b>T</b> C		Explosives (8.	JJUJ T IVINA				·
WELL PURG	GING DATA								
Date:		N/A	-	Well	Depth (ft. BGS):_		20	.0	
Time Started:		N/A	_	Depth to Water (ft BGS): 17.0					
Time Complet	ed:	N/A	_	Water Column Length: 3.0					
PID/FID Meas	urements		V	Volume of Water in Well (liters): 0.9					
Background:		0.0 ppm	_	Purge Rate (liters/min): N/A					
Breathing Zo	ne:	0.0 ppm	_	Level of Drawdown (ft. BTOC): N/A					
Well Head:		0.0 ppm	Amount Purged (liters): 0.0						
Head Space:		0.0 ppm	-						
FIELD MEAS	SUREMENTS				<del></del>		<del></del>		
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters	)	(℃)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate
				_					
	-						İ		
		<b></b> •	113	F			, ,	···	
		<b>F</b> 1	eld N	leasu	remen	its N	/A		
<del></del>			I	T			,		
								-	
				<u> </u>					
FIELD EQUI	PMENT AND C							<del></del>	
Dhasalant at	D-44		odel		O 171		<u>Calibration</u>		
Photoionization		MiniRAE 10.6		-	Calibration Verifi			<del></del>	
FID (1-50,000		Photovac Micr			Calibration Verifi	cation Daily			_
Water Level Pr	rope	Slope Indicato	<u>r</u>	-	······································				
GENERAL CO	OMMENTS							·	
Well Diameter		1"		-					
Screen Interval		15' - 20'							
Turbidity of Sa	mple =	> 1000 NTUs							
<del></del>							.,		
									<del></del> -

PROJ. NAME:	Iowa Army A	mmunition Pl	ant		PROJECT NO.	16169421.00	201	· 	
SITE NAME:	IAAAP FS D	ata Collection			WELL NO.	FTP-DP12-23	3		
DATE/TIME CO	OLLECTED:	10/	25/02	1125	PERSONNEL:	RC			
SAMPLE MET			Pump / Bailer						<del></del>
SAMPLE MED	IA:	Groundwater							
SAMPLE STAT	ΓUS:	3 TAT	7 TAT	1					
SAMPLE QA S	PLIT:	YES	NO	SPLI	T SAMPLE NO.				
SAMPLE QC D		YES	NO		E SAMPLE NO.			·····	
MS/MSD REQU	UESTED	YES	NO	MS/MS	D SAMPLE NO.				
SAMPLE CON	ITAINERS, PR	RESERVATIV	ES, ANALYSIS	s	<del></del>		<del></del>		
Sample Contain	er	Preservative		Analysis Requ	ested				
(3) 40 mL VOA		4C, HCL		Volatile Organ	nic Compounds (8	260B) + Freo	n 113		
(1) 1 L Glass Ar		4C		Explosives (83		<u> </u>			
				•					
WELL PURGI	NG DATA								
Date:		N/A		Well	Depth (ft. BGS):		23	5.0	
Time Started:		N/A		Depth to Water (ft BGS): 21.2				.2	
Fime Completed	d:	N/A	Water Column Length: 1.8						
PID/FID Measur	rements		Volume of Water in Well (liters): 0.5						
Background:		0.0 ppm	Purge Rate (liters/min): N/A						
Breathing Zone	e:	0.0 ppm	- I	Level of Drawdown (ft. BTOC): N/A					
Well Head:		0.0 ppm	-	Amount Purged (liters): 0.0			.0		
	-		-		• • • •				
Head Space:		0.0 ppm							
	JREMENTS	0.0 ppm	<u> </u>	<del></del>		<del></del> "	<del></del>	<del></del>	
FIELD MEASU			Townsombous	Candostisita	Dissolved	D.J.	T. A. D.	Water	
	Amount	рН	-	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
FIELD MEASU		рН	Temperature (°C)	Conductivity (μS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate
FIELD MEASU	Amount	рН	-	<del>-</del>			•		-
FIELD MEASU	Amount	рН	-	<del>-</del>			•		_
FIELD MEASU	Amount	рН	-	<del>-</del>			•		-
FIELD MEASU	Amount	pH	(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)		•
FIELD MEASU	Amount	pH	(°C)	(μS/cm)		(mV)	(NTU's)		•
FIELD MEASU	Amount	pH	(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)		_
FIELD MEASU	Amount	pH	(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)		-
Time	Amount Purged (liters)	<sub>рН</sub>	eld N	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)		-
Time	Amount Purged (liters)	pH Fi	eld M	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)		-
Time  Time	Amount Purged (liters)	pH Fi	eld N	(μS/cm)	remer	its N	(NTU's)		_
Time TELD EQUIPPE	Amount Purged (liters)  MENT AND C	pH  Fi  ALIBRATION  Mo  MiniRAE 10.6	eld N	(μS/cm)	remer	ication Daily	(NTU's)		_
Time  FIELD EQUIPT Photoionization FID (1-50,000 p)	Amount Purged (liters)  MENT AND C  Detector pm)	pH  ALIBRATION  MiniRAE 10.6  Photovac Mici	eld Nodel	(μS/cm)	remer	ication Daily	(NTU's)		_
Time  FIELD EQUIPT  Photoionization FID (1-50,000 p)	Amount Purged (liters)  MENT AND C  Detector pm)	pH  Fi  ALIBRATION  Mo  MiniRAE 10.6	eld Nodel	(μS/cm)	remer	ication Daily	(NTU's)		_
Time  FIELD EQUIPM Photoionization FID (1-50,000 p) Vater Level Project	Amount Purged (liters)  MENT AND C  Detector pm) be	PH  ALIBRATION  MiniRAE 10.6  Photovac Mici	eld Nodel	(μS/cm)	remer	ication Daily	(NTU's)		-
FIELD MEASU  Time  FIELD EQUIPPOPORT OF THE PROPERTY OF THE PR	Amount Purged (liters)  MENT AND C  Detector pm) be  MMENTS	pH  ALIBRATION  MiniRAE 10.6 Photovac Micr Slope Indicato	eld Nodel	(μS/cm)	remer	ication Daily	(NTU's)		-
FIELD MEASU	Amount Purged (liters)  MENT AND C  Detector pm) be  MMENTS	PH  ALIBRATION  MiniRAE 10.6  Photovac Mici	eld Nodel	(μS/cm)	remer	ication Daily	(NTU's)		•

SITE NAME: IAAAP FS Data Collection  DATETIME COLLECTED: 10/23/02 0833 PERSONNEL: RC  SAMPLE METHOD: Peristatic Pump/ Bailer  SAMPLE METHOD: GROUNdwater  SAMPLE STATUS: 3 TAT ATT ATT NO SAMPLE NO. SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. S
SAMPLE MEDIA: SAMPLE STATUS: SAMPLE QA SPLIT: SAMPLE QA SPLIT: SAMPLE QC DUPLICATE: WES SAMPLE QC DUPLICATE: YES NO MSMSD SAMPLE NO. DUPLICATE SAMPLE NO. MSMSD
SAMPLE MEDIA: SAMPLE STATUS: SAMPLE QA SPLIT: SAMPLE QA SPLIT: SAMPLE QC DUPLICATE: WES SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS  Sample Container Preservative Analysis Requested  (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113  (2) 1 L Glass Amber 4C Explosives (3330) + MNX  WELL FURGING DATA  Date: N/A Date: N/A Date: N/A Date: N/A Purge Rate (Hern/min): N/A Purge Rate (Hern/min): N/A Purge Rate (Hern/min): N/A Well Head: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 ppm FIELD MEASUREMENTS  FIELD MEASUREMENTS  FIELD MEASUREMENTS  Field Measurements Field Measurements Only purged (liters): CC) GLibration Value: CC) GLibration CC) GLibration CC) GLibration Calibr
SAMPLE MEDIA: SAMPLE QA SPLIT: SAMPLE QA SPLIT: YES NO MS/MSD REQUESTED YES NO MS/MSD REQUESTED YES NO MS/MSD REQUESTED YES NO MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. MS/MS
SAMPLE STATUS: 3 TAT SAMPLE QA SPLIT: YES NO MSAMPLE QO UPLICATE: YES NO MSAMSD REQUESTED YES NO MSAMSD REQUESTED YES NO MSAMSD SAMPLE NO.  SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS  Sample Container Preservative Analysis Requested  Analysis Req
SAMPLE QA SPLIT: YES NO DUPLICATE: YES NO NO DUPLICATE: SAMPLE NO. DUPLICATE: YES NO DUPLICATE: YES NO DUPLICATE: SAMPLE NO. MS/MSD SAMPLE
SAMPLE QC DUPLICATE: YES NO MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO.  SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS  Sample Container Preservative Analysis Requested  (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113  (2) 1 L Glass Amber 4C Explosives (8330) + MNX  WELL PURGING DATA  Date: N/A Well Depth (ft. BGS): 9.0  Time Started: N/A Depth to Water (ft BGS): N/A  Time Completed: N/A Water Column Length: N/A  Date: N/A Water Column Length: N/A  Date: N/A Water Column Length: N/A  Background: 0.0 ppm Purge Rate (liters/min): N/A  Breathing Zone: 0.0 ppm Amount Purged (liters): 0.0  Head Space: 0.0 ppm Amount Purged (liters): 0.0  FIELD MEASUREMENTS  Field Measurements N/A  Field Measurements N/A  Field Measurements N/A  Calibration Date (Life Column)  Field Measurements N/A  Calibration Detector MinRAE 10.6eV Calibration Daily  Field Distance Verification Daily  Field Distance Verification Daily  Field Distance Verification Daily  Field Distance Verification Daily
No
Sample Container
Sample Container
13   40 mL VOA
WELL PURGING DATA
WELL PURGING DATA
Date: N/A Well Depth (R. BGS): 9.0  Time Started: N/A Depth to Water (ft BGS): N/A  Time Completed: N/A Water Column Length: N/A  PID/FID Measurements Volume of Water in Well (liters): N/A  Background: 0.0 ppm Purge Rate (liters/min): N/A  Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A  Well Head: 0.0 ppm Amount Purged (liters): 0.0  Head Space: 0.0 ppm  FIELD MEASUREMENTS  Time Amount phy Temperature Conductivity Dissolved Redox Turbidity Water Purge (liters)  FIELD Measurements N/A  Field Measurements N/A  Field Measurements N/A  FIELD EQUIPMENT AND CALIBRATION  Model Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro  Calibration Verification Daily
Date: N/A Well Depth (R. BGS): 9.0  Time Started: N/A Depth to Water (R BGS): N/A  Time Completed: N/A Water Column Length: N/A  PID/FID Measurements Volume of Water in Well (liters): N/A  Background: 0.0 ppm Purge Rate (liters/min): N/A  Breathing Zone: 0.0 ppm Level of Drawdown (R. BTOC): N/A  Well Head: 0.0 ppm Amount Purged (liters): 0.0  Head Space: 0.0 ppm  FIELD MEASUREMENTS  Time Amount pH Temperature Conductivity Dissolved Redox Turbidity Water Purge (liters)  Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate  FIELD EQUIPMENT AND CALIBRATION  Model Calibration Verification Daily  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FIELD (1-50,000 ppm) Photovac Micro
Time   Started:   N/A   Depth to Water (ft BGS):   N/A
Time   Started:   N/A   Depth to Water (ft BGS):   N/A
Time Completed: N/A   Water Column Length: N/A   N/A
PID/FID Measurements
Background:   0.0 ppm   Purge Rate (liters/min):   N/A
Description   Column   Colu
Well Head: 0.0 ppm
FIELD MEASUREMENTS  Time Amount pH Temperature Conductivity Dissolved Redox Turbidity Water Purge (°C) (μS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate  Field Measurements N/A  Field Measurements N/A  FIELD EQUIPMENT AND CALIBRATION  Model Calibration Photoionization Detector MiniRAE 10.6eV Photovac Micro  Calibration Verification Daily  Field Neasurements N/A  Calibration Verification Daily  Calibration Verification Daily
FIELD MEASUREMENTS  Time Amount pH Temperature Conductivity Dissolved Redox Turbidity Water Purge (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate  Field Measurements N/A  Field Measurements N/A  FIELD EQUIPMENT AND CALIBRATION  Model Calibration Detector MiniRAE 10.6eV Calibration Daily  FID (1-50,000 ppm) Photovac Micro Calibration Daily  Calibration Daily
Time Amount pH Temperature Conductivity Dissolved Redox Turbidity Water Purge (conductivity Dissolved Redox Turbidity Water Purge (conductivity Dissolved Redox Turbidity Water Purge Rate)  Field Measurements N/A  Field Measurements N/A  FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Photovac Micro  Calibration Verification Daily  Calibration Daily  Calibration Daily
Purged (liters) (°C) (μS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate  Field Measurements N/A  FIELD EQUIPMENT AND CALIBRATION  Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Purged (liters) (°C) (μS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate  Field Measurements N/A  FIELD EQUIPMENT AND CALIBRATION  Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Photovac Micro Calibration Verification Daily Calibration Verification Daily Calibration Verification Daily Calibration Verification Daily
FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
FIELD EQUIPMENT AND CALIBRATION  Model Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Model Calibration  Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily  FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily
Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (I-50,000 ppm) Photovac Micro Calibration Verification Daily
FID (I-50,000 ppm) Photovac Micro Calibration Verification Daily
Water Level Probe Slope Indicator
CENTED AT COMMUNICO
GENERAL COMMENTS  Well Disputes To the Comment of t
Well Diameter = Screen Point Sampler Used.  Screen Interval = 5' - 9'
Furbidity of Sample = > 1000 NTUs
· · · · · · · · · · · · · · · · · · ·

PROJ. NAME:	Iowa Army A	Ammunition Pl	ant		PROJECT NO.	16169421.00	201		
SITE NAME:	IAAAP FS D	ata Collection			WELL NO.	L9-DP17-06			
DATE/TIME O	COLLECTED:	10/	25/02	1303	PERSONNEL:	RC.			
SAMPLE MET		-	Pump / Bailer	1303	_ I EKSONNEL.	KC			
			- wp / 241-01						***
SAMPLE MEI	DIA:	Groundwater		_					
SAMPLE STA		3 TAT	7 TAT	]					
SAMPLE QA :		YES	NO	4	T SAMPLE NO.				
SAMPLE QC I		YES	NO	DUPLICAT	E SAMPLE NO.			<u> </u>	
MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO.									
SAMPLE CO	NTAINERS, PE	RESERVATIV	ES, ANALYSI	s	<del></del>	<u> </u>		<del></del>	
Sample Contain	ner	Preservative		Analysis Requ	<u>iested</u>				
(3) 40 mL VO	A	4C, HCL		Volatile Organ	nic Compounds (8	3260B) + Fred	on 113		
(I) 1 L Glass A	mber	4C		Explosives (83	_				
WELL PURG	ING DATA	,							
Date:		N/A	_	Well	Depth (ft. BGS):		6.	0	
Time Started:		N/A	Depth to Water (ft BGS): 4.4						
Time Complete	ed:	N/A	Water Column Length: 1.6						
PID/FID Measu	<u>irements</u>		v	Volume of Water in Well (liters): 0.5					
Background:		0.0 ppm	Purge Rate (liters/min): N/A						
Breathing Zon	ie:	0.0 ppm	Level of Drawdown (ft. BTOC): N/A						
Well Head:		0.0 ppm	Amount Purged (liters): 0.0						
Head Space:		12.0 ppm	_						
FIELD MEAS	UREMENTS	•	<del></del>			<u></u>			
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters)		(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate
	-,			_					
								<u> </u>	
			44-	_					
	<u></u>	Fi	eld N	1easu	remen	its N	/A		
					- 0 0		,		
		L						;	
FIELD EQUIP	MENT AND C	ALIBRATION	1						
			<u>odel</u>				<b>Calibration</b>		
Photoionization	Detector	MiniRAE 10.6	ieV	_	Calibration Verif	ication Daily			
					Calibration Verif	ication Daily			
Water Level Pro	obe	Slope Indicato	r						
GENERAL CO	MMENTS	<del></del>				·		<del> </del>	<del></del>
Well Diameter		1"				·			
Screen Interval		1' - 6'						<u>.</u>	
Turbidity of Sar		107 NTUs		<del> </del>					
									<del></del>

PROJ. NAME: Iowa Army Ammunition Plant					PROJECT NO.	16169421.002	.01		
SITE NAME:	IAAAP FS D	ata Collection			_ WELL NO.	). FTP-DP18-10			
DATE/TIME C	OU ECTED:	10/	25/02	1205	DED CONNET.	DC DM			
SAMPLE MET			Pump / Bailer	1203	_ PERSONNEL:	RC, BM			
CAMPLE MED	ΤΑ.	- I .			_	Arter			-
SAMPLE MED		Groundwater	5 m t m	1					
SAMPLE STAT		3 TAT	7 TAT						
SAMPLE QA S		YES	NO	-	IT SAMPLE NO.			<u>-</u>	
SAMPLE QC D		YES	NO		E SAMPLE NO.		·		
MS/MSD REQU	DESTED	YES	NO	MS/MS	D SAMPLE NO.			<del></del>	
SAMPLE CON	TAINERS, PF	RESERVATIV	ES, ANALYSI	S					<del></del>
Sample Contain	<u>er</u>	Preservative		Analysis Requ	ıested				
(3) 40 mL VOA		4C, HCL		Volatile Organ	nic Compounds (	8260B) + Freoi	n 113		
(1) 1 L Glass Ar	nber	4C		Explosives (83	330) + MNX				
WELL BUDGE	NO DATA								=
WELL PURGE	NG DATA								
Date:		N/A		Well	Depth (ft. BGS):		10	0.0	
Time Started:		N/A	-	Depth to	Water (ft BGS):		8.	2	
Time Completed	1:	N/A	-		Column Length:		1.	8	
PID/FID Measur	rements		V	olume of Water	in Well (liters):		0.	6	
Background:		0.0 ppm			Rate (liters/min):	~	N/	'A	
Breathing Zone	 e:	0.0 ppm	Level of Drawdown (ft. BTOC): N/A						
Well Head:		0.0 ppm	Amount Purged (liters): 0.0						
Head Space:		0.0 ppm			<b>.</b>	<del></del>			
FIELD MEASU	REMENTS					<del></del>		<u>.</u>	
Time	Amount	pН	_	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters)		(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate
			.~						
			4 4 5	_					
		Fi	eld M	leasu	remer	nts N	<b>′A</b> ⊦		-
				ICaba	1 011101	165 1 1/	<b>4</b> •		
			-				-		}
				,			-		<del> </del>
FIELD EQUIP	MENT AND C	AI IRRATION	·	<del>"</del>			·**·		
LEED EQUIT	HEATT PETER C.		deI				Calibration		
Photoionization 1	Detector	MiniRAE 10.6			Calibration Veri	fination Daile	Cantilation		
FID (1-50,000 p)		Photovac Micr			Calibration Veri	-			
Water Level Pro		Slope Indicator			Canoration veri	neation Daily			
		Prope maicator			<del></del>				
GENERAL CO	MMENTS								
Well Diameter =		1"				- W. Mar-			
Screen Interval =		5' - 10'							
Turbidity of Sam	ple =	> 1000 NTUs	**-						
			· ··	<del></del>			<del></del>		

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP19-14 DATE/TIME COLLECTED: 10/25/02 0905 PERSONNEL: RC SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE OC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container Preservative **Analysis Requested** (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon I13 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 14.0 Time Started: N/A Depth to Water (ft BGS): 5.8 Time Completed: Water Column Length: N/A 8.2 PID/FID Measurements Volume of Water in Well (liters): 2.5 2.0 ppm Background: Purge Rate (liters/min): N/A Breathing Zone: Level of Drawdown (ft. BTOC): 2.0 ppm N/A Well Head: 1.1 ppm Amount Purged (liters): 0.0 Head Space: 1.1 ppm FIELD MEASUREMENTS Time pН Water Amount Temperature Conductivity Dissolved Redox Turbidity Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION <u>Model</u> <u>Calibration</u> Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 9' - 14' Turbidity of Sample = 10.4 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP20-23 DATE/TIME COLLECTED: 11/21/02 1515 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE OA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container Preservative Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 23.0 Time Started: N/A Depth to Water (ft BGS): 18.2 Time Completed: N/A Water Column Length: 4.2 PID/FID Measurements Volume of Water in Well (liters): 1.5 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: N/A Amount Purged (liters): 0.0 Head Space: N/A FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration MiniRAE 10.6eV Photoionization Detector Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 1" Screen Interval = 18' - 23' Turbidity of Sample = 11.9 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP21-30 DATE/TIME COLLECTED: 10/25/02 1020 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 7 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED NO YES MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative Analysis Requested** (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 30.0 Time Started: N/A Depth to Water (ft BGS): 18.0 Time Completed: N/A Water Column Length: 12.0 PID/FID Measurements Volume of Water in Well (liters): 3.7 Background: 2.4 ppm Purge Rate (liters/min): N/A Breathing Zone: 2.4 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 2.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time **Amount** pΗ Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 25' - 30' Screen Interval = Turbidity of Sample = 4.4 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP22-20 DATE/TIME COLLECTED: 11/21/02 1615 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 48 Hr TAT SAMPLE OA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative Analysis Requested** (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 20.0 Time Started: N/A Depth to Water (ft BGS): 10.6 Time Completed: Water Column Length: N/A 9.4 PID/FID Measurements Volume of Water in Well (liters): 2.9 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: Amount Purged (liters): 0.0 ppm 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (I-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator GENERAL COMMENTS Well Diameter = Screen Interval = 15' - 20' Turbidity of Sample = 16.1 NTUs

#### GENERAL INFORMATION PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP23-25 DATE/TIME COLLECTED: 11/21/02 1545 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 48 Hr TAT SAMPLE OA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: DUPLICATE SAMPLE NO. Duplicate 10 @ 1200 (VOCs Only) YES NO MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon I13 (2) I L Glass Amber 4C Explosives (8330) + MNX WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 25.0 Time Started: Depth to Water (ft BGS): 18.0 Time Completed: Water Column Length: N/A 7.0 PID/FID Measurements Volume of Water in Well (liters): 2.1 Background: 0.0 ppmPurge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.9 ppm FIELD MEASUREMENTS Time Amount pН Temperature Conductivity Dissolved Redox Turbidity Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator GENERAL COMMENTS Well Diameter = 20' - 25' Screen Interval = Turbidity of Sample = 953 NTUs

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP24-07 DATE/TIME COLLECTED: 11/22/02 1350 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater **SAMPLE STATUS:** 3 TAT 48 Hr TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE OC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container Preservative Analysis Requested (2) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 (1) 1 L Glass Amber 4C Explosives (8330) + MNX WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 7.0 Time Started: N/A Depth to Water (ft BGS): 6.5 Time Completed: N/A Water Column Length: 0.5 PID/FID Measurements Volume of Water in Well (liters): 0.2 0.0 ppm Background: Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount pΗ Temperature Conductivity Dissolved Redox **Turbidity** Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (NTU's) (mV) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 1" Screen Interval = 2' - 7' Turbidity of Sample = N/A

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP25-22 DATE/TIME COLLECTED: 11/22/02 1335 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 48 Hr TAT 3 TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. Duplicate 11 @ 1100 (VOCs Only) MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container **Preservative** Analysis Requested (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 (1) 1 L Glass Amber 4C Explosives (8330) + MNX WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 22.0 Time Started: N/A Depth to Water (ft BGS): 18.3 Time Completed: N/A Water Column Length: 3.7 PID/FID Measurements Volume of Water in Well (liters): 1.1 Background: 0.0 ppm Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time Amount Redox рH Temperature Conductivity Dissolved Turbidity Purge Water Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Rate Level Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION **Model** Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = 1" Screen Interval = 17' - 22' Turbidity of Sample = N/A

#### **GENERAL INFORMATION** PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201 SITE NAME: IAAAP FS Data Collection WELL NO. FTP-DP26-23 DATE/TIME COLLECTED: 11/25/02 1000 PERSONNEL: RC, BM SAMPLE METHOD: Peristaltic Pump / Bailer SAMPLE MEDIA: Groundwater SAMPLE STATUS: 3 TAT 48 Hr TAT SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. SAMPLE OC DUPLICATE: YES NO DUPLICATE SAMPLE NO. MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO. SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS Sample Container Preservative **Analysis Requested** (3) 40 mL VOA 4C, HCL Volatile Organic Compounds (8260B) + Freon 113 (1) 1 L Glass Amber 4C Explosives (8330) + MNX WELL PURGING DATA Date: N/A Well Depth (ft. BGS): 23.0 Time Started: N/A Depth to Water (ft BGS): I6.3 Time Completed: N/A Water Column Length: 6.7 PID/FID Measurements Volume of Water in Well (liters): 2.0 0.0 ppm Background: Purge Rate (liters/min): N/A Breathing Zone: 0.0 ppm Level of Drawdown (ft. BTOC): N/A Well Head: 0.0 ppm Amount Purged (liters): 0.0 Head Space: 0.0 ppm FIELD MEASUREMENTS Time **Amount** pН Temperature Conductivity Dissolved Redox **Turbidity** Water Purge Purged (liters) (°C) (µS/cm) Oxygen (mg/L) (mV) (NTU's) Level Rate Field Measurements N/A FIELD EQUIPMENT AND CALIBRATION Model Calibration Photoionization Detector MiniRAE 10.6eV Calibration Verification Daily FID (1-50,000 ppm) Photovac Micro Calibration Verification Daily Water Level Probe Slope Indicator **GENERAL COMMENTS** Well Diameter = Screen Interval = 18' - 23' Turbidity of Sample = 343 NTUs



Monitoring Well - Soil (Total Organic Carbon)

SITE NAME <u>Iowa AAP Six Site</u>	FS Dat	a Collection		_PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW1-05		· · · · · · · · · · · · · · · · · · ·		_WELL NO	FTP-MW1
DATE/TIME COLLECTED	3/2:	5/2003 / 1010		PERSONNEL	M. Sonderman
SAMPLE METHOD AND DEPTH		Laskey Sampler		_	4.0' - 4.8'
SAMPLE MEDIA (Circle 1):	Soil		Sediment	Sludg	e MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No	SPLIT SAMPLE	NUMBER	
FIELD DUPLICATE (Circle 1): Yes No DU		7	AMPLE NUMBER		
				_	
Sample Container		Prese	rvative		Analysis Requested
4 oz. Glass jar		N	one		ethod 9060 (Soil TOC)
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DESCRIPTION:					
DEPTH:		DESCRIPTION:			
			) - Soft moist de	ark arou blook and a	graymottled, low to medium
4.0' - 4.8'		plastic, fine-grain		irk gray-black and g	graymothed, low to medium
		<u> </u>			
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Comments					
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SITE NAME <u>Iowa AAP Six Site</u>	FS Da	ta Collection	PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW2-07		<u>-</u>	WELL NO	FTP-MW2
DATE/TIME COLLECTED	4/	14/03 / 1638	PERSONNEL_	M. Sonderman
SAMPLE METHOD AND DEPTH		Lasky Sampler		6.0' - 7.0'
SAMPLE MEDIA (Circle 1):	Soil	Sedime	nt Sluc	ige MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No SPLIT SAM	IPLE NUMBER	
FIELD DUPLICATE (Circle 1):	Yes	No DUPLICAT	TE SAMPLE NUMBER	₹
		. —		
Sample Container		<u>Preservative</u>		Analysis Requested
4 oz. Glass jar		None	N	Method 9060 (Soil TOC)
DESCRIPTION:				
DESCRIPTION:				
DEPTH:		DESCRIPTION:		
6.0' - 7.0'		Silty CLAY (CL) - Medium st with Sand and pieces of Limes	iiff, wet, dark brown ar stone	nd gray mottled, low plasite,
		With Saile and Stoods of Linion	stone	· · · · · · · · · · · · · · · · · · ·
			·. · · · · · · · · · · · · · · · · · ·	·
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				America Co
Comments				

SITE NAME Iowa AAP Six Site	FS Data Collection		_ PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW3-06			_ WELL NO	FTP-MW3
DATE/TIME COLLECTED	4/15/03 / 1320	<del></del>	PERSONNEL	M. Sonderman
SAMPLE METHOD AND DEPTH	Lasky Sample	er		4.0' - 5.0'
SAMPLE MEDIA (Circle 1):	Soil	Sediment	Sludge	MS/MSD
SAMPLE SPLIT (Circle 1):	Yes No	SPLIT SAMPLE	E NUMBER	
FIELD DUPLICATE (Circle 1):	Yes No	DUPLICATE SA	AMPLE NUMBER_	
Sample Container  4 oz. Glass jar	<u>Pr</u>	eservative None		nalysis Requested hod 9060 (Soil TOC)
				<u> </u>
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		· <u>-</u>	<del></del>	
		<del></del>		
DESCRIPTION:				
<b>DEPTH</b> :	DESCRIPTIO	N:		
4.0' - 5.0'	Clay (CH) - S	tiff, moist, yellowish	-brown, high plastic,	with Sand
· · · · · · · · · · · · · · · · · · ·				
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Comments				

SITE NAME <u>Iowa AAP Six Site</u>	FS Da	ta Collection	_ PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW4(B)-17			WELL NO	FTP-MW4 (B)
DATE/TIME COLLECTED	4/	13/03 / 0955	PERSONNEL	M. Sonderman
SAMPLE METHOD AND DEPTH		3" Split Spoon		16.0' - 17.0'
SAMPLE MEDIA (Circle 1):	Soil	Sediment	Sludge	MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No SPLIT SAMPL	E NUMBER	
FIELD DUPLICATE (Circle 1):	Yes	No DUPLICATE S	AMPLE NUMBER	
•				
Sample Container		<b>Preservative</b>	<u>A</u>	nalysis Requested
4 oz. Glass jar		None	Meth	nod 9060 (Soil TOC)
				<del>.</del>
DESCRIPTION:				
DEPTH:		DESCRIPTION:		
16.0' - 17.0'		Silty CLAY (CL) - Very stiff, moi	ist, gray dark gray, hig	h plastic, with Sand
			*	·
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Comments				

SITE NAME Iowa AAP Six Site	FS Da	ta Collection		_ PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW4(B)-26				_ WELL NO	FTP-MW4 (B)
DATE/TIME COLLECTED	4/1	3/2003 / 1030		PERSONNEL_	D. Berger
SAMPLE METHOD AND DEPTH		3" Split Spoon			26.0' - 26.5'
SAMPLE MEDIA (Circle 1):	Soil		Sediment	Sludge	MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No	SPLIT SAMPLE	ENUMBER	
FIELD DUPLICATE (Circle 1):	Yes	No	DUPLICATE SA	AMPLE NUMBER	<del></del>
			_		
Sample Container		Prese	rvative	<u>.</u>	Analysis Requested
4 oz. Glass jar		N	one		thod 9060 (Soil TOC)
		_		<del>_</del>	
				<del>-</del>	
					·
				<u></u>	
DESCRIPTION:					
DEPTH:		DESCRIPTION:			
			() - Very stiff mo	ist omnsish brown	with gray mottling, low to
26.0' - 26.5'			nedium- to coarse		with gray mottling, low to
			-		
			-		
			<del></del>	<u> </u>	
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Comments	···				

SITE NAME Iowa AAP Six Site	FS Dat	a Collection	PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW5-11			WELL NO	FTP-MW5
DATE/TIME COLLECTED	4/13	3/2003 / 1038	PERSONNEL_	M. Sonderman
SAMPLE METHOD AND DEPTH		2" Split Spoon		11.0' - 12.0'
SAMPLE MEDIA (Circle 1):	Soil	Sedimo	ent Slud	lge MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No SPLIT SA	MPLE NUMBER	
FIELD DUPLICATE (Circle 1):	Yes	No DUPLICA	TE SAMPLE NUMBER	2
Sample Container		<u>Preservative</u>		Analysis Requested
4 oz. Glass jar		None	M	Iethod 9060 (Soil TOC)
DESCRIPTION:				
DEPTH:		DESCRIPTION:		
		Sandy CLAY (CL) - Soft, mo	oist, vellowish-brown an	d grav mottled, medium
11.0' - 12.0'		plastic, iron staining, fine-gra		
				<del></del>
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Comments		<del></del>		

SITE NAME <u>Iowa AAP Six Site</u>	FS Da	ta Collection		_ PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW7-11				_ WELL NO	FTP-MW7
DATE/TIME COLLECTED	4/1	6/2003 / 0853		_ PERSONNEL	C. Anderson
SAMPLE METHOD AND DEPTH		2" Split Spoon			9.5' - 10.5'
SAMPLE MEDIA (Circle 1):	Soil		Sediment	Sludge	MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No	SPLIT SAMPLE	E NUMBER	
FIELD DUPLICATE (Circle 1):	Yes	No	DUPLICATE SA	AMPLE NUMBER_	
Sample Container		<u>Prese</u>	<u>rvative</u>	<u> </u>	analysis Requested
4 oz. Glass jar		N	one	Met	hod 9060 (Soil TOC)
		·			·····
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				<del>-</del>	
				_	·
DESCRIPTION					
DESCRIPTION:					
DEPTH:		DESCRIPTION:			
DLI III.			G.100		
9.5' - 10.5'		with Sand	) - Stiff, moist, gra	y with reddish-brow	n, low to medium plastic,
					<del></del>
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			<u>.</u>	···	<del></del>
			<del></del>	·	
Comments					
Comments					

SITE NAME <u>Iowa AAP Six Site</u>	FS Da	ta Collection		_ PROJECT NO	16169421.00201
SAMPLE NO. FTP-MW7-20				_ WELL NO	FTP-MW7
DATE/TIME COLLECTED	4/1	6/2003 / 0945		_PERSONNEL	C. Anderson
SAMPLE METHOD AND DEPTH		2" Split Spoon		_	18.5' - 19.5'
SAMPLE MEDIA (Circle 1):	Soil		Sediment	Sludg	e MS/MSD
SAMPLE SPLIT (Circle 1):	Yes	No	SPLIT SAMPLE	E NUMBER	
FIELD DUPLICATE (Circle 1):	Yes	No	DUPLICATE SA	AMPLE NUMBER	
Sample Container		Preser	vative		Analysis Requested
4 oz. Glass jar		No	one	Mo	ethod 9060 (Soil TOC)
				_	
			<u> </u>		
				<del></del>	
			· · · · · · · · · · · · · · · · · · ·	<u> </u>	
DESCRIPTION:					
DEPTH:		DESCRIPTION:			
18.5' - 19.5'		Sandy CLAY (CI grained Sand	.) - Medium stiff,	moist to wet, reddi	sh-brown, low plastic, fine
	-				
		· · · · · · · · · · · · · · · · · · ·			
		···			
Comments	<del></del>			-	

 $Monitoring\ Well-Groundwater$ 

PROJ. NAME:	Iowa Army	Ammunition Pl	ant ·		PROJECT NO.	·16169421.002	201	,	
SITE NAME:	IAAAP 6-Si	te FS Data Colle	ection			FTP-MW1		Page 1 of 2	
*					_	<del></del>			
DATE/TIME CO		5/13/03			PERSONNEL:	RC, MS			
SAMPLE MET	HOD:	Fultz	Pump	tu .	_	<del></del>			
SAMPLE MED	IA:	Groundwater							
SAMPLE QA S	PLIT:	YES	NO	SPL	IT SAMPLE NO.	FTP-MW1	Į.		
SAMPLE QC D	UPLICATE:	YES	NO	DUPLICAT	E SAMPLE NO.	FTP-MW9	)		
MS/MSD REQU	JESTED	YES	NO	MS/MS	D SAMPLE NO.		(		
SAMPLE CON	TAINERS, P	RESERVATIV	ES, ANALYSI	S		J			
Sample Contain	<u>er</u>	Preservative		Analysis Requ	uested				
(3) 1 L HDPE		4C, HNO3		Metals As, Ba	, Cd, Cr, Pb, Hg,	Se, Ag (6020/	7470)		
(6) 1 L Glass An	nber	4C		Explosives (82	330) + MNX				
(9) 40 mL VOA	**	4C, HCL		Volatile Organ	nic Compound (8	260B) + Freon	113		
(4) 40 mL VOA		4C, H3PO4		Total Organic	Carbon (415.1)			-	
(2) 1 L HDPE	******	4C, H2SO4		TKN (351.2),	Ammonia (350),	NO2+NO3 (35	53.2)		
(2) 500 mL HDF	PΕ	4C, ZnAcetate	/NaOH	Sulfide (376.2					
(2) 1 L HDPE		4C		Alk (310.1), S	O4 (300), Ortho	P (300), CL (3	00), CO2 (SM45	500D)	
WELL PURGI	NG DATA					·		<u></u>	<del></del>
Date:	5/13/03			Well D	epth (ft. BTOC):		18.	31	
Time Started:	0854		•	Depth to V	Vater (ft BTOC):		6.1	11	<del></del>
Time Completed	1004			Water	Column Length:		12.	20	
PID/FID Measur	ements		V	olume of Water	in Well (liters):		7.	6	
Background:	ND	\ ND		Purge l	Rate (liters/min):		0.	5	
Breathing Zone	ND	\ ND	,	Level of Drawd	lown (ft. BTOC):		0,1	15	
Well Head:	3.6	\ ND		Amoun	t Purged (liters):		38	.0	
FIELD MEASU	REMENTS								
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters	)	(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)
0855	0	6.74	9.95	0.540	1.85	-6.3	45	6.30	0.5
0859	2.0	6.86	10.00	0.530	0.30	-48.1	31	6.49	0.5
0903	4.0	6.81	10.10	0.515	0.17	-54.8	6.8	6.60	0.5
0907	6.0	6.79	10.06	0.514	0.13	-54.3	4.1	6.61	0.5
0911	8.0	6.77	10.07	0.508	0.15	-54.3	3	6.55	0.5
0915	10.0	6.75	9.94	0.504	0.09	-51.7	8.1	6.55	0.5
FIELD EQUIPM	MENT AND O	CALIBRATION	Ī	<u></u>			· <del>.</del>	· · · · · ·	<del></del>
		<u>Mo</u>	<u>del</u>				<b>Calibration</b>		
Photo ionization		MiniRAE 10.6			Twice Daily Cali	ibration Verific	cation also Calib	rated Weekly	
Flame ionization	··	Photovac Micro		ppm)	Twice Daily Cali	<del></del>	<del></del>	rated Weekly	
Water Level Prob		Slope Indicator			Checked Against				
Water Quality M	eter	YSI 556			Twice Daily Cali	ibration Verific	cation also Calib	rated Weekly	
GENERAL CO	MMENTS		<u> </u>						
Ferrous Iron =	1.21 mg/L				-				
Multi-Parameter		02J1177							·
Field Parameters		low Through Ce	:11						
Pump Placement		12' BTOC							
Well Diameter = Screen Interval =						<del></del>	<del></del>		
Turbidity of Sam		0.0 NTUs				<del></del>			
	r- <del>-</del>	2.0 1,1 03							

GENERAL INFORMATION

PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201

SITE NAME: IAAAP 6-Site FS Data Collection WELL NO. FTP-MW1 Page 2 of 2

	ME: IAAAP 6-Site FS Data Collection					FTP-MW1		Page 2 of 2		
FIELD MEASUE	REMENTS co	ont.								
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge	
F	Purged (liters)		(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)	
0919	12	6.74	9.90	0.504	0.08	-51.5	7.3	6.55	0.5	
0923	14	6.73	9.89	0.500	0.07	-48.8	2.5	6.55	0.5	
0927	16	6.72	9.85	0.499	0.06	-47.2	0	6.57	0.5	
0931	18	6.73	10.18	0.500	0.05	-45.0	0	6.55	0.5	
0935	20	6.74	10.01	0.501	0.05	-44.7	0	6.55	0.5	
0939	22	6.72	10.16	0.498	0.04	-42.8	0	6.55	0.5	
0943	26	6.72	10.12	0.496	0.04	-41.8	0	6.50	0.5	
0947	28	6.72	10.11	0.496	0.05	-40.1	0	6.55	0.5	
0951	30	6.70	9.77	0.494	0.04	-39.5	0	6.57	0.5	
0955	32	6.72	9.88	0.495	0.04	-39.9	0	6.55	0.5	
0959	36	6.70	9.86	0.494	0.04	-40.1	0	6.55	0.5	
1004	38	6.70	9.85	0.493	0.05	-40.4	0	6.55	0.5	
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THOS. THEME.	Iowa Army	Ammunition Pl	ant		_ PROJECT NO.	16169421.00	201	•	
SITE NAME:	IAAAP 6-Si	te FS Data Coll	ection		WELL NO.	FTP-MW2		-1.	
DATE/TIME CO	OLLECTED:	5/13/03	0905		PERSONNEL:	PC MS			
SAMPLE MET			Teflon Bailer		_ FERSONNEL.	RC, MS	·		
SAMPLE MED	TA:	Groundwater	•		_				
SAMPLE OA S		YES	NO	1 cm	IT CALADI E MO				
SAMPLE QC D		YES	NO	1	IT SAMPLE NO. FE SAMPLE NO.				
MS/MSD REQU		YES	NO	-	D SAMPLE NO.				
SAMPLE CON	TAINERS, P	RESERVATIV	ES, ANALYSI	S	-				
Sample Containe	<u>er</u>	Preservative		Analysis Req	uested				
(1) 1 L HDPE		4C, HNO3		Metals As, Ba	a, Cd, Cr, Pb, Hg,	Se, Ag (6020/	7470)		
(2) 1 L Glass Ar	nber	4C		Explosives (8	330) + MNX				
(3) 40 mL VOA		4C, HCL		Volatile Orga	nic Compound (82	260B) + Freon	113		
(2) 40 mL VOA		4C, H3PO4		Total Organic	Carbon (415.1)			<del>.</del> ,	
(1) 1 L HDPE		4C, H2SO4		TKN (351.2),	Ammonia (350), 1	NO2+NO3 (3:	53.2)		
(1) 500 mL HDF	PE .	4C, ZnAcetate	/NaOH	Sulfide (376.2			· ,		·
(1) 1 L HDPE		4C		Alk (310.1), S	O4 (300), Ortho F	(300), CL (30	00), CO2 (SM45	00D)	
WELL PURGI	NG DATA				· · · · · ·			<del></del>	
Date:	5/12/03			Well D	Depth (ft. BTOC):		19.	73	
Time Started:	1638		-		Water (ft BTOC):		11.		
Time Completed	1650		•		Column Length:		8.0		
PID/FID Measur			·		r in Well (liters):		5.	·	
Background:	ND	\ ND			Rate (liters/min):		0.		
Breathing Zone		\ ND			lown (ft. BTOC):		8.0		
Well Head:	ND	\ ND	· •		nt Purged (liters):		14		
FIELD MEASU	IREMENTS	<del></del>							
Time	Amount	рН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters	•	(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)
1639	0	7.40	12.01	0.309	5.00	142.8	>1100	11.74	0.5
1643	2	7.30	10.52	0.300	4.64	142.6	49	12.25	0.5
1647	4	7.17	9.51	0.293	5.56	142.3	315	16.10	0.5
1649	12	7.28	10.15	0.374	9.66	150.1	70	17.53	2.0
1650	14	Well is Dry		~~					2.0
0905	14.2	6.79	10.70	0.227	4.38	157.5	14	11.27	<u>-</u>
FIELD EQUIPA	MENT AND (	CALIBRATION	· · · · · · · · · · · · · · · · · · ·	<del></del>	<del></del>	<del> </del>			<del></del>
•		Mo					Calibration		
Photo ionization	Detector	MiniRAE 10.6			Twice Daily Cali	bration Verifi	-	rated Weekly	
Flame ionization			oFID (1-50,000	pnm)	Twice Daily Cali				
Water Level Prob		Slope Indicator		PP/	Checked Against			Tated Weekly	
	eter	YSI 556			Twice Daily Cali		<del></del>	rated Weekly	·
Water Quality M		W-411:	n screened inte	rval Well nur	ged dry before 3 v	olumes were o	ollected		
	MMENTS	water level is i		vii pui	D J 001010 J V		oncoica.		
GENERAL CO		water level is i							
GENERAL CO	0.72 mg/L			****	<del></del> .	·	· · · · · · · · · · · · · · · · · · ·		<del> </del>
GENERAL CO Ferrous Iron = Multi-Parameter	0.72 mg/L Probe Unit #	02J1177							
GENERAL CO Ferrous Iron = Multi-Parameter Field Parameters	0.72 mg/L Probe Unit # Measured in F	02J1177							
GENERAL CO Ferrous Iron = Multi-Parameter Field Parameters Pump Placement Well Diameter =	0.72 mg/L Probe Unit # Measured in F Depth = 2-inch	02J1177 Flow Through Ce 19' BTOC							
GENERAL CO Ferrous Iron = Multi-Parameter Field Parameters Pump Placement	0.72 mg/L Probe Unit # Measured in F Depth = 2-inch	02J1177 Flow Through Ce 19' BTOC							

	CORMATIO								
PROJ. NAME:	Iowa Army	Ammunition Pl	ant	<del></del>	_ PROJECT NO.	16169421.002	201		
SITE NAME:	IAAAP 6-Sit	te FS Data Colle	ection		WELL NO.	FTP-MW3			
DATE/TIME.C	OLLECTED:	5/13/03	0945		PERSONNEL:	BO RC MS			
SAMPLE MET			Teflon Bailer	···	_ I ERSONIVEE.	DO, RC, MS			
			TOTION BUILD		_		<u> </u>		
SAMPLE MED	IA:	Groundwater		_					
SAMPLE QA S	PLIT:	YES	NO	SPL	IT SAMPLE NO.				
SAMPLE QC D	UPLICATE:	YES	NO	DUPLICAT	TE SAMPLE NO.				`
MS/MSD REQU	JESTED	YES	NO	MS/MS	D SAMPLE NO.				· · · · · · · · · · · · · · · · · · ·
SAMPLE CON	TAINERS, P	RESERVATIV	ES, ANALYS	IS			<u></u>		
Sample Containe	<u>er</u>	Preservative		Analysis Requ	<u>uested</u>				
(I) 1 L HDPE		4C, HNO3		Metals As, Ba	, Cd, Cr, Pb, Hg,	Se, Ag (6020/7	7470)		
(2) 1 L Glass An	nber	4C	- 4-	Explosives (8:		, 6 (3-2-3)			
(3) 40 mL VOA		4C, HCL			nic Compound (82	260B) + Freon	113	**	
(2) 40 mL VOA		4C, H3PO4			Carbon (415.1)				<del></del>
(1) 1 L HDPE		4C, H2SO4			Ammonia (350),	NO2+NO3 (35	3.2)		
(1) 500 mL HDP	E	4C, ZnAcetate	/NaOH	Sulfide (376.2					
(1) 1 L HDPE		4C			O4 (300), Ortho F	(300), CL (30	0), CO2 (SM45	00D)	<del></del>
WELL PURGI	IC DATA	<del></del>							
WELLFURGI	NG DATA								
Date:	5/12/03			Well D	epth (ft. BTOC):		24.	00	
Time Started:	1745			Depth to V	Vater (ft BTOC):			68	
Time Completed	1754				Column Length:	-	9.3	32	
PID/FID Measur	ements		v	olume of Water	in Well (liters):	•/	5.	8	
Background:	ND	\ ND			Rate (liters/min):		0.		
Breathing Zone	ND	\ ND	j		own (ft. BTOC):	*	9.3		
Well Head:	ND	\ ND			t Purged (liters):		11		<del></del>
FIELD MEASU	REMENTS	<del></del>	<del></del>	<del></del>					
<b></b>			_						
Time	Amount	pН	Temperature	•	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters)	· · ·	(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)
1746	0	7.30	11.73	0.485	6.20	172.5	55	15.45	0.5
1750	2	7.18	11.13	0.478	5.41	171.9	16	16.40	0.4
1752	9	7.13	10.22	0.456	8.73	163.1	375	21.07	2.0
1754	11.5	Well is dry							
0945	12	7.24	12.44	0.473	3.97	101.2	9.1	20.49	- 1
	<del>-</del>								
FIELD EQUIPM	MENT AND C	ALIBRATION	<del></del>	<del>.</del>	<del></del>				<del></del>
•		Mod					Calibration		
Photo ionization l	Detector	MiniRAE 10.6e			Twice Daily Cali	hration Varifia		mate of Washin	
Flame ionization		Photovac Micro			Twice Daily Cali				
Water Level Prob		Slope Indicator	1110 (1-30,000					rated weekly	
Water Quality Me		YSI 556			Checked Against Twice Daily Cali			motod Waalde	
		161000			Twice Daily Call	oration verific	ation also Calib	rated weekly	
GENERAL CON									
	0.05 mg/L			-,					
Multi-Parameter I		02J1177							<del></del>
Field Parameters			11						
Pump Placement		23' BTOC	<del></del>			. , ,			
Well Diameter = Screen Interval = 1		TOC .					<del>-</del>	-3	
Turbidity of Samp		9.1 NTUs				<del></del>		<del></del>	
Ording Or Saint		×.1 111 U3		<del></del>					

PROJ. NAME:	Iowa Army	Ammunition Pl	ant		_ PROJECT NO.	16169421.00	201		
SITE NAME:	IAAAP 6-Si	te FS Data Colle	ection		WELL NO.	FTP-MW4		Page 1 of 2	
DATE/TIME C	OLLECTED:	5/14/03	0840		PERSONNEL:	RC			
SAMPLE MET	HOD:	Disposable	Teflon Bailer	<del></del>					
SAMPLE MED	IA:	Groundwater				×-	-		
SAMPLE QA S	PLIT:	YES	NO	] SPL	IT SAMPLE NO.				
SAMPLE QC D	UPLICATE:	YES	NO	7	TE SAMPLE NO.		<del></del>		
MS/MSD REQU	JESTED	YES	NO	7	D SAMPLE NO.				
SAMPLE CON	TAINERS, P	RESERVATIV	ES, ANALYSI	S					
Sample Containe	<u>er</u>	Preservative		Analysis Requ	uested				
(1) 1 L HDPE	_	4C, HNO3			a, Cd, Cr, Pb, Hg,	Sa Aa(6020/	7470)		
(2) 1 L Glass An	nber	4C		Explosives (83		3c, Ag (0020/	7470)	<del></del>	
(3) 40 mL VOA		4C, HCL			nic Compound (82	260R) + Freon	113		<del></del>
(2) 40 mL VOA	<del></del>	4C, H3PO4	4		Carbon (415.1)	JODJ + FICOII	113		
(1) 1 L HDPE		4C, H2SO4			Ammonia (350), 1	NO2+NO3 (34	53.2)	<del>" -</del>	
(1) 500 mL HDP	PE	4C, ZnAcetate	/NaOH	Sulfide (376.2)			)	·	
(1) 1 L HDPE		4C		· · · · · · · · · · · · · · · · · · ·	O4 (300), Ortho P	(300), CL (30	00), CO2 (SM45	00D)	
WELL PURGI	NG DATA	<del></del>	<del></del>	<del></del>		·	<del></del>	<del> </del>	
Date:	5/13/03			Well D	epth (ft. BTOC):		62.	28	
Time Started:	1614				Vater (ft BTOC):		17.		
Time Completed	1648				Column Length:		45.		
PID/FID Measur	ements		V		in Well (liters):	,	28		
Background:	ND	\ ND			Rate (liters/min):		0.		·
Breathing Zone	ND	\ ND	]		lown (ft. BTOC):		17.		
Well Head:	ND	\ ND			t Purged (liters):		53		
FIELD MEASU	REMENTS		:	<del></del>				<u> </u>	
Time	Amount		Таша	01	D' 1 1	<b>.</b> .	<b></b>		_
		рН	-	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
1615	Purged (liters)	7.19	(°C) 16.12	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)
1619	0.5	7.19	16.12	0.528 0.535	7.50	132.1	15	16.85	0.1
1628	22	6.94	12.63	0.533	3.99	127.3	17	17.19	0.1
1632	22.5	6.97	14.27	0.528	5.75 6.96	102.1	4.9	49.03	0.1
1636	23	6.98	15.21	0.526	6.98	87.7 79.7	3	49.33	0.1
1647	50	6.97	12.42	0.572	6.98	34.1	2.5 450	19.50	0.1
		0.5,	12.12	0.572	0.56	J4.1	430	00.20	2.0
FIELD EQUIPN	MENT AND C	CALIBRATION			<del></del>	<del></del>		<del></del>	
-		Mo					Calibration		
Photo ionization	Detector	MiniRAE 10.66			Twice Daily Cali	bration Verific	· <del></del>	rated Weekly	
Flame ionization	Detector	Photovac Micro	FID (1-50.000		Twice Daily Cali				
Water Level Prob	e	Slope Indicator	( , σ σ σ	PP	Checked Against		•	Tatou Weekiy	
Water Quality Me	eter	YSI 556			Twice Daily Cali		<del></del>	rated Weekly	
								rated Weekly	
GENERAL COM		Well purged dry	prior during a	ttempt at 3 to 5	well volumes.				
Ferrous Iron =	0.04 mg/L								<del>-</del>
Multi-Parameter		02J1177							
Field Parameters			11						
Pump Placement Well Diameter =		57' BTOC							
Screen Interval = :		`	<del></del>						<del></del>
Turbidity of Sam		3.0 NTUs	<del> </del>						
	·	2.0 1.1 00							<del></del>

#### **GENERAL INFORMATION**

PROJ. NAME: Iowa Army Ammunition Plant

PROJECT NO. 16169421.00201

SITE NAME: IAAAP 6-Site FS Data Collection

WELL NO. FTP-MW4

Page 2 of 2

	MALA USINE IS DATA CONCENSION				. WEEE NO.	F1P-MW4		Page 2 of 2			
LD MEASUR	EMENTS co	nt.									
	Amount urged (liters)	pН	Temperature	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Pur Rate (		
1648	53	Well is dry							ľ		
0840	53.2	7.11	15.62	0.537	6.00	108.9	3	-			
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PROJ. NAME:	Iowa Army	Ammunition Pl	ant		PROJECT NO.	16169421.002	201 .		
SITE NAME:	IAAAP 6-Si	te FS Data Colle	ection		WELL NO.	FTP-MW5		Page 1 of 2	
DATE/TIME CA	OLLECTED.	<i>5/12/02</i>	1045		DEDGOLDAN	20			
DATE/TIME CO SAMPLE METI		5/13/03	1245	<del></del>	_ PERSONNEL:	RC			
SAMIFLE MET	noD:	Fultz	Pump		_				<del></del> -
SAMPLE MED	IA:	Groundwater							
SAMPLE QA SI	PLIT:	YES	NO	] SPL	IT SAMPLE NO.				
SAMPLE QC D	UPLICATE:	YES	NO	DUPLICAT	TE SAMPLE NO.			'	
MS/MSD REQU	JESTED	YES	NO	MS/MS	D SAMPLE NO.				
SAMPLE CON	TAINERS, P	RESERVATIV	ES, ANALYS	IS	·				
Sample Containe	<u> </u>	Preservative		Analysis Requ	uested				
(1) 1 L HDPE		4C, HNO3		Metals As, Ba	a, Cd, Cr, Pb, Hg,	Se, Ag (6020/	7470)		
(2) 1 L Glass An	nber	4C	•••	Explosives (8					
(3) 40 mL VOA		4C, HCL		Volatile Orga	nic Compound (82	260B) + Freon	113		
(2) 40 mL VOA	·	4C, H3PO4		Total Organic	Carbon (415.1)				
(1) 1 L HDPE		4C, H2SO4	15.	TKN (351.2),	Ammonia (350),	NO2+NO3 (35	3.2)		
(1) 500 mL HDP	E	4C, ZnAcetate	/NaOH	Sulfide (376.2	2)				
(1) 1 L HDPE		4C		Alk (310.1), S	O4 (300), Ortho I	(300), CL (30	00), CO2 (SM45	00 <b>D</b> )	
WELL PURGI	NG DATA								
<b></b>									
Date:	5/13/03				epth (ft. BTOC):		16.	74	<del></del>
Time Started:	1150				Water (ft BTOC):		8.0	00	
Time Completed	1243				Column Length:		8.7	74	
PID/FID Measur		1 110	V		r in Well (liters):		5.		
Background:	ND	\ ND		_	Rate (liters/min):		0.		
Breathing Zone Well Head:	ND 0.5	\ ND			lown (ft. BTOC): nt Purged (liters):		8.7 26		
FIELD MEASU	REMENTS				•			=======================================	
Tri		**	_	~					
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters)	· · ·	(°C)	(μS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)
1151	0	6.93	11.71	0.483	2.52	81.7	50	9.08	0.5
1203	6 12	6.98	9.79	0.499	1.56	78.5	13	9.80	0.5
1213	18	6.92	9.90 9.99	0.498	1.55	79.8	11	9.80	0.5
1233	21	6.90	9.86	0.497 0.497	0.44	83.1 86.4	8.3	9.80	0.5
1239	24	6.89	9.89	0.493	0.88	87.8	7.1 5.2	9.50 9.52	0.5
FIELD EQUIPA	TENT AND C	ALIBRATION			<del></del>			<del></del>	
_ <		Mo					Calibration		
Photo ionization l	Detector	MiniRAE 10.66			Twice Daily Cali	ibration Verific		rated Weekly	
Flame ionization	Detector	Photovac Micro		(mag	Twice Daily Cali				
Water Level Prob	e	Slope Indicator		FF7	Checked Against			ratou Wookiy	
Water Quality Me	eter	YSI 556			Twice Daily Cali			rated Weekly	
GENERAL CON	MENTS				<del></del>		<del></del>		
Ferrous Iron = 0	0.12 mg/L					· · · · · · · · · · · · · · · · · · ·			
Multi-Parameter l		02J1177							
Field Parameters		low Through Ce	11						
Pump Placement		10' BTOC							
Well Diameter = Screen Interval = 6		000							
Turbidity of Sam		0.05 NTUs					<del></del>		<del></del>
									_

#### GENERAL INFORMATION

PROJ. NAME: Iowa Army Ammunition Plant

PROJECT NO. 16169421.00201

SITE NAME: IAAAP 6-Site FS Data Collection

WELL NO. FTP-MW5

Page 2 of 2

LD MEA	SUREMENTS con	ıt.							
Time	Amount Purged (liters)	рН	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lp
1243	26	6.88	9.91	0.494	0.47	87.6	0.05	9.52	0.5
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PROJ. NAME:	Iowa Army	Ammunition Pl	ant		_ PROJECT NO.	16169421.002	01		
SITE NAME:	IAAAP 6-Sit	e FS Data Coll	ection		WELL NO.	FTP-MW6		Page 1 of 2	
DATE/TIME C	OLLECTED:	5/14/03	1230		PERSONNEL:	BO RC MS			
SAMPLE MET			Teflon Bailer		_ I ERSONNEL.	DO, RC, 1913	<del>-</del>		
							<del></del>		
SAMPLE MED	IA:	Groundwater		-					
SAMPLE QA S		YES	NO	-1	IT SAMPLE NO.				
SAMPLE QC D		YES	NO		TE SAMPLE NO.				
MS/MSD REQU	JESTED	YES	NO NO	MS/MS	D SAMPLE NO.	-4			
SAMPLE CON	TAINERS, P	RESERVATIV	ES, ANALYSI	S			-		
Sample Contain	<u>er</u>	<u>Preservative</u>		Analysis Requ	uested				
(1) 1 L HDPE		4C, HNO3		Metals As, Ba	, Cd, Cr, Pb, Hg,	Se, Ag (6020/7	470)		
(2) 1 L Glass Ar	nber	4C		Explosives (8:					
(3) 40 mL VOA		4C, HCL		Volatile Orga	nic Compound (82	260B) + Freon	I13		
(2) 40 mL VOA		4C, H3PO4		Total Organic	Carbon (415.I)				
(1) 1 L HDPE		4C, H2SO4		TKN (351.2),	Ammonia (350), 1	NO2+NO3 (35	3.2)		
(1) 500 mL HDF	E	4C, ZnAcetate	/NaOH	Sulfide (376.2	2)				
(1) 1 L HDPE		4C		Alk (310.1), S	O4 (300), Ortho P	(300), CL (30	0), CO2 (SM45	00D)	
WELL PURGI	NG DATA	<del></del>		<del></del> `	<del></del> -:				
WELL TOROL	NO DATA								
Date:	10/13/03		-	Well D	epth (ft. BTOC):		47	.83	
Time Started:	1114		<u>-</u>	Depth to V	Vater (ft BTOC):		22	.91	
Time Completed				Water	Column Length:		24	.92	
PID/F1D Measur			V		in Well (liters):		15	5.5	
Background:	ND_	\ ND			Rate (liters/min): _			.1	
Breathing Zone		\ ND	. ]		lown (ft. BTOC):		24.	·	
Well Head:	0.2	\ ND	•	Amoun	t Purged (liters):		29	0.0	
FIELD MEASU	IREMENTS		<del></del>				<del></del>	-	
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
	Purged (liters)	1	(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lpm)
1115	0	7.21	12.41	0.694	4.19	57.9	17	23.14	0.1
1119	0.5	6.99	12.41	0.697	4.31	58.1	15	23.62	0.1
1122	3	7.18	11.48	0.594	4.48	59.0	7.1	28.19	0.1
1126	3.5	7.17	11.68	0.592	4.01	60.4	6.7	28.49	0.1
1131	18	7.17	11.34	0.675	5.35	60.9	32	21.00	2.0
1134	29	Well is Dry			<u> </u>			46.00	
FIELD EQUIP	MENT AND C	ALIBRATION	ī	<u> </u>	<del>,</del>		<del></del>	·	
		<u>Mo</u>	<u>del</u>				Calibration		
Photo ionization		MiniRAE 10.6			Twice Daily Cali	bration Verific	ation also Calib	orated Weekly	
Flame ionization		Photovac Micro	oFID (1-50,000	ppm)	Twice Daily Cali	bration Verific	ation also Calib	orated Weekly	
Water Level Prol		Slope Indicator			Checked Against		<del></del>	·	
Water Quality M	eter	YSI 556			Twice Daily Cali	bration Verific	ation also Calib	orated Weekly	
GENERAL CO	MMENTS	<del></del>							
	Insufficient vo	lume		****					
Multi-Parameter		02J1177	<del></del>						
Field Parameters			:11						
Pump Placement	Depth =	40' BTOC						<del>-</del>	
Well Diameter =									
Screen Interval =									
Turbidity of Sam	pie –	4.7 NTUs							·

### **GENERAL INFORMATION**

PROJ. NAME: Iowa Army Ammunition Plant

PROJECT NO. 16169421.00201

SITE NAME: IAAAP 6-Site FS Data Collection

WELL NO. FTP-MW6

Page 2 of 2

Time	Amount Purged (liters) 29.2	pН	Temperature (°C)	Conductivity (µS/cm) 0.782	Dissolved Oxygen (mg/L) 5.90	Redox (mV) 118.3	Turbidity (NTU's) 4.7	Water Level	Purg Rate (lp
	Purged (liters)	)	(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lp
	Purged (liters)	)	(°C)	(µS/cm)	Oxygen (mg/L)	(mV)	(NTU's)	Level	Rate (lp
								T	1
					3.50	110.5	7.7		
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PROJ. NAME: Iowa Army Ammunition Plant PROJECT NO. 16169421.00201									
SITE NAME: IAAAP 6-Site FS Data Collection						FTP-MW7		Page 1 of 2	
					_ "LLL NO.	111-11147		rage 1 01 2	
DATE/TIME COLLECTED:		5/14/03	1110		_ PERSONNEL:	RC, MS			
SAMPLE METHOD:		Fultz	Pump		_				
SAMPLE MED	IA:	Groundwater							
SAMPLE QA SPLIT:		YES	NO	] SPI	IT SAMPLE NO.				
SAMPLE QC DUPLICATE:		YES	NO	1	TE SAMPLE NO.		<del></del>		
MS/MSD REQUESTED		YES	NO	1	D SAMPLE NO.			<del></del> -	
SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS									
Sample Container		Preservative		Analysis Requ	uested				
(1) 1 L HDPE 4C, HNO				Metals As, Ba	a, Cd, Cr, Pb, Hg,	Se. Ag (6020/	7470)		
(2) 1 L Glass Amber 4		4C	3 Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)  Explosives (8330) + MNX						
(3) 40 mL VOA 4C,		4C, HCL	Volatile Organic Compound (8260B) + Freon 113						
(2) 40 mL VOA 4C, H3PO4				Total Organic	Carbon (415.1)			**	
(1) 1 L HDPE 4C, H2SO4 TKN (351.2), Ammonia (350), NO2+NO3 (353.2)									
(1) 500 mL HDPE 4C, ZnAcetate/NaOH Sulfide (376.2)									
(1) 1 L HDPE		4C		Alk (310.1), S	O4 (300), Ortho F	P (300), CL (30	00), CO2 (SM450	00D)	
WELL PURGI	NG DATA	· · · · · · · · · · · · · · · · · · ·	<del></del>		· · · · · · · · · · · · · · · · · · ·		<del></del>		
Date:	5/14/03			Well D	epth (ft. BTOC):		24	17	
Time Started:	0945	Well Depth (ft. BTOC):         24.17           Depth to Water (ft BTOC):         8.00							
Time Completed 1108			Water Column Length:				16.17		
PID/FID Measurements			Volume of Water in Well (liters): 10.0						
Background:	ND				Rate (liters/min):				
Breathing Zone	ND	\ ND	Level of Drawdown (ft. BTOC): 0.02						
Well Head:	ND	\ ND	Amount Purged (liters): 10.0						
FIELD MEASUREMENTS									
Time	Amount	mII	T	C4444	Discolar 1	ъ.	m 1111		_
	Purged (liters)	pΗ	Temperature (°C)	Conductivity	Dissolved	Redox	Turbidity	Water	Purge
0946	0	7.37	13.23	(μS/cm) 0.4	Oxygen (mg/L) 3.18	99.2	(NTU's)	Level	Rate (lpm)
0950	0.5	7.34	14.88	0.399	2.73	96.7	251 110	8.68	0.1
0954	1	7.34	13.63	0.398	2.70	91.1	93	8.71	0.15
0958	1.5	7.33	13.28	0.397	2.54	88.6	54	8.73	0.15
1002	2	7.32	13.55	0.396	2.42	86.7	65	8.70	0.15
1006	2.5	7.33	13.54	0.398	2.40	84.1	51	8.70	0.15
FIELD EQUIPN	MENT AND	ALIDDATION	<del> </del>				<del></del>		
FIELD EQUIT	MENT AND	ALIBRATION Mo					G-19		
		MiniRAE 10.66			Twice Deily Celi		Calibration	4 777 4 4	
_		<del></del>			Twice Daily Calibration Verification also Calibrated Weekly Twice Daily Calibration Verification also Calibrated Weekly				
-		Slope Indicator		ppin)	Checked Against Calibrated Length				
Water Quality Meter		<del></del>			Twice Daily Calibration Verification also Calibrated Weekly				
GENERAL CO	MMENTS			<del></del>					
	0.14 mg/L					<del></del>			<del></del>
Multi-Parameter		02J11 <b>7</b> 7	<b></b>					-	<del></del>
Field Parameters Measured in Flow Through Cell									
Pump Placement		20' BTOC							
Well Diameter =		FO.C				·			
Screen Interval = 13.6' - 23.6' BTOC  Turbidity of Sample = 6.1 NTUs									
or Dalli	r-v								

## WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: Iowa Army Ammunition Plant

PROJECT NO. 16169421.00201

SITE NAME: IAAAP 6-Site FS Data Collection

WELL NO. FTP-MW7

Page 2 of 2

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FIELD MEAS	SUREMENTS co	ont.						-	
Time	Amount	pН	Temperature	Conductivity	Dissolved	Redox	Turbidity	Water	<b>D</b>
	Purged (liters)	P	(°C)	(μS/cm)	Oxygen (mg/L)		(NTU's)	Level	Purge Rate (lpm)
1010	3	7.33	13.39	0.398	2.37	82.6	35	8.69	0.15
1014	3.5	7.33	13.43	0.398	2.31	83.5	40	8.70	0.15
1018	4	7.32	13.35	0.399	2.19	83.4	37	8.70	0.15
1022	4.5	7.32	13.36	0.399	2.17	83.3	29	8.70	0.15
1026	5	7.32	13.45	0.400	2.32	80.8	35	8.70	0.15
1030	5.5	7.32	13.31	0.401	2.17	81.1	37	8.70	0.15
1034	6	7.31	13.11	0.401	2.13	80.1	29	8.72	0.15
1038	6.5	7.31	13.07	0.403	2.10	78.9	11	8.70	0.15
1042	7	7.31	13.20	0.404	2.05	78.3	10	8.71	0.15
1046	7.5	7.31	13.09	0.403	2.05	78.2	9	8.71	0.15
1050	8	7.32	13.29	0.404	2.03	78.0	11	8.71	0.15
1054	8.5	7.31	13.43	0.404	2.04	77.9	10	8.70	0.15
1100	9	7.30	13.39	0.405	2.05	77.6	6.3	8.70	0.15
1104	9.5	7.31	13.29	0.404	2.04	77.5	5.5	8.70	0.15
1108	10	7.31	13.31	0.404	2.02	77.6	6.1	8.71	0.15
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# WATER SAMPLE COLLECTION FIELD SHEET

#### GENERAL INFORMATION

PROJ. NAME:	Iowa Army	Ammunition Pl	ant		_ PROJECT NO.	16169421.002	201		
SITE NAME:	IAAAP 6-Sit	e FS Data Coll	ection		WELL NO.	FTP-MW8		Page 1 of 2	
DATE/TIME C	OLLECTED:	5/14/03	1215		PERSONNEL:	PC MS			
SAMPLE MET	··		Teflon Bailer		_ I EKSONNEE.	KC, MS			
CAMPIEMED	T.A.			***	_		•	····	
SAMPLE MED		Groundwater		1					
SAMPLE QA S		YES	NO	1	IT SAMPLE NO.				
SAMPLE QC D		YES	NO	J	TE SAMPLE NO.		3 7 50 0 500		<del></del>
MS/MSD REQU		YES	NO		D SAMPLE NO.	FTP-MW	3 MS/MSD		
SAMPLE CON	TAINERS, PI	RESERVATIV	ES, ANALYSI	<b>s</b> .					
Sample Contain	<u>er</u>	Preservative		Analysis Requ	uested				
(2) 1 L HDPE		4C, HNO3		Metals As, Ba	ı, Cd, Cr, Pb, Hg,	Se, Ag (6020/	7470)		
(4) 1 L Glass Ar	nber	4C		Explosives (8.	330) + MNX				
(6) 40 mL VOA		4C, HCL		Volatile Organ	nic Compound (8	260B) + Freor	113		
(4) 40 mL VOA		4C, H3PO4		Total Organic	Carbon (415.1)				
(2) 1 L HDPE		4C, H2SO4		TKN (351.2),	Ammonia (350),	NO2+NO3 (3	53.2)		
(2) 500 mL HDI	<u> E</u>	4C, ZnAcetate	/NaOH	Sulfide (376.2	2)				
(2) 1 L HDPE	<u>.</u>	4C		Alk (310.1), S	O4 (300), Ortho	P (300), CL (3	00), CO2 (SM45	500 <b>D</b> )	
WELL PURGI	NG DATA	·			<u> </u>	<del></del> -	<u> </u>		
Date:	5/14/03			Well D	epth (ft. BTOC):		54.	.12	
Time Started:	0818		•		Vater (ft BTOC):		9.9		-
Time Completed	0921		•	_	Column Length:		44.		
PID/FID Measur	ements		V		in Well (liters):		27		
Background:	ND	\ ND			Rate (liters/min):		0.1		
Breathing Zone	ND	\ ND		_	lown (ft. BTOC):	<del></del>	44.		
Well Head:	ND	\ ND			nt Purged (liters):		41		
FIELD MEASU	REMENTS				<del></del>				
Time	Amount	Дq	Temperature	Conductivity	Dissolved	Redox	Tunki die .	W-4	<b>n</b> .
11110	Purged (liters)	•	(°C)	(μS/cm)			Turbidity	Water	Purge
0819	0	7.15	13.99	0.660	Oxygen (mg/L) 5.29	(mV) 106.3	(NTU's)	Level	Rate (lpm)
0824	0.5	7.07	14.68	0.670	3.67	112.7	<del> </del>	9.35	0.1
0828	19	7.07	12.22	0.539	4.65	92.7	15	9.81 36.57	0.1
0832	20	7.09	13.09	0.540	4.36	94.7	9.5	36.27	0.2
0836	22	7.09	13.64	0.540	4.27	96.0	3.6	36.60	0.2
0840	23	7.10	13.63	0.541	4.11	95.2	2.7	36.21	0.3
FIELD EQUIP	MENT AND C	'AL IRRATION	1						
		Mo					Calibration		
Photo ionization	Detector	MimiRAE 10.6			Twice Daily Cali	ibention Vanië		4 - 4 3771.1	
Flame ionization		Photovac Micro			Twice Daily Cali				
Water Level Prob		Slope Indicator	<del></del>	•• ′	Checked Against			rated weekly	
Water Quality M		YSI 556					<del></del>		
water Quarity IVI		131330			Twice Daily Cali	ibration verific	cation also Calib	rated Weekly	
GENERAL CO									<del></del>
Ferrous Iron =	0.10 mg/L								
Multi-Parameter		02J1177							
Field Parameters			11						
Pump Placement		50' BTOC							
Well Diameter = Screen Interval =									
Turbidity of Sam		2.1 NTUs							<u> </u>
or balli	F	11103							

# WATER SAMPLE COLLECTION FIELD SHEET

#### GENERAL INFORMATION

PROJ. NAME: Iowa Army Ammunition Plant

PROJECT NO. 16169421.00201

SITE NAME: IAAAP 6-Site FS Data Collection

WELL NO. FTP-MW8

Page 2 of 2

Time	SITE NAME:	IAAAP 6-Site	e FS Data Coll	ection	·	_ WELL NO	FTP-MW8	Page 2 of 2		
Time         Amount Purged (liters)         pH         Temperature (°C)         Conductivity (μS/cm)         Dissolved (mg/L)         Redox (mV)         Turbidity (NTU's)         Water Rate (lpm)           0849         24         7.08         13.43         0.544         3.83         78.3         9         36.51         0.15           0848         25         7.08         13.47         0.544         3.74         70.9         11.3         36.60         0.15           0852         26         7.09         13.90         0.545         3.52         64.1         10.7         36.68         0.15           0856         27         7.08         14.39         0.545         3.41         61.9         3.6         36.64         0.15           0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0916         30         7	FIELD MEAS	SUREMENTS C	ont.	·						
Purged (liters)         (°C)         (μS/cm)         Oxygen (mg/L)         (mV)         (NTU's)         Level Rate (lpm)           0849         24         7.08         13.43         0.544         3.83         78.3         9         36.51         0.15           0848         25         7.08         13.47         0.544         3.74         70.9         11.3         36.60         0.15           0852         26         7.09         13.90         0.545         3.52         64.1         10.7         36.68         0.15           0856         27         7.08         14.39         0.545         3.41         61.9         3.6         36.64         0.15           0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43										
0849         24         7.08         13.43         0.544         3.83         78.3         9         36.51         0.15           0848         25         7.08         13.47         0.544         3.74         70.9         11.3         36.60         0.15           0852         26         7.09         13.90         0.545         3.52         64.1         10.7         36.68         0.15           0856         27         7.08         14.39         0.545         3.41         61.9         3.6         36.64         0.15           0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         <	Time							Turbidity	Water	Purge
0848         25         7.08         13.47         0.544         3.74         70.9         11.3         36.60         0.15           0852         26         7.09         13.90         0.545         3.52         64.1         10.7         36.68         0.15           0856         27         7.08         14.39         0.545         3.41         61.9         3.6         36.64         0.15           0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15				7			(mV)	(NTU's)	Level	Rate (lpm)
0852         26         7.09         13.90         0.545         3.52         64.1         10.7         36.68         0.15           0856         27         7.08         14.39         0.545         3.41         61.9         3.6         36.64         0.15           0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15			·				78.3	9	36.51	0.15
0856         27         7.08         14.39         0.545         3.41         61.9         3.6         36.64         0.15           0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15							70.9	11.3	36.60	0.15
0900         28         7.08         15.68         0.548         3.19         50.7         2.3         36.65         0.15           0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15			·				64.1	10.7	36.68	0.15
0904         28.5         7.08         15.98         0.552         3.06         47.0         0.1         36.69         0.15           0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15			+				61.9	3.6	36.64	0.15
0908         29         7.08         15.88         0.554         3.11         43.2         0.5         36.80         0.15           0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15							50.7	2.3	36.65	0.15
0912         29.5         7.06         15.78         0.557         2.97         43.0         2.3         36.85         0.15           0916         30         7.07         15.84         0.557         2.95         44.9         2.1         36.89         0.15								0.1	36.69	0.15
0916 30 7.07 15.84 0.557 2.95 44.9 2.1 36.89 0.15				——————————————————————————————————————				0.5	36.80	0.15
2.1 30.09 0.13								2.3	36.85	0.15
1215 30.2 7.33 13.74 0.566 6.10 109.1 2.1							44.9	2.1	36.89	0.15
	1215	30.2	7.33	13.74	0.566	6.10	109.1	2.1		-
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**Monitoring Well Construction Diagrams Staff Gauge Construction Diagrams** 



**Monitoring Well Construction Diagrams** 

#### MONITORING WELL CONSTRUCTION LOG Project Name Iowa AAP Six Site FS Data Collection Well No. FTP-MW1 161<u>69</u>421 Location Burlington, Iowa Project No. Installed By Aquadrill, Jay Joslyn Date 3/25/03 1625 Time\_ Inspected By <u>URS, Mike Sonderman</u> 6 5/8" ID HSAs, 6" RWB Method of Installation Upper 5.5 feet of boring drilled with 6 5/8" HSA, remaining depth drilled with 6" tricone rotary. Remarks SWT = Shallow Weathered Till AGS Elevation Guard posts (feet) Elevation of top of casing (4) 3-inch steel, 6-foot 2.23 / 659.83 filled with concrete. **Buried 3-foot in concrete** 6-inch hole diameter. Type of backfill Filter pack Generalized Stratigraphy 0 0 0 / 657.6 Ground elevation 0.0 Sandy CLAY (CL) - Soft, moist, Ù. brown and dark brown, low I.D./Type of surface casing **BGS** Elevation plastic, fine-grained Sand, with 6-inch I.D. / Square, steel, casing (feet) Ċ organics with a lockable steel cap, 6-foot long Concrete Type of surface seal Ö Ö Ô I.D./Type of riser pipe 2-inch I.D. / Schedule 40, flush-threaded PVC Type of backfill 3/8" bentonite chips 2.0 / 655.6 Depth to top of seal Type of seal 1/2-inch sodium bentonite pellets 4.0 / 653.6 Depth to top of filter pack (SWT) 5.5 / 652.1 Depth to top of screen 5.5 LIMESTONE - Light gray, weathered Type of filter pack #20-40 clean, washed, silica sand I.D./Type of screen 2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot 11.0 Becomes weathered, with brown Clay Screen slot size 0.01-inch 12.9 Becomes Shaley, gray to dark gray, soft, dry 15.5 / 642.1 Depth to bottom of screen 16.0 / 641.6 Depth to bottom of plugged blank Type of backfill below monitoring well #20-40 filter pack sand Depth of bottom of boring 16.0 / 641.6 Diameter of boring 10" to 5.5' bgs, 6" from 5.5' - 16.0' bgs

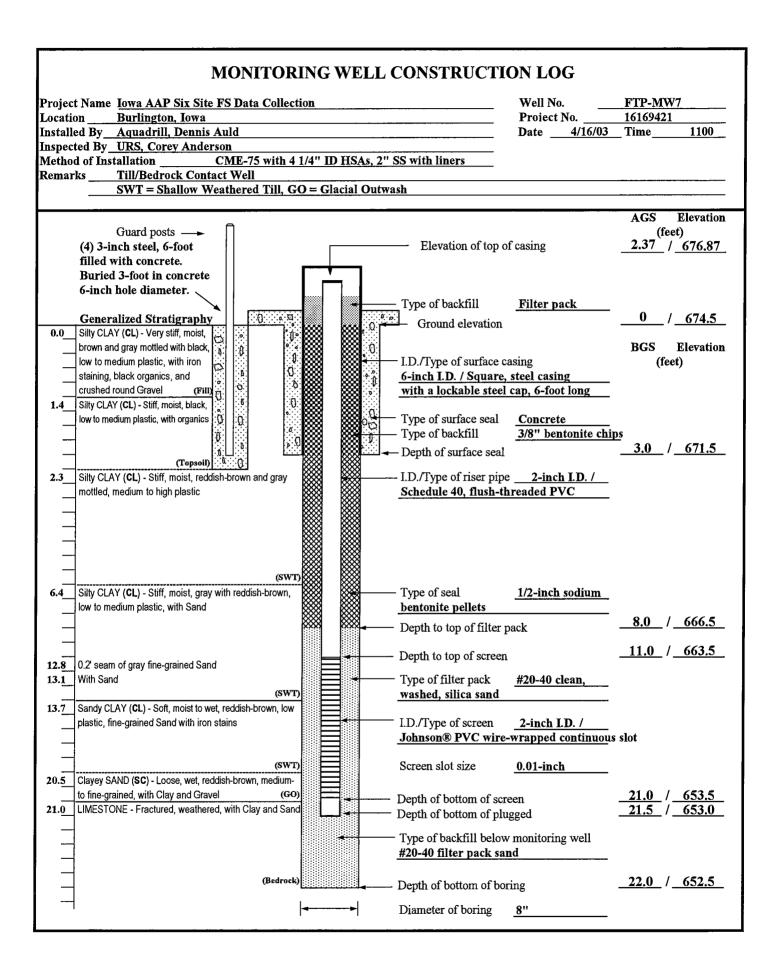
	MONI	TORING W	ELL CONSTRUCT	ION LOG	
Projec	t Name <u>Iowa AAP Six Site FS Dat</u>	a Collection		Well No.	FTP-MW2
Location				Project No.	16169421
	ed By Aquadrill, Jay Joslyn		<del></del>	Date <u>4/15/03</u>	Time1030
	ted By <u>URS, Mike Sonderman</u> d of Installation 6 5/8" II	HSAs, 6" RWB			
	ks <u>Upper 7.2 feet of boring d</u>	rilled with 10" HSA	A, remaining depth drilled with	h 6" tricone rotary.	
	SWT = Shallow Weathered	i Till			
	<u>.</u>	·			AGS Elevation
	Guard posts <		· · · ·		(feet)
İ	(4) 3-inch steel, 6-foot		Elevation of top o	of casing	2.38 / 663.18
	filled with concrete.		-		
	Buried 3-foot in concrete	1 📥			
	6-inch hole diameter.		Town of head of the	@14	
	Generalized Stratigraphy	3::00:	Type of backfill	filter pack	0 / 660.8
0.0	Silty CLAY (CL) - Stiff, moist,		Ground elevation		
	dark brown, low plastic, with		I.D./Type of surface o	asing	BGS Elevation
_	Sand and organics		6-inch I.D. / Square,	steel, casing	(feet)
_			with a lockable steel		
			Type of surface seal	Concrete	
	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )		I.D./Type of riser pipe	e 2-inch I.D. /	
			Schedule 40, flush-th		
	(Topsoil) 1		0 U		
2.4	Silty CLAY (CL) - Medium stiff,				
	moist, dark brown with faint gray mottling, low		Type of backfill	3/8" bentonite chip	
	plastic with Sand		→ Depth to top of seal		/657.8
_		₩ ₩	8		
			8		
_					
		₩ ₩			
_		₩ ₩	8		
_			Type of seal	1/2-inch sodium	
		₩ ₩	bentonite pellets		5.0 / 655.8
_		××× ×××	Depth to top of filter p	oack	
			Depth to top of screen		6.9 / 653.9
6.9	Becomes wet, with Sand, coarse-grained Lime	stone	Deput to top of screen		
	pieces	(SWI)	Type of filter pack	#20-40 clean,	
7.2	LIMESTONE - Whitish-gray, highly weathered		washed, silica sand		
7.8	With fossil fragments		I.D./Type of screen	2-inch I.D. /	
	•·····		Johnson® PVC, wire		s slot
12.6	Thin Shale seam				
			Screen slot size	0.01-inch	
12.9	Becomes bluish-gray, weathered				160 / 6/20
$\dashv$			Depth to bottom of scr		16.9 / 643.9 17.4 / 643.4
$\dashv$			Depth to bottom of plu	igged blank	1/.4 / 043.4
		###	Type of backfill below	monitoring well	
			#20-40 filter pack sar	-	
$\dashv$					
		(Bedrock)	Depth of bottom of bo	ring	<u>17.4</u> / <u>643.4</u>
		← →	Diameter of boring	10" to 7.2" bas 6" t	from 7.2' - 17.4' bgs
		1	1 Diamotor of borning	10 10 /.2 Ugs, 0	a our /- 2 - 1/-4 ngs

#### MONITORING WELL CONSTRUCTION LOG Project Name Iowa AAP Six Site FS Data Collection Well No. FTP-MW3 Location **Burlington**, Iowa Project No. 16169421 Installed By Aquadrill, Jay Joslyn Date 4/15/03 1530 Time\_ Inspected By URS, Mike Sonderman 6 5/8" ID HSAs, 6" AR Method of Installation Remarks Upper 5.5 feet of boring drilled with 6 5/8" HSA, remaining depth drilled with 6" AR. SWT = Shallow Weathered Till AGS Elevation Guard posts (feet) Elevation of top of casing (4) 3-inch steel, 6-foot 2.46 / 657.46 filled with concrete. **Buried 3-foot in concrete** 6-inch hole diameter. Type of backfill Filter pack Generalized Stratigraphy 0 / 655.0 Ground elevation 0.0 Silty CLAY (CL) - Medium stiff, moist, brown to dark brown, low I.D./Type of surface casing **BGS** Elevation plastic, with Sand and organics 6-inch I.D. / Square, steel, casing (feet) Ċ: with a lockable steel cap, 6-foot long Type of surface seal Concrete 0 (Topsoil) 1.4 CLAY (CH) - Stiff, brownish-gray I.D./Type of riser pipe 2-inch I.D. / and dark brown mottled, high Schedule 40, flush-threaded PVC plastic, with Sand and iron nodules Type of backfill 3/8" bentonite chips 3.0 / 652.0 Depth of surface seal (SWT Type of seal 1/2-inch sodium 5.5 SHALE - Gray, fissile, highly weathered bentonite pellets (Bedrock) 8.0 / 647.0 Depth to top of filter pack LIMESTONE - Whitish-gray, highly weathered 5.8 Becomes Crystalline, slightly weathered to unweathered 10.5 / 644.5 Depth to top of screen (Bedrock) Type of filter pack #20-40 clean, 12.0 SHALE - Gray, fissile, weathered washed, silica sand (Redrock) LIMESTONE - Shaley, brownish-gray to gray, 13.5 I.D./Type of screen 2-inch I.D. / weathered, with occasional Shale stringers Johnson® PVC, wire-wrapped, continuous slot Screen slot size 0.01-inch 20.5 / 634.5 Depth to bottom of screen 21.0 / 634.0 Depth to bottom of plugged blank Type of backfill below monitoring well #20-40 filter pack sand Depth of bottom of boring 21.0 / 634.0 Diameter of boring 10" to 5.5' bgs, 6" from 5.5' - 21.0' bgs

MONITORING WELL CONSTRUCTION LOG											
Proiec	t Name Iowa AAP Six Site FS Data Collecti	ion			Well No.	FTP-MW4					
Location					Project No	16169421					
	ed By <u>Aquadrill, Dennis Auld</u>				Date <u>4/24/03</u>	Time1100					
	ted By URS, Dave Berger	1 DIII									
Remar	d of Installation 6 5/8" ID HSA, 6' ks 6 5/8" HSA to 37.0' bgs, 6" tricone			' to 60.4' has							
ittiiai	SWT = Shallow Weathered Till, ST										
	Guard posts	_		—— Elevation of top o	of casing	AGS Elevation (feet)					
	(4) 3-inch steel, 6-foot					<u>2.35</u> / <u>682.85</u>					
	filled with concrete.		<del>_</del>								
	Buried 3-foot in concrete		- i								
	6-inch hole diameter.		<i>///</i>								
0.0	Generalized Stratigraphy		0	Ground elevation		/680.5					
0.0	Silty CLAY (CL) - Stiff, moist,			I.D./Type of surface c	naina	BGS Elevation					
_	1 1261   126		- V	6-inch I.D. / Square,	-	(feet)					
1.2	with organics (Topsoil) Silty CLAY (CL) - Stiff, moist,			with a lockable steel		(leet)					
'- <u>-</u> _	brown with black mottling and			Type of surface seal	Concrete						
_	iron staining, low plastic (Loess)			Type of surface sour	Concrete						
7.2	Silty CLAY (CL) - Stiff, moist, D			I.D./Type of riser pipe	e 2-inch I.D. /						
	orangish-brown with orange			Schedule 40, flush-th							
_	mottling and iron staining,										
	medium plastic, with Sand(swT)			Depth of surface seal		3.4 / 677.1					
14.7	Silty CLAY (CH) - Very stiff, moist, gray with dark										
	gray and orange mottling, high plastic, with Sand(st			Type of backfill							
26.5	Clayey SAND (SC) - Dense, wet, orangish-brown,			High solids bentonite	grout						
_	coarse-grained, with Limestone cobbles (GO)			<ul> <li>Type of double casing</li> </ul>	6-inch steel						
27.0	LIMESTONE			Depth of double casin	g	<u>37.0</u> / <u>643.5</u>					
39.4	(Bedrock) LIMESTONE - Shaley, medium gray, with :					42.6 / 627.0					
33.4	LIMES TONE - Shaley, medium gray, with t		₩-	- Depth to top of seal		42.6 / 637.9					
		₩	<b></b>	Type of seal	#100 clean,						
45.6	Becomes bluish-gray	₩	₩	washed, silica buffer	<del></del>						
		▓	<b></b>	- Depth to top of filter p	nack	46.4 / 634.1					
_				Dopan to top of inter p	puon						
				Depth to top of screen		49.1 / 631.4					
53.5	With numerous vugs filled with calcite crystals and chert										
53.9	Moderately fractured, unweathered with chert			Type of filter pack washed, silica sand	#20-40 clean,						
55.2	Becomes Shaley (Bedrock)			wasned, sinca sand							
55.4	SHALE - Black, fractured, fissile, slightly weathered		<b> </b>	I.D./Type of screen	2-inch I.D. /						
_	(Bedrock)			Johnson® PVC, wire		ıs slot					
55.7	LIMESTONE - Siliceous, Shaley, blue-gray and gray			,							
_	(Bedrock)			Screen slot size	0.01-inch						
56.6	SHALE - Black, soft, fissile, slightly weathered										
	(Bedrock)			Depth to bottom of sci	reen	<u>59.1</u> / <u>621.4</u>					
58.3	LIMESTONE - Shaley, Siliceous, dark gray and		<u>                                     </u>	Depth to bottom of plu		<u>59.6</u> / <u>620.9</u>					
				-							
				Type of backfill below	=						
				#20-40 filter pack sar	<u></u>						
_	(Bedrock)		<b>     </b>	Depth of bottom of bo	ring	60.4 / 620.1					
	\	1411111111111	- Little	Diameter of boring	10"						
	'  -	-	→ '	Diameter of boring	6"						
			•								

MONITORING WELL	CONSTRUCTION LOG	
Project Name Iowa AAP Six Site FS Data Collection	Well No.	FTP-MW5
Location Burlington, Iowa	Danis of No	16169421
Installed By Aquadrill, Jay Joslyn	Date 4/14/03	Time1420
Inspected By URS, Mike Sonderman		
Method of Installation 4 1/4" ID HSA Remarks		
Remarks		
G 1		AGS Elevation
Guard posts ——  (4) 3-inch steel, 6-foot	Elevation of top of casing	(feet) 2.39 / 670.59
filled with concrete.	Dievation of top of easing	7 070.35
Buried 3-foot in concrete		
6-inch hole diameter.		
Generalized Stratigraphy	Type of backfill <u>Filter pack</u>	0 / 668.2
Generalized Stratigraphy  0.0 Lean CLAY (CL-ML) - Medium	Ground elevation	0 / 668.2
stiff, moist, dark brown, low plastic		BGS Elevation
with organics	I.D./Type of surface casing	(feet)
	6-inch LD. / Square, steel casing	
	with a lockable steel cap, 6-foot long	
	Type of surface seal Concrete	
	Type of backfill 3/8" bentonite chip	s
	- Depth to top of seal	3.0 / 665.2
(Topsoil)	•	
2.6_ Sandy CLAY (CL) - Very stiff, moist, yellowish-brown and	I.D./Type of riser pipe 2-inch I.D./	
gray mottled, medium to high plastic, fine-grained Sand	Schedule 40, flush-threaded PVC	
with iron staining		
<u> </u>	T	
	Type of seal 1/2-inch sodium bentonite pellets	
─ ─	•	6.0 / 662.2
7.3 Becomes medium plastic	Depth to top of filter pack	·
	Depth to top of screen	<u>8.9</u> / <u>659.3</u>
9.8 Becomes soft	Type of filter pack #20-40 clean,	
	washed, silica sand	
	ID There of severe 2 in the ID	
11.0 Becomes wet	I.D./Type of screen 2-inch I.D. / Johnson® PVC wire-wrapped continuous	elot
	Johnson 1 v C wire-wrapped continuous	3101
	Screen slot size <u>0.01-inch</u>	
13.9 Becomes Clayey SAND (SC) - With pieces of Limestone	Don'th of hottom of gonzon	13.9 / 654.3
	Depth of bottom of screen Depth of bottom of plugged	14.4 / 653.8
		<del></del>
	Type of backfill below monitoring well	
$\dashv$	#20-40 filter pack sand	
(SWI)	Depth of bottom of boring	14.4 / 653.8
-	-	
	Diameter of boring 8 1/4"	

	MONITORIN	NG WELL	CONSTRUCT	ION LOG	
Projec	t Name Iowa AAP Six Site FS Data Collection	n		Well No.	FTP-MW6
Location					16169421
Installe	ed By <u>Aquadrill, Jay Joslyn</u> ted By <u>URS, Mike Sonderman</u>			Date4/14/03	Time0930
	d of Installation6 1/4" ID HSA, 6".	AR			
Remar		steel casing, 6"	AR from 24.4' to 45.3'	bgs.	
	SWT = Shallow Weathered Till				
					AGS Elevation
	Guard posts <		— Elevation of ton o	facina	(feet)
	(4) 3-inch steel, 6-foot		—— Elevation of top o	i casing	<u>2.64</u> / <u>670.44</u>
	filled with concrete.				
	Buried 3-foot in concrete	ightharpoonup			
	6-inch hole diameter.				
	Generalized Stratigraphy		Ground elevation		0 / 667.8
0.0	Lean CLAY (CL-ML) - Medium		Oround cicvation		
	stiff, moist, dark brown, low		I.D./Type of surface c	asing	<b>BGS</b> Elevation
_	plastic with organics (Topsoil)		6-inch I.D. / Square,	steel, casing	(feet)
2.6	Sandy CLAY (CL) - Very stiff,		with a lockable steel		
_	moist, yellowish-blown and gray [6]		Type of surface seal	Concrete	
_	mottled, medium to high plastic, fine-grained Sand with iron	0	I.D./Type of riser pipe	2-inch I.D. /	
_	staining (f)		Schedule 40, flush-th		
_					
	0 0		Depth of surface seal		2.0 / 665.8
	(SWI)				
14.4	LIMESTONE - Light gray, fossiliferous, slightly		= Type of backfill		
_	weathered		High solids bentonite	<u> </u>	
_			Type of double casing		24.4 / 643.4
			Depth of double casing	g	24.4 / 043.4
		<b>*************************************</b>	Depth to top of seal		26.0 / 641.8
		▓	- Type of seal	1/2-inch sodium	
_	<b>*</b>	₿	bentonite pellets		
	(Bedrock)	<b>₩</b> -	Depth to top of buffer	sand	<u>29.0</u> / <u>638.8</u>
29.1	LIMESTONE - Shaley, Siliceous, light gray and		Type of buffer sand #1	<del></del> -	
$\dashv$	brownish-gray interbeds, slightly weathered (Bedrock)		washed, silica buffer s	sand	30.0 / 637.8
39.4	SHALE - Black, fissile, weathered (Bedrock)		Depth to top of filter p		$\frac{30.0}{34.8} / \frac{037.8}{633.0}$
39.6	LIMESTONE - Light gray, slightly weathered		Depth to top of screen		
	(Bedrock)		Type of filter pack	#20-40 clean,	
	SHALE - Black, fissile, weathered (Bedrock)		washed, silica sand		
40.4	LIMESTONE - Shaley, grading to light gray		7 I D /m C	4 · 1 × 7 · /	
41.9	(Bedrock) SHALE - Dark gray to black, medium soft, fissile,		I.D./Type of screen  Johnson® PVC, wire	2-inch I.D. /	g glot
71.3	unweathered to slightly weathered, with clacareous		Screen slot size	0.01-inch	s slut
	clasts (Bedrock)				
43.6	LIMESTONE - Shaley, light gray and gray, isolated		Depth to bottom of scr	reen	44.8 / 623.0
	1-2 mm vugs		Depth to bottom of plu		45.3 / 622.5
_			-		
$\dashv$			Type of backfill below	-	
$\dashv$			#20-40 filter pack san	ıd	
	(Bedrock)		Depth of bottom of bo	ring	45.3 / 622.5
	<del> </del>		Diameter of boring	10"	TOIO I VALID
	'   <b>←</b>	<b>──</b>	Diameter of boring	6"	
	<u>'</u>	•			

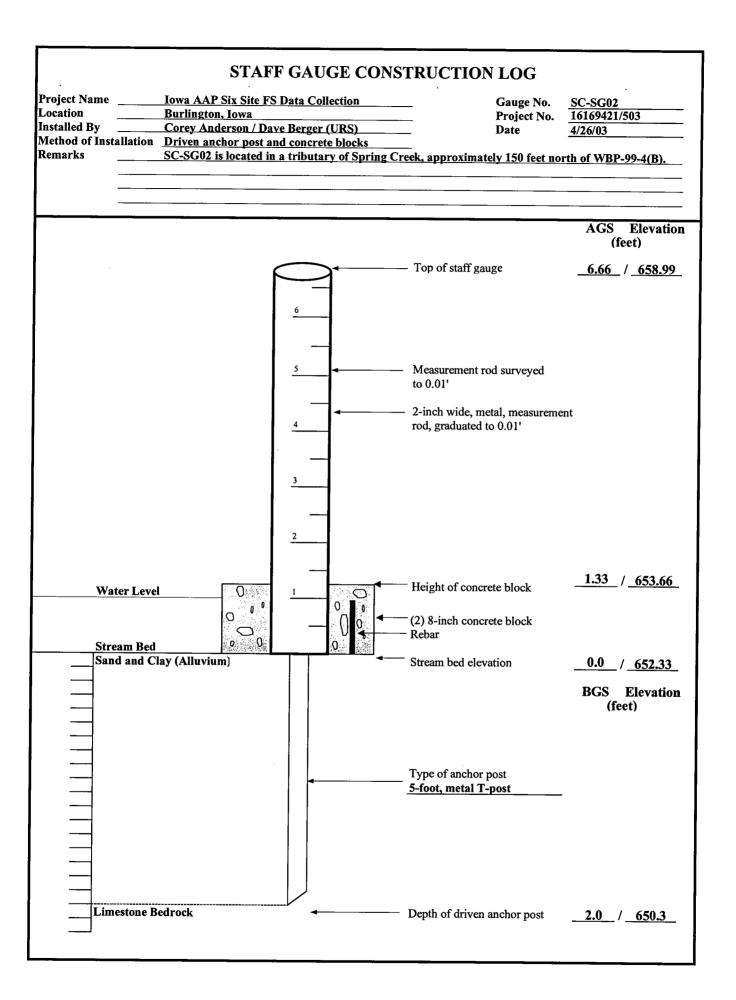


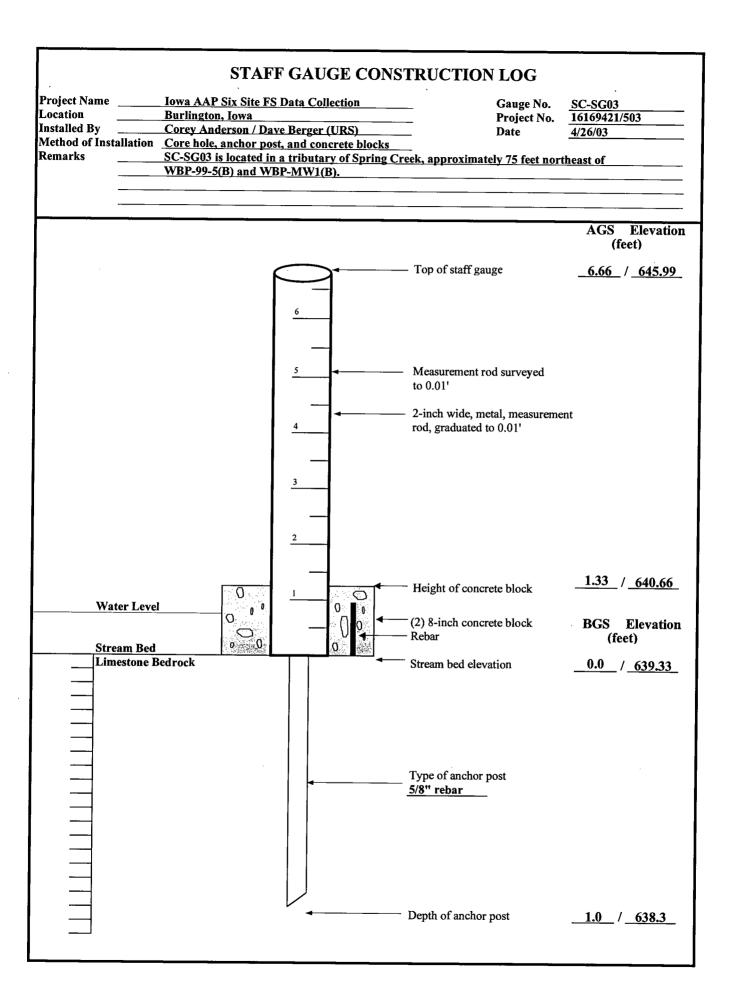
MONITORING WELI	CONSTRUCTION LOG
Project Name Iowa AAP Six Site FS Data Collection	Well No. FTP-MW8
Location Burlington, Iowa	Project No. 16169421
Installed By Aquadrill, Dennis Auld	Date <u>4/23/03</u> Time 1150
Inspected By URS, Mike Sonderman  Method of Installation 10" RWB, 6" AR	<del></del>
Remarks 10" RWB to 27.7' bgs and set a steel casing, 6" AR	from 27.7' to 52.1' hgs.
SWT = Shallow Weathered Till, GO = Glacial Outs	
	-
Guard posts	AGS Elevation  (feet)
(4) 3-inch steel, 6-foot	
filled with concrete.	
Buried 3-foot in concrete	
6-inch hole diameter.	
1.1.1.1.1	Ground elevation
0 Silty CLAY (CL) - Very stiff, moist,	
brown and gray mottled with black,	I.D./Type of surface casing BGS Elevation
— low to medium plastic, with iron	6-inch I.D. / Square, steel, casing (feet)
staining, black organics, and staining, black organics, and	with a lockable steel cap, 6-foot long
crushed round Gravel (Fill)	Type of surface seal Concrete
1.4 Silty CLAY (CL) - Stiff, moist,	
black, low to medium plastic,	I.D./Type of riser pipe2-inch I.D. /
— with organics (Topsoil) ∯	Schedule 40, flush-threaded PVC
2.3 Silty CLAY (CL) - Stiff, moist,	Depth of surface seal
reddish-brown and gray	
mottled, medium to high plastic	
(SWI)	Type of backfill
20.5 Clayey SAND (SC) - Loose, wet, reddish-brown,	High solids bentonite grout
medium- to fine-grained, with Clay and Gravel	Type of double casing 6-inch steel
(GO)	Depth of double casing <u>27.7</u> / <u>646.4</u>
21.0 LIMESTONE - Light gray to whitish-gray, weathered	
(Bedrock)	— Depth to top of seal
29.0 SHALE - Gray to dark gray, soft, highly fractured, fissile,	T
highly weathered to mostly Clay (Bedrock)	Type of seal #100 clean,
32.1 LIMESTONE - Shaley, Siliceous, medium gray,	washed, silica buffer sand
moderately fractured, unweathered except along	— Depth to top of filter pack/
fracture surface, few isolated vugs ~1 mm in diameter	41.1 / (22.0
41.0 Very fractured chert layer, some fracture surfaces	— Depth to top of screen/
stained dark  42.0 Some Shale	— Town of file and by 1/00 40 1
	Type of filter pack #20-40 clean,
44.3 Fracture surfaces slightly weathered 45.0 Shale content increasing	washed, silica sand
46.7 Fracture surfaces weathered and dark stained	I.D./Type of screen
(Bedrock)	
47.7 SHALE - Black to dark gray, fissile, moderately	Johnson® PVC, wire-wrapped, continuous slot
fractured, weathered (Bedrock)	Screen slot size 0.01-inch
49.2 LIMESTONE - Shaley, Siliceous, brownish-gray to dark	Screen slot size 0.01-inch
gray	511 / 6220
50.4 Vertical fractures	Depth to bottom of screen 51.1 / 623.0 51.5 / 622.6
- I strong market	Depth to bottom of plugged blank
	Type of backfill below monitoring well
	#20-40 filter pack sand
	"AV-10 IIICI paca sanu
(Bedrock)	— Depth of bottom of boring 52.1 / 622.0
	Diameter of boring 10"
	Diameter of boring 6"
1 1	



**Staff Gauge Construction Diagrams** 

### STAFF GAUGE CONSTRUCTION LOG Iowa AAP Six Site FS Data Collection Project Name Gauge No. SC-SG01 Location **Burlington**, Iowa 16169421/503 Project No. Installed By Corey Anderson / Dave Berger (URS) Date 4/25/03 Method of Installation Driven anchor post and concrete blocks Remarks SC-SG01 is located in Spring Creek, approximately 400 feet northeast of JAW-24 and WBP-MW2(B). A permanent benchmark was installed on the west bank and surveyed Elevation of the benchmark is 642.04 feet. AGS Elevation (feet) Top of staff gauge <u>6.66</u> / <u>641.83</u> Measurement rod surveyed to 0.01' 2-inch wide, metal, measurement rod, graduated to 0.01' Water Level 1.33 / 636.50 Height of concrete block 0 -0 0...0 Ó (2) 8-inch concrete block o 🗍 0. 0 . Stream Bed Sand and Clay (Alluvium) Stream bed elevation 0.0 / 635.17 Rebar **BGS** Elevation (feet) Depth of rebar 0.5 / 634.7 Type of anchor post 5-foot, metal T-post Depth of driven anchor post <u>3.0</u> / <u>632.2</u>





## STAFF GAUGE CONSTRUCTION LOG Project Name Iowa AAP Six Site FS Data Collection Gauge No. SC-SG04 Location **Burlington**, Iowa 16169421/503 Project No. Installed By Corey Anderson / Dave Berger (URS) Date 4/29/03 Method of Installation Core hole, anchor post, and concrete blocks Remarks SC-SG04 is located in Spring Creek, immediately south of the East Burn Pads road and approximately 100 feet east of WBP-99-3(B) and WBP-99-7(B). AGS Elevation (feet) - Top of staff gauge <u>6.66</u> / <u>641.83</u> Measurement rod surveyed to 0.01' 2-inch wide, metal, measurement rod, graduated to 0.01' Water Level 1.33 / <u>636.50</u> Height of concrete block 0 0 (2) 8-inch concrete block Rebar o 12 ( ) Stream Bed Limestone Bedrock Stream bed elevation <u>0.0</u> / <u>635.17</u> **BGS** Elevation (feet) Type of anchor post 5/8" rebar Depth of anchor post **2.0** / 633.2

## STAFF GAUGE CONSTRUCTION LOG Project Name Iowa AAP Six Site FS Data Collection Gauge No. SC-SG05 Location **Burlington**, Iowa 16169421/503 Project No. Installed By Corey Anderson / Dave Berger (URS) Date 4/29/03 Method of Installation Core hole, anchor post, and concrete blocks SC-SG05 is located in a tributary of Spring Creek, approximately 100 feet east Remarks of FTP-MW3(B). AGS Elevation (feet) Top of staff gauge <u>6.66</u>/<u>648.76</u> Measurement rod surveyed to 0.01' 2-inch wide, metal, measurement rod, graduated to 0.01' 1.33 / <u>643.43</u> Height of concrete block 0 Water Level 0 (2) 8-inch concrete block Rebar 0-7 0 Stream Bed Limestone Bedrock Stream bed elevation <u>0.0</u> / <u>642.10</u> **BGS** Elevation (feet) Type of anchor post 5/8" rebar Depth of anchor post **\_\_2.0**\_\_/\_\_640.1\_\_

### STAFF GAUGE CONSTRUCTION LOG Project Name Iowa AAP Six Site FS Data Collection Gauge No. SC-SG06 16169421/503 Location **Burlington, Iowa** Project No. Installed By Corey Anderson / Dave Berger (URS) Date 4/27/03 Method of Installation Driven anchor post and concrete blocks Remarks SC-SG06 is located in a tributary of Spring Creek, approximately 20 feet southeast of FTP-MW1 AGS Elevation (feet) - Top of staff gauge <u>6.66</u> / <u>658.50</u> Measurement rod surveyed to 0.01' 2-inch wide, metal, measurement rod, graduated to 0.01' Water Level 1.33 / 653.17 Height of concrete block 0 0 O (2) 8-inch concrete block o \_ 0 Stream Bed Sand and Clay (Alluvium) Stream bed elevation 0.0 / 651.84 Rebar **BGS** Elevation (feet) Depth of rebar 0.5 / 651.3 Type of anchor post 5-foot, metal T-post Limestone Bedrock Depth of driven anchor post <u>1.5</u> / <u>650.3</u>

### STAFF GAUGE CONSTRUCTION LOG Project Name Iowa AAP Six Site FS Data Collection Gauge No. SC-SG07 Location Burlington, Iowa 16169421/503 Project No. Installed By Corey Anderson / Dave Berger (URS) Date 4/29/03 Method of Installation Driven anchor post and concrete blocks Remarks SC-SG07 is located in Spring Creek, approximately 280 feet southwest of EBP-MW5(B) and EBP-MW6(B). A permanent benchmark was installed on the east bank and surveyed. Elevation of the benchmark is 632.67 feet. AGS Elevation (feet) Top of staff gauge <u>6.66</u> / <u>634.33</u> Measurement rod surveyed to 0.01' 2-inch wide, metal, measurement rod, graduated to 0.01' 1.33 / <u>629.00</u> Height of concrete block Water Level 0 0 O. (2) 8-inch concrete block $\bigcirc$ Rebar o 0 Stream Bed Sand and Clay (Alluvium) Stream bed elevation <u>0.0</u> / <u>627.67</u> **BGS** Elevation (feet) Type of anchor post 5/8" rebar Limestone Bedrock Depth of driven anchor post <u>1.0</u> / <u>626.7</u>

Project:			Site FS I	Data Col	lection		Well N	o:	FTP-MW1		
Project No:	161694	421.0020	01				Date:		3/27/2003		
				<u>WEI</u>	LL MEA	SUREN	<u>IENTS</u>				
	Well in	nside dia	meter:					2			in.
		of well c							ft.		
	-	water lev						18.31 6.95			ft. below MP
	Measur	ring poir	nt (MP):						Casing	•	11. 5010 W 1VII
			ıg volum						.8	<del></del>	gal.
	Weathe	er condit	ions:		Partly o	loudy, v	vind 20 t	to 30 mp	h, 40 to	50 degrees Fahrenl	neit
				SAMPI	LING M	EASIE	REMEN'	т			
<b>DATE</b>	3/27	4/12	!	D2 HVII 1	LING IV	<u>IL/ADCI</u>	CEIVIEIN	<u>.</u>			
—— DISCHARGE											
Water level	<u></u>	<del></del>	<del></del>		<del></del>		<del></del>			<u> </u>	
(ft. BMP)	-	9.08	16.38	16.12	16.23	15.38	14.4	13.74	12.8		1 1
,	<b> </b>	<del>                                     </del>			ļ		<u> </u>	<u> </u>		<del></del>	
Гime	1830	1425	1430	1432	1434	1436	1439	1442	1445		
Discharge	10	1.4	10				-				
(Gal.)	10	14	19	21	23	25	27	29	32		1 1
Flow Rate		1	1		1						
(gpm)	<u>-</u>	1	1	1	1	1	1	1	1		
PUMPING/SU	JRGINO	}							_		
Depth of		1.0	16	10	10	4.0	10			7	
Pump Intake	i -	18	16	18	18	18	18	18	18		
Ouration of			]								
Surging	<u> </u>	<u> </u>	<u> </u>	_		<u> </u>			-		
VATER QUA	LITY I	<u>DATA</u>									
Н	_	6.99	7.05	7.15	7.18	7.18	7.21	7.18	7.18		
		0.55	7.03	7.15	7.10	7.10	7.21	7.16	7.16		
Conductivity	_	0.791	0.830	0.800	0.806	0.772	0.769	0.777	0.774		
μS/cm)	<u> </u>	<u> </u>									
Temperature °C)	-	11.5	10.3	10.7	10.6	10.7	10.7	10.3	10.5	1	
		·						-			<del>-  -   </del>
Color	-	Brown	Brown	Gray	Gray	Clear	Clear	Clear	Clear		1
Turbidity		100	400	210	160	- 00	16	2.0			·
NTUs)		100	400	310	160	90	16	2.3	1.8		
otal discharge			32 Gallo	na.			Casina			1. 10	
I ethod of disp				)IIS			sposal A		removed	l: <u>18</u>	
remote or trop	osur or u	nsonar ge	a water.			IIICI ( DI	sposai A	ıca		<del>_</del>	<del></del>
				<u>QUA</u>	LITY A	<u>SSURA</u>	NCE				
	Water L	evel Me	ter:		Solinst						
		Bailer/F			-	ble teflo	n bailer	nylon t	wine		
		uality m			J-10 / L				Calibrate	ed: Daily	
		sible Pur		Geosqui			Surge B		N/A		<del></del>
	Comme	nts:	Well ins	talled or	3/25/03					nstallation	<del></del>

Project:	Iowa A	AP Six	Site FS I	Data Col	lection		_				FTP-MW	TP-MW2 Page 1 of 3		of 3
Project No:	161694	121.0020	)1	-			_	Date:		4/21/20	2003 to 4/27/2003			
				WEI	L MEA	SUREM	<u>IENTS</u>							
	Well in	side dia	meter:				2						in.	
	Depth	of well c	asing:				19.73						ft.	
	Initial v	water lev	/el:				11.41			-		ft. be	low MP	
	Measu	ring poir	t (MP):_				Top of	Casing	-		_			
			ig volum				1	.3					gal.	-
	Weathe	er condit	ions:		Overca	st, wind	15 to 20	mph, 50	) degrees	Fahren	heit			
				SAMPI	LING M	EASUR	EMEN	<u>r</u>						
<u>DATE</u>	4/21				4/23								4/24	
<b>DISCHARGE</b>	<u></u>													
Water level (ft. BMP)	-	-	-	Dry	17.00	Dry	13.02	Dry	12.10	15.85	18.00	Dry	11.61	14.00
Time	1653	1658	1702	1705	0948	0952	1237	1241	1525	1535	1540	1542	0837	0841
Discharge (Gal.)	0.3	2	4	5	10	12	_	17	-	19	21	22	-	24
Flow Rate (gpm)	-	-	-	-	1	0.5	_	1	-	0.2	0.4	0.4	-	0.5
PUMPING/SURGING														
Depth of					10	10.								$\overline{}$
Pump Intake	<u>-</u>			-	19	19.5	-	19.5		19	19	19	-	19
Duration of	<b> </b>   _	i _	_	_	_	_	_	_			_		_	
Surging	<u> </u>													
WATER QUA	LITY	<u> PATA</u>												
pН	6.61	6.73	6.76	-	6.82	-	-	6.88	-	7.00	6.85	-	-	6.38
Conductivity (µS/cm)	0.448	0.461	0.470	-	0.454	-	-	0.466	-	0.463	0.461	-	-	0.474
Temperature (°C)	8.2	8.1	8.3	-	10.2	-	-	11.0	-	12.9	10.6	-	-	8.4
Color	Brown	Brown	Gray		Gray	-	-	Gray	-	Gray	Clear	-	-	Clear
Turbidity (NTUs)	>1100	>1100	>1100	_	272		-	171	-	233	84	· -	-	42
Total discharge	<b>):</b>		66.5 Ga	llons		•••	Casing v	olumes	removed	1.	51			
Method of disp						Inert Dis	_			<b>*·</b> ——	- 31			
				<u>OUA</u>	LITY A	SSURA	NCE							
	Water L	evel Me	ter:		Solinst									
		Bailer/F			PVC bai	ler / pol	y twine		•					
		uality m			J-10 / La				Calibrate	 ed:	Daily			
		sible Pur		Geosqui			Surge B		N/A					
	Comme	nts:	Well ins				-			installa	tion			

Project: Project No:	No: 16169421.00201  WELL MEASUR  Well inside diameter:								o:		FTP-MW2 Page 2 of 21/2003 to 4/27/2003			of 3
rioject No	101094	21.0020	/1				-	Date:		4/21/20	JU3_to 4/	27/2003		
				<u>WEI</u>	L MEA	SUREM	<u>IENTS</u>							
							2	٠	**-				in.	
	_						19.73						ft.	
		vater lev			11.41							ft. be	olow MP	•
	Measur	mg poin	t (MP):_					Casing						-
	Fluid W	ell casın	g volum	e:	0			.3	<b>\</b>	D.1 1	• • .		gal.	
	weame	r conditi	ions:		Overca	st, wind	15 to 20	mpn, 50	degrees	Fahren	neit			_
				<u>SAMPI</u>	LING M	EASUR	EMEN'	<u>r</u>						
<u>DATE</u>							4/25				4/26			
DISCHARGE	<u>C</u>													
Water level (ft. BMP)	18.00	Dry	17.00	Dry	16.00	Dry	15.00	Dry	13.50	Dry	Dry	Dry	13.60	14.95
Time	0847	0851	1120	1121	1631	1639	0848	0852	1241	1244	1208	-	1537	1543
Discharge (Gal.)	27	29	31	33	37.5	39.5	41	43	44	47	49.5	52	53	54.5
Flow Rate (gpm)	0.5	0.5	1	1	0.1	0.3	0.5	0.5	0.5	1	1	1	0.3	0.3
PUMPING/SI	IRGING	1	·				·			<u> </u>				
Depth of					<u> </u>		<del></del>	Ī	<del> </del>				<u> </u>	
Pump Intake	19	19	19	-	19	19	19	19	19	19	19.7	19.7	19	17
Duration of														
Surging		-	-	_	_	-	_	-	_	-	-		_	-
WATER OUA	LITY D	<u>ATA</u>								·				
pН	6.31	-	6.46	-	6.74	_	5.97	6.02	6.82	-	-	-	6.69	6.71
Conductivity (µS/cm)	0.471	-	0.487	-	0.487	-	0.268	0.461	0.287	-	-	-	0.33	0.339
Temperature (°C)	8.7	-	8.1	-	12.5	-	7.7	8.3	9.7	-	-	-	12.9	12.2
Color	Clear	,	Clear	-	Clear	-	Clear	Clear	Clear	-	-	-	Clear	Clear
Turbidity (NTUs)	40	~	23	-	43	-	52	50	55	_	-	-	32	23
Total discharge	e:		66.5 Gal	llons			Casing	volumes	removed		51			
Method of disp						Inert Di			101110 1 0 1		<u> </u>	<del></del>	·	
_				<u>OUA</u>	LITY A								···	
	Water L	evel Me	ter:		Solinst									
	Type of				PVC bai	iler / nol	v twine							
	Water Q				U-10 / L		•		Calibrat	ed:	Daily	_		
	Submers			Geosqui			Surge B	lock:	N/A					
	Comme	nts:	Well ins	talled or	1 4/14/03	3; 20 gal	lons of v	vater use	d during	installa	tion			

Project: Project No:		AP Six :					-	Well N	o:	F	TP-MW2	Page 3 of 3	
Troject No	101094	121.0020	<u>'1</u>				-	Date:		4/21/20	03 to 4/27	/2003	
				<u>WEI</u>	LL MEA	SUREN	<u>1ENTS</u>						
		side diar					2					in.	
	Depth	of well c	asing:				19.73					ft.	
		water lev					11.41					ft. below MP	
	Fluid w	ring poin rell casin	ii (ivir): o volum	ie.		·	Top o	Casing		_			
	Weathe	r conditi	ions:		Overca	st, wind	15 to 20		) degree	s Fahrenh	eit	gal.	
				SAMPI	LING M	EASUR	EMEN'	<u>r</u>					
<u>DATE</u>								_					
DISCHARGE													
Water level (ft. BMP)	Dry	-	Dry	13.20	14.20	15.78	16.80	18.45	18.75				
Time	1548	1753	1755	1119	1202	1221	1226	1231	1243				
Discharge (Gal.)	56.5	57.5	59	60	61.5	63	64	65.5	66.5				
Flow Rate (gpm)	0.5	1	1	0.1	0.05	0.3	0.3	0.3	0.3				
PUMPING/SU	JRGING	Ì											
Depth of Pump Intake	19.5	19.5	19.5	17.5	16	18	19	19.5	19.5				
Duration of Surging	-	-	<u>.</u>	-	-	-		-	_				
WATER QUA	LITY D	<u>ATA</u>											
pН	-	6.72	1	6.70	6.69	6.59	6.57	6.58	6.47				
Conductivity (µS/cm)	_	0.323	-	0.399	0.409	0.403	0.387	0.382	0.391				
Temperature (°C)	,	11.1	-	15.0	18.7	13.8	13.1	13.5	13.9				
Color	-	Clear	,	Clear	Clear	Clear	Clear	Clear	Clear				
Turbidity (NTUs)	•	43	· <u>-</u>	19	12	7.7	3.9	8.5	11				
Total discharge	<b>;</b>		66.5 Ga	llons			Casing	volumes	remove	d:	51		
Method of disposal of discharged water: Inert Disposal Area										_			
	QUALITY ASSURANCE												
	Water L	evel Me	ter:		Solinst								
		Bailer/R				iler / pol	y twine			<del></del>			
		uality m		Horiba U	J-10 / L	aMotte 2	2020		Calibrat	ed: I	Daily		
		sible Pun		Geosqui			Surge B		N/A				
	Comme	nts:	well ins	talled or	<u>1 4/14/03</u>	s; 20 gal	lons of v	vater use	d during	installat	ion		

Project:	_ Iowa A	AAP Six	Site FS	Data Col	lection		_	Well N	lo:	F	TP-MW3	(B)		
Project No: _	16169	421.0020	)1				_	Date:		4/21/20	003 to 4/			
				<u>WEI</u>	L MEA	SURE	<u>MENTS</u>							
	Well in	nside dia	meter:				2						in.	
	Depth	of well c	asing:				24.00					·	ft.	
		water lev	/el <u>:</u>	***			19.72					ft. be	low MP	
		ring poin					Тор о	f Casing						
		vell casir						0.7					gal.	•
	Weath	er condit	ions:		Sunny,	calm, 8	0 degree	s Fahren	heit					
				SAMPI	LING M	<u>IEASUF</u>	REMEN	Т						
<b>DATE</b>	4/21	l	4/23			4/28			4/30					
DISCHARGI	F.													
Water level		<del></del>	<del></del>	T	<del></del>	r—	Τ	1	1	<del>r</del>				
(ft. BMP)	19.72	Dry	20.74	-	Dry	20.80	23.10	Dry	22.30	23.47	Dry			
Time	1635	1640	0920	0923	0926	1422	1426	1428	0816	0820	0822			
Discharge (Gal.)	0.3	1	-	1.5	2	2.2	3	3.5	3.7	4.3	4.5			
Flow Rate (gpm)	_	-	_	-	-	0.2	0.2	0.5	0.1	0.1	0.1			
PUMPING/S	URGINO	<u> </u>			-									
Depth of						1 01	22.5		22.5					
Pump Intake	<u> </u>				_ <del>-</del>	21	23.5	24	23.5	23.5	23.5		ł	
Duration of	_	_	_	_	_		_							
Surging	<u></u>	<u> </u>						<u> </u>						
WATER OUA	ALITY I	<u>DATA</u>												
pН	6.61	6.63	-	6.57	-	6.90	6.90	6.73	6.44	6.56	-			
Conductivity (µS/cm)	1.28	1.06	•	1.08	•	0.797	0.813	0.837	0.808	0.772	-			
Temperature (°C)	9.9	9.4	-	10.6	-	12.0	12.0	12.0	11.2	11.6	-		-	
Color	Brown	Brown	-	Brown	-	Brown	Brown	Brown	Clear	Clear	-	_		
Turbidity (NTUs)	>1100	>1100		>1100	-	250	210	260	60	36	-		-	
Total discharge	e:		4.5 Gall	ons			Casing	volumes	remove/	<del> '</del> 1.	6	<del></del>		
Method of disp						Inert Di	_		icinova	·				
-		J				SSURA								
	Water I	evel Me	ter <sup>,</sup>		Solinst									
		Bailer/R				iler / pol	v twine	<u>.</u>		<del></del>				
		uality m		Horiba U					Calibrate	ed:	 Daily			
		sible Pur		Geosqui			Surge B		N/A		- uny			
	Comme			talled or			-			netallati				

Project:	Iowa A	AP Six	Site FS I	Data Col	lection		_	Well N	o:	FTP-	MW4(B)		
Project No: _	161694	21.0020	01				_	Date: 4/21/2003 to 4/30/2003					
				<u>WEL</u>	L MEA	SUREM	<u>IENTS</u>						
	Well in	side dia	meter:				2					in.	
	Depth o	of well c	asing:				62.28					ft.	
		vater lev					17.85					below MP	
	Measur	ing poin	t (MP):_				Top of	Casing					
	Fluid w	ell casin	ıg volum	e:				.1				gal.	
	Weathe	r condit	ions:		Sunny,	wind 5 t	o 10 mp	h, 75 de	grees Fal	nrenheit			
				CAMDI	TNIC M	EASUR	EN/IEN	г					
<u>DATE</u>	4/26		4/23	SAIVIII		4/28		<u>L</u>	4/30				
<u>DISCHARGI</u>	<u> </u>												
Water level (ft. BMP)	-	-	Dry	Dry	33.10	54.20	56.44	44.30	52.60				
Time	1347	1411	1437	1730	1659	1716	1727	0816	0823		;		
Discharge (Gal.)	0.5	6.5	13	26	27	34	36	39.5	42				
Flow Rate (gpm)	_	-	-	-	0.5	0.4	0.2	0.2	0.2				
PUMPING/S	(IDCING	٦										_	
Depth of	RGING	<u>z</u>	<del></del>	_		<del></del>		<del></del>	<del></del>				
Pump Intake	-	-	-	-	59	57	61.5	53	55				
Duration of Surging		-	-	-	-	-	-	-	-				
WATER OUA	ALITY D	ATA											
pН	6.75	6.44	6.39	-	6.79	6.61	-	6.16	6.00				- "
Conductivity (µS/cm)	0.751	0.764	0.810	-	0.797	0.809	_	0.796	0.815				
Temperature (°C)	14.5	13.1	13.1	<u>-</u>	14.1	14.2	-	11.7	11.9				
Color	Gray	Gray	Gray	-	Clear	Clear	-	Clear	Clear				
Turbidity (NTUs)	>1100	>1100	>1100		40	75	-	23	11				
Total discharge			42 Gallo	ons			Casing v	volumes	removed	l:	6		
Method of disp	osal of d	lischarge	d water:			Inert Di	sposal A	rea					
				<u>OUA</u>	LITY A	ASSUR <i>A</i>	NCE						
	Water L	evel Me	ter:		Solinst								
		Bailer/F				iler / pol	v twine				<del></del> -		
		uality m				aMotte 2			Calibrate	ed: Da	nily		
	Submer			Geosqui			Surge B	·	N/A		_•		
										nstallation			

Project:	Iowa A	AP Six	Site FS 1	Data Col	llection		_	Well N	lo:	I	TP-MW	5		
Project No: _	161694	121.0020	)1				_	Date:		4/16/20	003 to 4/2	22/2003		
				<u>WEI</u>	LL MEA	SUREN	<u> 1ENTS</u>						77.5	
	Well in	side dia	meter:				2						in.	
	Depth	of well c	asing:				16.74						ft.	
		water lev					11.63					ft. bel	ow MP	
			t (MP):				Top of	f Casing			_			
	Fluid w	ell casir	ıg volum	ne:			(	).8					gal.	*
						, light ra	in, wind	5 to 10	mph, 70	degrees	Fahrenhe	eit	0	
				CAMDI	I INIC N	TIC A CYTIC	TO BATTORY	T						
<u>DATE</u>	4/16	i		4/22		<u>IEASUR</u>	<u>CLIVILIN</u>	1						
<u>DISCHARGI</u>	<u></u>													
Water level (ft. BMP)	_	-	Dry	12.52	12.80	12.85	13.53	13.40	13.55	13.55				
Гіте	0935	0940	0945	1714	1722	1726	1731	1731	1735	1739				
Discharge (Gal.)	0.2	1.5	4.5	5.5	6.3	7.1	7.9	8.7	9.5	10.3				
Flow Rate (gpm)		-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2			-	
PUMPING/S	URGING	3												
Depth of Pump Intake	-	-	-	16	16	15	15	15	15	15				
Duration of Surging		<u>-</u>		<u>-</u>	_	-			-	-			-	
WATER OUA	LITY	<u> ATA</u>						_						
Н	6.66	6.61	6.54	6.54	6.40	6.30	6.31	6.30	6.23	6.22				
Conductivity [µS/cm]	0.770	0.792	0.791	0.777	0.791	0.801	0.795	0.787	0.785	0.782				
Temperature °C)	9.0	8.5	8.6	11.5	11.0	10.9	10.3	10.6	10.7	10.5				
Color	Light Brown	Light Brown	Light Brown	_	Light Brown		Clear	Clear	Clear	Clear				
Turbidity NTUs)	>1100	>1100	>1100	1004	227	250	92	42	17	12.5				
Total discharge			10.3 Ga				_		remove	d:	13			
Method of disp	osal of d	ischarge	d water:			Inert Di	sposal A	rea		-				
				<u>OUA</u>	LITY A	ASSURA	NCE							
	Water L	evel Me	ter:		Solinst									
		Bailer/R				iler / pol	y twine							
		uality m				aMotte 2			Calibrat	ed:	Daily			
	Submer			Geosqui			Surge B		N/A					
										installatio	าท			

Project:	Iowa A	AP Six	Site FS I	Data Col	lection		_	Well N	o:	F	ΓP-MW6	6(B)	Page 1	of 2
Project No:	161694	121.0020	)1				_	Date:		4/16/2	003 to 4/			
				<u>WEI</u>	L MEA	SUREM	<u>IENTS</u>							
	Well in	side dia	meter:				2						in	
	Depth of	of well c	asing:				47.83					-		
	Initial v	water lev	/el:				40.13					ft. be	low MI	
	Measur	ing poir	nt (MP):_				Top of	Casing			_			
			ıg volum				1	.2					gal	-
	Weathe	r condit	ions:		Cloudy	, light ra	in, wind	5 to 10	mph, 70	degrees	Fahrenh	eit	0	
<b>DATE</b>	4/16	I		<u>SAMPI</u>	LING M 4/23	EASUR	EMEN'	<u>r</u>					4/27	 1
DISCHARGE	י												., 2 ,	
Water level	<u> </u>	<del></del>	<del></del>	<del>;                                     </del>			<del></del>		<del></del>		<del>, :</del>			
(ft. BMP)	-	43.15	Dry	Dry	25.91	30.05	33.90	37.08	38.09	39.45	43.08	46.50	31.72	36.42
Time	0910	0914	0920	0925	0825	0828	0833	0838	0843	0848	0855	0902	1319	1324
Discharge (Gal.)	0.2	1.5	3	4.5	_	5	6	7	8	9	10.2	12	13	14.5
Flow Rate (gpm)	_	-	_	-	_	0.2	0.2	0.2	0.2	0.2	0.2	1	0.3	0.3
PUMPING/SI	URGING	j												
Depth of		Ī						<del></del> -						T 1
Pump Intake	_	-	i - I	-	-	47	47	47	47	45	47.5	47.5	43	41
Duration of														
Surging		<u>-</u>		-	1	-		•		-	-	-	-	~
WATER OUA	LITY D	ATA								······				<u>-</u>
pН	7.03	6.97	6.98		_	6.31	6.65	6.56	6.52	6.55	6.49		6.63	6.63
Conductivity	<b> </b>									0.55	0.49	-	0.03	0.03
(µS/cm)	0.744	0.765	0.800		-	1.00	0.980	0.980	0.990	1.01	1.07	-	1.12	1.03
Temperature (°C)	12.4	12.1	11.5	-	-	11.6	11.8	12.2	12.3	12.5	12.2		14.9	14.9
Color	Gray	Gray	Gray	-		Gray	Gray	Gray	Gray	Gray	Brown	- ]	Clear	Brown
Turbidity (NTUs)	>1100	>1100	>1100	-	-	724	386	528	292	156	>1100	_	60	110
Total discharge	÷.		19.7 Gal	llone			Casing v	zolumec	ramazia	1.	16			
Method of disp				110118		Inert Dis			removed	ı	10			
	0, 0		a water.	<u>OUA</u>		SSURA		ica			*			
	Water L	evel Me	ter:		Solinst									
	Type of					iler / poly	v twine	<del></del>						
	Water Q					aMotte 2		_	Calibrate		Daily			
	Submers			Geosqui			Surge B		N/A	м.	Jany			
	Comme		Well ins				_	-		nstallati	 On			

Project: Project No: _					llection		-			FTP-MW6(B) 6/2003 to 4/30/20	Page 2 of 2
-						SUREM	- IENTS			0/2003 to 1/30/20	
	Well in	ıside dia	meter:				2				in
											in. ft.
	Initial	water lev	vel <u>:</u>				40.13			ft.	below MP
						·		f Casing			·
	Fluid v	vell casıı	ig volun	ıe:	<u> </u>		1 15	1.2		nheit	gal.
	Weath	er condit	.10118						grees Fahrer	theit	
DATE				SAMP)	LING M	<u>IEASUR</u>	EMEN'	<u>T</u>			
DISCHARGE	1.										
Water level (ft. BMP)	38.12	41.55	45.80	40.60	41.80	45.48	Dry				
Time	1329	1338	1343	0840	0842	0846	0847				
Discharge (Gal.)	15.5	16.5	17.5	18.5	19	19.5	19.7				
Flow Rate (gpm)	0.2	0.2	0.5	0.5	0.3	0.2	0.2				
PUMPING/SU	JRGINO	<u>3</u>									
Depth of Pump Intake	41	45	47	43	43	47	47.5				
Duration of Surging	_	_		<u>-</u>	-	-	-				
WATER QUA	LITY	<u>DATA</u>									
pH	6.47	6.52	6.43	6.50	6.41	6.48	-				
Conductivity (µS/cm)	0.959	1.03	1.09	1.06	0.970	1.07	-				
Temperature (°C)	14.4	15.2	13.5	11.7	12.1	12.1	-				
Color	Clear	Brown	Brown	Clear	Brown	Brown	-				
Turbidity (NTUs)	90	320	700	26	600	180	-				
Total discharge			19.7 Ga				_	volumes re	emoved:	16	
Method of disp	osal of d	uscharge	ed water:			Inert Dis	sposal A	rea			
				<u>OUA</u>	LITY A	SSURA	<u>NCE</u>				
	Water L	evel Me	ter:		Solinst						
	_	Bailer/F			PVC ba	iler / pol					
		uality m				aMotte 2			alibrated:	Daily	<del></del>
	Submer Comme	sible Pur		Geosqui			Surge B		[/A	1	
	Comme	піз:	well ins	taned of	<u>14/14/0:</u>	o; u gallo	ns of wa	ater used c	luring instal	lation	

Project:		AAP Six		Data Co	llection		_	Well N	Vo:		FTP-M	<i>N</i> 7	Page 1	of 2
Project No:	16169	421.0020	01				_	Date:		4/21/2	003 to 4	/25/2003	3	
				<u>WEI</u>	LL MEA	ASURE	<u>MENTS</u>							
	Well is	nside dia	meter:				2							
		of well of		<del></del>	· · · · · · · · · · · · · · · · · · ·	<del></del>	24.17						in ft	
	Initial	water lev	vel:		-	<del></del> ,-	10.92		<del></del> ,			ft b	nelow MI	
		ring poir						Casing		<del>-</del>		16. 0	CIOW IVII	
	Fluid v	vell casii	ng volun	ne:				2.1					gal	_
	Weath	er condit	ions:		Overca	st, wind	15 to 20	mph, 50	0 degree	s Fahren	heit		844	•
				SAMP	LING	TEASIII	REMEN'	г						_
<b>DATE</b>	4/21	Į		OIRIVEE .	ZII (G IV	4/25		<b>-</b>						
DISCHARGI	r.													
Water level		<del></del>	<del></del>	Т	<del></del>			<del></del>	<del></del>	<del></del>	<del></del>	<del></del>		<del></del>
(ft. BMP)	-	-	-	-	15.85	15.00	22.00	Dry	15.65	16.50	17.85	17.22	18.70	21.00
Time	1725	1729	1722	1726	1720	0001	2022	2006					<del>                                     </del>	<del>                                     </del>
	1/23	1/29	1733	1736	1738	0921	0932	0936	1001	1009	1017	1026	1034	1043
Discharge	0.3	2.5	4.5	6.5	9	12	25	29	30	33	35	38	41	45
(Gal.) Flow Rate	<b> </b>	<del> </del>	<u> </u>	<del>                                      </del>	<del>                                     </del>					55		1 30	ļ 1	1 73
(gpm)	-	-	-	-	-	0.3	1	1	0.3	0.3	0.3	0.3	0.3	1
PUMPING/SI	IID CINA	7			<u> </u>				<u>'</u>	<u> </u>	<u> </u>	<u>.                                    </u>		<u> </u>
Depth of	OKGINO	<u> </u>	<del></del>	<del></del>	<del></del>	<del>                                     </del>		<del></del>	T					
Pump Intake	∦ -	-	-	-	-	24	24	24	18	18	24	22	21	24
Duration of	<u></u>		<del>                                     </del>							<u> </u>	<del></del>		<u> </u>	<del>                                     </del>
Surging		<u> </u>						-	_	-	-	-	i -	-
WATER QUA	LITY I	<u> PATA</u>							<del></del>		·			
pН	6.68	6.73	6.76	6.70	6.75	6.31	6.21		6.54	6.58	6.61	6.69	6.57	
	0.00 	0.75	0.70	0.70	0.73	0.51	0.21	-	0.34	0.38	6.61	6.68	6.57	6.44
Conductivity (µS/cm)	0.637	0.657	0.671	0.659	0.611	0.657	0.701	-	0.654	0.657	0.670	0.659	0.642	0.674
Temperature										_	_	-		
(°C)	9.8	9.6	9.5	9.9	9.7	9.9	10.3	-	10.5	10.7	11.3	11.3	11.1	11.1
Color	Brown	Brown	Brown	Brown	Brown	Brown	Brown	-	Brown	Brown	Brown	Brown	Brown	Brown
Turbidity (NTUs)	>1100	>1100	>1100	>1100	>1100	687	>1100	_	261	466	331	120	206	>1100
	<u> </u>								<u></u>					
Total discharge			57 Galle				Casing v		remove	d:	27			
Method of disp	osal of d	lischarge	d water:			Inert Di	sposal A	rea		_,				
				<u>QUA</u>	LITY A	<u>ASSURA</u>	NCE							
	Water L	evel Me	ter:		Solinst									
	Type of	Bailer/R	lope:			iler / pol	y twine			¬·				
		uality m				aMotte 2			Calibrat	ed:	Daily			
		sible Pur		Geosqui			Surge B	ock:	N/A					
	Comme	nts:	Well ins	talled or	1 4/1 <u>6/03</u>	3; 0 gallo	ns of wa	ter used	during	installati	on			

Project: Project No:				Data Col	llection		_	Well No	:	FTP-MW7	Page 2 of 2
Troject No	10109	+21.0020	71				_	Date: _	4/.	21/2003 to 4/25/2	2003
				<u>WEI</u>	LL MEA	SURE	<u>IENTS</u>				
	Well in	iside dia	meter:				2				in.
	Depth	of well c	asing:								ft.
	Initial '	water lev	/el <u>:</u>				10.92				ft. below MP
	Measu	ring poin	ıt (MP):_		_	·	Top of				
	Fluid v	vell casir	ig volum	ne:			2	.1			
	Weath	er condit	ions:		Overca	st, wind	15 to 20	mph, 50	degrees Fa	hrenheit	
				SAMP	LING M	EASUR	EMENT	Γ			
<u>DATE</u>								_			
DISCHARG)	E										
Water level		T	Π	<u> </u>	<u> </u>	T .	<u> </u>	<u> </u>	<del></del>	<del> </del>	<del></del>
(ft. BMP)	Dry	14.50	14.74	14.55	15.02	15.05					
Time	1045	1257	1206	1212	1210	1226					
	1045	1257	1306	1312	1319	1326					
Discharge	46	47	50	52	54	57	_				
(Gal.)		ļ		32	34	3,					
Flow Rate	1	0.3	0.3	0.3	0.3	0.3					
(gpm)	<u> </u>	<u> </u>	l	<u> </u>			<u> </u>		<u> </u>		
PUMPING/S	URGINO	<u> </u>									
Depth of		21	21	10	17	22		Ī			T
Pump Intake		21	21	19	17	22					
Duration of	<b>I</b> _	_	_	_		_					
Surging	<u></u>	<u> </u>							<u> </u>		
WATER OU	ALITY I	<u>DATA</u>			<u> </u>						
рН	ļ -	6.69	6.78	6.75	6.70	6.68					
•	<b> </b>		01,0	01,0	0.70	0.00	_				
Conductivity (µS/cm)	-	0.647	0.664	0.647	0.655	0.655					
Temperature	<del> </del>	<u> </u>								<del></del>	
(°C)	-	11.9	12.8	13.0	12.9	13.0					
			~-							<del></del>	
Color		Brown	Clear	Clear	Clear	Clear	ĺ		ŀ		
<b>Furbidity</b>		255	84	41	40	32					
NTUs)		233	04	41	40	32					
Total discharge	۵۰		57 Gallo				C:			25	
Method of dist							casing v sposal Ai	olumes re	emovea:	27	
uiou or uioj	Josef Of U	sonarge	u watel.			THEIL DI	sposai Al	iva	<del></del> -		···
				<u>OUA</u>	LITY A	SSURA	NCE				
	Water I	evel Me	ter:		Solinst						
		Bailer/R			PVC bai	iler / nol	v twine		<del></del>		
	. –	uality m			U-10 / La				alibrated:	Daily	
		sible Pur		Geosqui			Surge Bl		/A		
	Comme								luring insta	llation	

Project:		AP Six	Site FS 1	Data Col	lection		_	Well N	o:	F7	P-MW8	(B)		
Project No:	161694	121.0020	1				_	Date:		4/25/20	003 to 4/	27/2003		
				<u>WEI</u>	LL MEA	SUREM	<u>IENTS</u>							
	Well in	iside dia	meter:				2						in.	
	Depth	of well c	asing:				54.12						ft.	
	Initial v	water lev	rel <u>:</u>				11.17						low MP	
	Measur	ring poin	t (MP):_				Top of	f Casing						
	Fluid w	vell casin	ig volum	ne:				5.9						
	Weathe	er conditi	ions:		Overca	st, wind	15 to 20	mph, 50	degrees	s Fahren	heit			
				SAMPI	LING M	EASUR	EMEN'	Т						
<u>DATE</u>	4/25	i			4/26			_ 4/27						
DISCHARGE	C													
Water level	Ī	T T	Almost	T ===	<del></del>	<del></del> -	Ì		Γ :		i i	<del>-</del>	<del></del>	<del></del>
(ft. BMP)	-	-	Dry	-	28.00	27.05	Dry	26.28	43.87	52.03	F			
Time	1030	1107	1117	1337	1226	1237	1245	1600	1613	1629		-		
Discharge (Gal.)	0.5	7	10	17	20	27	29	31	37.5	44				
Flow Rate (gpm)	-	-	-	-	1.5	0.3	0.7	0.2	0.3	0.3				
PUMPING/SI	IDCING	7	-									-		<u> </u>
Depth of	RGING	<u> </u>		<del></del>	<del></del>	<del>r </del>	<del></del>	<del></del>						
Pump Intake	-	-	-	-	54	49	54	49	47	53.5				
Duration of	<b>-</b>				[						-			
Surging	-	-	-	-	- ,	-	-	-	-	-				
WATER OUA	LITY	)ATA			-							<del></del>	:	<del> </del>
pН	6.61	6.42		6.49	(5)	6.47		(11	<i>c</i> 40	6.24				
_	0.01	0.42	-	6.49	6.56	6.47	-	6.44	6.48	6.34				 
Conductivity (µS/cm)	0.617	0.646	-	0.770	0.837	0.840	-	0.811	0.830	0.824				
Temperature (°C)	11.3	11.5	-	12.3	14.2	16.2	-	15.8	14.8	15.2	·			
Color	Gray	Gray	-	Gray	Clear	Gray	-	Clear	Clear	Clear				
Turbidity (NTUs)	>1100	>1100	-	>1100	92	156	<u>-</u>	85	34	75				
Total discharge			44 C-11				<u> </u>			<del></del>				
Method of disp			44 Gallo			Inert Dis		volumes	remove	1:	6			
wiction of disp	osai oi u	nscharge	u water.			SSURA		rea						
						BBCILI	IVE							
		evel Me			Solinst									
		Bailer/R				ler / poly			G 1"	•	- · · ·			
		Quality m sible Pur		Horiba ( Geosqui		aMotte 2	020 Surge B		Calibrate N/A	ed:	Daily			
		nts:	-							a install	ation			

TABLE F-1
SLUG TEST RESULTS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Well No.		Hydraulic C	Conductivity		Screened Geologic
Test No.	(ft/min)	(ft/day)	(cm/sec)	(gpd/ft²)	Unit
JAW-58	4.20E-05	6.05E-02	2.13E-05	0.45	Shallow Till
JAW-61	7.70E-05	1.11E-01	3.91E-05	0.83	Shallow Till
JAW-61 2ND	1.42E-05	2.04E-02	7.22E-06	0.15	Shallow Till
JAW-62	1.24E-04	1.79E-01	6.30E-05	1.34	Shallow Till
JAW-62 2ND	1.47E-05	2.12E-02	7.47E-06	0.16	Shallow Till
FTA-99-1	5.54E-05	7.98E-02	2.82E-05	0.60	Till/Bedrock Contact
FTA-99-2	2.94E-07	4.23E-04	1.49E-07	0.00	Bedrock
FTP-MW1	1.19E-03	1.71E+00	6.05E-04	12.82	Till/Upper Bedrock
FTP-MW1R	1.97E-04	2.84E-01	1.00E-04	2.12	Till/Upper Bedrock
FTP-MW2	3.16E-05	4.55E-02	1.61E-05	0.34	Till/Upper Bedrock
FTP-MW3(B)	1.18E-06	1.70E-03	6.00E-07	0.01	Upper Bedrock
FTP-MW4(B)	1.16E-06	1.67E-03	5.90E-07	0.01	Bedrock
FTP-MW5	4.88E-04	7.03E-01	2.48E-04	5.26	Till/Upper Bedrock
FTP-MW5 2ND	1.50E-04	2.16E-01	7.62E-05	1.62	Till/Upper Bedrock
FTP-MW6(B)	1.20E-06	1.73E-03	6.10E-07	0.01	Bedrock
FTP-MW7	1.34E-04	1.93E-01	6.81E-05	1.44	Till/Upper Bedrock
FTP-MW8(B)	5.28E-06	7.60E-03	2.68E-06	0.06	Bedrock

#### Notes:

2ND = Second response (clays)

cm = Centimeter(s)

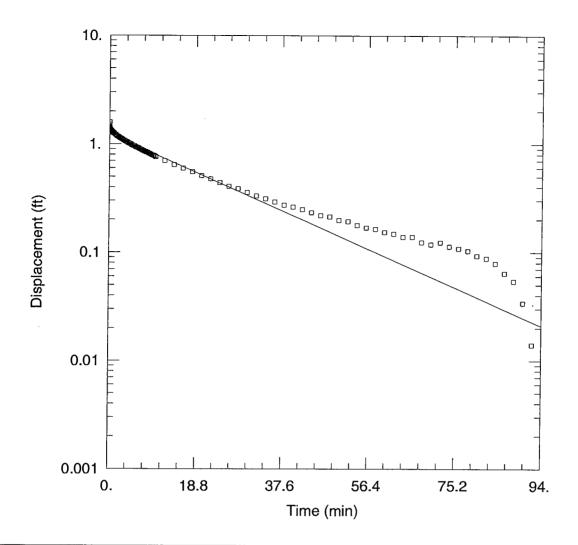
ft = Foot or Feet

 $ft^2$  = Square Foot

min = Minute(s)

R = Retest

sec = Second(s)



#### **JAW-58**

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-1\JAW-58.aqt

Date: 05/20/03 Time: 08:28:09

#### PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: JAW-58

#### AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (JAW-58)

Initial Displacement: 1.585 ft Casing Radius: 0.083 ft Screen Length: 10. ft Water Column Height: 17.72 ft Wellbore Radius: 0.333 ft

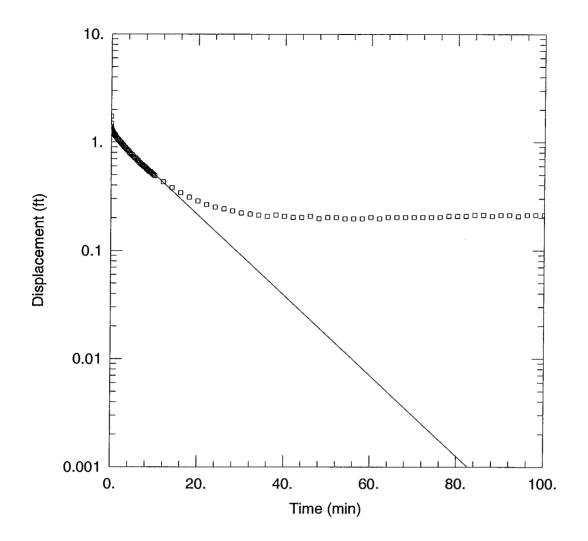
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 4.195E-05 ft/min

y0 = 1.23 ft



#### **JAW-61**

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-2\JAW-61.agt Date: 05/20/03 Time: 09:06:38

#### PROJECT INFORMATION

Company: URS Client: USACE Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: JAW-61

#### AQUIFER DATA

Saturated Thickness: 16. ft Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (JAW-61)

Initial Displacement: 1.735 ft Casing Radius: 0.083 ft Screen Length: 10. ft

Water Column Height: 15.1 ft Wellbore Radius: 0.333 ft

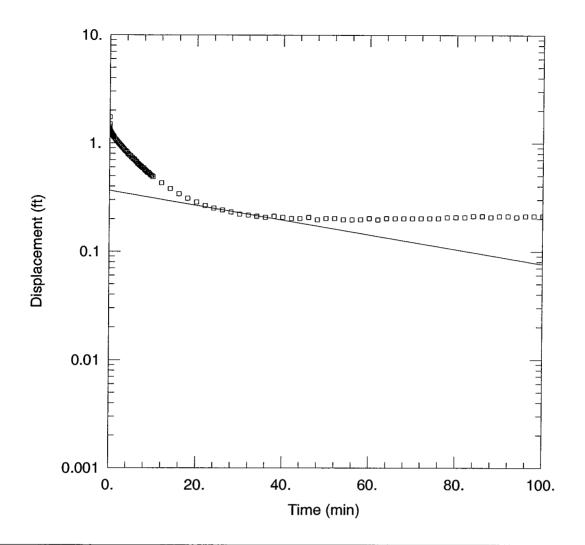
#### SOLUTION

Aquifer Model: Unconfined

K = 7.703E-05 ft/min

Solution Method: Bouwer-Rice

y0 = 1.185 ft



#### **JAW-61 2ND RESPONSE**

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-2\JAW-61 2ND.aqt

Date: 05/21/03 Time: 14:10:19

#### PROJECT INFORMATION

Company: URS Client: USACE

Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: JAW-61

#### AQUIFER DATA

Saturated Thickness: 16. ft Anisotropy Ratio (Kz/Kr): 1.

#### **WELL DATA (JAW-61)**

Initial Displacement: 1.735 ft Casing Radius: 0.083 ft Screen Length: 10. ft

Water Column Height: 15.1 ft Wellbore Radius: 0.333 ft

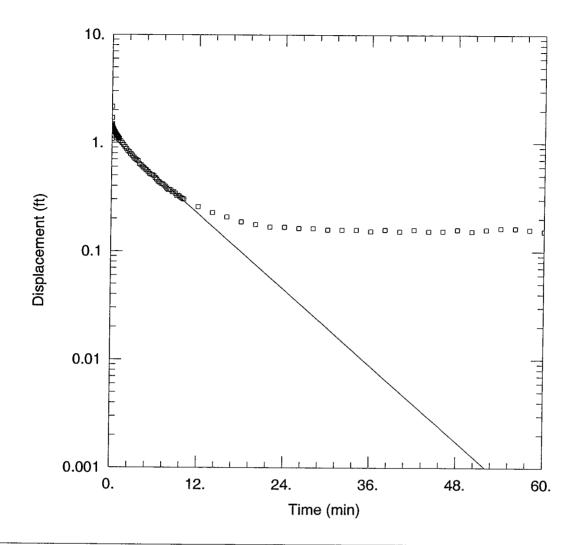
## SOLUTION

Aquifer Model: Unconfined

K = 1.415E-05 ft/min

Solution Method: Bouwer-Rice

y0 = 0.3657 ft



#### **JAW-62**

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-1\JAW-62.aqt

Date: 05/20/03

Time: 09:24:58

#### **PROJECT INFORMATION**

Company: <u>URS</u> Client: <u>USACE</u>

Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: JAW-62

**AQUIFER DATA** 

Saturated Thickness: 17. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (JAW-62)

Initial Displacement: 2.154 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 16.22 ft Wellbore Radius: 0.333 ft

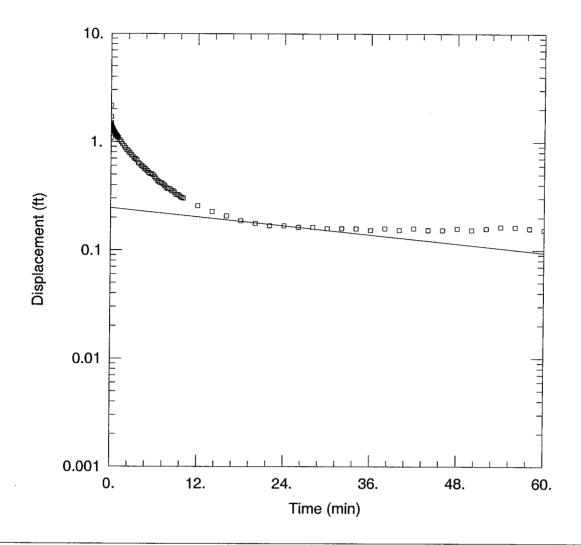
SOLUTION

Aquifer Model: Unconfined

K = 0.0001235 ft/min

Solution Method: Bouwer-Rice

y0 = 1.119 ft



#### **JAW-62 2ND RESPONSE**

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-1\JAW-62 2ND.aqt

Time: 14:20:18 Date: 05/21/03

#### PROJECT INFORMATION

Company: URS Client: USACE Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: JAW-62

#### **AQUIFER DATA**

Saturated Thickness: 17. ft

Anisotropy Ratio (Kz/Kr): 1.

#### **WELL DATA (JAW-62)**

Initial Displacement: 2.154 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 16.22 ft

Wellbore Radius: 0.333 ft

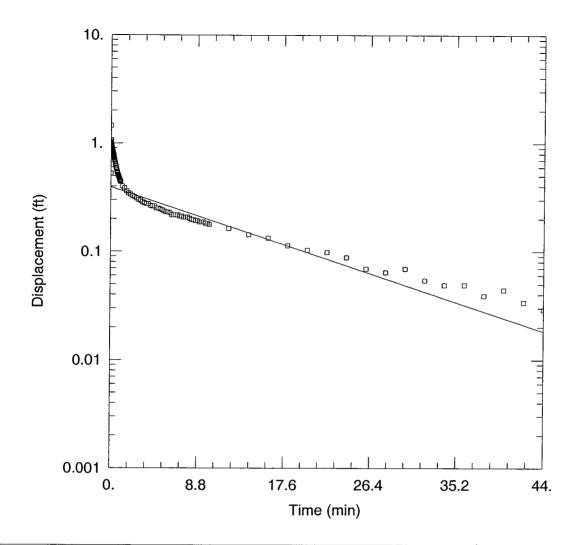
#### **SOLUTION**

Aquifer Model: Unconfined

K = 1.466E-05 ft/min

Solution Method: Bouwer-Rice

y0 = 0.2458 ft



#### FTP-99-1

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-2\FTP-99-1.aqt

Date: 05/20/03 Time: 08:34:22

#### PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-99-1

#### **AQUIFER DATA**

Saturated Thickness: 9. ft Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-99-1)

Initial Displacement: 1.453 ft Casing Radius: 0.083 ft Screen Length: 10. ft Water Column Height: 8.28 ft Wellbore Radius: 0.333 ft

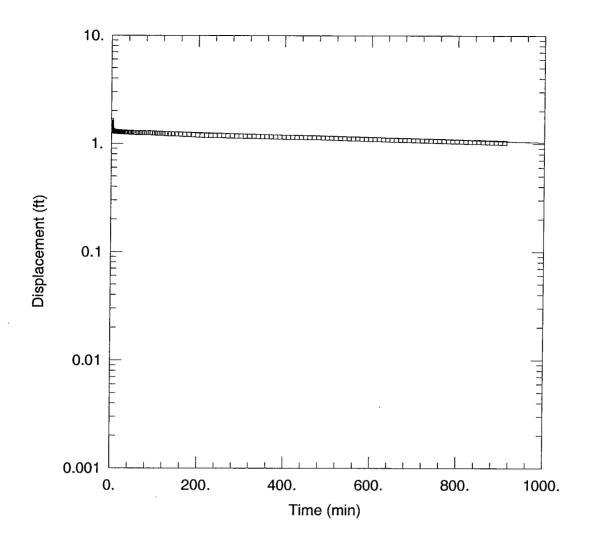
#### SOLUTION

Aquifer Model: Unconfined

K = 5.54E-05 ft/min

Solution Method: Bouwer-Rice

y0 = 0.3947 ft



#### FTP-99-2

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\FTA-99-2.aqt
Date: 05/20/03 Time: 08:53:05

#### PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-99-2

#### **AQUIFER DATA**

Saturated Thickness: 33. ft Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (FTP-99-2)

Initial Displacement: 1.625 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 32.9 ft Wellbore Radius: 0.333 ft

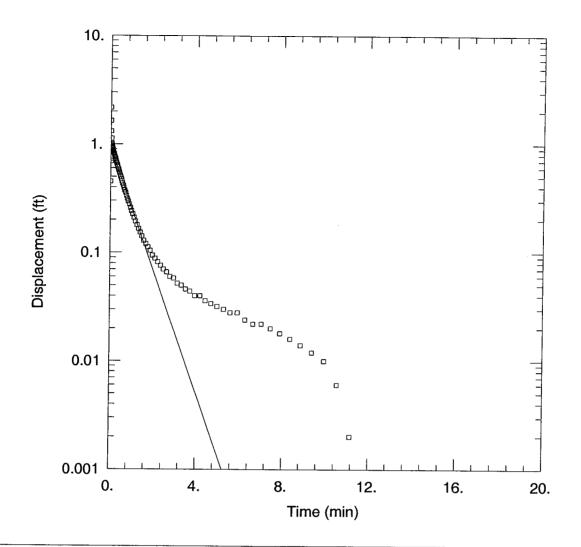
#### **SOLUTION**

Aquifer Model: Unconfined

K = 2.935E-07 ft/min

Solution Method: Bouwer-Rice

y0 = 1.329 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\TROL\FTP-MW1B.aqt

Date: 05/27/03

Time: 13:24:14

#### PROJECT INFORMATION

Company: URS Client: USACE Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW1

#### **AQUIFER DATA**

Saturated Thickness: 12. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW1)

Initial Displacement: 2.173 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 11.86 ft Wellbore Radius: 0.333 ft

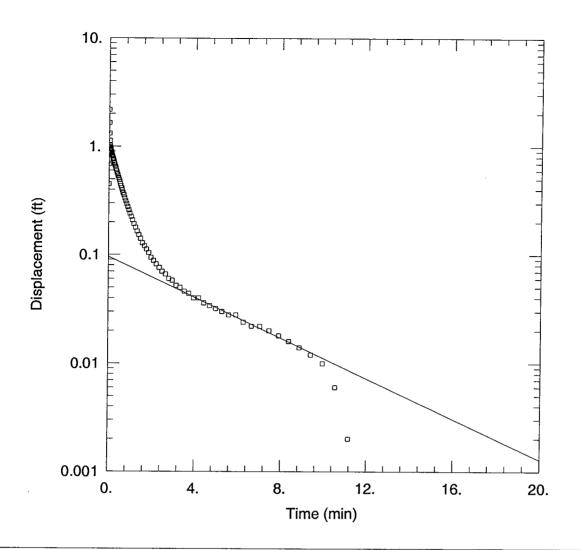
#### SOLUTION

Aquifer Model: Unconfined

K = 0.001187 ft/min

Solution Method: Bouwer-Rice

y0 = 0.9261 ft



#### FTP-MW1 2ND RESPONSE

Data Set: H:\slug\MINI TROLL\Data\IAAAP\TROL\FTP-MW1B 2ND.aqt Date: 05/27/03 Time: 13:24:40

#### PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW1

#### **AQUIFER DATA**

Saturated Thickness: 12. ft Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW1)

Initial Displacement: 2.173 ft Casing Radius: 0.083 ft Screen Length: 10. ft Water Column Height: 11.86 ft Wellbore Radius: 0.333 ft

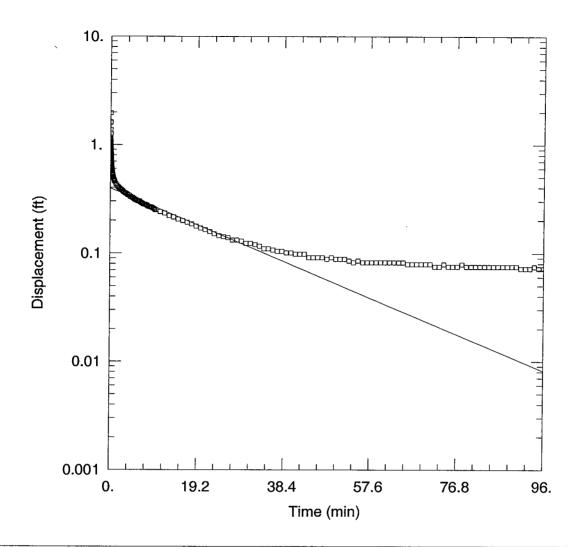
#### SOLUTION

Aquifer Model: Unconfined

K = 0.0001966 ft/min

Solution Method: Bouwer-Rice

y0 = 0.09574 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT3\FTP-MW2.aqt

Date: 05/23/03 Time: 11:50:38

## PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 1616950

Project: <u>16169503</u>

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW2

#### **AQUIFER DATA**

Saturated Thickness: 9. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW2)

Initial Displacement: 1.966 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 8.07 ft Wellbore Radius: 0.333 ft

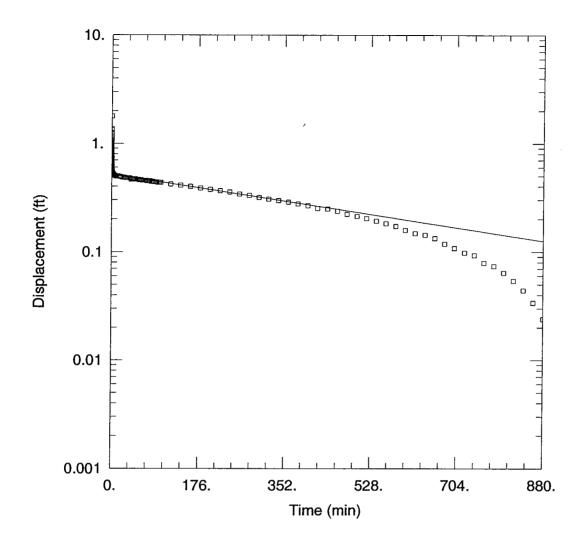
#### **SOLUTION**

Aquifer Model: Unconfined

K = 3.162E-05 ft/min

Solution Method: Bouwer-Rice

y0 = 0.3954 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW3.aqt

Date: 05/23/03

Time: 12:06:16

#### PROJECT INFORMATION

Company: URS Client: USACE Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW3

#### **AQUIFER DATA**

Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW3)

Initial Displacement: 1.788 ft Casing Radius: 0.083 ft

Water Column Height: 6.13 ft Wellbore Radius: 0.333 ft

Screen Length: 10. ft

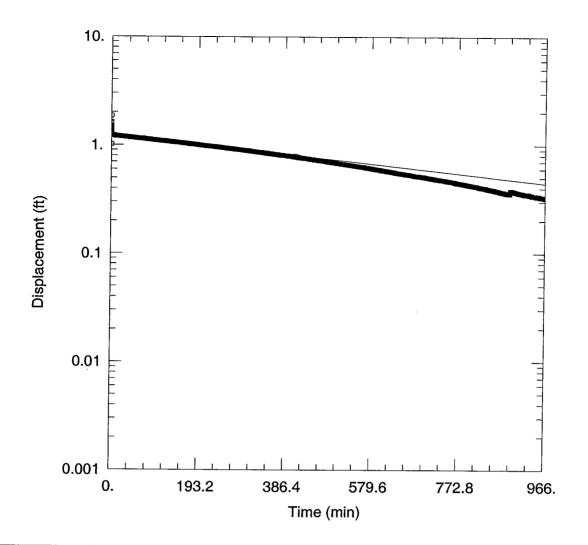
### **SOLUTION**

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 1.176E-06 ft/min

y0 = 0.5162 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT3\FTP-MW4.aqt

Date: 05/23/03

Time: 11:51:26

## PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW4

#### **AQUIFER DATA**

Saturated Thickness: 46. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW4)

Initial Displacement: 1.849 ft Casing Radius: 0.083 ft Screen Length: 10. ft

Water Column Height: 45.18 ft Wellbore Radius: 0.333 ft

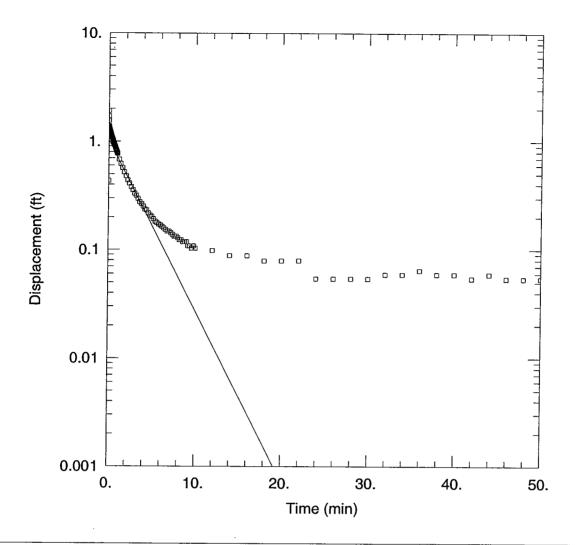
SOLUTION

Aquifer Model: Unconfined

K = 1.164E-06 ft/min

Solution Method: Bouwer-Rice

y0 = 1.249 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW5.aqt

Date: <u>05/27/03</u> Time: <u>14:07:09</u>

#### PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW5

#### **AQUIFER DATA**

Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW5)

Initial Displacement: 1.912 ft Casing Radius: 0.083 ft

Screen Length: 5. ft

Water Column Height: <u>6.56</u> ft Wellbore Radius: <u>0.333</u> ft

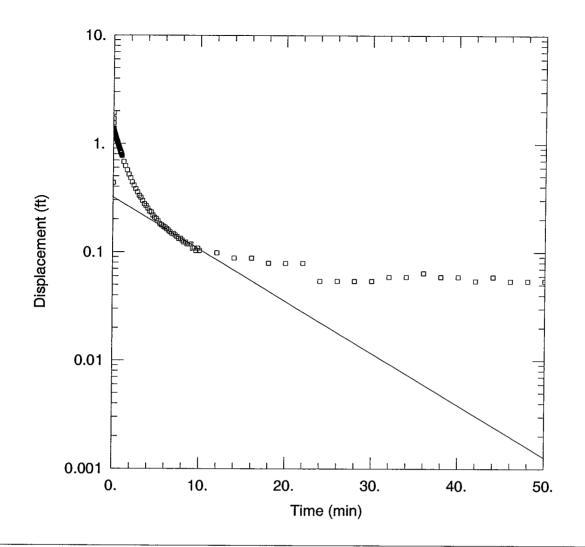
## SOLUTION

Aquifer Model: Unconfined

K = 0.0004881 ft/min

Solution Method: Bouwer-Rice

y0 = 1.025 ft



#### FTP-MW5 2ND RESPONSE

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW5 2ND.aqt Time: 14:07:06

Date: 05/27/03

#### PROJECT INFORMATION

Company: URS Client: USACE

Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW5

#### AQUIFER DATA

Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW5)

Initial Displacement: 1.912 ft Casing Radius: 0.083 ft

Screen Length: 5. ft

Water Column Height: 6.56 ft Wellbore Radius: 0.333 ft

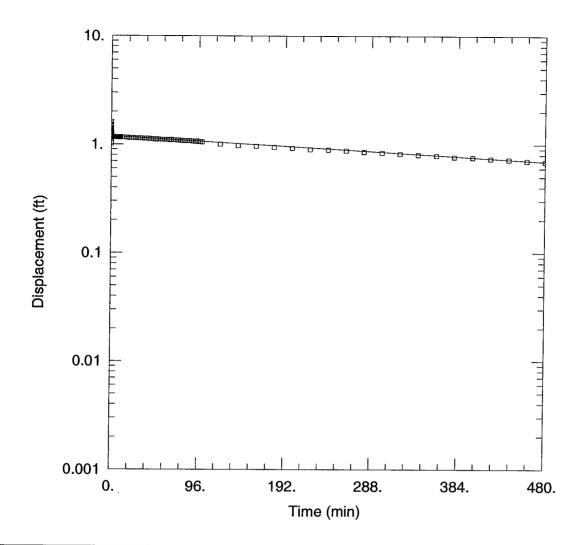
#### SOLUTION

Aquifer Model: Unconfined

K = 0.0001495 ft/min

Solution Method: Bouwer-Rice

y0 = 0.3195 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT1\FTP-MW6.aqt

Date: 05/23/03 Time: 12:28:15

### PROJECT INFORMATION

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW6

#### **AQUIFER DATA**

Saturated Thickness: 24. ft Anisotropy Ratio (Kz/Kr): 1.

# WELL DATA (FTP-MW6)

Initial Displacement: 1.605 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 23.88 ft Wellbore Radius: 0.333 ft

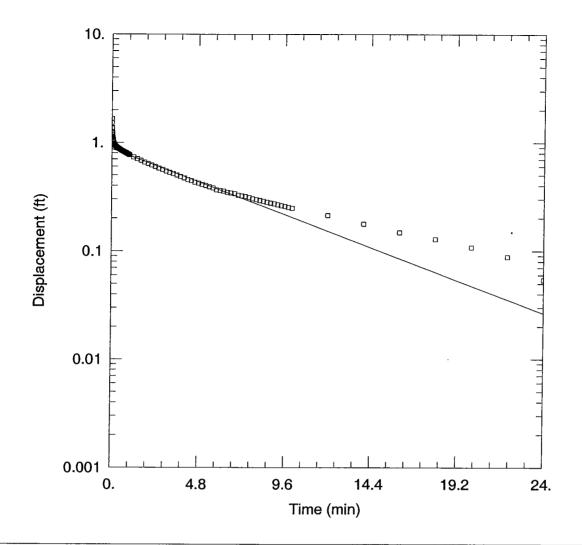
### **SOLUTION**

Aquifer Model: Unconfined

K = 1.195E-06 ft/min

Solution Method: Bouwer-Rice

y0 = 1.193 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW7.aqt

Date: 05/23/03

Time: 12:14:54

## **PROJECT INFORMATION**

Company: <u>URS</u> Client: <u>USACE</u> Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW7

#### **AQUIFER DATA**

Saturated Thickness: 16. ft

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (FTP-MW7)

Initial Displacement: 1.665 ft Casing Radius: 0.083 ft

Screen Length: 10. ft

Water Column Height: 15.51 ft Wellbore Radius: 0.333 ft

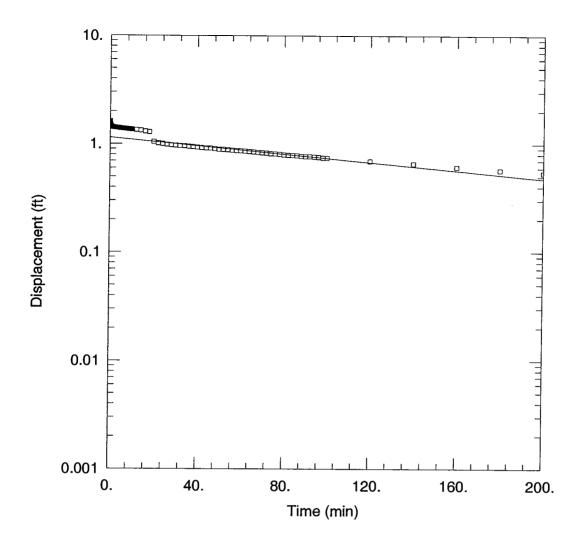
#### SOLUTION

Aquifer Model: Unconfined

K = 0.0001343 ft/min

Solution Method: Bouwer-Rice

y0 = 0.8704 ft



Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT1\FTP-MW8.aqt

Date: 05/23/03 Time: 12:30:37

#### PROJECT INFORMATION

Company: URS Client: USACE Project: 16169503

Test Location: FIRE TRAINING PIT

Test Well: FTP-MW8

#### **AQUIFER DATA**

Saturated Thickness: 44. ft Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (FTP-MW8)

Initial Displacement: 1.61 ft Casing Radius: 0.083 ft Screen Length: 10. ft

Water Column Height: 43.93 ft Wellbore Radius: 0.333 ft

#### **SOLUTION**

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 5.282E-06 ft/min

y0 = 1.143 ft

TABLE G-1 SUMMARY OF SURVEY RESULTS FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Coord	linates	Coord	linates	Well TO	OC (msl)	Groun	d (msl)		Screen	ı (feet)		Bedro	ck (feet)
Identification Number	Northing (feet)	Easting (feet)	Northing (meters)	Easting (meters)	Elevation (feet)	Elevation (meters)	Elevation (feet)	Elevation (meters)	Top of Screen (bgs)	Bottom of Screen (bgs)	Top of Screen Elevation (msl)	Bottom of Screen Elevation (msl)	Depth (bgs)	Elevation (msl)
FTP Monitoring W	ells													
FTP-MW1	300,609.83	2,276,086.26	91,626.06	693,752.48	659.83	201.12	657.59	200.43	5.5	15.5	652.1	642.1	5.5	652.1
FTP-MW2	300,731.91	2,276,308.27	91,663.27	693,820.15	663.18	202.14	660.81	201.42	6.9	16.9	653.9	643.9	7.2	653.6
FTP-MW3	300,944.02	2,276,473.95	91,727.92	693,870.65	657.46	200.39	654.95	199.63	10.5	20.5	644.5	634.5	5.7	649.3
FTP-MW4(B)	300,877.80	2,275,795.51	91,707.74	693,663.86	682.85	208.13	680.47	207.41	49.1	59.1	631.4	621.4	27.0	653.5
FTP-MW5	301,104.05	2,276,257.30	91,776.70	693,804.61	670.59	204.40	668.16	203.66	8.9	13.9	659.3	654.3	14.4	653.8
FTP-MW6(B)	301,103.79	2,276,262.61	91,776.62	693,806.23	670.44	204.35	667.81	203.55	34.8	44.8	633.0	623.0	14.4	653.4
FTP-MW7	300,575.55	2,275,582.83	91,615.61	693,599.03	676.87	206.31	674.52	205.60	11.0	21.0	663.5	653.5	21.0	653.5
FTP-MW8(B)	300,575.15	2,275,590.86	91,615.49	693,601.48	676.81	206.29	674.12	205.47	41.1	51.1	633.0	623.0	21.0	653.1
FTP Direct Push B	orings									-		-		
FTP-DP01	301,166.42	2,275,733.78	N/A	N/A	N/A	N/A	688.09	N/A	33.0	38.0	655.1	650.1	38.0	650.1
FTP-DP02	301,145.65	2,276,076.72	N/A	N/A	N/A	N/A	678.16	N/A	20.0	25.0	658.2	653.2	25.0	653.2
FTP-DP03	301,096.82	2,275,965.19	N/A	N/A	N/A	N/A	683.70	N/A	26.0	31.0	657.7	652.7	31.0	652.7
ETD DD04	200 977 70	2 275 570 22	DT/A	NT/A	NT/A	NT/A	COO 41	NT/A	8.0	13.0	672.4	667.4	27.0	652.4
FTP-DP04	300,876.60	2,275,570.22	N/A	N/A	N/A	N/A	680.41	N/A	22.0	27.0	658.4	653.4	27.0	653.4
FTP-DP05	300,975.05	2,275,988.40	N/A	N/A	N/A	N/A	681.48	N/A	18.0	23.0	663.5	658.5	23.0	658.5
FTP-DP06	301,020.67	2,276,218.50	N/A	N/A	N/A	N/A	677.61	N/A	19.0	24.0	658.6	653.6	24.0	653.6
FTP-DP07	300,738.21	2,275,618.68	N/A	N/A	N/A	N/A	680.35	N/A	22.0	27.0	658.4	653.4	27.0	653.4
FTP-DP08	300,792.34	2,275,831.22	N/A	N/A	N/A	N/A	677.47	N/A	18.0	23.0	659.5	654.5	23.0	654.5
FTP-DP09	300,888.77	2,275,993.44	N/A	N/A	N/A	N/A	682.25	N/A	15.0	20.0	667.3	662.3	30.0	652.3
F1P-DP09	300,000.77	2,273,993.44	N/A	IN/A	N/A	N/A	082.23	IN/A	25.0	30.0	657.3	652.3	30.0	032.3
FTP-DP10	300,571.34	2,275,717.97	N/A	N/A	N/A	N/A	669.91	N/A	13.0	18.0	656.9	651.9	18.0	651.9
FTP-DP11	300,679.31	2,275,839.27	N/A	N/A	N/A	N/A	671.74	N/A	15.0	20.0	656.7	651.7	20.0	651.7
FTP-DP12	300,866.41	2,276,235.00	N/A	N/A	N/A	N/A	676.79	N/A	18.0	23.0	658.8	653.8	23.0	653.8
FTP-DP13	300,979.51	2,276,375.23	N/A	N/A	N/A	N/A	669.87	N/A	11.0	16.0	658.9	653.9	16.0	653.9
FTP-DP14	300,613.92	2,276,076.36	N/A	N/A	N/A	N/A	658.27	N/A	5.0	9.0	653.3	649.3	9.0	649.3
FTP-DP15	300,548.50	2,276,366.76	N/A	N/A	N/A	N/A	665.70	N/A	9.0	13.0	656.7	652.7	13.0	652.7
FTP-DP16	300,693.62	2,276,642.12	N/A	N/A	N/A	N/A	665.70	N/A	10.0	15.0	655.7	650.7	15.0	650.7
FTP-DP17	300,641.48	2,276,248.81	N/A	N/A	N/A	N/A	656.86	N/A	1.0	6.0	655.9	650.9	6.0	650.9
FTP-DP18	300,805.64	2,276,393.57	N/A	N/A	N/A	N/A	661.00	N/A	5.0	10.0	656.0	651.0	10.0	651.0
FTP-DP19	300,500.11	2,275,851.04	N/A	N/A	N/A	N/A	665.10	N/A	9.0	14.0	656.1	651.1	14.0	651.1

# TABLE G-1 SUMMARY OF SURVEY RESULTS FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Coord	linates	Coord	linates	Well TO	OC (msl)	Groun	d (msl)		Scree	n (feet)		Bedroo	ek (feet)
Identification Number	Northing (feet)	Easting (feet)	Northing (meters)	Easting (meters)	Elevation (feet)	Elevation (meters)	Elevation (feet)	Elevation (meters)	Top of Screen (bgs)	Bottom of Screen (bgs)	Top of Screen Elevation (msl)	Bottom of Screen Elevation (msl)	Depth (bgs)	Elevation (msl)
FTP-DP20	300,429.27	2,276,145.78	N/A	N/A	N/A	N/A	670.55	N/A	18.0	23.0	652.6	647.6	23.0	647.6
FTP-DP21	300,981.84	2,275,843.51	N/A	N/A	N/A	N/A	683.73	N/A	25.0	30.0	658.7	653.7	30.0	653.7
FTP-DP22	301,202.60	2,276,297.39	N/A	N/A	N/A	N/A	672.07	N/A	15.0	20.0	657.1	652.1	20.0	652.1
FTP-DP23	300,963.95	2,276,105.72	N/A	N/A	N/A	N/A	677.41	N/A	20.0	25.0	657.4	652.4	25.0	652.4
FTP-DP24	300,938.78	2,276,472.81	N/A	N/A	N/A	N/A	654.53	N/A	2.0	7.0	652.5	647.5	6.0	648.5
FTP-DP25	300,876.76	2,276,084.78	N/A	N/A	N/A	N/A	674.93	N/A	17.0	22.0	657.9	652.9	22.0	652.9
FTP-DP26	300,686.27	2,276,617.12	N/A	N/A	N/A	N/A	663.94	N/A	18.0	23.0	645.9	640.9	14.0	649.9
FTP Staff Gauges														
SC-SG01	302,077.80	2,276,937.05	92,073.50	694,011.80	N/A	N/A	635.17	195.43	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG02	301,907.15	2,276,003.77	92,021.48	693,727.34	N/A	N/A	652.33	200.66	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG03	301,788.11	2,276,558.38	91,985.20	693,896.38	N/A	N/A	639.33	196.70	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG04	301,308.49	2,276,935.84	91,839.01	694,011.43	N/A	N/A	629.91	193.83	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG05	300,910.29	2,276,519.88	91,717.64	693,884.65	N/A	N/A	642.10	197.54	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG06	300,573.07	2,276,077.77	91,614.86	693,749.89	N/A	N/A	651.84	200.51	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG07	300,870.76	2,277,116.80	91,705.59	694,066.59	N/A	N/A	627.67	193.14	N/A	N/A	N/A	N/A	N/A	N/A

#### Notes:

bgs = Below Ground Surface

msl = Mean Sea Level (NAVD88)

N/A = Not Available

TOC = Top of Casing

NAVD88 = North American Vertical Datum of 1988

NAD83 = North American Datum of 1983

Survey was completed using the Iowa State Planar Coordinates - South Zone. Datums used were NAD83 (horizontal) and NAVD88 (vertical)

# Iowa Army Ammunition Plant, Burlington, Iowa Field Survey Points and Control NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

IOWA ARMY	AMM	UNITION PLANT	<u>-</u>	UNITS=METER	RS			
PT#		SPC N	SPC E	NAVD 88	DESC	Diff N	Diff E	Diff elev
CONTROL								
IAAP 041		87491.147	692559.177	208.441	CP			
IAAP 024		91471.259	692482.323	212.151		<u> </u>		
	5000	91471.261	692482.323		CHECK#O24			
IAAP 011	0000	93598.232	690878.328		CP-IAAP140			
IAAP 119		93730.281	691667.520	219.264				
IAAP 111		93582.332	690201.780	219.264				
IAAF III		93302.332	090201.780	221.013	СР			···
LINE 3								
	5001	93730.284	691667.514	210 260	CHECK #119	0.003	0.006	0.00
	5002	93582.334	690201.776		CHECK #119	0.003	-0.006	-0.00
16-C-G	JUUZ	91440.846	691485.230	211.870		0.002	-0.004	0.00
16-C	+	91440.773	691485.245	212.472				-
16-B-G		91653.859	691405.892	212.472		<del></del>	,	
16-B		91653.774	691405.876	213.514				
16-E-G	-	91131.190						****
16-D-G	-		691352.564	211.872				
16-D-G		91130.212	691355.806	211.908				
16-E		91130.226	691355.737	212.504				
		91131.157	691352.498	212.444				
L3-MW1-G		91327.791	691251.473	211.885				
L3-MW1		91327.682	691251.489	212.328				
JAW-54-G		91324.876	691250.194	211.966				
JAW-54		91324.817	691250.213	212.649				
L3-MW2-G		91316.324	691277.739	211.448				
L3-MW2		91316.239	691277.786	212.092				
16-A-G		91318.517	691278.026	211.484				
16-A		91318.459	691278.054	212.079	MW			
LINE 2								
L2-MW2-G		91350.559	692182.417	208.439				
_2-MW2		91350.420	692182.486	209.162	MW			-
_2-MW1-G		91230.763	692185.417	206.438			,,,,	-
_2-MW1		91230.646	692185.408	207.004	MW			
_2-MW4-G		91079.906	692253.145	207.715	MW			
_2-MW4		91079.930	692253.288	208.410	MW			
JAW-70-G		91078.066	692252.595	207.829	MW			
JAW-70		91078.058	692252.665	208.702	MW		-	
JAW-71 <b>-</b> G		91048.995	692232.746	207.814	MW			
JAW-71		91048.958	692232.823	208.555	MW			
_2-MW5-G		91071.040	692132.530	206.767				
_2-MW5		91070.938	692132.520	207.480				
12-C-G		90806.765	692144.657	209.957				
12-D-G		90803.878	692145.687	209.974	•			
12-B-G		90804.931	692148.535	209.947				
12-B		90804.909	692148.635	210.624				
12-D		90803.804	692145.759	210.578				

# lowa Army Ammunition Plant, Burlington, Iowa Field Survey Points and Control NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

12.0	00000 740	000444.740	040.000	Jana,		<del></del>	
12-C L2-MW7-G	90806.710	692144.716			<del> </del>		-
	90695.861	692028.100					
L2-MW7	90695.747	692028.095					
L2-MW6-G	90695.87	692030.065					
L2-MW6	90695.757	692030.076					
L2-MW8-G	90551.669	691921.333					
L2-MW8 (B)	90551.544	691921.316	200.704	MW			
G-15-G	90553.587	691922.634	199.860	MW			
G-15	90553.434	691922.587	200.952	MW			
6000	90402.010	691862.572	201.429	CP	T.,		-
6001	90392.832	691850.513	201.663				
6002	90699.940	691990.338	205.982				
6003	90718.456	691993.913	206.322				
6004	90991.765	691979.780	201.770				
6005	91020.023	692003.857	202.390		+	-	
	31020.020	002000.007	202.030	OF	-		
			-,-				
LINE 9	-		<u>.</u>		1	<del>   </del>	
LINE 3					<del> </del>		
IAW 642 C	04007 400	000007.400	045.000	00			
JAW-612-G	91307.493	690267.106	215.626				! 
JAW-612	91307.459	690267.164	216.275		ļ		
L9-MW11-G	91314.641	690216.351	215.811				
L9-MW12-G	91313.476	690215.096	215.715				
L9-MW13-G	91312.365	690213.61	215.686	MW			
L9-MW13	91312.246	690213.575	216.439	MW			
L9-MW12	91313.351	690215.091	216.429	MW			
L9-MW11	91314.516	690216.321	216.518	MW			
L9-MW6-G	91246.808	690302.462	215.312	MW	<u> </u>		
L9-MW5-G	91247.972	690303.523	215.342		<u> </u>		
L9-MW5	91247.836	690303.537	216.061		<del> </del>		-
L9-MW6	91246.674	690302.549	215.998		<del> </del>		
JAW-611-G	91389.419	690297.994	216.496		<del> </del>		
JAW-611	91389.349	690297.945	217.206			V. 4.	
JAW-30-G	91391.208	690260.914	216.673				
L9-MW2-G	91390.355	690242.657	216.449				
L9-MW1-G	91391.159	690240.811			<del>                                     </del>		
L9-MW1			216.450		<del> </del>		
	91391.052	690240.825	217.091				
L9-MW2	91390.254	690242.672	217.103				-1121
JAW-31-G	91397.186	690241.368	216.540				
JAW-31	91397.097	690241.33	217.278			-	
JAW-30	91391.170	690260.887	217.520	<u> </u>			
JAW-29-G	91424.472	690240.776	216.602				
JAW-29	91424.362	690240.746	217.430	MW	ļ l		
L9-MW4-G	91490.212	690328.264	217.128	MW.			
L9-MW3-G	91491.724	690329.162	217.122	MW			-
L9-MW3	91491.610	690329.245	217.843	MW			
L9-MW4	91490.136	690328.313	217.702				
JAW610-G	91454.149	690240.193	216.297				
JAW610	91454.025	690240.192	216.999			-	
L9-MW10-G	91371.939	690051.432	215.762		<del>                                     </del>		
L9-MW9-G	91371.509	690049.970	215.762		-		
L9-MW9	91371.394	690049.930					
L9-MW10			216.520				
	91371.799	690051.443	216.427				
5003	93730.299	691667.527		CHECK 119	0.018	0.007	-0.001
5004	93730.282	691667.509		CHECK 119	0.001	-0.011	0.002
L9-MW7-G	91177.393	690179.928	212.278	MW			

# lowa Army Ammunition Plant, Burlington, Iowa Field Survey Points and Control NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

L9-MW8-G	91176.748	690181.393	212.249	NAVA/			
L9-MW8	91176.642	690181.418	212.249				
L9-MW7	91177.313	690179.902	213.012		<del></del>		
20 111177	31177.010	030173.302	213.012	IVIVV		<del></del>	
	-						
FIRE TRAINING PI	т -						
THE HOUNTS I			<del></del>				
SA 99-1-G	91766.615	693664.006	208.859	CLIMD			<u> </u>
SA 99-1	91766.547	693663.995					
FTP-MW4-G	91707.856	693663.888	209.307				<u> </u>
FTP-MW4 (B)	91707.737		207.408				
JAW-60-G	91711.407	693663.858	208.134				
JAW-60	91711.318	693660.696	207.558				
JAW-80-G		693660.678	208.401				
JAW-80	91650.405	693682.418	204.892				
FTP-MW8-G	91650.317	693682.405	205.682				
	91615.573	693601.481	205.473				
FTP-MW7-G	91615.677	693599.029	205.595				
FTP-MW7	91615.610	693599.033	206.310				
FTP-MW8 (B)	91615.489	693601.482	206.293				
M-01-G	91545.063	693702.145	203.556				
M-01	91545.010	693702.128	204.236				
FTP-MW1-G	91626.158	693752.501	200.434				
FTP-MW1	91626.058	693752.481	201.118				
FTA-99-1-G	91670.741	693760.786	203.660				-
FTA-99-2-G	91671.634	693757.704	203.731				
FTA-99-1	91670.573	693760.787	204.577				-
FTA-99-2	91671.502	693757.631	204.550	MW			
FTP-MW-2-G	91663.368	693820.255	201.415	MW			
FTP-MW2	91663.269	693820.148	202.138	MW			
FTP-MW3-G	91728.047	693870.581	199.630	MW			
FTP-MW3	91727.922	693870.647	200.393	MW			
FTP-MW6-G	91776.731	693806.234	203.548	MW			
FTP-MW5-G	91776.828	693804.577	203.657	MW			
FTP-MW5	91776.699	693804.613	204.395				
FTP-MW6 (B)	91776.618	693806.230	204.352	MW			
				<u></u>	-		
WEST BURN PAD			-				
WBP-99-1-G	91861.680	693720.629	209.771	MW			
WBP-99-1	91861.570	693720.575	210.555	MW			
JAW-25-G	91878.164	693773.777	209.345	MW			
JAW-25	91878.107	693773.721	210.135	MW	-		1
WBP-MW3-G	91909.256	693813.125	205.542	MW			
WBP-MW3 (B)	91909.122	693813.127	206.303	MW			<del>-</del>
WBP-99-2-G	91942.599	693713.654	206.051		-	-	Ţ~
WBP-99-2	91942.538	693713.671	206.852		~~		
WBP-99-4-G	91978.932	693718.169	202.985			<u> </u>	1
WBP-99-4	91978.895	693718.224	203.723		<del>-</del>		
WBP-99-6-G	91969.201	693807.818	199.149				<del>                                     </del>
WBP-99-6 (B)	91969.066	693807.826	199.922			-	+
WBP-99-5-G	91969.520	693877.081	197.195			<del></del>	
WBP-99-5	91969.450	693877.056	197.979				
WBP-MW1-G	91970.005	693881.077	197.110			<del></del>	-
WBP-MW1 (B)	91969.887	693881.095	197.879			<del></del>	<del> </del>
WBP-MW2-G	91952.618	693960.748	195.136				<del>                                     </del>
	0.002.010	000000.740	190.100	IAI A A			1

# lowa Army Ammunition Plant, Burlington, Iowa Field Survey Points and Control NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

WBP-MW2 (B)	91952.535	693960.683	195.916	S M/M		· I	
JAW-24-G	91951.509	693957.677	195.105				
JAW-24	91951.479	693957.584	195.103				
G-30-G	91781.166	693888.290	198.571				
G-30	91781.023	693888.333	199.449				
6007	91856.971	693887.445	202.872				
6006	91869.176	694007.128	197.963				
WBP-99-3-G	91853.991	693979.058		777 - 3			
WBP-99-3 WBP-99-3			197.942				
WBP-99-7-G	91853.886	693979.111	198.768				_
WBP-99-7-G WBP-99-7	91844.080	693973.872	198.002				
	91844.024	693973.892	198.817				
6008	91947.512	693899.417	200.325				
5005	93582.339	690201.772	221.024	CHECK 111	0.007	-0.008	0.011
EAST BURN PAD							
5006	93582.354	690201.779	221 011	CHECK 111	0.022	-0.001	0.000
EBP-MW4-G	92025.346	694099.615	206.395		0.022	-0.001	-0.002
EBP-MW4 (B)	92025.209	694099.592	207.199				
6009	91788.725	694192.026	204.523				
6010	91817.507	694151.117	204.523				
EBP-MW2-G	91937.625	694454.848					
EBP-MW2			207.895				
EDA-4-G	91937.514	694454.843	208.550				
	92150.875	694483.080	208.100				
EDA-4	92150.760	694483.042	208.668				
EDA-3-G	91907.261	694264.074	205.366				
EDA-3	91907.219	694263.981	206.034				
JAW-614-G	91905.125	694260.346	205.136				
JAW-614	91904.993	694260.441	205.819				
6011	91434.820	692045.395	203.058				
6012	91428.275	692090.608	210.737	CP			
5007	93582.348	690201.786	221.011	CHECK 111	0.016	0.006	-0.002
5011	91817.509	694151.115	202.791	CHECK 6010	0.002	-0.002	-0.001
EBP-MW1-G	91752.060	694279.800	203.578	MW			
EBP-MW1	91751.946	694279.894	204.300	MW			
EBP-MW5-G	91821.722	694117.102	202.092	MW			
EBP-MW5 (B)	91821.554	694117.130	202.793			<u> </u>	
EBP-MW6-G	91824.264	694116.065	201.936				· ·
EBP-MW6 (B)	91824.144	694116.011	202.664				
STAFF GAUGES AI	ND POPE						
	ND BURE			<u></u>		-	<del></del>
5010	91869.177	694007.127		CHECK 6006	0.001	-0.001	0.005
SC-SG01	92073.497	694011.801	195.429				
SC-SG01-BM	92073.305	694005.26	195.694	ВМ			
WBP-SB01	91969.919	693811.284	199.268	BORE			
SC-SG03	91985.199	693896.382	196.698	STAFE			
SC-SG06	91614.855	693749.892					_
00-0000	31014.000	093149.092	200.511	SIAFF			
5013	91817.509	694151.118	202.790	CHECK 6010	0.002	0.001	-0.002
SC-SG07	91705.592	694066.588	193.144				5.00L
SC-SG07-BM	91700.449	694064.651	192.839				
			.02.000				

# Iowa Army Ammunition Plant, Burlington, Iowa Field Survey Points and Control NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

5014	91942.565	693713.650	206.050	CHECK WBP-99-2-G	-0.034	-0.004	-0.001
SC-SG02	92021.484	693727.338	200.660		0.00	0.001	0.001
5015	91020.023	692003.857	202.388	CHECK 6005	0	0	-0.002
BC-SG02	90992.930	691940.526	200.918	STAFF			
BC-SG02-BM	90986.723	691939.157	201.493	ВМ			
5019	90392.833	691850.514	201.664	CHECK 6001	0.001	0.001	0.001
BC-SG04-BM	90420.287	691864.115	198.183	ВМ			
BC-SG04	90423.759	691860.130	199.193	STAFF			
5017	90699.941	691990.336	205.979	CHECK 6002	0.001	-0.002	-0.003
BC-SG03-BM	90680.459	691917.324	199.678		0.001	0.002	-0.000
5018	91428.278	692090.587	210.741	CHECK 6012	0.003	-0.021	0.004
BC-SG01-BM	91416.370	692004.574	203.151		0.000	-0.021	0.004
BC-SG01	91416.694	691998.018	202.489				
5008	91856.974	693887.446	202 878	CHECK 6007	0.003	0.001	0.006
SC-SG05	91717.640	693884.648		STAFF	0.000	0.001	0.000
5009	91856.971	693887.450	202 874	CHECK 6007	0	0.005	0.002
SC-SG04	91839.011	694011.431	193.825			0.000	0.002

# Iowa Army Ammunition Plant, Burlington, Iowa Monitor Wells NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
LINE 2	-				
12-B	North rim PVC	90804.909	692148.635	210.624	
12-B-G	Ground North side	90804.931	692148.535	209.947	
12-C	North rim PVC	90806.710	692144.716	210.699	
12-C-G	Ground North side	90806.765	692144.657	209.957	
12-D	North rim PVC	90803.804	692145.759	210.578	
12-D-G	Ground North side	90803.878	692145.687	209.974	
G-15	North rim PVC	90553.434	691922.587	200.952	
G-15-G	Ground North side	90553.587	691922.634	199.860	
JAW-70	North rim PVC	91078.058	692252.665	208.702	
JAW-70-G	Ground North side	91078.066	692252.595	207.829	
JAW-71	North rim PVC	91048.958	692232.823	208.555	
JAW-71-G	Ground North side	91048.995	692232.746	207.814	
L2-MW1	North rim PVC	91230.646	692185.408	207.004	
L2-MW1-G	Ground North side	91230.763	692185.417	206.438	
L2-MW2	North rim PVC	91350.420	692182.486	209.162	
L2-MW2-G	Ground North side	91350.559	692182.417	208.439	,
L2-MW4	North rim PVC	91079.930	692253.288	208.410	
L2-MW4-G	Ground North side	91079.906	692253.145	207.715	
L2-MW5	North rim PVC	91070.938	692132.520	207.480	
L2-MW5-G	Ground North side	91071.040	692132.530	206.767	
L2-MW6	North rim PVC	90695.757	692030.076	207.608	
L2-MW6-G	Ground North side	90695.870	692030.065	206.889	
L2-MW7	North rim PVC	90695.747	692028.095	207.525	
L2-MW7-G	Ground North side	90695.861	692028.100	206.889	
L2-MW8	North rim PVC	90551.544	691921.316	200.704	
L2-MW8-G	Ground North side	90551.669	691921.333	199.973	
LINE 3					
16-A	North rim PVC	91318.459	691278.054	212.079	
16-A-G	Ground North side	91318.517	691278.026	211.484	
16-B	North rim PVC	91653.774	691405.876	213.514	
16-B-G	Ground North side	91653.859	691405.892	212.913	
16-C	North rim PVC	91440.773	691485.245	212.472	
16-C-G	Ground North side	91440.846	691485.230	211.870	
16-D	North rim PVC	91130.226	691355.737	212.504	
16-D-G	Ground North side	91130.212	691355.806	211.908	
16-E	North rim PVC	91131.157	691352.498	212.444	
16-E-G	Ground North side	91131.190	691352.564	211.872	
JAW-54	North rim PVC	91324.817	691250.213	212.649	
JAW-54-G	Ground North side	91324.876	691250.194	211.966	Concrete pad is broken & heaved +/- 0.03
L3-MW1	North rim PVC	91327.682	691251.489	212.328	
L3-MW1-G	Ground North side	91327.791	691251.473	211.885	
L3-MW2	North rim PVC	91316.239	691277.786	212.092	
L3-MW2-G	Ground North side	91316.324	691277.739	211.448	
INE 9		-			
JAW-29	North rim PVC	91424.362	690240.746	217.430	
JAW-29-G	Ground North side	91424.472	690240.776	216.602	
JAW-30	North rim PVC	91391.170	690260.887	217.520	
JAW-30-G	Ground North side	91391.208	690260.914	216.673	

# Iowa Army Ammunition Plant, Burlington, Iowa Monitor Wells NAD83 (1996) lowa South zone (meters), NAVD88 (meters)

JAW-31	Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
JAW-31-C   Ground North side   91397.188   690241.398   216.540     JAW-610-G   Ground North side   91454.149   890240.192   216.399     JAW-610-G   Ground North side   91454.149   890240.193   216.297     JAW-611-M   North side   91454.149   890240.192   216.296     JAW-612   North side   91398.349   690297.994   216.496     JAW-612   North side   91307.499   890267.164   216.275     JAW-612   North side   91307.493   890267.164   216.275     JAW-612   North side   91307.493   890267.164   216.275     JAW-612   Ground North side   91307.493   890267.164   216.275     L9-MW1   North side   91391.595   690240.811   216.450     L9-MW10   North side   91371.799   690051.443   216.427     L9-MW10   North side   91371.393   6900218.321   215.762     L9-MW11-G   Ground North side   91314.641   690216.351   215.811     L9-MW11-G   Ground North side   91314.641   690216.351   215.811     L9-MW12-G   Ground North side   91313.351   690216.921   216.429     L9-MW13-G   Ground North side   91313.351   690215.996   215.715     L9-MW13-G   Ground North side   91312.365   690213.575   216.439     L9-MW2-G   Ground North side   91312.365   690213.575   216.439     L9-MW2-G   Ground North side   91390.254   690224.657   217.103     L9-MW2-G   Ground North side   91390.355   690224.2672   217.103     L9-MW2-G   Ground North side   91390.355   690224.2672   217.103     L9-MW2-G   Ground North side   91390.355   690224.2672   217.103     L9-MW3-G   Ground North side   9149.174   690302.9162   217.122     L9-MW4-G   Ground North side   9149.174   690302.9162   217.122     L9-MW4-G   Ground North side   9149.174   690302.9162   217.122     L9-MW4-G   Ground North side   9149.174   690303.537   216.061     L9-MW3-G   Ground North side   9167.731   690303.537   216.061     L9-MW3-G   Ground North side   9167.573   690303.537   216.061     L9-MW3-G   Ground North side   9167.573   69376.787   204.577     L9-MW4-G   Ground North side   9167.573   69376.787   204.577     L9-MW3-G   Ground North side   9167.573   69376.787   204.577						TOTAL
JAW-31-G   Ground North side   91397.186   680240.192   216.999   JAW-610-G   North rim PVC   91454.025   680240.192   216.999   JAW-610-G   Ground North side   91454.149   680240.193   216.297   JAW-611-G   Ground North side   91454.149   680240.193   216.297   JAW-611-G   Ground North side   91389.419   680297.9945   217.206   JAW-612-G   Ground North side   91307.493   680297.994   216.496   JAW-612-G   Ground North side   91307.493   680267.164   216.275   JAW-612-G   Ground North side   91307.493   680267.164   216.275   JAW-612-G   Ground North side   91307.493   680267.164   216.275   JAW-612-G   Ground North side   91391.052   680240.811   216.450   Jaw-612-G   Ground North side   91371.799   6800240.811   216.450   Jaw-612-G   Ground North side   91371.799   680051.432   215.762   Jaw-612-G   Jaw-612-G   Ground North side   91371.939   680051.432   215.762   Jaw-612-G	JAW-31	North rim PVC	91397.097	690241.330	217.278	
JAW-610   North rim PVC   91454.025   690240.192   216.999   216.297   JAW-6110   Ground North side   91389.349   690297.945   217.206   Ground North side   91389.349   690297.994   216.496   JAW-612   North rim PVC   91389.349   690297.994   216.496   JAW-612   North rim PVC   91307.459   690267.164   216.275   JAW-612-6   Ground North side   91307.459   690267.164   216.275   JAW-612-6   Ground North side   91307.459   690267.106   215.626   JAW-612-6   Ground North side   91307.493   690267.106   215.626   JAW-612-6   Ground North side   91391.159   690240.825   217.091   JAW-612-6   Ground North side   91391.159   690240.825   217.091   JAW-612-6   Ground North side   91371.799   690051.443   216.427   JAW-71-7	JAW-31-G	Ground North side				
JAW-610-G   Ground North side   91454.149   690229.7945   217.206     JAW-611-G   North rim PVC   91399.349   690297.945   217.206     JAW-612-G   Oround North side   91399.419   690297.945   216.275     JAW-612-G   Cround North side   91307.459   690267.164   216.275     JAW-612-G   Ground North side   91307.489   690267.164   216.275     JAW-612-G   Ground North side   91307.489   690267.164   216.275     L9-MW1   North rim PVC   91391.052   690240.825   217.091     L9-MW1   Ground North side   91391.159   690240.811   216.480     L9-MW10-G   Ground North side   91371.399   690051.443   216.427     L9-MW11-G   Ground North side   91371.399   690051.432   215.762     L9-MW11-G   Ground North side   91374.516   690216.351   215.811     L9-MW12-G   Ground North side   91314.516   690216.351   215.811     L9-MW12-G   Ground North side   91313.351   690215.096   215.715     L9-MW13-G   Ground North side   91313.3476   690215.096   215.715     L9-MW13-G   Ground North side   91312.466   690215.096   215.715     L9-MW2-G   Ground North side   91390.254   690242.672   217.103     L9-MW2-G   Ground North side   91390.254   690242.672   217.103     L9-MW3-G   Ground North side   91491.724   690328.245   217.843     L9-MW3-G   Ground North side   91491.724   690328.162   217.122     L9-MW3-G   Ground North side   91491.724   690328.245   217.843     L9-MW3-G   Ground North side   91491.724   690328.245   217.843     L9-MW3-G   Ground North side   91491.724   690328.245   217.843     L9-MW3-G   Ground North side   91491.734   690328.313   217.702     L9-MW3-G   Ground North side   91491.734   690328.245   217.843     L9-MW3-G   Ground North side   91491.734   690328.245   217.843     L9-MW3-G   Ground North side   91491.731   690328.245   217.843     L9-MW3-G   Ground North side   9147.972   690303.537   216.061     L9-MW3-G   Ground North side   9147.972   690303.537   216.061     L9-MW3-G   Ground North side   9147.973   690308.393   216.520     L9-MW3-G   Ground North side   9147.973   690376.787   203.731     FTA-9	JAW610	North rim PVC				
JAW-611	JAW610-G	Ground North side	91454.149			
JAW-611-G   Ground North side   91389.419   690297.994   216.496     JAW-612-G   North rim PVC   91307.459   690267.164   216.275     JAW-612-G   Ground North side   91307.493   690267.106   215.626     L9-MW1   North rim PVC   91391.052   690240.825   217.091     L9-MW10-G   Ground North side   91391.159   690240.825   217.091     L9-MW10   North rim PVC   91391.159   690240.825   217.091     L9-MW10   North rim PVC   91371.799   690051.443   216.427     L9-MW11   North rim PVC   91371.799   690051.432   215.762     L9-MW11   North rim PVC   91314.516   690216.321   216.518     L9-MW12   North rim PVC   91313.351   690216.321   216.518     L9-MW12   North rim PVC   91313.351   690215.091   216.429     L9-MW12-G   Ground North side   91312.246   690215.096   215.715     L9-MW13-G   Ground North side   91312.365   690213.610   215.686     L9-MW2   North rim PVC   91390.254   690242.672   217.103     L9-MW2-G   Ground North side   91390.255   690242.672   217.103     L9-MW3-G   Ground North side   91491.610   690329.245   217.843     L9-MW3-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91491.724   690329.162   217.122     L9-MW4-G   Ground North side   91147.797   69030.523   215.342     L9-MW5-G   Ground North side   91147.797   69030.523   215.342     L9-MW9-G   Ground North side   91177.313   690179.902   215.891     L9-MW9-G   Ground North side   91176.748   690302.549   215.998     L9-MW9-G   Ground North side   91176.748   690302.549   215.998     L9-MW9-G   Ground North side   91670.573   693760.787   204.577     FTA-99-1   North rim PVC   91670.573   693760.787   204.577     FTA-99-1   North rim PVC   91670.573   693760.787	JAW-611	North rim PVC				
JAW-612   North rim PVC   91307.459   690267.164   216.275     JAW-612-G   Ground North side   91307.493   690267.106   215.626     L9-MW1   North rim PVC   91391.052   690240.825   217.091     L9-MW10   North rim PVC   91391.159   690240.811   216.450     L9-MW10   North rim PVC   91371.799   690051.432   216.762     L9-MW11-G   Ground North side   91371.793   690051.432   215.762     L9-MW11-G   Ground North side   91371.793   690051.432   216.518     L9-MW11-G   Ground North side   91314.516   690216.351   215.811     L9-MW12-G   Ground North side   91313.351   690215.091   216.429     L9-MW12-G   Ground North side   91313.351   690215.096   215.715     L9-MW13-G   Ground North side   91312.246   690213.575   216.439     L9-MW2-G   Ground North side   91312.365   690215.509   215.715     L9-MW2-G   Ground North side   91312.365   690215.510   215.686     L9-MW3-G   Ground North side   91390.355   690242.657   217.103     L9-MW3-G   Ground North side   91491.724   690329.162   217.122     L9-MW3-G   Ground North side   91491.724   690329.362   217.122     L9-MW4-G   Ground North side   91490.212   690328.264   217.128     L9-MW4-G   Ground North side   91490.212   690328.313   217.702     L9-MW6-G   Ground North side   91247.972   690303.537   216.061     L9-MW6-G   Ground North side   91247.972   690303.537   216.061     L9-MW6-G   Ground North side   91177.313   690179.928   212.278     L9-MW6-G   Ground North side   91177.319   690179.928   212.278     L9-MW8-G   Ground North side   91177.319   690179.928   212.279     L9-MW8-G   Ground North side   91177.319   690349.30   216.520     L9-MW9-G   Ground North side   91177.319   690149.930   216.520     L9-MW9-G   Ground North side   91177.319   690149.930   216.520     L9-MW9-G   Ground North side   91671.634   693760.786   203.660     FTA-89-1   North rim PVC   91670.573   693760.787   204.577     FTE-MW1-G   Ground North side   91671.634   693757.061   204.550     FTA-99-2   North rim PVC   91670.543   693757.631   204.550     FTA-99-1   North rim PVC	JAW-611-G	Ground North side		0.77		· · · · · · · · · · · · · · · · · · ·
JAW-612-G   Ground North side   91307.493   690267.106   215.626   L9-MW1   North rim PVC   91391.052   690240.825   217.091   L9-MW1-G   North rim PVC   91371.799   690051.443   216.427   L9-MW10-G   Ground North side   91391.159   690240.811   216.456   Morth rim PVC   91371.799   690051.443   216.427   L9-MW10-G   Ground North side   91317.939   690051.432   215.762   L9-MW11   North rim PVC   91314.516   690216.321   216.518   L9-MW11-G   Ground North side   91314.641   690216.351   215.811   L9-MW12-G   Ground North side   91313.3476   690215.091   216.429   L9-MW12-G   Ground North side   91312.246   690215.096   215.715   L9-MW13-G   Ground North side   91312.365   690213.575   216.439   L9-MW2-G   Ground North side   91312.365   690213.576   216.849   L9-MW2-G   Ground North side   91312.365   690242.672   217.103   L9-MW3-G   Ground North side   91390.355   690242.672   217.103   L9-MW3-G   Ground North side   91490.136   690328.312   217.22   L9-MW3-G   Ground North side   91491.724   690329.162   217.843   L9-MW3-G   Ground North side   91490.136   690328.313   217.702   L9-MW4-G   Ground North side   91490.136   690328.313   217.702   L9-MW4-G   Ground North side   91490.136   690328.313   217.702   L9-MW4-G   Ground North side   91490.136   690328.316   217.128   L9-MW5-G   Ground North side   91490.212   690328.264   217.128   L9-MW6-G   Ground North side   91247.972   690303.523   215.342   L9-MW6-G   Ground North side   91247.973   690303.523   215.342   L9-MW6-G   Ground North side   91176.642   690302.462   215.312   L9-MW7-G   Ground North side   91176.748   690302.462   215.312   L9-MW8-G   Ground North side   91176.748   690302.462   215.881   L9-MW8-G   Ground North side   91176.642   690181.418   212.921   L9-MW8-G   Ground North side   91176.642   690181.493   212.278   L9-MW8-G   Ground North side   91670.573   693760.786   203.660   FTA-99-1   North rim PVC   91671.502   693757.631   204.550   FTA-99-1   North rim PVC   91670.573   693760.787   204.577   203.731   FTR-499-1   North r	JAW-612					
L9-MW1	JAW-612-G	7.7				
L9-MW1-G Ground North side 91391.159 690240.811 216.450 L9-MW10-G Ground North side 91371.799 690051.443 216.427 L9-MW11-G Ground North side 91371.939 690051.432 215.762 L9-MW11-G Ground North side 91314.516 690216.321 216.518 L9-MW11-G Ground North side 91314.641 690216.351 215.811 L9-MW12-G Ground North side 91313.351 690215.091 216.429 L9-MW13- North rim PVC 91312.346 690215.096 215.715 L9-MW13- North rim PVC 91312.365 690215.095 216.439 L9-MW13-G Ground North side 91312.365 690213.610 215.686 L9-MW2-G Ground North side 91390.355 690242.672 217.103 L9-MW2-G Ground North side 91390.355 690242.672 217.103 L9-MW3-G Ground North side 91491.724 690329.245 217.843 L9-MW3-G Ground North side 91491.724 690329.162 217.122 L9-MW4-G Ground North side 91490.136 690328.264 217.122 L9-MW4-G Ground North side 91490.136 690328.264 217.128 L9-MW5-G Ground North side 91490.136 690328.264 217.128 L9-MW6-G Ground North side 91490.136 690328.264 217.128 L9-MW6-G Ground North side 91247.872 690303.523 215.342 L9-MW6-G Ground North side 91247.872 690303.523 215.342 L9-MW6-G Ground North side 91247.872 690303.523 215.342 L9-MW6-G Ground North side 91247.873 690179.902 213.012 L9-MW7-G Ground North side 91246.808 690302.549 215.998 L9-MW8-G Ground North side 91246.808 690302.549 215.998 L9-MW8-G Ground North side 91371.309 690179.902 213.012 L9-MW7-G Ground North side 91371.309 690179.902 213.012 L9-MW8-G Ground North side 91371.309 69018.393 212.249 L9-MW8-G Ground North side 91371.309 69049.970 215.881 FIRE TRAINING PIT  FTA-99-1 North rim PVC 91670.573 693760.787 204.577 FTA-99-1-G Ground North side 91670.741 693760.786 203.660 FTA-99-2-G Fround North side 91670.741 693760.786 203.660 FTA-99-2-G Ground North side 91670.84 690382.148 202.38 FTP-MW1-G Ground North side 91670.84 693752.501 200.434 FTP-MW1-G Ground North side 91683.68 693352.245 201.415	L9-MW1	<del></del>				
L9-MW10- North rim PVC 91371.799 690051.443 215.762 L9-MW10-G Ground North side 91371.939 690051.432 215.762 L9-MW11-G Ground North side 91314.516 690216.321 216.518 L9-MW12-G Ground North side 91313.351 690215.091 216.429 L9-MW12-G Ground North side 91313.476 690215.096 215.715 L9-MW13-G Ground North side 91312.365 690215.096 215.715 L9-MW13-G Ground North side 91312.365 690215.075 216.439 L9-MW2-D-MW12-G Ground North side 91312.365 690213.610 215.686 L9-MW2 North rim PVC 91390.254 690242.672 217.103 L9-MW3-G Ground North side 91390.355 690242.657 216.449 L9-MW3-G Ground North side 91491.724 690329.162 217.122 L9-MW3-G Ground North side 91491.724 690329.162 217.122 L9-MW4 North rim PVC 91491.610 690329.245 217.843 L9-MW5-G Ground North side 91490.121 690328.246 217.122 L9-MW5-G Ground North side 91490.212 690328.264 217.122 L9-MW5-G Ground North side 91247.836 690303.537 216.061 L9-MW5-G Ground North side 91247.836 690303.523 215.342 L9-MW5-G Ground North side 91247.872 690303.523 215.342 L9-MW6-G Ground North side 91246.674 690302.549 215.989 L9-MW7-G Ground North side 91246.680 690302.462 215.312 North rim PVC 91466.642 690302.549 215.989 L9-MW7-G Ground North side 91177.333 690179.902 213.012 L9-MW7-G Ground North side 91177.333 690179.902 213.012 L9-MW7-G Ground North side 91177.336 690179.902 213.012 L9-MW7-G Ground North side 91177.393 690179.902 213.012 L9-MW9-G Ground North side 91176.748 690309.2462 215.881 FIRE TRAINING PIT  FTA-99-1 North rim PVC 91670.573 693760.787 204.577 FTA-99-1-G Ground North side 91670.741 693760.786 203.660 FTA-99-2-G Ground North side 91670.741 693760.786 203.660 FTA-99-2-G Ground North side 91671.634 693757.04 203.731 FTP-MW1-G Ground North side 91671.634 693757.04 203.731 FTP-MW1-G Ground North side 91670.634 693757.04 203.731 FTP-MW1-G Ground North side 91671.634 693757.04 203.731 FTP-MW1-G Ground North side 91671.634 693757.04 203.731 FTP-MW1-G Ground North side 91671.634 693757.04 203.731 FTP-MW1-G Ground North side 91671.634 693757.04 203.731 FTP-MW1-G Ground North s	L9-MW1-G	Ground North side		*******		
L9-MW10-G   Ground North side   91371.939   690051.432   215.762   L9-MW11-G   Ground North side   91314.616   690216.351   215.811   L9-MW12-Q   North rim PVC   91313.351   690215.091   216.429   L9-MW12-G   Ground North side   91314.641   690215.096   215.715   L9-MW13-Q   Ground North side   91312.246   690215.096   215.715   L9-MW13-G   Ground North side   91312.365   690213.575   216.439   L9-MW2-G   Ground North side   91312.365   690213.610   215.686   L9-MW2-G   Ground North side   91390.355   690242.672   217.103   L9-MW3-G   Ground North side   91390.355   690242.672   217.403   L9-MW3-G   Ground North side   91491.724   690329.245   217.423   L9-MW3-G   Ground North side   91491.724   690329.162   217.122   L9-MW4-G   Ground North side   91490.136   690328.313   217.702   L9-MW4-G   Ground North side   91490.212   690328.264   217.128   L9-MW5-G   Ground North side   91247.972   690330.557   216.061   L9-MW5-G   Ground North side   91247.972   690303.523   215.342   L9-MW6-G   Ground North side   91247.972   690303.523   215.342   L9-MW6-G   Ground North side   91246.674   690302.549   215.998   L9-MW6-G   Ground North side   91246.674   690302.549   215.998   L9-MW7-G   Ground North side   91246.674   690302.549   215.912   L9-MW7-G   Ground North side   91246.674   690302.549   215.912   L9-MW7-G   Ground North side   91246.674   690302.549   215.912   L9-MW8-G   Ground North side   9177.333   690179.902   213.012   L9-MW8-G   Ground North side   9177.333   690179.902   213.012   L9-MW8-G   Ground North side   9176.642   690181.393   212.249   L9-MW9-G   Ground North side   9176.642   690181.393   212.249   L9-MW9-G   Ground North side   91670.741   693760.786   203.660   FTA-99-1-G   Ground North side   91670.573   693760.786   203.660   FTA-99-2-G   Ground North side   91670.573   693760.786   203.660   FTA-99-2-G   Ground North side   91670.584   693752.691   200.434   FTP-MW1-G   Ground North side   91626.058   693752.691   200.434   FTP-MW1-G   Ground North side   91626.058   693752.501   20	L9-MW10	North rim PVC				11-11
L9-MW11	L9-MW10-G	Ground North side				
L9-MW11-G Ground North side 91314.641 690216.351 215.811   L9-MW12-G Ground North side 91313.351 690215.091 216.429   L9-MW13 North rim PVC 91312.246 690213.575 216.439   L9-MW13-G Ground North side 91312.365 690213.610 215.686   L9-MW13-G Ground North side 91312.365 690213.610 215.686   L9-MW2-Q North rim PVC 91390.254 69024.672 217.103   L9-MW2-G Ground North side 91390.355 69024.657 216.449   L9-MW3-G Ground North side 91491.610 690329.245 217.843   L9-MW3-G Ground North side 91491.724 690329.162 217.122   L9-MW4 North rim PVC 91490.136 690328.313 217.702   L9-MW4 North rim PVC 91490.136 690328.264 217.128   L9-MW4-G Ground North side 91497.792 690303.537 216.061   L9-MW5-G Ground North side 91247.972 690303.523 215.342   L9-MW6-G Ground North side 91247.972 690303.523 215.342   L9-MW6-G Ground North side 91246.674 690302.549 215.998   L9-MW6-G Ground North side 91246.674 690302.549 215.998   L9-MW7- North rim PVC 91177.313 690179.902 213.012   L9-MW7-G Ground North side 91177.393 690179.902 213.012   L9-MW8-G Ground North side 91177.393 690179.902 213.012   L9-MW8-G Ground North side 91176.642 690181.393 212.278   L9-MW9-G Ground North side 91176.642 690181.393 212.278   L9-MW9-G Ground North side 91176.748 690181.393 212.249   L9-MW9-G Ground North side 91176.748 690181.393 212.249   L9-MW9-G Ground North side 91176.748 690181.393 212.249   L9-MW9-G Ground North side 91671.694 69049.970 215.881   FTR-99-1 North rim PVC 91670.573 693760.786 203.660   FTA-99-2-G Ground North side 91671.502 693757.631 204.550   FTA-99-1-G Ground North side 91671.694 693757.094 203.731   FTP-MW1 North rim PVC 91680.266 693820.148 202.138   FTP-MW1-G Ground North side 91676.586 693752.581 201.118   FTP-MW1-G Ground North side 91663.368 693752.581 201.415	L9-MW11	North rim PVC	91314.516			
L9-MW12   North rim PVC   91313.351   690215.091   216.429   L9-MW13   North rim PVC   91312.246   690215.096   215.715   L9-MW13   North rim PVC   91312.246   690213.675   216.439   L9-MW2   North rim PVC   91390.254   690242.672   217.103   L9-MW2   North rim PVC   91390.255   690242.672   217.103   L9-MW2-G   Ground North side   91390.355   690242.672   217.103   L9-MW3   North rim PVC   91491.610   690329.245   217.843   L9-MW3-G   Ground North side   91491.724   690329.162   217.122   L9-MW4   North rim PVC   91490.136   690328.313   217.702   L9-MW4   North rim PVC   91490.136   690328.364   217.128   L9-MW5-G   Ground North side   91490.212   690328.264   217.128   L9-MW5-G   Ground North side   91247.972   690303.537   216.061   L9-MW6-G   Ground North side   91247.972   690303.537   215.342   L9-MW6-G   Ground North side   91247.972   690302.549   215.998   L9-MW6-G   Ground North side   91246.808   690302.462   215.312   L9-MW7-O   North rim PVC   91177.313   690179.902   213.012   L9-MW7-G   Ground North side   91177.393   690179.928   212.278   L9-MW8-G   Ground North side   91176.748   690181.393   212.249   L9-MW8-G   Ground North side   91176.748   690181.393   212.249   L9-MW9-G   Ground North side   91371.509   690049.970   215.881   FIRE TRAINING PIT  FTA-99-1   North rim PVC   91670.573   693760.786   203.660   FTA-99-2-G   Ground North side   91670.574   693760.786   203.660   FTA-99-1-G   Ground North side   91670.574   693760.786   203.660   FTA-99-1-G   Ground North side   91671.502   693757.631   204.550   FTA-99-1-G   Ground North side   91671.502   693757.034   203.731   FTP-MW1   North rim PVC   91626.058   693752.481   201.118   FTP-MW1-G   Ground North side   91626.158   693752.501   200.434   FTP-MW2-G   Ground North side   91626.158   693752.501   200.434   FTP-MW2-G   Ground North side   91626.158   693820.148   202.138   FTP-MW2-G   Ground North side   91663.368   693820.255   201.415	L9-MW11-G	Ground North side				
L9-MW12-G Ground North side 91313.476 690215.096 215.715   L9-MW13 North rim PVC 91312.246 690213.575 216.439   L9-MW2 North rim PVC 91390.254 690242.672 217.103   L9-MW2-G Ground North side 91390.355 690242.657 216.449   L9-MW3 North rim PVC 91491.610 690329.245 217.843   L9-MW3 North rim PVC 91491.610 690329.245 217.843   L9-MW4 North rim PVC 91490.136 690329.162 217.702   L9-MW4 North rim PVC 91490.136 690328.313 217.702   L9-MW4 North rim PVC 91490.136 690328.264 217.128   L9-MW5 North rim PVC 91247.836 690303.537 216.061   L9-MW5 North rim PVC 91247.836 690303.523 215.342   L9-MW6-G Ground North side 91247.972 690303.523 215.342   L9-MW6-G Ground North side 91246.674 690302.549 215.998   L9-MW7 North rim PVC 91177.313 690179.902 213.012   L9-MW7 North rim PVC 91177.313 690179.902 213.012   L9-MW7 North rim PVC 91176.642 690181.393 212.278   L9-MW8-G Ground North side 91177.393 690179.902 213.012   L9-MW8-G Ground North side 91177.393 690179.902 213.012   L9-MW7-G Ground North side 91177.393 690179.902 213.012   L9-MW7-G Ground North side 91177.393 690179.902 213.012   L9-MW7-G Ground North side 91177.393 690179.902 213.012   L9-MW7-G Ground North side 91177.393 690179.902 213.012   L9-MW8-G Ground North side 91176.642 690181.393 212.278   L9-MW9-G Ground North side 91176.748 690181.393 212.249   L9-MW9-G Ground North side 91176.748 690181.393 212.249   L9-MW9-G Ground North side 91670.741 693760.786 203.660   FTA-99-1 North rim PVC 91670.573 693760.787 204.577   FTA-99-1-G Ground North side 91670.741 693760.786 203.660   FTA-99-2-G Ground North side 91670.741 693760.786 203.660   FTA-99-2-G Ground North side 91670.573 693757.601 200.4350   FTP-MW1 North rim PVC 91663.86 693752.481 201.118   FTP-MW1-G Ground North side 91626.658 693752.481 201.118   FTP-MW1-G Ground North side 91663.368 693820.255 201.415	L9-MW12	North rim PVC				
L9-MW13	L9-MW12-G	Ground North side				
L9-MW13-G         Ground North side         91312.365         690213.610         215.686           L9-MW2-G         North rim PVC         91390.254         690242.672         217.103           L9-MW3-G         Ground North side         91390.355         690242.657         216.449           L9-MW3-G         Ground North side         91491.610         690329.245         217.843           L9-MW3-G         Ground North side         91491.724         690329.162         217.122           L9-MW4-G         Ground North side         91490.212         690328.313         217.702           L9-MW5-G         Ground North side         91247.836         690303.537         216.061           L9-MW5-G         Ground North side         91247.836         690303.532         215.342           L9-MW6-North side         91246.674         690302.549         215.998           L9-MW6-G         Ground North side         91246.674         690302.462         215.312           L9-MW7-G         Ground North side         91177.313         690179.902         213.012           L9-MW8-G         Ground North side         91176.642         690181.418         212.278           L9-MW9-G         Ground North side         91371.509         690049.930         216.520	L9-MW13	North rim PVC				
L9-MW2- Ground North side 91491.724 690329.245 217.103 91491.810 690329.245 217.122 17.103 19.40W3-G Ground North side 91491.724 690329.162 217.122 19.40W3-G Ground North side 91490.136 690329.162 217.122 19.40W3-G Ground North side 91490.136 690328.264 217.122 19.40W3-G Ground North side 91490.212 690328.264 217.128 19.40W3-G Ground North side 91490.212 690328.264 217.128 19.40W3-G Ground North side 91247.836 690303.537 216.061 19.40W3-G Ground North side 91247.872 690303.523 215.342 19.40W3-G Ground North side 91246.674 690302.549 215.998 19.40W3-G Ground North side 91246.808 690302.549 215.998 19.40W3-G Ground North side 91246.808 690302.462 215.312 19.40W3-G Ground North side 91177.313 690179.902 213.012 19.40W3-G Ground North side 91177.393 690179.928 212.278 19.40W3-G Ground North side 91176.642 690181.318 212.921 19.40W3-G Ground North side 91176.748 690181.393 212.249 19.40W3-G Ground North side 91176.748 690181.393 212.249 19.40W3-G Ground North side 91176.748 690181.393 212.249 19.40W3-G Ground North side 91176.748 690049.930 216.520 19.40W3-G Ground North side 91670.573 693760.787 204.577 FTA-99-1 North rim PVC 91671.502 693757.631 204.550 FTA-99-2-G Ground North side 91670.573 693760.787 203.731 FTP-MW1 North rim PVC 91626.058 693752.481 201.118 FTP-MW1 North rim PVC 91626.058 693752.481 201.118 FTP-MW1 North rim PVC 91626.058 693752.501 200.434 FTP-MW2-G Ground North side 9163.368 693820.255 201.415	L9-MW13-G	Ground North side	91312.365			
L9-MW2-G         Ground North side         91390.355         690242.657         216.449           L9-MW3         North rim PVC         91491.610         690329.245         217.843           L9-MW3-G         Ground North side         91491.724         690329.162         217.122           L9-MW4         North rim PVC         91490.136         690328.313         217.702           L9-MW5-G         Ground North side         91490.212         690328.264         217.128           L9-MW5-D         North rim PVC         91247.836         690303.537         216.061           L9-MW5-D         Ground North side         91247.872         690303.523         215.342           L9-MW6-D         Oround North side         91246.674         690302.549         215.998           L9-MW6-D         Ground North side         91246.808         690302.462         215.312           L9-MW7-D         North rim PVC         91177.313         690179.902         213.012           L9-MW7-D         Ground North side         91176.642         690181.418         212.278           L9-MW8-D         Ground North side         91176.748         690181.393         212.249           L9-MW9-D         North rim PVC         91670.573         693760.787         204.577 <td>L9-MW2</td> <td>North rim PVC</td> <td></td> <td></td> <td></td> <td></td>	L9-MW2	North rim PVC				
L9-MW3         North rim PVC         91491.610         690329.245         217.843           L9-MW4-G         Ground North side         91491.724         690329.162         217.122           L9-MW4-G         North rim PVC         91490.136         690328.313         217.702           L9-MW4-G         Ground North side         91490.212         690328.264         217.128           L9-MW5         North rim PVC         91247.836         690303.537         216.061           L9-MW5-G         Ground North side         91247.972         690303.523         215.342           L9-MW6-G         Ground North side         91246.674         690302.549         215.998           L9-MW6-G         Ground North side         91246.808         690302.462         215.312           L9-MW7         North rim PVC         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8-D         North rim PVC         91176.642         690181.393         212.249           L9-MW9         North rim PVC         91371.394         69049.930         216.520           L9-MW9-G         Ground North side         91670.573         693760.787         204.577 <td>L9-MW2-G</td> <td>Ground North side</td> <td>91390.355</td> <td></td> <td></td> <td></td>	L9-MW2-G	Ground North side	91390.355			
L9-MW3-G         Ground North side         91491.724         690329.162         217.122           L9-MW4         North rim PVC         91490.136         690328.313         217.702           L9-MW4-G         Ground North side         91490.212         690328.264         217.128           L9-MW5         North rim PVC         91247.836         690303.537         216.061           L9-MW5-G         Ground North side         91247.972         690303.523         215.342           L9-MW6         North rim PVC         91246.674         690302.549         215.998           L9-MW6-G         Ground North side         91246.808         690302.462         215.312           L9-MW7-G         Ground North side         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8         North rim PVC         91176.642         690181.418         212.921           L9-MW9-G         Ground North side         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         69049.970         215.881           FIRE TRAINING PIT           FTA-99-1-G         North rim PVC	L9-MW3	North rim PVC	91491.610	·	217.843	
L9-MW4-G         Ground North side         91490.136         690328.313         217.702           L9-MW5-G         Ground North side         91490.212         690328.264         217.128           L9-MW5-G         North rim PVC         91247.836         690303.537         216.061           L9-MW5-G         Ground North side         91247.972         690303.523         215.342           L9-MW6-G         Ground North side         91246.808         690302.462         215.998           L9-MW7-G         Ground North side         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8-G         Ground North side         91176.642         690181.418         212.291           L9-MW8-G         Ground North side         91176.748         690181.418         212.249           L9-MW9         North rim PVC         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FTA-99-1 North rim PVC         91670.573         693760.787         204.577           FTA-99-2 North rim PVC         91671.502         693757.631         204.550	L9-MW3-G	Ground North side	91491.724			
L9-MW4-G         Ground North side         91490.212         690328.264         217.128           L9-MW5         North rim PVC         91247.836         690303.537         216.061           L9-MW5-G         Ground North side         91247.972         690303.523         215.342           L9-MW6         North rim PVC         91246.674         690302.462         215.998           L9-MW6-G         Ground North side         91246.808         690302.462         215.312           L9-MW7-G         Ground North side         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8         North rim PVC         91176.642         690181.393         212.249           L9-MW8-G         Ground North side         91176.748         690181.393         212.249           L9-MW9-G         Ground North side         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FTA-99-1	L9-MW4	North rim PVC	91490.136	690328.313	217.702	
L9-MW5         North rim PVC         91247.836         690303.537         216.061           L9-MW6-G         Ground North side         91247.972         690303.523         215.342           L9-MW6         North rim PVC         91246.674         690302.549         215.998           L9-MW6-G         Ground North side         91246.808         690302.462         215.312           L9-MW7         North rim PVC         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.313         690179.928         212.278           L9-MW8         North rim PVC         91176.642         690181.418         212.921           L9-MW9-G         Ground North side         91176.748         690181.393         212.249           L9-MW9-G         Ground North side         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         69049.970         215.881           FTR-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-2         North rim PVC         91671.634         693750.786         203.660           FTA-99-2-G         Ground North side         91671.634         693752.481	L9-MW4-G	Ground North side	91490.212	690328.264		
L9-MW5-G         Ground North side         91247.972         690303.523         215.342           L9-MW6         North rim PVC         91246.674         690302.549         215.998           L9-MW6-G         Ground North side         91246.808         690302.462         215.312           L9-MW7         North rim PVC         91177.313         690179.902         213.012           L9-MW8         Ground North side         91177.393         690179.928         212.278           L9-MW8-G         Ground North side         91176.642         690181.418         212.921           L9-MW9-G         Ground North side         91176.748         690181.393         212.249           L9-MW9-G         Ground North side         91371.509         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1-G	L9-MW5	North rim PVC	91247.836	690303.537		
L9-MW6-G         Ground North side         91246.808         690302.462         215.312           L9-MW7         North rim PVC         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8         North rim PVC         91176.642         690181.418         212.921           L9-MW8-G         Ground North side         91176.748         690181.393         212.249           L9-MW9-G         Ground North side         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT         FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2-D         North rim PVC         91671.502         693757.631         204.550           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2-G         Ground North side	L9-MW5-G	Ground North side	91247.972	690303.523	215.342	
L9-MW7         North rim PVC         91177.313         690179.902         213.012           L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8         North rim PVC         91176.642         690181.418         212.921           L9-MW8-G         Ground North side         91176.748         690181.393         212.249           L9-MW9         North rim PVC         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91663.269         693820.148         202.138           FTP-MW-2-G	L9-MW6	North rim PVC	91246.674	690302.549	215.998	
L9-MW7-G         Ground North side         91177.393         690179.928         212.278           L9-MW8         North rim PVC         91176.642         690181.418         212.921           L9-MW8-G         Ground North side         91176.748         690181.393         212.249           L9-MW9         North rim PVC         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415	L9-MW6-G	Ground North side	91246.808	690302.462	215.312	
L9-MW8         North rim PVC         91176.642         690181.418         212.921           L9-MW8-G         Ground North side         91176.748         690181.393         212.249           L9-MW9         North rim PVC         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415	L9-MW7	North rim PVC	91177.313	690179.902	213.012	
L9-MW8-G         Ground North side         91176.748         690181.393         212.249           L9-MW9         North rim PVC         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415	L9-MW7-G	Ground North side	91177.393	690179.928	212.278	
L9-MW9         North rim PVC         91371.394         690049.930         216.520           L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415	L9-MW8	North rim PVC	91176.642	690181.418	212.921	
L9-MW9-G         Ground North side         91371.509         690049.970         215.881           FIRE TRAINING PIT           FTA-99-1         North rim PVC         91670.573         693760.787         204.577           FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW2-G         Ground North side         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415	L9-MW8-G		91176.748	690181.393	212.249	
FIRE TRAINING PIT  FTA-99-1 North rim PVC 91670.573 693760.787 204.577  FTA-99-1-G Ground North side 91670.741 693760.786 203.660  FTA-99-2 North rim PVC 91671.502 693757.631 204.550  FTA-99-2-G Ground North side 91671.634 693757.704 203.731  FTP-MW1 North rim PVC 91626.058 693752.481 201.118  FTP-MW1-G Ground North side 91626.158 693752.501 200.434  FTP-MW2 North rim PVC 91663.269 693820.148 202.138  FTP-MW-2-G Ground North side 91663.368 693820.255 201.415	L9-MW9	North rim PVC	91371.394	690049.930	216.520	
FTA-99-1 North rim PVC 91670.573 693760.787 204.577  FTA-99-1-G Ground North side 91670.741 693760.786 203.660  FTA-99-2 North rim PVC 91671.502 693757.631 204.550  FTA-99-2-G Ground North side 91671.634 693757.704 203.731  FTP-MW1 North rim PVC 91626.058 693752.481 201.118  FTP-MW1-G Ground North side 91626.158 693752.501 200.434  FTP-MW2 North rim PVC 91663.269 693820.148 202.138  FTP-MW-2-G Ground North side 91663.368 693820.255 201.415	L9-MW9-G	Ground North side	91371.509	690049.970	215.881	
FTA-99-1 North rim PVC 91670.573 693760.787 204.577  FTA-99-1-G Ground North side 91670.741 693760.786 203.660  FTA-99-2 North rim PVC 91671.502 693757.631 204.550  FTA-99-2-G Ground North side 91671.634 693757.704 203.731  FTP-MW1 North rim PVC 91626.058 693752.481 201.118  FTP-MW1-G Ground North side 91626.158 693752.501 200.434  FTP-MW2 North rim PVC 91663.269 693820.148 202.138  FTP-MW-2-G Ground North side 91663.368 693820.255 201.415						
FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW1-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415	FIRE TRAINING	G PIT				
FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW1-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415						
FTA-99-1-G         Ground North side         91670.741         693760.786         203.660           FTA-99-2         North rim PVC         91671.502         693757.631         204.550           FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW1-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415		North rim PVC	91670.573	693760.787	204.577	
FTA-99-2-G         Ground North side         91671.634         693757.704         203.731           FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW1-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415				693760.786		
FTP-MW1         North rim PVC         91626.058         693752.481         201.118           FTP-MW1-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415		North rim PVC	91671.502	693757.631	204.550	
FTP-MW1-G         Ground North side         91626.158         693752.501         200.434           FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415		Ground North side	91671.634	693757.704	203.731	
FTP-MW2         North rim PVC         91663.269         693820.148         202.138           FTP-MW-2-G         Ground North side         91663.368         693820.255         201.415		North rim PVC	91626.058	693752.481	201.118	·
FTP-MW-2-G Ground North side 91663.368 693820.255 201.415				693752.501	200.434	
			91663.269	693820.148	202.138	
FTP-MW3   North rim PVC   01727 022   603870 647   200 202				693820.255	201.415	
	FTP-MW3	North rim PVC	91727.922	693870.647	200.393	
FTP-MW3-G Ground North side 91728.047 693870.581 199.630				693870.581		
FTP-MW4 North rim PVC 91707.737 693663.858 208.134		North rim PVC	91707.737	693663.858	208.134	
FTP-MW4-G Ground North side 91707.856 693663.888 207.408		Ground North side	91707.856	693663.888		
FTP-MW5 North rim PVC 91776.699 693804.613 204.395		North rim PVC	91776.699	693804.613		
FTP-MW5-G Ground North side 91776.828 693804.577 203.657	FTP-MW5-G	Ground North side				
FTP-MW6 North rim PVC 91776.618 693806.230 204.352		North rim PVC	91776.618	693806.230	<del></del>	
FTP-MW6-G Ground North side 91776.731 693806.234 203.548		Ground North side	91776.731			
FTP-MW7 North rim PVC 91615.610 693599.033 206.310	FTP-MW7	North rim PVC	91615.610	693599.033		

# Iowa Army Ammunition Plant, Burlington, Iowa <u>Monitor Wells</u> NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
					Kernance
FTP-MW7-G	Ground North side	91615.677	693599.029	205.595	
FTP-MW8	North rim PVC	91615.489	693601.482	206.293	
FTP-MW8-G	Ground North side	91615.573	693601.481	205.473	
JAW-60	North rim PVC	91711.318	693660.678	208.401	
JAW-60-G	Ground North side	91711.407	693660.696	207.558	
JAW-80	North rim PVC	91650.317	693682.405	205.682	
JAW-80-G	Ground North side	91650.405	693682.418	204.892	
M-01	North rim PVC	91545.010	693702.128	204.236	
M-01-G	Ground North side	91545.063	693702.145	203.556	
SA 99-1	North rim PVC	91766.547	693663.995	209.307	SUMP
SA 99-1-G	Ground North side	91766.615	693664.006	208.859	SUMP
	O. Gard Horar Glad	01700.010	000004.000	200.009	SUMP
WEST BURN F	PAD				
G-30	North rim PVC	91781.023	693888.333	199.449	
G-30-G	Ground North side	91781.166	693888.290	198.571	No concrete pad
JAW-24	North rim PVC	91951.479	693957.584	195.891	Elevation corrected to top pvc from top cap
JAW-24-G	Ground North side	91951.509	693957.677	195.105	No concrete pad
JAW-25	North rim PVC	91878.107	693773.721	210.135	110 considio pad
JAW-25-G	Ground North side	91878.164	693773.777	209.345	
WBP-99-1	North rim PVC	91861.570	693720.575	210.555	
WBP-99-1-G	Ground North side	91861.680	693720.629	209.771	
WBP-99-2	North rim PVC	91942.538	693713.671	206.852	
WBP-99-2-G	Ground North side	91942.599	693713.654	206.051	
WBP-99-3	North rim PVC	91853.886	693979.111	198.768	
WBP-99-3-G	Ground North side	91853.991	693979.058	197.942	
WBP-99-4	North rim PVC	91978.895	693718.224	203.723	
WBP-99-4-G	Ground North side	91978.932	693718.169	202.985	
WBP-99-5	North rim PVC	91969.450	693877.056	197.979	
WBP-99-5-G	Ground North side	91969.520	693877.081	197.195	
WBP-99-6	North rim PVC	91969.066	693807.826	199.922	
WBP-99-6-G	Ground North side	91969.201	693807.818	199.149	
WBP-99-7	North rim PVC	91844.024	693973.892	198.817	
WBP-99-7-G	Ground North side	91844.080	693973.872	198.002	
WBP-MW1	North rim PVC	91969.887	693881.095	197.879	
WBP-MW1-G	Ground North side	91970.005	693881.077	197.110	
WBP-MW2	North rim PVC	91952.535	693960.683	195.916	<del></del>
	Ground North side	91952.618	693960.748	195.136	
WBP-MW3	North rim PVC	91909.122	693813.127		
WBP-MW3-G		91909.256	693813.125	206.303 205.542	· · · · · · · · · · · · · · · · · · ·
WEI MINIO	Crodita Notal Side	91909.230	093013.123	205.542	
EAST BURN P	AD				A
			`	****	
EBP-MW1	North rim PVC	91751.946	694279.894	204.300	-
EBP-MW1-G	Ground North side	91752.060	694279.800	203.578	
EBP-MW2	North rim PVC	91937.514	694454.843	208.550	
EBP-MW2-G	Ground North side	91937.625	694454.848	207.895	
EBP-MW4	North rim PVC	92025.209	694099.592	207.199	
EBP-MW4-G	Ground North side	92025.346	694099.615	206.395	· · · · · · · · · · · · · · · · · · ·
EBP-MW5	North rim PVC	91821.554	694117.130	202.793	
EBP-MW5-G	Ground North side	91821.722	694117.102	202.092	
EBP-MW6	North rim PVC	91824.144	694116.011	202.664	
EBP-MW6-G	Ground North side	91824.264	694116.065	201.936	
EDA-3	North rim PVC	91907.219	694263.981	206.034	
	HOIGH HILL VO	31301.218	034203,301	200.034	

# Iowa Army Ammunition Plant, Burlington, Iowa Monitor Wells NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
EDA-3-G	Ground North side	91907.261	694264.074	205.366	
EDA-4	North rim PVC	92150.760	694483.042	208.668	
EDA-4-G	Ground North side	92150.875	694483.080	208.100	·
JAW-614	North rim PVC	91904.993	694260.441	205.819	
JAW-614-G	Ground North side	91905.125	694260.346	205.136	
			· v.		
				, , , , , , , , , , , , , , , , , , ,	
Total new mon	itor wells = 34			***	
Total existing n	nonitor wells = 41				

# Iowa Army Ammunition Plant, Burlington, Iowa <u>Staff Gauges</u> NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northing m	Easting m	Elevation m	Remarks
BC-SG01	6' mark on staff gauge	91416.694	691998.018	202.489	STAFF
BC-SG01-BM	Rebar in concrete	91416.370	692004.574	203.151	ВМ
BC-SG02	6' mark on staff gauge	90992.930	691940.526	200.918	STAFF
BC-SG02-BM	Rebar in concrete	90986.723	691939.157	201.493	ВМ
BC-SG03-BM	6' mark on staff gauge	90680.459	691917.324	199.678	ВМ
50.000					
BC-SG04	6' mark on staff gauge	90423.759	691860.130	199.193	STAFF
BC-SG04-BM	Rebar in concrete	90420.287	691864.115	198.183	ВМ
SC-SG01	6' mark on staff gauge	92073.497	694011.801	195.429	STAFF
SC-SG01-BM	Rebar in concrete	92073.305	694005.26	195.694	ВМ
SC-SG02	6' mark on staff gauge	92021.484	693727.338	200.660	STAFF
SC-SG03	6' mark on staff gauge	91985.199	693896.382	196.698	STAFF
SC-SG04	6' mark on staff gauge	91839.011	694011.431	193.825	STAFF
SC-SG05	6' mark on staff gauge	91717.640	693884.648	197.54	STAFF
SC-SG06	6' mark on staff gauge	91614.855	693749.892	200.511	STAFF
SC-SG07	6' mark on staff gauge	91705.592	694066.588	193.144	STAFF
SC-SG07-BM	Rebar in concrete	91700.449	694064.651	192.839	ВМ
Fotal staff gauge	no = 11				

# Iowa Army Ammunition Plant, Burlington, Iowa Soil Boring NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Northing m	Easting m	Elevation	Remarks			
WBP-SB01	91969.919	693811.284	199.268	BORE			
Fotal borings =	1						

# **DAILY QUALITY**

DAILY QUALITY		Date	10-14-0a					)a				
CONTROL	REPORT	Day	S	M	Т	W	TH	F	S			
IAAAP F.S. Data Collection		On Site Hours Travel Time Office Time		5.0								
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	To 32		Clear	Overcast		Rain	Snow			
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	•			32-50			70-85 85				
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10	Wind			erate erate	High Humid		Report No.				
Subcontractors on S	DACA45-02-D-0003, DO 16			×								
		Y			<del></del>							
	Joe Combs, John Willinson, and Bruce I											
<del></del>	ice - Jessie Kalvig and Darin DeGrusen-	æ						<del>.</del>	·			
Equipment on Site:					4							
DP Rigs, URS trucks, well-	materials, water levels, PIDs, FIDs, Free	n detector, p	eristali	tic pum	p, turbi	dity me	ters, w	ater tan	KS.			
Decon equipment, soil sam	pling equipment, water sampling equipm	ent, PPE, pa	aperwo	rk.					•			
Visitors on Site:	None		<del></del>									
<u>URS Personnel on Si</u>	te:		<u> </u>									
Corey Anderson, Ryan Car	penter, Dan <del>Hatfield, Dave Breger, and J</del>	<del>ustin Cove</del> y										
Field West Design	1 /*· - 1 .1*· · · · P			•								
	d (including sampling):											
	field Event						-					
	eu trailer	_										
		<u>o)                                    </u>										
- Talk to Millie Nelson												
- Mobile Fip, word, EBP, Line 2 for initial siteusit												
Quality Control Activities (including field calibration):												
<u>Health and Safety and</u>	d Activities: None											
						<del></del>						
3h												
Joservations/Problet	ms Encountered/Corrective Act	<u>ion Taker</u>	<u>ı:</u> /	vone		-						
								<u>-</u>				
Office Work Performe	nd: D. aan	<del></del>										
SILICE AAOLK LEHOUHE	ed: Paper work.											
	Ву	Corey And	erson		-	Γitle ]	Field N	/Ianage	r			

#### **DAILY QUALITY** 10-15-02 Date **CONTROL REPORT** w TH Dav S Т F S M 10.0 IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Snow **Bright Sun** Clear Overcast Rain **Project** Iowa Army Ammunition Plant × Project No. 16169421.00201, 16169421.00301 Temp 32-50 To 32 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Report No. Moderate High DACA45-96-D-0017, DO 65 Contract No. 2 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Ioe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. 🖒 Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freun detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Field Work Performed (including sampling): Staked locations @ FTP Relocate FTP 99-102 chater on mo State locutine EBP Quality Control Activities (including field calibration): Health and Safety and Activities: Non C Observations/Problems Encountered/Corrective Action Taken: PonC Office Work Performed: paperart

By Corey Anderson

Title Field Manager

#### **DAILY QUALITY** 10-16-02 Date **CONTROL REPORT** Day S Т W TH F S M **IAAAP F.S. Data Collection** On Site Hours 16.0 Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe Bright Sun Clear Overcast × **Project Iowa Army Ammunition Plant** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 X DACA45-02-D-0003, DO 10 3 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 X Subcontractors on Site: Saherprobe Tom Payton, Joe Combs, John Willinson, and Bruce Birgo Plains Environmental Service - Jessie Kalvig and Darin DeGruson: CO Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: Deb halling usace **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Field Work Performed (including sampling): Station locations @EBP Pickup equipment @ Central Stores mobile pick of Hydrogen for FID located chunks & WBPA Quality Control Activities (including field calibration): Calibration Check of **BIDS-FIU** Health and Safety and Activities: MAL Observations/Problems Encountered/Corrective Action Taken: (Coca For Chunks + Shiked) at holes Office Work Performed: paperone By Corey Anderson Title Field Manager

#### **DAILY QUALITY** 10-17-07 Date **CONTROL REPORT** w Day T F S M TH S On Site Hours 5.0 **IAAAP F.S. Data Collection** 6.0 Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow **Project** Iowa Army Ammunition Plant X X Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Report No. Moderate High DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 Humidity 4 Drv Moderate Humid DACA45-02-D-0003, DO 16 X Subcontractors on Site: Saherprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. -Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Field Work Performed (including sampling): Stake locations Line 3 Student location Q Line of artific fenc-1 ocated 6-15 Quality Control Activities (including field calibration): محرب Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Belocuted 6-15 Office Work Performed: page --By Corey Anderson Title Field Manager

# **DAILY QUALITY**

DAILY QUA	Date 10-20-02										
CONTROL	REPORT	Day	s X	М	Т	W	тн	F	s		
IAAAP F.S. Data Collection		On Site H Travel Tir Office Tir	me		6.0						
COE Project Manager Project	Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear X	Ove	ercast	Rain	Snow		
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302	-	To Still	32 Mod	32-50 <b>X</b> derate		-70 igh	70-85	85 up ort No.		
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10	Humidity		Mod	<b>⊁</b> derate		mid				
Subcontractors on S	DACA45-02-D-0003, DO 16		1	<u>`</u>	<u> </u>						
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.  Plains Environmental Service - Jessie Kalvig and Darin DeGruson.  Equipment on Site:  DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks  Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site:											
	ite: -penter, Dan Hatfield, Dave Breger, and Jed (including sampling):		,. <b>(</b>	(64	ay hi	3 6	These	-3	•nsite)		
Quality Control Activities (including field calibration):											
Health and Safety an	d Activities:										
Observations/Proble	ms Encountered/Corrective Act	tion Take	<u>n: פע</u>	mï							
Office Work Perform	ed: Hudmeding with co	rew.									
	Ву	Corey And	derson			Title	Field 1	Manage	er		

# **DAILY QUALITY**

DAILY QUALITY			10-21-02								
CONTROL	REPORT	Day	S	M X	Т	W TH	F	S			
IAAAP F.S. Data Colle	ection	On Site H	ours		13	0 /14.0					
		Travel Tir				-					
		Office Tin	ne								
COE Project Manager	Al Kam/Kevin Howe  Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear Overcast	Overcast	Rain	Snow			
Project Project No.	16169421.00201, 16169421.00301	Temp	То	32	32-50	50-70	70-85	85 up			
	16169503.00101, 16169556.00101	-			X		<u> </u>				
0 ( )	16169556.00201, 16169556.00302	Wind	Still		lerate K	High	Repo	rt No.			
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10	Humidity	Dry		lerate	Humid	1 (	6			
	DACA45-02-D-0003, DO 16		Í	Υ							
Subcontractors on S	lito:			<u></u> .							
	Joe Combs, John Willinson, and Bruce F	Riroe									
<u> </u>	ice - Jessie Kalvig and Darin DeGruson.	mge.									
Equipment on Site:											
DP Rigs, URS trucks, well	materials, water levels, PIDs, FIDs, Free	n detector, j	peristali	ic pum	ıp, turbi	dity meters, v	vater tan	ks			
Decon equipment, soil sam	pling equipment, water sampling equipm	ent, PPE, pa	aperwo	k.		<del></del>					
Visitors on Site: 🔥	one				-						
Field Work Performe	penter, Dan Hatfield, Dave Breger, and I d (including sampling): Soil Baring (30%) well SB (36), we'll (19	ustin Covey	, re , re	hok ك		Planes/ Sabopube	cory				
Quality Control Activ	rities (including field calibration	) <u>:</u> (al	peAn	. Che	ck c	K PFD, w	, _				
Health and Safety and Activities: likel safety / Pic-cun meeting @ Admin bld.  URS Safety meeting / Signed safety comp. Agreement											
Observations/Proble	ms Encountered/Corrective Ac	tion Take	<u>n:</u> پہ	٠٠٠							
Office Work Perform	ed: papernork.										
	Ву	Corey And	derson			Title Field	Manag	er			

#### DAILY QUALITY 10-22-02 Date CONTROL REPORT S Day S M T W TH F On Site Hours IAAAP F.S. Data Collection Travel Time J. 1984 Office Time Weather Bright Sun Clear Overcast Rain Snow COE Project Manager Al Kam/Kevin Howe Iowa Army Ammunition Plant **Project** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 × Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 7 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: NOME **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. ((over hours - 12.5 hours) Field Work Performed (including sampling): FTP OPOH -5B (27) 13. FTP DP07 - SB 7 a7 Vell 27 FTP DP 10 - 5B 18 18 سداا 20' يبود FTP PPO9-5B -58 FIDO 9TA 23 FTP OP 13 (over Calibration check of RID, WL Quality Control Activities (including field calibration): Had Smin Has meeting Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: ハウヘレ Office Work Performed: puperwork.

By Corey Anderson

Title Field Manager

EBP OP 12 - SB (26), well (26), reunde, 3P/DH

EBP OP 07 - SB (53'), well (20'/53') neutoles, SP/DH

EBP OP 09 - well (250) neutole, SP, DB

EBP OP 11 - 3B (24'a'), well (110') 22'a') neutole, SP/DB

EBP OP 13 - SB (6.0'), well (50'), neutole, SP/DB

EBP OP 15 - SB (15.0), well (14'3), neutole, SP/DB

EBPOP 16 - SB (170-7), well (14'3), neutole, SP/DB

Sampled: FTP OP 01 - 38 (voc')

EBP OP 08-36 (EXP.)

Suberproof + DB Soil Sumple EBPOP 21 to 26' bys and stopped fortheday

### **DAILY QUALITY** Date 10-23-02 CONTROL REPORT Day S M Т W TH F S On Site Hours 13 KH **IAAAP F.S. Data Collection** Travel Time Office Time Weather **Bright Sun** Clear Overcast Rain Snow COE Project Manager Al Kam/Kevin Howe X X **Iowa Army Ammunition Plant Project** 32-50 50-70 70-85 Project No. 16169421.00201, 16169421.00301 Temp To 32 85 up 16169503.00101, 16169556.00101 X Report No. 16169556.00201, 16169556.00302 Wind Still High Moderate Contract No. DACA45-96-D-0017, DO 65 8 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: Avanech utility locators. **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey Field Work Performed (including sampling): FTP DP 14 - 5B (9' screen poin sumply FTP OP 17- 9B (6 FTPDP18 - 18 ( 10' FTPDP06 - 58 ( 24 well newhole', plains / JC 24' Threel-Fulled SP@24, newhole, plains/JC **a**3 well well Calibration check of PAD Quality Control Activities (including field calibration): Health and Safety and Activities: Had Bonn Has neeting Observations/Problems Encountered/Corrective Action Taken: problems = 1 tole Squeezing during Temp wellinstall. Office Work Performed: Dude work Title Field Manager By Corey Anderson

EBP DP 22 - SB (65'), WCII (25/65'), Failed 1st well attempt (Drillweren),

new hole, subcrptobe 1DH

EBPDP 14 - SB (34'), Well (25,34'), failed 3P to 34', Brewhole, SP/DH

EBP DP 21 - SB (68') attempted well @ 68' (polled competed well)

attempted well @ 66' (hole colorpated afterpalantula)

newholes, suberprobe 1DB

- Installed Shallow well EBPDP21-26'

newhole, superprobe 1DB.

Sampled:

EBP DP 08-36 (explosives) CD

Source ( (Explosive + vocs)

EBP DP 07-53 (Explosives)

FTP DP 07-37 (vocs)

FTP DP 04-37 (vocs)

EBP 0P 07-20 (vocs) - Still needs explosives (explosives obtained to NY)

FTP DP 10-18 (vocs)

FTP 0P 09-30 (vocs+ Explosives)

DAILY QUA	LITY	Date	10-24-02								
CONTROL	REPORT	Day	S	M	T	<b>W</b> -,	тн	F	S		
IAAAP F.S. Data Collection			On Site Hours Travel Time Office Time								
Project	Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65	Weather	Bright Sun		Clear		rcast	Rain	Snow		
Project No.		-	.Still		32-50 × erate		-70 gh	70-85 Repo	85 up ort No.		
Contract No.		Humidity	Dry	Mod	erate	Humid			9		
Subcontractors on S	ito.	•			· · · ·		· ·				
Saberprobe - Tom Payton,	Joe Combs, John Willinson, and Bruce I rice - Jessie Kalvig and Darin DeGruson.	Birge.	·						<del></del>		
Equipment on Site:	100 Jobbio Italvig and Daim Doordoom										
	materials, water levels, PIDs, FIDs, Free	on detector,	peristal	tic pum	p, turbi	dity me	ters, w	ater tan	ks		
	npling equipment, water sampling equipm										
					- 						
Visitors on Site:	Brian Ryndel (Tech	Law -	(015)	1 fam	t to E	EPA)					
	-										
		<del></del>							_		
URS Personnel on S							15	<b>\</b>			
Corey Anderson, Ryan Car	rpenter, Dan Hatfield, Dave Breger, and	Justin Covey	<u>'·   (                                  </u>	ovey	אטר	s —	101.0	$\rightarrow$			
Field Work Dorforms	ed (including sampling):										
	<u> </u>			l. N. s	1 ~						
FTP PP 11 -	5 B (20) Scroon point	, hourd (20').				. 1	TC				
	SB (30), well (30')	a contract	معدم	Kuns	771	4) /_×	<i>,</i>				
	5 B (23) , well (33)	, news	. , , ,	Plain	<del>/ )                                   </del>	7			_		
WOP DP 08 -	S B (UI') - manifelle	-Jun - Po		76	CA.	well (4	u. (ii	A. Alone	151		
WAP DE03 -	5B (391), well (38)	new hole	5(	2/1	<b>&gt;6</b>				7-		
wel Deou -	3B (0-12' +Stoped) - NO	wer yet	- 3		DB	((	<b>&gt;</b> V (5	<u> </u>			
<b>Quality Control Activ</b>	ities (including field calibration	1): (a			Check	L of	PJD 1	- FIC	>		
						,					
		<del></del>									
						· ·					
Health and Safety an	d Activities: Had Smin	HARM	etine	)—							
deep wells. T	ms Encountered/Corrective Ache Subcontractors Graderal  Filter puck around the ed: paper were	314	<u>n:</u>	C M	1 S	e Hing Sho	) Ji Ji d	nicne	laic•		
	Ву	Corey An	derson			Title	Field !	Manag	er		

Report No.

9

EBP DP 02-5B (60'), ~ wellyof - 5P/DH
EBP DP 03-5B (55'), ~ wellyof. - 5P/DH

## Sumped:

EBP DP 07-20 (Explosives)

EBP DP 14-25 (Explosives + duplicate (EBPDP 1400 Time 1400)

FTP DP 11-20 (Explosives + VOC3)

EBPPP 22-65 (Explosives)

EBPOP 14-34 (Explosives)

DAILY QUA	Date		10 - 25 02						
CONTROL	REPORT	Day	S	М	Т	w	тн	F	S
IAAAP F.S. Data Coll	ection	On Site H Travel Ti Office Ti	me		L?	a S			,
COE Project Manager Project Project No.	Al Kam/Kevin Howe Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Weather Temp		azy 32	Clear 32-50	Overca <b>2</b> 50-70	0	Rain  70-85	Snow 85 up
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Wind Humidity	Still Dry	\	lerate / lerate	High		•	O No
URS Personnel on S Corey Anderson, Ryan Car  Field Work Performe  PBP DP 10 - 2  PBP DP 14 - 4  PBP DP 13 - 2  PBP DP 13 - 5  PBP DP 11 - 50  PBP PP 09 - 5	ite:  repenter, Dan Hatfield, Dave Breger, and ded (including sampling):  SB (28'), well (28')  SB (14'), well (4')  SB (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  3 (18'), well (18'), rell  4 (18'), rell (18'), rell  5 (18'), well (18'), rell  6 (18'), rell (18'), rell  7 (18'), rell (18'), rell  8 (18'), well (18'), rell  9 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  19 (18'), rell (18'), rell  20 (18'), rell (18'), rell  3 (18'), rell (18'), rell  4 (18'), rell (18'), rell  5 (18'), rell (18'), rell  6 (18'), rell (18'), rell  6 (18'), rell (18'), rell  7 (18'), rell (18'), rell  8 (18'), rell (18'), rell  9 (18'), rell (18'), rell (18'), rell  9 (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rell (18'), rel	Justin Covey  , η e ν hole , η e ν hole  ν hole ν	pky pky pky pky pky pky ky ky  1	caen	η <u>ς</u> Τ <u>ς</u> Σ	s - H	ver)	3' bg	\$ - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 -
WEP-DP 13,	ms Encountered/Corrective Ac word DPD and word DPD	tion Take	n: [	1 00	lers d lers d	wm '	<del>54 ო</del> გ <b>S</b> .	plins Stul	nut se
	Ву	Corey And	lerson		-	<b>Title</b> Fi	ield M	1anage	er

 $\label{eq:constraints} \mathcal{L}(x) = \frac{1}{2} \mathcal{L}(x) + \frac{1}{2} \mathcal{L}($ 

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grand grand in Special

\$ WBP -DP06 - SB (161), well (161), newbole, pains /JC -odome & 5' and 10' WBP-PPO4-3B (251), well (251, new hole, SP/OB (drilled 0-12 on 10-24) wop-ppo1 - SB (10), well (10), newhole, SP/DB wBP-PDOA-SB (8), well (8), newhole, SP/DB WBP 0105-5B(6'), -al (9') newson, SP/DB EBP DPOI - SB (60'), well (18'), neurole, SP/DH, waiting on muterials for Despural. EBP DP05 - SB (So'), well (25'), newbole, SP/DH, mailing innuter of the Docputal.

## Samples '.

FTP DP12-23 UOC (Still needs Eyp.) voc (still needs Exp.) FTP OP 17-06 FTP PP 21-30 ٧٥٥ FTP DP 09-23 UGC FTP PP 19-14 UOC Land Control of the Control of the Control of the FTPBP 18 - 10 voc + Explains (only 1 Amber) WBP DP 03-38 USC + Explained FTP DP 05 -23 voc ( Duplicate FTP DP 05-00 Time 1500) only 1004 for dupo well confected. FFP OP O 

Locuted

All OP's Forside Line 2

#### DAILY QUALITY 10-26-02 Date CONTROL REPORT Day S M Т W TH F S 11.5/12.5 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Rain Snow **Project** Iowa Army Ammunition Plant X x 16169421.00201, 16169421.00301 Temp Project No. To 32 32-50 70-85 85 up 50-70 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High X DACA45-96-D-0017, DO 65 Contract No. 11 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 × Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson Ryan Carpenter Dan Hatfield, Dave Breger, and Justin Covey. In Not on site today Field Work Performed (including sampling): L2-D113-3B(56) , wells SB (Sb'), wells La - 0108 EBP-DP05-Screen point (46' EBP - DPOYwell 45 EBP -0903 -Well WBP-DP07 - SB (251) I well newhole, SP DB Ger) Quality Control Activities (including field calibration): Calibration Cruck of PIDOFFID FID is not fuctioning properly recharged u/ hydrogen + cleaned + driedout. 14 ad 5 min H& Sneeph Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Stuker loughus @ Line9 utilities in the over - utility located is needed for several points - muse 12 PPOG allothers @ 12+3 one OK. - Located whiles (w/ Aut (A)) Office Work Performed: paper nont

By Corey Anderson

Title Field Manager

EBP-DP17 - 5B (33), well (35), newbole, SP/DB La - DP05 - SB (57') only.

Samples: EBP-DP05-46' (EXPASSIOS + VOL)

## **DAILY QUALITY** 10-27-02 Date **CONTROL REPORT** w Day M Т TH F S 10/105 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Clear Overcast Rain Snow Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp Project No. To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 12 DACA45-02-D-0003, DO 10 Humidity Drv Moderate Humid X DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: Name **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (عوره المحالية) = 10.0 Hours 4.0 Field Work Performed (including sampling): 5B (56'), wells (20/56'), names, phins/JC 5B (56'), new (28/52'), newholes, plains /J( L2 DP 09 -EBP DPO1 - well (45) t5B La DP 05 for well (54') 12 DP 21-5B ( 640 for sumpley collected Quality Control Activities (including field calibration): Calibratum char of PID FID was exeased our and period off - it is now working property, callibrated FID w/ 100 ppm methane Health and Safety and Activities: Had Smin HAS meeting Observations/Problems Encountered/Corrective Action Taken: hoge Office Work Performed: paperwrk Title Field Manager By Corey Anderson

Samples:

12 DP 16 - 42 (explosues)

FTP DP 02 - 25 (vocs) FTP DP 06 - 24 (wcs)

Partial samples Olected Q:

FTP DP 12 - 23

FTP P.P 17 - 6

EBP DP08-18

EBPAPAR-25

## **DAILY QUALITY** 10-28-02 Date CONTROL REPORT Day M Т TH F S 12.5 On Site Hours 12.01 **IAAAP F.S. Data Collection** Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Overcast × Iowa Army Ammunition Plant **Project** 70-85 16169421.00201, 16169421.00301 Temp 32-50 50-70 Project No. To 32 85 up 16169503.00101, 16169556.00101 × 16169556.00201, 16169556.00302 Wind Report No. Moderate High X DACA45-96-D-0017, DO 65 Contract No. Humidity 13 DACA45-02-D-0003, DO 10 Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brandon Miner (Coverhous = 12.0) Field Work Performed (including sampling): 43 PPO1 - SB (48 L3 DP03 - 56 (52) L3 PPO 6-5B Plains 2 DP 02 - 5B (35' + SCRON PAINT P DP07-5B 0-5 Health and Safety and Activities: Smin H+Sncetinh disussed with Dave Beyerang Saberpabe crew - potential Observations/Problems Encountered/Corrective Action Taken: - helen Point Zonc ( pomble ) \$707 At Line 9 = 29000 @ 30 bys. Montard OBZ and upgade to matified level 10 OBZ = 0.0 ppm for the remainder of the day. Still have 4 ppm ee 61' bys. Office Work Performed: puper work. Title Field Manager By Corey Anderson

Samples:

FTP DP 12-23 (Explosives) 1-Lite Amber (parties collected 10-27) EBP DP. 22-25 (Explosives) 1-Liter Ambor (portrui calecter on 10-27) L2 DP. 02 -33 (Explosues) L2 DP 05-25 (Explosive) Dup = L2DS 05-25 (one lite enon) FTP DP 17 - 06 (Explosizs) 1-Litu Amber (pertial collected on 10-25) EBP DP 17 - 35 (Explos 1105) WBP PP04-25 (VO(5) walting on Exp. EBP 0P 62 - 45 (vai) maining in Exp. EBPPP03 - 45 (vocs) -atms on EXP. UBPOPO8 - 41 (Explusives + VOCS)

EBP 0 PO8-18 E 600003-45 MAG D6011-32

## **DAILY QUALITY** Date 10-29-02 CONTROL REPORT Dav S M w TH F S IAAAP F.S. Data Collection On Site Hours 12.0/120 Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow X × Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp 32-50 50-70 Project No. To 32 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High DACA45-96-D-0017, DO 65 Contract No. 14 DACA45-02-D-0003, DO 10 **Humidity** Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: ルぬし **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Breaks Misco Justin Cover his: 125 Field Work Performed (including sampling): 43 DPO6 - ucili (52' Plains 130P05 - 5B **30 1/ 60**1 13 PP 10 - 3B 13 DP 02 - SB 60 '45 L3 PP 64 - 50 101 SB 59-80 COMACKER HA @ EAP DPCG-OR Quality Control Activities (including field calibration): Calibratus checker PIPS und FID **Health and Safety and Activities:** How Smin H+Smeeting Observations/Problems Encountered/Corrective Action Taken: Still hours, problem -1 Suberpaloc (John Milkery) of Selhin walls @ Office Work Performed: paper with Title Field Manager By Corey Anderson

Samples collected:

WBP DP 10-28 (Explosive + vocs) (1 Amber)
L2 DP 05-54 (Explosives)

L2 DP 05-54 (Explosives)

(partial collected on 10-28) (voc scalacted on 10

EDP OP 03 - 45 (Explosives) (partial collected on 10-28) (vac scalacted on 10-28)
(Only 1 Ambox)

WBPDP04-25 (Explosives) (partial collected on 10-28) (vacs collected on 10-28)
(only 1 Amber)

Portial Sumples

EBPOPO8-18

EBPOPO8-18

### **DAILY QUALITY** Date 10-30-02 CONTROL REPORT TH S W F Day S M On Site Hours 8/9 **IAAAP F.S. Data Collection** Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Clear Overcast Rain Snow X **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 Temp 50-70 70-85 85 up Project No. To 32 32-50 X 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 15 DACA45-02-D-0003, DO 10 Humidity Moderate Humid Drv DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: none **URS Personnel on Site:** Corey Anderson, Ryan Carpente, Dan Hatfield, Dave Breger, and Justin Covey & (Ishn (over hours = 7.5) Field Work Performed (including sampling): L3 DP10 well (58') inownik plans L9 DP 05 -(73'), newhole L3 D108-SB ( 55' L9 DP07-36 SP La DP21-40, L2 DP08-24, Samples Collected - VOC'S only L9 DP 07-102 Sumples collected @ Quality Control Activities (including field calibration): 44 Smeeting **Health and Safety and Activities:** <u>Smin</u> Observations/Problems Encountered/Corrective Action Taken: Allemotol set well @ Laropo7-50 - casing pulled and filter pack entack casing larot - well abandoned Office Work Performed: paperwork. Title Field Manager By Corey Anderson

#### DAILY QUALITY 11-4-02 Date **CONTROL REPORT** Day Т W TH F S S 7.5/8.0 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Clear Overcast Rain Snow **Project** Iowa Army Ammunition Plant X Project No. 16169421.00201, 16169421.00301 Temp 32-50 To 32 50-70 70-85 85 up X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 16 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson- Blake (Duch **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: utility checrance **URS Personnel on Site:** Joshnary hours. 8.0 hs Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brandon Minor Field Work Performed (including sampling): L9 PP 05 - (SB-72' 13 DP09-43 DP08replacement such. L9 PPO7 screen pant EBPPPO1-45 (Exp+102) -18 (vocenty) Collected: WBPDPOS-9 (UDC) only Quality Control Activities (including field calibration): Calibrated PID FID Freen Delecton Health and Safety and Activities: S min Has meeting GOLVE H+S breakhed Blake Caxh-RES. Observations/Problems Encountered/Corrective Action Taken: We are do limit Office Work Performed: papervark. By Corey Anderson Title Field Manager

## **DAILY QUALITY** 11-5-02 Date **CONTROL REPORT** Day M T TH S On Site Hours 13.0 **IAAAP F.S. Data Collection** Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Rain **Project** Iowa Army Ammunition Plant X 16169421.00201, 16169421.00301 Temp Project No. To 32 32-50 85 up 50-70 70-85 X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Moderate High DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 Humidity 17 Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Rlate Couch Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: **URS Personnel on Site:** ( Justin Cover hours Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brandon Minor. Field Work Performed (including sampling): L9 DP05 0-24 Screenparl 43 DP 00 3 DP0 (Gre-) Quality Control Activities (including field calibration): Calibration check of rendfrice not working properly. The Response frictor may have reset, which will give higher readings on the FID. Re Calibrated Had 5 min H+S meeting Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Located Piczoneka (P?-10)

PTT FID 1's reading not varing proberty. The Response Friction may have been reset, which will give higher readings. We have noticed higher readings on the FID. Re Calibrated.

Health and Safety and Activities: Had 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: Located Pictoncler (P?-10 @ Lini, 9, the health space was 8100ppm, patential Sumple point of Relater point tone

O 190904 > 5 ppm -> monitored OB2, up graded to broadified (evel D.)

Office Work Performed: paper work

By Corey Anderson Title Field Manager

Page 1 of 2

## Samples colected and sent to cab

L2DPO6-25 (expl.)

L2DPO6-25 (exp.)

L2DP13-20 (exp.)

L2DP13-36 (exp.)

L2DP16-20 (exp.)

L2DP16-20 (exp.)

L9DP05-53 (vol.)

L9DP05-53 (vol.)

L9DP05-53 (vol.)

EBPDP01-18 (exp.)

EBPDP01-18 (exp.)

EBPDP04-45 (exp.)

EBPDP04-45 (exp.)

EBPDP04-35 (vol.)

EPPDP04-13 (vol.)

## Samples Collector

L9 DP16 - 25 ( 56 VO( 5)

L9 DP10 - 55 ( vol.)

L9 DP10 - 65 ( vol.)

L9 DP 04 - 53 ( vol.)

L9 DP 04 - 69 ( vol.)

## Pollected Field Blanks

Duplicate 1 = DI water only

Duplicate 2 = DI motor collected with a localite

Project No. 10wa Army Ammunition Plant 16169421.00201, 16169421.00301 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169505.00101 Temp 16169506.00201, 16169506.00302 Wind DACA45-96-D-0017, DO 65 DACA45-96-D-0017, DO 65 DACA45-96-D-0017, DO 65 DACA45-96-D-0017, DO 65 DACA45-96-D-0003, DO 16 Temp 16169506.00201, 16169506.00302 Wind DACA45-96-D-0003, DO 16 Temp 16169506.0030 Temp 17 Moderate High Proposed Temp 17 Moderate High Proposed Temp 18 Moderate	DAILY QUA	Date		ı	-૦ <b>ન</b>	0-3						
COE Project Manager  Al Kam/Kevin Howe  Project  Iowa Army Ammunition Plant  Project No. 16169421,00201, 16169421,00301 Temp 16169556,00301, 16169556,00302 Wind DACA45-02-D-0003, DO 10 DACA45-02-D-0	CONTROL	REPORT	Day	S	M	Т		TH	F	S		
Project No. 16169421.00201, 16169421.00301 Temp 16169503.00101, 16169505.00101 16169505.00101 16169505.00101 16169505.00101 16169505.00101 16169505.00101 16169505.00101 16169505.00101 16169505.00102 Wind DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16 Humidity Dry Moderate Humid 18 Subcontractors on Site:  Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.  Plains Environmental Service - Jessie Kalvig and Derin DeGrason. Plants Environmental Service - Jessie Kalvig and Derin DeGrason. Plants  Decon equipment on Site:  DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Fron detector, peristaltic pump, turbidity meters, water tanks  Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site: Nonc  URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Thous = 12.0)  Pranche Minor  Field Work Performed (including sampling):  L9 DP 00 - 50 (24-63'), secret pant (67), wells (50'), PES DB  L9 DP 14 - 5B (0-16') only, PES DB  L9 DP 18 - 5B (0-10') only, SP DB  L9 DP 18 - 5B (0-10') only SP DB  L9 DP 18 - 5B (0-10') only SP DB  L9 DP 18 - 5B	IAAAP F.S. Data Coll	ection	Travel Ti	.0) 11								
Tontract No.  Toles 16169503.00101, 16169556.00101  Toles 16169556.00201, 16169556.00302 Wind  DACA45-96-D-0017, DO 65  DACA45-96-D-0017, DO 65  DACA45-96-D-0013, DO 10  DACA45-02-D-0003, DO 16  Tory Moderate Humid 18  Subcontractors on Site:  Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.  Plains Environmental Service - Jessie Kalvig and Derim DeGrason. Plants Environmental Service - Jessie Kalvig and Derim DeGrason. Plants  Decon equipment on Site:  Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Wisitors on Site: None  URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Toles - Ta.o)  Promulum Minor  Field Work Performed (including sampling):  L. 9 DP 00 - SD (24 - 63') Science Part (67), wells (52'), PES / DB  L. 3 DP 01 - SB (43-54') Science Part (67), wells (52'), PES / DB  L. 3 DP 01 - SB (43-54') Science Part (67), SP / DH  (612 OF 18 - SB (0-18') only SP / DH  (613 OF 18 - SB (0-18') only SP / DH  (614 OF SD (24') only SP / DH  (615 OF SD (24') only SP / DH  (616 OF SD (24') only SP / DH  (617 OF 10-18') only SP / DH  (618 OF SD (24') only SP / DH  (619 OF SD (24') only SP /	•	··· · · · · · · · · · · · · · · · · ·	Weather	Brigh	ıt Sun	Clear					Rain	Snow
DACA45-96-D-0017, DO 65   DACA45-92-D-0003, DO 16   DACA45-02-D-0003	Project No.	16169421.00201, 16169421.00301	-	То	32		50	-70		85 up		
Subcontractors on Site:  Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.  Plains Environmental Service - Jessie Kalvig and Darin DeGrasoff.  Plains Environmental Service - Jessie Kalvig and Darin DeGrasoff.  Plains Environmental Service - Jessie Kalvig and Darin DeGrasoff.  Plains Environmental Service - Jessie Kalvig and Darin DeGrasoff.  Plains Environmental Service - Jessie Kalvig and Darin DeGrasoff.  Plains Environmental Service - Jessie Kalvig and Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin DeGrasoff.  Plains Environmental Service - Joseph Gaussian Darin Da	Contract No.	DACA45-96-D-0017, DO 65			`	×						
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.  Plains Environmental Service - Jessie Kalvig and Darin DeGrusoff.  Equipment on Site:  DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site:  Over Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.  (To hours > 12.0)  Brownbon Minor  Field Work Performed (including sampling):  L. 9. DP 0.4 - 50 (2.4 - 6.3') screen pant (6.7), wells (5.2'), PES / DB.  L. 9. DP 1.4 - 50 (0 - 16') galy, PES / DB.  L. 9. DP 0.7 - 5. B. (4.3 - 5.4') vells (18'/55'), S. P. / JC.  L. 9. DP 0.8 - 50 (0 - 2.1') only, S. P. JC.  L. 9. DP 0.9 - 50 (0 - 6.5') only, S. P. JL.  De 1.9 - 50 (0 - 6.5') only, S. P. JL.  Garage Grossophy.  Quality Control Activities (Including field calibration): (Allopsha Oncok of PID),  FT. D. 11 only Short Flanc. (willed FTE. They will sead of a new FID owenth.  Health and Safety and Activities: 14 Jul Smin 14-5 meeting, Depoted to Monthfield Control Problems Encountered/Corrective Action Taken: Sample Coac Manhael 2 wells.  Deservations/Problems Encountered/Corrective Action Taken: Sample Coac Manhael 2 wells.  Also Grandersto.							2.31110					
Plains Environmental Service - Jessie Kalvig and Darin Dechason. Plant (OWN  Equipment on Site:  DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site: None  URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (3 ( hours > 12.0)  Branchen Minor  Field Work Performed (including sampling):  L9 DP 06 - 5D (24 - 63'), screen pant (67), wells (53'), PES / DB.  L9 DP 14 - 5B (0 - (6') only, PES / DB.  L9 DP 18 - 5B (0 - 3'), vells (18'/55'), SP / 3 ( L9 DP 18 - 5B (0 - 3') only, SP / 3 ( L9 DP 18 - 5B (0 - 3') only, SP / 3 ( L9 DP 18 - 5B (0 - 3') only, SP / 3 ( L9 DP 18 - 5B (0 - 3') only, SP / DH  (614 for sample)  Quality Control Activities (including field calibration): Collidate Once for sample)  PERD will not Short Plane. Colled FIE. They will same fix of Bookfield  Level DQ L9.  Deservations/Problems Encountered/Corrective Action Taken: Sample Constitutions Also Breachests  with Control Problems Encountered/Corrective Action Taken: Sample Constitutions Also Breachests  With Control Problems Encountered/Corrective Action Taken: Sample Constitutions Also Breachests  With Control Problems Encountered/Corrective Action Taken: Sample Constitutions Also Breachests						·		,				
Equipment on Site:  DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site: None  URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (3 ( hours > 12.0)    Drawlon Minor  Field Work Performed (including sampling):  L9 DP 00 - 5D (24 - 63')   Screen pant (67)   wells (52')   PES   DB    L9 DP 14 - 5B (0 - (6') only   PES   DB    L3 DP 07 - 5B (43-54')   wells (18'/55')   SP / JC    L9 DP 18 - 5B (0 - 31') only   SP / JC    L9 DP 18 - 5B (0 - 31') only   SP / JC    L9 DP 10 - 5B (0 - 65') only   SP / JC    L9 DP 10 - 5B (0 - 65') only   SP / DH    (6.00 for sample)  Quality Control Activities (including field calibration): (an open on the first of	· <del></del>											
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Fron detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site: None  URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (3 ( hours > 12.0)  Branchan Minor  Field Work Performed (including sampling):  L9 DP 06 - 50 (24 - 63'), screen pant (67), wells (52'), PES / DB  L9 DP 14 - 5B (0 - 16') only, PES / DB  L3 DP 07 - 5B (43-54'), wells (18'/55'), SP / JC  L2 DP 18 - 5B (0 - 21') only, SP / JC  L9 DP 10 - 5B (0 - 21') only, SP / JC  L9 DP 10 - 5B (0 - 25') only, SP / DH  (6.22 for sample)  Quality Control Activities (including field calibration): (and party the check of PTD,  FTD - 11 not Share. (miled FTE. They will sample the Body field Calibration)  Health and Safety and Activities: 14nd Smin 14-5 meeting, Up greate to Body field  Deservations/Problems Encountered/Corrective Action Taken: Sample Con Jankshed 2 wells  with Body from the Watershape L2 DP 20 - 56' and L3 DP 3 - 48. Also Breakershapes		vice - Jessie Kalvig and Darin DeGruson.	Blance	(60ch								
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.  Visitors on Site:  Nonc  URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.  Promote Minor  Field Work Performed (including sampling):  L9 DPOO - SO (24 - (3')), Screen pant ((07)), wells (52'), PES / DB  L9 DPOO - SB (43 - 54'), wells (18'/55'), SP / JC  L9 DPOO - SB (43 - 54'), wells (18'/55'), SP / JC  L9 DPOO - SB (72'), wells (18'/55'), SP / JC  L9 DPOO - SB (72'), wells (18'/55'), SP / JC  L9 DPOO - SB (0 - 21') only, SP / DH  (61' (or Sumply))  Quality Control Activities (including field calibration): (milpophe Oncek of PID,  FID will not Short Flanc, (willed FIE, They will same given fit outside)  Health and Safety and Activities: 1 and Smin 14-5 meching, Upgradic to Workfield  Leach DQ L9.  Disservations/Problems Encountered/Corrective Action Taken: Sample, Cons. (Anaphrent 2 wells)  with Bookership to the Williams L2 DPOO - 56' and L3 DPOO - 48. Also Breatersh												
URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.  Brandle Miner  Field Work Performed (including sampling):  L9 DP06 - SD (24-63'), Screen pant (67), wells (52'), PES / DB.  L9 DP14 - SB (0-16') only, PES / DB.  L3 DP07 - SB (43-54') vells (18'/55'), SP / JC.  L2 DP18 - SB (0-21') only, SP / JC.  L9 DP03 - SB (72'), vells (18'/55'), SP / JC.  L9 DP03 - SB (72'), vells (18'/55'), SP / JC.  L9 DP03 - SB (72'), vells (18'/55'), SP / DH.  Core for sample)  Quality Control Activities (including field calibration): Calibrate Oncek of PID.  FID will not short flanc. Called FIE. They will same given fit outside.  Health and Safety and Activities: 1 and Smin 14-5 meeting, Upgrade to Bodified.  Disservations/Problems Encountered/Corrective Action Taken: Sample can inhappen a wells.  Disservations/Problems Encountered/Corrective Action Taken: Sample can inhappen a wells.  Disservations/Problems Encountered/Corrective Action Taken: Sample can inhappen a wells.						ip, turbi	dity m	eters, w	ater tan	ks		
URS Personnel on Site:  Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (3 ( hours = 12.0)  Brandon Minor  Field Work Performed (including sampling):  L9 DP 06 - SB (24-63'), Screen pant (67), wells (52'), PES / DB  L9 DP 14 - SB (0-(6') only, PES / DB  L3 DP 07 - SB (43-54'), wells (18'/55'), SP / JC  L9 DP 18 - SB (0-21') only, SP / JC  L9 DP 03 - SB (12'), wells (22 / 53), Screen pant (70'), SP / DH  L9 DP 10 - SB (0-65') only, SP / DH  (60 for Sample))  Quality Control Activities (including field calibration): (alippan Oncok of PID,  FID will not short Flanc. (alled FIE. They will soon at new FID outside  Health and Safety and Activities: 14nd Smin 1425 meeting, Upgrade to Bookfield  Level DQ L9.  Disservations/Problems Encountered/Corrective Action Taken: Sample con identified 2 wells  with Activities in the valuable L2 DP09 - 56 and L3 DP03 - 48. Also Preserved.	Decon equipment, soil san	npling equipment, water sampling equipm	nent, PPE, p	aperwo	rk.							
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (7 ( hours = 12.0)  Branchen Minor  Field Work Performed (including sampling):  L9 DPOO - 50 (24-63'), screen pant (67), wells (52'), PES / DB  L9 DP14 - 58 (0-16') only, PES / DB.  L3 DPO7 - 58 (43-54'), wells (18'/55'), SP / JC  L4 DP18 - 58 (0-21') only, SP / JC  L9 DP03 - 58 (72'), wells (22/53), screen for (70'), SP / DH  L9 DP 11 - 58 (0-65') only, SP / DH  (610 for sample))  Quality Control Activities (including field calibration): (alipsipe Once of PID,  FID will not short flanc. Culled FIE. They will same a new fito ownite  Health and Safety and Activities: 11ml Smin 14-5 meeting, Upgrade to 180h/field  Deservations/Problems Encountered/Corrective Action Taken: Sample Crow it and first 2 wells  with deservations/Problems Encountered/Corrective Action Taken: Sample Crow it and first 2 wells	Visitors on Site: A	Jone										
Field Work Performed (including sampling):  L9 DPOG - SB (24-63'), scient pant (67), wells (52'), PES / DB  L9 DP14 - SB (0-6') only, PES / DB.  L3 DP07 - SB (43-54'), wells (18'/55'), SP / JC  L3 DP18 - SB (0-21') only, SP / JC  L9 DP18 - SB (0-21') only, SP / JC  L9 DP03 - SB (72'), wells (22 / 53), scientiff (70'), SP / DH  L9 DP 11 - SB (0-65') only, SP / DH  (600 for sample))  Quality Control Activities (including field calibration): Calibration check of PID.  FID will not short flyne. Called FIE. They will some a new FID owenthe  Health and Safety and Activities: 1 that Smin 14-5 meeting, Up grade to Blockfield  Deservations/Problems Encountered/Corrective Action Taken: Sample crow identified 2 wells  with development to the wilcomes L2 DP09 - SC and L3 DP03 - 48. Also Breaters				· "					<u> </u>			
Field Work Performed (including sampling):  L9 DPO6 - SD (24-63'), screen pant (67), wells (52'), PES / DB  L9 DP14 - SB (0-16') only, PES / DB.  L3 DP07 - SB (43-54'), wells (18'/55'), SP / JC  L3 DP18 - SB (0-21') only, SP / JC  L9 DP18 - SB (0-21') only, SP / JC  L9 DP03 - SB (72'), wells (22 / 53), scombat (70'), SP / DH  (610 for sample))  Quality Control Activities (including field calibration): Calibrate Oncok of PTD.  FTD -11 not Start Flanc. Called FTE. They will some after FTD occurring  Health and Safety and Activities: 11 Smin 14-5 meeting, Upgrade to Bookfield  Level DQ L9.  Disservations/Problems Encountered/Corrective Action Taken: Sample Care identified 2 wells  with applications of the valence L2 DP09 - SC and L3 DP03 - 48. Also Cocastered			Justin Covey	<u>/. (                                   </u>	2 C F	wws.	= 13	.0)				
L9 DPO6 - SB (24-63'), scien pant (67), wells (52'), PES / DB  L9 DP14 - SB (0-16') only, PES / DB.  L3 DP07 - SB (43-54'), wells (18'/55'), SP / JC  L3 DP18 - SB (0-21') only, SP / JC  L9 DP18 - SB (0-21') only, SP / JC  L9 DP18 - SB (0-21') only, SP / JC  L9 DP18 - SB (0-25') only, SP / DH  (610 for samply)  Quality Control Activities (including field calibration): Calibration Oncck of PTD,  FTD will not start flanc. Called FTE. They will samd given fito overthe  Health and Safety and Activities: 1 flad Smin 14-5 meeting, Upgrade to Bodified  Deservations/Problems Encountered/Corrective Action Taken: Sample Considerated  Disservations/Problems Encountered/Corrective Action Taken: Sample Considerated  With Approximate to the valence L2 DP09 - SC and L3 DP03 - 48. Also Preservations					•		•					
LA DP 03- SB (72'), wells (22/53), scombat (70'), SP/DH  LA DP 11- SB (0-65') only, SP/DH  (610 for samply)  Quality Control Activities (including field calibration): Calibrata Oncck of PTD.  FID will not start flags. Called FIE. They will sound a new FID ownite  Health and Safety and Activities: 11 Jan Smin 14-5 meeting, Upgrade to Bodified  Level DQ L9.  Observations/Problems Encountered/Corrective Action Taken: Sample Coa identified 2 wells  with Observations is the Williams L2 DP09-56 and L3 DP03-48. Also Occasional	L9 DP06 - 5 L9 DP14 - 5 L3 DP07 - 5	50 (24-63'), screen pu B (0-16') only, PES/D B (43-54'), wells (18'	B.'/55')	) , we , S F			) , P	ES /	DB			
Quality Control Activities (including field calibration): Calibrate Oncck of PTD.  FID will not Start Flanc. Called FIE. They will sound a new FIO owends  Health and Safety and Activities: 1 had Smin 1445 meeting, Upgrade to Madified  Level DQ L9.  Disservations/Problems Encountered/Corrective Action Taken: Sample Come identified 2 wells  with Approximation in the valence L2 DPO9-56 and L3DPO3-48. Also Occapted	L9 DP 03-	5 B (72'), wells (22/	53), sc	m Bant	(70	·) , :	>P/	DH				
FID will not short flyne. Culled FIE. They will sound a new fito overthe dealth and Safety and Activities: 1 flux 5min 14-5 meeting, Up grade to Blockfield Level D@ L9.  Disservations/Problems Encountered/Corrective Action Taken: Sample can identified 2 wells with appropriate in the valence L2 DP09-56 and L3 DP03-48. Also presented	6 to for 4	oumple)										
Level D@ L9.  Disservations/Problems Encountered/Corrective Action Taken: Sample crack identified 2 wells with appropriate in the valence L2 DP09-56 and L3 DP03-48 Also Encountered												
Dbservations/Problems Encountered/Corrective Action Taken: Sample con identified 2 wells with deservation in the valence L2 DP09 - 56 and L3 DP03 - 48. Also Occapied	LTD ail not	Start Plane. Coulled FJE.	They wi	الا جمع	A 01 4	en E	to	on over !	<u> </u>			
with downwhat is the valence L2DPO9-54 and L3DPO3-48. Also presented		L9.	1445 me	thing	, \	26211	rule 4	» <b>19</b> 0	અહ્ય			
Substance (Suspect Byon From concentrators) of LADP14 during Soil Buring. Stoppolyank	Observations/Proble	ems Encountered/Corrective Ac	tion Take	<u>n:</u> S	e-ple	C/62	ident Als	fied Co.	2 wells	· · · · · · · · · · · · · · · · · · ·		
	Substance Conspection	+ thigh from concentrators) at	LADP	14 0	luring	341 I	Brih)	. Slep	bor-o	rklee		
By Corey Anderson Title Field Manager		Rv	Corey An	derson			Title	Field 1	Manag			

## samples collected and sent to the lab:

La DPO2-23 (explosites only) L2 DP 09-80 (Cxp.) L2 DP 12-28 (exp.) -> Duplicate 3 (only 1 Amber) La DP 12-52 (4P.)

L3 DP 01-25 (exp) L3 PPOI -50 (exp) L3PPO2 - 45 (exp) L30803 - 25 (exp) 230804 - 22 (exp) -> Duplimite 4 130105 - 20 (exp.) 13 ppo5- 60 (exp) L30906-25 (exp.) LSPPO6 - 52 (41P.) L3 8P 10 - 25 (94P.)

L9 DP04 - 53 (VOL) - CONTROL 11-5 19 ppo 4 - 69 (vol) - comme 11-5 190006-67 (UOL) (90P10 - 25 (UGL)= Collected 11-5
L90P10 - 55 (UGL) - Collected 11-5 19pp 10 - 65 ( voc ) - collected 11-5

## Samples - Collected, and not sent:

L90P03-71 (vol) 1909 06-52 (10C)

#### DAILY QUALITY 11-7-02 Date CONTROL REPORT Day S W TH F S M On Site Hours 120 13.0 **IAAAP F.S. Data Collection** Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Clear Overcast Rain Snow **Project Iowa Army Ammunition Plant** X Project No. 16169421.00201, 16169421.00301 Temp To 32 50-70 70-85 85 up X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Moderate High Report No. DACA45-96-D-0017, DO 65 Contract No. 19 DACA45-02-D-0003, DO 10 Humidity Humid Drv Moderate DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork Visitors on Site: (AO Otility locate **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Justin (over hes = 11.5) Brundon Minor Field Work Performed (including sampling): DP14 - 5B(67' SB (0-48 PES 5 B , well (26), screen point 16.0 >B well - SB ( 64') GOO FOR SUMPE Quality Control Activities (including field calibration): Culibrata check triu FID / nut writing. New FID will arrived 11-8-02 Freen desector colchect. Health and Safety and Activities: Ifud 5 min H+ Sactmeeting. Opgaded to Observations/Problems Encountered/Corrective Action Taken: Encontract more from D L9 OP 18 - expensel work to find additional PPE alternatives. 3 DP beatons Q Line 9 16,17,88 Added Office Work Performed: puper-urk. Title Field Manager By Corey Anderson

## Samples edlect any sent to the Lab &

EBP DP 02-45 (Explosies) (IAmber) storted cultertry on 11/5

EBP 0P 05-25 (Explosies) (IAmber) Storted culterfry on 11/5

L2 DP 18-12 (Explosies)

L3 DP 04-45 (Exp) Streeten collectors on 11/5 (IAmber)

L3 DP 08-25 (Exp)

L3 DP 08-55 (Exp)

L9 DP03-22 (WC)

2 9 pp03 - 71 (voc) collected on 11/6

LADPO4 - 24 (vac)

190 pos - 25 ( +oc)

190006 - 25 (wc)

LAPPOL - 52 (vac) collecter on 11/6

19 PPO7. 26 (voc) -9 Doplicate 5

L9 DP11 - 55 (val)

L9 PP11 - 69 (vol)

19 pp 14 - 53 (vol)

(9PP 14-46 (voi)

R10 PZ 02 (val) - existing Piezometer.

- All Samples collect were sent to the lab.

- several purtial explaines sumple remain.

#### DAILY QUALITY 11-8-02 Date CONTROL REPORT w TH S Т F Day M IAAAP F.S. Data Collection On Site Hours 12.0 Travel Time Office Time Weather **Bright Sun** Clear COE Project Manager Al Kam/Kevin Howe Overcast Rain Snow Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp 50-70 70-85 85 up Project No. To 32 V 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 20 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. -Bloke Coven Left **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey, J( ha = 10.0 Brundon Minor Field Work Performed (including sampling): schen paint (62') L9DP16-58 (67) , well (28' Screenpoint (60), PES/DB LADP 13 - screen point (64') 5P/DH 1900 02 - SB 12 PP15 - 50 (21-41 120P14 -5B (0-17) Samples over Instally HA Holes @ wof DPO1, 02, 21 Quality Control Activities (including field calibration): PID+ FID. **Health and Safety and Activities:** 5 min Har 1445 meeting, Upgradeu to Modified lesel D Linea Observations/Problems Encountered/Corrective Action Taken: plune Added 25 DP much furner to the South west. locations Q (mc 9 19+20 - observed only substance of sheet in spring creek tributing near wopany . Budwar extension in store dry. Office Work Performed: By Corey Anderson Title Field Manager

Samples Collected and sent to the Lab.

EBP DP 08-18, expl., partial Amber, sturted on 11/4. EBPPP04.45 , exp, I Amber, Starton on 11/5. EBPPP21-26, exp, 1 Amber 1 started 11/4.

WBPPPOSI-09, EYP, 1 Amborg sturtenon 11/4. L2 8P15-44, exp,

WDP DP 07-22, vol, 2-vas. - Actual deptr is 25' WOPPP 13-12, VOL, 1-VOA. w8 P PP 14-14, voc. ■

L9 DP 11-23, VOES LAPP 13- 20, vols. LADD 13 - 55, val. L90913 - 64, vac. 190915-60, vac. L90P 16-28, voc. 190916-62, vol.

DAILY QUA	Date	11-9-02								
CONTROL	REPORT	Day	S	M	Т	W TH		F	S X	
IAAAP F.S. Data Coll	On Site H Travel Tir Office Tir	ne		9. 	S J11.	5				
COE Project Manager	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear	Overcast		Rain	Snow	
Project Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	То		32-50 <b>X</b>			70-85	85 up	
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Wind Humidity	Still	Mod	<u>^</u>	High Humid		Report No.		
Subcontractors on S	Site:_	·	· ·	4			····	·		
	Joe Combs, John Willinson, and Bruce I	Birge.			٠.					
	rice - Jessie Kalvig and Darin DeGruson.	<del></del>		•						
Equipment on Site:	materials, water levels, PIDs, FIDs, Fred	n datactar :	noristalt	io num	n turbi	ditu me	tore 317	otor ton	leo .	
	i materials, water levels, PIDS, FIDS, FIES, PIE				ք, աւտ	dity me	icis, w	ater tan	KS	
Visitors on Site: д	Jone									
URS Personnel on S	ito:									
	rpenter, Dan Hatfield, Dave Breger, and J	ustin Covey	. (	7 (	_ h/s	e	1.0	)		
Brunden	-			<b>-</b>				, <u> </u>		
	ed (including sampling):			\						
<del></del>	5 B ( 64), well (25),	Screen Par		54)	PE	ا / ح	<u> </u>	-		
		5 G From W	cu depr	) / N	<u>?'→</u> (	طال.	-61	)		
	OC (60'), wells (25) B (73'), SP/DH	137,	<u>٠</u> .	/	) <i> </i>					
	50 (17-41), SP/JC	1000	<del>(1)</del> 3	<b>Q</b>						
Tried HA ha	KS @ EBOOP-10, WOP C	1919								
(Sandes	>> ( >> (		<u> </u>							
Quality Control Activ	vities (including field calibration	<u>):</u> (	ibrah	ia (	heck	oF	PJD	+ LIt	<b>)</b>	
			_		-	<del></del>				
		·-···								
Health and Safety an	d Activities: الميل علم ا	+5 mu	etinn		JPA	متعاما	49	MOD		
level DQ										
01 41 45 14		·			<u>.</u>					
	ms Encountered/Corrective Act			• • •			1.00	•		
- 5 P has all -	of contemporate class to se	sofere val	* INS	alto	but	er r	<u>.1759</u> . den	* †		
Office Work Performed: papervork										
	- Dak									
	P	Corey And	1			T:41 ~	TN:-1 1 3	Manage		

samples collected:

WBP 0002-01 (VOL)
L9 0 002-22 (VOC)
L9 0 P 02-65 (VOC) - Lables - word (Sheel C 60') LADP 15-25 (WC) La 0 P 12 - 54 (va)

L2 DP15-17 (exp), 1 Amber L2DP18-26 (FXP.)

DAILY QUALITY Date 11-10-02 **CONTROL REPORT** w Day Т TH S M 8116.5 IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Snow Rain Iowa Army Ammunition Plant **Project** K X 16169421.00201, 16169421.00301 Temp Project No. To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 X 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High X Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 22 Humidity Drv Humid Moderate DACA45-02-D-0003, DO 16 X X Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: Mone **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brunden Miner Field Work Performed (including sampling); 490P09 - VUL 166), PES L90P19 -, weil (54), screen PAIN+(25), PES/DB L9 DP20 -SB 141-60 92, \*vells ( 00 ) , screm pants 6631 3B (G5 Quality Control Activities (including field calibration): Calibratus chack of PIDOFID Health and Safety and Activities: Had Smil Has meeting, opgraded to MOO Level D Q Line 9 Observations/Problems Encountered/Corrective Action Taken: 5 P/JC (reu has samples still locked up. -Identified a gust full locations where some soil scarpes collected had high handspace QLO 9-(00. Upgration different wor NO for hands pare - different land to campille Added 2D Office Work Performed: 31+3

By Corey Anderson

Title Field Manager

Report No.

Samples collected :

~ wordpopod-01 (explosion) I Amber

~ L9DP09-52 (NOY)

- L90808 - SS (voc)

-L90909-66 (voc)

- La 0001 - 63 (vac)

- LAPPO8-25 (va)

- La 0P12 - 25 (10L)

- L90 POI - 71 (JOC)

-La0819-25 (m)

# **DAILY QUALITY**

D/1121 Q0/		Date			17	<u> </u>			
CONTROL	REPORT	Day "	s	M	Τ,	W	ТН	F	S
IAAAP F.S. Data Colle	On Site H Travel Tir Office Tir	me		11.	5/1	3. <b>D</b>			
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather			Clear	Ove	rcast	Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	То	32	32-50	50	-70	70-85	85 up
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Wind Humidity	Still		erate erate	High Humid		Report No	
Subcontractors on S	ite:	· · · · · · · · · · · · · · · · · · ·							
Plains Environmental Serv Equipment on Site:  DP Rigs, URS trucks, well Decon equipment, soil same Visitors on Site:  Visitors on Site:  URS Personnel on Site:  Corey Anderson, Ryan Carey Anderson, Ryan Care Mine Field Work Performe  LA DP 03 - Site:  LA DP 03 - Site:  LA DP 11 - Site Site Site Site Site Site Site Site	penter, Dan Hatfield, Dave Breger, and  d (including sampling):  had screen from screen  B (33/kga) screen  B (53) screen from  B (55) screen from  B (50) screen from	Justin Covey  (@ 3  Annts (  (@ 3)  ((	9' b	5 ( 35) 61. 7 ( 7 ( 9 /	PI PI DIL SY')	ES /1 ES /	1.5) DB 08' 3	towns	# h
of line 2 that dire	ms Encountered/Corrective Acousting the BC. They or language to between \$12000 and \$20	tion Take	<u>n:</u>	ocute	и <b>2</b>	Tr.k	،بابرداد	, nom	<b>n</b>
	Ву	Corey And	derson			Title	Field l	Manage	er

Samples collected:

L20P03-14 (explosins)

L30PO9-18 (explains)

L90821-62 (VOC)
L90822-54 (VOC)
L90820-39 (VOC)

## **DAILY QUALITY** Date 11-12-02 **CONTROL REPORT** TH Day S M. T F S 12.0 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow Iowa Army Ammunition Plant **Project** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High DACA45-96-D-0017, DO 65 Contract No. 24 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: Mone **URS Personnel on Site:** hours = 11.5 Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JC Brundon Minor Field Work Performed (including sampling): L2DPO4 - Screen screen paints 69 - Screen point in ditch L9DP17 - 5B (65 LADPAO-SB L2DP 17 - 5B (0-53 Quality Control Activities (including field calibration): FID Smin Has meeting. Upgraded to **Health and Safety and Activities:** Had Moo Line 9 Lavel D P Observations/Problems Encountered/Corrective Action Taken: - Cleared obstaction in L2 DP09-56 and L3 DP03-48, PES. - Scien point Sumpling in differs does not work. Headspea on SP rods was then the FD in the NWamon of mistle Office Work Performed: paperors

By Corey Anderson

Title Field Manager

# Samples collected:

L2DP64-12 explosives

LADPO4-37 CYPHING

L2 DP 07 -14 explains

La DP07-27 explosins

La DP 11 - 08 explaises

LADPII - 55 explains

L3 DP 07-18 CFAOIS - 1 Ansen

L 3 0 P 10 -58 - explasives - 1 march.

190901-20 (voc) - Dopicak #8

LADP 17-23 (voc)

(10P17-62 (VOL)

L90P19-54 (vac)

(90120-20 (00)

140P21-20 (vol)

Samples Collected and not sent to lab

L2 0P20-61 (exp)

DAILY QUA	LITY	Date		<u>-</u>	11-1	3-02	2		
CONTROL	REPORT	Day	S	М	Т	w ×	iн	F	S
IAAAP F.S. Data Colle	ection	On Site H Travel Tir Office Tir	ne		6	0/7	.0		
COE Project Manager Project	Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear	Ove	rcast	Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302	-	To Still	32 Mad	32-50 <b>×</b> lerate	50-		70-85	85 up
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity	Dry		lerate	High Humid		Report No	
Plains Environmental Service Equipment on Site:  DP Rigs, URS trucks, well Decon equipment, soil same Visitors on Site:  URS Personnel on Site:  URS P	penter, Dan Hatfield, <del>Dave Broger</del> , and J d (including sampling):	ustin Covey  (ustin Covey  (ustin Covey)	posht	SP (Si	( = M ( ) , ( ) where	مان 5 P/ ط 11:	= 7 DH-	7.0	
-made list of 1	ms Encountered/Corrective Act Euspoon -5spplies needer for www. in L3 DP 09 -55 ed: paper wrk.								
	Rv	Corey And	lerson			Title	Field I	Manage	er

#### **DAILY QUALITY** 11-18-02 Date CONTROL REPORT S Т TH F S Day Μ Y 65175 On Site Hours IAAAP F.S. Data Collection Travel Time Office Time Weather Bright Sun Overcast Rain Snow COE Project Manager Al Kam/Kevin Howe Iowa Army Ammunition Plant X **Project** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High X Contract No. DACA45-96-D-0017, DO 65 Moderate 26 DACA45-02-D-0003, DO 10 Humidity Dry Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JC hars = 6.5 Minor Brandon Field Work Performed (including sampling): La DP 17 - Screen point (56'), PE La DP 10 - SB (32), Spreen much 1 111' , spreen point (14'), SP/JC Samples colocted and sent to the lab. - L2 DPII =32 (eyp), L20014.23 (eyp) (20P14-55 (exp), L20P17-50 (exp), L90P14-25 (voc), L90P22-20 (voc) Quality Control Activities (including field calibration): Calibration Check of PID and FID FID is not working properly . (a) check mak Level D Line 9 Smin **Health and Safety and Activities:** Had Observations/Problems Encountered/Corrective Action Taken: None

By Corey Anderson

Office Work Performed: pap work

#### DAILY QUALITY 11-19-02 Date **CONTROL REPORT** Day S Μ Т TH F S On Site Hours 12.0 / 14.0 IAAAP F.S. Data Collection Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain **Iowa Army Ammunition Plant Project** 16169421.00201, 16169421.00301 Temp Project No. To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High DACA45-96-D-0017, DO 65 Contract No. 27 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 × Subcontractors on Site: Saberprobe - Tom Payton, Jee Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. J Char = 12.0 Brandon Minor Field Work Performed (including sampling): L2 DP10-SB (32-44) · pulled well after Schapling L2 DP 22 - SB ( 51' screen point (SI'), SP/ Well ( 101 FTP OP 15 - 5B (131) 26/12 well Same hole PES / DB L90023 - well (44 (all), same hole, PES/DB L9DP24 - 5B (24) L90P25 - 56 (24' 24 Lappia - Scienpoint (64' PES Quality Control Activities (including field calibration): Health and Safety and Activities: Smin 145 meeting , upgraded to mad level D @ Line 9 Observations/Problems Encountered/Corrective Action Taken: None Office Work Performed: papervork. Title Field Manager By Corey Anderson

#### La Dramage dites

L9 DP 27 - pushed hole to 201 + installed TW @ 20' - outfall

L9 DP 28 - pushed hole to 201 + installed TW @ 20' - 100' N or outfall

L9 DP 29 - pushed hole to 20' - installed TW @ 20' - NU corner or drawged the

Samples collected & Sont to Lord.

Lapp 10 - 14 (explosives) (collected 11-18-02)

Lapp 10 - 45 (explosives) + Amster)

Lapp 22 - 51 (explosives)

Lapp 23 - 15 (vocs)

Lapp 12 - 64 (vocs)

warper 14 - 14 (explosives 1 4mbor)

Duplicate 9 is Field Blank WIDI

#### **DAILY QUALITY** Date 11-20-02 CONTROL REPORT Day S M Т W TH F S Х On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow Iowa Army Ammunition Plant **Project** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still High Moderate Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 Humidity Dry 28 Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: work **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. **3**c Brandon Minon Field Work Performed (including sampling): LADPOS - SB (60-71 screen point (70 preproduto (00). L9 DPAG - SB (5a screen point (50) FTP PP16 -SB FTP 00 20 - 3B **23**' 22 - 2B SPIJC 20 , Same have, Fouled Scrom point @ 24, SP/T Sß 25 FTPOP 24 - 5B mell Quality Control Activities (including field calibration): ρπο **Health and Safety and Activities:** Smin Has neeting I mad level DOL9. Observations/Problems Encountered/Corrective Action Taken: None Office Work Performed: paper work, plotter til resplay on

**By** Corey Anderson

11-20-02 Report No. 28

FTP PP25 -SB(22), well (22') , sometok, SP/JC

Samples Collected and sont to fac leb L90902-70 (voc) L90923-44 (voc 1 vox) L90924-21 (vas) 1908 25-25 (voc's) Labled works shouldbe 25-24

198726-50 (vai)

(90P2 7-20 (vac) - Diton

190P28-20 (voc) -Diton

120P22-10 (explosing) 6-15 (explosives existing well)

#### **DAILY QUALITY** 11-21-02 Date CONTROL REPORT Day S M Т TH S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 Temp Project No. 32-50 50-70 70-85 85 up To 32 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 × DACA45-02-D-0003, DO 10 Dry 29 Humidity Moderate Humid × DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGrusen. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: Keun Howe USACE) **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JChn= 12.0 Brazion Miner Field Work Performed (including sampling): EBP DP 20 - 5B (49' wells (22/49) EBPPP 11 - 50 (341) 0-23 overbunka , 23-34 rock room , well (33 L90930 - postery hole to 10', institute vell Q 10', scar role, PES/DB L90131 - 5B ISAMUHOLC, PES/DB screen point (15') L30802 - reinstalled L3 PPO2 - 13, well (B) only, PES/DB Lappol - SB (48'), well (39') screen point (12') Quality Control Activities (including field calibration): PIO Tub Cal chack of **Health and Safety and Activities:** Smin Mod Level D L9 It & mechini Observations/Problems Encountered/Corrective Action Taken: Office Work Performed: paperwork. By Corey Anderson Title Field Manager

Samples collected and surtate las

FTP DP 20-23 (vx)

FTPPP 22-20 (voc')

FTP PP 23-25 (voc) Duplicale 10

LADE 310-14 (not 2004) mong to 26-30 iscorled.

LADP 29-20 ( 40C )

1909 30 - 10 (voc)

LADE 39-12 ( NOC)

L3DP07-55 (exp. states on 11/19/02) 1 Amber.

#### **DAILY QUALITY** 11-22-02 Date **CONTROL REPORT** Day S M T W TH S 14/11.5 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Overcast Rain X Iowa Army Ammunition Plant **Project** Project No. 16169421.00201, 16169421.00301 Temp To.32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 ~ 30 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid ¥ DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darlin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. <u>Visitors on Site:</u> Keyn Howe + Ben Letak ( USACE) **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JCh13. 11.5 Brandon Minor Field Work Performed (including sampling): well (28'), sanchole, 4" FAWI ROCKREM, SP/JC 24'), some hole, 4" FAWI ROCKREM, SP/JC 4" FAWIRR, SP/JC EBP0123 -280 - 5B(28' WBP0015 - 5B (26'), well (24' WBPOP 19 - SB (0-16.5' L20P24 - 5B (16'), Screen point (12') PES/DB EBPDP21- 3B (72-84') , well (67'), pre proved to 72 for SB, PES/DB Gamples over) Quality Control Activities (including field calibration): Cal Greck PIO /PIO / WL **Health and Safety and Activities:** Smin H+S meeting Had Observations/Problems Encountered/Corrective Action Taken: 5 ite Reco @ wor, FIP, EBP and line 9 see logbook for Activities and findings Office Work Performed: papers.

By Corey Anderson

#### Samples collected anasontholico.

Ladf 01-12 (explosives collected 11/21)

Ladf 19-20 (explosives 1 Amber)

Ladf 23-12 (explosives)

Ladf 24-06 (explosives)

EBP DP20-22 (explosives 1 Amber)

EBP DP20-22 (explosives 1 Amber)

EBP DP23-28 (explosives 1 Amber)

FTP DP24-07 (JGC) (2 VOA)

FTP DP25-22 (JOC) (Duplicate 11)

L9 DP31-22 (JOC)

DAILY QUA	LITY	Date			11-2.	)-o`	<u> </u>		·.·
CONTROL	REPORT	Day	s	М	Т	w	ТН	F	s
IAAAP F.S. Data Coll	Travel Ti	n Site Hours ravel Time ffice Time					4 % A & A		
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear	Ove	rcast	Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	To	32	32-50 50-70		-70	70-85	85 up
Contract No.	16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65		Still	>	lerate High			Report No	
7 · v	DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity	Dry	Mod	lerate	Humid		31	
Subcontractors on S	Site:		Se SY						
	Joe Combs, John Willinson, and Bruce I	Rirge		* * *	<u> </u>	<u> </u>			,
	ice - Jessie Kalvig and Darin DeGruson.								
Equipment on Site:	vessio ituivig mia 2 min 2 totason.		7 , 3		P	, -			· · · ·
	materials, water levels, PIDs, FIDs, Free	n detector. 1	peristali	tic num	n. turbi	dity me	ters. w	ater tan	ks
	pling equipment, water sampling equipm				<b>P</b> ,				
URS Personnel on S Corey Anderson, Ryan Car  Corey Anderson, Ryan Car  Corey Anderson, Ryan Car  Corey Anderson, Ryan Car  Corey Anderson, Ryan Car  WHO POR PROPRIES  WHO POR PROPRIES  WHO POR POR POR POR POR POR POR POR POR PO	penter, Dan Hatfield Dava Broger, and John defined the Broger, and John de	Some hole  which bedra  which bedra  with bedra  with bedra  Turb	, bedrous local: h : ( on = ), sa ck = 9	(= 5 91 (0) bo 1 bo m 4 K 11 bgs	/ bgs; 295; 15; 5 15; 5	50 50 50 50 50 50 50 50 50 50 50 50 50 5	9/5 /5C /5C /6 /4	2035 (	5P/J( va)
Results indicate	ms Encountered/Corrective Act  L2 (5-15 wall hit is loce  or discharge oren / folgble water lin  ed: puper-ort	d only.	Poss	bk :	sour ce	gra	her	ру	
	Bv	Corey And	erson			Title	Field N	Manage	r

WBPPPO2 - SB(14'), well (14'), somethile, bedeck = 9'bgs, SP/JC EBPPP02 - SB(84'-116'), well (95'), Newhole, PES/CA EBPPP02 - preprobed to 64' bgs. DES/CA

2 0 0 0 0 - 301 (expl. 1 4mbor)
1 2 0 0 0 - 25 (expl. 1 4mbor)

WBPPP 07-23 (eyp). 5 Anson) or 07-25? This is correct.

WBPPP 12-09 (exp 1 Ambon + Vac') Dryliche 12 (eyp. 07/4)

EBPPP 21-67 (eyp. 1 Anbor)

FTP DP 25-22 (Eyp. 1 Anbor)

## **DAILY QUALITY**

DAILY QUA	LITY	Date	11/24/02						
CONTROL	REPORT	Day	s ×	М	Т	w	ТН	F	S
IAAAP F.S. Data Colle	ection	On Site H Travel Tir Office Tir	ours ne		9.,	5/10	0.0		
COE Project Manager Project	Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear		rcast	Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101		<u>×</u>		32-50 50-		50-70		85 up
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Wind Humidity	Still	૪	erate	High Humid			
Plains Environmental Servi Equipment on Site: DP Rigs, URS trucks, well	Ite:  Jee Combs, John Willinson, and Bruce Fice - Jessie Kalvig and Darin DeGruson.  materials, water levels, PIDs, FIDs, Free pling equipment, water sampling equipment.	on detector, p	<del></del>		p, turbi	dity me	ters, w	ater tanl	ks
URS Personnel on Si Corey Anderson, Ryan Car Brandon Minor Field Work Performe	penter, Ban Hatfield, Dave Breger, and J				ins ≈	11.5			
L9DP33 L9DP34No Sunples	3B (46-100) only +, 5B (55'), well (22') 5B (60') only, 5P/J(64) (64) only for 4" FP holes.	prepable to	0(d) (1 m)-(48	(- a3 -	92) , SP /	9F2	,/4		
	ities (including field calibration /Fエロ/ w、/ ていっち .								
Health and Safety and	d Activities: Had Smin H	+5 meetin	5 /6	ciell	) <b>+</b> / 10	of Feac	10		
Observations/Probler	ms Encountered/Corrective Act	ion Taker	<u>1:</u>	ont.		'ES	LeA	られ	
Office Work Performe	ed: papernork								
	Ву	Corey And	erson			Title ]	Field N	Manage	r

#### **DAILY QUALITY** 11-25-02 Date CONTROL REPORT F Day S M TH S X 11.0- 12.0 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast X V **Project Iowa Army Ammunition Plant** Project No. 16169421.00201, 16169421.00301 Temp 50-70 70-85 To 32, 32-50 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Report No. Moderate High Contract No. DACA45-96-D-0017, DO 65 Dry DACA45-02-D-0003, DO 10 33 Humidity Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darlin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. John Caron (AD/ NPDES Visitors on Site: **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JUN5-11.0 Drundon Minur Field Work Performed (including sampling): LODP 34 - well (22) , sorcen point (40' L9 DP 35 - 30 ( 60') " meil (30. screen print (44') HA-LADP37-50 (70'), vell (7.0' , CA, BC, BM 1+A ~ (9 DP 38 - 50 (7.01) , well (7.0) CARC, BM L9DP34-19 (mx) Samples collected - LADP 33-47 (vac collected 11-24) 6700 26-33 (va), EDO DO 21-95 (expl.), WBP 08 13-12 (exp.) 12-12 (exp.) 12-12 (exp.) lamber for both exp Quality Control Activities (including field calibration): (a) Check of PID/ FID/ WL | TO/D Health and Safety and Activities: Had Sons Had mehan / Level D + Mad Level D

Observations/Problems Encountered/Corrective Action Taken: Had meeting い Dong (great above washer treatment) Q L2, Looked @ NPDES の31 +022, See log book は I for notes.

Completed

Office Work Performed: paperak

suffice soil mapping w/ FID+FD @ Line 9 ditables . Six recomingial line 9 continued.

By Corey Anderson

#### **DAILY QUALITY** 11-26-02 Date CONTROL REPORT Day S Μ T w TH F S **IAAAP F.S. Data Collection** On Site Hours 12.0 Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow **Project Iowa Army Ammunition Plant** Project No. 16169421.00201, 16169421.00301 Temp 32-50 To 32 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 ィ 34 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Visitors on Site: None **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Broger, and Justin Covey. J ( hrs. = 12.0 Brendon Mnon. Field Work Performed (including sampling): LAD(36 - SB (56) \_ well WBP0PO6-5B(83) incli (2) 1 Bedrauc = 13' SH WB 01000 -3B (23) mell (24' bedrock = 13° SH EB109 24 - 5B bedrock & 12' (22) SH Lade 30 - HA(7) CA, AC, BA well (7) Sanoks colleged - L9DP3 19 0/36-21/val), 190/36-45 (voc) 3-22 (voc 19039-07 (val) FTP PP 26-23 (exp.) FTPPP 2407 (exp.), L3DP 02.13 (exp.) Quality Control Activities (including field calibration): PID Check **Health and Safety and Activities:** 5m. Had Husmachny Observations/Problems Encountered/Corrective Action Taken: MONE needed to Add Consider 2 was - EBP Office Work Performed: Duper work PIEDE DE-MOB

By Corey Anderson

#### DAILY QUALITY 11-27-02 Date **CONTROL REPORT** F Day S Т W TH S M X On Site Hours 4.0 **IAAAP F.S. Data Collection** Travel Time 6.0 Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow **Project** Iowa Army Ammunition Plant **Y** Project No. 16169421.00201, 16169421.00301 Temp 85 up To 32 32-50 50-70 70-85 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 35 DACA45-02-D-0003, DO 10 Humidity Moderate Humid Dry DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs. John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGrusen Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. NAC Visitors on Site: **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JL hours, 10.0 Field Work Performed (including sampling): EPPDP25-SB(24), well (23), beclock = 17', SH, SP/JC Quality Control Activities (including field calibration): Cal creek OF RID / ML Health and Safety and Activities: Had Has neeting Observations/Problems Encountered/Corrective Action Taken: Sent back all equipment, returned IPA Keyto building, AK+BM will Ritum to collect firm somples. Office Work Performed: De Mob.

By Corey Anderson

#### **DAILY QUALITY** 12/02/03 Date **CONTROL REPORT** Day S W TH M F S IAAAP F.S. Data Collection On Site Hours 6.0 Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Snow **Project** Iowa Army Ammunition Plant Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Moderate High Report No. Contract No. DACA45-96-D-0017, DO 65 Dry DACA45-02-D-0003, DO 10 36 Humidity Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks well materials, water levels PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters water tanks Decon equipment, soil sampling equipment, water sampling equipment PPE paperwork. Visitors on Site

Visitors of Site.
NONE
URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brandon Miner
Field Work Performed (including sampling):
Ground water sampling:
L9DP3520: 3 Voas WBOP1916: 3 Voas; 1 Amber
WBOP1916: 3 Voas: 1 Amber
WBDP 1818: 3 Voas; Partial Amber
<b>,</b>
Quality Control Activities (including field calibration):
M/A
Health and Safety and Activities: Had 5 min H+3 meeting
Observations/Problems Encountered/Corrective Action Taken:
· NIA
Office Work Performed:
N) r
By Gorey Anderson Title Field Manager
•

#### **DAILY QUALITY** 12/03/02 Date **CONTROL REPORT** w Day S M T TH F S On Site Hours **IAAAP F.S. Data Collection** 11 Travel Time P Office Time Ø COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow **Project Iowa Army Ammunition Plant** 16169421.00201, 16169421.00301 Temp Project No. 32-50 50-70 70-85 To 32 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Moderate High DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 37 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs; FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks-Decon equipment, soil-sampling equipment, water sampling equipment, PPE, paperwork. **Visitors on Site: URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brancha Miner Field Work Performed (including sampling): Ground water Sampling: WBDPOILS - portial WB OP 1524 WBDP 1710 L1 DP40 05 Quality Control Activities (including field calibration): MA **Health and Safety and Activities:** Observations/Problems Encountered/Corrective Action Taken: NIA Office Work Performed: By Corey Anderson ( Title Field Manager

#### **DAILY QUALITY** 12/4/02 Date CONTROL REPORT Day TH S S М F **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast **Project** Iowa Army Ammunition Plant Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 70-85 50-70 85 un 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Moderate Report No. High Contract No. DACA45-96-D-0017, DO 65 38 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe Tom Payton, Joe Combs, John Willinson, and Bruce Birge-Plains Environmental Service - Jessie Kalvig and Darin DeGruson. **Equipment on Site:** DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork of the Visitors on Site: None **URS Personnel on Site:** R4 Brandon Miner Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey-Field Work Performed (including sampling): - Ground water Bampling - Collected additional Sample Vol. EBDP 113 WBOPO113-Shit Person - Winderize Trailer Quality Control Activities (including field calibration): AIG Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Office Work Performed: Unload Supplies @ office in Ounter By Corey Anderson Title Field Manager

## DAILY QUALITY CONTROL REPORT

CONTROL	REPORT	Day	S	M	Т	W	ТН	F	S		
IAAAP F.S. Data Colle	ection	On Site H	ours		090	0-17	.00				
		Travel Time				hours	·····				
		Office Tir	ne			5 how	<b>.</b> 2				
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigl	nt Sun	Clear	Overcast		Rain	Snow		
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	То	32	32-50	50-	·70	70-85	85 up		
Contract No.	16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65		Still	Mod	16derate High Re				Report No.		
	DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity	Dry	Mod	erate	Hui	nid	3	 		
Subcontractors on S	ite:					· · · · · · · · · · · · · · · · ·					
	Joe Combs, John Willinson, and Bruce I	Birge.							··-		
·	iee Jessie Kalvig and Darin DeGruson.				_	_					
Equipment on Site:											
	materials, water levels, PIDs, FIDs, Free				p, turbi	dity me	ters, w	ter tan	k <del>e)</del>		
Decon equipment, soil sam	pling equipment, water sampling equipm	nent, PPE, pa	aperwo	rk.							
Visitors on Site:											
None											
<b>URS Personnel on Si</b>	ite:	······································									
C <del>orcy Anderson, Ryan Car</del>	penter, <del>Dan Hatfiel</del> d, Dave Breger, <del>and J</del>	ustin Covey									
	d (including sampling):										
Attempted to co	ellect ground water samples	from: w	8P~	SOPO	14:0	JBP-	P062	22;			
WBP-DPO9ZZ; WBP	ollect groundwater Samples	EBP- C	P25	23. N	0 90	<u>ound</u>	weste/	•			
observed in any o	of the aforementioned we	JIS.						<del> </del>			
Quality Control Activ	ities (including field calibration	ı <u>):</u>									
Calibrated PID will	th 100 ppm Isobutylene								-		
Health and Safety and	d Activities:										
Use of approprie	TE PPE	<del></del>									
Observations/Proble	ms Encountered/Corrective Act	ion Takeı	<u>1:</u>								
Office Work Performe	ed:										
Equipment prepare	tion. Completion of field	boberna	rk								
	By-	Corey And	erson	•		Title 4	Field N	<del>lanage</del>	, T		
		David'	Beng	4			Sampli				

Date

12/16/02

#### DAILY QUALITY 2-10-63 Date CONTROL REPORT F Day S **(**M) Т TH S 6.5 On Site Hours IAAAP F.S. Data Collection Travel Time 6.0 Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Clear Overcast Rain Snow **Project** Iowa Army Ammunition Plant 70-85 16169421.00201, 16169421.00301 Temp 32-50 Project No. To 32 50-70 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Moderate Report No. High DACA45-96-D-0017, DO 65 Contract No. 40 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Survey lead, Rod, GPS, Abundanment tools, bentonite Visitors on Site: None **URS Personnel on Site:** CA, RC, BM, BO Corcy Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Field Work Performed (including sampling): - Survey en eleverture at FTP all DP locations (26 locations) - Collect WBP DP DC - VOL + Exp. + | Poplicisk Exp. Quality Control Activities (including field calibration): Cationalism creek of Sufety meeting Health and Safety and Activities: Initial Site Observations/Problems Encountered/Corrective Action Taken: 「「ナータ ロートーク いらん 15 of by approx. 4" Office Work Performed: 人かく

By Corey Anderson

#### 2-11-03 DAILY QUALITY Date CONTROL REPORT (T) Day S M W TH F S **IAAAP F.S. Data Collection** On Site Hours 11.0 Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp Project No. 32-50 50-70 70-85 85 up To 32 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still High Moderate DACA45-96-D-0017, DO 65 Contract No. 41 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Ioe Combs, John Willinson, and Bruce Birge. None Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Survey level, Rad, CPS, Abundan nont tools, bentonite Visitors on Site: Monc **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Field Work Performed (including sampling): -Surveyer elevations @ Line3 at all PP Loutines (10) all 10 DP Locations - GPS Locutions @ Lines - Abundonal all to Lambur Q cine 3. - Surveyed alevations Q LAPPAZ, 11, 17, 19,20, 15,418. Quality Control Activities (including field calibration): NONE min 1+ Sneeting Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Office Work Performed: By Corey Anderson Title Field Manager

#### 2-12-03 **DAILY QUALITY** Date **CONTROL REPORT** Day S Т TH S M 11.3 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp Project No. 32-50 50-70 70-85 85 up To 32 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 × DACA45-02-D-0003, DO 10 Dry 42 Humidity Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs. URS trucks, well materials, water levels, PIDs, FIDs, Freen detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Survey Courpment, Lead, Red, GPS, Academy tooks, benjonite Visitors on Site: MUNC **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. BM 30 Field Work Performed (including sampling): -Surjevel of PP Country inside Line 2 Fonce - OPS all Locations in side fence - Abandoned all Country inside fonce. - Surveyed LAPPOT, 10, 04, 14 + tred into 6-15. - GPS + Apandoned - Q Line 2 -Quality Control Activities (including field calibration): Health and Safety and Activities: 5min 14th meeting Observations/Problems Encountered/Corrective Action Taken: معربة المجادة المج according to JAW-71 Office Work Performed: Am Title Field Manager By Corey Anderson

#### DAILY QUALITY 2-13-03 Date **CONTROL REPORT** Т Day W (III) F S S M On Site Hours **IAAAP F.S. Data Collection** 12.0 12.0 Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Clear Overcast Rain Snow X **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 Temp To 32 32-50 70-85 85 up Project No. 50-70 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 43 DACA45-02-D-0003, DO 10 Humidity Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge. None Plains Environmental Service - Jessie Kalvig and Darin DeGruson. Equipment on Site: DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon-equipment, soil sampling equipment, water sampling equipment, PPE, paperwork. Survey equipment, level, Rod, GPS, abandonnest tools, bentonite Visitors on Site: **URS Personnel on Site:** Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey BM, BC Field Work Performed (including sampling): locations at EBP Survey all DP GPS at FTP = EDP Abandoned all FTP DE Quality Control Activities (including field calibration): Health and Safety and Activities: Smin H+S meeting Observations/Problems Encountered/Corrective Action Taken: NOTICE

By Corey Anderson

Office Work Performed: Non C

## DAILY QUALITY CONTROL REPORT

CONTROL	REPORT	Day	S	М	Т	W	TH	F	S
IAAAP F.S. Data Colle	ection	On Site Hours Travel Time Office Time				12.0	//3	3.0	
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigh	nt Sun	Clear	Overcast		Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp		To 32		32-50 50-70		70-85	85 up
Contract No.	<u>16169556.00201, 16169556.003</u> 02 <u>DACA45-96-D-0017, DO 65</u>		Still	Mod ➤	erate	Hi	gh		rt No.
	DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity	Dry	Mod ×	erate	Hur	nid	44	
Plains Environmental Serv	ite: Joe Combs, John Willinson, and Bruce E ice Jessie Kalvig and Darin DeGruson.	Sirge. A	ne		· · · · · ·				
	materials, water levels, PIDs, FIDs, Free				 p, turbi	<del>dity mc</del>	ters, w	ater tan	ks
Visitors on Site:  URS Personnel on S Corey Anderson, Ryan Car  Field Work Performe	ite:  penter, Dan Hatfield, Dave Breger, and I  d (including sampling):  II EOP Des  Byter beach mer t.S.	abandon	ment > B/	tool	, 0	bent	9.F.C		
Quality Control Activ	ities (including field calibration	):_ No.	nC			-		-	
Health and Safety an	d Activities: らかり 丹もら	meetin	19						
Observations/Proble	ms Encountered/Corrective Act	ion Takeı	<u>n:</u> //	onc					
Office Work Perform	ed: Mnc								
	Ву	Corey And	lerson		•	Title ]	Field N	/lanage	er

Date

2-14-03

### **DAILY QUALITY** Date

DAILY QUA	LITY	Date			2-1	5-0	3		
CONTROL	REPORT	Day	S	М	Т	w	TH	F	(3)
IAAAP F.S. Data Colle	ection	On Site H Travel Tir Office Tir	me			12.0			
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigh	ht Sun	Clear	Ove	ercast	Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	•	<u> </u>	32	32-50		-70	70-85	85 up
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10	Wind Humidity	Still	>	derate		igh mid		ort No. 15
	DACA45-02-D-0003, DO 16	Humaity	Dry	× NIOU	lerate	Hu	mid		 
Subcontractors on S	Site: Loe Combs, John Willinson, and Bruce I		rank						
			07	<del>-</del>					
	vice Jessie Kalvig and Darin DeGruson.								
Equipment on Site:	-		<del> </del>						
	materials, water levels, PIDs, FIDs, Free				ı <del>p; turbi</del>	<del>dity m</del> o	<del>sters, w</del>	ater tan	ks
	pling equipment, water sampling equipm		aperwo	rk.					
survey equip			_		tout	s1	bento	nite_	
linitare on Citar	NON								
JRS Personnel on Si	ite:								
	rpenter, Dan Hatfield, Dave Breger, and J	ustin Covey	<del>- 6</del>	MC	10				
	F		<u></u>	<del> ,</del>					
Field Work Performe	ed (including sampling):								
	OPS at WBPA								
GPS a4	DPS AT WOPA					<del></del>			
1017 47	UI AI WOLD								
Section Control Active	-141 /in struction field collibration	1- 4/6	~ #						
Anguith Courtor Acria	vities (including field calibration	i): Nov	1C						
	<del></del>					<del></del>		<del></del>	
<u>lealth and Safety and</u>	d Activities: 5min H*5	nieting	•~						
Observations/Proble	ms Encountered/Corrective Act	ion Taker	<u>n: سر</u>	m'					
				<u> </u>					
Office Work Performe	ed: which				-				
			-						
	Ву-	Corey And	<del>lerson</del> -	BC	·	Title	Field l	Manage	er
					_				

## DAILY QUALITY CONTROL REPORT

CONTROL REPORT  Day  TH						F	s		
IAAAP F.S. Data Colle	ection	On Site Hours Travel Time Office Time				10.0	0/11	.0	
COE Project Manager Project Project No.	Al Kam/Kevin Howe  Iowa Army Ammunition Plant  16169421.00201, 16169421.00301	Weather	Brigh		Clear 32-50	×		Rain 70-85	Snow 85 up
·	16169503.00101, 16169556.00101 16169556.00201, 16169556.00302	•	To Still	<u> </u>		Hi		Report N	
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity	Dry	•	erate	: Humid		46	
Plains Environmental Serve Equipment on Site: DR Rigs, URS trucks, well	ite:  Joe Combs, John Willinson, and Bruce I ice - Jessie Kalvig and Darin DeGruson.  materials, water levels, PIDs, FIDs, Free pling equipment, water sampling equipm	on-detector,	•		p, turbi	dity-me	ters, w	ater tan	ks
	mt, Red, Level, GPS,		•		ر د	pento	mite		
Field Work Performe	penter, Dan Hatfield, Dave Breger, and J d (including sampling): DPs ロレ しゅって Ps ロナ しゅっち	lustin Covey	<u> </u>	sM,	60				
Quality Control Activ	ities (including field calibration	<u>):</u>	inc	J					
Health and Safety an	d Activities: 5 mm 14.5	meet	ોગ						
Observations/Proble	ms Encountered/Corrective Act	tion Take	<u>n:</u> 🗡	von'					
Office Work Perform	ed: ponc								
	Ву	Corey And	lerson (	RC	-	Title	Field I	Manage	er

Date

2-16-03

## **DAILY QUALITY**

DAILY QUA	LITY	Date	2-17-03						
CONTROL	REPORT	Day	S	M	Т	W	ТН	F	S
IAAAP F.S. Data Colle	On Site H Travel Tir Office Tir	4.0							
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigh	t Sun	Clear	Ove		Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	_	To	<	32-50	50-	, ,	70-85	85 up
Contract No.	DACA45-02-D-0003, DO 16  DACA45-02-D-0003, DO 16	W ind Humidity	Still Dry	Mode					ort No.
Plains Environmental Service Equipment on Site:  DP Rigg, URS trucks, well Decorrequipment, soil same Survey Equipment, soil same Survey Equipment, soil same Visitors on Site:  URS Personnel on Site:  URS Personnel on Site:  Field Work Performe  Finish abane Pack carriems  Clean ask	Joe Combs, John Willinson, and Bruce I lice - Jessie Kalvig and Darin DeGruson.  materials, water levels, PIDs, FIDs, Free pling equipment, water sampling equipment, Level, Red, GPS  ite:  penter, Dan Hatfield, Dave Breger, and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and John Christian Company and Compan	ustin Covey	: (3	ie pumj k	tons		ters_w	ater tan	ks
Health and Safety an	d Activities:_ 5 տող H+Տո	vehas							
Observations/Proble	ms Encountered/Corrective Act	ion Taker	<u>1:</u> /	une					
Office Work Performe	ed: ranc			-			-		
	Ву-	Corey And	crson	RC		Γitle ]	Field N	/Ianage	er

## **DAILY QUALITY**

3-23-03 **CONTROL REPORT** F · M T W TH Day S S On Site Hours IAAAP F.S. Data Collection **Travel Time** 6.0 Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow **Iowa Army Ammunition Plant Project** 16169421.00201, 16169421.00301 Project No. Temp To 32 32-50 70-85 50-70 85 up 16169503.00101, 16169556.00101 × 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 48 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16

Date

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freen detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality prohe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: Noge.
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter
Field Work Performed (including sampling):
- Mob to Burlington - Had meeting about SOW of WP, or HSP
- Had meeting about SOW + WP, & HSP
O14-O4-1A-0-200-1-1-1-0-1-1-1-1-0-1-1-1-1-1-1-1
Quality Control Activities (including field calibration): Nonc
Health and Cafety and Authorities
Health and Safety and Activities:
Observations/Droblems Enservatored/Compatible Action Tallons
Observations/Problems Encountered/Corrective Action Taken: ペット
Office Work Performed:
Office Work Performed: Λως C
By (Grey And erson Title Field Manager

#### **DAILY QUALITY** 3-24-03 Date **CONTROL REPORT** T W TH Day

		l		X	<u> </u>		<u></u>	
IAAAP F.S. Data Coll	On Site Ho Travel Tin Office Tin	ne		<b>D</b> .0				
COE Project Manager	Al Kam/Kevin Howe	Weather	Brigh	t Sun	Clear	Overcast	Rain	Snow
Project	Iowa Army Ammunition Plant	_				×		
Project No.	16169421.00201, 16169421.00301	_ Temp	To 32		32-50	50-70	70-85	85 up
	16169503.00101, 16169556.00101	-			<u> </u>	$\sim$		
	16169556.00201, 16169556.00302	Wind	Still	Mod	lerate	High	Repo	rt No
Contract No.	DACA45-96-D-0017, DO 65	_		>	<			
	DACA45-02-D-0003, DO 10	Humidity	Dry	Mod	lerate	Humid	49	
	DACA45-02-D-0003, DO 16	_		<u> </u>				
Subcontractors on S	Site:				•			
Aquadrill - Jay Joslyn, Der	nnis Auld, Danny Moore, Scott Elsinger, Mark Claa	issen						
Equipment on Site:							-	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: Marilya Smith (Ausworty), Tonya (Storct websta)
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter.
Field Work Performed (including sampling):
Pick up equipment from Burlington.  Located and Staked MW ? @ FTP, Line 9, WBP, FBP.  Set up decon Station @ Line 800 decon pad.
Located and Staked MW & FTP, 476 9, WBP, EBP
Setup decon station @ Lincolo decon pad.
<u></u>
Quality Control Activities (including field calibration): (alibration OF PID /FID
Health and Safety and Activities: Had Tail gate H& Smeeting / Sturtup with Tonya Marilyn Dmih issued for werk permits
Marilya Smith issued the were permits
Observations/Problems Encountered/Corrective Action Taken:
Office Work Performed: paperix/C.
1
By (rey Arks Title Field Manager

# DAILY QUALITY CONTROL REPORT Day S M T W TH F S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time

	Al Kam/Kevin Howe	Travel Time Office Time						
COE Project Manager		Weather	Brigh	t Sun	Clear	Overcast	Rain	Snow
Project	Iowa Army Ammunition Plant				$\times$			
Project No. Contract No.	16169421.00201, 16169421.00301	Temp	To 32		32-50	50-70	70-85	85 up
	16169503.00101, 16169556.00101	_ ^						
	16169556.00201, 16169556.00302	Wind	Still	Mode	rate	High	Report No	
	DACA45-96-D-0017, DO 65	<del>.    </del>	.	×	- :			
	DACA45-02-D-0003, DO 10	Humidity	Dry	Moderate		Humid	50	
	DACA45-02-D-0003, DO 16							
		<u> </u>						

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: ME 75
Drilling Rigs (Mobile-57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: ponc
UDO Demonstration Office
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter
Field Work Performed (including sampling):
FTP-MUI - Drilledand Sampled overloaden from \$ to 5.0 feet BGS with Gus Pech and GJ "IDASAS.
FTP-MWI - Polled in bedrack from 5.0 to 16.0 feet BOS with Ous Para and 6" AR later Bit.
FTP-MWI- Collected geotech sumple from 4.0 4.4.6' BGS + TOC sumple FFP-MWI-05.
PTP: MW 1 - Used 5.0 and a afraction device well the bill white
PTP-MW 13 - Used 5.0 gallors of nator during well installation.  Ma-MW 13 - Drilled and Simpled Till from \$ to 65 Feet BGS with CME-75+ 46ID HSAS.
19-MW13 - Collected geotech sompes from 10-11, 20.5-21.5, 50.5-51.5, 59-59.5 and 70C
Samples L9-MuB-12, -22, -60.
FTP-MWI - Institute and screen 6-16 bgs.
Quality Control Activities (including field calibration): Gliproto Checker PID+PIO.
Health and Safety and Activities: 1th Smin Has neeting.
Observations/Problems Encountered/Corrective Action Taken: Observed potential free product
in soil samples from 20:30' Blos at L9-MW13 (presumed Freen113).
Office Mork Desformed:
Office Work Performed: purpliment
<b>2</b>
By Title Field Manager
Oran Price Field Wallager

#### **DAILY QUALITY** 3-26-63 Date **CONTROL REPORT** Day S ·M T W TH F S X 12.5 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time Weather Bright Sun COE Project Manager Al Kam/Kevin Howe Clear Overcast

Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302

Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Snow 32-50 50.70 Temp To 32 70-85 85 up Report No. Wind Still Moderate High Humidity Dry Moderate Humid 51

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile-57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
<u>Visitors on Site:</u> Fire depertment to issue Hotwerk Permit
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter.
Field Work Performed (including sampling):
L9-MW13 - Drilled and sumpled till from 65.0 to 85.0' feet BGS with CME-75 + 48 ZDMSAS.
L9-MW13 - Drilled and sumpled till from 65.0' to 85.0' feet BGS with CME-75 +4\$ ZDASAS. L9-MW13 - Collected geoties so-ples from 78.5-79.5, 84.5-85.0, and 700 sumples
19-MW13-80
L9 - MW 13 - Installed screen from 800 - 85.0 ft B65 in Gracult Sands. (5'som)  L9 · MW 13 - Installed screen from 800 - 85.0 ft B65 in Gracult Sands. (5'som)  L9 · MW 13 - Used 35.0 · gallows of water during installation.  FTP-MW (6 (B) - Prilled from \$6 +024.5 feet B65 with Guspech # 10' RWB  FTP-MW (6 (B) - Installed 60" Steel casing to 24.5 feet B65  Measure water levels at FTP+ Line 9
19 mu 13 - used 35.0 gallons of nator during installation.
FTY-MWG (B) - Prilled from \$ 4024,5 test B65 with Guspech + 10" RWP
FTP-MWG(B) - Installed is 6" Steel casing to 29.5 feet Blos
Measical mater levels at FTP+ Lincol
Overlife Constant Antivitation (in abudious field enlithmation).
Quality Control Activities (including field calibration): Calibration Check of PID+FID
Health and Safety and Activities: りょく Sman HtS meeting
Health and Safety and Activities: Had Smin H&Smcehing
<del></del>
Observations/Problems Encountered/Corrective Action Taken: 49-MW 13, drillers but problems
instaling Bikerany seed.
7
Office Work Performed:
By / Title Field Manager

#### **DAILY QUALITY** 3-2703 Date **CONTROL REPORT** Day $\mathbf{S}^{*}$ $\cdot M$ Ť W TH. F X 12.5 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time

Weather

Temp

Bright Sun

To 32

Clear

32-50

COE Project Manager Al Kam/Kevin Howe

**Project** 

Project No.

Iowa Army Ammunition Plant

16169421.00201, 16169421.00301

-	16169503.00101, 16169556.00101	<del></del>		.		
	16169556.00201, 16169556.00302	Wind	Still	Moderate	High	Report No.
Contract No.	DACA45-96-D-0017, DO 65	<u> </u>			×	
	DACA45-02-D-0003, DO 10	Humidity	Dry	Moderate	Humid	
	DACA45-02-D-0003, DO 16			×		<u>  52</u>
0.1	0			·		
Subcontractors						
Aquadriii - Jay Josiyi	n, Dennis Auld, Danny Moore, Scott Elsinger, Mark Cla	aassen				
Equipment on S	ite:					
	=== 87 & Gus Pech 1000AR) and support trucks, 4.25" &	6.625" ID HSAs, 1	0" & 6"	RWB, URS tr	ucks, well m	aterials,
	etector, turbidity meters, water tanks, development equip					
	, water levels, soil sampling equipment (2" & 3" split sp					
Visitors on Site:	_ None	·				
LIDO D	OV					<del>.</del>
URS Personnel						
Corey Anderson, Dav	ve Berger, Mike Sonderman, Ryan Carpenter.					
Field Work Porfe	ormed (including sampling):					<u> </u>
	B) - Prilled from B to 23.4 fee	al taxes at	· . O .		0LA	
E 0 P - MW ()	Tal 1 4 compagnitions	1 ( Y C) . ( - · · ·	ous rec	22 U £	WAR BIC	
FRR MAGE	(6) - Instaled Colors Hereing and grad (6) - Drilled and Sumpled Till overbu	Ut 6 Steel cash	19 h	0 d 3.7 T	Let Do	P-1 cost
EDE - MM 2	68" IDHSAS	rden trom se	- <i>Id</i> .C	7726 150	CIA COS	[ CEA 470]
19-MW12	2 - Drilled and Sumpled from D	s to bo a f	zet (	Bas ah C	ME-75+	41 TO HEAS
19-MW12	- Collected gestern Sumples from	25.5 -26.5	56.5	-57.5 a	M 700	· y & O F) SH ·
	Surples 69-MW 12-27	-58.	, , , , ,	, <u>, , , , , , , , , , , , , , , , , , </u>	<del></del>	<del>-</del>
FBP-MUS (	B) - collected geoleon Sample Fra	m 4.1 - 4.8	i' B	66		
19-M412	- Installed intermediate till well scree	en from 50.0	-60	.0 Feet BG	Dag	U BANK NO
Quality Control	Activities (including field calibration): C	alibration on	CCKO	e PID+F	TO	
Health and Safet	ty and Activities: 🤼 ዙ서 5 m, n 나 다	15 neeting				
<u>Observations/Pr</u>	oblems Encountered/Corrective Action Tal	ken: None	_			
	<del>.</del>				<del></del>	
Office Mork Dow	formed a second					
Office Work Perl	formed: paper work.		<del></del>			<del></del>
		7	<u> </u>	· · · · · · · · · · · · · · · · · · ·		
		By vul	mile L		Title Field	l Manager
		- Joulf	777			

·S

Snow

85 up

Rain

70-85

Overcast

×

50-70

## **DAILY QUALITY**

Date 3-28-03 **CONTROL REPORT** T w TH S Day S  $\cdot M$ F On Site Hours IAAAP F.S. Data Collection 12.0 Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe Bright Sun Clear Overcast Rain Snow × Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 85 up Project No. Temp To 32 32-50 50-70 70-85 X 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High X Contract No. DACA45-96-D-0017, DO 65 Humidity DACA45-02-D-0003, DO 10 Dry Moderate Humid DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: cos 15
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: None
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, R <del>yan Carpenter.</del>
Field Monte Destance of the hydrone consults as
Field Work Performed (including sampling):
L9-MWII - Origed to 30.0 feat BGS with CME-75 and 44 ID HSDS
17. MW 11 - Installed Smaller fill well from 15.0 - 30.0' feet BOS.
19-MWII - Used O gallors of water during well installation.
EBP AWS Drilled and Jamphel for to feel Bos with Cooker and 6 & ID 11505
EBP. M WS - Drilled from 12.0 to 60.0 feet BGs in bedock with Guslech and 6" AR
EBP-MW 5 - Installed Shallow Grand-ator (untertaile) well in bedrock from 35-45' BGS.
EDP-MW5 - Used & gallow of nater during hall installation.
Quality Control Activities (including field calibration): (Albertia Creek of PID +FID
Quality Control Floor Incidenting field Campitation): CAT (Dia 14 CA)
Health and Safety and Activities: Had S min 1445 methy
140 400
Observations/Problems Encountered/Corrective Action Taken: Over dulled parties of the baring
Observations/Problems Encountered/Corrective Action Taken: Over drilled partial of the baring was backfilled with Pulets (acc EDP-MWS) constraint diagram for defails)
Dann More noticed rollets missing and the URS gordon Cut missing.
Office Work Performed:
_// ^/
By / xu fn/r Title Field Manager

#### DAILY QUALITY 3-29-03 Date CONTROL REPORT F TH Day · M 12.5 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast X Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 Project No. X 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High X DACA45-96-D-0017, DO 65 Contract No. 54 DACA45-02-D-0003, DO 10 Humid Humidity Drv Moderate DACA45-02-D-0003, DO 16 Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Equipment on Site: Drilling Rigs (Mobile 37 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visitors on Site: Dean with Stone + webster + Backhie **URS Personnel on Site:** Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Field Work Performed (including sampling): La-MW 1- Drilled belleger and sapked to 70' BGS with CME-75 and 44 HSAS. La-Mu Al- Installed intermediale till well from 550 - 650 fl. BGS. 19-MWDI- Collected Geotech Sumples from 65.5 to 66.5 and TOC from 67' (19-MWD-67) 19-MWDI- Bailed well and removed sedimmt and 8.0 gallensonates. 19-MWD - USE 40.0 gallens of muter were used to install Well. Quality Control Activities (including field calibration): Calibration Charles PID+FID FID pump stopped nurkity over so the unit was recollibrated and storted marking ordued 20 more FID'S 5min H+ Smooting **Health and Safety and Activities:** Had Observations/Problems Encountered/Corrective Action Taken: The Gos Path Rig & got stack mostly of of EBP-MW 5 44 0830, Dear with State writing with backness at 1600 hrs. Mike Soulemen went to hotel at 12:30 for the day . Becurity took report on thest of My Office Work Performed: DADONAK

Title Field Manager

By perphylers

## **DAILY QUALITY**

**CONTROL REPORT** F W S Day · M Т TH 12.5 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Rain Snow X **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 32-50 Project No. Temp To 32 70-85 85 up 50-70  $\rightarrow$ 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High > Contract No. DACA45-96-D-0017, DO 65 55 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 ャ

Date

3-30.03

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
inga prossure waster, water revers, son sampling equipment (2 to 3 spin specims), 11 b, paper work.
Visitors on Site: None
<u> </u>
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter.
Field Work Performed (including sampling):
L9-MW10 - Drilled and Sampled from \$10 65.0 Bus with CME-75 and 41 "ID HSAI  L9-MW10 - Collected Goodeen Sumples from 15.5 16.5, 23.5-24.5, 50.5-51.5, 58-58.5  and TOC Sumples L9-MW 10-17, -25, -52, -59.  L9-MW10-Installed internediat Till well from \$1.5 - 61.5 bgs.
19-Mm10 - Collected Genteen Sumples from 15.5 16.5, 23.5-24.5, 50.5-51.5, 58-58.5
and TOC Su-ples L9-MW 10-17, -25, -52, -59
69 -MW10 - In stallow internation Tail well from 51.5 - 61.5' bgs.
19-MW10 - USEA 45 gallons of water during installation of well.  FTP-MW8(B) - Drilled to 27.7 'BGS with Gus Peen and 10" RWB (rock artad')  FTP-MW8(B) - Installat and grated 6" Steel casing From \$p\$ to 27.7 'bgs.
FTP-MWB(B) - Prilled to 27.7 BGS with Gus Peen and 10" RWB (rock article)
PTP-MWB(B) - Installed and gratted 6" Steel casing from \$10 27.7" bgs.
Quality Control Activities (including field calibration): (a) barks chark of PID+ FIO.
Health and Safety and Activities: Hud Smin Has meeting
Observations/Problems Encountered/Corrective Action Taken: Monc
Office Mork Desfermed
Office Work Performed: paper-one, 30400 Siperal Sheet, Gosten Login, Development Reserved.
By / pur Pries Title Field Manager
By flee Fleid Wallager
lacktriangle

### DAILY QUALITY 3-31-03 Date CONTROL REPORT F S Т w TH Day ·M On Site Hours 12.0 IAAAP F.S. Data Collection Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe Bright Sun Clear Overcast Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up Project No. 16169503.00101, 16169556.00101 X Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High × DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 56 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 X Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Equipment on Site: Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visitors on Site: None. **URS Personnel on Site:** Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Field Work Performed (including sampling): WBP-MWZ- Drilled and Sompetto 7.4' BGS of 10" RUD and Guspech Rig (TOP OF ROCK) WOP-MUZ- Drilled from 7.4 to 18.0 w/ Guspeen Rig and 104RUD (Badock) WAR-MU 2. Frylly and grouted 6" Steel casing. from \$ to 18.0' bgs. 49-Mary - Prilled to 28' with CMF-75 + 4';" IO 14A' (9-MW9 Instalch formation shallowtill well from 13.5-27,5' BW 19-MW 6 - Driller and Som Plead to 61.0 BGS with CME-75+ 42 "IDHSAS 14 - Mu (6 - Collected geoteen samples at 10.5-11.5, 18.0-19.5, 50.5-51.5, 58.5-59.5 and 70 C Simpley L9-MW 6-12, -20, -52, -60 - Installed well screen 50-(10 (100), 20) allow Quality Control Activities (including field calibration): (alibratum Creck of PID + FIF Health and Safety and Activities: 14ad 5 min 4.5 meeting, Discussor Fleon 113 Issues -/ driller at WBPA Observations/Problems Encountered/Corrective Action Taken: Discussed IDW disposal with Dean (Stane & newster) identified the Debra Wallin and Dean at Trenco. Cutting disposel Office Work Performed: paperwork

Title Field Manager

By Jon Brillon

4-1-03 Date **CONTROL REPORT** Day Ś M w TH F ' S IAAAP F.S. Data Collection On Site Hours 13.0 Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow X **Project** Iowa Army Ammunition Plant Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 X 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High × Contract No. DACA45-96-D-0017, DO 65 57 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: CONE 15
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: None
)- <b>(</b> )\(\)
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter.
Corty 12101001, 2410 201801, 11110 Contonium, Nymi Curpontor.
Field Work Performed (including sampling):
L9-MW5- Drilled to 25' with CME-75 14t # DKAS
L9-MWS - Institut analog till well from 100-25.0' BGS
L9. MWS - Used & gallons of weather during well installation.
L9-MUH + Drilled and sampled to 65' Bas with CME-75 +46 ID Habs
19. MW4 - Collected gesteen 30-ply ort 10.5-11.5, 26.0.26.5, and contrasts sumple
with CME sample and lijes, retained and capped all lines. Offered TX
19-MW 4 - Installed intermedial till hell from 54.8 to 64.8'865
19-MW 9 = 1364 of all of mater of soil is all thing
WBP-MWI - Prilkham sampled from of to 600 feet BG with 10 RWB + Gestan (Till overlanden) GUES
WBP-MWI - Drikkann Sampled from & to Got feet Bes with 10th RWB + Gestan (Till overlanden) (OVER Quality Control Activities (including field calibration): Calibration of Both FIDS and PID
Health and Safety and Activities: Had Smin Has meeting
·
Observations/Drablems Engage toward/Comments and Action Tales
Observations/Problems Encountered/Corrective Action Taken: μος ℓ
Office Work Performed: paperory
Onice work renormed. Dapo var-
By / rent Mers Title Field Manager
-3 / Day From Title Hillinger

Date 4-1-03 Report No. 57

UBP-MUI - Drilled from 60 to 17.0' feet logs with Gus Pech +10'RWB (Dehack)

UBP-MUI - Installed and growted 6" Steel casing from \$23.0' feet Bos.

UBP-MUS - Brilled and Sumpled from \$1 to 15.0' feet Bos ~1 Gus pren + 10"RWB (Tujaurburgen)

Ein)

4-2-03 Date **CONTROL REPORT** Day S ·M T w TH F S × 7.0 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time Weather Bright Sun COE Project Manager Al Kam/Kevin Howe Clear Overcast Snow × **Iowa Army Ammunition Plant Project** 50-70 16169421.00201, 16169421.00301 32-50 70-85 Project No. Temp To 32 85 up X 16169503.00101, 16169556.00101 Report No. Wind 16169556.00201, 16169556.00302 Still Moderate High Contract No. DACA45-96-D-0017, DO 65 58 DACA45-02-D-0003, DO 10 Humidity Moderate Dry Humid X DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: (me-75
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: None
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carponter.
Field Work Performed (including sampling):
L9. MW3 - Drulled to 29.5 Feet Oct with (ME-75 and 45 TOHSAS.
19. MW3 - I notalled well seem from 14.0 - 29.0 Feet B65.
WBP. MW3 - Used B galloni of neutro during installation WBP. MW3 - Drilled from 15.0'BGS to 23.0'BGS with Compact 10" RWB (FIL/IN outlooks)
WBP. MW 3 - DAILOT FROM 13.0' BGS to 23.0 BGS WITH GUIROST 10" RUB (FIT/IN DUPLING)
WBP. Mu3 - Orllen from 23.0 to 29.0 'BOS wim (asteen + 10" RWB (Belnek)
WBP-MU3 - Installed and growted G" speel casing from & to 29.01 BGS.
Quality Control Activities (including field calibration): (alibration cheese PDD+PID
Quality Collitor Activities (incliding neid campration). [NIDINAM CHORS 1920 127
Health and Safety and Activities: Had Smn 17+5 meeting
Health and Safety and Activities: How Smin 17+5 meeting
Observations/Problems Encountered/Corrective Action Taken: None
Observations// Toblettis Encountered/Corrective Action Taken. 70010
Office Work Performed:_ vapemen
Onice Work Tonicinica.
By green mills Title Field Manager
- John Williams

DAILY QUA	ALITY	Date	4-7-0>														
CONTROL	Day	S	·M	Т	W	TH	F	S									
IAAAP F.S. Data Coll	ection	On Site H Travel Tir Office Tin	ne		7.0												
COE Project Manager	Al Kam/Kevin Howe	Weather	Bright Sun		Clear	Ove	rcast	Rain	Snow								
Project	Iowa Army Ammunition Plant					;	×	<b>&gt;</b>	×								
Project No.	16169421.00201, 16169421.00301	Temp	To 32		To 32		To 32		To 32		To 32	32 32-50	32-50	50-70	-70	70-85	85 up
•	16169503.00101, 16169556.00101				$ \times $												
	16169556.00201, 16169556.00302	Wind	Still Moderate High Rep				Repo	rt No									
Contract No.	DACA45-96-D-0017, DO 65	<del></del>		<b>\</b>	<												
	DACA45-02-D-0003, DO 10	— Humidity			mid	59											
	DACA45-02-D-0003, DO 16					×											
<u>Subcontractors on S</u>	Site:					· 											
1 1 11 T T T T		1															

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: CME-25
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: Nonc
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Brian Osburn (Storten Deuthonert)
Field Work Performed (including sampling):
L9-MW2 - Prilled and sumpled from of to 35' BGS with (ME75 and 41" TDASAS (TIL)
WBP-SBOI - Driller and sampled From Q - 9.0' BGS with Mobile 57 am 44 "to HED (TOPEREN
49. MW 13 - Developed out 14.0 gallen with Boiling and pumping
L9-MW6 - Bented 3.0 = akuns of rester
49-MW6 - Bented 3.0 = 716ms of -476m 69-MW2 - Collected geodern Sumpts 12.5-13.5, 18.5-19.5, 35.5-30.5 + Toc samples 14, 120, -37.
NBP-3BOI - Collected geotech Sample 2.9-3.5' bos.
Quality Control Activities (including field calibration): Calibration check of PIOs, FIDs, Jurbially meter, Hurling U-10 mater quality meter.
Health and Safety and Activities: Had surely meeting with Brian astorn + Head Smith Hiss miching with ability and crew
Observations/Problems Encountered/Corrective Action Taken:
Office Work Performed: paperook
By Grafonder Title Field Manager

DAILY QUA	ALITY	Date	4,8.03						
CONTROL REPORT		Day	S	-М	T X	W TH	F	S	
IAAAP F.S. Data Coll	On Site Hours 12.5								
	Travel Tir	ne							
		Office Tin	ne			•		,	
COE Project Manager	Al Kam/Kevin Howe	Weather	Bright Sun		Clear	Overcast	Rain	n Snow	
Project	Iowa Army Ammunition Plant				l I	X			
Project No.	16169421.00201, 16169421.00301	Temp	To 32		32-50	50-70	70-85	85 up	
	16169503.00101, 16169556.00101								
	16169556.00201, 16169556.00302	Wind	Still	Mod	lerate	High	Repo	rt No	
Contract No.	DACA45-96-D-0017, DO 65		_   X						
	DACA45-02-D-0003, DO 10	Humidity	Dry	Moderate		Humid	7 6	60	
	DACA45-02-D-0003, DO 16				<i>X</i>				
Subcontractors on S	Site:								
Aquadrill - Jay Joslyn, Der	nnis Auld, Danny Moore, Scott Elsinger, Mark Cl	laassen							
						·· · · · · · · · · · · · · · · · · · ·			

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: Mad with AD utility lowe service
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Brian 050007
Field Work Performed (including sampling):
MBP-SBD) - (ared from 88' 1-50.2' Bb and marted hile
MBP-SBO) - (oren for 8.8' to 50.2' BB and grated hale L9-MWZ - Driller and sumpled for 35' to 100.0 BGS with CME-75 & 44 "IDEAS (TH)
L9-MWD - USEN 350 collars xweller derive in chellerton
La-Must - Installed well secreta from 94.0 to 99.0 Feet 1865, send to control
19-MV2 - Collected creates and 50 5-51,5 65,5-50,5 10 5-66,5, 88.6-89.3.
970-976 976-983 + 706 Sungles 19-19-50 -57 -62
19-MWB -completed levelsoment
L9-MWZ - Used 35.0 gallors two ten during in stallation  L9-MWZ - Installed well served from 94.0 to 99.0 feet Blos, send to gruted.  L9-MWZ - Collected geoties sumples of 50.5-51.5, 55.5-50.5, 60.5-60.5, 88.6-89.3,  970-97.6, 97.6-98.3 + 70l Sumples L9-MWZ-50, -57, -62  L9-MWZ - Completed development  L9-MWZ - Completed development.
Quality Control Activities (including field calibration): (4), Seafon creck of PID, FID, Hu-10+U-D
Health and Safety and Activities: Had Smin H+3 meeting
Observations/Dushlems Enseysters (Corrective Action Taken)
Observations/Problems Encountered/Corrective Action Taken: MonC
Office Work Performed:
Onice Front Griefman. Va Jowet
A A 1
By Title Field Manager
Con hilling

DAILY QUA	ALIIY	Date	4-9-03						
CONTROL REPORT		Day	S	·M	Т	w ×	TH	F	S
AAAP F.S. Data Co	llection	On Site Ho Travel Tir Office Tin	vel Time —						
COE Project Manage	r Al Kam/Kevin Howe	Weather	Bright Sun		Clear	Overcast		Rain	Snow
Project	Iowa Army Ammunition Plant			Υ	$ \times $				
Project No.	16169421.00201, 16169421.00301	Temp	To 32		32-50	50	50-70	70-85	85 up
	16169503.00101, 16169556.00101				X				
	16169556.00201, 16169556.00302	Wind	Still	Mod	derate	H	gh	Repo	rt No
Contract No.	DACA45-96-D-0017, DO 65			. <b>&gt;</b>	-				
	DACA45-02-D-0003, DO 10	Humidity	dity Dry Mod		derate Humid		mid	6	51
	DACA45-02-D-0003, DO 16								

Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen  Equipment on Site:
Equipment on Site:
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1909AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: New
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Bring Osboro
Field Work Performed (including sampling):
L2-MW4- Dilled and Sampled from \$ to 35' BB' with CME-75+ 4; "IO HSAS L2-MW4- Collected geotech samples from 24.4-25.0 +34.5-25.0 +700 L2-MW4-42+90 WBP-MW) - Cored and Regimed (U"Rober Bit) from 22.9 to 46.2 with BTV MOILS 7 +2"N Core
L2. MWY - Collected geotech sumply from 24.4-25.0 +34.5-350 +70c 47 MWY-42+50
WBP-MW) - Cored any Regney (U"Rolle Bit) from 22.9 to 46.2 -in BTV 150ile 57 + 2"N Core
mad 6 Rolls bit.
WBP-MW 1- Inshilled will below from 35-45 1065 + set Pockethill coming after growing.
WBP-MWI - Used 27.0 gallons of water during install
L9-MU 12,-MW3,-MW4" - Completed development.
my 6' Roler bit.  WBP-MW 1- Inshilled well Scien from 35-45' BGS + set Peckettive coming after grading.  WBP-MW 1 - Used 270 gallons of noter during install  L9-MW 12,-MW3,-MW4 - Completed development.  L9-MW 11 - Contilled development.
Quality Control Activities (including field calibration): (Alibratus cneck of PID, FID, Harba 6-10
Health and Safety and Activities: Had Smin 14-15 meeting
<b>)</b>
Observations/Problems Encountered/Corrective Action Taken: None
Office Work Performed: proposition
// 11
By Title Field Manager

## DAILY QUALITY CONTROL REPORT

On Site Hours IAAAP F.S. Data Collection Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Snow Clear Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp To 32 50-70 70-85 85 up Project No. 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High DACA45-96-D-0017, DO 65 Contract No. **63** Møderate Humid DACA45-02-D-0003, DO 10 Humidity Dry DACA45-02-D-0003, DO 16 Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Equipment on Site: CME -75 Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visito<u>rs on Site:</u> مرمر **URS Personnel on Site:** Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Brian Osborn Field Work Performed (including sampling): LAZ-MW4- Drilled and Sampled To 50.0'BGS with CME-75; 41/4"ID HSAs; geotech samples from 40.5-41.5; 48.5-495-475', TOC Samples LZ-MW4-4Z, -50; used 1.5 gallons of waterdwing installation, Installed well screened from 40-56'865 L9-mw9 L9-mw11 - Completed development 19-MW6, 19-MW1, 19-MW10- continued development 49-muz, 49-muy, 69-muy - began well completions
ubf-mwz - cored from 18-41'BBS. Learned with 6"tricone to 40.9! Installed well screen 30.5-405! WBP-MWI - Began development Quality Control Activities (including field calibration): Calibration check of PID: FID . Horiba U-10 Health and Safety and Activities: Had 5 min. HiS meetings Observations/Problems Encountered/Corrective Action Taken: No. Office Work Performed: paperwork Gcologist Title Field Manager

Date

Day

4-10-03

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Date 4-11-03 **CONTROL REPORT** S. Day S ·M T W TH On Site Hours 11.5 **IAAAP F.S. Data Collection** Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Snow Clear Overcast Rain X **Iowa Army Ammunition Plant Project** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 6# DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: CME-75
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
<u>Visitors on Site: ผลง</u>
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter: Brian Osborn
Field Work Performed (including sampling):
62-63-mw2-Drilled and sampled T050'865 with CME-75:4'14" IO H3A3; geotech samples from: 7.0-8.0, 10.0-11.5 16.2-16.7,27.0-28.0,30.0-33.0,39.5-40.0,40.5-41.5, 43.5-44.0,49.0-49.5, T0 < Samples at 42:50;
16.2-16.7,27.0-28.0,30.0-33.0,39.5-40.0,40.5-41.5, 43.5-44.0,49.0-49.5 TOC Samples at 42 & 50;
Tastalled well screened from 49.7-39.7863
L3-MWI - Drilled and sampled to 37'665 with CME-75: 41/4"ID HSA's geotech samples from: 7.0-8.0 11.8-11.8,  18.2-16.7, 20.5-21.5, 35.5-36.5 & TOC at 22 + 37 605.  L9-MWI, L9-MW6, L9-MWIO - Continued development / L9-MWZ - Began development
18,2-16,7,20,5-21.5,35,5-36,5 + TOC at 22+37 Bob.
L9-mw1, L9-mw6, L9-mw10 - Continued development /L9-mwz-Began development
L9-MW'S 5,6,11,12,13,3,49 - Well completions WBP-MW3- Cored from 29.0- Edg. Instayed well screened from 40,5-50,8
WBP-MW3- Cored from 29.0- Eag! Instanced well screened from 40,5-50,8
Quality Control Activities (including field calibration): Calbridge of F10; P10; Hariba U10
Health and Safety and Activities: Held 5 min HiS meetings
· · · · · · · · · · · · · · · · · · ·
Observations/Problems Encountered/Corrective Action Taken:
Horiba U-10 ceased operation
Office Work Performed: paperwork
•
By Della Title Field Manager
By July Title Field Manager

## **DAILY QUALITY CONTROL REPORT**

CONTROL	REPORT	Day	S	·М	T W TH F				
IAAAP F.S. Data Colle	ection	On Site Hours Travel Time Office Time							
COE Project Manager		Weather		nt Sun	Clear	Ove	rcast	Rain	Snow
Project No.	Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	To	To 32 3			-70 <b>/</b>	70-85	85 up
Contract No.	16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Wind Humidity	Still	_X	lerate lerate	Н	Humid 65		
Equipment on Site:	nnis Auld, Danny Moore, Scott Elsinger, Mark Claas		D!! Pr 6!!	, DWD	I IDC to	avoles v	wall mo	tariols	
PIDs, FIDs, Freon detector	the Gus Pecir 1000AR) and support trucks, 4.25" & 6.6 (c, turbidity meters, water tanks, development equipment equipment (2" & 3" split spoots.	ent (Grundfos, ba	ailers, v						nt,
Field Work Performe  L3-mw1 - Drilled  10.5-41.5  wellscre  L9-mw1, L9-mw10, L  L9-mw2, WBP-mw  L9-mw1, L9-mw2	ite:  rger, Mike Sonderman, Ryan Carpenter. Brian Cond (including sampling):  and sampled To 55 BGS with CME-15', 48.5-49.5', 51.5-52.0', 54.2-56  encd from 55.7-245.7'  9-mw6, FTP-mw1 - Completed develop  22(A)-Continued development  19-mw4, 19-mw10 - Continued well  24 from 23.0 - 75.6'. Installed well seed from 23.0 - 75.6'. Installed well seed	75:4/4"ID 4.7; FOC SO ment Completions				, SQ.	mple j·En	s from	n: led
Quality Control Activ	rities (including field calibration): مده	ibroted Fl	D, P	ι <b>D</b> , ς` ι	Horib	a U-	-10		
Health and Safety an	d Activities: 5 minute His meeting	3							
	ms Encountered/Corrective Action Take and dwing installation of L3-MWI. Removed to a paperwork.		edril	led(c	lean	ا (اعد	o eri	g <del>m</del> d	
		By De	y .	,		Title_	()eo Field	logis Manag	Ter

Date

DAILY QUA	LITY	Date			4/13/03				
CONTROL REPORT		Day	×	·M	Т	W	TH	F	S
IAAAP F.S. Data Coll	ection	On Site H Travel Tir Office Tir	me		/0.0 				
COE Project Manager	Al Kam/Kevin Howe	Weather	Bright Sun		Clear	Ove	ercast	Rain	Snow
Project	Iowa Army Ammunition Plant	<del></del>	<b>&gt;</b>	<b>&lt;</b>					
Project No.	16169421.00201, 16169421.00301	Temp	To 32		32-50	50	50-70	70-85	85 up
•	16169503.00101, 16169556.00101						×		
	16169556.00201, 16169556.00302	Wind	Still	Moderate High		igh	Report No		
Contract No.	DACA45-96-D-0017, DO 65	· · ·		>			_		5
	DACA45-02-D-0003, DO 10	Humidity	Humidity Dry Mo		oderate Humid		mid	7 6€	
	DACA45-02-D-0003, DO 16			X					<i>F.</i> .'
Subcontractors on S	***************************************								
Aquadrili - Jay Josiyn, Dei	nnis Auld, Danny Moore, Scott Elsinger, Mark Cl	iaassen							

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: (AE-75
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: None
URS Personnel on Site:
Gorcy Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter, Brian Osborn
Field Work Performed (including sampling):
FTP-MWH(B) - Drilled and sampled To 27 with CME-75; 41/4 IDHSAs; geotech samples collected from 25.5-26.5; 15.5-16.5; TOC samples collected at 17; 26; Rotary wash bord To 37'BGS. Set and grouted 6" Steel casing at 37'BGS (user 7; bit to fleen hole)
from 25.5-26.5 : 15.5-16.5, TOC samples collected at 17:26; Rotary wash bord To
37'BGS. Set and grouted 6" Steel casing at 37'BGS (user 7 = bit to fleen hote)
L3-MWI - Finish Completion
L3-mwz, WBP-mw3(B)-Began development
WBP-MWI(A) WBP-MWZ(B), L9-MWJ-Continued development
FTP-MW6(B)-Cored from 24.6-50.0'
Quality Control Activities (including field calibration): Calibrated FID; PID; Horiba 4-10
Health and Safety and Activities: 5 minute His meetings
Observations/Problems Encountered/Corrective Action Taken:
Off. W. J. D. J
Office Work Performed: Paperwork
By Do Character Title Field Manager
By By Title Field Manager

### **DAILY QUALITY** 4-14.03 Date **CONTROL REPORT** Т F S $\mathbf{W}^{\cdot}$ TH Day S M 12.0 On Site Hours **IAAAP F.S. Data Collection Travel Time** Office Time

Weather COE Project Manager Al Kam/Kevin Howe Bright Sun Snow Clear Overcast Rain **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 70-85 85 up Project No. Temp To 32 32-50 50-70 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High X DACA45-96-D-0017, DO 65 Contract No. 676 Humidity Dry Humid Moderate

DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: CME-15
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: None
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter.
Field Work Performed (including sampling):
PTP - MW6(B) - Romal wickle with DRU+ 6"AR from 24,5' to 45' bgs, set well  Screen from 35.8'- 45.8' BGS.  FTP: MW5 - Drilled and Sampled to 15' with ORU + 4th TD HSAS, collected  geo teen sumples from 0.2-1.2, 5.4-6.4, 11-0-12.0, 12.0-14.4 +  TOC Sample from FTP-MUS-11, Installed screen (5') from 9.4'-14.4' bgs  L2-MW5 - Drilledand sumpled with (ME-75 + 4th TD HSAS from & to 51' bgs, collected
Screen from 35.8'-45.8' BGS.
FTP: MWS - Drilled and Sampled to 15' with ORU + 4; "ID HSAS, collected
gesteen surples from 0.2-1.2, 5.4-6.4, 11-0-12.0, 12:0-14.4+
TOC Sample from FTP-MUS-11, Installed Screen (5') from 9.4'-14.4' bys
L2-MW5 - Prilluland sumpled with (ME-75 - # TDHSAS from & to 51' bys, collected
geotich Sumples from 11-12, 24-24.5, 34-35, 36.2-37.2, 40.5-41.5, 44-45, 48-50.
geotich Su-plus from 11-12, 24-24.5, 34-35, 36.2-37.2, 40.5-41.5, 44-45, 48-50.  Inshilled well gircen from 40.5'-50.5'. Collected TOC Su-pk FTP-MUS-42.
Continued development at WBP.MW 1; MWZ, - MWZ, EBP-MWZ, + L9-MWZ. Stephen Development at EBP-MWG, L3-MWI, L3-MWY
Quality Control Activities (including field calibration): (11.6 mm creck of PID, FID, 160-64 U-10
Health and Safety and Activities: Had Smin Has meeting
Observations/Problems Encountered/Corrective Action Taken: אמש
Observations/Problems Encountered/Corrective Action Taken:
Office Work Performed:
$A \cap A$
By men onles Title Field Manager
<b>~</b> 1

Date 4-14-03 Report No. 66

FTP-MW2 - Driller and Surpled From DI - 7.2 w ORU + 65 "IDHSAS to lopor booker, collected geoleen simple at 6.0-7.0' bgs, Collected Tell simple FTP-MW2-07

### **DAILY QUALITY** 4-15-03 Date **CONTROL REPORT** S M T W TH F · S Day On Site Hours 12.0 **IAAAP F.S. Data Collection** Travel Time Office Time Snow

COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Rain Clear X **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 Temp 32-50 Project No. To 32 50-70 X 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Report No. Moderate High X DACA45-96-D-0017, DO 65 Contract No. 687 Humidity DACA45-02-D-0003, DO 10 Dry Moderate Humid DACA45-02-D-0003, DO 16 X

Subcontractors on Site:	
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen	
Equipment on Site:	
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RW	
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water	quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.	
Visitors on Site: Nonc	
URS Personnel on Site:	
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. By Good	
Field Work Performed (including sampling):	
L2-MW7 - Dilled and Scaped to 50.0' bys with CME-75+ 46" FE from 39.5.49.5' bys, used 5.0 gallor of uniter during 1'r acotech surples 9+ 10.0-11.0, 180-19.0, 40.0-41.0, 48.5-49.5.  (dected Tix surples L2-MW7-11, -17, -41, -50.  E3FTP-MW2 - Drilled from 7.2 - 17.4 with 6" (RW), 3ch wells	HSAS, installed wellstoren
from 39.5.49.5' bys, used 5.0 gallow of water during in	1stalkation, collected
acotech Surples 9+ 10.0-11.0, 18.0-19.0, 40.0-41.0, 48.5-49.5	Entre bering in lines
Collected TOL Sumples L2-MW7-11,-17,-41,-50.	
ESFTP-MWZ - Driller from 7.2 - 17.4 with 6" ARWA, sen wells	crec for 6.9-16.4 by
used 6 opplies of moter during his hollowing	
FTP-MW3 - Driller one surper from \$ 10 5.8 bgs with ORV+ 68" ID	HSAS, instructed
gestech simply + 4.0-5.0' bys. Collected TOL FTP-MW3	-Ob, Briller from 5.8 to
21.0' beswith 6"AR, sexual from 10.5 - 20.3' bas, men	8 gollow of muter drives intell (
gestech snow at 4.0-5.0' bgs. Collected TOL FTP-Mu3 21.0' bes with 6"AR sequely from 10.5" bgs., ssed a Quality Control Activities (including field calibration): Calibration check of PI	D, FID, Hor. 6 UIO
Health and Safety and Activities: 5 min H+ Sniching	
Observations/Problems Encountered/Corrective Action Taken: None	
Office Work Performed: paperor	
$A_{-1}$	·····
By perforton	Title Field Manager

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Report No. \_\_\_ 67

Finished development of WBP-MWZ, EBP-MWS Continuen development at L9-MWZ, WBP-MWI, EBP-MWG

010. 12-MUG - Drilled with (ME-75+ 44 IDHSAS. to 20.5, installed will screen from 9.9-19.9' bgs, used of 5-1000 or orter.

DAILY QUA	LITY	Date	4-1603						
CONTROL	REPORT	Day	S M T W TH F						Ş
IAAAP F.S. Data Colle	ection	On Site H Travel Tir Office Tin	ne		8.5				
COE Project Manager	Al Kam/Kevin Howe	Weather	ther Bright Sun Clear (				rcast Rain		Snow
Project	Iowa Army Ammunition Plant					_ >	~	$ \lambda $	
Project No.	16169421.00201, 16169421.00301	Temp	To	32 32-50		50-70		70-85	85 up
	16169503.00101, 16169556.00101				<del> </del>				
	16169556.00201, 16169556.00302	Wind	Still	Mod	derate	Hi	gh	Repo	rt No
Contract No.	DACA45-96-D-0017, DO 65	-		>	×			_	
	DACA45-02-D-0003, DO 10	Humidity	* 1 * 1					6 <b>8</b>	
	DACA45-02-D-0003, DO 16					ゞ			

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: CAS-75
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
<u>Visitors on Site:</u> Dean with Stancewebster installed colvertat La-AW8(B)
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter Sum Colom
Coto) Interestin, Dave Berger, Mike Senderman, Nyaman Berger
Field Work Performed (including sampling):
FTP-MUT - Drillerand sampled to 21,5' bgs -it (ME-75 + 4\$"IDITSAS, Collected geotech samples at 9,5-10.5 18.5-19.5 + 20.8-21.5, TOC samples at FTP-MUT-11' - 20', it's taylor well screen from 11-0-21.0' bgs,
Collected acotech samples at 9,5-10.5 18.5-19.5+ 20.8-21.5, 70C
Smalls at FTP-MW7- 11' - 20', it's taylor well screen from 11-0-21.0' bgs
Used & dallow o-autor asimi installation
Storted development at FTP-MUS+6
Started development at 'FTP-MN5+6
Continue development at wBP-MWI + EBP-MW6
Completed development at L2-MW5
Tristalky Culustat La-MwD(B) - her (0-15.
Quality Control Activities (including field calibration): (a) on the creek of PIO, FIO, Ibrim U-10
Health and Cafety and Astinting Carry Name
Health and Safety and Activities: 5 Min Has neeting
<u> </u>
Observations/Problems Encountered/Corrective Action Taken: Josfall Colvet in small
diken west of Brush creek new Line 3 for occess to 6-15.
Office Work Performed:
part
7 1.
By / gre/hhl/ Title Field Manager

## **CONTROL REPORT** S Т w TH F S Day ·M 7.0 On Site Hours IAAAP F.S. Data Collection Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Rain Snow Overcast **Iowa Army Ammunition Plant Project** Project No. 16169421.00201, 16169421.00301 32-50 85 up Temp To 32 50-70 70-85 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Moderate High Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 Humidity Humid Dry Moderate DACA45-02-D-0003, DO 16 X Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Equipment on Site: Equipment on Site: Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visitors on Site: NONE **URS Personnel on Site:** Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Field Work Performed (including sampling): EBP-MW4- Drilled and sampled from Ø to 24.0' bgs with ORV-57 and (of IDHSAS (overbaden), dry corelect from 24.0 to 45.4 bgs with 2" N-series equipment. Collected gooden At 18.0 to 19.9' les. Started development at FTP-MWZ, FTP-MWZ, FTP-MWZ. Continued development at L9-MWZ, WBP-MWI, WBP-MWJ. Setup (MR at FTP-MW8 for car, regm, + well. Quality Control Activities (including field calibration): (aliberta PID, FID, waterpulity probe Horriba U-10), Turbidity Meter, Health and Safety and Activities: 5 min 4+5 meeting, discussed hunting source and orange vest. Observations/Problems Encountered/Corrective Action Taken: After Solays & 9- Mwd has recountered 70' bgs - 30' of wester in uses, and WBP-MU3 thus reconssed up to 45 bgs - 6.0 'or unterin well. Office Work Performed: paper work

DAILY QUALITY

Title Field Manager

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4-21-03

Date

DAIL I WUF	ALII I	Date	9-22-03						
CONTROL	REPORT	Day	S	•М	T ×	W	TH	F	S
IAAAP F.S. Data Coll	ection	On Site H Travel Tir Office Tir	ne		11.5				
COE Project Manager	Al Kam/Kevin Howe	Weather	Brigh	ıt Sün	Clear	Ove	rcast	Rain	Snow
Project	Iowa Army Ammunition Plant		•	<u> </u>	J				
Project No.	16169421.00201, 16169421.00301	Temp	To 32 32-50 50-70			70-85	85 սբ		
	16169503.00101, 16169556.00101				7	7	<u> </u>		
	16169556.00201, 16169556.00302	Wind	Still	Mod	derate	High		Repo	ort No
Contract No.	DACA45-96-D-0017, DO 65	. <u> </u>			` ≻				
	DACA45-02-D-0003, DO 10	Humidity	Dry	Mod	derate	Hu	mid	7	'O
	DACA45-02-D-0003, DO 16			7				<u> </u>	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: None
IIDS Dergannel on Sites
URS Personnel on Site: Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Brian Osborn
Corey Anderson, Dave Berger, Mike Sonderman, Ayan Camenter. 157 1017 055077
Field Work Performed (including sampling):
EBP-MW4 - Remen from 24.0 to 45.4' bys with DRV-57+ 6"AR, Installar well
6m 34.6 to 44.6
from 34.5 to \$4.5.  FTP-MW8- Cored from 27.7 to 52.2 with CME-75 and 2' N series are equipment.  Completed developmentat L2-MW6, L2-MW7, and FTP-MWS.  Continuedde urbpaent at L2-MW4, EBP-MW6.
Completes developmentat L2-MWG. L2-MW7 and ETP-MWS.
Continued de velocient at La-MWY, EBP-MWO
1
Located Sorting Creek Stoff Guser (SC-SG OI though 07)  Quality Control Activities (including field calibration): (alibrature Cyck of PID, FID, Having other
Quality Control Activities (including field calibration): (alibration chek of PID, FID, Horley orto
Turbidity meter.
Health and Safety and Activities: 5min 143 meeting
Observationa/Dyshlema Engavytavad/Compative Action Takens 4/ N 1 7 1 1 1
Observations/Problems Encountered/Corrective Action Taken: Acome Driller Day Joslyn Lecytons
Sitz at 1500 his to putup some mediculus and will notice back to the Sitz until 4-23-03
Office Work Performed: papuwk.
Onio Hone papewore.
1 1
By Josepher Title Field Manager

	Date	ate 7 8 3 0 5							
REPORT	Day	S	· М	Т	<b>∀</b>	тн	F	S	
ection	Travel Tir	ravel Time							
Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Bright Sun		Clear Overcas		rcast	Rain	Snow	
16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	To 32		32-50			70-85	85 up	
16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65	Wind	\ \ \ \ \		lerate	Hi	gh	Repo	Report No	
DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity			oderate H		umid		2	
	Al Kam/Kevin Howe  Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10	REPORT       Day         Section       On Site H       Travel Tin Office Tin         Al Kam/Kevin Howe       Weather         Iowa Army Ammunition Plant       16169421.00201, 16169421.00301       Temp         16169503.00101, 16169556.00101       16169556.00201, 16169556.00302       Wind         DACA45-96-D-0017, DO 65       DACA45-02-D-0003, DO 10       Humidity	Day   S   S   S	Al Kam/Kevin Howe       Weather       Bright Sun         16169421.00201, 16169421.00301       Temp       To 32         16169556.00201, 16169556.00302       Wind       Still       Moo         DACA45-96-D-0017, DO 65       Humidity       Dry       Moo         DACA45-02-D-0003, DO 10       Humidity       Dry       Moo	Day   S   M   T	Day   S   M   T   W	Day   S   M   T   W   TH	Day   S   M   T   W   TH   F	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
<u>Visitors on Site:</u> Guy Kuminski (AO Surty) extended Line 3 workpermit
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Brian OSban
Field Work Performed (including sampling):
FTP-MWB - Reunal with CNE-75 + 6"AR for 27.7-52.1, installar reliseren
from 41.1' to 51.1' bgs.  FTP-MU 4 - Cored with (MF-73 + 2" N-scries coretained from 37.5 to 60.7' bgs.  L9-MW 8 - Drilled and sampled to 60.0' bgs with ORV and 4"ID HSPs, collected  geotices at 11-11.5, 20.5-21.5, 50.5-51.5 + TOC sumpled at 19-MW8-12, -22,
FTP-MU 4 - Corcul with UMF-73 + 2" N-scries corebarrel from 37.5 to 60.7' bas.
L9-MW 8- Drilled and sumpled to 60.0' bas with ORV and 4"ID HSAs, collected
redict at 11-11.5, 20.5-21.5, 50.5-51.5 + TOC sunder at 19-AUB-12, -22.
L9-M47- Drilliand Swaped to 29.9' bgs with ORU + 4"IDHSB1, collected geotion at 27.5-28.5 + Tol GI L9-M47-29, Instituted well screen for 14.4' to 29.4' bgs. Finited developmental L3-MW2, Continued at EBP-MWS, WDP-MWI, FIP-MW3, FIP-MW3, FIP-MW6, L3-MW1. Quality Control Activities (including field calibration): (21 brates of PID, PID, HUNDA V-10 FURNHAY)
at 27.5-28.5 + Tal at L9-MV7 - 29, Inshilly well screen for 14.4' to 29.4' bas
Finited developmental L3-MWZ, Continued at ESP-MWS, WOP-MWI, FIP-MWZ, FIP-MWZ, FIP-MWG, L3-MWI.
Quality Control Activities (including field calibration): ( ) bruton of PID, PID, Haribu U-10 Turbully
Health and Safety and Activities: 5min Has necting
<b>,</b>
Observations/Problems Encountered/Corrective Action Taken: None,
Office Work Performed: paperark
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By Title Field Manager

## DAILY QUALITY 4-24-03 Date CONTROL REPORT S TH F S Day ·M Т W On Site Hours 11.0 IAAAP F.S. Data Collection Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Rain Snow **Project** Iowa Army Ammunition Plant × Project No. 16169421.00201, 16169421.00301 Temp 32-50 50-70 70-85 85 up To 32 16169503.00101, 16169556.00101 × 16169556.00201, 16169556.00302 Wind Report No. Moderate High DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 7*3*2 Humidity Dry Humid Moderate DACA45-02-D-0003, DO 16 **Subcontractors on Site:** Dennii Aulu left sik at 3pm Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen **Equipment on Site:** Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. sitors on Site: Fire Department extended the Hot work permit to 5-1-0> Radger Allison & Melenic Mutchler (MKM) observed well dulling at L2-MW8(B) (FAMP) Visitors on Site: URS Personnel on Site: Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. By a Osboro Field Work Performed (including sampling): FTP-MW4 - Reamed with CME-75 + 6" Rook AR from 37.5 to 60.4 bas, instalker will screen from 49.4 to 59.41 bys. Continued development at La-MWZ, L3-MWI, FTP-MWZ, WBP-MWI, EBP-MWY, RAP-MUG Quality Control Activities (including field calibration): Calibrate PID, FID, Horiou U-10 Judoulty Smin H+Smeting Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Cleared at brush crown (3-15

Office Work Performed:

Title Field Manager

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DAILY QUA	LITY	Date	4-25-03						
CONTROL	REPORT	Day	S	·M	Т	w	ТН	F	S.
IAAAP F.S. Data Coll	ection	On Site H Travel Tir Office Tin	ne						
COE Project Manager Project	Al Kam/Kevin Howe Iowa Army Ammunition Plant	Weather	Brigh	nt Sun	Clear Overcast			Rain	Snow
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101	Temp	То	0 32 32-50 50-70				70-85	85 up
Contract No.	16169556.00201, 16169556.00302 DACA45-96-D-0017, DO 65	Wind	Still	Moderate High Repor					
	DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16	Humidity	umidity Dry Moderate		Hu	mid	7	¥3	
Subcontractors on S	Site:								

Subcontractors on Site:
Aquadrill - Jay Joslyn, <del>Donnis Auld,</del> Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site: CME-15
Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: Pan-
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Brian Osborn
Field Work Performed (including sampling):
FTP L2-MW8 - Set 6" cosing -in ORV to S&1 bgs.
Instalea SC-SGO)
(ompleted deuklopmentat FTP-MW)
Confirm development at La-MW], L3-MW, L3-MW, FTP-MWB, WAP-MWI
Quality Control Activities (including field calibration): (alibrate check of PID, FID, Note of Jurbidity
· · · · · · · · · · · · · · · · · · ·
Health and Safety and Activities: メール けっちゃくがら
Observations/Problems Encountered/Corrective Action Taken: 🔑 🛰
Office Work Performed:
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By By Title Field Manager

### **DAILY QUALITY** 4-26-03 Date CONTROL REPORT w Day S .M T TH F Ş 11.5 **IAAAP F.S. Data Collection** On Site Hours Travel Time Office Time

COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow **Iowa Army Ammunition Plant Project** 16169421.00201, 16169421.00301 Project No. Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16

Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen **Equipment on Site:** CME-15 Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visitors on Site: Nonc URS Personnel on Site: Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. Double Os bear Mike Sondoman Loftsite Field Work Performed (including sampling): L2-MUB- cond + Reamed with ORU + 2" Mesering + 6"RWP from 58.5 to 80.5, 585-81.9 Set well from 71.4-81.4' bgs
Frsklin S(-SG 02, SC-SG03, BC-SG01
Continued desclopment at L3-Mb1, FTP-Mb2, FTP-Mb9, FTP-Mb4. Quality Control Activities (including field calibration): Calibrator cack ce PED, FID, Hurba U-10, Mibility Health and Safety and Activities: Smit HOS meeting Observations/Problems Encountered/Corrective Action Taken: (completed all delling. Office Work Performed: \* \* Coperation of the Company of the Compan Title Field Manager

## DAILY QUALITY CONTROL REPORT Day S M T W TH F S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time Weather Reight Sur Clear Connect Reight Sur

		Office Tir	L						
COE Project Manager	Al Kam/Kevin Howe	Weather	Brigh	t Sun	Clear	Overcast	Rain	Snow	
Project	Iowa Army Ammunition Plant	<del></del>	×		$ \mathbf{x} $				
Project No.	16169421.00201, 16169421.00301	Temp	To	32	32-50	50-70	70-85	85 up	
	16169503.00101, 16169556.00101			l	1				
	16169556.00201, 16169556.00302	Wind	Still	Mode	rate	High	Repo	rt No.	
Contract No.	DACA45-96-D-0017, DO 65			×	<b>-</b> .				
	DACA45-02-D-0003, DO 10	Humidity	,Dry	Mode	rate	Humid	7 7	'B5	
	DACA45-02-D-0003, DO 16			ゞ					

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1006AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.
Visitors on Site: Nor
IIDS Paragnal on Sita
URS Personnel on Site:  Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. & Cim Oslando
Corey Anderson, Dave Berger, white Sonderman, Byan Curpenter. 13 (1600) 1000
Field Work Performed (including sampling):
FIELD WORK PERFORMED (Including sampling):  This tellist BC - SGOD
Competed touchambat ETE-MWZ ETE-MWZ E9-MWZ
Continues development at L9-MUT , 3-MUI, FTP-MUB FTP-MUB , WBP-MUY
FTP-MY, LD, MUS
Quality Control Activities (including field calibration): (a); with creck of PIO, FID, Horse UN Dichardy
Health and Safety and Activities: 5min 1485 weeking
Observations/Problems Encountered/Corrective Action Taken:
Office Work Performed: prompt
By Title Field Manager
By Title Field Manager

## DAILY QUALITY 4-28-03 Date **CONTROL REPORT** F Day S $\cdot M$ Т W TH S 13.0 On Site Hours **IAAAP F.S. Data Collection** Travel Time Office Time Weather COE Project Manager Al Kam/Kevin Howe **Bright Sun** Snow Overcast Rain Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Temp 32-50 50-70 85 up Project No. To 32 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High $\rightarrow$ Contract No. DACA45-96-D-0017, DO 65 7**7**6 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid X DACA45-02-D-0003, DO 16 Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Dennis Auld crosses at 12:00 Acon **Equipment on Site:** Equipment on Site: Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visitors on Site: **URS Personnel on Site:** Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. By Company Field Work Performed (including sampling): Installed BM at SC-SGOI, BC-SGOY Finished SG at several bectains Continued development at LJ-MWI, La-MWY, WOP-MWI, EBP-MWY, EBP-MWY, La-MWS Quality Control Activities (including field calibration): Calibration or PJO, Hunion Und, Juniolity Health and Safety and Activities: Smin 145 mehns Observations/Problems Encountered/Corrective Action Taken: ----Office Work Performed:

Title Field Manager

# DAILY QUALITY CONTROL REPORT Day S M T W TH F S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager, Al Kam/Keyin Howe

		Office Tir	Office Time				-				
COE Project Manager	Al Kam/Kevin Howe Weather		Bright Sun		Clear	Overcast	Rain	Snow			
Project	Iowa Army Ammunition Plant			İ		×	4				
Project No.	16169421.00201, 16169421.00301	 Temp	То	32	32-50	50-70	70-85	85 up			
	16169503.00101, 16169556.00101			ĺ		4		•			
	16169556.00201, 16169556.00302	Wind	Still	Mode	erate	High	Repo	rt No.			
Contract No.	DACA45-96-D-0017, DO 65			۲	<b>~</b>	J	_	-			
•	DACA45-02-D-0003, DO 10	Humidity	Dry	Mode	erate	Humid	17	'\$'			
	DACA45-02-D-0003, DO 16	<del></del>				8	Ι ΄	٣			
		<del></del>									

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen
Equipment on Site:
Drilling Rigs (Mobile 57 & Gus Pech 1006AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials,
PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment,
high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Compress + Rockdoll
Visitors on Site: Nonc
URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, Ryan Carpenter. 3000
Field Work Performed (including sampling):
In stated SC -SG05, 5(-SG04, 5(-SG07
I Thankled 18 M a L relieud will
Continued development at L9-MUD, WSP-MUJ, EBP-MUD, FTP-MUJ, La-MUS Continued development at L3-MUJ, EBP-MUY, WBP-MUJ.
Continued accompant of 13-Mul, EBP-MUY, WBP-MW3
Quality Control Activities (including field calibration): (alibrata crecket PID, FID, Harby U-10, Turbidat)
Health and Safety and Activities: Smin Hex methy
Observations/Problems Encountered/Corrective Action Taken: مصمر
Office Work Performed: property
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By Gun Title Field Manager
By Title Field Manager
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## **DAILY QUALITY** 4-30-03 Date **CONTROL REPORT** Day S $\cdot M$ T W TH F S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow Iowa Army Ammunition Plant **Project** X Project No. 16169421.00201, 16169421.00301 Temp 32-50 50-70 70-85 To 32 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Report No. Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 X DACA45-02-D-0003, DO 10 Humidity Humid Dry Moderate DACA45-02-D-0003, DO 16 Subcontractors on Site: Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Drilles are leaving the site **Equipment on Site:** Drilling Rigs (Mobile 57 & Sus Pech 1600AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Visitors on Site: **URS Personnel on Site:**

Corey Anderson, Dave Berger, Mike Sonderman, Byan Carpenter. Area o's large
Field Mark Derformed (including compling).
Field Work Performed (including sampling):
well drilling, development, completions, IDW, Decen is all completed - drilles
are leaving the site,
Finished developmental PTP-MW3, FTP-MW6, L3-MW
Measured Stream velocity and area out Brush Creek and K-Road.
•
Quality Control Activities (including field calibration): ( ~\\omega \cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot
Health and Safety and Activities: 5min + 45mehm
Tionisi and Calcay and Academy / Print of Artice and
Observations/Problems Encountered/Corrective Action Taken:
Observations Toblems Encountered/Corrective Action Taken.
Office World Desformed and
Office Work Performed:_ გ-და/~აო
By Title Field Manager
By Title Field Manager

## DAILY QUALITY CONTROL REPORT

**IAAAP F.S. Data Collection** 

	Date	<u> </u>	5	<u> </u>	>~(	ره <u>—</u>							
	Day	s	M ×	Т	W	ТН	F	S					
	On Site H	ours		6	>.5	·S							
	Travel Tir	ne		4									
	Office Tir		ď	Ø									
	Weather	Brigh	ıt Sun	Clear	Ove	rcast	Rain	Snow 85 up					
<del></del>	Temp	То	32	32-50	50	-70 <b>(</b>	70-85						
	Wind	Still	Mod	lerate	Hi	igh	Repo	ort No.					
	Humidity	Dry	Mod	lerate	Hu	8	10 19						

COE Project Manager Al Kam/Kevin Howe

Project Iowa Army Ammunition Plant

Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302

Contract No. DACA45-96-D-0017, DO 65

Contract No.

DACA45-96-D-0017, DO 65

DACA45-02-D-0003, DO 10

DACA45-02-D-0003, DO 16

Subcontractors on Site: N/A

Equipment on Site:

Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment. Visitors on Site: NA **URS Personnel on Site:** Brian Osborn, Mike Sonderman, Ryan Carpenter. Field Work Performed (including sampling): Line 3 water levels & well head readings w/ PID + FID Quality Control Activities (including field calibration): Calibrated PID, FID, YSI 556,
Turbidity mate, HACH Kit, and water Level indicator H+S meeting, Grange Vests in remote orgs **Health and Safety and Activities:** 5 min Observations/Problems Encountered/Corrective Action Taken: NONE Office Work Performed: NONE By Ryan Carpertr Title Field Manager

### **DAILY QUALITY** 5/6/03 Date **CONTROL REPORT** S W Day . M TH F S **IAAAP F.S. Data Collection** RC.73 On Site Hours 12 **Travel Time** 0 Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Snow Rain X **Project** Iowa Army Ammunition Plant Project No. 16169421.00201, 16169421.00301 Temp 50-70 To 32 32-50 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High

DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10

DACA45-02-D-0003, DO 16

Contract No.

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Dry

Moderate

Humid

Humidity

80

Subcontractors on Site:	Survey	crew	Steve	Chappel	and coworker
	arrived	1 000	pax.	1300 hrs.	
Equipment on Site:					
Fultz pump, YSI 556, Lamotte turbidity meter, HACH	iron kit, Mini	RAE PID, PI	notovac Mi	croFID, Freon detec	tor, water level indicator
Hermit data logger, water tanks, decontamination equi					
Visitors on Site: N/M					
<u>'</u>					
URS Personnel on Site:					
Brian Osborn, Mike Sonderman, Ryan Carpenter.	_				
Field Work Performed (including sampling					
Sampled ground water @	: Brian	Osborn	1 Rya.	Carpu	
43 - MW (				· · · · · · · · · · · · · · · · · · ·	
13-MW2					
L2- MM5					
Line a we round + St	of garage	: Mike	Sond	erman	
					· · · · · · · · · · · · · · · · · · ·
Quality Control Activities (including field	<u>calibration)</u>	: Cali	brated	PID FI	D, 457 556
Quality Control Activities (including field of Turbidity Metu, Hach K	it L	WL in	dicat	<u> </u>	
		•		·	
III III 1 O - 5 - 6 1 A - 4' - 14'					
Health and Safety and Activities: or	age ves	t in	remot	t areas	
Observations/Problems Franctic 1/0	4* <b>A</b> - 4*			. 450	
Observations/Problems Encountered/Corr	rective Acti	on raken:	Not	J.E.	
Office Work Performed:	ه	41 .1 .		- )	,
Office Work Performed: Review of	Free	Sherts	- 1	at to otto	رو
			<del>.</del>		
			. 2	C I -	Title Field Manager
			<del>y 7/1</del>	- Larpent	Title Field Manager

# DAILY QUALITY CONTROL REPORT Day S M T W TH F S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager, Al Kam/Keyin Howe

IAAAI F.S. Data Conection		On Site ri	On Site Hours			101.0				
			Travel Time			Ø.5				
		Office Tin	ne		8	<u> </u>				
COE Project Manager	Al Kam/Kevin Howe	Weather	Brigh	nt Sun	Clear	Overcast	Rain	Snow		
Project	Iowa Army Ammunition Plant					×				
Project No.	16169421.00201, 16169421.00301	Temp	To	32	32-50	50-70	70-85	85 up		
	16169503.00101, 16169556.00101	_				X		•		
	16169556.00201, 16169556.00302	Wind	Still	Mod	lerate	High	Repo	rt No.		
Contract No.	DACA45-96-D-0017, DO 65	_			X		1	,		
	DACA45-02-D-0003, DO 10	Humidity	Dry Mode		derate Humid		821			
	DACA45-02-D-0003, DO 16				- 1	X				
							-			
Subcontractors on S	Site: Surveyous Mike Chap	vel & co	و بيا	rker	_					
		•								

Subcontractors on Site: 50-yeyous Mike Chappel & coworker
Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.
Visitors on Site: N/A
URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter.
Field Work Performed (including sampling):
Sampled MW: Ryan Carpente Brian Usbarn L2-MW7
12-MW 6
19-MW4
L9-MW 3 Water Level @ L9 - New wells
Sampled Brush Creek Surface Hzo, helped Surveyors: Mike Sondamen
Quality Control Activities (including field calibration): Callbridge 710, FtD, 451 556 (chile Turbidity Meter, Hack Kit + WL
Health and Safety and Activities: NA Level D
Observations/Problems Encountered/Corrective Action Taken: NoNE
Office Work Performed: Fax COC, Review Field Shelt
By Byan Cayer Title Field Manager

## **DAILY QUALITY** 5/8/02 Date **CONTROL REPORT** w F Day S M Т TH S On Site Hours 11.5 **IAAAP F.S. Data Collection** Travel Time . 5 Office Time /. o Weather Overcast COE Project Manager Al Kam/Kevin Howe Bright Sun Snow **Project** Iowa Army Ammunition Plant 16169421.00201, 16169421.00301 Project No. Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 Report No. 16169556.00201, 16169556.00302 Wind Still Moderate High DACA45-96-D-0017, DO 65 Contract No. 832 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: Surveyors - Mike Chappell + Co-worker Equipment on Site: Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment. NA Visitors on Site: **URS Personnel on Site:** Brian Osborn, Mike Sonderman, Ryan Carpenter, Dan Galde Field Work Performed (including sampling): Ryan Carpenter / Mike Sonderman Sampled MW: 12-MW8 - bunged dry 49-MW6-19-MW5 LJ-MW8 Slugtestal: Braun Osburn / Don Galde 12-mw3 Quality Control Activities (including field calibration): Calibrate PID, FID YST 556 (check) curb. meter, Hach Icit. Level D Toranguest in remote areas **Health and Safety and Activities:** Observations/Problems Encountered/Corrective Action Taken: NoNE Fox COC + SCFS - Create WL spreadsheet 62,3,9 Office Work Performed: By Ryan Carpeter Title Field Manager

### 5/9/03 DAILY QUALITY Date CONTROL REPORT TH Day S · M Т W S IAAAP F.S. Data Collection On Site Hours Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Clear Overcast Rain Snow Iowa Army Ammunition Plant **Project** 16169421.00201, 16169421.00301 Project No. Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Report No. Wind Still Moderate High Contract No. DACA45-96-D-0017, DO 65 843 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Surveyors - Mike Chappell + Co Worker Subcontractors on Site: **Equipment on Site:** Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment. Visitors on Site: N/A **URS Personnel on Site:** Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Carbe Field Work Performed (including sampling): Sampled Monitoring Wells: Ryan Carpenter 1 LZ-NW8 19-MW10 Purped L2-MW 4, went dry Slug Tested Mondains wells: Brian 3AW-70 WBP 99-2 WB JAW-70 12-mw2 WBP 99-5 WBP 99-6 JAW-25 WB1-899-1 46P 99-4 WBP 99-3 Quality Control Activities (including field calibration): Calibrate PID FID. YS± 556 (check) Hach Kit WL. Health and Safety and Activities: Level D , orange vest in remote areas Observations/Problems Encountered/Corrective Action Taken: NONE COLOREST IN CEMPLE GOES (R Office Work Performed: NONE

Title Field Manager

By Rya Capintr

### **DAILY QUALITY** 5/10/03 Date **CONTROL REPORT** F Day S TH · M On Site Hours *1* a IAAAP F.S. Data Collection Travel Time , 5 Office Time Ø COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Snow X **Project Iowa Army Ammunition Plant** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 854 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: - they Surveyora Until 1300 completed all Sites -Equipment on Site: Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment. AIN Visitors on Site: **URS Personnel on Site:** Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan (21) Field Work Performed (including sampling): Sampling Monitoring wells: Ryan Carpenter / Mike Sonderman 12-MW4 19-MW7 19-MW13 EBP-MWZ 5AW-55 EBP-mw1 FTA 99-2 Quality Control Activities (including field calibration): Calbia + Turb. Kit Hach Kit, Health and Safety and Activities: Level D - orange vest in remote areas Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: NONE

Title Field Manager

### 5/11/03 **DAILY QUALITY** Date **CONTROL REPORT** Day W F · M T TH S **IAAAP F.S. Data Collection** On Site Hours 11.5 Travel Time ,5 Office Time 5 COE Project Manager Al Kam/Kevin Howe Weather Bright Sun Overcast Clear Rain Snow **Iowa Army Ammunition Plant Project** Project No. 16169421.00201, 16169421.00301 Temp 32-50 X To 32 50-70 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still High Report No. Moderate Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 8Ø5 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16

Subcontractors on Site: N/A
Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.
Visitors on Site: NA
URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Coulde
Field Work Performed (including sampling):
Browndwater sampling @: Ryan Caspenter / Mike Sonderman
L-9MW1)
19-MW 1
Lg-MW2 - pumped dry
EBP-MWY- pumped dry
Slugtested Monitoring Wells: Brian Osburn / Dan Galde
19-MW2 - pumped dry  EBP-MWY - pumped dry  Slugtisted Monitoring Wells: Brian Osburn / Dan Galde  12-MWS 12-E SAW 61  12-MW6 JAW-71 G-30
12-mw6 JAW-11 G=30
22-MW7 JAW-62  Quality Control Activities (including field calibration): Calibrate DID FID, YSI Check,
Quality Control Activities (including field calibration): (alibrate PID, FID, 751 Check,
Turbidity Kit, Hach Kit, W.L.
Health and Safety and Activities:
Health and Safety and Activities: Level D - orange vest in remote areas.
Observations/Problems Encountered/Corrective Action Taken: NoNE
<u>Observations/Problems Encountered/Corrective Action Taken: ハゥヽモ</u>
Office Work Performed: update spreadsheet, Fax 205CFs;
Upica is spreading, pax +000-154.
By Ryan Carpento Title Field Manager
- 1- Take Control Hamingon

## DAILY QUALITY 5/12/03 Date CONTROL REPORT F M TH S Day On Site Hours **IAAAP F.S. Data Collection** 13.5 Travel Time 15 Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Overcast Rain Snow **Project** Iowa Army Ammunition Plant Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: NIA **Equipment on Site:** Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment. Visitors on Site: NIA **URS Personnel on Site:** Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan ( alc) Field Work Performed (including sampling): Ground water sangles: Ryan Cappenter/Mile Sond · L9-MWZ · FBP-MWY · FBP-MWY · WBP-MWI- pumped do · FBP-MWS · FTP-MW3- pumped · EBP-MWG - purped Dry · WBPrMW 3- Dunger de Slung figed monturing wells: bean Osburn / Dan Golde - 19-may 29-may 69-may 6-15 -19-mws -19-nw6 5AW-64 19-mar -L9-mw3 Quality Control Activities (including field calibration): Calibrate PID, FID, YSI Turb Kit, Hach Kit, W.L. Collect QA Split EBP-MUS, Duplicate for \$80-MUS (EBP-MUS) following Decon. of EBP+ MW5. (Rinsate #1) Health and Safety and Activities: Level D orange vest in vemore areas Observations/Problems Encountered/Corrective Action Taken: NONE Office Work Performed: update spreadsheet, Fax SCFGS

Ar purtur Title Field Manager

## CONTROL REPORT S W F S Day TH · M **IAAAP F.S. Data Collection** On Site Hours 12.5 **Travel Time** Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Overcast Rain Snow **Project** Iowa Army Ammunition Plant Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 70-85 85 up 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302 Wind Still Report No. Moderate High DACA45-96-D-0017, DO 65 Contract No. DACA45-02-D-0003, DO 10 Humidity 887 Dry Moderate Humid DACA45-02-D-0003, DO 16 Subcontractors on Site: NA Equipment on Site: Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment. Visitors on Site: NA **URS Personnel on Site:** Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Calde Field Work Performed (including sampling): Grown Lwater Sampling of thus: EUBP-MW2 - Rempldy FTP-MW1 WBP-MW1 FTP-MW3 FTP-MW6 - Pomped Ory LBP-MW3 FBP-MW6 FTP-MW5-FTP-MW4-pumped Dry Repurge \$2-MW5 for Hod quality data Quality Control Activities (including field calibration): Calibrated YSI (check) PID FID WL, TUIS. Rit, Hack Kit. Collected Duplicate Sample FIRMWOR from FTRMW1 and Splid of FT-P-MWI QA /QC Health and Safety and Activities: Observations/Problems Encountered/Corrective Action Taken: Office Work Performed:

Date

DAILY QUALITY

Title Field Manager

5/13/03

DAILY QUALITY		Date <u>5/14/03</u>							
CONTROL REPORT		Day	s	М	Т	w	тн	F	S
IAAAP F.S. Data Collection		On Site H Travel Tin Office Tir	ne		7.5 5.5				
COE Project Manager	Al Kam/Kevin Howe	Weather	Brigh	ght Sun Clear		Overça	Overcast I		Snow
Project	Iowa Army Ammunition Plant				X		,		
Project No.	16169421.00201, 16169421.00301	Temp	To	32	32-50	50-70	0 70	0-85	85 up
	16169503.00101, 16169556.00101								
	16169556.00201, 16169556.00302	Wind	Still	Mod	erate	High	ı  R	Repo	rt No.
Contract No.	DACA45-96-D-0017, DO 65				X			_	
	DACA45-02-D-0003, DO 10	Humidity	Dry	Mod	erate	Humi	d	8	8
	DACA45-02-D-0003, DO 16			,					
Visitors on Site:  URS Personnel on Sibrian Osborn, Mike Sonder	otte turbidity meter, HACH iron kit, MiniRAE PID, Phanks, decontamination equipment.			eon det	ector, w	rater leve	l indicat	ttor	
Health and Safety and Observations/Problem	ms Encountered/Corrective Action Taken:	ated ys grounder	atu	Check Sa	k),	PID	, F.1 , R - M	8	N'SJUS (
Office Work Performe	ed:_ N) %								
	D.	1 1/2/		77	7	Title E:	ald Ma	2000	

# **DAILY QUALITY**

5-19-03 Date **CONTROL REPORT** S T Day M TH F S **IAAAP F.S. Data Collection** On Site Hours 7.5 **Travel Time** 6.0 Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow **Project Iowa Army Ammunition Plant** Project No. 16169421.00201, 16169421.00301 Temp To 32 32-50 85 up 50-70 70-85 16169503.00101, 16169556.00101 X 16169556.00201, 16169556.00302 Wind Still Moderate Report No. High Contract No. DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 89 Humidity Dry Moderate Humid DACA45-02-D-0003, DO 16 X

Subcontractors on Site: Nonc  Equipment on Site:  GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.  Visitors on Site: Nanc  URS Personnel on Site: Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Sluggisster: FTP-Mu8, FTP-Mu7, FTP-Mu1, FTP-Mu1, FTP-Mu3, ~nq-Mu3  L 2 - Mu8  Quality Control Activities (including field calibration): Nonc  Health and Safety and Activities: Smin H-15-metring safet seeing for TS  Observations/Problems Encountered/Corrective Action Taken: Calica Timap (accioning abut to Calica)  Office Work Performed: Nanc.  By Laufillar.  Title Field Manager	
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.  Visitors on Site: May  URS Personnel on Site:  Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (Including sampling):  Slugglested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW3, way-MW3  L 2 - MW8  Quality Control Activities (Including field calibration): Mone  Health and Safety and Activities: Smin H-15 metang safet westing for S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acres with a data of the Cocks)  Office Work Performed: Mane.	Subcontractors on Site: Nonc
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.  Visitors on Site: May  URS Personnel on Site:  Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (Including sampling):  Slugglested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW3, way-MW3  L 2 - MW8  Quality Control Activities (Including field calibration): Mone  Health and Safety and Activities: Smin H-15 metang safet westing for S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acres with a data of the Cocks)  Office Work Performed: Mane.	
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.  Visitors on Site: May  URS Personnel on Site:  Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (Including sampling):  Slugglested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW3, way-MW3  L 2 - MW8  Quality Control Activities (Including field calibration): Mone  Health and Safety and Activities: Smin H-15 metang safet westing for S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acres with a data of the Cocks)  Office Work Performed: Mane.	
Visitors on Site: Name  URS Personnel on Site: Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW1, FTP-MW3, VRP-MW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15 metrog Seet Seefing for TS  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acres with a glant Seet Cocks)  Office Work Performed: None.	Equipment on Site:
URS Personnel on Site: Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW1, FTP-MW3, ~AP-AW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15 method safety and Activities: 5min H-15 method safety and Activities: 6min H-15 method safety and Activities: 5min H-15 method safety and Activities: 6m	GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.
URS Personnel on Site: Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW1, FTP-MW3, ~AP-MW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15 metag screening for 3 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acks) and a during the service of	
URS Personnel on Site: Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW1, FTP-MW3, ~AP-AW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15 method safety and Activities: 5min H-15 method safety and Activities: 6min H-15 method safety and Activities: 5min H-15 method safety and Activities: 6m	
URS Personnel on Site: Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW1, FTP-MW3, ~AP-AW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15 method safety and Activities: 5min H-15 method safety and Activities: 6min H-15 method safety and Activities: 5min H-15 method safety and Activities: 6m	
Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB FTP-MW7 FTP-MW4, FTP-MW1, FTP-MW3, ~AP-MW3  L 2 - MWB  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15meting Seet Seeting for TS  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acits min about the Cocks)  Office Work Performed: Nac.	Visitors on Site: Nunc
Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB FTP-MW7 FTP-MW4, FTP-MW1, FTP-MW3, ~AP-MW3  L 2 - MWB  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15meting Seet Seeting for TS  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acits min about the Cocks)  Office Work Performed: Nac.	
Corey Anderson, Brian Osborn, Josh Sales  Field Work Performed (including sampling):  Slugtested: FTP-MWB FTP-MW7 FTP-MW4, FTP-MW1, FTP-MW3, ~AP-MW3  L 2 - MWB  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-15meting Seet Seeting for TS  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acits with great Seet Seeting for TS)  Office Work Performed: Nac.	
Field Work Performed (including sampling):  Slugtested: FTP-MWB, FTP-MW7, FTP-MW1, FTP-MW3, VAP-MW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: Smin H-35 metry Starting Safet Sections for S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acks min about Mell Cocks)  Office Work Performed: Name.	URS Personnel on Site:
Shoptested: FTP-MW8, FTP-MW7, FTP-MW4, FTP-MW1, FTP-MW3, WAP-MW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-3 methog safet bearing for 5  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acres min about well Cocks)  Office Work Performed: Name.	Corey Anderson, Brian Osborn, Josh Sales
Shoptested: FTP-MW8, FTP-MW7, FTP-MW4, FTP-MW1, FTP-MW3, WAP-MW3  L 2 - MW8  Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min H-3 methog safet bearing for 5  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acres min about well Cocks)  Office Work Performed: Name.	
Quality Control Activities (including field calibration): None  Health and Safety and Activities: 5min けっちゃられる マルチ シャッチリッチャック マルチ マー・フィー・フィー・フィー・フィー・フィー・フィー・フィー・フィー・フィー・フィ	Field Work Performed (including sampling):
Quality Control Activities (including field calibration): Nonc  Health and Safety and Activities: 5min けっちゃられる マルチル マント (acissmin またい)  Observations/Problems Encountered/Corrective Action Taken: Called TAMBP (acissmin またい)  Office Work Performed: パスに	Slugtested: FTP-MW8, FTP-MW7, FTP-MW1, FTP-MW3, WAP-MW3
Health and Safety and Activities: 5min H-15meting sweet breiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin abut bell Cocles  Office Work Performed: Mane.	L 2 - MW8'
Health and Safety and Activities: 5min H-15meting sweet breiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin abut bell Cocles  Office Work Performed: Mane.	
Health and Safety and Activities: 5min H-15 meting sweet weiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin about the Cocles  Office Work Performed: Manc.	
Health and Safety and Activities: 5min H-15 meting sweet weiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin about the Cocles  Office Work Performed: Manc.	
Health and Safety and Activities: 5min H-15 meting sweet weiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin about the Cocles  Office Work Performed: Manc.	
Health and Safety and Activities: 5min H-15 meting sweet weiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin about the Cocles  Office Work Performed: Manc.	
Health and Safety and Activities: 5min H-15 meting sweet weiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin about the Cocles  Office Work Performed: Manc.	
Health and Safety and Activities: 5min H-15 meting sweet weiting for 5 S  Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (acresmin about the Cocles  Office Work Performed: Manc.	
Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (see Smith abut well Cocks)  Office Work Performed: Manc.	Quality Control Activities (including field calibration): None
Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (see Smith abut well Cocks)  Office Work Performed: Manc.	
Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (see Smith abut well Cocks)  Office Work Performed: Manc.	
Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (action of the file of the colors)  Office Work Performed: Manc.	
Observations/Problems Encountered/Corrective Action Taken: Called TAMAP (see Smith abut well Cocks)  Office Work Performed: Mane.	Health and Safety and Activities: Smin H-Smeeting Safet breifing for JS
Office Work Performed: My .	
Office Work Performed: My .	
Office Work Performed: Myc.	Observations/Problems Encountered/Corrective Action Taken: Called TARRY Constants about
Office Work Performed: Myc.	mell Cocks
	Office Work Performed: My .
By Could be Title Field Manager	
By Complete Title Field Manager	
God in	By / Title Field Manager
	- Continue - Continue

#### **DAILY QUALITY** 5-20-03 Date **CONTROL REPORT** M S Day S T TH **IAAAP F.S. Data Collection** On Site Hours 12.0 Travel Time Office Time Rain Snow

COE Project Manager	Al Kam/Kevin Howe	Weather	Brigh	t Sun	Clear	Overcast
Project	Iowa Army Ammunition Plant					
Project No.	16169421.00201, 16169421.00301	Temp	То	32	32-50	50-70
	16169503.00101, 16169556.00101					X
	16169556.00201, 16169556.00302	— Wind	Still	Mod	lerate	High
Contract No.	DACA45-96-D-0017, DO 65	<del></del>		,	<b>≻</b> '	J
	DACA45-02-D-0003, DO 10	Humidity	Dry	Mod	lerate	Humid
	DACA45-02-D-0003 DO 16	<u> </u>	,			

Subcontractors on Site: Nov-
Equipment on Site:
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.
Visitors on Site: Jeff Cont (Honl)
URS Personnel on Site:
Corey Anderson, Brian Osborn, Josh Sales
Field Work Performed (including sampling):
Slugtested: FTP.MUQ, FTP-MUD, FTP-MUS, FBP-MUQ, WBP-MUI  EBP-MUS EBP-MUD, EBP-MULI  Resumer CM B C-SCHOD - 4.79" below BC-BMOD.  Walked BC and BC Tribbings army circl + circl.
Resummed B (-SCO) - 4.78° below BC-BM 03
walked BC and BC Tribbings and eight + cinca
Quality Control Activities (including field calibration):
Health and Safety and Activities: 5 min 14+5 musting
Observations/Problems Encountered/Corrective Action Taken: Days Off well locks to Mike R
Observations/Problems Encountered/Corrective Action Taken: Day of well locks to Mike B.
Office Work Performed: Nanc
By wurness Title Field Manager
- Company of the state of the s

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85 up

Report No.

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## **DAILY QUALITY CONTROL REPORT**

**IAAAP F.S. Data Collection** 

**Project** 

Project No.

Contract No.

5-21-03 Date Day S M Т w TH F S X On Site Hours <u>/a.o</u> Travel Time Office Time COE Project Manager Al Kam/Kevin Howe Weather **Bright Sun** Clear Overcast Rain Snow Iowa Army Ammunition Plant X 16169421.00201, 16169421.00301 Temp To 32 32-50 50-70 70-85 85 up 16169503.00101, 16169556.00101 X 16169556.00201, 16169556.00302 Wind Report No. Still Moderate High DACA45-96-D-0017, DO 65 X DACA45-02-D-0003, DO 10 91 Humidity Drv Moderate Humid

DACA45-02-D-0003, DO 16 Subcontractors on Site: Menc **Equipment on Site:** GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara. Visitors on Site: une **URS Personnel on Site:** Corey Anderson, Brian Osborn, Josh Sales Field Work Performed (including sampling): Slugtested 12-MW4, 12-MW8, 16-D, 19-MW8, 19-MW2 Marked Sinkhad at FTP Abandoned last 2 DPS Q EBP Site Rean of BL from I-Routh D-Road. Quality Control Activities (including field calibration): Health and Safety and Activities: 5min H+Sneeting Observations/Problems Encountered/Corrective Action Taken: Office Work Performed: Non> By Jumphor Title Field Manager

# **DAILY QUALITY CONTROL REPORT**

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IAAAP F.S. Data Collecti
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COE Project Manager Al Kam/Kevin Howe

**Project** Project No.

**Iowa Army Ammunition Plant** 16169421.00201, 16169421.00301

16169503.00101, 16169556.00101 16169556.00201, 16169556.00302

Contract No.

DACA45-96-D-0017, DO 65

DACA45-02-D-0003, DO 10

DACA45-02-D-0003, DO 16

Date

5-22-03

Day

S Ť M W TH F S

On Site Hours **Travel Time** Office Time

3.0 6.0

Weather

**Bright Sun** Clear Overcast Rain Snow × Temp To 32 32-50 50-70 70-85

Moderate

Wind

85 up Moderate Still Report No. High

Humidity

Dry

92 Humid

Subcontractors on Site: Nunc
Subcontractors on Site: MMC
Equipment on Site:
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.
Visitors on Site: und .
TIONOTO OTT ONC. NOM.
URS Personnel on Site:
Corey Anderson, Brian Osborn, Josh Sales
1 Medicion, Dian Osoon, Josh Bates
Field Work Performed (including sampling):
Pickup over night slugtestat 22-Mus
Drowned URS trailer and with a Value
Organize urs trailer and pick-up York-M left site - F.S. Data Collection Field Activity o'c complete!
THE THE METHOD OF COMPANY
Quality Control Activities (including field calibration):
Health and Safety and Activities: 5min Hadmother
No. 1 April 10 April
Observations/Problems Encountered/Corrective Action Taken: Called Mike about locks
Call Jest G (HGIL), he will puten Locks next week.
Office Work Performed: Ava
By Title Field Manager
The Field Wallager

Daily Quality Control Reports (DQCRs) are included—electronically only—on the CD-ROM that accompanies this Draft RAA report.

Direct Push Results

Monitoring Well Results

Surface Water Results

Duplicate Sample Pair Results

Quality Assurance Split Sample Pair Results

This appendix presents the review and validation of the analytical data associated with the Six Sites Groundwater RAA field activities.

#### I.1 SUMMARY OF ANALYTICAL RESULTS

Groundwater, surface water, and soil samples were sent to Laucks for analysis. The preparation methods, analytical methods, and method-specific QA/QC criteria are presented in Section 4 of the QAPP from the IAAAP Facility-Wide Work Plan (URS 2002a) and the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Work Plan Addendum (URS 2002b). **Tables I-1** and **I-2** summarize the analytical results in direct push samples and monitoring well samples collected during the groundwater RAA field activities.

#### I.1.1 Chemicals Detected in Direct Push Samples

The groundwater samples collected during the direct push field activities were analyzed for VOCs and explosives compounds. The primary VOCs detected in direct push groundwater samples included 2-butanone, carbon disulfide, Freon 113, 1,1-DCA, 1,1-dichloroethene, and 1,1,1-trichloroethane. Additional VOCs detected included acetone, benzene, 1,2-DCA, cis-1,2-DCE, and PCE.

The primary explosives compounds detected in direct push groundwater samples included RDX, HMX, MNX, 2-Am-DNT, and 4-Am-DNT. Additional explosives compounds detected included 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and tetryl.

## I.1.2 Chemicals Detected in Monitoring Well Samples

The groundwater samples collected during the monitoring well installation field activities were analyzed for VOCs, SVOCs, explosives compounds, metals, and natural attenuation parameters. The primary VOCs detected in groundwater samples included 1,1,1-TCA, 1,1-DCA, 1,1-DCE, Freon 113, and xylene.

The primary SVOC detected in groundwater samples was bis(2-ethylhexyl)phthalate.

The primary explosives compounds detected in groundwater samples included RDX, HMX, MNX, 2-Am-DNT, and 4-Am-DNT. Additional explosives compounds detected included 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and tetryl.

The primary metal analytes detected in groundwater samples included arsenic, barium, lead, mercury, and selenium.

Natural attenuation parameter analytes in groundwater samples included: alkalinity, ammonia, carbon dioxide, chloride, NO<sub>3</sub>+NO<sub>2</sub>, sulfate, sulfide, TKN, TOC, calcium, magnesium, and sodium.

#### I.1.3 Chemicals Detected in Surface Water Samples

Surface water samples collected from Brush Creek were analyzed for explosives compounds. The primary explosives compounds detected in surface water samples collected in Brush Creek included RDX and HMX. MNX was also detected at one surface water sampling location.

Spring Creek surface water samples were collected, analyzed, and reviewed/validated by HGL, and results are presented in the 2003 Groundwater Monitoring Report (HGL 2003b). Spring Creek surface water samples results are not discussed in the following data quality review/validation but are included on **Table I-3** for reference only.

#### 1.2 DATA QUALITY REVIEW/VALIDATION PROCESS

The analytical data generated by the laboratory were checked for accuracy, precision, representativeness, comparability, completeness and sensitivity. The data validation process for this project consisted of data generation, reduction, and two levels of review.

#### I.2.1 Laboratory Data Reduction and Validation

The first level of chemical data review, which contained multiple sublevels, was conducted by the analytical laboratory. The laboratory had the initial responsibility for the correctness and completeness of the data. Section 4 of the QAPP in the IAAAP Facility-Wide Work Plan (URS 2002a) identifies the laboratory reduction and validation processes.

#### I.2.2 Data Review

The second level of chemical data review was completed by the URS project chemist. All analytical data were subjected to this review. The data review was completed following the procedures described below, utilizing QA/QC criteria specified in the IAAAP Facility-Wide Work Plan, Section 4 of the QAPP (URS 2002a); the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Work Plan Addendum (URS 2002b); United States Environmental Protection Agency (USEPA) Function Guidelines (USEPA 2001b and 2002a); and United States Army Toxic and Hazardous Materials Agency (USATHAMA) QA Program, January, 1990. The QC parameters for the review of the laboratory analytical data packages included the following:

- Completeness of package
- Review of laboratory case narrative
- Compliance with required holding times and sample preservation
- Presence or absence of compounds in method and field blanks
- Results of low spike, high spike, and high spike duplicate samples
- Surrogate spike recovery in samples
- Results of matrix spike and matrix spike duplicate samples
- Field duplicate samples

#### I.2.3 Validation

The URS project chemist completed full data validation on ten percent of the analytical data, as detailed in the project QAPP. The full validation of the analytical data included reviewing all the parameters identified above and the additional parameters listed below:

- Initial calibration
- Continuing calibration
- Chromatogram review
- Standard preparation log review
- Sample preparation log review
- Analytical run log review
- Recalculation of sample and QC results using the raw data
- Instrument tune

#### 1.3 DIRECT PUSH SAMPLE REVIEW/VALIDATION RESULTS

The data review/validation process was implemented to assess the quality of data resulting from the field sampling program with respect to the QA/QC objectives established for the project. Data were assessed to evaluate the appropriate usage to support decision-making. Data assessment involved a consideration of data use, the decision type, identification of data that were qualified or did not meet project QA/QC requirements, and limitations on data use. The data review/validation was based on the laboratory data summary reports and raw data. Direct push groundwater samples were analyzed for VOCs (5030/8260B) and explosives (8330).

## I.3.1 Laboratory Sample Delivery Groups

The following sections collectively summarize the review and validation of the direct push analytical data for Laucks sample delivery groups (SDGs) IAP39 through IAP56. The data review and validation results are presented in the following sections.

## I.3.1.1 Data Package Completeness

The data packages were reviewed to verify that each SDG contained the data contractually required in the deliverable and that all samples listed on the chain-of-custody (COC) forms were analyzed for the requested parameters. The review indicated that the data packages were complete.

## I.3.1.2 Laboratory Case Narrative

The laboratory case narratives for SDGs IAP39 though IAP56 indicated that the initial VOC calibrations (10/23/03, 11/02/03, 11/05/03, 11/27/03, and 02/03/03) yielded percent relative standard deviation (%RSD) values greater than 15 percent for several analytes. Using linear

regression the correlation coefficient (r) values were greater that the method required 0.990; therefore, no qualification of data was required based on outlying precision.

The laboratory case narratives for SDGs IAP40, IAP42, IAP45, IAP46, IAP48, IAP49, IAP50, IAP52, IAP54, IAP55, and IAP56 indicated that the pH values for VOC samples FTP-DP11-20, FTP-DP18-10, FTP-DP12-23, WBP-DP05-09, WBP-DP06-22, WBP-DP07-22, WBP-DP12-09, WBP-DP15-24, L9-DP02-70, L9-DP05-53, L9-DP07-75, L9-DP09-52, L9-DP09-66, L9-DP12-54, L9-DP12-64L9-DP15-60, L9-DP16-62, L9-DP20-39, L9-DP22-54, L9-DP23-15, L9-DP26-50, L9-DP32-15, L9-DP36-45 were greater than 2.0. The samples were analyzed within seven days and were not qualified based on outlying preservation criteria.

The laboratory case narratives for SDGs IAP41, IAP43, IAP44, IAP45, IAP46, IAP47, IAP48, IAP51, IAP52, IAP54, and IAP55 indicated that several samples were received at temperatures below the evaluation criteria. The samples were not frozen; therefore, no qualification of data was required based on outlying preservation criteria.

The laboratory case narratives for SDGs IAP42, IAP43, IAP44, IAP45, IAP46, IAP47, IAP48, IAP49, IAP51, IAP53, and IAP54 indicated the reporting limit for Freon 113 was raised from 3 μg/L to 5 μg/L due to instrument contamination. The USEPA Region 9 Tap Water PRG for Freon 113 is 59,00 μg/L; no corrective action was required.

The laboratory case narratives for SDGs IAP48 and IAP50 indicated that the explosives continuing verification (CV) (3B260214) recoveries on the secondary column for HMX and tetryl were outside evaluation criteria. The samples bracketed by the CV were reported as nondetect for HMX and tetryl on the primary column. Only compounds detected on the primary column require secondary column confirmation; therefore, no qualification of data was required based on outlying CV recoveries.

The laboratory case narrative for SDG IAP51 indicated that an unknown peak was detected on the secondary column in the HMX and tetryl retention windows for samples L2-DP24-06 and L2-DP23-13, respectively. The HMX result on the secondary column was biased high due to the contribution of the unknown peak. Results were reported from the primary column; therefore, no qualification of data was required.

The laboratory case narrative for SDG IAP55 indicated the CV (3C140233.d) recovery for 4-Am-DNT exceeded the evaluation criteria. The samples bracketed by the CV were reported as nondetect for 4-Am-DNT; therefore, no qualification of data was required based on outlying CV recoveries.

Additional problems identified in the laboratory case narratives for SDGs IAP39 through IAP56 are discussed in subsequent sections.

## 1.3.1.3 Holding Times and Sample Preservation

Review of the sample collection and analyses dates involved comparing the chemicals of concern, the chemical results summary forms, and the raw data forms for accuracy, consistency, and holding time compliance. Several samples were received at the laboratory below 2°C), but

the samples were not frozen; therefore, no qualification of data was required based on preservation criteria. All samples were extracted and analyzed within the required holding time criteria with the exception of the samples listed in the table below.

Site ID	Field ID	Parameter	Analyte	Qualification
West Burn Pads Area	WBP-DP14-14	8260B	Entire Sample	J
Line 9	L9-DP04-53DL	8260B	Freon 113	J
Line 9	L9-DP04-69DL	8260B	Freon 113	J
Line 9	L9-DP06-67DL	8260B	Freon 113	J
Line 9	L9-DP10-25DL	8260B	Freon 113	J
Line 9	L9-DP10-65DL	8260B	Freon 113	J
Line 9	L9-DP03-71	8260B	Entire Sample	J
Line 9	L9-DP06-52	8260B	Freon 113 Only	J
Line 9	L9-DP11-55	8260B	Entire Sample	J
Line 9	L9-DP11-69	8260B	Entire Sample	J
Line 9	L9-DP14-66	8260B	Entire Sample	J
Line 9	L9-DP13-20	8260B	Entire Sample except Freon 113	J
Line 9	L9-DP13-55	8260B	Entire Sample except Freon 113	J
Line 9	L9-DP13-64	8260B	Freon 113	J

#### 1.3.1.4 Initial Calibration

Initial calibration criteria were established to assess whether the instrument was capable of producing acceptable qualitative and quantitative data. As identified in various standard operating procedures, the linearity of the calibration curve was established using a blank and five standard concentrations.

The initial VOC calibration response factors (RFs) were reviewed and were greater than 0.10 for chloromethane, 1,1-dichloroethane and bromoform, greater than 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, and greater than 0.05 for all other analytes. Review of the initial calibration summary forms indicated %RSDs were less than or equal to 30 percent for calibration compounds (CCCs) 1,1-DCE. toluene. chloroform. ethylbenzene. check (i.e., 1,2-dichloropropane, and vinyl chloride). %RSD values were below 15 percent for non-CCCs. In some instances, linearity was determined using linear regression or quadratic curve fit. All r values were greater than 0.990; therefore, no qualifications of data were required. recalculation of the RFs and %RSD was performed, and no errors in calculations were noted.

Review of the initial explosives calibration summary forms indicated that %RSDs for the calibration factors were below the method criteria of 20 percent, so no qualification of data was required. In addition, the calibration factor and %RSD values presented on the summary forms for both the primary and secondary columns were recalculated for 10 percent of the target analytes. No calibration or transcription errors were noted.

#### *1.3.1.5 Retention Times*

Retention time windows are crucial to the identification of target compounds. USEPA SW-846 defines the retention time windows as plus or minus three standard deviations of the mean absolute retention time. Chromatographs from associated samples with target compound detections were reviewed. The chromatographs were reviewed to determine if VOC and explosives peaks were within known retention time windows and that those compounds were identified correctly. All target compounds were identified correctly, so no qualification of data was required.

#### 1.3.1.6 Calibration Verification

Review of the VOC sample chromatograms indicated the CVs were performed at the required frequency of every 12 hours. Review of continuing calibration summary form indicated all RFs met the evaluation criteria of greater than 0.10 (chloromethane, 1,1-DCA, and bromoform), 0.30 (chlorobenzene and 1,1,2,2-tetrachloroethane), and greater than 0.05 for all other analytes. In addition, percent differences (%Ds) met the evaluation criteria of less than 20 percent for CCCs and less than 50 percent for all other analytes; therefore, no qualification of data was required. Recalculation of the RFs and %Ds was completed, and no errors in calculation were noted.

CV samples were established to assess whether the instrumentation was capable of producing acceptable qualitative and quantitative data established by the initial calibration. Explosives CVs were analyzed at the required frequency of one every 12 hours. Review of the CV summary forms indicated that all percent differences (%Ds) met the evaluation criteria of less than 15 percent for all target compounds; therefore, no qualification of explosives data was required based on outlying CV recoveries. In addition, the calibration factor and %RSD values presented on the summary forms for both the primary and secondary columns were recalculated for 10 percent of the target analytes. No calibration or transcription errors were noted.

#### I.3.1.7 Blank Samples

Blank samples were analyzed to assess the existence and magnitude of contamination during laboratory activities. All method preparation blank data were reported as nondetect with the exception of Freon 113. Associated samples were reported as nondetect or had Freon 113 concentrations greater than five times the blank contamination; therefore, no qualification of data was required based on preparation blank contamination.

Source water, rinsates, and trip blank data were reported as nondetect, with the exceptions of acetone, chloroform, bromodichloromethane, dibromochloromethane, and methylene chloride. Associated samples qualified as nondetect based on blank contamination are listed below.

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Fire Training Pit	FTP-DP01-38	8260B	Acetone		U
Fire Training Pit	FTP-DP03-31	8260B	Acetone		U
Fire Training Pit	FTP-DP03-31	8260B	Chloroform	4	U

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Fire Training Pit	FTP-DP04-27	8260B	Acetone		U
Fire Training Pit	FTP-DP05-23	8260B	Acetone		U
Fire Training Pit	FTP-DP07-27	8260B	Acetone		U
Fire Training Pit	FTP-DP08-23	8260B	Chloroform		U
Fire Training Pit	FTP-DP09-30	8260B	Acetone		U
Fire Training Pit	FTP-DP10-18	8260B	Acetone		U
Fire Training Pit	FTP-DP11-20	8260B	Acetone		U
Fire Training Pit	FTP-DP14-09	8260B	Acetone		U
Fire Training Pit	FTP-DP17-06	8260B	Acetone		U
Fire Training Pit	FTP-DP18-10	8260B	Chloroform		U
West Burn Pads Area	WBP-DP03-38	8260B	Acetone		U
West Burn Pads Area	WBP-DP05-09	8260B	Chloroform		U
West Burn Pads Area	WBP-DP08-41	8260B	Acetone		U
West Burn Pads Area	WBP-DP15-24	8260B	Acetone	25	U
East Burn Pads	EBP-DP01-18	8260B	Acetone		U
East Burn Pads	EBP-DP02-45	8260B	Acetone	22	U
East Burn Pads	EBP-DP03-45	8260B	Acetone	14	U
East Burn Pads	EBP-DP04-45	8260B	Acetone		U
East Burn Pads	EBP-DP05-25	8260B	Acetone		U
East Burn Pads	EBP-DP05-46	8260B	Acetone		U
East Burn Pads	EBP-DP07-20	8260B	Acetone		U
Line 9	L9-DP01-63	8260B	Acetone	13	U
Line 9	L9-DP04-53	8260B	Chloroform		U
Line 9	L9-DP05-73	8260B	Acetone	11	U
Line 9	L9-DP07-75	8260B	Acetone	26	U
Line 9	L9-DP08-55	8260B	Acetone		U
Line 9	L9-DP09-52	8260B	Acetone		U
Line 9	L9-DP11-23	8260B	Acetone	15	U
Line 9	L9-DP12-54	8260B	Acetone		U
Line 9	L9-DP19-54	8260B	Acetone		U
Line 9	L9-DP20-20	8260B	Acetone		U
Line 9	L9-DP21-20	8260B	Acetone		U
Line 9	L9-DP23-44	8260B	Acetone	17	U
Line 9	L9-DP25-24	8260B	Acetone		U
Line 9	L9-DP26-19	8260B	Acetone	15	U
Line 9	L9-DP27-20	8260B	Acetone	12	U

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Line 9	L9-DP28-20	8260B	Acetone	16	U
Line 9	L9-DP29-20	8260B	Acetone	11	U
Line 9	L9-DP35-46	8260B	Acetone		U
Line 9	L9-DP35-46	8260B	Chloroform	12	U
Line 9	L9-DP36-45	8260B	Acetone		U
Line 9	R10PZ02	8260B	Chloroform		U

## 1.3.1.8 Surrogate Compound Percent Recoveries

Surrogate recoveries were used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate recoveries for all VOC samples were within evaluation criteria with the exception of sample FTP-DP03-31. The surrogate recovery for dibromofluoromethane was above evaluation criteria, indicating a possible high bias. Associated nondetect results for sample FTP-DP03-31 were not qualified as estimated. Data qualifications based on outlying VOC surrogate recovery are listed in the table below. Ten percent of surrogate recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Fire Training Pit	FTP-DP03-31	8260B	1,1,1-Trichloroethane	J
Fire Training Pit	FTP-DP03-31	8260B	1,1-Dichloroethane	J
Fire Training Pit	FTP-DP03-31	8260B	1,1-Dichloroethene	J
Fire Training Pit	FTP-DP03-31	8260B	1,2-Dichloroethane	J
Fire Training Pit	FTP-DP03-31	8260B	2-Butanone	J
Fire Training Pit	FTP-DP03-31	8260B	Trichloroethene	J

Surrogate recoveries for all explosives samples were within evaluation criteria, with the exceptions of samples EBP-DP21-95, WBP-DP05-09DL2, and L2-DP18-26. Due to the elevated concentration of RDX in sample WBP-DP05-09, the sample was diluted by a factor of 800. The original sample and the first dilution (40 xf) had surrogate recoveries within evaluation criteria; therefore, no qualifications were required for sample WBP-DP05-09 based on outlying surrogate recovery. Data qualifications based on explosives outlying surrogate recoveries are listed in the table below. Ten percent of surrogate recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
East Burn Pads	EBP-DP21-95	8330	Entire Sample	J
Line 2	L2-DP18-26	8330	Entire Sample	J

## I.3.1.9 Laboratory Control Samples

Laboratory control samples (LCSs) were analyzed to assess the accuracy of the analytical method and demonstrate laboratory performance. LCS recoveries were within the evaluation criteria and therefore, no qualification was required based on outlying LCS recoveries. Ten percent of LCS recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

## 1.3.1.10 Laboratory Duplicate Analysis

Laboratory duplicate sample pairs were not analyzed for VOCs or explosives due to lack of sample volume.

## 1.3.1.11 Field Duplicate Analysis

Field duplicate sample pairs were established to determine both field and laboratory precision. Thirteen direct push field duplicate sample pairs were collected and submitted to the laboratory for analysis. The field duplicate sample pairs are presented in the table below.

	Field Duplica	te Sample Pairs	
Site ID	Original Sample ID	Duplicate Sample ID	Analysis
Fire Training Pit	FTP-DP05-23	FTP-DP05-00	VOCs
Fire Training Pit	FTP-DP23-25	Duplicate 10	VOCs
Fire Training Pit	FTP-DP25-22	Duplicate 11	VOCs
East Burn Pads	EBP-DP14-25	EBP-DP14-00	Explosives
West Burn Pads Area	WBP-DP06-22	Duplicate 13	Explosives
West Burn Pads Area	WBP-DP12-09	Duplicate 12	Explosives
Line 2	L2-DP05-25	L2-DS05-25	Explosives
Line 2	L2-DP12-28	Duplicate 3	Explosives
Line 3	L3-DP04-22	Duplicate 4	Explosives
Line 9	L9-DP01-20	Duplicate 8	VOCs
Line 9	L9-DP07-26	Duplicate 5	VOCs
Line 9	L9-DP11-23	Duplicate 6	VOCs
Line 9	L9-DP13-20	Duplicate 7	VOCs

Field duplicate sample pair results were within evaluation criteria (25 percent) for all duplicate sample pairs, with one exception. Data qualification based on outlying field duplicate precision is listed in the table below. Analytical results for the field duplicate sample pairs are presented in Table I-3.

Site ID	Field ID	Analyte	Qualification
Line 9	L9-DP07-26	Freon 113	J

#### I.3.1.12 Matrix Spike/Matrix Spike Duplicate Analysis

No matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed for VOCs or explosives due to lack of sample volume.

#### I.3.1.13 PARCC Parameters

## Precision and Accuracy

The agreement between duplicate analyses within control limits indicates satisfactory precision in a measurement system. The recovery of predetermined amount of a spike within control limits indicates satisfactory accuracy with respect to the method on the individual sample and general matrix. Ninety-nine percent of the indicators reviewed for accuracy (LCS and surrogate recoveries) were within evaluation criteria. One hundred percent of the indicators reviewed for precision (field duplicates) were within evaluation criteria (with the exception of one compound).

#### Representativeness

Representativeness expresses the degrees to which sample data accurately and precisely represent the characteristics of a population. Representativeness is a qualitative parameter, which is of concern in the proper design of the sampling program, such that the sampling locations selected will provide representative data for decisions made. Representativeness was assessed using 13 field duplicate sample pairs collected during the direct push phase of the groundwater RAA. Field duplicate sample pairs were within evaluation criteria with the exception of one compound; therefore, it was concluded that the overall representativeness was satisfactory.

## Comparability

Comparability expresses the confidence with which one data set can be compared to another. In accordance with the QAPP, data are comparable when siting considerations, collection techniques, measurement methods, and reporting procedures are equivalent for the samples within a sample set. Throughout this investigation, appropriate procedures for sampling and shipping were implemented as specified in the IAAAP Facility Wide Work Plan (URS 2002a) and the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Draft Final Work Plan Addendum (URS 2002b). Within this data set, it was concluded that results were comparable to one another.

## Completeness

Completeness is defined as the percentage of the total number of analytical results requested which are judged to be valid, including estimated **J** values, in accordance with the IAAAP Facility-Wide Work Plan (URS 2002a). After data review and validation, 100 percent of the direct push groundwater analytical data were considered to be valid.

## Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Method detection limits (MDLs) were determined as outlined in 40 Code of Federal Regulations (CFR) Part 136 and are defined as the minimum concentration of a substance that can be identified, measured and reported with a 99 percent confidence that the analyte concentration is greater that zero, and is determined for analysis of a sample in a given matrix containing the analyte. Laboratory reporting limits (RLs) are generally 3 to 5 times higher than the laboratory MDLs. Values above the MDL and less than the RL were qualified as estimated.

Sample dilutions, volume constraints, and matrix interference will decrease sensitivity. RLs were elevated in SDGs IAP39 through IAP56; however, project sensitivity requirements established in the project DQOs were met.

#### 1.4 MONITORING WELL AND SURFACE WATER REVIEW/VALIDATION RESULTS

The data review/validation process was implemented to assess the quality of data resulting from the field sampling program with respect to the QA/QC objectives established for the project. Data were assessed to evaluate the appropriate usage to support decision-making. Data assessment involved a consideration of data use, the decision type, identification of data that were qualified or did not meet project QA/QC requirements, and limitations on data use. The data review/validation was based on the laboratory data summary reports and raw data.

## I.4.1 Laboratory Sample Delivery Groups

The following sections collectively summarize the review and validation of the direct push analytical data for Laucks SDGs IAP57 through IAP63. The data review and validation results are presented in the following sections.

## I.4.1.1 Data Package Completeness

The data packages were reviewed to verify that each SDG contained the data contractually required in the deliverable and that all samples listed on the COC forms were analyzed for the requested parameters. The review indicated that the data packages were complete.

## I.4.1.2 Laboratory Case Narrative

The laboratory case narratives for SDGs IAP57, IAP61, IAP62, and IAP63 indicated that the initial VOC calibrations (03/20/03, 03/28/03, 05/12/03, and 05/21/03) yielded %RSD values greater than 15 percent for several analytes. Using linear regression the r values were greater that the method required 0.990; therefore, no qualification of data was required based on outlying precision.

The laboratory case narratives for SDGs IAP57, IAP61, IAP62, and IAP63 indicated that several samples were received at temperatures below the evaluation criteria. The samples were not frozen; therefore, no qualification of data was required based on outlying preservation criteria.

The laboratory case narratives for SDGs IAP58, IAP59, and IAP60 indicated that several TOC sample results were less than the reporting limit of 0.1 percent. The reported concentration is dependent on the weight of the sample injected into the furnace and the amount of sample/standard sand homogenized for injection. Results below the reporting limit and method detection limit were calculated based on half of the lowest calibration standard. These values were report as estimated values. Soil samples collected during the monitoring well installation field activities were analyzed for TOC and presented in **Section 4**. TOC was detected in 49 of the 53 soil samples collected during the monitoring well installation field activities. The TOC results ranged from nondetect to 1.6 percent dry basis. The highest concentration of TOC was detected at monitoring well location FTP-MW1.

The laboratory case narrative for SDG IAP61 indicated that the VOC CV analyzed on 05/14/03 yielded percent difference (%D) values greater that 25 percent for carbon tetrachloride and 1,3-dichloropropene. Associated sample results were reported as nondetect and qualified as estimated based on the outlying accuracy.

The laboratory case narratives for SDGs IAP61 and IAP62 indicated that the initial SVOC calibration analyzed on 05/13/03 yielded a %RSD value greater than 15 percent for di-n-butylphthalate. Using linear regression the r values were greater that the method required 0.990; therefore, no qualification of data was required based on outlying precision.

The laboratory case narratives for SDG IAP61 and IAP62 indicated that the SVOC CV analyzed on 05/19/03, 06/02/03, and 06/04/03 yielded %D values greater that 25 percent for several analytes. Associated sample (05/19/03) results for indeno[1,2,3-cd]pyrene, benzo[g,h,I]perylene and dibenz[a,h]anthracene were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (06/02/03) results for 4-chloroaniline were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (06/04/03) results for 2,2(1-chloropropane) and 2,4-dinitrophenol were reported as nondetect and qualified as estimated based on the outlying precision.

The laboratory case narrative for SDG IAP61 indicated that the VOC CV analyzed on 05/15/03, 5/19/03, and 05/20/03 yielded %D values greater that 25 percent for several analytes. Associated sample (05/15/03) results for bromomethane, chloroethane, chloromethane, methylene chloride, trans-1,3-dichloropropene, trichlorofluoromethane, and dichlorodifluoromethane were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (05/19/03) results for bromomethane, carbon disulfide, methylene chloride, carbon tetrachloride, cis-1,3-dichloropropene, trans-1,3-dichloropropene, dibromochloromethane, dibromomethane, trichlorofluoromethane, and bromoform were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (05/20/03) results for bromomethane, methylene chloride, 2-butanone, carbon tetrachloride, cis-1,3-dichloropropene, trans-1,3-dichloropropene, dibromochloromethane, tichlorofluoromethane, and bromoform were reported as nondetect and qualified as estimated based on the outlying precision.

The laboratory case narratives for SDG IAP61 and IAP62 indicated that the VOC CV analyzed on 05/23 yielded a %D value greater that 25 percent for dichlorodifluoromethane. Associated sample results were reported as nondetect and qualified as estimated based on outlying precision.

The laboratory case narrative for SDG IAP61 indicated that the chromium CV recovery was outside evaluation criteria. The associated sample was qualified as estimated based on outlying accuracy.

Additional problems identified in the laboratory case narratives for SDGs IAP57 through IAP63 are discussed in subsequent sections.

#### I.4.1.3 Holding Times and Sample Preservation

Review of the sample collection and analyses dates involved comparing the chemicals of concern, the chemical results summary forms, and the raw data forms for accuracy, consistency, and holding time compliance. Several samples were received at the laboratory below 2°C. The samples were not frozen; therefore, no qualification of data was required based on preservation criteria. All samples were extracted and analyzed within the required holding time criteria with the exception of SVOCs and ortho-phosphate. Data qualifications based on the outlying holding time criteria are presented in the following table.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 2	L2-MW4	E300.0	ortho-Phosphate	J
Line 3	L3-MW1RE	8270C	Entire Sample	J
Line 3	L3-MW2RE	8270C	Entire Sample	J
Line 9	L9-MW1	8270C	Entire Sample	J
Line 9	L9-MW3RE	8270C	Entire Sample	J
Line 9	L9-MW4RE	8270C	Entire Sample	J
Line 9	L9-MW5RE	8270C	Entire Sample	J
Line 9	L9-MW6RE	8270C	Entire Sample	J
Line 9	L9-MW7	8270C	Entire Sample	J
Line 9	L9-MW7	E300.0	ortho-Phosphate	J
Line 9	L9-MW8RE	8270C	Entire Sample	J
Line 9	L9-MW9RE	8270C	Entire Sample	J
Line 9	L9-MW10RE	8270C	Entire Sample	J
Line 9	L9-MW11	8270C	Entire Sample	J
Line 9	L9-MW12	8270C	Entire Sample	J
Line 9	L9-MW12	E300.0	ortho-Phosphate	J
Line 9	L9-MW13	8270C	Entire Sample	J
Line 9	L9-MW13	E300.0	ortho-Phosphate	J

#### I.4.1.4 Initial Calibration

Initial calibration criteria were established to assess whether the instrument was capable of producing acceptable qualitative and quantitative data. As identified in various standard operating procedures, the linearity of the calibration curve was established using a blank and at

least five standard concentrations for VOCs, SVOCs, explosives, metals, mercury, and various wet chemistry analyses.

The VOC initial calibration response factors (RFs) were reviewed and were greater than 0.10 for chloromethane, 1,1-dichloroethane and bromoform, greater than 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, and greater than 0.05 for all other analytes. Review of the initial calibration summary forms indicated %RSDs were less than or equal to 30 percent for CCCs (1,1-dichloroethene, toluene, chloroform, ethylbenzene, 1,2-dichloropropane, and vinyl chloride). RSD values were below 15 percent for non-CCCs. In some instances, linearity was determined using linear regression or quadratic curve fit. All r values were greater than 0.990, therefore, no qualifications of data were required. A recalculation of the RFs and %RSD for four compounds was performed, and no errors in calculations were noted.

The SVOC initial calibration response factors (RFs) were reviewed and were greater than 0.05 for all analytes. Review of the initial calibration summary forms indicated the %RSDs were less than or equal to 30 percent for CCCs and less than or equal to 15 percent for non-CCCs, with the exception of 2,4-dinitrophenol and di-n-butylphthlate. The table below identifies associated samples qualified as estimated based on outlying SVOC %RSD recoveries Recalculation of the RFs and %RSD for six compounds was performed, and no errors in calculations were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 3	L3-MW1	8270C	Di-n-butylphthalate	J
Line 3	L3-MW1	8270C	2,4-Dinitrophenol	J
Line 3	L3-MW2	8270C	2,4-Dinitrophenol	J
Line 3	L3-MW2	8270C	Di-n-butylphthalate	J
Line 9	L9-MW3	8270C	2,4-Dinitrophenol	J
Line 9	L9-MW3	8270C	Di-n-butylphthalate	J
Line 9	L9-MW5	8270C	2,4-Dinitrophenol	J
Line 9	L9-MW5	8270C	Di-n-butylphthalate	J
Line 9	L9-MW6	8270C	2,4-Dinitrophenol	J
Line 9	L9-MW6	8270C	Di-n-butylphthalate	J

Review of the explosives initial calibration indicated that the %RSD for the calibration factors of all analytes met the criteria of less than 20 percent RSD. Therefore, no qualification of data was required. In addition, the calibration factor and %RSD values presented on the summary forms for both the primary and secondary columns were recalculated for 10 percent of the target analytes. No calibration or transcription errors were noted.

All initial metals calibration verification recoveries were within evaluation criteria of 90 to 110 percent for inductively coupled plasma (ICP) metals and 80 to 120 percent for mercury. One hundred percent of the initial calibrations and recoveries were recalculated and compared to the raw data; no calculation or transcription errors were noted. No qualification of the data was required based on initial calibration data.

Review of the various initial wet chemistry parameter calibrations indicated that all verification samples were within the method established criteria; therefore, no qualification of wet chemistry data was required based on the initial calibration.

#### **1.4.1.5 Retention Times**

Retention time windows are crucial to the identification of explosives target compounds. Retention time windows are established for each explosives analyte and surrogate by injecting each single component compound into the chromatographic system three times over a 72-hour period. EPA SW-846 then defines the width of the retention time windows as plus or minus three standards deviations of the mean absolute retention time established during the 72-hour period. The center of the retention time window for each analyte and surrogate is the absolute retention time determined during the calibration verification standard analyzed at the beginning of each analytical batch.

Chromatographs from associated samples with target compound detections were reviewed. The chromatographs were reviewed to determine if the associated peaks were within known retention time windows and that those compounds were identified correctly. All target compounds were identified correctly; therefore, no qualification of data was required.

#### I.4.1.6 Calibration Verification

CV samples were established to assess whether the instrumentation was capable of producing acceptable qualitative and quantitative data established by the initial calibration.

Review of the VOC sample chromatograms indicated the CVs were performed at the required frequency of every 12 hours. Review of continuing calibration summary form indicated all RFs met the evaluation criteria of greater than 0.10 (chloromethane, 1,1-DCA, and bromoform), 0.30 (chlorobenzene and 1,1,2,2-tetrachloroethane) and greater than 0.05 for all other analytes. In addition, %Ds met the evaluation criteria of less than 20 percent for CCCs and less than 50 percent for all other analytes with the exception of carbon tetrachloride, dichlorodifluoromethane, 1,3-dichloropropene. The table below identifies associated samples qualified as estimated based on outlying VOC %RSD. Recalculation of the RFs and %Ds (associated validated data from four compounds) was completed and no errors in calculation were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW1	8260B	Bromoform	J
Line 9	L9-MW1	8260B	Bromomethane	J
Line 9	L9-MW1	8260B	2-Butanone	J
Line 9	L9-MW1	8260B	Carbon Tetrachloride	J
Line 9	L9-MW1	8260B	Dibromochloromethane	J
Line 9	L9-MW1	8260B	cis-1,3-Dichloropropene	J
Line 9	L9-MW1	8260B	trans-1,3-Dichloropropene	J

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW1	8260B	Methylene Chloride	J
Line 9	L9-MW1	8260B	Trichlorofluoromethane	J
Line 9	L9-MW2	8260B	Bromoform	J
Line 9	L9-MW2	8260B	Bromomethane	J
Line 9	L9-MW2	8260B	Carbon Disulfide	J
Line 9	L9-MW2	8260B	Carbon Tetrachloride	J
Line 9	L9-MW2	8260B	cis-1,3-Dichloropropene	J
Line 9	L9-MW2	8260B	trans-1,3-Dichloropropene	J
Line 9	L9-MW2	8260B	Dibromochloromethane	J
Line 9	L9-MW2	8260B	Dibromomethane	J
Line 9	L9-MW2	8260B	Methylene Chloride	J
Line 9	L9-MW2	8260B	Trichlorofluoromethane	J
Line 9	L9-MW3	8260B	Carbon Tetrachloride	J
Line 9	L9-MW3	8260B	1,3-Dichloropropene	J
Line 9	L9-MW4	8260B	Carbon Tetrachloride	J
Line 9	L9-MW4	8260B	1,3-Dichloropropene	J
Line 9	L9-MW5	8260B	Carbon Tetrachloride	J
Line 9	L9-MW5	8260B	1,3-Dichloropropene	J
Line 9	L9-MW6	8260B	Carbon Tetrachloride	J
Line 9	L9-MW6	8260B	1,3-Dichloropropene	J
Line 9	L9-MW7	8260B	Bromomethane	J
Line 9	L9-MW7	8260B	Chloroethane	J
Line 9	L9-MW7	8260B	Chloromethane	J
Line 9	L9-MW7	8260B	Dichlorodifluoromethane	J
Line 9	L9-MW7	8260B	trans-1,3-Dichloropropene	J
Line 9	L9-MW7	8260B	Methylene Chloride	J
Line 9	L9-MW7	8260B	Trichlorofluoromethane	J
Line 9	L9-MW8	8260B	Carbon Tetrachloride	J
Line 9	L9-MW8	8260B	1,3-Dichloropropene	J
Line 9	L9-MW9	8260B	Carbon Tetrachloride	J
Line 9	L9-MW9	8260B	1,3-Dichloropropene	J
Line 9	L9-MW10	8260B	Carbon Tetrachloride	J
Line 9	L9-MW10	8260B	1,3-Dichloropropene	J
Line 9	L9-MW11	8260B	Bromomethane	J
Line 9	L9-MW11	8260B	Chloroethane	J
Line 9	L9-MW11	8260B	Chloromethane	J

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW11	8260B	Dichlorodifluoromethane	J
Line 9	L9-MW11	8260B	trans-1,3-Dichloropropene	J
Line 9	L9-MW11	8260B	Methylene Chloride	J
Line 9	L9-MW11	8260B	Trichlorofluoromethane	J
Line 9	L9-MW12	8260B	Bromomethane	J
Line 9	L9-MW12	8260B	Chloroethane	J
Line 9	L9-MW12	8260B	Chloromethane	J
Line 9	L9-MW12	8260B	Dichlorodifluoromethane	J
Line 9	L9-MW12	8260B	trans-1,3-Dichloropropene	J
Line 9	L9-MW12	8260B	Methylene Chloride	J
Line 9	L9-MW12	8260B	Trichlorofluoromethane	J
Line 9	L9-MW13	8260B	Bromoform	J
Line 9	L9-MW13	8260B	Bromomethane	J
Line 9	L9-MW13	8260B	Carbon Disulfide	J
Line 9	L9-MW13	8260B	Carbon Tetrachloride	J
Line 9	L9-MW13	8260B	Dibromochloromethane	J
Line 9	L9-MW13	8260B	Dibromomethane	J
Line 9	L9-MW13	8260B	cis-1,3-Dichloropropene	J
Line 9	L9-MW13	8260B	trans-1,3-Dichloropropene	J
Line 9	L9-MW13	8260B	Methylene Chloride	J
Line 9	L9-MW13	8260B	Trichlorofluoromethane	J
Fire Training Pit	FTP-MW4	8260B	Dichlorodifluoromethane	J
Fire Training Pit	FTP-MW5	8260B	Dichlorodifluoromethane	J
Fire Training Pit	FTP-MW6	8260B	Dichlorodifluoromethane	J
Fire Training Pit	FTP-MW7	8260B	Dichlorodifluoromethane	J
Fire Training Pit	FTP-MW8	8260B	Dichlorodifluoromethane	J
East Burn Pads	EBP-MW4	8260B	Bromoform	J
East Burn Pads	EBP-MW4	8260B	Bromomethane	J
East Burn Pads	EBP-MW4	8260B	Carbon Disulfide	J
East Burn Pads	EBP-MW4	8260B	Carbon Tetrachloride	J
East Burn Pads	EBP-MW4	8260B	Dibromochloromethane	J
East Burn Pads	EBP-MW4	8260B	Dibromomethane	J
East Burn Pads	EBP-MW4	8260B	cis-1,3-Dichloropropene	J
East Burn Pads	EBP-MW4	8260B	trans-1,3-Dichloropropene	J
East Burn Pads	EBP-MW4	8260B	Methylene Chloride	J
East Burn Pads	EBP-MW4	8260B	Trichlorofluoromethane	J

Site ID	Field ID	Parameter	Analyte	Qualification
East Burn Pads	EBP-MW6	8260B	Dichlorodifluoromethane	J
West Burn Pads Area	WBP-MW1	8260B	Dichlorodifluoromethane	J
West Burn Pads Area	WBP-MW2	8260B	Dichlorodifluoromethane	J
West Burn Pads Area	WBP-MW3	8260B	Dichlorodifluoromethane	J

Review of the SVOC injection log summary report indicated that the CVs were performed at the required frequency of every 12 hours or batch of 20 samples. Based on the review of continuing calibration raw data and summary forms, all RFs met the evaluation criteria of greater than 0.05 for all analytes. In addition, %Ds met the evaluation criteria of less than 20% for CCCs and for non-CCCs with the exception of benzo(g,h,i perylene), 4-chloroaniline, dibenz(a,h)anthracene, 4,6-dinitro-2-methylphenol, and indeno(1,2,3-cd)pyrene. The table below identifies associated samples qualified as estimated based on outlying SVOC %RSD. Recalculation of the RF and %D for CV was completed (associated validated data for six compounds), and no errors in calculation were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 3	L3-MW1	8270C	Indeno (1,2,3-cd) pyrene	J
Line 3	L3-MW1	8270C	Benzo (g,h,i) perylene	J
Line 3	L3-MW1	8270C	Dibenz (a,h) anthracene	J
Line 3	L3-MW1	8270C	4,6-Dinitro-2-methylphenol	J
Line 3	L3-MW2	8270C	Indeno (1,2,3-cd) pyrene	J
Line 3	L3-MW2	8270C	Benzo (g,h,i) perylene	J
Line 3	L3-MW2	8270C	Dibenz (a,h) anthracene	J
Line 3	L3-MW2	8270C	4,6-Dinitro-2-methylphenol	J
Line 9	L9-MW1	8270C	4-Chloroaniline	J
Line 9	L9-MW3	8270C	Indeno (1,2,3-cd) pyrene	J
Line 9	L9-MW3	8270C	Benzo (g,h,i) perylene	J
Line 9	L9-MW3	8270C	Dibenz (a,h) anthracene	J
Line 9	L9-MW3	8270C	4,6-Dinitro-2-methylphenol	J
Line 9	L9-MW4	8270C	Indeno[1,2,3-cd]pyrene	J
Line 9	L9-MW4	8270C	Benzo[g,h,i]perylene	J
Line 9	L9-MW4	8270C	Dibenz[a,h]anthracene	J
Line 9	L9-MW5	8270C	Indeno (1,2,3-cd) pyrene	J
Line 9	L9-MW5	8270C	Benzo (g,h,i) perylene	J
Line 9	L9-MW5	8270C	Dibenz (a,h) anthracene	J
Line 9	L9-MW5	8270C	4,6-Dinitro-2-methylphenol J	
Line 9	L9-MW6	8270C	Indeno (1,2,3-cd) pyrene	
Line 9	L9-MW6	8270C	Benzo (g,h,i) perylene	J

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW6	8270C	Dibenz (a,h) anthracene	J
Line 9	L9-MW6	8270C 4,6-Dinitro-2-methylphenol		J
Line 9	L9-MW7	8270C	4-Chloroaniline	J
Line 9	L9-MW8	8270C	Indeno[1,2,3-cd]pyrene	J
Line 9	L9-MW8	8270C	Benzo[g,h,i]perylene	J
Line 9	L9-MW8	8270C	Dibenz[a,h]anthracene	J
Line 9	L9-MW11	8270C	4-Chloroaniline	J
Line 9	L9-MW12	8270C	4-Chloroaniline	J
Line 9	L9-MW12	8270C	4-Chloroaniline	J

Explosives CVs were analyzed at the required frequency, one every 12 hours of analysis, as required by the method. Review of the CV summary forms indicated that all %Ds met the evaluation criteria of less than 15 percent for all target compounds, with the exception of 2,4,6-TNT and RDX on the secondary column. Data was quantified using the primary column, so no qualification of explosives data was required based on outlying CV recoveries. Ten percent of the %D (associated validated data) was recalculated for each CV sample and no calculation or transcription errors were noted.

Metals CVs were analyzed at the required frequency of one per ten samples analyzed. Review of the CV summary forms indicated that all recoveries were within the evaluation criteria with the exception of chromium. The associated sample (WBP-MW3) was qualified as estimated based on the outlying CV recovery. Ten percent of the CV recoveries (associated validated data) were recalculated for each CV sample and no calculation or transcription errors were noted.

Wet chemistry CVs were analyzed at the method recommended frequency and were within the evaluation criteria; therefore, no qualification of data was required based on wet chemistry CV recoveries. Ten percent of CV recoveries (associated validated data) were recalculated for each CV sample and no calculation or transcription errors were noted.

## I.4.1.7 Blank Samples

Blank samples were analyzed to assess the existence and magnitude of contamination during laboratory activities. All method preparation, source water, rinsate, and trip blanks were reported as nondetect with the exception of acetone, chloroform, bromodichloromethane, dibromochloromethane, Freon 113, arsenic, barium, calcium, chromium, lead, magnesium, silver, and sodium. Associated acetone, bromodichloromethane and dibromochloromethane results were reported as nondetect and did not require qualification. Associated barium, calcium, magnesium, and sodium results were five times greater than the blank contamination and did not require qualification. Associated chloroform, Freon 113, arsenic, chromium, lead, and silver results qualified as nondetect based on blank contamination are listed in the table below.

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Fire Training Pit	FTP-MW1	6020	Arsenic		U
Fire Training Pit	FTP-MW1	6020	Chromium		U
Fire Training Pit	FTP-MW2	6020	Arsenic		U
Fire Training Pit	FTP-MW2	6020	Chromium		U
Fire Training Pit	FTP-MW2	6020	Lead		U
Fire Training Pit	FTP-MW3	6020	Arsenic		U
Fire Training Pit	FTP-MW3	6020	Chromium		U
Fire Training Pit	FTP-MW3	6020	Lead		U
Fire Training Pit	FTP-MW4	6020	Arsenic		U
Fire Training Pit	FTP-MW4	6020	Chromium		U
Fire Training Pit	FTP-MW4	6020	Lead		U
Fire Training Pit	FTP-MW4	6020	Silver		U
Fire Training Pit	FTP-MW5	6020	Arsenic		U
Fire Training Pit	FTP-MW5	6020	Chromium		U
Fire Training Pit	FTP-MW5	6020	Lead		U
Fire Training Pit	FTP-MW5	6020	Silver		U
Fire Training Pit	FTP-MW6	6020	Arsenic		U
Fire Training Pit	FTP-MW6	6020	Chromium		U
Fire Training Pit	FTP-MW6	6020	Lead		U
Fire Training Pit	FTP-MW6	6020	Silver		U
Fire Training Pit	FTP-MW7	8260B	Freon 113		U
Fire Training Pit	FTP-MW7	6020	Arsenic		U
Fire Training Pit	FTP-MW7	6020	Chromium		U
Fire Training Pit	FTP-MW7	6020	Lead		U
Fire Training Pit	FTP-MW7	6020	Silver		U
Fire Training Pit	FTP-MW8	6020	Arsenic		U
Fire Training Pit	FTP-MW8	6020	Chromium		U
Fire Training Pit	FTP-MW8	6020	Lead		U
Fire Training Pit	FTP-MW8	6020	Silver		U
West Burn Pads Area	WBP-MW1	6020	Arsenic		U
West Burn Pads Area	WBP-MW1	6020	Chromium		U
West Burn Pads Area	WBP-MW1	6020	Lead		U
West Burn Pads Area	WBP-MW1	6020	Silver		U
West Burn Pads Area	WBP-MW2	8260B	Freon 113		U
West Burn Pads Area	WBP-MW2	6020	Arsenic		U
West Burn Pads Area	WBP-MW2	6020	Chromium		U

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
West Burn Pads Area	WBP-MW2	6020	Lead		U
West Burn Pads Area	WBP-MW2	6020	Silver		U
West Burn Pads Area	WBP-MW3	8260B	Freon 113		U
West Burn Pads Area	WBP-MW3	6020	Silver		U
East Burn Pads	WBP-MW4	8260B	Freon 113		U
East Burn Pads	WBP-MW5	8260B	Freon 113		U
Line 2	L2-MW4	6020	Chromium		U
Line 2	L2-MW4	6020	Lead		U
Line 2	L2-MW5	6020	Chromium		U
Line 2	L2-MW5	6020	Lead		U
Line 2	L2-MW5	6020	Silver		U
Line 2	L2-MW6	6020	Arsenic		U
Line 2	L2-MW6	6020	Chromium		U
Line 2	L2-MW6	6020	Lead		U
Line 2	L2-MW6	6020	Silver		U
Line 2	L2-MW7	6020	Arsenic		U
Line 2	L2-MW7	6020	Chromium		U
Line 2	L2-MW7	6020	Lead		U
Line 2	L2-MW7	6020	Silver		U
Line 2	L2-MW8	6020	Arsenic		U
Line 2	L2-MW8	6020	Chromium		U
Line 2	L2-MW8	6020	Lead		U
Line 2	L2-MW8	6020	Silver		U
Line 3	L3-MW1	6020	Arsenic		U
Line 3	L3-MW1	6020	Chromium		U
Line 3	L3-MW1	6020	Lead		U
Line 3	L3-MW1	6020	Silver		U
Line 3	L3-MW2	6020	Arsenic		U
Line 3	L3-MW2	6020	Chromium		U
Line 3	L3-MW2	6020	Lead		U
Line 3	L3-MW2	6020	Silver		U
Line 9	L3-MW3	8260B	Freon 113		U
Line 9	L3-MW4	8260B	Freon 113		U
Line 9	L3-MW6	8260B	Freon 113		U
Line 9	L3-MW12	8260B	Chloroform		U

## I.4.1.8 Surrogate Compound Percent Recoveries

Surrogate recoveries were used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate recoveries for all samples were within evaluation criteria with the exception of L3-MW1 (2-fluorophenol), L9-MW8 (2-fluorophenol and 2,4,6-tribromophenol) and L9-MW9 (2-fluorophenol). Based on Functional Guidelines (USEPA 1999), two or more SVOC surrogates must be outside evaluation criteria before data qualification is required; therefore, samples L3-MW1 and L9-MW9 were not qualified. Data qualifications based on outlying surrogate recoveries are listed in the table below. Ten percent of surrogate recoveries (associated validated data) were recalculated, no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW8	8260B	Acid Fraction	J

#### I.4.1.9 Laboratory Control Samples

LCSs were analyzed to assess the accuracy of the analytical method and demonstrate laboratory performance. LCS recoveries were all within the evaluation criteria with the exception of benzoic acid, 2,4-dinitrophenol, hexachlorocyclopentadiene, nitrobenzene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. Data qualifications based on outlying LCS recoveries are listed in the table below. Ten percent of LCS recoveries (associated validated data) were recalculated, no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 3	L3-MW1	8260B	Benzoic Acid	R
Line 3	L3-MW1	8260B	2,4-Dinitrophenol	J
Line 3	L3-MW1	8260B	Hexachlorocyclopentadiene	R
Line 3	L3-MW2	8260B	Benzoic Acid	R
Line 3	L3-MW2	8260B	2,4-Dinitrophenol	J
Line 3	L3-MW2	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW1	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW2	8260B	Benzoic Acid	J
Line 9	L9-MW2	8260B	2,4-Dinitrophenol	J
Line 9	L9-MW2	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW3	8260B	Benzoic Acid	R
Line 9	L9-MW3	8260B	2,4-Dinitrophenol	J
Line 9	L9-MW3	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW4	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW5	8260B	Benzoic Acid	R
Line 9	L9-MW5	8260B	2,4-Dinitrophenol	J

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW5	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW6	8260B	Benzoic Acid	R
Line 9	L9-MW6	8260B	2,4-Dinitrophenol	J
Line 9	L9-MW6	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW7	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW8	8260B	Benzoic Acid	R
Line 9	L9-MW8	8260B	2,4-Dinitrophenol	J
Line 9	L9-MW8	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW9	8260B	Benzoic Acid	R
Line 9	L9-MW9	8260B	2,4-Dinitrophenol	J
Line 9	L9-MW9	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW10	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW11	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW12	8260B	Hexachlorocyclopentadiene	R
Line 9	L9-MW13	8260B	Hexachlorocyclopentadiene	R
Fire Training Pit	FTP-MW4	Explosives	Nitrobenzene	J
Fire Training Pit	FTP-MW4	Explosives	2-Nitrotoluene	J
Fire Training Pit	FTP-MW4	Explosives	3-Nitrotoluene	J
Fire Training Pit	FTP-MW4	Explosives	4-Nitrotoluene	J
Fire Training Pit	FTP-MW6	Explosives	Nitrobenzene	J
Fire Training Pit	FTP-MW6	Explosives	2-Nitrotoluene	J
Fire Training Pit	FTP-MW6	Explosives	3-Nitrotoluene	J
Fire Training Pit	FTP-MW6	Explosives	4-Nitrotoluene	J
Fire Training Pit	FTP-MW7	Explosives	Nitrobenzene	J
Fire Training Pit	FTP-MW7	Explosives	2-Nitrotoluene	J
Fire Training Pit	FTP-MW7	Explosives	3-Nitrotoluene	J
Fire Training Pit	FTP-MW7	Explosives	4-Nitrotoluene	J
Fire Training Pit	FTP-MW8	Explosives	Nitrobenzene	J
Fire Training Pit	FTP-MW8	Explosives	2-Nitrotoluene	J
Fire Training Pit	FTP-MW8	Explosives	3-Nitrotoluene	J
Fire Training Pit	FTP-MW8	Explosives	4-Nitrotoluene	J
West Burn Pads Area	WBP-MW2	Explosives	Nitrobenzene	J
West Burn Pads Area	WBP-MW2	Explosives	2-Nitrotoluene	J
West Burn Pads Area	WBP-MW2	Explosives	3-Nitrotoluene	J
West Burn Pads Area	WBP-MW2	Explosives	4-Nitrotoluene	J
East Burn Pads	EBP-MW4	8260B	Hexachlorocyclopentadiene	R

Site ID	Field ID	Parameter	Analyte	Qualification
East Burn Pads	EBP-MW5	8260B	Hexachlorocyclopentadiene	R
East Burn Pads	EBP-MW6	8260B	Hexachlorocyclopentadiene	R

## I.4.1.10 Laboratory Duplicate Samples

Laboratory duplicate samples were established to determine laboratory precision. The laboratory duplicated various samples for metals and wet chemistry analysis. All duplicate samples RPDs were within the established evaluation criteria; therefore, no qualification of data was required based on outlying precision. Ten percent of the laboratory sample pair precision (associated validated data) was recalculated; no calculation or transcription errors were noted.

## 1.4.1.11 Field Duplicate Analysis

Field duplicate sample pairs were established to determine both field and laboratory precision. Two groundwater field duplicate sample pairs collected and submitted to the laboratory for analysis. The field duplicate sample pairs are presented in the following table:

Field Duplicate Sample Pairs								
Site ID	Duplicate Sample ID							
Fire Training Pit	FTP-MW1	FTP-MW9						
East Burn Pads	EBP-MW5	EBP-MW7						

Field duplicate sample pair results were within evaluation criteria (25 percent) for all duplicate sample pairs; therefore, no qualifications were required based on outlying precision. Analytical results for the field duplicate sample pairs are presented in **Table I-3**.

## I.4.1.12 Quality Assurance Analysis

QA split samples were collected to determine laboratory accuracy and precision. Two groundwater samples were collected and submitted to a secondary laboratory (USACE Chemistry Quality Assurance Branch) for analysis and comparison. The QA split samples are listed in the table below:

Quality Assurance Split Sample Pairs								
Site ID	QA Split Sample ID							
Fire Training Pit	FTP-MW1	FTP-MW1 Split						
East Burn Pads	EBP-MW5	EBP-MW5 Split						

The USACE places the QA sample evaluations into three categories: major, minor, or data agreed. Major discrepancies for groundwater are defined as relative percent differences (RPDs) greater than five times the QA split sample result. Minor discrepancies for groundwater are defined as RPDs equal to and/or no more than two times the split sample result. Data results categorized as agreed are defined as RPDs of less than two times the split sample result.

**Table I-4** presents the data comparison of the original data and the QA samples. All data agreed with the exception of unconfirmed HMX and RDX concentrations in split sample EBP-MW5 (minor).

## I.4.1.13 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed to assess laboratory accuracy and the effects of matrix inferences on sample preparation and analyses. Two groundwater well locations (FTP-MW8 and EBP-MW6) were selected prior to the sampling event to be collected and submitted to the laboratory for MS/MSD analyses. The laboratory also spiked various samples that were not submitted for MS/MSD analyses. The MS/MSD samples are presented in the table below.

Matrix Spike/Matrix Spike Duplicate Samples							
Site ID	Original Sample ID	Parameters					
Fire Training Pit	FTP-MW8	8260B, 8330, 6020/7470, Wet Chemistry					
East Burn Pads	EBP-MW6	8260B, 8270C, 8330, 6020/7470, Wet Chemistry					
Line 2	L2-MW7	Metals					
Line 3	L3-MW2	Wet Chemistry					
Line 9	L9-MW7	8260B, 8270C, 8330, 6020/7470, Wet Chemistry					

The following table identifies the MS/MSD samples with outlying recoveries.

Site ID	Field ID	Parameter	Analyte	MS/MSD Recovery	RPD	Criteria
Fire Training Pit	FTP-MW8	300.0	Chloride	150/115	26	73-121/11
Fire Training Pit	FTP-MW8	300.0	ortho-Phosphate	100/113	12	81-115/10
Fire Training Pit	FTP-MW8	300.0	Sulfide	137/139	2	72-124/10
Fire Training Pit	FTP-MW8	300.0	Total Organic Carbon	76/ <b>68</b>	11	70-119/11
Fire Training Pit	FTP-MW8	300.0	Calcium	146	-	75-125
East Burn Pads	EBP-MW6	8270C	2,4-Dinitrophenol	<b>0</b> /79	200	20-160/50
East Burn Pads	EBP-MW6	8270C	Hexachlorocyclopentadiene	0/7	200	20-160/50
East Burn Pads	EBP-MW6	8270C	4-Nitrophenol	<b>7</b> /100	174	10-98/50
East Burn Pads	EBP-MW6	8270C	4,6-Dinitro-2-Methylphenol	<b>0</b> /100	200	20-160/50
East Burn Pads	EBP-MW6	8270C	Pentachlorophenol	<b>9</b> /79	159	10-137/-
East Burn Pads	EBP-MW6	8270C	2-Nitrophenol	22/79	113	20-160/50
East Burn Pads	EBP-MW6	8270C	Benzoic Acid	0/63	200	20-160/50
East Burn Pads	EBP-MW6	8270C	2,4-Dichlorophenol	41/74	50	20-160/57
East Burn Pads	EBP-MW6	8270C	4-Chloro-3-Methylphenol	63/105	16	27-109/50
East Burn Pads	EBP-MW6	8270C	2,4,5-Trichlorophenol	29/84	73	20-160/50
East Burn Pads	EBP-MW6	8270C	Pyrene	116/126	8	44-116/20

Site ID	Field ID	Parameter	Analyte	MS/MSD Recovery	RPD	Criteria
East Burn Pads	EBP-MW6	8270C	1,4-Dichlorobenzene	37/63	52	24-63/39
East Burn Pads	EBP-MW6	8270C	1,3,4-Trichlorobenzene	43/63	38	31-67/28
Line 2	L2-MW7	6020	Calcium	96/72	29	68-122/10
Line 2	L2-MW7	6020	Magnesium	70		75-125
Line 3	L3-MW2	353.2	NO <sub>3</sub> +NO <sub>2</sub>	72		75-125
Line 9	L9-MW7	300.0	Sulfate	95/107	12	81-115/10

Functional guidelines indicate that organic data should not be qualified based on MS/MSD criteria alone. Because surrogate recovery and associated LCS recoveries were within criteria, no qualification of SVOC data was required based on outlying MS/MSD recoveries.

Sulfide results were reported as nondetect; therefore, no qualification of sulfide data was required.

The native calcium and magnesium concentrations in groundwater samples FTP-MW8 and L2-MW7 were four times greater that the spike concentration added; therefore, no qualification of associated calcium or magnesium data was required. Data qualifications based on outlying MS/MSD recoveries are presented in the table below. Ten percent of MS/MSD recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

Site ID	Field ID	Analyte	Qualification
Fire Training Pit	FTP-MW8	Chloride	J
Fire Training Pit	FTP-MW8	ortho-Phosphate	J
Fire Training Pit	FTP-MW8	Total Organic Carbon	J
Line 3	L3-MW2	NO <sub>3</sub> +NO <sub>2</sub>	J
Line 9	L9-MW7	Sulfate	J

#### I.4.1.14 PARCC Parameters

## Precision and Accuracy

The agreement between duplicate analyses within control limits indicates satisfactory precision in a measurement system. The recovery of a predetermined amount of a spike within control limits indicates satisfactory accuracy with respect to the method on the individual sample and general matrix. For all analyses, ninety-seven percent of the indicators reviewed for accuracy (LCS, MS, and/or surrogate spikes) were within evaluation criteria. Ninety-six percent of the indicators reviewed for precision (matrix spike duplicate and/or field duplicates) were within evaluation criteria.

The overall accuracy and precision of the groundwater and surface water data collected and reported during the sampling event were concluded to be satisfactory.

#### Representativeness

Representativeness expresses the degrees to which sample data accurately and precisely represent the characteristics of a population. Representativeness is a qualitative parameter that is of concern in the proper design of the sampling program, such that the sampling locations selected will provide representative data for decisions made at IAAAP. Representativeness was assessed using the two field duplicate sample pairs collected during the groundwater RAA field activities. Field duplicate sample pairs were within evaluation criteria; therefore, it was concluded that representativeness was satisfactory.

## Comparability

Comparability expresses the confidence with which one data set can be compared to another. In accordance with the QAPP, data are comparable when siting considerations, collection techniques, measurement methods, and reporting procedures are equivalent for the samples within a sample set. Throughout this investigation, appropriate procedures for sampling and analytical shipping were implemented as specified in the IAAAP Facility Wide Work Plan (URS 2002a). Within this data set, it was concluded that results were comparable to one another.

#### **Completeness**

Completeness is defined as the percentage of the total number of analytical results requested which are judged to be valid, including estimated J values, in accordance with the IAAAP Facility-Wide Work Plan (URS 2002a). Ninety-nine percent of the analytical data collected was considered to be valid after data review and validation.

## Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. MDLs were determined as outlined in 40 CFR Part 136 and are defined as the minimum concentration of a substance that can be identified, measured and reported with 99 percent confidence that the analyte concentration is greater that zero, and is determined for analysis of a sample in a given matrix containing the analyte. Laboratory RLs are generally three to five times higher than the laboratory MDLs. Values above the MDL and less than the RL were qualified as estimated.

Sample dilutions, volume constraints, and matrix interference will decrease sensitivity. RLs were elevated in SDGs IAP57 through IAP63, but project sensitivity requirements established in the project DQOs were met.

#### I.5 REFERENCES

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- USATHAMA. 1990. Quality Assurance Program. January.
- USEPA. 2001b. USEPA Contract Laboratory Program National Functional Guidelines for Low Concentrations Organic Data Review. 9240.1-05. EPA 540/R-94/012. June.
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**Direct Push Results** 

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-DP01	-38	FT	P-DP02	2-25	FT	P-DP03	-31	FT	P-DP04	l-13	FT	P-DP04	-27
DATE COLLECTED	Regulatory	Maximum	Detection	Octo	ber 22,	2002	Octo	ber 27,	2002	Octo	ber 27,	2002	Nove	mber 5	, 2002	Octo	ber 23,	2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	<	3	U	190	3		2100	150	JD	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	1	3	J	26	3		<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	<	3	U	4	3		72	3	J	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	<	3	U	150	6	D	2800	150	JD	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	5	3	J	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	14	10	J	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	<	3	U	2	3	J	37	3		<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-DP01	-38	FT	P-DP02	-25	FT	P-DP03	-31	FT	P-DP04	-13	FT	P-DP04	-27
DATE COLLECTED	Regulatory	Maximum	Detection	Octo	ber 22,	2002	Octo	ber 27,	2002	Octo	ber 27,	2002	Nove	mber 5,	2002	Octo	ber 23,	2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	<	3	U	4	3	J	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (μg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10		NE			NE			NE			NE			NE	
1,3-Dinitrobenzene	1 (b)	-	0/10		NE			NE			NE			NE			NE	
2,4,6-Trinitrotoluene	2 (b)	-	0/10		NE			NE			NE			NE			NE	
2,4-Dinitrotoluene	1 (d)	-	0/10		NE			NE			NE			NE			NE	
2,6-Dinitrotoluene	1 (d)	-	0/10		NE			NE			NE			NE			NE	
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10		NE			NE			NE			NE			NE	
2-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE			NE	
3-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE			NE	
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10		NE			NE			NE			NE			NE	
4-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE			NE	
HMX	400 (b)	27	2 / 10		NE			NE			NE			NE			NE	
MNX	N/A	-	0/10		NE			NE			NE			NE			NE	
Nitrobenzene	3.4 (c)	-	0/10		NE			NE			NE			NE			NE	
RDX	2 (b)	3.5 P	1 / 10		NE			NE			NE			NE			NE	
Tetryl	N/A	2.8 P	1 / 10		NE			NE			NE			NE			NE	

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP				P-DP05			P-DP06			P-DP07			P-DP08			P-DP09	
DATE COLLECTED	Regulatory	Maximum	Detection		ber 25,	2002		ber 27,	2002		ber 23,	2002	Octo	ber 25,	2002	Octo	ber 23,	2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	40	3		6	3		6	3		24	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	2	3	J	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	3	3		<	3	U	<	3	U	41	3		<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	51	3		4	3		4	3		74	3		<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	<	3	U	17	3		<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	1	3	J	<	3	U	<	3	U	46	3		<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	3	3	J	<	3	U	<	3	U	3	3		<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-DP05	5-23	FT	P-DP06	-24	FTI	P-DP07	-27	FT	P-DP08	3-23	FT	P-DP09	-30
DATE COLLECTED	Regulatory	Maximum	Detection		ber 25,	2002	Octo	ber 27,	2002	Octo	ber 23,	2002	Octo	ber 25,	2002	Octo	ber 23,	2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	<	3	U	1	3	J	12	3		<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	3	3		<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (μg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
1,3-Dinitrobenzene	1 (b)	-	0/10		NE			NE			NE			NE		<	0.36	U
2,4,6-Trinitrotoluene	2 (b)	-	0/10		NE			NE			NE			NE		<	0.36	U
2,4-Dinitrotoluene	1 (d)	-	0/10		NE			NE			NE			NE		<	0.36	U
2,6-Dinitrotoluene	1 (d)	-	0/10		NE			NE			NE			NE		<	0.36	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10		NE			NE			NE			NE		<	0.36	U
2-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
3-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10		NE			NE			NE			NE		<	0.36	U
4-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
HMX	400 (b)	27	2 / 10		NE			NE			NE			NE		<	0.36	U
MNX	N/A	-	0/10		NE			NE			NE			NE		<	0.36	U
Nitrobenzene	3.4 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
RDX	2 (b)	3.5 P	1 / 10		NE			NE			NE			NE		<	0.36	U
Tetryl	N/A	2.8 P	1 / 10		NE			NE			NE			NE		<	0.36	U

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP				P-DP10			P-DP11			P-DP12			P-DP14			P-DP17	
DATE COLLECTED	Regulatory	Maximum	Detection		ber 23,	2002		ber 24,	2002		ber 25,	2002	Octo	ber 23,	2002	Octo	ber 25,	2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	POUNDS (μg/	L)																
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	3	3		25	3		11	3		3	3	J	5	3	
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	<	3	U	3	3		<	3	U	17	3		4	3	
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	1	3	J	23	3		8	3		2	3	J	1	3	J
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	<	3	U	1	3	J	<	3	U	1	3	J	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	3	3	J	3	3	J	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-DP10	-18	FT	P-DP11	-20	FT	P-DP12	-23	FT	P-DP14	l-09	FT	P-DP17	-06
DATE COLLECTED	Regulatory	Maximum	Detection	Octo	ber 23,	2002	Octo	ber 24,	2002	Octo	ber 25,	2002	Octo	ber 23,	2002	Octo	ber 25,	2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	2	3	J	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	29	3		<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
1,3-Dinitrobenzene	1 (b)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2,4,6-Trinitrotoluene	2 (b)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2,4-Dinitrotoluene	1 (d)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2,6-Dinitrotoluene	1 (d)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2-Nitrotoluene	61 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
3-Nitrotoluene	61 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
4-Nitrotoluene	61 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
HMX	400 (b)	27	2 / 10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
MNX	N/A	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
Nitrobenzene	3.4 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
RDX	2 (b)	3.5 P	1 / 10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
Tetryl	N/A	2.8 P	1 / 10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP				P-DP18			P-DP19			P-DP20			P-DP21			P-DP22	
DATE COLLECTED	Regulatory		Detection		ber 25,			ber 25,			nber 21	*		ber 25,		Noven	nber 21	*
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	POUNDS (μg/	L)																
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	35	3		3	3	J	<	3	U	4	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	6	3		3	3		<	3	U	8	3		<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	37	3		<	3	U	<	3	U	9	3		<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	1	3	J	<	3	U	<	3	U	1	3	J	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	2	3	J	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	5	3		<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	3	3		1	3	J	<	3	U	9	3		<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	3	U	<	3	U	<	5	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	1	3	J	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-DP18	-10	FT	P-DP19	-14	FTI	P-DP20	-23	FT	P-DP21	-30	FT	P-DP22	2-20
DATE COLLECTED	Regulatory	Maximum	Detection	Octo	ber 25,	2002	Octo	ber 25,	2002	Noven	iber 21	, 2002	Octo	ber 25,	2002	Noven	nber 21	, 2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	2	3	J	<	3	U	<	3	U	2	3	J	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	1	3	J	<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (μg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
1,3-Dinitrobenzene	1 (b)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2,4,6-Trinitrotoluene	2 (b)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2,4-Dinitrotoluene	1 (d)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2,6-Dinitrotoluene	1 (d)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10	<	0.27	U		NE			NE			NE			NE	
2-Nitrotoluene	61 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
3-Nitrotoluene	61 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10	<	0.27	U		NE			NE			NE			NE	
4-Nitrotoluene	61 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
HMX	400 (b)	27	2 / 10	0.64	0.27			NE			NE			NE			NE	
MNX	N/A	-	0/10	<	0.27	U		NE			NE			NE			NE	
Nitrobenzene	3.4 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
RDX	2 (b)	3.5 P	1 / 10	<	0.27	U		NE			NE			NE			NE	
Tetryl	N/A	2.8 P	1 / 10	2.8	0.27	P		NE			NE			NE			NE	

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FTI	P-DP23	-25	FT	P-DP24	-07	FTI	P-DP25	-22	FT	P-DP26	-23
DATE COLLECTED	Regulatory	Maximum	Detection	Noven	ber 21	, 2002	Noven	nber 22	, 2002	Noven	iber 22	, 2002	Noven	nber 25	, 2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)													
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	20	3		18	3		5	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	<	3	U	4	3		<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	12	3		7	3		<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	5	U	<	5	U	<	5	U	31	5	
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1 SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-DP23	-25	FT	P-DP24	-07	FT	P-DP25	-22	FT	P-DP26	-23
DATE COLLECTED	Regulatory	Maximum	Detection	Nover	nber 21	, 2002	Nover	nber 22	, 2002	Nover	nber 22	, 2002	Noven	nber 25	, 2002
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)													
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)															
1,3,5-Trinitrobenzene	1100 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
1,3-Dinitrobenzene	1 (b)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2,4,6-Trinitrotoluene	2 (b)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2,4-Dinitrotoluene	1 (d)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2,6-Dinitrotoluene	1 (d)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2-Nitrotoluene	61 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
3-Nitrotoluene	61 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
4-Nitrotoluene	61 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
HMX	400 (b)	27	2 / 10	<	0.39	U	27	0.75		<	0.52	U	<	0.95	U
MNX	N/A	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
Nitrobenzene	3.4 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
RDX	2 (b)	3.5 P	1 / 10	<	0.39	U	3.5	0.75	P	<	0.52	U	<	0.95	U
Tetryl	N/A	2.8 P	1 / 10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level



**Monitoring Well Results** 

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP				TA-99-		F'	ΓA-99-2	2	J	AW-58	;	J	AW-59		J.	AW-60	,
DATE COLLECTED	Regulatory	Maximum	Detection	May	y 20, 20	$003^{1}$	Mag	y 20, 20	)03 <sup>1</sup>	Mag	y 30, 20	$003^{1}$	Ma	y 21, 20	$003^{1}$	Mag	y 21, 20	$003^1$
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	90	3		<	3	U	130	6	D	170	3		91	3	
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	1	3	J	<	3	U	<	3	U	1	3	J	4	3	
1,1-Dichloroethane	810 (c)	240 D	9 / 19	12	3		<	3	U	3	3		6	3		140	3	
1,1-Dichloroethene	7 (a)	380 D	10 / 19	84	3		<	3	U	81	3		180	3		380	15	D
1,2-Dichloroethane	5 (a)	130 J	5 / 19	4	3		<	3	U	<	3	U	2	3	J	30	3	
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	<	10	U	<	10	U	<	10	UJ	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	11	3	
Bromochloromethane	90 (b)	2 J	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	2	3	J	<	3	U	<	3	U	<	3	U	5	3	
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	9	3		<	3	U	<	3	U	4	3		110	3	
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	120	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	<	3	U	2	3	J	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	<	3	U	<	3	U	2	3	J	5	3		<	3	U
Toluene	1000 (a)	5600 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			F'	Γ <b>A-99-</b> 1	[	F'	ГА-99-2	2	J	AW-58		J	AW-59		J	AW-60	
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 20, 20	003 <sup>1</sup>	Ma	y 20, 20	003 <sup>1</sup>	Ma	y 30, 20	$03^{1}$	Ma	y 21, 20	$03^{1}$	Ma	y 21, 20	03 <sup>1</sup>
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	1	3	J
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	8	3		<	3	U	<	3	U	2	3	J	74	3	
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
1,3-Dinitrobenzene	1 (b)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
3-Nitrotoluene	61 (c)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
HMX	400 (b)	1.7	3 / 19	1.7	0.38		<	0.22	U	<	0.39	U	0.28	0.33	JP	<	0.65	U
MNX	N/A	0.31 JP	1 / 19	0.31	0.38	JP	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
RDX	2 (b)	6.9	5 / 19	6.9	0.38		<	0.22	U	<	0.39	U	1.3	0.33		<	0.65	U
Tetryl	N/A	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
METALS (μg/L)																		
Arsenic	10 (a)	58	3 / 19	<	10	U	3.4	10	J	<	10	U	<	10	U	3.3	10	J
Barium	2000 (a)	353	19 / 19	151	200	J	54.9	200	J	85.4	200	J	133	200	J	219	200	
Cadmium	5 (a)	0.16 J	4 / 19	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	1.7 J	4 / 19	1.7	10	J	<	10	U	<	10	U	1	10	J	<	10	U
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	16.2	10 / 19	<	10	U	<	10	U	5.9	10	J	<	10	U	<	10	U
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U

**TABLE I-2** SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			F.	ГА-99-1		F	ΓA-99-2	2	J	AW-58		J	AW-59		J	AW-60	,
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 20, 20	03 <sup>1</sup>	Ma	y 20, 20	003 <sup>1</sup>	Ma	y 30, 20	$003^{1}$	Ma	y 21, 20	$003^{1}$	Ma	y 21, 20	)03¹
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (μg/L) (ME	ETALS)																	
Calcium	NE	92000	8 / 8		NE			NE			NE			NE			NE	
Magnesium	NE	35500	8 / 8		NE			NE			NE			NE			NE	
Sodium	NE	110000	8/8		NE			NE			NE			NE			NE	
NA PARAMETERS (mg/L)																		
Alkalinity	NE	540	19 / 19	300	20		420	20		270	8		330	20		380	20	
Ammonia	NE	0.33	9 / 19	<	0.02	U	<	0.02	U	0.1	0.02		<	0.02	U	<	0.02	U
Carbon Dioxide	NE	180	18 / 18	45	0.1		45	0.1		29	0.1		107	0.1		89	0.1	
Chloride	NE	40	19 / 19	8	1		2	1		2	1		12	10		21	10	
Nitrate, Nitrite as N	10 (a)	2	14 / 19	1.6	0.05		0.13	0.05		0.09	0.05		0.18	0.05		0.08	0.05	
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Sulfate	NE	240	18 / 19	40	10		59	10		35	10		66	10		39	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	<	0.3	U	0.4	0.3		0.4	0.3		<	0.3	U	<	0.3	U
Total Organic Carbon	NE	130	10 / 19	<	1	U	<	1	U	2.1	1		1.6	1		1.9	1	

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

mg/L = Milligrams Per Liter

MNX = Mono-Nitroso RDX

N/A = Not Available

NA = Natural Attenuation

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

<sup>1</sup> Samples collected during Annual Groundwater Monitoring Event (HGL 2003).

All others collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (c) Region 9 Preliminary Remediation Goal (PRG)

- (b) Health Advisory Level (HAL)
- (d) Proposed DNT Mixture Action Level

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			JA	AW-61		J	AW-62		J.	AW-63		J	AW-80			M-01	
DATE COLLECTED	Regulatory	Maximum	Detection	May	28, 20	)03¹	Mag	y 28, 20	$003^{1}$	Ma	y 28, 20	003 <sup>1</sup>	Mag	y 28, 20	$003^{1}$	Ma	y 20, 20	$003^1$
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	270	15	D	<	3	U	<	3	U	19	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	1	3	J	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	240 D	9 / 19	48	3		<	3	U	<	3	U	1	3	J	<	3	U
1,1-Dichloroethene	7 (a)	380 D	10 / 19	190	15	D	<	3	U	<	3	U	17	3		<	3	U
1,2-Dichloroethane	5 (a)	130 J	5 / 19	4	3		<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	2 J	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	3	3		<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	21	3		<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	120	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	1	3	J	<	3	U	<	3	U	7	3		2	3	J
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	76	3		<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	5600 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			-	AW-61		J	AW-62		J	IAW-63		J	AW-80			M-01	
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 28, 20	)03 <sup>1</sup>	Ma	y 28, 20	003 <sup>1</sup>	Ma	y 28, 20	03 <sup>1</sup>	Ma	y 28, 20	$003^{1}$	Ma	y 20, 20	)03¹
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (μg/	L)																
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	120	3		<	3	U	<	3	U	2	3	J	<	3	U
Trichlorofluoromethane	1300 (c)	_	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
1,3-Dinitrobenzene	1 (b)	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2,4,6-Trinitrotoluene	2 (b)	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2,4-Dinitrotoluene	1 (d)	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2-Amino-4,6-Dinitrotoluene	N/A	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2-Nitrotoluene	61 (c)	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
3-Nitrotoluene	61 (c)	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
4-Amino-2,6-Dinitrotoluene	N/A	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
HMX	400 (b)	1.7	3 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
MNX	N/A	0.31 JP	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
Nitrobenzene	3.4 (c)	_	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
RDX	2 (b)	6.9	5 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
Tetryl	N/A	-	0 / 19	<	0.47	$\mathbf{U}$	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
METALS (μg/L)																		
Arsenic	10 (a)	58	3 / 19	<	10	UJ	<	10	UJ	<	10	UJ	<	10	UJ	<	10	U
Barium	2000 (a)	353	19 / 19	93.5	200	J	70.8	200	J	79.2	200	J	189	200	J	231	200	
Cadmium	5 (a)	0.16 J	4 / 19	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	1.7 J	4 / 19	<	10	U	<	10	U	<	10	U	<	10	U	0.75	10	J
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	16.2	10 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U

**TABLE I-2** SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			J	AW-61		J	AW-62		J	AW-63		J	AW-80			M-01	
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 28, 20	003 <sup>1</sup>	Ma	y 28, 20	003 <sup>1</sup>	Ma	y 28, 20	003 <sup>1</sup>	Ma	y 28, 20	$003^{1}$	Ma	y 20, 20	)03¹
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (μg/L) (ME	TALS)																	
Calcium	NE	92000	8 / 8		NE			NE			NE			NE			NE	
Magnesium	NE	35500	8/8		NE			NE			NE			NE			NE	
Sodium	NE	110000	8/8		NE			NE			NE			NE			NE	
NA PARAMETERS (mg/L)																		
Alkalinity	NE	540	19 / 19	190	20		170	20		270	20		320	20		270	20	
Ammonia	NE	0.33	9 / 19	0.05	0.02		0.07	0.02		<	0.02	U	<	0.02	U	<	0.02	U
Carbon Dioxide	NE	180	18 / 18	65	0.1		34	0.1		45	0.1		38	0.1		36	0.1	
Chloride	NE	40	19 / 19	7	1		14	10		1	1		3	1		6	1	
Nitrate, Nitrite as N	10 (a)	2	14 / 19	0.38	0.05		0.31	0.05		0.38	0.05		1.9	0.05		0.07	0.05	
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Sulfate	NE	240	18 / 19	45	10		39	10		37	10		27	10		33	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	<	0.3	U	<	0.3	U	<	0.3	U	<	0.3	U	0.3	0.3	
Total Organic Carbon	NE	130	10 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

mg/L = Milligrams Per Liter

MNX = Mono-Nitroso RDX

N/A = Not Available

NA = Natural Attenuation

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

<sup>1</sup> Samples collected during Annual Groundwater Monitoring Event (HGL 2003).

All others collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

# Regulatory Standards:

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

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TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			S	A-99-1		FT	P-MW	1	FT	P-MW	2	FT	P-MW	3	FT	P-MW	4
DATE COLLECTED	Regulatory	Maximum	Detection	Mag	y 20, 20	$003^{1}$	Ma	y 13, 20	003	Ma	y 13, 20	003	Ma	y 13, 20	003	Ma	y 14, 2	003
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	68	3		<	3	U	17	3		<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	240 D	9 / 19	240	150	D	15	3		2	3	J	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	380 D	10 / 19	28	3	J	2	3	J	13	3		<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	130 J	5 / 19	130	3	J	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	190	10	J	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	980	500	JD	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	110	3		<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	2 J	1 / 19	2	3	J	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	4	3		<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	3700	150	D	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	400	150	D	<	3	U	1	3	J	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	UJ
Ethylbenzene	700 (a)	120	1 / 19	120	3		<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	83	3		<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	1600	500	JD	<	10	U	<	10	U	<	10	U	<	3	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	510	150	JD	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	5600 D	1 / 19	5600	150	D	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			S	A-99-1		FT	P-MW	1	F	rP-MW2	2	FI	rp-MW	3	FT	P-MW	4
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 20, 20	$003^{1}$	Ma	y 13, 20	003	Ma	ay 13, 20	003	Ma	ay 13, 20	003	Ma	ıy 14, 2	003
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)																
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	4	3		<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	3	3		<	3	U	1	3	J	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	360	150	D	19	3		<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	470	150	D	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	160	3		<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	1.9	1.2	P	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
1,3-Dinitrobenzene	1 (b)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	2.7	1.2	P	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	UJ
3-Nitrotoluene	61 (c)	-	0 / 19	<	1.2	$\mathbf{U}$	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	UJ
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	1.2	UJ	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	1.2	U	1.2	0.96	P	<	0.42	U	<	0.2	U	<	0.81	UJ
HMX	400 (b)	1.7	3 / 19	<	1.2	U	<	0.96	U	<	0.42	U	0.47	0.2		<	0.81	U
MNX	N/A	0.31 JP	1 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	UJ
RDX	2 (b)	6.9	5 / 19	1.9	1.2	P	<	0.96	U	1.2	0.42		<	0.2	U	<	0.81	U
Tetryl	N/A	1	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
METALS (μg/L)																		
Arsenic	10 (a)	58	3 / 19	58	10		<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	353	19 / 19	353	200		142	200	J	88.6	200	J	106	200	J	71.6	200	J
Cadmium	5 (a)	0.16 J	4 / 19	<	5	U	<	5	U	<	5	U	<	5	U	0.11	5	J
Chromium	100 (a)	1.7 J	4 / 19	0.78	10	J	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	16.2	10 / 19	3.7	10	J	0.44	10	J	0.16	10	J	16.2	10		1.5	10	J
Silver	100 (b)	-	0 / 19	<	10	$\mathbf{U}$	<	10	U	<	10	U	<	10	U	<	10	U

**TABLE I-2** SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			S	A-99-1		FI	P-MW	1	FI	P-MW	2	F	ΓP-MW	3	FI	P-MW	4
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 20, 20	003 <sup>1</sup>	Ma	y 13, 20	003	Ma	y 13, 20	003	Ma	ay 13, 20	003	Ma	y 14, 20	003
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (μg/L) (ME	ETALS)																	
Calcium	NE	92000	8/8		NE		92000	5000		47800	5000		79900	5000		81000	5000	
Magnesium	NE	35500	8 / 8		NE		29300	5000		9590	5000		34900	5000		35500	5000	
Sodium	NE	110000	8 / 8		NE		11700	5000		4460	5000	J	18200	5000		28100	5000	
NA PARAMETERS (mg/L)																		
Alkalinity	NE	540	19 / 19	540	20		380	2		180	2		340	2		420	2	
Ammonia	NE	0.33	9 / 19	0.15	0.02		0.33	0.02		0.02	0.02		<	0.02	U	0.07	0.02	
Carbon Dioxide	NE	180	18 / 18	180	0.1			NE		60	0.25		40	0.25		38	0.25	
Chloride	NE	40	19 / 19	40	10		5	1		3	1		11	10		6	1	
Nitrate, Nitrite as N	10 (a)	2	14 / 19	<	0.05	U	0.36	0.05		0.16	0.05		<	0.05	U	<	0.05	U
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Sulfate	NE	240	18 / 19	<	1	U	27	10		15	1		62	10		33	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	0.7	0.3		0.7	0.3		<	0.3	U	<	0.3	U	<	0.3	U
Total Organic Carbon	NE	130	10 / 19	130	10		3.4	1		1.8	1		1.3	1		<	1	U

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

mg/L = Milligrams Per Liter

MNX = Mono-Nitroso RDX

N/A = Not Available

NA = Natural Attenuation

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

<sup>1</sup> Samples collected during Annual Groundwater Monitoring Event (HGL 2003).

All others collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-MW	5	FT	P-MW	6	FT	P-MW	7	FT	P-MW	8
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 13, 20	003	Ma	y 14, 20	003	Ma	y 14, 2	003	Ma	y 14, 2	003
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	'OUNDS (μg/	L)													
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	8	3		<	3	U	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	240 D	9 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	380 D	10 / 19	6	3		<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	130 J	5 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	2 J	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	UJ	<	3	UJ	<	3	UJ	<	3	UJ
Ethylbenzene	700 (a)	120	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	5600 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-MW	5	FT	P-MW	6	FT	P-MW	7	FT	P-MW	8
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 13, 2	003	Ma	y 14, 20	003	Ma	y 14, 2	003	Ma	y 14, 2	003
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	$\mathbf{RL}$	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/	L)													
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)															
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
1,3-Dinitrobenzene	1 (b)	_	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
3-Nitrotoluene	61 (c)	-	0 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
HMX	400 (b)	1.7	3 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
MNX	N/A	0.31 JP	1 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
RDX	2 (b)	6.9	5 / 19	<	0.7	U	<	1.4	U	0.35	0.56	J	<	0.52	U
Tetryl	N/A	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
METALS (μg/L)															
Arsenic	10 (a)	58	3 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	353	19 / 19	55.6	200	J	67.4	200	J	130	200	J	86.8	200	J
Cadmium	5 (a)	0.16 J	4 / 19	0.16	5	J	0.11	5	J	0.06	5	J	<	5	U
Chromium	100 (a)	1.7 J	4 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	0.022	0.2	J
Selenium	50 (a)	16.2	10 / 19	0.26	10	J	6.1	10	J	1	10	J	4.1	10	J
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-2 SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FT	P-MW	5	FT	P-MW	6	F	rp-MW	7	F	rP-MW	8
DATE COLLECTED	Regulatory	Maximum	Detection	Ma	y 13, 20	003	Ma	y 14, 20	003	Ma	ay 14, 20	003	Ma	ay 14, 20	003
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (μg/L) (MI	ETALS)														
Calcium	NE	92000	8/8	85200	5000		73900	5000		67400	5000		80900	5000	
Magnesium	NE	35500	8 / 8	24200	5000		34200	5000		27200	5000		33600	5000	
Sodium	NE	110000	8 / 8	23000	5000		110000	5000		11400	5000		46400	5000	
NA PARAMETERS (mg/L)															
Alkalinity	NE	540	19 / 19	280	2		380	2		270	2		410	2	
Ammonia	NE	0.33	9 / 19	<	0.02	U	0.13	0.02		<	0.02	U	0.13	0.02	
Carbon Dioxide	NE	180	18 / 18	70	0.25		27	0.25		26	0.25		30	0.25	
Chloride	NE	40	19 / 19	30	10		6	10	J	22	10		17	10	J
Nitrate, Nitrite as N	10 (a)	2	14 / 19	<	0.05	U	0.19	0.05		2	0.1		<	0.05	U
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	UJ
Sulfate	NE	240	18 / 19	81	10		240	50		36	10		56	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	<	0.3	U	<	0.3	U	<	0.3	U	0.4	0.3	
Total Organic Carbon	NE	130	10 / 19	1.7	1		1.1	1		<	1	U	1.1	1	J

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

 $mg/L = Milligrams \ Per \ Liter$ 

MNX = Mono-Nitroso RDX

N/A = Not Available

NA = Natural Attenuation

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

 $^{\rm 1}$  Samples collected during Annual Groundwater Monitoring Event (HGL 2003).

All others collected during the Six Sites RAA Data Collection (URS 2003).

**Bold Result** = Concentration Detected

Above IAAAP Regulatory Standard

Regulatory Standards:

- (a) Maximum Contaminant Level (MCL)
- (b) Health Advisory Level (HAL)
- (c) Region 9 Preliminary Remediation Goal (PRG)
- (d) Proposed DNT Mixture Action Level

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**Surface Water Results** 

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP		SC1			SC2			SC3			SC4			SC5	
DATE COLLECTED	Regulatory	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	$03^{1}$
	Standard	Result	RL	Qual	Result	RĹ	Qual	Result	RĹ	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (ug/I	<u> </u>														
1,1,1-Trichloroethane	200 (a)	ĺ <	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	<	3	U	130	6	D	50	3		3	3		29	3	
Methyl Bromide	10 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP		SC1			SC2			SC3			SC4			SC5	
DATE COLLECTED	Regulatory	Ma	y 15, 20	$03^{1}$	Ma	y 15, 20	$03^{1}$	Ma	y 15, 20	$03^{1}$	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	03¹
	Standard	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (μg/I	<u>.                                     </u>														
trans-1,2-Dichloroethene	100 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																
1,3,5-Trinitrobenzene	1100 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
1,3-Dinitrobenzene	1 (b)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2,4,6-Trinitrotoluene	2 (b)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2,4-Dinitrotoluene	1 (d)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2,6-Dinitrotoluene	1 (d)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2-Amino-4,6-Dinitrotoluene	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2-Nitrotoluene	61 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
3-Nitrotoluene	61 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
4-Amino-2,6-Dinitrotoluene	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
4-Nitrotoluene	61 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
HMX	400 (b)	<	0.58	U	<	0.99	U	0.33	0.36	J	0.18	0.27	J	<	0.44	U
MNX	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
Nitrobenzene	3.4 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
RDX	2 (b)	<	0.58	U	0.92	0.99	JP	0.58	0.36	P	0.3	0.27	P	<	0.44	U
Tetryl	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
METALS (μg/L)																
Arsenic	10 (a)	<	10	U	<	10	U	5.3	10	J	<	10	U	<	10	U
Barium	2000 (a)	137	200	J	146	200	J	135	200	J	172	200	J	125	200	J
Cadmium	5 (a)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	<	10	U	0.94	10	J	0.83	10	J	3.8	10	J	<	10	U
Lead	15 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Silver	100 (b)	0.63	10	J	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP		SCT1			SCT2			SCT3	
DATE COLLECTED	Regulatory	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	$003^{1}$	Ma	y 15, 20	031
	Standard	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMP	OUNDS (µg/I									
1,1,1-Trichloroethane	200 (a)	<	3	U	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	3	3	J	390	15	D	<	3	U
Methyl Bromide	10 (b)	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U

**TABLE I-3** SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP		SCT1			SCT2			SCT3		
DATE COLLECTED	Regulatory	Ma	y 15, 20	$003^{1}$	Ma	ay 15, 20	$003^{1}$	Ma	y 15, 20	003 <sup>1</sup>	
	Standard	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	
VOLATILE ORGANIC COMP	POUNDS (µg/I										
trans-1,2-Dichloroethene	100 (a)	<	3	U	<	3	U	<	3	U	
trans-1,3-Dichloropropene	N/A	<	3	U	<	3	U	<	3	U	
Trichloroethene	5 (a)	<	3	U	<	3	U	<	3	U	
Trichlorofluoromethane	1300 (c)	<	3	U	<	3	U	<	3	U	
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U	
m,p-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U	
o-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U	
EXPLOSIVES (μg/L)											Notes:
1,3,5-Trinitrobenzene	1100 (c)	<	0.78	U	<	0.46	U	<	0.35	U	< = Less Than
1,3-Dinitrobenzene	1 (b)	<	0.78	U	<	0.46	U	<	0.35	U	$\mu g/L = Microgr$
2,4,6-Trinitrotoluene	2 (b)	<	0.78	U	<	0.46	U	<	0.35	U	D = Dilution
2,4-Dinitrotoluene	1 (d)	<	0.78	U	<	0.46	U	<	0.35	U	HMX = Octahy
2,6-Dinitrotoluene	1 (d)	<	0.78	U	<	0.46	U	<	0.35	U	IAAAP = Iowa
2-Amino-4,6-Dinitrotoluene	N/A	<	0.78	U	<	0.46	U	<	0.35	U	J = Estimated
2-Nitrotoluene	61 (c)	<	0.78	U	<	0.46	U	<	0.35	U	MNX = Mono-l
3-Nitrotoluene	61 (c)	<	0.78	U	<	0.46	U	<	0.35	U	N/A = Not Avai
4-Amino-2,6-Dinitrotoluene	N/A	<	0.78	U	<	0.46	U	<	0.35	U	P = Percent diff
4-Nitrotoluene	61 (c)	<	0.78	U	<	0.46	U	<	0.35	U	Qual = Qualifie
HMX	400 (b)	<	0.78	U	4.3	0.46	P	<	0.35	U	RAA = Remedia
MNX	N/A	<	0.78	U	0.34	0.46	JP	<	0.35	U	RDX = Hexahy
Nitrobenzene	3.4 (c)	<	0.78	U	<	0.46	U	<	0.35	U	RL = Reporting
RDX	2 (b)	<	0.78	U	16	0.46		<	0.35	U	U = Nondetect
Tetryl	N/A	<	0.78	U	<	0.46	U	<	0.35	U	Z = Co-Elution
METALS (μg/L)											<sup>1</sup> Samples collec
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	Event (HGL 2
Barium	2000 (a)	121	200	J	138	200	J	118	200	J	<b>Bold Result</b> = 0
Cadmium	5 (a)	<	5	U	<	5	U	<	5	U	Ab
Chromium	100 (a)	<	10	U	<	10	U	0.68	10	J	Regulatory Stan
Lead	15 (a)	<	10	U	<	10	U	<	10	U	(a) Maximum C
Mercury	2 (b)	<	0.2	U	<	0.2	U	<	0.2	U	(b) Health Advi
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	(c) Region 9 Pre
Silver	100 (b)	<	10	U	<	10	U	<	10	U	(d) Proposed Di

grams Per Liter

nydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

a Army Ammunition Plant

-Nitroso RDX

ailable

fference greater than 25%

dial Alternatives Analysis

nydro-1,3,5-trinitro-1,3,5-triazine

ng Limit

Concentration Detected

Above IAAAP Regulatory Standard

andards:

- Contaminant Level (MCL)
- visory Level (HAL)
- Preliminary Remediation Goal (PRG)
- ONT Mixture Action Level

ected during Annual Groundwater Monitoring 2003).



**Duplicate Sample Pair Results** 

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME FIELD ID	EI	Burn Pa BP-MW	5	EI	Burn P 3P-MW	7			FT	Training P -MW	1	FT	Trainin; P -MW	79		
SAMPLE TYPE		toring V	Vell		toring V		ъ и			toring \			toring \		ъ и	
QC TYPE		)riginal	0.2		uplicate		Duplica	ite Pair		riginal			uplicate		Duplica	ite Pair
DATE COLLECTED	Result	y 12, 20 RL	os Oual	· ·	y 12, 20 RL	os Oual	Precision	Action	Result	y 13, 20 RL	os Oual	Result	ıber 28, RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOU			Quai	Kesuit	KL	Quai	1 1 CCISIOII	Action	Kesuit	KL	Quai	Result	KL	Quai	1 Tecision	Action
1.1-Dichloroethane	πυσ (μg	, <b>L</b> )	U	<	3	U		None	15	3		15	3		0.0%	None
1,1-Dichloroethene	<	3	U	<	3	U		None	2	3	ī	2	3	J	0.0%	None
m,p-Xylene	1	3	J	<	3	U		None	<	3	U	<	3	U		None
o-Xylene	1	3	J	<	3	U		None	<	3	Ü	<	3	Ü		None
Vinyl Chloride	<	3	U	<	3	U		None	19	3		19	2		0.0%	None
EXPLOSIVES (µg/L)																
4-Nitrotoluene	<	0.84	U	<	1.5	U		None	1.2	0.96		<	0.36	U		None
HMX	7.2	0.84		7.8	1.5		8.0%	None	<	0.96	U	<	0.36	U		None
MNX	1.2	0.84		<	1.5	U		None	<	0.96	U	<	0.36	U		None
RDX	26	0.84		31	1.5		17.5%	None	<	0.96	U	<	0.36	U		None
METALS (μg/L)																
Barium		NE			NE				142	200	J	146	200	J	2.8%	None
Selenium		NE			NE				0.44	10	J	0.4	10	J	9.5%	None
NA METALS (μg/L)																
Calcium	78500	5000		87100	5000		10.4%	None	92000	5000		93000	5000		1.1%	None
Magnesium	22300	5000		22400	5000		0.4%	None	29300	5000		29700	5000		1.4%	None
Sodium	9210	5000		9420	5000		2.3%	None	11700	5000		11500	5000		1.7%	None
NA PARAMETERS (mg/L)																
Alkalinity	300	2		300	2		0.0%	None	380	2		380	2		0.0%	None
Ammonia	<	0.02	U	<	0.2	U		None	0.33	0.02		0.33	0.02		0.0%	None
Chloride	3	1		3	1		0.0%	None	5	1		5	1		0.0%	None
Nitrate/Nitrite as N	0.77	0.05		0.81	0.05		5.1%	None	0.36	0.05		0.36	0.05		0.0%	None
Total Kjeldahl Nitrogen	<	0.3	U	<	0.3	U		None	0.7	0.3		0.7	0.3		0.0%	None
Sulfate	32	10		31	10		3.2%	None	27	10		27	10		0.0%	None
Total Organic Carbon	1.4	1		1.4	1		0.0%	None	3.4	1		3.4	1		0.0%	None

< = Less ThanHMX = Octahydro-1,3,5,7-tetranitro-mg/L = Milligrams Per LiterNE = Not EvaluatedRL = Reporting Limit-- = Not Measured1,3,5,7-tetrazocineMNX = Mono-Nitroso RDXQual = QualifierU = Nondetect $\mu g/L$  = Micrograms Per LiterJ = EstimatedNA = Natural AttenuationRDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME		Line 2			Line 2					Line 2		]	Line 2			
FIELD ID	L2·	-DP05-2	25	L2-	DS05-	25			L2-	-DP12-2	28	DUP	LICAT	TE 3		
SAMPLE TYPE	Dia	rect Pus	sh	Dir	Direct Push				Dia	rect Pus	sh	Dir	ect Pu	sh		
QC TYPE	C	)riginal		D	uplicat	e	Duplica	(	)riginal		D	uplicat	e	Duplica	ate Pair	
DATE COLLECTED	Octob	October 28, 2002		October 28, 2002					Nover	nber 6,	2002	Noven	nber 6,	2002		
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg	g/L)															
1,1-Dichloroethane		NE			NE					NE			NE			
1,1-Dichloroethene		NE			NE					NE			NE			
Freon113		NE			NE					NE			NE			
1,1,1-Trichloroethane		NE			NE					NE			NE			
Tetrachloroethene		NE			NE					NE			NE			
EXPLOSIVES (μg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.79	U	<	0.82	U		None	<	0.99	U	<	0.82	U		None
4-Amino-2,6-Dinitrotoluene	<	0.79	U	<	0.82	U		None	<	0.99	U	<	0.82	U		None
HMX	<	0.79	U	<	0.82	U		None	<	0.99	U	<	0.82	U		None
MNX	<	0.79	U	<	0.82	U		None	<	0.99	U	<	0.82	U		None
RDX	<	0.79	U	<	0.82	U		None	<	0.99	U	<	0.82	U		None

-- = Not Measured

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME		Line 3		]	Line 3					Line 9			Line 9			
FIELD ID	L3-	-DP04-	22	DUP	LICAT	TE 4			L9-	-DP01-2	20	DUP	LICAT	E 8		
SAMPLE TYPE	Diı	rect Pu	sh	Dir	Direct Push				Direct Push			Di	rect Pu	sh		
QC TYPE	C	Original		D	Duplicate			<b>Duplicate Pair</b>				D	uplicat	e	Duplica	ite Pair
DATE COLLECTED	Noven	November 6, 2002		Noven	November 6, 2002				Novem	ber 12,	2002	Noven	iber 12	, 2002		
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane		NE			NE				<	3	U	<	3	U		None
1,1-Dichloroethene		NE			NE				<	3	U	<	3	U		None
Freon113		NE			NE				37000	3000	D	35000	3000	D	5.6%	None
1,1,1-Trichloroethane		NE			NE				<	3	U	<	3	U		None
Tetrachloroethene		NE			NE				<	3	U	<	3	U		None
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.6	U	<	0.29	U		None		NE			NE			
4-Amino-2,6-Dinitrotoluene	<	0.6	U	<	0.29	U		None		NE			NE			
HMX	<	0.6	U	<	0.29	U		None		NE			NE			
MNX	<	0.6	U	<	0.29	U		None		NE			NE			
RDX	<	0.6	U	<	0.82	U		None		NE			NE			

-- = Not Measured

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	]	Line 9		]	Line 9				]	Line 9			Line 9			
FIELD ID	L9-	DP07-2	26	DUP	LICA	ΓE 5			L9-	DP11-	23	DUP	LICAT	ГЕ 6		
SAMPLE TYPE	Dir	ect Pus	sh	Dir	Direct Push				Dir	ect Pu	sh	Diı	ect Pu	sh		
QC TYPE	O	Original		D	Duplicate			<b>Duplicate Pair</b>			l	D	uplicat	e	Duplicate Pair	
DATE COLLECTED	Noven	′		Noven	November 7, 2002				Noven	nber 8,	2002	Noven	nber 8,	2002		
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane	<	3	U	<	3	U		None	<	3	U	<	3	U		None
1,1-Dichloroethene	<	3	U	<	3	U		None	<	3	U	<	3	U		None
Freon113	20000	750	DJ	26000	300	DJ	26.1%	QUAL	1100	60	D	1100	60	D	0.0%	None
1,1,1-Trichloroethane	<	3	U	<	3	U		None	<	3	U	<	3	U		None
Tetrachloroethene	<	3	U	<	3	U		None	<	3	U	<	3	U		None
EXPLOSIVES (μg/L)																
2-Amino-4,6-Dinitrotoluene		NE			NE					NE			NE			
4-Amino-2,6-Dinitrotoluene		NE			NE					NE			NE			
HMX		NE			NE					NE			NE			
MNX		NE			NE					NE			NE			
RDX		NE			NE					NE			NE			

-- = Not Measured

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME		Line 9			Line 9				Fire T	rainin	g Pit	Fire 7	rainin	g Pit		
FIELD ID	L9-	-DP13-2	20	DUP	LICAT	TE 7			FTP	-DP05	-23	FTP	P-DP05	-00		
SAMPLE TYPE	Dia	rect Pus	sh	Dia	Direct Push				Dir	ect Pu	sh	Dir	ect Pu	sh		
QC TYPE	C	Original		D	Duplicate		Duplicate Pair		Original			Duplicate			Duplicate Pair	
DATE COLLECTED	Noven	nber 8,	2002	Nover	nber 8,	2002			Octob	er 25,	2002	Octob	er 25,	2002		
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane	<	3	U	<	3	U		None	3	3		3	3		0.0%	None
1,1-Dichloroethene	<	3	U	<	3	U		None	51	3		42	3		19.4%	None
Freon113	7800	300	D	8500	300	D	8.6%	None	<	3	U	<	3	U		None
1,1,1-Trichloroethane	<	3	U	<	3	U		None	40	3		39	3		2.5%	None
Tetrachloroethene	<	3	U	<	3	U		None	3	3	J	2	3	J	SD>RL	None
EXPLOSIVES (μg/L)																
2-Amino-4,6-Dinitrotoluene		NE			NE					NE			NE			
4-Amino-2,6-Dinitrotoluene		NE			NE					NE			NE			
HMX		NE			NE					NE			NE			
MNX		NE			NE					NE			NE			
RDX		NE			NE					NE			NE			

-- = Not Measured

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	Fire T	rainin	g Pit	Fire T	rainin	g Pit			Fire T	raining	g Pit	Fire T	rainin	g Pit		
FIELD ID	FTP	P-DP23	-25	DUPI	LICAT	E 10			FTP	-DP25	-22	DUPI	LICAT	E 11		
SAMPLE TYPE	Dir	ect Pus	sh	Dir	Direct Push				Direct Push			Dir	ect Pu	sh		
QC TYPE	O	Original		Di	Duplicate			Duplicate Pair				Duplicate			Duplicate Pair	
DATE COLLECTED	Novem	′		Novem	November 21, 2003				Novem	ber 22,	2002	Novem	ber 22	, 2002		
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane	<	3	U	3	3	U		None	<	3	U	3	3	U		None
1,1-Dichloroethene	12	3		12	3		0.0%	None	<	3	U	<	3	U		None
Freon113	<	5	U	<	5	U		None	<	5	U	<	5	U		None
1,1,1-Trichloroethane	20	3		20	3		0.0%	None	5	3		5	3		0.0%	None
Tetrachloroethene	<	3	U	2	3	J		None	<	3	U	2	3	J		None
EXPLOSIVES (μg/L)																
2-Amino-4,6-Dinitrotoluene		NE			NE					NE			NE			
4-Amino-2,6-Dinitrotoluene		NE			NE					NE			NE			
HMX		NE			NE					NE			NE			
MNX		NE			NE					NE			NE			
RDX		NE			NE					NE			NE			

-- = Not Measured

< = Less Than

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	East			East	Burn I	Pads			West B	urn Pad	ls Area	West Bu	urn Pac	ds Area		
FIELD ID	EBF	P-DP14	-25	EBI	P-DP14	-00			WB	P-DP06	5-22	DUP	LICAT	E 13		
SAMPLE TYPE	Dir	ect Pus	sh	Dia	rect Pu	sh			Di	rect Pu	sh	Di	rect Pu	sh		
QC TYPE	C	Original		Duplicate			Duplica	(	Original	l	D	uplicat	e	Duplica	ite Pair	
DATE COLLECTED	Octob	October 24, 2002		October 24, 2002					Febru	ary 10,	2003	Febru	ary 10	, 2003		
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane		NE			NE					NE			NE			
1,1-Dichloroethene		NE			NE					NE			NE			
Freon113		NE			NE					NE			NE			
1,1,1-Trichloroethane		NE			NE					NE			NE			
Tetrachloroethene		NE			NE					NE			NE			
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.79	U	<	0.44	U		None	<	0.83	U	<	1.9	U		None
4-Amino-2,6-Dinitrotoluene	<	0.79	U	<	0.44	U		None	<	0.83	U	<	1.9	U		None
HMX	100	7.9	D	110	4.4	D	9.5%	None	<	0.83	U	<	1.9	U		None
MNX	3.6	0.99		3.6	0.55		0.0%	None	<	0.83	U	<	1.9	U		None
RDX	70	7.9	DP	76	4.4	DP	8.2%	None	<	0.83	U	<	1.9	U		None

-- = Not Measured

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	West Burn Pads Area WBP-DP12-09			West B	ırn Pac	ls Area		
FIELD ID	WB	P-DP12	2-09	DUP	LICAT	E 12		
SAMPLE TYPE	Di	rect Pu	sh	Di	rect Pu	sh		
QC TYPE	(	Original	l	D	uplicat	e	Duplica	ite Pair
DATE COLLECTED	Noven	nber 23	, 2002	Noven	ıber 23	, 2002		
	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg								
1,1-Dichloroethane		NE			NE			
1,1-Dichloroethene		NE			NE			
Freon113		NE			NE			
1,1,1-Trichloroethane		NE			NE			
Tetrachloroethene		NE			NE			
EXPLOSIVES (µg/L)								
2-Amino-4,6-Dinitrotoluene	1.4	0.22	PZ	1.5	0.18	PZ	6.9%	None
4-Amino-2,6-Dinitrotoluene	1.6	0.22	PZ	1.8	0.18	PZ	11.8%	None
HMX	38	2.2	D	42	1.8	D	10.0%	None
MNX	2.3	0.22	P	2.4	0.18	P	4.3%	None
RDX	64	2.2	D	70	1.8	D	9.0%	None

-- = Not Measured

< = Less Than

 $\mu$ g/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-

-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect



**Quality Assurance Split Sample Pair Results** 

TABLE I-5
SUMMARY OF ANALYTICAL RESULTS FOR QUALITY ASSURANCE SPLIT SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME FIELD ID SAMPLE TYPE QC TYPE DATE COLLECTED	El Moni	Burn Pa BP-MWa Itoring V Driginal y 12, 20	5 Well	EBP Mon	Burn P -MW5 S itoring V QA Split y 12, 20	Split Well	QA Split Pair		Fire Training Pit FTP -MW1 Monitoring Well Original May 13, 2003			Fire Training Pit FTP-MW1 Split Monitoring Well QA Split May 13, 2003			QA Split Pair	
	Result	RL	Qual		-	Qual	Precision	Action	Result	•	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMP	OUNDS	(μg/L)														
1,1-Dichloroethane	<	3	U	<	2	U		Data Agreed	15	3		15.1	2		0.7%	Data Agreed
1,1-Dichloroethene	<	3	U	<	2	U		Data Agreed	2	3	J	2	2	J	0.0%	Data Agreed
cis-1,2-Dichloroethene	<	3	U	<	2	U		Data Agreed	<	3	U	0.6	2	J	SD <rl< td=""><td>Data Agreed</td></rl<>	Data Agreed
m,p-Xylene	1	3	J	<	2	U	SD <rl< td=""><td>Data Agreed</td><td>&lt;</td><td>3</td><td>U</td><td>&lt;</td><td>2</td><td>U</td><td></td><td>Data Agreed</td></rl<>	Data Agreed	<	3	U	<	2	U		Data Agreed
o-Xylene	1	3	J	<	2	U	SD <rl< td=""><td>Data Agreed</td><td>&lt;</td><td>3</td><td>U</td><td>&lt;</td><td>2</td><td>U</td><td></td><td>Data Agreed</td></rl<>	Data Agreed	<	3	U	<	2	U		Data Agreed
Vinyl Chloride	<	3	U	<	2	U		Data Agreed	19	3		30	2		44.9%	Data Agreed
SEMIVOLATILE ORGANIC C	COMPOU	JNDS (μ	g/L)													
Bis(2-ethylhexyl)phthalate	<	5	U	1	4.9	J	SD <rl< td=""><td>Data Agreed</td><td></td><td>NE</td><td></td><td></td><td>NE</td><td></td><td></td><td></td></rl<>	Data Agreed		NE			NE			
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.84	U	0.35	0.21	C	SD <rl< td=""><td>Data Agreed</td><td>&lt;</td><td>0.96</td><td>U</td><td>&lt;</td><td>0.21</td><td>U</td><td></td><td>Data Agreed</td></rl<>	Data Agreed	<	0.96	U	<	0.21	U		Data Agreed
4-Amino-2,6-Dinitrotoluene	<	0.84	U	0.60	0.19			Data Agreed	<	0.96	U	<	0.19	U		Data Agreed
4-Nitroltoluene	<	0.84	U	<	0.26	U		Data Agreed	1.2	0.96		<	0.26	U	SD <rl< td=""><td>Data Agreed</td></rl<>	Data Agreed
HMX	7.2	0.84		14	1.6	$\mathbf{C}$	64.2%	Minor	<	0.96	U	<	1.6	U		Data Agreed
RDX	26	0.84		64	1.3	$\mathbf{C}$	84.4%	Minor	<	0.96	U	<	1.3	U		Data Agreed
METALS (μg/L)																
Barium		NE		63.1	2.5	J			142	200	J	150	2.5		5.5%	Data Agreed
Silver	<	10	U	<	10	U		None	<	10	U	<	10	U		None
Total Organic Carbon	<	1	U	<	1	U		None	<	1	U	<	1	U		None
Selenium		NE		<	20	U			0.44	10	J	<	20	U	SD <rl< td=""><td>Data Agreed</td></rl<>	Data Agreed

< = Less Than

SD = Sample Difference

 $\mu g/L = Micrograms Per Liter$ 

U = Nondetect

C = Result not confirmed due to matrix interference

Split samples were not collected at Line 3 during the Remedial Alternatives Analysis.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

J = Estimated

NE = Not Evaluated

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

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Figure J-1 Site Conceptual Exposure Model

## List of Acronyms and Abbreviations

μg Microgram(s)

% Percent

AT Averaging Time

bgs Below Ground Surface

BW Body Weight

CF Conversion Factor

cm Centimeter(s)

cm<sup>2</sup> Square Centimeter(s)
CNS Central Nervous System
COC Chemical of Concern

COPC Chemical of Potential Concern
CTE Central Tendency Exposure

**D** Qualifier indicating "diluted" data value

E Emission RateED Exposure DurationEF Exposure Frequency

EPC Exposure Point Concentration

ET Exposure Time ft Foot or Feet

ft<sup>2</sup> Square Foot or Square Feet

FTP Fire Training Pit

g Gram(s)

GWM Groundwater Monitoring Event

HEAST Health Effects Assessment Summary Tables

HGL HydroGeoLogic, Inc.

HHRA Human Health Risk Assessment

HI Hazard Index HQ Hazard Quotient

hr Hour

IAAAP Iowa Army Ammunition Plant

IF Intake Factor
IR Ingestion Rate

IRIS Integrated Risk Information System

J Qualifier indicating "estimated data" value

kg Kilogram(s) L Liter(s)

LOAEL Lowest Observed Adverse Effects Level

m Meter(s)

m<sup>3</sup> Cubic Meter(s)

MCL Maximum Contaminant Level

mg Milligram(s)
mL Milliliter(s)
NA Not Applicable

NCEA National Center for Environmental Assessment

ND Nondetect or Not Detected

NOAEL No Observed Adverse Effects Level
ORNL Oak Ridge National Laboratory

P Qualifier indicating percent difference greater than 25 percent

PC Permeability Coefficient

PRG Preliminary Remediation Goal
QA/QC Quality Assurance/Quality Control

**R** Qualifier indicating "rejected" data value

RAA Remedial Alternatives Analysis

RAGS Risk Assessment Guidance for Superfund RAIS Risk Assessment Information System

RDA Recommended Daily Allowance

RDX Hexahydro-1,3,5-trinitro-1,3,5-triazine; a common military explosive

RfD Reference Dose RL Reporting Limit

RME Reasonable Maximum Exposure

SA Surface Area

SCEM Site Conceptual Exposure Model
SDEF Standard Default Exposure Factor

SF Slope Factor

SVOC Semivolatile Organic Compound

U Qualifier indicating "nondetected" data value

UCL Upper Confidence Limit

URS URS Group, Inc.

USEPA United States Environmental Protection Agency

VF Volatilization Factor

VOC Volatile Organic Compound

#### J.1 **OBJECTIVES AND METHODOLOGY**

A human health risk assessment (HHRA) was performed to assess potential adverse health effects or risks due to current or future exposure to chemicals of potential concern (COPCs) released from the Iowa Army Ammunition Plant (IAAAP). The results of the HHRA were used

- Estimate the magnitude of potential human health risk associated with site-related chemicals
- Identify the primary contributors to the risk at the site
- Help determine whether remediation is warranted at the site to protect public health

The risk assessment methodology used in this study is consistent with United States Environmental Protection Agency (USEPA) Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A) (USEPA 1989). USEPA guidance was applied because it is the most appropriate and widely accepted guidance for such an assessment. USEPA cautions that its documents are intended to provide guidance only and that considerable professional judgment must be exercised in applying the guidance to site-specific HHRAs.

The steps in the HHRA process are:

- 1. Selection of COPCs
- 2. Exposure assessment
- 3. Calculation of exposure point concentrations
- 4. Estimation of chemical intakes
- 5. Toxicity assessment
- 6. Risk characterization (including an evaluation of uncertainties in the risk assessment)
- 7. Human health risk-based preliminary remediation goal (PRG) concentrations, if warranted

#### J.1.1 **Previous Risk Evaluation**

A previous soil, groundwater, and surface water risk assessment was completed by ICAIR Life Systems Inc., Cleveland, Ohio and presented in the Revised Draft Final Remedial Investigation/Risk Assessment, Volume 11 (JAYCOR 1996). The current groundwater and surface water HHRA was completed to reevaluate the risk at the Fire Training Pit (FTP) using Spring 2003 site conditions. The groundwater monitoring data and surface water sampling results from the Spring 2003 groundwater monitoring event (Spring 2003 GWM) (HGL 2003) and the FTP groundwater Remedial Alternatives Analysis (RAA) field activities were used for this HHRA.

#### SELECTION OF COPCS **J.2**

COPCs are chemicals that may have been released from process activities or waste sources at IAAAP that have been detected in groundwater and/or surface water and may be significant

contributors to human health risks. Groundwater was categorized into two distinct zones during the risk assessment evaluation: shallow (3 to 30 feet below ground surface [bgs]) and bedrock (30 to 65 feet bgs). FTP COPCs were selected based on the following screening criteria:

- Chemical data evaluation: Data were considered usable for risk assessment purposes if the data were unqualified or estimated. Rejected data were not used in the HHRA. Chemicals at concentrations that can be attributed to laboratory or field contamination were not considered COPCs.
- Essential nutrients: Essential nutrients (i.e., calcium, magnesium, potassium, and sodium, as specified in USEPA Region 4 guidance [USEPA 1996a]) that did not exceed recommended daily allowances (RDAs) were not considered COPCs.
- Comparison to project human health screening values: Chemicals that were detected at concentrations below human health risk-based screening levels were not considered COPCs. Maximum detected site concentrations were compared to a variety of federal screening levels and calculated background levels. If the maximum detected concentration exceeded the screening value for a medium, the chemical was considered to be a COPC.
- Availability of USEPA toxicity criteria: COPCs that had USEPA-established toxicity factors were evaluated quantitatively in the HHRA. COPCs that did not have USEPA-established toxicity factors but that could potentially contribute to risks were evaluated qualitatively in the HHRA if a suitable surrogate could not be found.

#### J.2.1 Use of Data

This risk assessment included groundwater and surface water data collected during the Spring 2003 GWM (HGL 2003) and the FTP groundwater RAA field activities.

### J.2.2 Chemical Data Evaluation

## Data Usability

Prior to use in the HHRA, all site data collected during the FTP groundwater RAA were validated and qualified following the quality assurance/quality control (QA/QC) procedures described in the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Work Plan Addendum (URS 2002). The QA review was performed in compliance with USEPA laboratory data validation guidelines (USEPA 2001a, 2002a). Data of insufficient quality based on QA/QC criteria were rejected at this point and not used in the HHRA. Sample results were assigned appropriate qualifiers during the review and validation process. (e.g., **J**-estimated).

Data were considered usable for risk assessment purposes if the data were unqualified, diluted (D qualifier), nondetect (U qualifier), or estimated (J or P qualifier). Data were not used if the data were rejected (R qualifier). Additionally, samples collected for QA/QC purposes (e.g., matrix spike/matrix spike duplicate) were not used in the HHRA.

Results of the data review and validation are presented in **Section 5** and **Appendix I**.

### J.2.3 Essential Nutrients

Chemicals that are essential nutrients (calcium, iron, magnesium, potassium, and sodium, as specified in USEPA Region 4 guidance [USEPA 1996a]) were not considered to be COPCs if daily intakes calculated from maximum concentrations did not exceed RDAs. These chemicals are generally not considered toxic at environmental levels but are required to maintain normal health in humans and biota. The screening of essential nutrients is presented in **Table J-1**.

# J.2.4 Comparison to Human Health Screening Criteria

Maximum concentrations for each chemical were compared to USEPA Region 9 Tap Water PRGs (USEPA 2002b) and calculated background concentrations. The drinking water standard (USEPA 2002b) was used as a screening value if a Region 9 PRG was not available (e.g., lead). If the maximum detected concentration exceeded the screening value for a medium, the chemical was considered to be a COPC.

# J.2.5 Availability of USEPA Toxicity Criteria

The sources of toxicity values used in this HHRA are 1) USEPA's Integrated Risk Information System (IRIS) (online database), 2) USEPA's National Center for Environmental Assessment (NCEA) and 3) the Health Effects Assessment Summary Tables (HEAST) (USEPA 1997a).

## J.3 EXPOSURE ASSESSMENT

The objectives of the exposure assessment were to:

- Characterize the exposure setting
- Identify populations (receptors) that may be potentially exposed to site-related constituents
- Identify and evaluate the complete pathways by which exposure may occur by developing a site conceptual exposure model (SCEM) of potential exposure pathways

For this HHRA, the exposure assessment involved developing the reasonable maximum exposure (RME) and central tendency exposure (CTE) intake factors for each receptor. CTE variables are those that, applying USEPA guidance and professional judgment, represent the most likely estimates of exposure for an individual with normal activity patterns. The CTE (most likely) scenarios are conservative in that they assume that contact with a contaminated medium occurs routinely over the course of many years. The RME scenario was defined from a set of exposure variables (e.g., body weight [BW], ingestion rate [IR], body surface area [SA]) that resulted in the highest exposure that would reasonably be expected to occur at the site.

# J.3.1 Characterization of Exposure Setting

# Physical Setting and Land Use

A description of the general physical setting of the FTP area is provided in **Section 2**. The primary land use at the FTP was industrial. Although, the FTP is no longer active it is

periodically patrolled by a security work force. While IAAAP is fenced, the FTP area itself is not fenced. The receptors who might be directly exposed to COPCs detected at the FTP are the current and future construction worker, commercial/industrial worker, and hunter/trespasser.

# J.3.2 Potentially Exposed Populations

# Current Exposures

Groundwater receptors are limited to the construction worker and the commercial/industrial worker. Surface water receptors are limited to the construction worker and the hunter/trespasser. However, during the COPC selection (see **Section 6** of this RAA), no COPCs were identified in surface water. Therefore, surface water is not a media of concern and no receptors were evaluated for surface water.

# Future Site Exposures

The same exposure assumptions were used to evaluate the current and future construction worker and the current and future commercial/industrial worker exposures to groundwater. Groundwater contaminant fate and transport modeling results (presented in **Section 8**) indicated that contaminant concentrations are now at their highest predicted values and are expected to decline in the future. Therefore, the Spring 2003 groundwater results used in the current/future risk calculations are considered to be representative of the potential risks at the FTP.

#### Site Conceptual Exposure Model J.3.3

Information concerning contaminant sources, contaminant release and transport mechanisms, and locations of potentially exposed individuals (receptors) were used to develop an SCEM that describes potential human exposure pathways. The SCEM is a schematic representation of the contaminant source area, chemical release mechanisms, environmental transport media, exposure media, potential human intake routes, and potential human receptors. The purpose of the SCEM was to provide a framework for problem definition, to identify exposure pathways that may result in human health risks, to aid in identifying data needed to evaluate those pathways, and to aid in identifying effective cleanup measures, if necessary, that would target significant contaminant sources. An SCEM includes four elements:

- A source of chemicals and a mechanism of chemical release
- An environmental transport media (e.g., groundwater, surface water)
- An exposure point
- A human intake route (e.g., inhalation, ingestion, or dermal)

Each one of these four elements must be present for an exposure pathway to be complete. If only three elements are present, the exposure cannot occur and the pathway is incomplete. Only potentially complete pathways were addressed in this HHRA. The SCEM for potential human receptor populations considered for the FTP groundwater is presented on Figure J-1.

Volatile organic compounds (VOCs) and explosives compounds disposed of at the FTP may be a potential source for chemical release. Volatiles and/or explosives may have inadvertently transferred into soil via spills, leaking containers, incomplete combustion or detonation, indirect product discharges and storm water runoff. Surface contamination infiltrates through the soil to groundwater. Potential exposure may occur through inhalation, ingestion, incidental ingestion or dermal contact with groundwater.

Exposure routes are the modes (e.g., ingestion, dermal contact, inhalation) by which receptors contact the contaminated media. Exposure to the FTP shallow groundwater plume via inhalation, incidental ingestion, and dermal contact represent potentially complete exposure pathways for the construction worker. Exposure to the FTP shallow groundwater plume via ingestion represents the potentially complete exposure pathway for the commercial/industrial worker.

Hypothetical construction workers could be exposed to contaminants in shallow groundwater via inhalation, incidental ingestion or dermal contact, if future excavations encounter the shallow groundwater plume. Ten feet was considered a reasonable maximum depth for a construction excavation (groundwater at the FTP was encountered at 3 to 12 feet bgs).

Although it is unlikely that on-post groundwater could be used for drinking water, USEPA Region 7 requested in the 1996 dispute resolution that the commercial/industrial workers' exposure to contaminants in groundwater via ingestion be evaluated (USEPA 1996b). Ingestion of groundwater was considered the only significant pathway.

Spring Creek runs adjacent to the FTP and was initially considered to be a potential medium of concern. However, during the COPC selection process (**Section 6**), no compounds were detected in surface water above the screening values. Therefore, surface water was no longer considered a medium of concern and the hunter/trespasser was not considered a potential receptor for this risk assessment. Potential receptors and potentially complete pathways are summarized as follows:

## Current/Future Construction Workers

- Incidental ingestion of shallow groundwater (e.g., during excavation)
- Dermal contact with shallow groundwater (e.g., during excavation)
- Inhalation of volatile emissions from groundwater (e.g., during excavation)

### Current/Future Commercial/Industrial Worker

• Ingestion of groundwater (e.g., drinking water)

#### J.4 CALCULATION OF EXPOSURE POINT CONCENTRATIONS

#### J.4.1 **Exposure Point Concentrations in Groundwater and Surface Water**

## General

USEPA (1989) recommends that for each COPC, the 95-percent upper confidence limit (95% UCL) (based on assumed lognormal distribution for sample groups greater than 10) be calculated using chemical analytical results. According to USEPA guidance (USEPA 1989), the lognormal statistical approach is very sensitive to sample size and variance. The FTP data set was composed of fewer than 10 samples; therefore, a 95% UCL was not calculated. Instead, the maximum detected concentration was used as the RME value. The maximum concentration is likely to significantly overestimate the average concentration to which people would be exposed. The exposure point concentrations for the FTP shallow groundwater plume are presented in Table J-2.

# Dermal Adjusted Concentrations

Concentrations of chemicals detected in groundwater were adjusted for dermal-aqueous permeability. Chemical-specific permeability coefficients (PCs) were obtained from USEPA's Dermal Guidance (USEPA 2001b) when possible.

## J.4.2 VOC Concentrations in Construction Trenches from Groundwater

A USEPA Box Model (USEPA, 1999) was used to estimate the upper-bound exposure point concentration for workers in trenches flooded with groundwater off-gassing VOCs. derivation is based on a mass balance equation using a well mixed, single-compartment model (i.e., "box" model). This approach is commonly used to estimate air concentrations in enclosed spaces (Andelman, 1985). In this conservative approach, the VOC concentration everywhere in the "box" (e.g., the trench air compartment) is assumed to be the same. The VOC enters the box through emission from groundwater at the base of the trench and leaves the box by wind-induced convection. At steady state, the mass balance for the system is obtained by setting the emission rate (E) of a VOC from water to air equal to the rate at which the chemical is carried away from the trench by exchange with the overlying air mass.

A generic VOC volatilization factor (VF<sub>voc</sub>) can be obtained using the conservative estimates based on the mass transfer coefficients for water and air (USEPA, 1999) assuming that for volatile chemicals, the overall mass transfer coefficient for water-to-air transfer is approximately equal to its liquid mass transfer coefficient. Multiplying the volatilization factor by groundwater concentration yields a conservative estimate of the air concentrations to which workers in trenches with groundwater off-gassing VOCs could be exposed.

Thus,

$$C_{air} = C_{H2O} x V F_{VOC} x C F$$

where:

```
C_{air} = Concentration of the chemical in the vapor phase (mg/m<sup>3</sup>)
C_{H2O} = Concentration of the chemical in the water phase (mg/L)
CF = Conversion Factor (L/m^3)
VF_{VOC} = 1.8 \times 10^{-5} (unitless)
```

Table J-13 shows the estimation of air concentrations of VOCs from the shallow groundwater plume at the FTP.

#### **J.5 ESTIMATION OF CHEMICAL INTAKES**

Using the exposure point concentrations of COPCs it is possible to estimate the potential human intake of those chemicals via each exposure pathway. Intakes are expressed in terms of milligrams chemical per kilogram body weight per day (mg/kg-day). Intakes were calculated following guidance in the Risk Assessment Guidance for Superfund (USEPA 1989), Exposure Factors Handbook (USEPA 1997b), other USEPA guidance documents as appropriate, and professional judgment regarding probable site-specific exposure conditions. estimated using reasonable estimates of body size, inhalation rates, ingestion rates, dermal absorption rates, and frequency and duration of exposure.

Intakes were estimated for both the CTE and RME conditions. The CTE is the exposure that, applying USEPA guidance and professional judgment, represents the typical exposure for an individual with normal activity patterns. The CTE scenarios are conservative (i.e., protective of most receptors) in that they assume that contact with contaminated media occurs routinely over the course of many years (when in fact such assumptions may never be realized). The RME was estimated by selecting values for exposure variables so that the combination of all variables results in the reasonable maximum (high end) exposure that can be expected to occur at the site. In this risk assessment, the RME scenarios were developed using USEPA's Standard Default Exposure Factors (SDEFs) (USEPA 1991a).

The general equation for calculating the construction worker and the commercial/industrial worker intake in terms of mg/kg-day is:

Intake Factor =  $(IR \times EF \times ED \times CF)/(BW \times AT)$ 

where:

IR **Ingestion Rate** EF **Exposure Frequency** ED **Exposure Duration** = CF **Conversion Factor** = BW **Body Weight** = AT **Averaging Time** 

The variable "averaging time" is expressed in days to calculate average daily intake. For noncarcinogenic chemicals, intakes are calculated by averaging the total cumulative dose over the period of exposure to yield an average daily intake. For carcinogens, intakes are calculated

by averaging the total cumulative dose over a 70-year lifetime, yielding "lifetime average daily dose." Different averaging times are used for carcinogens and noncarcinogens because it is thought that their effects occur by different mechanisms. The approach for carcinogens is based on the scientific opinion that a high dose received over a short period of time is equivalent to a corresponding low dose spread over a lifetime, and that any dose, no matter how small, has a probability of causing cancer. Therefore, the intake of a carcinogen, for whatever duration, is averaged over a 70-year lifetime (USEPA 1989).

Omitting chemical concentrations from the intake equation yields a pathway-specific "intake factor" (kg soil, L water, and cubic meters [m<sup>3</sup>] air per kg-day). Because the exposure pattern resulting in exposure to various COPCs is the same, the pathway-specific intake of a chemical can be calculated by multiplying the concentration of each chemical by the intake factor (IF). IFs were calculated separately for each receptor and exposure pathway. The intake assumptions used in the HHRA are presented in **Tables J-3** through **J-6** and are summarized in **Table J-7**. The assumptions used in deriving IFs are discussed below.

#### J.5.1 **General Assumptions**

Several exposure parameters, such as body weight and averaging times, have general application in all intake estimations, regardless of pathway.

# Exposure Frequency

- The exposure frequency for the construction worker was assumed to be 45 days per year (nine work weeks, five days per week for one year) for the CTE case, which is the estimated duration for excavation activities for an average construction project (e.g., small foundation construction, pipeline installation/maintenance). The RME duration for the construction worker was assumed to be 90 days per year (18 work weeks, five days per week for one year), which is the estimated duration of excavation activities for a larger construction project (foundation for a large building).
- The exposure frequency for the commercial/industrial worker was assumed to be 250 days per year for the CTE and RME case (USEPA 1996b).

# Exposure Time

Construction workers were assumed to spend eight hours per day at the site for both the CTE and RME cases. This is equivalent to a typical workday.

# **Exposure Duration**

- The exposure duration for the construction worker was assumed to be one year for both the CTE and RME cases. This assumes that a construction project will be completed within a one-year time span.
- The exposure duration for the commercial/industrial worker to groundwater as drinking water was assumed to be 6.6 years (CTE) and 21.9 years (RME) (USEPA 1997b).

# Averaging Time

- The CTE and RME averaging time for noncarcinogenic effects was assumed to be 365 days for the construction worker.
- The CTE and RME averaging times for noncarcinogenic effects were assumed to be 2,409 days (365 days per year for 6.6 years) and 7,994 days (365 days per year for 21.9 years), respectively, for the commercial/industrial worker.
- Averaging time for carcinogens was 25,550 days (365 days per year for 70 years).

# **Body Weight**

The recommended average adult body weight was 70 kg (USEPA 1989). This value was used in both the CTE and RME cases for all receptors.

# J.5.2 Groundwater Inhalation Assumptions

Uptake of COPCs via inhalation of VOCs from groundwater is a function of the volume of vapor inhaled per hour and the frequency and duration of exposure. The following assumptions were used to estimate exposure to COPCs through inhalation of volatile compounds from groundwater:

The construction workers' inhalation rate was assumed to be 1.3 cubic meters per hour (m<sup>3</sup>/hr) and 2.5 m<sup>3</sup>/hr for the CTE and RME cases, respectively (USEPA 1997b).

# J.5.3 Groundwater Ingestion Assumptions

Uptake of COPCs via ingestion of groundwater is a function of the volume of water ingested per day and the frequency and duration of exposure. The following assumptions were used to estimate exposure to COPCs through ingestion of groundwater:

- The construction worker was assumed to incidentally ingest 5 milliliters per day (mL/day) and 10 mL/day of groundwater for the CTE and RME cases, respectively (USEPA 1988). Incidentally ingested groundwater was assumed to be on the hands of the construction workers, not from actual standing water.
- The commercial/industrial worker was assumed to ingest 500 mL/day and 1,000 mL/day of groundwater for the CTE and RME cases, respectively. The RME ingestion rate for the commercial/industrial worker was recommended by USEPA Region 7 (USEPA 1996b).

Exposure frequency and exposure duration assumptions were discussed in **Section J.5.1**.

#### J.5.4 **Dermal Absorption from Groundwater**

Uptake of COPCs through dermal contact with groundwater is a function of exposed body surface area, the rate at which chemicals penetrate the skin, and exposure frequency and duration. The following assumptions were used to estimate exposure to COPCs through dermal contact with groundwater:

- Construction workers were assumed to wear clothing appropriate for weather and activity. For the construction worker, the body surface area exposed per day was 3,160 square centimeters (cm²) for the CTE case and 5,230 cm² for the RME case. The CTE value is equivalent to the head, forearms, and hands; the RME value is equivalent to the head, forearms, lower legs, and hands (USEPA 2001b).
- The PC is a chemical-specific parameter. The PC for inorganic analytes (metals) was assumed to 1x10<sup>-3</sup>, which is the recommended default value (USEPA 1992a). The PCs for organic compounds are chemical-specific and were obtained from USEPA (2001b) or the Risk Assessment Information System (RAIS) (2003). This is a conservative approach for evaluating metals, because absorption through the skin does not occur readily. For organic analytes that do not have a chemical-specific PC, a recommended default factor was used (USEPA 1992a).

Exposure frequency and exposure duration assumptions were discussed in **Section J.5.1**.

## J.6 TOXICITY ASSESSMENT

USEPA toxicity factors were used to assess potential health risks resulting from the estimated chemical intakes. Toxicity factors are expressed either as a reference dose (RfD) or a slope factor (SF). An RfD is the daily dose that is unlikely to result in noncancer toxic effects to humans over a lifetime of exposure. SFs and the USEPA weight-of-evidence classification are used to estimate potential carcinogenic risks. The SF is an estimate of the upper-bound probability of an individual developing cancer as a result of exposure to a potential carcinogen. The weight-of-evidence classification is an evaluation of the quality and quantity of carcinogenic potency data for a given chemical. The RfDs and SFs are presented in **Tables J-8** and **J-9**, respectively.

# J.6.1 RfDs for Noncarcinogenic Effects

Substances that produce adverse noncarcinogenic effects are generally thought to have a threshold dose, below which the adverse effect is not likely to be observed over a lifetime (chronic) or a portion of lifetime (subchronic) exposure. Chemical intakes that are expected to result in no adverse effects to humans are referred to as RfDs by USEPA. USEPA defines a chronic RfD as an estimate of a daily exposure level for the human population that is unlikely to result in deleterious effects, even to sensitive subpopulations (e.g., the very young or very old), during a lifetime (70 years). A chronic RfD is used to evaluate the potential noncarcinogenic hazards associated with long-term chemical exposures (from seven years to a lifetime). Chronic RfDs were used to assess noncarcinogenic RME hazards for the commercial/industrial worker.

Subchronic RfDs have been developed to characterize potential noncarcinogenic hazards associated with shorter-term chemical exposures. USEPA defines subchronic exposure as periods ranging from two weeks to seven years (USEPA 1989). Subchronic RfDs tend to be higher (generally by an order of magnitude) than chronic RfDs, because a higher dose can be tolerated for the shorter exposure duration. Construction workers are expected to be on site for one year or less; therefore, subchronic RfDs (if available) were used to evaluate potential exposures. Subchronic RfDs should be used to evaluate the CTE exposure scenario for the

construction worker (one year). According to USEPA Region 4 (USEPA 1996a), the chronic RfD should be used if a subchronic RfD is not available.

To develop the RfD, the threshold dose or "no observed adverse effect level" (NOAEL) is identified through experimentation on animals. A NOAEL is an experimentally determined highest dose at which there was no statistically or biologically significant effect of concern, often called the "critical toxic effect." For certain substances, only a "lowest observed adverse effect level" (LOAEL) has been determined. This is the lowest dose of a substance that produces either a statistically or biologically significant indication of the critical toxic effect. The NOAEL or the LOAEL may be used to calculate the RfD of a particular chemical. USEPA bases the RfD on the most sensitive animal species tested (i.e., the species that experiences adverse effects at the lowest doses). In some cases, RfDs may be based on human epidemiologic data.

RfDs are generally calculated by dividing the NOAEL (or LOAEL) by uncertainty factors that usually range from 10 to 1,000. Uncertainty factors are intended to account for specific types of uncertainty inherent in extrapolation from one exposure route to another, extrapolation of data from laboratory animals to humans, variations in species sensitivity, variations in sensitivity among individuals within a species, limitations in exposure duration in animal experiments, and other limitations in the experimental data. Experimental animal data have historically been relied upon by regulatory agencies and other expert groups to assess the hazards of human Although this reliance has been generally supported by empirical chemical exposures. observations, there are known interspecies differences in chemical adsorption, metabolism, excretion, and toxic responses. There are also uncertainties concerning the relevance of animal studies using exposure routes that differ from the human exposure routes under consideration. Additionally, extrapolating results of short-term or subchronic animal studies to long-term exposures in humans has inherent uncertainty.

Despite the many limitations of experimental animal data, such information is essential for chemical toxicity assessment, especially in the absence of human epidemiological evidence. The uncertainty factors used in the derivation of RfDs are intended to compensate for data limitations. Synergistic effects may occur when the adverse effect of one chemical is greater in the presence of a second chemical than if the exposure were to one chemical alone. Antagonistic effects may occur when two chemicals interfere with each other's actions or when one chemical interferes with the action of the other chemical (USEPA 1986a).

The method of deriving human RfDs from short-term studies in sensitive animals is conservative by design and introduces the potential to overestimate, but very likely not underestimate, noncarcinogenic effects. The methodology for deriving RfDs is more fully described in USEPA's current human health risk assessment guidance (USEPA 1989). The RfD is expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day).

USEPA recognizes that, even with the application of uncertainty factors, RfDs are provisional estimates with uncertainty perhaps spanning an order of magnitude or more (USEPA 1997b). USEPA rates the confidence level of verified RfDs as high, medium, or low.

# Slope Factors for Carcinogenic Effects

In estimating the potential risk posed by potential carcinogens, it is the practice of USEPA and other regulatory agencies to assume that any exposure level has a finite probability, however minute, of producing a carcinogenic response. USEPA assumes that a small number of molecular events can evoke changes in a single cell that can lead to uncontrolled cellular proliferation. This mechanism for carcinogenicity is referred to as "nonthreshold," because there is theoretically no level of exposure for such a substance that does not pose a small probability of producing a carcinogenic response. USEPA assigns the substance a weight-of-evidence classification that describes the likelihood, based on scientific evidence, that the substance is a human carcinogen. Given sufficient data, an SF is then calculated, with a selected computer model specific for the assumed mechanism of action for carcinogenesis, that describes quantitatively the relationship between average lifetime dose and carcinogenic risk (USEPA 1986b).

The SFs are based primarily on the results of animal studies. There is uncertainty whether animal carcinogens are also carcinogenic in humans. While many chemical substances are carcinogenic in one or more animal species, only a small number of chemical substances are known to be human carcinogens. USEPA assumes that humans are as sensitive to all animal carcinogens as the most sensitive animal species. This policy decision introduces the potential to overestimate, but very likely not to underestimate, carcinogenic risk.

A number of mathematical models and procedures have been developed to extrapolate from carcinogenic responses observed at high doses in experimental animals to responses expected at low doses in humans. USEPA uses a linearized multistage model for low-dose extrapolation. This conservative mathematical model is based on the multistage theory of carcinogenesis, wherein the response is assumed to be linear at low doses. USEPA further calculates the upper 95th percent confidence limit of the slope of the resulting dose-response curve. This value, the SF, expressed in units of (mg/kg-day)<sup>-1</sup>, is used to convert the average daily intake of a chemical, normalized over a lifetime, directly to an estimate of cancer risk. The resulting risk estimate represents an estimation of an upper-bound lifetime probability that an individual will develop cancer as a result of exposure to a potential carcinogen. This model provides a conservative estimate of cancer risk at low doses, and is likely to overestimate the actual cancer risk. USEPA acknowledges that actual risk is likely to be less than the estimate calculated with the SF using the linearized multistage model (USEPA 1989), and in fact may be zero.

#### J.6.3 Sources and Uses of Toxicity Information

The result of toxicity assessments performed by USEPA was the development of chemical-specific toxicity factors (i.e., RfDs and SFs) for the oral, dermal, or inhalation exposure pathway. According to USEPA Region 4 (USEPA 1996a), IRIS is the primary source of toxicity data to be used in a HHRA. IRIS is a USEPA database containing health risk and regulatory information for numerous chemicals. Only toxicity factors that have been verified by USEPA science work groups are included in IRIS. If a toxicity value is available in IRIS, it was used in the HHRA. Information in IRIS supersedes all other sources. If a value is not available in IRIS,

the next source to be consulted was the latest update of NCEA and then finally HEAST. HEAST typically contains interim and subchronic toxicity factors that do not appear in IRIS.

Table J-8 summarizes the subchronic and chronic RfDs, sources, uncertainty factors, confidence level, critical effect, and experiment used to derive the RfDs for each noncarcinogenic COPC identified in the HHRA. Table J-9 summarizes the SFs, sources, weight-of-evidence classification, critical effect, and experiment used to determine the SF for each carcinogenic COPC identified in the HHRA.

#### J.7 **RISK CHARACTERIZATION**

Risk characterization combines the outputs of the exposure and toxicity assessments to develop quantitative estimates of risks associated with exposures to COPCs released from the site. The risk characterization should present the risk estimates in an unbiased manner and explain the uncertainties associated with the calculation of the risk estimates. Both the CTE and RME risks were calculated for shallow groundwater. A human health risk summary for all receptors and pathways is presented in Table J-10. The human health risk summaries for each receptor are presented in Tables J-11 and J-12. The calculation of human health risks for each receptor and pathway is presented in **Tables J-14** through **J-17**.

# Hazard Index for Noncarcinogenic Effects

The potential for noncarcinogenic effects is characterized by comparing estimated chemical intakes with chemical-specific RfDs. Chemical intake is calculated by multiplying the RME chemical concentration and the intake factor. The RfD is considered to be the average daily dose (in terms of mg chemical per kg body weight per day) that is not likely to result in adverse effects, even to sensitive individuals over a lifetime of exposure. Chemical intake is the chemical concentration in the exposure medium multiplied by the pathway-specific intake factor. The ratio of the estimated intake to the RfD is called a hazard quotient (HQ), which is calculated as follows:

Noncancer Hazard Quotient (HQ) = 
$$\frac{Chemical\ Intake\ (mg/kg\ -\ day)}{RfD\ (mg/kg\ -\ day)}$$

It should be noted that the level of concern does not increase linearly as the RfD is approached or exceeded. This is because all RfDs have built-in safety or modifying factors and are generally specific to experimental conditions. Furthermore, the HO does not represent a statistical probability of an effect occurring. The HQ provides a rough measure of potential toxicity, but it is conservative and dependent on the quality of the experimental evidence. Because the HQ does not define dose-response relationships, its numerical value cannot be construed as a direct estimate of the magnitude of risk (USEPA 1986a).

For each receptor (i.e., construction workers and commercial/industrial workers), HOs were summed for all COPCs and their relevant exposure pathways to yield a total hazard index (HI). A HI value equal to or less than 1 indicates that no adverse noncarcinogenic health effects are expected to occur, even to sensitive individuals over a lifetime of exposure to contaminants in the shallow groundwater. A HI value above 1 indicates a potential cause for concern and the need for further evaluation of assumptions about exposure and toxicity (e.g., effects of several different chemicals are not necessarily additive, although the HI approach assumes additivity).

The assumption of additive effects reflected in the cumulative HI is most properly applied to substances that induce the same toxic effect by the same mechanism (USEPA 1986a). Consequently, application of the equation to a mixture of substances that are not expected to induce the same type of effects could overestimate the potential for adverse health effects. When the HI exceeds 1, a qualitative assessment of the major contributors to the HI was made to determine whether different target organ systems were affected. If different target organ systems were affected, the addition of the HQs may be causing an overestimation of adverse health effects. Therefore, the major contributors to the HI were evaluated individually to assess whether a single target organ system has a HI greater than 1.

# J.7.2 Carcinogenic Risk

Potential carcinogenic effects are characterized in terms of the excess probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Excess probability means the increased probability over and above the normal probability of getting cancer (i.e., background risk), which in the United States is 1 in 3 (American Cancer Society 1990).

Excess lifetime cancer risk is calculated by multiplying the average daily chemical intake by the cancer SF, which is a risk-per-unit chemical intake:

$$Risk = Chemical\ Intake(mg/kg-day)\ x\ SF(mg/kg-day)^{-1}$$

For each receptor category at each site, cancer risks were calculated separately for each carcinogen and each exposure pathway, and the resulting risks are summed to yield a total upperbound estimate of cancer risk due to multiple exposures. This is a conservative approach that can result in an artificially elevated estimate of cancer risk, especially if several carcinogens are present. This is because 95th percentile estimates may not be strictly additive (USEPA 1986a). RME cancer risks are likely to be overestimated significantly because they are calculated by multiplying 95th percentile estimates of cancer potency and RME of concentration and exposure. The approach also ignores potential antagonistic or synergistic effects.

The following guidance should be considered in order to interpret the significance of the cancer risk estimates. In the National Oil and Hazardous Substances Pollution Contingency Plan (USEPA 1990a), USEPA states that: "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between  $1x10^{-4}$  and  $1x10^{-6}$ ." These values are equivalent to a 1 in 10,000 to 1 in 1,000,000 excess individual lifetime chance of developing cancer from the exposure. These risk levels are extremely low and would not be measurable or discernible (compared to the background cancer risk of 1 in 3) in individuals or even in a large population. For example, a risk level of 1 in 10,000 (1x10<sup>-4</sup>) would increase an individual's chance of getting cancer from the background risk of 1 in 3 to 1.0001 in 3. The Guidance on Risk Characterization for Risk Managers and Risk Assessors (USEPA 1992c) concurs with the 1x10<sup>-6</sup> to 1x10<sup>-4</sup> target risk range.

#### **J.8 UNCERTAINTIES AND LIMITATIONS**

Throughout the HHRA, conservative assumptions were used that probably overestimate actual risks at the site. Although some uncertainties may exist that may underestimate risk, the overall conservative features of the HHRA process are likely to compensate for them and yield an upper-bound estimate of potential risk. The important factors that tend to over- or underestimate risk are discussed below. Site-specific uncertainties and limitations are discussed in relevant sections of the report.

#### Factors that Tend to Overestimate Risk J.8.1

- For commercial/industrial workers, direct ingestion of groundwater as drinking water was assumed. It is not likely that groundwater would be used for a drinking water source; however, USEPA Region 7 requested in the 1996 dispute resolution that the commercial/industrial workers' exposure to contaminants in groundwater via ingestion be evaluated (USEPA 1996b). These assumptions overstate current and probable future exposure conditions at the FTP by one or more orders of magnitude.
- No source decay of organic compounds in groundwater was assumed to occur over a 30-year period. This assumption is likely to result in overestimation of exposure point concentrations and risks due to ingestion and dermal contact of organic compounds, perhaps by several times.
- USEPA RfDs are based on conservative estimates of the potential for adverse noncarcinogenic effects. Most RfDs are developed by reducing the dose at which no adverse effects were observed in the most sensitive animal species by uncertainty factors ranging from 10 to 10,000. This method provides a considerable level of conservatism in the RfDs used to estimate the potential for noncarcinogenic health effects and could result in an overestimate of potential hazards by one or more orders of magnitude.
- USEPA SFs are highly conservative estimates of dose-response relationships and probably result in a significant overstatement of actual cancer risk. Cancer SFs are calculated using the 95% UCL on a dose-response curve estimated by a linear mathematical model that extrapolates from short-term, high-dose animal exposures to long-term, low-dose human USEPA guidance states that the cancer SFs are upper-bound estimates of potency, and actual potency is likely to be lower.
- RME cancer risks are estimated by multiplying a series of upper 95th percentile estimates of carcinogenicity, concentration, and exposure factors. This practice can result in a significant overestimate of potential risk.
- The RME was estimated by selecting the maximum exposure for all variables. The RME scenarios were developed using USEPA SDEFs (USEPA 1991a). These factors probably significantly overestimate actual exposures at the site.

# J.8.2 Factors that May Over- or Underestimate Risk

- Rates of ingestion, medium matrix effects, gut absorption, dermal adherence, and dermal
  absorption were selected to bracket "best estimate" (CTE) and "reasonable maximum"
  (RME) rates. The values may overestimate or underestimate actual rates. However, values
  used in the RME scenario are selected to provide an upper-bound estimate of the maximum
  exposure (and risk) that could reasonably be expected to occur at this site.
- The risk assessment does not consider how other individual risk factors (e.g., occupational exposure) may interact synergistically with the risks due to groundwater exposure, potentially underestimating the risk.
- Bromodichloromethane was used as a surrogate for bromochloromethane. In actuality, bromodichloromethane may have significantly different chemical and physical properties than bromochloromethane. Therefore, site risks may be overestimated or underestimated using a surrogate compound.

# J.9 CALCULATION OF HUMAN HEALTH RISK-BASED PRELIMINARY REMEDIATION GOALS

Human health risk-based PRGs were calculated for all receptors and potentially complete pathways at the site. Calculated human health risk-based cleanup concentrations are presented in **Table J-18**.

### Calculation of PRGs

There are two methods to calculate PRGs. The first method consists of rearranging the chemical intake equations to solve for the concentration term. The second method (shown below) is a simplified method based on site-specific exposure data and was used to calculate for COPCs of concern. A ratio between the target HQ or cancer risk and the calculated HQ or cancer risk due to a specific chemical in a specific medium is calculated. The proportion is:

$$\frac{EPC_{chemical\ i}}{Calculated\ HQ\ or\ Cancer\ Risk_{chemical\ i}} = \frac{PRG_{chemical\ i}}{Target\ HQ\ or\ Cancer\ Risk}$$

where:

EPC = exposure point concentration

PRGs for a target cancer risk of  $1x10^{-6}$  to  $1x10^{-4}$  or a target HQ of 1.0 were calculated by rearranging the above equation as:

$$PRG_{chemical i} = EPC_{chemical i} \times \frac{Target \ HQ \ or \ Cancer \ Risk}{Calculated \ HQ \ or \ Cancer \ Risk_{chemical i}}$$

## J.10 REFERENCES

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TABLE J-1
ESSENTIAL NUTRIENTS SCREENING
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	Number of Detects	Number of Samples	Frequency of Detection (Percentage)	Maximum Detected Concentration	Daily Intake from the Site <sup>1</sup> (mg/day)	Recommended Daily Allowance <sup>2</sup> (mg/day)	Screening Value Source <sup>3</sup>	Above the RDA (YES/NO)
METALS in Groundwater (mg/L)								
Calcium	8	8	100	92	92	1,200	RDA	NO
Magnesium	8	8	100	35.5	35.5	400	RDA	NO
Sodium	8	8	100	110	110	1,000	RDA	NO

COPC = Chemical of Potential Concern

L = Liter(s)

mg = Milligram(s)

RDA = Recommended Daily Allowance

**Bold** indicates chemicals retained as COPCs

<sup>&</sup>lt;sup>1</sup> If a chemical's daily intake based on the maximum concentration did not exceed the RDA, it was eliminated as a COPC.

<sup>&</sup>lt;sup>2</sup> Recommended Daily Allowance of Essential Nutrients. National Research Council 1989. RDAs have not been established for sodium. These numbers are based on recommendations for a 2,000-calorie diet (a sodium restricted diet). Daily intake from site groundwater (mg/day) = maximum detected concentration (mg/L)\*ingestion rate of 1000 mL/day\*conversion factor of 1x10<sup>-3</sup> L/mL.

<sup>&</sup>lt;sup>3</sup> National Academy of Sciences (NAS)

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Identification	1,1,1-Tı	richloroethane		1,1,2-T	richloroethane	;	1,1-Di	ichloroethene		1,2-Di	chloroethane	
Sample Identification	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	$RL \; (ng/L)$	Qual	Result (ng/L)	$RL \; (ng/L)$	Qual
FTP-DP03-031	2100	150	JD	26	3		2800	150	JD	5	3	J
FTA -99-1	90	3		1	3	J	84	3		4	3	
JAW-58	130	6	D	1.5	6	U	81	3		1.5	3	U
JAW-59	170	3		1	3	J	180	3		2	3	J
JAW-60	91	3		4	3		380	15	D	30	3	
JAW-61	270	5	D	1	5	J	190	15	D	4	3	
JAW-80	19	3		1.5	3	U	17	3		1.5	3	U
SA-99-1	68	3		1.5	3	U	28	3	J	130	3	J
FTP-MW1	1.5	3	U	1.5	3	U	2	3	J	1.5	3	U
FTP-MW2	17	3		1.5	3	U	13	3		1.5	3	U
FTP-MW5	8	3		1.5	3	U	6	3		1.5	3	U
FTP-MW7	1.5	3	U	1.5	3	U	1.5	3	U	1.5	3	U
Number	12			12			12			12		
Minimum	8.0			1.0			2.0			2.0		
Maximum	2100			26			2800			130		
Average	247			4			315			15		
Standard Deviation	589			7			791			37		
RME	2100			26			2800			130		

 $\mu g/L = Micrograms Per Liter$ 

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Commis Idantification	A	Acetone		I	Benzene		Bromoo	hloromethan	e	Chloroethane		
Sample Identification	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	$RL \; (ng/L)$	Qual
FTP-DP03-031	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTA -99-1	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-58	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-59	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-60	5	10	U	11	3		1.5	3	U	1.5	3	U
JAW-61	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-80	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
SA-99-1	980	500	JD	110	3		2	3	J	3700	150	D
FTP-MW1	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW2	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW5	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW7	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
Number	12			12			12			12		
Minimum	980			11			2.0			3700		
Maximum	980			110			2.0			3700		
Average	86			11			1.5			310		
Standard Deviation	281			31			0.14			1068		
RME	980			110			2.0			3700		

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RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Commis Islandicion	cis-1,2-I	Dichloroether	ie	Eth	ylbenzene		Methyl l	sobutyl Ketor	ne	Methy	Methylene Chloride		
Sample Identification	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	$RL \; (ng/L)$	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	
FTP-DP03-031	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U	
FTA -99-1	9	3		1.5	3	U	5	10	U	1.5	3	U	
JAW-58	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U	
JAW-59	4	3		1.5	3	U	5	10	U	1.5	3	U	
JAW-60	110	3		1.5	3	U	5	10	U	1.5	3	U	
JAW-61	21	3		1.5	3	U	5	10	U	1.5	3	U	
JAW-80	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U	
SA-99-1	400	150	D	120	3		1600	500	JD	510	150	JD	
FTP-MW1	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U	
FTP-MW2	1	3	J	1.5	3	U	5	10	U	1.5	3	U	
FTP-MW5	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U	
FTP-MW7	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U	
Number	12			12			12			12			
Minimum	1.0			120			1600			510			
Maximum	400			120			1600			510			
Average	46			11			138			44			
Standard Deviation	116			34			460			147			
RME	400			120			1600			510			

 $\mu g/L = Micrograms \ Per \ Liter$ 

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Commis Identification	Tetra	chloroethene		7	Гoluene		Tric	hloroethene		Vin	yl Chloride	
Sample Identification	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual
FTP-DP03-031	37	3		1.5	3	U	4	3	J	1.5	3	U
FTA -99-1	1.5	3	U	1.5	3	U	8	3		1.5	3	U
JAW-58	2	3	J	1.5	3	U	1.5	3	U	1.5	3	U
JAW-59	5	3		1.5	3	U	2	3	J	1.5	3	U
JAW-60	1.5	3	U	1.5	3	U	74	3		1.5	3	U
JAW-61	76	3		1.5	3	U	120	3		1.5	3	U
JAW-80	1.5	3	U	1.5	3	U	2	3	J	1.5	3	U
SA-99-1	1.5	3	U	5600	150	D	3	3		360	150	D
FTP-MW1	1.5	3	U	1.5	3	U	1.5	3	U	19	3	
FTP-MW2	1.5	3	U	1.5	3	U	1	3	J	1.5	3	U
FTP-MW5	1.5	3	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW7	1.5	3	U	1.5	3	U	1.5	3	U	1.5	3	U
Number	12			12			12			12		
Minimum	2.0			5600			1.0			19		
Maximum	76			5600			120			360		
Average	11			468			18			33		
Standard Deviation	23			1616			38			103		
RME	76			5600			120			360		

 $\mu g/L = Micrograms \ Per \ Liter$ 

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Commis Identification	m,	p-Xylene		2,6-Di	initrotoluene			RDX			Arsenic	
Sample Identification	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	RL (ng/L)	Qual	Result (ng/L)	$RL \; (\text{ng/L})$	Qual
FTP-DP03-031	1.5	3	U	NE	NE	NE	NE	NE	NE	NE	NE	NE
FTA -99-1	1.5	3	U	0.19	0.38	U	6.9	0.38		5	10	U
JAW-58	1.5	3	U	0.195	0.39	U	0.195	0.39	U	5	10	U
JAW-59	1.5	3	U	0.165	0.33	U	1.3	0.33		5	10	U
JAW-60	1.5	3	U	0.325	0.65	U	0.325	0.65	U	3.3	10	J
JAW-61	1.5	3	U	0.235	0.47	U	0.235	0.47	U	5	10	UJ
JAW-80	1.5	3	U	0.5	1	U	0.5	1	U	5	10	UJ
SA-99-1	470	150	D	2.7	1.2	P	1.9	1.2	P	58	10	
FTP-MW1	1.5	3	U	0.48	0.96	U	0.48	0.96	U	5	10	U
FTP-MW2	1.5	3	U	0.21	0.42	U	1.2	0.42		5	10	U
FTP-MW5	1.5	3	U	0.35	0.7	U	0.35	0.7	U	5	10	U
FTP-MW7	1.5	3	U	0.28	0.56	U	0.35	0.56	J	5	10	U
Number	12			11			11			11		
Minimum	470			2.7			0.35			3.3		
Maximum	470			2.7			6.9			58		
Average	41			0.51			1.2			10		
Standard Deviation	135			0.73			2.0			16		
RME	470			2.7			6.9			58		

 $\mu g/L = Micrograms \ Per \ Liter$ 

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

# INTAKE ASSUMPTIONS FOR INHALATION OF VOCs FROM GROUNDWATER (CONSTRUCTION WORKER)

## FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

 $Intake Factor = \underbrace{IR \ x \ ET \ x \ EF \ x \ ED}_{BW \ x \ AT}$ 

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
IR: Inhalation rate (m³/hour)¹	1.3	2.5
ET: Exposure time (hours/day) <sup>2</sup>	8	8
EF: Exposure frequency (days/year) <sup>3</sup>	45	90
ED: Exposure duration (years) <sup>4</sup>	1	1
BW: Body weight (kg) <sup>5</sup>	70	70
AT: Average time (days) <sup>6</sup>		
Noncarcinogenic	365	365
Carcinogenic	25,550	25,550
Intake factor (m³/kg-day)		
Noncarcinogenic	1.8E-02	7.0E-02
Carcinogenic	2.6E-04	1.0E-03

#### Notes:

kg = Kilogram(s)

 $m^3 = Cubic Meter(s)$ 

 $<sup>^{1}</sup>$  IR: The recommended inhalation values for outdoor activities (USEPA 1997b). Short-term exposures: hourly rate  $1.3 \text{ m}^{3}$ /hr for the CTE case and heavy activities  $2.5 \text{ m}^{3}$ /hour for the RME case.

<sup>&</sup>lt;sup>2</sup>ET: The CTE and RME values represent the standard workday.

<sup>&</sup>lt;sup>3</sup> EF: Estimated duration of construction activities; 5 days/week for 9 weeks for the CTE case and 5 days/week for 18 weeks for the RME case.

 $<sup>^4\,\</sup>mathrm{ED}\colon$  Construction activities are assumed to be completed within one year.

<sup>&</sup>lt;sup>5</sup> BW: The recommended average adult body weight (USEPA 1989).

<sup>&</sup>lt;sup>6</sup> AT: ED x 365 days/year for the CTE and RME cases; 70 years x 365 days/year for carcinogens (USEPA 1989).

# INTAKE ASSUMPTIONS FOR INCIDENTAL INGESTION OF GROUNDWATER (CONSTRUCTION WORKER)

## FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Intake Factor =  $\frac{IR \times EF \times ED \times CF}{BW \times AT}$ 

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
IR: Ingestion rate (mL/day) <sup>1</sup>	5	10
EF: Exposure frequency (days/year) <sup>2</sup>	45	90
ED: Exposure duration (years) <sup>3</sup>	1	1
CF: Conversion factor (L/mL)	1E-03	1E-03
BW: Body weight (kg) <sup>4</sup>	70	70
AT: Average time (days) <sup>5</sup>		
Noncarcinogenic	365	365
Carcinogenic	25,550	25,550
Intake factor (L/kg-day)		
Noncarcinogenic	8.8E-06	3.5E-05
Carcinogenic	1.3E-07	5.0E-07

Notes:

kg = Kilogram(s)

L = Liter(s)

mL = Milliliter(s)

<sup>&</sup>lt;sup>1</sup> IR: Estimated rates of incidental water ingested. 10 mL/day is one-fifth the incidental water ingestion rate while swimming (50 mL/swimming event, 1.0 hour/event, 1 event/day) reported in USEPA 1988.

<sup>&</sup>lt;sup>2</sup>EF: Estimated duration of construction activities; 5 days/week for 9 weeks for the CTE case and 5 days/week for 18 weeks for the RME case.

<sup>&</sup>lt;sup>3</sup> ED: Construction activities are assumed to be completed within one year.

<sup>&</sup>lt;sup>4</sup> BW: The recommended average adult body weight (USEPA 1989).

<sup>&</sup>lt;sup>5</sup> AT: ED x 365 days/year for the CTE and RME cases; 70 years x 365 days/year for carcinogens (USEPA 1989).

# INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH GROUNDWATER (CONSTRUCTION WORKER)

## FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Intake Factor =  $SA \times PC \times ET \times EF \times ED \times CF$ 

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
SA: Surface area (cm <sup>2</sup> ) <sup>1</sup>	3,160	5,230
PC: Permeability coefficient (cm/hour) <sup>2</sup>	Chemical specific	Chemical specific
ET: Exposure tme (hours/day) <sup>3</sup>	8	8
EF: Exposure frequency (days/year) <sup>4</sup>	45	90
ED: Exposure duration (years) <sup>5</sup>	1	1
CF: Conversion factor (L/cm³)	1E-03	1E-03
BW: Body weight (kg) <sup>6</sup>	70	70
AT: Average time (days) <sup>7</sup>		
Noncarcinogenic	365	365
Carcinogenic	25,550	25,550
Intake Factor (L/kg-day)		
Noncarcinogenic	4.5E-02	1.5E-01
Carcinogenic	6.4E-04	2.1E-03

Notes:

cm = Centimeter(s)

kg = Kilogram(s)

L = Liter(s)

<sup>&</sup>lt;sup>1</sup> SA: The worker is assumed to wear civilian clothing appropriate for weather and type of outdoor work. The CTE surface area (3,160 cm<sup>2</sup>) is equivalent to head, forearms and hands (assumes the worker is wearing a short-sleeve shirt, jeans, and boots); RME surface area (5,230 cm<sup>2</sup>) is equivalent to head, forearms, hands, and lower legs (assumes the worker is wearing a short-sleeve shirt, jeans, and boots) (USEPA 1997b).

<sup>&</sup>lt;sup>2</sup> PC: Chemical-specific permeability coefficients are used to adjust chemical concentrations for use in calculating risks for the dermal contact route (USEPA 1992a, 2001b, and RAIS 2003). The intake factors shown here are calculated using PC = 1.0.

<sup>&</sup>lt;sup>3</sup> ET: The CTE and RME values represent the standard workday.

<sup>&</sup>lt;sup>4</sup> EF: Estimated duration of construction activities; 5 days/week for 9 weeks for the CTE case and 5 days/week for 18 weeks for the RME case.

 $<sup>^{5}\,\</sup>mathrm{ED}\colon$  Construction activities are assumed to be completed within one year.

<sup>&</sup>lt;sup>6</sup> BW: The recommended average adult body weight (USEPA 1989).

<sup>&</sup>lt;sup>7</sup> AT: ED x 365 days/year for the CTE and RME cases; 70 years x 365 days/year for carcinogens (USEPA 1989).

# INTAKE ASSUMPTIONS FOR INGESTION OF GROUNDWATER (COMMERCIAL/INDUSTRIAL WORKER)

## FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Intake Factor =  $\frac{IR \times EF \times ED \times CF}{BW \times AT}$ 

Parameter	Central Tendency Exposure (CTE)	v	
IR: Ingestion rate (mL/day) <sup>1</sup>	500	1,000	
EF: Exposure frequency (days/year) <sup>2</sup>	250	250	
ED: Exposure duration (years) <sup>3</sup>	6.6	21.9	
CF: Conversion factor (L/mL)	1E-03	1E-03	
BW: Body weight (kg) <sup>4</sup>	70	70	
AT: Average time (days) <sup>5</sup>			
Noncarcinogenic	2,409	7,994	
Carcinogenic	25,550	25,550	
Intake factor (L/kg-day)			
Noncarcinogenic	4.9E-03	9.8E-03	
Carcinogenic	4.6E-04	3.1E-03	

Notes:

cm = Centimeter(s)

kg = Kilogram(s)

L = Liter(s)

mL = Milliliter(s)

<sup>&</sup>lt;sup>1</sup> IR: Commercial/industrial worker estimated daily water consumption rate is 500 mL for the CTE case and 1,000 mL for the RME case (USEPA Resolution of Dispute Letter, March 6, 1996).

<sup>&</sup>lt;sup>2</sup> EF: Estimated frequency of exposure is 250 days/year for both the CTE and RME cases (USEPA Resolution of Dispute Letter, March 6, 1996b).

<sup>&</sup>lt;sup>3</sup> ED: Estimated duration of exposure is 6.6 years for the CTE case and 21.9 years for the RME case (USEPA 1997b).

<sup>&</sup>lt;sup>4</sup>BW: The recommended average adult body weight (USEPA 1997b).

<sup>&</sup>lt;sup>5</sup> AT: ED x 365 days/year for noncarcinogens; 70 years x 365 days/year for carcinogens (USEPA 1989).

TABLE J-7
SUMMARY OF INTAKE FACTORS FOR ALL RECEPTORS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

December/Dethyror	Central Tendency Exposure		Reasonable Maximum Exposure	
Receptor/Pathway	Noncarcinogenic	Cancer Risk	Noncarcinogenic	Cancer Risk
Construction Worker				
Inhalation of Groundwater	1.8E-02	2.6E-04	7.0E-02	1.0E-03
Incidental Ingestion of Groundwater	8.8E-06	1.3E-07	3.5E-05	5.0E-07
Dermal Contact with Groundwater	4.5E-02	6.4E-04	1.5E-01	2.1E-03
Commercial/Industrial Worker				
Ingestion of Groundwater	4.9E-03	4.6E-04	9.8E-03	3.1E-03

Exposure assumptions and intake factors are shown in **Tables J-3** through **J-6**. Intake factors are multiplied by exposure point concentrations of chemicals of potential concern to estimate daily chemical intake.

TABLE J-8
REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	Noncaro	cinogenic l	RfD (mg/kg	g-day)	Uncertaint	y Factor	Confidence	Critical Effect	Species/Experiment Length/Target Organ
Chemicai	Inhalation	Source	Oral	Source	Inhalation	Oral	Level	Critical Effect	Species/Experiment Length/Target Organ
1,1,1-Trichloroethane									
Subchronic	6.3E-01	2	2.8E-01	2	N/A	N/A	N/A	N/A	N/A
Chronic	6.3E-01	3	2.8E-01	3	N/A	N/A	IN/A	N/A	N/A
1,1,2-Trichloroethane									
Subchronic	N/A	N/A	4.0E-02	4	N/A	100	Medium	Clinical serum chemistry	Mouse/subchronic/Serum
Chronic	N/A	N/A	4.0E-03	1	N/A	1000	Medium	Clinical serum chemistry	Mouse/subcnronic/Serum
1,1-Dichloroethene									
Subchronic	5.7E-02	2	9.0E-03	4	N/A	1000	M - 1:	T incompanion	D-4/-1
Chronic	5.7E-02	1	5.0E-02	1	N/A	100	Medium	Liver toxicity	Rat/chronic or drinking water study/liver
1,2-Dichloroethane									
Subchronic	1.4E-03	2	3.0E-02	2	N/A	N/A	NT/A	Hepatotoxicity, renal toxicity, CNS	Human and animal studies, both oral and
Chronic	1.4E-03	3	3.0E-02	3	N/A	N/A	N/A	effects, gastric effects	inhalation/multiple systems.
cis-1,2-Dichloroethene									
Subchronic	N/A	N/A	1.0E-01	4	N/A	300	DT/A	Decreased hematocrit and	D : (00 1
Chronic	N/A	N/A	1.0E-02	4	N/A	3000	N/A	hemoglobin	Rats/90 days, gavage/blood
Acetone									
Subchronic	N/A	N/A	1.0E+00	4	N/A	100	3.6 11	N. 1	B / / 1 1
Chronic	N/A	N/A	9.0E-01	1	N/A	1000	Medium	Nephropathy	Rats/subchronic or drinking water study/kidney
Benzene									
Subchronic	8.6E-03	2	4.0E-03	2	N/A	N/A	3.6 11	B 11 1	TT / 2 12 1 2 41 1
Chronic	8.6E-03	1	4.0E-03	1	300	300	Medium	Decreased lymphocyte count	Human/occupational inhalation/blood
Bromochloromethane <sup>1</sup>									
Subchronic	N/A	N/A	2.0E-02	4	N/A	1000	3.6.11	<b>D</b>	Mouse/chronic drinking water study,
Chronic	N/A	N/A	2.0E-02	1	N/A	1000	Medium	Renal cytomegaly	gavage/kidney
Chloroethane									
Subchronic	2.9E+00	2	4.0E-01	2	N/A	N/A		5	
Chronic	2.9E+00	1	4.0E-01	3	300	N/A	Medium	Delayed fetal ossification	Mouse/developmental inhalation study
Ethylbenzene									
Subchronic	2.9E-01	2	1.0E-01	2	N/A	N/A	<del>-</del>		B . / I I
Chronic	2.9E-01	1	1.0E-01	1	300	1000	Low	Liver/kidney toxicity	Rats/subchronic to chronic/liver, kidney
Methyl Isobutyl Ketone									
Subchronic	8.6E-01	2	8.0E-01	4	N/A	300	-	T	D : /12 1 /
Chronic	8.6E-01	1	8.0E-02	4	300	3000	Low	Lethargy, increased organ weight	Rats/13 weeks, gavage/whole body, liver, kidney

TABLE J-8
REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chamiaal	Noncare	cinogenic 1	RfD (mg/kg	-day)	Uncertaint	y Factor	Confidence	Cuitical Effect	Species/Europiment Length/Touget Organ
Chemical	Inhalation	Source	Oral	Source	Inhalation	Oral	Level	Critical Effect	Species/Experiment Length/Target Organ
Methylene Chloride								Gastrointestinal, hematologic,	
Subchronic	8.6E-01	2	6.0E-02	4	N/A	100	3.6.11	hepatic, renal, endocrine, and	Mouse/studies, oral/multiple systems
Chronic	8.6E-01	4	6.0E-02	1	N/A	100	Medium	metabolic effects.	
Tetrachloroethene									
Subchronic	1.7E-01	2	1.0E-01	4	N/A	100	3.6.11	TT	M /c 1 /l'
Chronic	1.7E-01	3	1.0E-02	1	N/A	1000	Medium	Hepatotoxicity	Mouse/6 weeks, gavage/liver
Toluene									
Subchronic	1.1E-01	2	2.0E+00	4	N/A	100	3.6.11		D + /12
Chronic	1.1E-01	1	2.0E-01	1	300	1000	Medium	Changes in liver/kidney weight	Rats/13-week study, gavage/liver, kidney
Trichloroethene									
Subchronic	1.0E-02	2	3.0E-04	2	N/A	N/A	N/A	Liver/kidney damage, CNS and	D ( 1 ' ( 1'
Chronic	1.0E-02	3	3.0E-04	3	N/A	N/A	N/A	hepatic effects	Rat and mice studies
Vinyl Chloride									
Subchronic	2.9E-02	2	3.0E-03	2	N/A	N/A	3.6.11	7: 11 1 1:	D ( / 1 ' C 1' ( 1 / 1 / 1')
Chronic	2.9E-02	1	3.0E-03	1	30	30	Medium	Liver cell polymorphism	Rats/chronic feeding study/liver
m,p-Xylene									
Subchronic	2.9E-02	2	2.0E-01	2	N/A	N/A	Medium	Decreased body weight	Rats/oral exposure/whole body;
Chronic	2.9E-02	1	2.0E-01	1	300	1000	Medium	Impaired motor coordination	Rats/subchronic inhalation/CNS
RDX									
Subchronic	N/A	N/A	3.0E-03	4	N/A	100	High	CNS, renal failure	Rats/oral gavage, 90 days
Chronic	N/A	N/A	3.0E-03	1	N/A	100	nigii	CNS, Tellar ramure	Rats/orar gavage, 90 days
2,6-Dinitrotoluene									
Subchronic	N/A	N/A	1.0E-02	4	N/A	300	N/A	CNS, methemoglobinemia,	Dog/12 wooks/CNS blood kidney
Chronic	N/A	N/A	1.0E-03	4	N/A	3000	1 <b>N</b> /A	histopathology	Dog/13 weeks/CNS, blood, kidney
Arsenic									
Subchronic	N/A	N/A	3.0E-04	4	N/A	3	Medium	Hyperpigmentation, keratosis,	Human/chronic oral exposure/skin
Chronic	N/A	N/A	3.0E-04	1	N/A	3	Medium	vascular complications	riuman/enrome orai exposure/skin

1 = Verifiable in IRIS mg = Milligram(s) EPA Class A = Human carcinogen Bromodichloromethane was used as a surrogate for this 2 = Chronic RfD adopted as subchronic RfD. N/A = Not Applicable/Not Available EPA Class B = Probable human carcinogen compound.
3 = National Center for Environmental Assessment RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine EPA Class B2 = Sufficient evidence of carcinogenicity in animals with inadequate data or lack of evidence in humans.

CNS = Central Nervous System

EPA Class D = Not classified as to human carcinogenicity

EPA Class C = Possible human carcinogen

kg = Kilogram(s)

TABLE J-9
SLOPE FACTORS FOR CARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	Slop	e Factor (	mg/kg-day	)-1			
Chemicai	Inhalation	Source	Oral	Source	<b>EPA Class</b>	Critical Effect	Species/Experiment Length/Target Organ
1,1,2-Trichloroethane	5.6E-02	1	5.7E-02	1	C	Hepatocellular carcinoma	Mice/oral gavage/liver
1,2-Dichloroethane	9.1E-02	1	9.1E-02	1	B2	Hemangiosarcomas	Rat/oral gavage/liver
Benzene	2.9E-02	1	5.5E-02	1	A	Leukemia	Human/occupational inhalation/blood
Bromochloromethane <sup>1</sup>	NA	N/A	6.2E-02	1	D	Tubular cell adenomas, adenocarcinomas	Mice/oral gavage/kidney
Chloroethane	NA	N/A	2.9E-03	2	C	Brain, skin, and uterine tumors	Rats/subchronic, inhalation
Ethylbenzene	3.9E-03	2	N/A	N/A	C	Renal tubule adenomas, testicular adenomas	Rat and mice studies
Methylene Chloride	1.6E-03	1	7.5E-03	1	C	Liver cancer	Mice and rats/both oral and inhalation studies/liver
Tetrachloroethene	1.0E-02	2	5.2E-02	2	С	Bladder cancer, kidney cancer, cervical cancer, leukemia	Human studies/chronic, both oral and inhalation
Trichloroethene	4.0E-01	2	4.0E-01	2	В	Liver, kidney, and cervical cancer	Rat and mice studies
Vinyl Chloride	1.6E-02	1	7.2E-01	1	A	Liver cancer	Rats/oral, diet and inhalation/liver
RDX	1.1E-01	1	1.1E-01	1	C	Hepatocellular carcinoma	Liver, CNS
Arsenic	N/A	1	1.5E+00	1	A	Skin cancer, Lung cancer	Human/oral, drinking water/skin Human/inhalation, occupational/lungs

1 = Verifiable in IRIS

2 = National Center for Environmental Assessment

CNS = Central Nervous System

mg/kg-d = Milligram(s) Per Kilogram Per Day

N/A = Not Applicable

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

<sup>1</sup> Bromodichloromethane was used as a surrogate for this compound.

EPA Class A = Human carcinogen

EPA Class B = Probable human carcinogen

EPA Class B2 = Sufficient evidence of carcinogenicity in animals with inadequate data or lack of evidence in humans.

EPA Class C = Possible human carcinogen

EPA Class D = Not classified as to human carcinogenicity

TABLE J-10 SUMMARY OF HEALTH RISKS FOR ALL RECEPTORS AND PATHWAYS FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Madium/Dagantan	Central Ter	ndency Exposure	Reasonable Maximum Exposure		
Medium/Receptor	HI	Cancer Risk	НІ	Cancer Risk	
Shallow Groundwater					
Construction Worker	0.3	1.6E-06	1.2	5.7E-06	
Commercial/Industrial Worker	3.5	1.8E-04	7.1	1.2E-03	

HI = Hazard Index

Hazard quotients and cancer risks are from Tables J-14 through J-17.

TABLE J-11 SUMMARY OF HEALTH RISKS FOR THE CONSTRUCTION WORKER FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Daganta u/Dathunau	Central Ter	dency Exposure	Reasonable Maximum Exposure			
Receptor/Pathway	HI	Cancer Risk	HI	Cancer Risk		
Construction Worker						
Inhalation of Groundwater	0.08	3.8E-07	0.31	1.5E-06		
Incidental Ingestion of Groundwater	0.01	4.9E-08	0.03	1.9E-07		
Dermal Contact with Groundwater	0.3	1.2E-06	0.9	4.0E-06		
	0.35	1.6E-06	1.2	5.7E-06		

HI = Hazard Index

Hazard quotients and cancer risks are from Tables J-14 through J-16.

TABLE J-12 SUMMARY OF HEALTH RISK FOR THE COMMERCIAL/INDUSTRIAL WORKER FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

December/Dethyror	Central Ter	ndency Exposure	Reasonable Maximum Exposure		
Receptor/Pathway	HI	Cancer Risk	HI	Cancer Risk	
Commercial/Industrial Worker					
Ingestion of Groundwater	3.5	1.8E-04	7.1	1.2E-03	
	3.5	1.8E-04	7.1	1.2E-03	

 $HI = Hazard\ Index$ 

Hazard quotients and cancer risks are from Table J-17.

#### **TABLE J-13**

# AIR CONCENTRATIONS OF VOLATILE CHEMICALS OF POTENTIAL CONCERN FROM GROUNDWATER FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

**Equation 1:**  $VF_{voc} = k_{LG}/(kNH)$ 

where:  $VF_{voc} = volatilization factor of volatile organic compound (unitless)$ 

 $k_{LG}$  = Aqueous mass transfer coefficient from the liquid phase to gas phase for VOC of interest (m/sec)

k = Mixing factor to account for incomplete air exchange in trench (unitless)

N = Number of air exchanges per unit time in the trench (sec<sup>-1</sup>)

H = Height of the trench (m)

 $k_{LG} = 3 \times 10^{-6}$  m/sec (conservative estimate of mass transfer coefficient for VOCs from groundwater to air, USEPA, 1999)

**Equation 2:** N = u/L

where: u = wind speed (m/sec)

L = length of trench (m)

**Equation 3:**  $C_{air} = C_{H2O} * VF_{voc} * CF$ 

assuming:

where:  $C_{air} = Concentration of the chemical in the vapor phase (mg/m<sup>3</sup>)$ 

 $C_{H2O}$  = Concentration of the chemical in the water phase (mg/L)

 $CF = Conversion Factor (L/m^3)$ 

Chemical	C <sub>H2O</sub> (mg/L)	K <sub>LG</sub> (m/sec)	k (unitless)	H (m)	L (m)	u (m/sec)	N (sec <sup>-1</sup> )	VF <sub>voc</sub> (unitless)	CF (L/m³)	$C_{air} (mg/m^3)$
1,1,1-Trichloroethane	2.1E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	3.8E-02
1,1,2-Trichloroethane	2.6E-02	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	4.7E-04
1,1-Dichloroethene	2.8E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	5.0E-02
1,2-Dichloroethane	1.3E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.3E-03
Acetone	9.8E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	1.8E-02
Benzene	1.1E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.0E-03
Bromochloromethane	2.0E-03	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	3.6E-05
Chloroethane	3.7E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	6.7E-02
cis-1,2-Dichloroethene	4.0E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	7.2E-03
Ethylbenzene	1.2E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.2E-03
Methyl Isobutyl Ketone	1.6E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.9E-02
Methylene chloride	5.1E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	9.2E-03
Tetrachloroethene	7.6E-02	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	1.4E-03
Toluene	5.6E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	1.0E-01
Trichloroethene	1.2E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.2E-03
Vinyl Chloride	3.6E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	6.5E-03
m,p-Xylene	4.7E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	8.5E-03

Notes:

$$\begin{split} L &= Liter(s) & mg &= Milligram(s) \\ m &= Meter(s) & sec &= Second \end{split}$$

 $m^3 = Cubic Meter(s)$ 

TABLE J-14
CONSTRUCTION WORKER HEALTH RISK (INHALATION OF VOCs FROM GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Air	Noncarcii	nogenic IF	Carcino	genic IF	Subchronic	Subchronic	Hazard (	Quotient <sup>1</sup>	Cance	r Risk <sup>2</sup>
	RME	CTE	RME	CTE	RME	RfD	Slope Factor	CTE	RME	CTE	RME
	(mg/m <sup>3</sup> )	(m³/kg-day)	(m³/kg-day)	(m³/kg-day)	(m³/kg-day)	(mg/kg-day)	(mg/kg-day) <sup>-1</sup>				
Volatile Organic Compoun	ds										
1,1,1-Trichloroethane	3.8E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	6.3E-01	NTF	1.1E-03	4.2E-03	NTF	NTF
1,1,2-Trichloroethane	4.7E-04	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	5.6E-02	NTF	NTF	6.9E-09	2.6E-08
1,1-Dichloroethene	5.0E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	5.7E-02	NTF	1.6E-02	6.2E-02	NTF	NTF
1,2-Dichloroethane	2.3E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	1.4E-03	9.1E-02	3.1E-02	1.2E-01	5.6E-08	2.1E-07
Acetone	1.8E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	NTF	NTF	NTF	NTF	NTF
Benzene	2.0E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	8.6E-03	2.9E-02	4.2E-03	1.6E-02	1.5E-08	5.8E-08
Bromochloromethane	3.6E-05	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	NTF	NTF	NTF	NTF	NTF
Chloroethane	6.7E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E+00	NTF	4.3E-04	1.6E-03	NTF	NTF
cis-1,2-Dichloroethene	7.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	NTF	NTF	NTF	NTF	NTF
Ethylbenzene	2.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E-01	3.9E-03	1.4E-04	5.2E-04	2.2E-09	8.4E-09
Methyl Isobutyl Ketone	2.9E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	8.6E-01	NTF	6.1E-04	2.4E-03	NTF	NTF
Methylene chloride	9.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	8.6E-01	1.6E-03	2.0E-04	7.5E-04	3.8E-09	1.5E-08
Tetrachloroethene	1.4E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	1.7E-01	1.0E-02	1.5E-04	5.7E-04	3.6E-09	1.4E-08
Toluene	1.0E-01	1.8E-02	7.0E-02	2.6E-04	1.0E-03	1.1E-01	1.0E-02	1.7E-02	6.5E-02	2.6E-07	1.0E-06
Trichloroethene	2.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	6.0E-03	NTF	NTF	3.4E-09	1.3E-08
Vinyl Chloride	6.5E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E-02	1.6E-02	4.2E-03	1.6E-02	2.7E-08	1.0E-07
m,p-Xylene	8.5E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E-02	NTF	5.3E-03	2.1E-02	NTF	NTF
Totals							_	0.08	0.31	3.8E-07	1.5E-06

CTE = Central Tendency Exposure

IF = Intake Factor

kg = Kilogram(s)

 $m^3 = Cubic Meter(s)$ 

mg = Milligram(s)

NTF = No established USEPA toxicity factor

RME = Reasonable Maximum Exposure

RfD = Reference Dose

Air concentration from Table J-13.

<sup>&</sup>lt;sup>1</sup> Air RME x Noncarcinogenic IF/RfD

<sup>&</sup>lt;sup>2</sup> Air RME x Carcinogenic IF x Slope Factor

TABLE J-15
CONSTRUCTION WORKER HEALTH RISK (INCIDENTAL INGESTION OF GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Groundwater Concentration	Noncarci	nogenic IF	Carcino	genic IF	Subchronic	Subchronic	Hazard (	Quotient <sup>1</sup>	Cance	r Risk <sup>2</sup>
	RME (mg/L)	CTE (L/kg-day)	RME (L/kg-day)	CTE (L/kg-day)	RME (L/kg-day)	RfD (mg/kg-day)	Slope Factor (mg/kg-day) <sup>-1</sup>	CTE	RME	CTE	RME
Volatile Oganic Compound	ls										
1,1,1-Trichloroethane	2.1E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.8E-01	NTF	6.6E-05	2.6E-04	NTF	NTF
1,1,2-Trichloroethane	2.6E-02	8.8E-06	3.5E-05	1.3E-07	5.0E-07	4.0E-02	5.7E-02	5.7E-06	2.3E-05	1.9E-10	7.5E-10
1,1-Dichloroethene	2.8E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	9.0E-03	NTF	2.7E-03	1.1E-02	NTF	NTF
1,2-Dichloroethane	1.3E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-02	9.1E-02	3.8E-05	1.5E-04	1.5E-09	6.0E-09
Acetone	9.8E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E+00	NTF	8.6E-06	3.5E-05	NTF	NTF
Benzene	1.1E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	4.0E-03	5.5E-02	2.4E-04	9.7E-04	7.6E-10	3.0E-09
Bromochloromethane	2.0E-03	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.0E-02	6.2E-02	8.8E-07	3.5E-06	1.6E-11	6.2E-11
Chloroethane	3.7E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	4.0E-01	2.9E-03	8.1E-05	3.3E-04	1.3E-09	5.4E-09
cis-1,2-Dichloroethene	4.0E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-01	NTF	3.5E-05	1.4E-04	NTF	NTF
Ethylbenzene	1.2E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-01	NTF	1.1E-05	4.2E-05	NTF	NTF
Methyl Isobutyl Ketone	1.6E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	8.0E-01	NTF	1.8E-05	7.0E-05	NTF	NTF
Methylene Chloride	5.1E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	6.0E-02	7.5E-03	7.5E-05	3.0E-04	4.8E-10	1.9E-09
Tetrachloroethene	7.6E-02	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-01	5.2E-02	6.7E-06	2.7E-05	5.0E-10	2.0E-09
Toluene	5.6E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.0E+00	NTF	2.5E-05	9.9E-05	NTF	NTF
Trichloroethene	1.2E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	6.0E-03	1.1E-02	1.8E-04	7.0E-04	1.7E-10	6.6E-10
Vinyl Chloride	3.6E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-03	7.2E-01	1.1E-03	4.2E-03	3.3E-08	1.3E-07
m,p-Xylene	4.7E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.0E-01	NTF	2.1E-05	8.3E-05	NTF	NTF
Explosives											
2,6-DNT	2.7E-03	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-02	NTF	2.4E-06	9.5E-06	NTF	NTF
RDX	6.9E-03	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-03	1.1E-01	2.0E-05	8.1E-05	9.5E-11	3.8E-10
Metals											
Arsenic	5.8E-02	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-04	1.5E+00	1.7E-03	6.8E-03	1.1E-08	4.4E-08
Totals							<del>-</del>	0.01	0.03	4.9E-08	1.9E-07

CTE = Central Tendency Exposure RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

2,6-DNT = 2,6-Dinitrotoluene RfD = Reference Dose

IF = Intake Factor RME = Reasonable Maximum Exposure

kg = Kilogram(s)

L = Liter(s)

Groundwater Concentration x Noncarcinogenic IF/RfD

mg = Milligram(s)

<sup>2</sup> Groundwater Concentration x Carcinogenic IF x Slope Factor

NTF = No established USEPA toxicity factor

TABLE J-16
CONSTRUCTION WORKER HEALTH RISK (DERMAL CONTACT WITH GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Groundwater		Dermal										
	Concentration	Dermal	Adjusted	Noncarcii	nogenic IF	Carcino	genic IF	Subchronic	Subchronic	Hazard (	Quotient <sup>1</sup>	Cance	r Risk <sup>2</sup>
	RME	PC	RME	CTE	RME	CTE	RME	RfD	Slope Factor	CTE	RME	CTE	RME
	(mg/L)	(cm/hour)	(mg/L)	(L/kg-day)	(L/kg-day)	(L/kg-day)	(L/kg-day)	(mg/kg-day)	(mg/kg-day) <sup>-1</sup>				
Volatile Oganic Compoun	ıds												
1,1,1-Trichloroethane	2.1E+00	1.7E-02	3.6E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.8E-01	NTF	5.7E-03	1.9E-02	NTF	NTF
1,1,2-Trichloroethane	2.6E-02	6.4E-03	1.7E-04	4.5E-02	1.5E-01	6.4E-04	2.1E-03	4.0E-02	5.7E-02	1.9E-04	6.1E-04	6.0E-09	2.0E-08
1,1-Dichloroethene	2.8E+00	1.2E-02	3.4E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	9.0E-03	NTF	1.7E-01	5.5E-01	NTF	NTF
1,2-Dichloroethane	1.3E-01	4.2E-03	5.5E-04	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-02	9.1E-02	8.1E-04	2.7E-03	3.2E-08	1.0E-07
Acetone	9.8E-01	5.7E-04	5.6E-04	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E+00	NTF	2.5E-05	8.2E-05	NTF	NTF
Benzene	1.1E-01	1.5E-02	1.7E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	4.0E-03	5.5E-02	1.8E-02	6.1E-02	5.8E-08	1.9E-07
Bromochloromethane	2.0E-03	4.6E-03	9.2E-06	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.0E-02	6.2E-02	2.0E-05	6.8E-05	3.6E-10	1.2E-09
Chloroethane	3.7E+00	6.1E-03	2.3E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	4.0E-01	2.9E-03	2.5E-03	8.3E-03	4.2E-08	1.4E-07
cis-1,2-Dichloroethene	4.0E-01	7.7E-03	3.1E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-01	NTF	1.4E-03	4.5E-03	NTF	NTF
Ethylbenzene	1.2E-01	4.9E-02	5.9E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-01	NTF	2.6E-03	8.7E-03	NTF	NTF
Methyl Isobutyl Ketone	1.6E+00	4.0E-03	6.4E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	8.0E-01	NTF	3.5E-04	1.2E-03	NTF	NTF
Methylene Chloride	5.1E-01	3.5E-03	1.8E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	6.0E-02	7.5E-03	1.3E-03	4.4E-03	8.5E-09	2.8E-08
Tetrachloroethene	7.6E-02	3.3E-02	2.5E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-01	5.2E-02	1.1E-03	3.7E-03	8.3E-08	2.7E-07
Toluene	5.6E+00	3.1E-02	1.7E-01	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.0E+00	NTF	3.9E-03	1.3E-02	NTF	NTF
Trichloroethene	1.2E-01	1.2E-02	1.4E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	6.0E-03	1.1E-02	1.1E-02	3.5E-02	1.0E-08	3.3E-08
Vinyl Chloride	3.6E-01	5.6E-03	2.0E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-03	7.2E-01	3.0E-02	9.9E-02	9.2E-07	3.1E-06
m,p-Xylene	4.7E-01	5.3E-02	2.5E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.0E-01	NTF	5.5E-03	1.8E-02	NTF	NTF
Explosives													
2,6-DNT	2.7E-03	2.1E-03	5.7E-06	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-02	NTF	2.5E-05	8.4E-05	NTF	NTF
RDX	6.9E-03	3.5E-04	2.4E-06	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-03	1.1E-01	3.6E-05	1.2E-04	1.7E-10	5.6E-10
Metals													
Arsenic	5.8E-02	1.0E-03	5.8E-05	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-04	1.5E+00	8.6E-03	2.8E-02	5.5E-08	1.8E-07
Totals										0.3	0.9	1.2E-06	4.0E-06

cm = Centimeter(s) PC = Permeability Coefficient (cm/hour) (USEPA 1992a, 2001b, RAIS 2003)

CTE = Central Tendency Exposure RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

2,6-DNT = 2,6-Dinitrotoluene RfD = Reference Dose

IF = Intake Factor RME = Reasonable Maximum Exposure

kg = Kilogram(s)

L = Liter(s)

Dermal Adjusted RME x Noncarcinogenic IF/RfD

mg = Milligram(s)

<sup>2</sup> Dermal Adjusted RME Concentration x Carcinogenic IF x Slope Factor

NTF = No established USEPA toxicity factor

TABLE J-17 COMMERCIAL/INDUSTRIAL WORKER HEALTH RISK (INGESTION OF GROUNDWATER) FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Groundwater			G .		CI .	CI .		o		<b>D.</b> 12
_	Concentration		nogenic IF		genic IF	Chronic	Chronic		Quotient <sup>1</sup>		r Risk <sup>2</sup>
	RME	CTE	RME	CTE	RME	RfD	Slope Factor	CTE	RME	CTE	RME
	(mg/L)	(L/kg-day)	(L/kg-day)	(L/kg-day)	(L/kg-day)	(mg/kg-day)	(mg/kg-day) <sup>-1</sup>				
Volatile Oganic Compound	ds										
1,1,1-Trichloroethane	2.1E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.8E-01	NTF	NTF	7.3E-02	NTF	NTF
1,1,2-Trichloroethane	2.6E-02	4.9E-03	9.8E-03	4.6E-04	3.1E-03	4.0E-02	5.7E-02	3.2E-03	6.4E-03	6.8E-07	4.5E-06
1,1-Dichloroethene	2.8E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	9.0E-03	NTF	1.5E+00	3.0E+00	NTF	NTF
1,2-Dichloroethane	1.3E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-02	9.1E-02	2.1E-02	4.2E-02	5.5E-06	3.6E-05
Acetone	9.8E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E+00	NTF	4.8E-03	9.6E-03	NTF	NTF
Benzene	1.1E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	4.0E-03	5.5E-02	1.3E-01	2.7E-01	2.8E-06	1.9E-05
Bromochloromethane	2.0E-03	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.0E-02	6.2E-02	4.9E-04	9.8E-04	5.7E-08	3.8E-07
Chloroethane	3.7E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	4.0E-01	2.9E-03	4.5E-02	9.1E-02	4.9E-06	3.3E-05
cis-1,2-Dichloroethene	4.0E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-01	NTF	2.0E-02	3.9E-02	NTF	NTF
Ethylbenzene	1.2E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-01	NTF	5.9E-03	1.2E-02	NTF	NTF
Methyl Isobutyl Ketone	1.6E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	8.0E-01	NTF	9.8E-03	2.0E-02	NTF	NTF
Methylene Chloride	5.1E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	6.0E-02	7.5E-03	4.2E-02	8.3E-02	1.8E-06	1.2E-05
Tetrachloroethene	7.6E-02	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-01	5.2E-02	3.7E-03	7.4E-03	1.8E-06	1.2E-05
Toluene	5.6E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.0E+00	NTF	1.4E-02	2.7E-02	NTF	NTF
Trichloroethene	1.2E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	6.0E-03	1.1E-02	9.8E-02	2.0E-01	6.1E-07	4.0E-06
Vinyl Chloride	3.6E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-03	7.2E-01	5.9E-01	1.2E+00	1.2E-04	7.9E-04
m,p-Xylene	4.7E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.0E-01	NTF	1.1E-02	2.3E-02	NTF	NTF
Explosives											
2,6-DNT	2.7E-03	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-03	NTF	1.3E-02	2.6E-02	NTF	NTF
RDX	6.9E-03	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-03	1.1E-01	1.1E-02	2.3E-02	3.5E-07	2.3E-06
Metals											
Arsenic	5.8E-02	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-04	1.5E+00	9.5E-01	1.9E+00	4.0E-05	2.7E-04
Totals							_	3.5	7.1	1.8E-04	1.2E-03

CTE = Central Tendency Exposure RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

2,6-DNT = 2,6-Dinitrotoluene RfD = Reference Dose

IF = Intake Factor RME = Reasonable Maximum Exposure

kg = Kilogram(s)

L = Liter(s)

Hazard Quotient = Groundwater Concentration x Noncarcinogenic IF/RfD

mg = Milligram(s)

<sup>2</sup> Groundwater Concentration x Carcinogenic IF x Slope Factor

NTF = No established USEPA toxicity factor

TABLE J-18 HUMAN HEALTH RISK-BASED PRELIMINARY REMEDIATION GOALS FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Medium/Receptor	Chemical	RME Concentration (ng/L)	Noncarcinogenic Effects (ng/L) <sup>1</sup>	Carcinogenic Effects (ng/L) <sup>2</sup>
Shallow Groundwater				
Commercial/Industrial Worker	1,1,1-Trichloroethane	2,100	29,000	NTF
- Ingestion	1,1,2-Trichloroethane	26	4,100	6
mgestron	1,1-Dichloroethene	2,800	920	NTF
	1,2-Dichloroethane	130	3,100	4
	Acetone	980	100,000	NTF
	Benzene	110	410	6
	Bromochloromethane	2.0	2,000	5
	Chloroethane	3,700	41,000	110
	cis-1,2-Dichloroethene	400	10,000	NTF
	Ethylbenzene	120	10,000	NTF
	Methyl Isobutyl Ketone	1,600	82,000	NTF
	Methylene Chloride	510	6,100	44
	Tetrachloroethene	76	10,000	6
	Toluene	5,600	200,000	NTF
	Trichloroethene	120	610	30
	Vinyl Chloride	360	310	0.5
	m,p-Xylene	470 <b></b>	20,000	NTF
	2,6-Dinitrotoluene	2.7	100	NTF
	RDX	6.9	310	3
	Arsenic	58	30	0.2
Construction Worker	1,1,1-Trichloroethane	2,100	500,000	NTF
- Inhalation	1,1,2-Trichloroethane	26	NTF	990
	1,1-Dichloroethene	2,800	45,000	NTF
	1,2-Dichloroethane	130	1,100	610
	Acetone	980	NTF	NTF
	Benzene	110	6,800	1,900
	Bromochloromethane	2	NTF	NTF
	Chloroethane	3,700	NTF	NTF
	cis-1,2-Dichloroethene	400	NTF	NTF
	Ethylbenzene	120	230,000	14,000
	Methyl Isobutyl Ketone	1,600	680,000	NTF
	Methylene Chloride	510	680,000	35,000
	Tetrachloroethene	76	130,000	5,500
	Toluene	5,600	87,000	5,500
	Trichloroethene	120	NTF	9,200
	Vinyl Chloride	360	23,000	3,500
	m,p-Xylene	470	23,000	NTF
Construction Worker	1,1,1-Trichloroethane	2,100	7,900,000	NTF
- Incidental Ingestion	1,1,2-Trichloroethane	26	1,100,000	35,000
	1,1-Dichloroethene	2,800	260,000	NTF
	1,2-Dichloroethane	130	850,000	22,000
	Acetone	980	28,000,000	NTF
	Benzene	110	110,000	36,000
	Bromochloromethane	2.0	570,000	32,000

TABLE J-18 HUMAN HEALTH RISK-BASED PRELIMINARY REMEDIATION GOALS FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Medium/Receptor	Chemical	RME Concentration (ng/L)	Noncarcinogenic Effects (ng/L) <sup>1</sup>	Carcinogenic Effects (ng/L) <sup>2</sup>
Shallow Groundwater				
Construction Worker	Chloroethane	3,700	11,000,000	690,000
- Incidental Ingestion (Continued)	cis-1,2-Dichloroethene	400	2,800,000	NTF
-	Ethylbenzene	120	2,800,000	NTF
	Methyl Isobutyl Ketone	1,600	23,000,000	NTF
	Methylene Chloride	510	1,700,000	265,000
	Tetrachloroethene	76	2,800,000	38,000
	Toluene	5,600	57,000,000	NTF
	Trichloroethene	120	170,300	180,700
	Vinyl Chloride	360	85,000	2,800
	m,p-Xylene	470	5,700,000	NTF
	2,6-Dinitrotoluene	2.7	280,000	NTF
	RDX	6.9	85,000	18,000
	Arsenic	58	8,500	1,300
Construction Worker	1,1,1-Trichloroethane	2,100	110,000	NTF
- Dermal	1,1,2-Trichloroethane	26	42,000	1,300
	1,1-Dichloroethene	2,800	5,100	NTF
	1,2-Dichloroethane	130	48,000	1,200
	Acetone	980	12,000,000	NTF
	Benzene	110	1,800	580
	Bromochloromethane	2	30,000	1,700
	Chloroethane	3,700	440,000	27,000
	cis-1,2-Dichloroethene	400	88,000	NTF
	Ethylbenzene	120	14,000	NTF
	Methyl Isobutyl Ketone	1,600	1,400,000	NTF
	Methylene Chloride	510	120,000	18,000
	Tetrachloroethene	76	21,000	280
	Toluene	5,600	440,000	NTF
	Trichloroethene	120	3,400	3,600
	Vinyl Chloride	360	3,600	120
	m,p-Xylene	470	26,000	NTF
	2,6-Dinitrotoluene	2.7	32,000	NTF
	RDX	6.9	58,000	12,000
	Arsenic	58	2,000	320

 $\mu g/L = Micrograms \ Per \ Liter$ 

HQ = Hazard Quotient

NTF = No established USEPA toxicity factor

PRG = Preliminary Remediation Goal

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

 $RME = Reasonable\ Maximum\ Exposure$ 

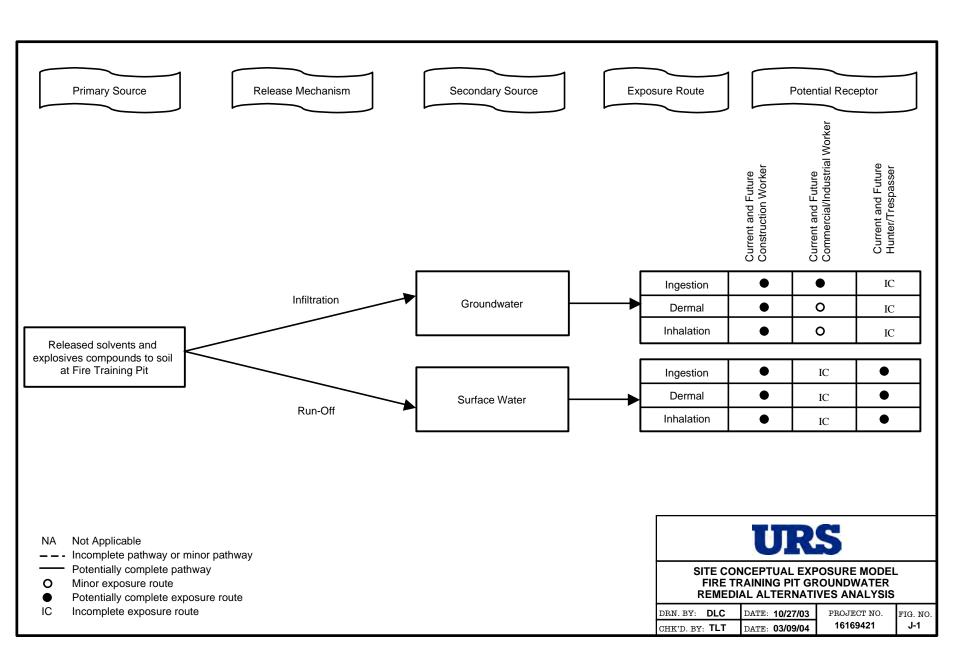
 $UTL = Upper \ Tolerance \ Limit$ 

<sup>&</sup>lt;sup>1</sup> Risk-based PRGs (noncarcinogenic) = (RME concentration/HQ) x 1.0.

<sup>&</sup>lt;sup>2</sup> Risk-based PRGs (carcinogenic) = (RME concentration/cancer risk) x 10<sup>-6</sup>.

Shading indicates the lowest calculated risk-based PRG for each chemical.

<sup>\*</sup> Note the arsenic PRG of 0.22 µg/L is less than the background UTL of 40.3 µg/L (see **Appendix M**).



# FIRE TRAINING PIT GROUNDWATER FLOW AND CONTAMINANT FATE AND TRANSPORT MODELING

# IOWA ARMY AMMUNITION PLANT MIDDLETOWN, IOWA





Prepared for U.S. Army Corps of Engineers Omaha District

May 2004



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Attachment K-1	Groundwater Flow Model-Related Calculations and Input Calibrated Baseline Flow Model Volumetric Water Budget Hydraulic Conductivity Fields
Attachment K-2	MODFLOW and MODPATH Documentation
Attachment K-3	MT3DMS Model Documentation
Attachment K-4	Contaminant Fate and Transport Model Input Justification Half-Life Estimations and Model Input Initial Target Compound Concentrations Input Dispersivity Input
Attachment K-5	Contaminant Fate and Transport Modeling Results Baseline Fate and Transport Model Alternatives 1 and 2 – No-Action and MNA Alternative 3 – Focused Extraction/MNA Alternative 4 – ISCO/MNA Alternative 5 – Enhanced Degradation/MNA

### List of Acronyms and Abbreviations

% Percent

Microgram(s) μg

1,1-DCE 1,1-Dichloroethene

GCG Generalized Conjugate Gradient

 $D_l$ Longitudinal Dispersivity  $D_l$ Longitudinal Dispersivity  $D_t$ Transverse Dispersivity  $D_{v}$ Vertical Dispersivity

EBP East Burn Pads

**EDA** Explosives Disposal Area

FS Feasibility Study

ft Foot or Feet

 $ft^2$ Square Foot or Square Feet

FTP Fire Training Pit

Gram(s) g

Gallons Per Minute gpm

HAL Health Advisory Level

**IAAAP** Iowa Army Ammunition Plant

IGS Iowa Geological Survey

in Inch(es)

ISCO In-Situ Chemical Oxidation

k **Decay Constant** 

 $K_d$ Soil/water partition coefficient

Organic carbon/water partition coefficient  $K_{oc}$ 

 $K_{ow}$ Octanol/water partition coefficient

 $K_x$ Longitudinal Hydraulic Conductivity

Transverse Hydraulic Conductivity  $K_{v}$ 

 $K_z$ Vertical Hydraulic Conductivity

L Liter(s)

mL Milliliter(s)

Monitored Attenuation MNA

Mean Sea Level msl

**Total Porosity** η

NAVD88 North American Vertical Datum 1988

**Effective Porosity**  $\eta_e$ 

Pounds Per Cubic Foot pcf

**RAA** Remedial Alternatives Analysis

**RDX** Hexahydro-1,3,5-trinitro-1,3,5-triazine

**RMS** Root Mean Squared

**Total Organic Carbon** TOC

URS Group, Inc. **URS** 

United States Army Corps of Engineers **USACE** 

**USGS** United States Geological Survey

WHI Waterloo Hydrogeologic Inc.

SIP **Strongly Implicit Procedure** 

**SSOR** Slice-Successive Overrelaxation

TCE Trichloroethene

**TVD Total Variation Diminishing** 

Volatile Organic Compound **VOC** 

West Burn Pads Area **WBPA** 

#### **K**.1 INTRODUCTION

### Purpose and Authority for the Project

The United States Army Corps of Engineers (USACE) contracted URS Group, Inc. (URS) to complete a groundwater model in conjunction with the Groundwater Remedial Alternatives Analysis (RAA) for the Fire Training Pit (FTP) at the Iowa Army Ammunition Plant (IAAAP) located near Middletown, Iowa. Work for this assignment is being performed under Contract Number DACA45-96-D-0017, Delivery Order 0063. The purpose of this technical memorandum is to provide the technical documentation for the groundwater flow and contaminant fate and transport modeling completed by URS in support of the RAA for the FTP.

### K.1.2 Groundwater Modeling Objectives and Scope of Work

The objectives for the groundwater flow and contaminant fate and transport modeling effort were:

- Design and construct a baseline MODFLOW groundwater flow model and baseline MT3DMS contaminant fate and transport model for the FTP.
- Calibrate the flow model based on water level data collected during the Spring 2003 FTP Feasibility Study (FS) data collection investigation (presented in **Section 4**).
- Evaluate the effectiveness of various remedial alternatives for the RAA.

The overall modeling scope of work completed by URS is subsequently presented.

#### K.1.2.1 Groundwater Flow Modeling Scope of Work

The groundwater flow modeling scope of work included:

- Construction of a three-dimensional, numerical, finite-difference groundwater flow model in MODFLOW (Harbaugh, et al. 2000). The MODFLOW model was constructed using the Visual MODFLOW (WHI 2003) modeling software. The flow model simulated baseline steady-state groundwater flow conditions for the saturated materials (unconsolidated and bedrock) underlying the FTP.
- Calibration of the flow model to Spring 2003 water levels.
- Simulation of advective particle transport using MODPATH (Pollock 1994). predicted transport was compared to the Spring 2003 volatile organic compound (VOC) plume to verify flow directions and maximum extent of groundwater movement.
- Evaluation of the remedial alternatives presented in the RAA using MODPATH (Pollock 1994) to determine capture zones and/or hydrogeologic effects of the alternatives on the baseline groundwater flow conditions.

#### K.1.2.2 Contaminant Fate and Transport Modeling Scope of Work

The contaminant fate and transport modeling scope of work included:

- Construction of a three-dimensional, numerical solute transport model using MT3DMS (Zheng and Wang 1998). The transport model was used in conjunction with the calibrated MODFLOW flow model. The transport model used the flow terms (e.g., head, velocity, and gradient) from the MODFLOW simulations to calculate transport of VOCs over time. The existing grid and model setup was used as a basis for the fate and transport model. Concentrations of VOCs were input into the model using the Spring 2003 groundwater sampling results.
- Using the baseline contaminant fate and transport model to predict current and future exposure point concentrations of VOCs in support of a human health risk assessment completed for FTP groundwater.
- Using the baseline contaminant fate and transport model to predict natural attenuation trends (e.g., dilution, dispersion, retardation, and degradation) for VOCs in groundwater at the FTP.
- Using the contaminant fate and transport model for evaluation of the effectiveness of various groundwater remedial alternatives to support the RAA.

#### **K.2 GROUNDWATER FLOW MODELING**

#### K.2.1 Groundwater Flow Modeling Approach, Methodology, and Assumptions

The approach, methods, and assumptions used to simulate groundwater flow conditions for the FTP are discussed in the following sections.

#### K.2.1.1 Groundwater Flow Modeling Approach and Methodology

Groundwater flow conditions at the site were simulated using the United States Geological Survey (USGS) Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW) (Harbaugh, et al. 2000). The MODFLOW model was constructed using Visual MODFLOW 3.1 (WHI 2003). Visual MODFLOW 3.1 is a pre- and post-processing program and does not affect the results generated by running MODFLOW.

#### K.2.1.2 Project Uses of the Groundwater Flow Model

After the groundwater flow model was constructed and calibrated for the baseline condition (i.e., Spring 2003), the remedial alternative components (e.g., vertical wells) were applied to the baseline MODFLOW model to simulate the aquifer response to the alternatives. MODPATH, the USGS advective particle-tracking model, was used in the baseline flow model to compute and plot advective particle flow paths in the area of the existing VOC plumes. MODPATH was also used to compute and plot capture zones for the active remedial alternatives. MODFLOW and MODPATH model descriptions, assumptions, and flow equations are included in

Attachment K-2. The remedial alternative groundwater flow models were then used for the contaminant fate and transport modeling. Contaminant fate and transport model assumptions, input, and results are presented in **Section K.3**.

#### K.2.1.3 Groundwater Flow Modeling Assumptions

The assumptions for the groundwater flow modeling effort included the following:

- General MODFLOW model code assumptions, which include single, calculated head values within each individual cell, completely efficient sinks and sources, and uniformly porous aguifer materials.
- Only steady-state groundwater flow conditions were modeled.
- Influences of surface water and drainages (e.g., Spring Creek and surface drainages around the FTP) were effectively simulated using drain node boundary conditions applied to the cells in the surface water/drainage locations.
- General head boundary conditions, used to simulate the influence of regional flow, did not significantly influence model results in the local areas of interest (e.g., the area around the plumes).
- Only non-reactive, advective particle transport was simulated by MODPATH.

### K.2.2 Groundwater Flow Model Setup and Input Parameters

To facilitate a cohesive idea of the groundwater flow at the Explosives Disposal Area (EDA) (which includes FTP, West Burn Pads Area [WBPA], and East Burn Pads [EBP]), all three areas were included within a single flow model grid. The potentiometric surface map (Figure 4-2) shows that FTP is adjacent to the WBPA and indicates groundwater at FTP and WBPA are connected. The eastern boundary of these two sites (Spring Creek) is also the western boundary of the EBP. Based on these interrelationships among the three sites, a single, multi-layer flow model was used to simulate groundwater flow in the saturated unconsolidated soils and bedrock underlying the EDA. This technical memorandum primarily presents the flow results for the EDA, as well as the fate and transport results for FTP (Section K.3).

The finite-difference grid, model boundary conditions, and hydrogeologic input parameters for the EDA flow model are described below and are presented on **Figure K-1**.

#### K.2.2.1 Finite-Difference Grid

The finite-difference grid for the baseline flow model consisted of 244 rows, 354 columns, and 7 layers (for a total of 604,632 cells). The model grid covered an area approximately 4,000 feet in the x (east–west) direction and 2,800 feet in the y (north–south) direction. The grid was oriented north to south.

The model area was discretized into grid cells varying from 10 feet by 10 feet to 40 feet by 40 feet, with the highest resolution in the areas of greatest interest (e.g., near the FTP VOC plume).

The largest grid cells were placed around the edges of the model area to expand the model domain to reduce potential adverse effects in the areas of greatest interest from boundary conditions.

Seven layers were constructed in the flow model to simulate groundwater flow in the unconsolidated soils and bedrock. The topographic surface of the model was based on the Baker surveyed topographic map (Baker 1998), direct push elevations, and monitoring well ground surface elevations. The vertical boundaries of the model layers were determined from geologic boring logs and model calibration. The base of the model was set to twenty feet below the deepest boring (EBP-MW2). Model-generated cross-sections in the FTP area, with model layers outlined, are shown on Figures K-2 and K-3. Model-generated cross-sections A-A' and B-B' can be compared to the interpreted FTP geologic cross-sections A-A' and B-B' on Figures 4-3 and **4-4**.

In the model setup, the flow condition for Layer 1 was unconfined (MODFLOW type 1). Layers 2 through 7 were variable confined/unconfined (MODFLOW type 3) and allowed to vary between the two conditions.

Layer thicknesses were input to the model as follows:

- Layer 1 thickness varied from 5 to 65 feet.
- Layer 2 thickness was 10 feet.
- Layer 3 thickness was 10 feet.
- Layer 4 thickness was 20 feet.
- Layer 5 thickness was 20 feet.
- Layer 6 thickness was 20 feet.
- Layer 7 thickness was 20 feet.

#### K.2.2.2 Model Boundary Conditions

Boundary conditions in MODFLOW determine how water enters (sources) and leaves (sinks) the model. The model boundary conditions discussed below include drain nodes, general heads, and no-flow boundary conditions.

#### Drain Nodes

Drain nodes, simulating removal of water from the model, were used to simulate the influence of Spring Creek and surface drainages around the EDA. The locations of drain nodes were based on existing surface features (e.g., Spring Creek and major surface drainages around the EDA) that exhibited significant impacts on the water table surface. The elevations of the drain nodes were set to simulate the observed groundwater elevations in the wells, with conductance values that ranged from 100 square feet per day (ft<sup>2</sup>/day) to 1600 ft<sup>2</sup>/day (about 1 ft<sup>2</sup>/day per square foot of cell size) to represent transfer of water from the aquifer to surface water drains.

conductance values were generally set high enough to not inhibit the flux of water flowing out of the model into the drains.

### General Head Boundary Conditions

General head boundary conditions, representing the regional groundwater flow regime's influence on local conditions, were input along the northern, eastern, southern, and western sides of the model in model Layers 1, 2, and 4 through 7, as shown on Figures K-1, K-2, and K-3. The model dimensions were sufficiently large to minimize adverse effects of general head boundaries on model results in local areas of interest (i.e., the VOC plumes). General head boundary elevations were also used to simulate interpreted effects of the topography on the groundwater flow regime.

General head boundary elevations were estimated using Spring 2003 flow conditions. The model grid extends past the area with observed and interpreted groundwater elevations. In these areas, general heads were input to the model using projected groundwater elevations. general head boundaries in each layer were independent of the general head boundaries in other layers.

General head boundary conditions are required to have a conductance value input to the model that represents the resistance to flow between the boundary head and the model domain. General head conductance values assigned in the calibrated flow model ranged from 25 ft<sup>2</sup>/day to 200 ft<sup>2</sup>/day, depending on the length of the boundary cells. A constant value of 5 feet per day (ft/day) per linear foot of boundary was used (e.g., a 5-foot-long cell would have a conductance of 25 ft<sup>2</sup>/day). These values were based upon model calibration and water balance considerations. The model was not sensitive to the range of general head boundary conductance values.

### No-Flow Boundary Conditions

No-flow boundary conditions were used in areas where groundwater flow into and out of the model was relatively insignificant. By default, the bottom of the model is a no-flow condition in MODFLOW. The area of interest for the model is well above the bottom of the model and the no-flow boundary does not have a significant effect on the modeling results. No-Flow boundary conditions were also used along all four sides of the model in Layer 3. This model layer simulated a hydrogeologic unit that had significantly lower hydraulic conductivities than Layers 1 and 2. Based on the difference in elevations of the shallow groundwater and the bedrock groundwater, Layer 3 generally acted as an aquitard between the shallow groundwater units and the bedrock wells. The groundwater flux into and out of the model through this layer was considered relatively insignificant. Therefore, no-flow boundaries were used.

#### K.2.2.3 Hydrogeologic Input Parameters

MODFLOW requires the user to construct and define the model with a number of site-specific parameters, including aquifer-specific parameters. Modeling of physical and chemical systems requires the use of simplifying assumptions based on existing site information. The model input

### **APPENDIXK**

parameters were based on the hydrogeologic data collected during the FTP, EBP, and WBPA FS data collections, Spring 2003 groundwater analytical results, and recent literature values. Aquifer-specific input parameters for the EDA are listed in Table K-1. The development of input values for the EDA flow model is summarized below:

Top and Bottom of Unit (feet above msl). Seven model layers were established in the EDA flow model. The thickness of each layer was determined from geologic boring logs and model calibration. The seven model layers were used to facilitate evaluation of horizontal and vertical groundwater flow and contaminant transport using the model. The model layers included the following hydrogeologic units:

- Layer 1 Shallow till, fill, and weathered bedrock
- Layer 2 Upper bedrock/intermediate till
- Layers 3, 4, 5, and 6 Bedrock/deep till
- Layer 7 Bedrock

The bottom of the model was set in the bedrock unit.

Hydraulic Conductivity (K). Hydraulic conductivity model input values for the FTP portion were selected based on aquifer testing results (Appendix F), geologic boring logs, and model calibration and sensitivity analysis. These values are summarized in Table 8-2. The measured horizontal hydraulic conductivity values ranged from:

- Approximately 0.020 to 0.47 ft/day for shallow till wells and approximately 0.046 to 2.2 ft/day for till/bedrock contact wells
- Approximately 0.38 to 8.6 ft/day for deep till/bedrock contact wells
- Approximately 0.0013 to 2.4 ft/day for upper bedrock wells
- Approximately 0.00015 to 0.0076 ft/day for bedrock wells

Ranges of hydraulic conductivity values were assigned to all layers in the numerical model based on the aquifer slug test data and model calibration. The hydraulic conductivity values used in the model generally ranged from:

- 0.02 to 2 ft/day in Layer 1 for shallow till and till/bedrock contact (1 ft/day for the sump monitoring well (SA-99-1) area
- 0.001 to 0.2 ft/day in Layer 2 for upper bedrock
- 0.01 ft/day in Layer 2 for intermediate till (EBP only)
- 1x10<sup>-6</sup> to 0.002 ft/day in Layers 3 to 7 for bedrock
- 1x10<sup>-5</sup> to 0.006 ft/day in Layer 3 to 6 for deep till (EBP only)
- 0.4 ft/day for in Layer 1 for alluvium underlying Spring Creek and its tributaries

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Longitudinal  $(K_x)$  and transverse  $(K_y)$  hydraulic conductivity values were set equal. Vertical hydraulic conductivity ( $K_2$ ) values were set at a 1:10 ratio of vertical to horizontal values for all layers.

*Porosity* (n). Geotechnical analysis of the soils from the EDA indicated a range of total porosity values from 23.0 to 38.0 percent (0.23 to 0.38) with an overall average of about 32 percent (**Table 4-1**). In most unconsolidated sediments, the total porosity  $(\eta)$  is equal to the effective porosity ( $\eta_e$ ) (Fetter 1988). A uniform effective porosity value of 32 percent was assigned to the model for the unconsolidated units at the FTP. Porosity values for the upper bedrock and bedrock were not available. Effective porosity values of 22 and 20 percent were assigned to the model for the upper bedrock and bedrock, respectively.

Horizontal Hydraulic Gradient (i). Average hydraulic gradients were simulated for each model layer by varying hydrogeologic parameters and constant head boundary conditions. Hydraulic heads and the resulting horizontal and vertical gradients were calibrated to Spring 2003 FTP values (Table 4-3). The FTP water table map generated from Spring 2003 water level data is shown on Figure 4-5. A comparison of the Spring 2003 water table map and the modelpredicted water table surface is shown on **Figure K-6**.

Recharge. Recharge was based on average annual precipitation, evaporation, soil types, other ground cover, land use, and model calibration. Precipitation was considered uniform across the model area. Therefore, variations in ground cover and land use primarily accounted for spatial variations in recharge across the model. **Figure K-4** presents the distribution of recharge values across the EDA model domain. Recharge was applied to the highest active layer in the model (i.e., Layer 1). In general, recharge values input to the model ranged from 0 to 0.7 inches per year. Based on observed groundwater mounds near JAW-25 (WBPA), SA-99-1 (FTP), EDA-01 (EBP), and JAW-04(B) (EBP), localized zones of higher recharge (1 to 20 inches per year) were assigned in these areas.

Storage Coefficient (S). Storage coefficients were not used in the model simulations because the model was run as a steady-state simulation. Even under confining conditions, the contribution to hydraulic flow from release of water from storage was less than the mass balance uncertainty of the model.

Leakance (L). Vertical leakance values for all layers were automatically calculated by the model using the vertical hydraulic conductivity of each layer, the volume of the model grid cell specified by the layer top and bottom elevations, and the cell size.

<u>Time (t).</u> The groundwater flow model was not time dependent (i.e., steady-state conditions were modeled).

### K.2.3 Baseline Groundwater Flow Model Calibration, Sensitivity, Uncertainties, and Limitations

Groundwater flow model calibration and sensitivity analysis were completed prior to the contaminant fate and transport modeling. Calibration of the groundwater flow model, comparison of model-generated potentiometric head data to actual site data, groundwater flow model sensitivity analysis, and uncertainties and limitations of the groundwater flow model are presented in the following sections.

#### K.2.3.1 Groundwater Flow Model Calibration

The flow model was calibrated using Spring 2003 water levels (**Table 4-2**) by varying the model input values discussed in Section K.2.2. Calibration model executions included varying the hydraulic conductivity values, varying the hydraulic conductivity fields, varying the recharge field and values, varying the conductance of the drain nodes, and varying the elevations of constant head boundaries and drains. These values were varied, within the boundaries of the available data, until the model-predicted groundwater flow regime reasonably simulated the observed conditions.

### Calibrated Groundwater Flow Configuration

The Spring 2003 and the model-predicted shallow and intermediate groundwater potentiometric surfaces are shown on Figures K-5 and K-6, respectively. In general, model-predicted groundwater flow directions, hydraulic gradients, and hydraulic head values closely matched the interpreted field data.

Potential sources of calibration error in the model are related to the areas of undefined geology and hydrogeology west of FTP, north of WBPA, and south of EBP. However, this area is a relatively small portion of the model and does not significantly impact the overall model results. The final aquifer parameter values were set in these areas such that the model results would closely match the Spring 2003 water levels.

#### Calibration Statistics

The calculated differences between the baseline model-estimated water levels and observed water levels are presented in **Table K-2**. A summary of the calibration statistics calculated for each layer is shown in Table K-3. The mean absolute differences between observed hydraulic heads and simulated hydraulic heads in each layer are as follows:

Layer 1: 0.74 feet

Layer 2 1.23 feet

Layer 4: 0.98 feet

Layer 6: 0.5 feet

Overall Model: 0.86 feet

The slope of the zero-intercept, linear regression comparison line for all model calibration points was 0.99. A perfect linear relationship (included as the perfect calibration line on **Table K-3**) yields a slope of 1.0. This indicated a very strong linear relationship between model-predicted hydraulic heads and actual site conditions. More importantly, the simulated hydraulic gradients appeared to closely match actual hydraulic gradients and groundwater flow directions (Figures K-5 and K-6).

Mean absolute model calibration residuals within 5 percent of total head variations generally are considered acceptable. The calibrated mean absolute head residual values for the EDA model averaged about 1.64 percent of the total head change, indicating statistically excellent model calibration.

The root mean squared (RMS) value of the model is defined as the square root of the sum of the squared head residual values, divided by the number of observations. The RMS for the EDA flow model was 1.14 feet. The normalized RMS is the RMS divided by the head difference across the model. The calibrated normalized RMS value for the EDA model was 2.19 percent, indicating excellent model calibration.

### Calibrated Volumetric Water Budget

In addition to calibration statistics, a volumetric water budget calculation was used to estimate the accuracy of the numerical groundwater flow model. The volumetric water budget calculates the amount of water that flows in and out of model through the sinks and sources. volumetric water budget indicates the overall acceptability of the groundwater flow model by providing the percent difference in the inflow and outflow of the modeled sinks and sources (Harbaugh, et al. 2000). The volumetric water budget for the baseline flow model had a relatively insignificant 0.01 percent discrepancy in mass balance, indicating that the model was acceptable for the project uses. Attachment K-1 includes the MODFLOW-generated volumetric water budget for the baseline calibrated groundwater flow model.

### Advective Particle Tracking Calibration

After model calibration and sensitivity analysis indicated the model reasonably predicted the baseline groundwater elevations, the baseline groundwater flow model was used to simulate the historical movement of the groundwater at the EDA. Advective particles were input to the baseline flow model in interpreted source areas (e.g., around SA-99-1) and were forward tracked throughout the model area for a period of 70 years.

The final baseline advective particle tracking results are shown on **Figures K-7** and **K-8**. The particle tracking results indicated that the model-simulated flow paths were similar to those interpreted for the Spring 2003 plumes. Advective water particles input to the model near the sump monitoring well (SA-99-1) area generally traveled south, southeast, and east toward the Spring Creek tributary (assigned as drain nodes). However, no significant VOC concentrations

are expected to be transported in the surface drainages and any VOCs daylighting at the surface are expected to volatilize rapidly.

Advective particle tracking results typically predict downgradient movement of advective particles significantly greater than the actual plumes because only non-reactive, advective transport can be simulated by MODPATH. MODPATH does not simulate the effects of naturally occurring processes of dispersion, retardation, and degradation of the plume concentrations. These processes will spread contaminants laterally, slow contaminant movement, and reduce contaminant concentrations with time and distance from the source. However, the widespread downgradient extent of groundwater VOC contamination at the FTP is interpreted to be related to surface transport in surface drainage features (discussed in Section 7.1.1). Therefore, the particles inserted near the FTP sump monitoring well area were not expected to be transported across the entire VOC plume.

#### K.2.3.2 Groundwater Flow Model Sensitivity Analysis

Sensitivity of the MODFLOW groundwater flow model was evaluated qualitatively and quantitatively to describe possible variability in the subsequent aquifer response analyses. The model was sensitive to most aquifer parameters, including (in order of highest sensitivity) boundary conditions, hydraulic conductivity, and recharge. Fluctuating these parameters within reasonable estimated ranges created noticeable differences in predicted flow conditions.

### Qualitative Sensitivity Analysis

The sensitivity of model-predicted heads to recharge and general head values were qualitatively evaluated during the calibration process. Measured water level data does not extend to all model boundaries. Therefore, the groundwater elevations outside of the existing water level data were extrapolated from the nearest measured water levels until model residuals (i.e., departure from observed conditions) were reasonably minimized. Systematic changes in the recharge areas and general head boundaries created similar systematic changes in the model-predicted heads. For example, increasing the amount of recharge or general head boundary elevations increased the model-predicted water table elevation. This procedure was repeated during the calibration process until a groundwater flow regime similar to the interpreted water levels was achieved.

Similar to the response of the recharge areas and general head elevations, increasing drain elevations directly impacted (i.e., raised) potentiometric surface elevations in the modeled areas around the surface water drainages. The drain conductance values were varied to more accurately simulate aquifer responses near the surface water drainage areas.

### Quantitative Sensitivity Analysis

The sensitivity of the model to hydraulic conductivity and recharge was quantitatively evaluated following the final calibration of the groundwater flow model. Model runs were completed using a range of values for each parameter. During the sensitivity analysis, all other parameters not being evaluated were held constant to the values used in the final calibrated groundwater

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flow model. Calibration statistics, specifically the normalized root mean squared (RMS) values between observed and simulated hydraulic heads, were compared and used to determine the statistically best fit for each model run. The quantitative sensitivity analysis results are presented in Table K-4.

### **Hydraulic Conductivity Sensitivity Analysis**

The highest hydraulic conductivity for Layer 1 was varied from 1 ft/day to 4 ft/day, with the calibrated groundwater flow model using a value of 2 ft/day. The resulting RMS values for the entire model ranged from 2.19% to 2.28%, with the calibrated model configuration producing an RMS of 2.19%. The model was slightly sensitive to this parameter.

The lowest hydraulic conductivity for Layer 1 was varied from 0.015 ft/day to 0.06 ft/day, with the calibrated groundwater flow model using a value of 0.03 ft/day. The resulting RMS values for the entire model ranged from 2.19% to 6.36%, with the calibrated model configuration producing an RMS of 2.19%. The model was very sensitive to this parameter.

### **Recharge Sensitivity Analysis**

The highest recharge area at WBPA (near JAW-25) was varied from 10 inches/year to 40 inches/year, with the calibrated groundwater flow model using a value of 20 inches/year. The resulting RMS values ranged from 2.19% to 2.3%, with the calibrated groundwater flow model configuration producing the lowest RMS at 2.19%. The model was slightly sensitive to this parameter.

The highest recharge area at FTP (near SA-99-1) was varied from 2.5 inches/year to 10 inches/year, with the calibrated groundwater flow model using a value of 5 inches/year. The resulting RMS values ranged from 2.19% to 4.39%, with the calibrated groundwater flow model configuration producing the lowest RMS at 2.19%. The model was slightly sensitive to this parameter.

The highest recharge area at EDA (near EDA-01) was varied from 2.5 inches/year to 10 inches/year, with the calibrated groundwater flow model using a value of 5 inches/year. The resulting RMS values ranged from 2.19% to 3.16%, with the calibrated groundwater flow model configuration producing the lowest RMS at 2.19%. The model was slightly sensitive to this parameter. These areas (i.e., WBPA, FTP, EDA) are shown on Figure K-4.

#### K.2.3.3 Groundwater Flow Model Uncertainties

Uncertainties in the groundwater flow model included:

- Limited available hydrogeologic data for subsurface characterization of Layers 3, 5, 6, and 7.
- Actual conductance values are not available for drain nodes. This was accounted for by calibration to the observed conditions.

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- Groundwater elevations at the extents of the model cannot be measured and were extrapolated from observed water level information.
- Actual recharge values are not available. Values were based on topography, vegetation, land use, and model calibration.

#### K.2.3.4 Groundwater Flow Model Limitations

Limitations of the flow model:

The groundwater flow model was constructed using steady-state conditions from the Spring 2003 groundwater elevations (**Table 4-2**). These measurements were completed in late spring (following spring precipitation and storm events) and are anticipated to be slightly higher than the average groundwater elevations at EDA during fall and winter.

#### K.2.3.5 Baseline Groundwater Flow Modeling Results Summary

The groundwater flow modeling results are summarized as follows:

- The overall baseline groundwater flow model calibration was statistically excellent with model-predicted heads calibrated to within 2.19 percent normalized root mean squared error and 1.64 percent absolute residual mean error.
- The mass balance of the model had a 0.01 percent discrepancy.
- The calibrated baseline groundwater flow model adequately simulated the hydraulic gradients and flow directions interpreted from the Spring 2003 potentiometric surface maps.
- Advective particle tracking results indicated that water particles originating from the sump monitoring well area would be transported toward the south, southeast, and east, similar to the interpreted plume movement at the FTP.

### K.2.4 Groundwater Flow Modeling Remedial Alternatives Evaluation and Capture Zone **Predictions**

After model calibration and sensitivity analysis indicated that the model reasonably predicted the baseline groundwater elevations, the proposed groundwater remediation alternatives were evaluated. This evaluation was completed using a MODFLOW (Harbaugh, et al. 2000) baseline groundwater flow model and revising the model to simulate each of the remedial alternatives (e.g., adding extraction wells, etc.). Capture zone analysis for each alternative was completed using the reverse particle tracking option in MODPATH (Pollock 1994). Particle tracks were generally calculated for 70 years. A 70-year period was considered sufficient to adequately simulate the capture zones. The model-predicted capture zones and flow rates assumed 100percent well efficiency. However, subsurface conditions usually create actual efficiencies that are significantly lower (Driscoll 1986). Therefore, the remedial alternatives were typically designed in a conservative manner to compensate for potential inefficiencies.

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Five groundwater remediation alternatives were evaluated with the particle-tracking options in the groundwater flow model. The five remedial alternatives included:

- **Alternative 1: No Action** The baseline flow model was used to simulate the No Action remedial alternative.
- **Alternative 2: Monitored Natural Attenuation (MNA)** The baseline flow model was also used to simulate the MNA alternative.
- Alternative 3: Focused Extraction/MNA The baseline flow model was modified to include extracting groundwater from the sump monitoring well.
- Alternative 4: In-Situ Chemical Oxidation (ISCO)/MNA The baseline flow model was modified to include extracting groundwater from sump monitoring well and four injection wells around the perimeter of the sump excavation to inject a solution of hydrogen peroxide and water.
- Alternative 5: Enhanced Degradation/MNA This alternative used the same flow model as Alternative 4.

The objective of each modeling evaluation was to determine the optimum locations and extraction rates that would facilitate cleanup of VOCs. For the remedial alternative evaluations, it was conservatively assumed that the remedial alternatives would address all FTP plume groundwater with VOC concentrations greater than the FTP risk-based PRG for each contaminant.

#### K.2.4.1 Alternative 1: No Action

The calibrated baseline groundwater flow model was used for the No Action and MNA alternatives evaluations. Construction of this model did not differ from construction of the previously described baseline flow model. The No Action flow model advective particle tracking results (Figure K-9) indicated that groundwater originating near the sump monitoring well would travel to the south, southeast, and east.

#### K.2.4.2 Alternative 2: Monitored Natural Attenuation

The MNA alternative groundwater flow model was the same as the No Action model.

#### K.2.4.3 Alternative 3: Focused Extraction/MNA

The Focused Extraction Alternative groundwater flow model consisted of extracting groundwater from the sump monitoring well at a rate of 0.25 gpm. Advective particle tracking results indicated the extraction well effectively captured the high concentration VOC plume near SA-99-1. Particle tracking results are presented on **Figure K-10**.

#### K.2.4.4 Alternative 4: ISCO/MNA

Alternative 4 consisted of extracting groundwater from the sump monitoring well at a rate of 2 gpm and injecting a solution of hydrogen peroxide and water through four injection wells at a rate if 0.5 gpm each. Figure K-11 presents the extraction well location and model-predicted capture zones created the modeled flow rates. The extraction and injection wells were placed in model Layer 1 with 10-foot well screens. Advective particle tracking results for the ISCO alternative indicated effective capture of the VOC plume around the sump monitoring well.

#### K.2.4.5 Alternative 5: Enhanced Degradation/MNA

The flow model for Alternative 5 was identical to Alternative 4. Figure K-12 presents the extraction well location and model-predicted capture zones created by the modeled flow rates. Advective particle tracking results for the Enhanced Degradation Alternative indicated effective capture of the VOC plume around the sump monitoring well.

#### K.2.4.6 Groundwater Flow Modeling Remedial Alternative Evaluation Conclusions

The groundwater flow modeling evaluation results for the five alternatives indicated:

- Advective particle tracking results for the No Action and MNA Alternatives indicated that water particles originating from the sump monitoring well area would be transported to the south, southeast, and east.
- Advective particle tracking results for the Focused Extraction Alternative indicated the extraction well effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for the ISCO and Enhanced Degradation Alternatives indicated the extraction and injection wells effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for all of the alternatives also indicated particles traveling in the FTP shallow groundwater plume area would not be transported into the bedrock groundwater.

The groundwater flow model accuracy was considered adequate to use in the subsequent contaminant fate and transport modeling evaluation (presented in **Section K.3**).

#### K.3 CONTAMINANT FATE AND TRANSPORT MODELING

The objectives of the contaminant fate and transport modeling effort were to:

Simulate baseline contaminant transport for the FTP VOC plumes (using Spring 2003 concentrations).

- Assess whether VOC concentrations currently detected above the IAAAP regulatory standards will be transported further downgradient at the FTP to other potential receptors.
- Assess the ability of the soil and groundwater system to naturally attenuate VOCs at the FTP.
- Evaluate remedial alternatives for the RAA.

### K.3.1 Contaminant Fate and Transport Modeling Approach, Methodology, and **Assumptions**

The approach, methods, and assumptions used to simulate groundwater contaminant fate and transport at the FTP are discussed in the following sections.

#### K.3.1.1 Contaminant Fate and Transport Modeling Approach and Methodology

Groundwater flow conditions at the site were simulated using MODFLOW. The MODFLOW modeling approach and methodology was discussed in Section K.2. Contaminant fate and transport of VOCs was simulated using MT3DMS (Zheng and Wang 1998), a three-dimensional, block-centered, finite-difference, numerical transport model. MT3DMS retrieves the hydraulic heads, flow terms, and source-sink terms from the MODFLOW groundwater flow model results and calculates chemical concentrations over time. The MT3DMS models were constructed using Visual MODFLOW (WHI 2003). Visual MODFLOW is a pre- and post-processor and does not affect results generated by running MT3DMS.

The same model dimensions, groundwater configurations, and flow parameters used in the groundwater flow model were used in the contaminant fate and transport model.

#### Chemicals Selected for MT3DMS Model

A contaminant fate and transport model was constructed to model benzene, chloroethane, trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), and vinyl chloride concentrations at the FTP. Benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride were selected as the main contaminants above IAAAP regulatory standards in groundwater at the FTP because they were reported at concentrations (110, 3700, 120, 2800, and 360 micrograms per liter [µg/L], respectively) significantly higher than the IAAAP regulatory standards (5, 4.6, 5, 7, and 2 µg/L, respectively) and are mobile in groundwater. It was not considered necessary to model other VOCs because the VOCs selected provided results representative of the various suites of contaminants present at FTP. Explosives were not modeled because they were reported at concentrations only slightly higher than the IAAAP regulatory standards, did not have significant areal distribution, and were not anticipated to be transported any significant distance at concentrations above the IAAAP regulatory standards.

#### K.3.1.2 Project Uses for the Contaminant Fate and Transport Model

The baseline groundwater flow model was used in conjunction with MT3DMS (Zheng and Wang 1998) to simulate baseline contaminant fate and transport. The remedial alternative flow

models were then used in conjunction with MT3DMS to predict the effectiveness of the remedial alternatives on contaminant fate and transport. Some of the final flow model design parameters (e.g., placement of wells, etc.) were based upon the contaminant fate and transport modeling results.

#### K.3.1.3 Contaminant Fate and Transport Modeling Assumptions

MT3DMS uses chemical and site-specific characteristic input values to calculate contaminant dispersion and degradation (i.e., fate) and MODFLOW output to calculate advection (i.e., transport). MT3DMS accounts for the effects of adsorption/desorption, dispersion, and natural degradation (biotic and abiotic) or other chemical reactions that can be simulated with a firstorder decay rate term for the removal of a chemical from the modeled system. MT3DMS cannot simulate more complicated chemical reaction systems, such as precipitation/re-solution based on changing local conditions, the rate of exhaustion of bio-nutrients based on variable uptake by indigenous microorganisms, or the transformation of a chemical into a degradation by-product.

In addition to the general MT3DMS modeling assumptions listed in Attachment K-3, key assumptions for this modeling effort included the following:

- The steady-state MODFLOW model assumptions, setup, and results were appropriate for the contaminant fate and transport model.
- Dissolved VOC concentrations measured from the Spring 2003 sampling event (Table 5-2) were used to interpret the isoconcentration maps (Figures 7-1a, 7-1b, 7-2a, 7-2b, 11-2, and 11-3). These isoconcentrations were used to input initial concentration values (Attachment K-4). Adsorption was also considered to be at equilibrium at the time of the Spring 2003 sampling event.
- VOCs are subject to adsorption, dispersion, and degradation (approximated with a first-order decay rate, **Attachment K-4**) as it is transported through the saturated zones of the aquifer.

## K.3.2 Contaminant Fate and Transport Model Setup and Input Parameters

The FTP contaminant fate and transport model was constructed using the same overall model setup as the MODFLOW groundwater flow model. The fate and transport model setup included use of the baseline flow model finite-difference grid, hydrostratigraphic layers (i.e., model Layers 1 through 7), and groundwater flow boundary conditions, with the added input of chemical-specific parameters. The groundwater flow components were previously described in **Section K.2**. The chemical-specific input parameters are documented in this section.

#### K.3.2.1 Initial Target Compound Concentrations

Chemical data from the Spring 2003 sampling event were the basis for the interpreted initial VOC isoconcentration maps and the subsequent conservative initial concentration values input to the baseline contaminant fate and transport model. Initial concentration values were extrapolated from the isoconcentration maps.

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Current VOC concentration data were discretized and input into the model at values ranging from 2 µg/L to 2,800 µg/L. These values were used for initial concentration input. contaminant data were discretized into fields of VOC concentrations to match Spring 2003 conditions. VOC values were input in model Layer 1 for the FTP shallow groundwater plume. A conservative approach (i.e., likely overestimating VOC mass) was used when discretizing VOC input into the model.

Initial concentration plots were constructed from MT3DMS results at a time period of 1-day. These initial concentration plots (i.e., initial concentration input) are included in Attachment K-4. Considering the modeling objectives (e.g., long-term simulations), these plots were considered appropriate and conservative representations of the nature and extent of contamination in Spring 2003.

#### Contaminant Fate and Transport Model Input Parameters K.3.2.2

MT3DMS requires the definition of a number of site-specific and chemical-specific input parameters for each contaminant model (e.g., benzene, chloroethane, TCE, 1,1-DCE, and VC) and to make some simplifying assumptions based on existing site information. Contaminant fate and transport model input parameter values are summarized in Table K-5. The model input parameter values were based on the hydrogeologic characteristics of the model layers, site chemical analyses, and estimates of chemical characteristics from recent literature values.

The input parameters for the FTP contaminant fate and transport model were established as follows:

Source Concentrations: Current benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride concentration data were discretized and input in the model in values ranging from 2 µg/L to 2,800 µg/L to match Spring 2003 FTP contaminant concentration data (Figures 7-1a and 7-1b).

Source Mass Decay: The Spring 2003 concentrations in groundwater of benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride were input as initial concentrations (i.e., a one-time, nonconstant source).

MT3DMS used the steady-state, time independent, flow field generated by MODFLOW to simulate contaminant fate and transport over time. The fate and transport model was simulated for a time period of 70 years. This was considered to be a sufficient amount of time to predict contaminant transport results to support a 70-year risk evaluation period (maximum lifetime exposure) and for the contaminant plume to reach equilibrium.

Bulk Density (pb). The bulk density of the EDA soils was based on geotechnical analysis completed during the FTP, EBP, and WBPA FS data collections. Bulk density values ranged from 1.6 to 1.9 grams per cubic centimeter (g/cc). An average bulk density value of 1.8 g/cc was input for unconsolidated sediments in the model. Site-specific bulk density values for the upper bedrock and bedrock were not available. Bulk density values of 2.1 g/cc and 2.2 g/cc were assigned to the model for the upper bedrock and bedrock, respectively.

<u>Dispersivity</u> ( $D_l$ ,  $D_t$ ,  $D_v$ ). Chemical dispersivity input values were assumed based on varying distances chemicals have been transported from the assumed source areas at FTP. Longitudinal dispersivity  $(D_l)$  values were assumed to be 10 percent of the downgradient transport distance. Longitudinal dispersivities were conservatively estimated at approximately 10 to 80 feet, and vertical dispersivities  $(D_v)$  and transverse dispersivities  $(D_t)$  were estimated as a fraction of the longitudinal values. Longitudinal dispersivity values are typically reported to be much larger than transverse values, which are much larger than vertical values (Gelhar 1992; Anderson 1979). The ratios of longitudinal-to-transverse-to-vertical dispersivity (e.g.,  $D_l$ ,  $D_t$ ,  $D_v$ ) were input at 100:20:1. These ratios were established during model calibration based on the geometry of the existing plumes.

Degradation Half-life  $(t_{1/2})$ . Reported benzene, chloroethane, TCE, 1,1-DCE, and vinvl chloride degradation (abiotic and biotic) half-life literature values ranged from 0.15 to 7.88 years. Sitespecific half-lives were calculated from historical data in the FTP shallow groundwater for benzene, chloroethane, PCE, TCE, 1,1-DCE, and vinyl chloride. Half-life calculations are included in Attachment K-4. Site-specific half-life calculations for other chemicals were not completed due to a lack of a historical decline in concentrations. The half-life values selected the modeling of benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride were 2.1, 8.9, 3.9, 2.1, and 8.7 years, respectively.

Half-life values were input to the model as first-order decay constants (k) using  $k = \ln(2)/t_{1/2}$ . The values selected were considered to be representative of natural decay processes occurring at the site, based on the site-specific half-life and literature values.

The MT3DMS code also requires an adsorbed-phase half-life value to simulate degradation of the contaminant in the adsorbed phase. It has been reported that certain biological reactions only occur in the dissolved phase (Zheng and Wang 1988), therefore, sorbed-phase half-life values are typically longer than dissolved-phase half-lives. The sorbed-phase half-life for all contaminants was assumed at a conservative value of 100 years.

<u>Organic Carbon/Water Partition Coefficient ( $K_{oc}$ ).</u> The  $K_{oc}$  values used in the model for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride are based on reported literature values (USEPA 1989) (**Table 8-1**). The following  $K_{oc}$  values were used in the model:

Benzene: 165.5 milliliters per gram (mL/g)

Chloroethane: 23.7 mL/g

TCE: 67.7 mL/g

1,1-DCE: 35 mL/g

Vinyl Chloride: 23.7 mL/g

Model calibration indicated that these values yielded results that were considered reasonable.

Total Organic Carbon (TOC). The TOC content of the EDA soils was based on laboratory analysis of soils collected during the FTP, EBP, and WBPA FS data collections and are shown on

**Table 4-1**. TOC values for the EDA shallow glacial till ranged from 0.05 percent to 1.6 percent with an average value of 0.1 percent. The average TOC value of 0.1 percent was assigned to the model in the shallow, intermediate, and deep tills. Site-specific TOC values for the upper bedrock and bedrock were not available. TOC values 0.05 percent and 0.03 percent were assigned to the model for the upper bedrock and bedrock, respectively.

Sorption Distribution Coefficient ( $K_d$ ). Soil/water partition coefficients ( $K_d$ ) were estimated for each chemical from the product of the  $K_{oc}$  and TOC values listed above. The following  $K_d$ values were used in the model:

Benzene: 0.05 mL/g to 0.17 mL/g

Chloroethane: 0.007 mL/g to 0.023 mL/g

TCE: 0.02 mL/g to 0.07 mL/g

1,1-DCE: 0.011 mL/g to 0.035 mL/g

Vinyl Chloride: 0.007 mL/g to 0.023 mL/g

Retardation Factor (R). The model uses the bulk density, the sorption coefficient, and effective aquifer porosity to calculate a retardation factor using the following equation:

$$R = 1 + \frac{K_d \cdot \rho b}{\eta_e}$$

Where,

 $\rho b$  = Bulk density

 $K_d = \text{Soil/water partition coefficient}$ 

 $\eta_e = Porosity$ 

Using the above values, retardation factors were calculated by the model for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride. The values for each chemical ranged from:

Benzene: 1.55 to 1.88

Chloroethane: 1.08 to 1.13

TCE: 1.22 to 1.36

1,1-DCE: 1.12 to 1.19

Vinyl Chloride: 1.08 to 1.13

# K.3.3 Baseline Contaminant Fate and Transport Model Calibration, Sensitivity, and Limitations

The contaminant fate and transport model was calibrated to accurately simulate the extent of the Spring 2003 benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plumes and predict future

behavior of the plumes. This calibration effort included qualitative model calibration, parameter sensitivity analysis, and understanding the limitations of the model predictions.

#### Contaminant Fate and Transport Model Calibration K.3.3.1

Contaminant fate and transport model setup and calibration were completed to reproduce the Spring 2003 benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride concentrations at the site as closely as possible. An iterative calibration process was used to refine MT3DMS input based on model-predicted results. Historical source release information (e.g., mass release and dates of multiple releases) cannot be accurately estimated because of the nature of the multiple source releases over time. Therefore, calibration of the contaminant fate and transport model relied on Spring 2003 groundwater analytical data, and the method of inputting sources at an assumed mass and time of release was not implemented. The model input assumed that the subsurface was at equilibrium adsorption. The calibration procedures completed included:

- Discretizing Spring 2003 VOC concentrations into model Layer 1 for the FTP shallow groundwater plume.
- Inputting dispersivity values based on distance the contaminant has traveled from the assumed origination area.
  - Longitudinal Dispersivity  $(D_l) = 1/10$  downgradient transport distance
  - Transverse Dispersivity  $(D_t) = 1/5$  longitudinal dispersivity
  - Vertical Dispersivity ( $D_{\nu}$ ) was estimated at 1/100 of the longitudinal dispersivity.
  - Ratio of longitudinal to transverse to vertical dispersivity (e.g.,  $D_l:D_t:D_v$ ) was determined from the geometry of historic and Spring 2003 VOC plumes.

These parameters were systematically varied until the model-predicted behavior of the VOC plumes most accurately simulated the existing plumes.

#### K.3.3.2 Contaminant Fate and Transport Model Sensitivity

Sensitivity of the contaminant fate and transport model was evaluated qualitatively to describe possible variability in the subsequent model-predicted results. Contaminant fate and transport modeling results were sensitive to both contaminant-specific and groundwater flow input parameters. Section K.2.3.2 summarized the groundwater flow model sensitivity to groundwater flow input parameters. It was assumed that if the flow model was sensitive to a parameter, the contaminant fate and transport model was also sensitive to the same parameter since the advective transport portion of the contaminant fate and transport model is determined by the output from the groundwater flow model.

Additionally, the contaminant fate and transport modeling results were sensitive to most contaminant fate and transport model input parameters. These parameters included: initial concentrations, degradation half-life, retardation factor, and dispersivity. Fluctuating these

parameters within reasonable estimated ranges created noticeable differences in model-predicted results.

The degree of contaminant fate and transport model sensitivity to contaminant specific input parameters was variable. Qualitative sensitivity analysis results are summarized in the following table.

Input Parameter	Sensitivity	Summary
Initial Concentration	High	
Degradation Half-life	High	û Decay rate - ⇩ Future Transport
Retardation Factor	Moderate	
Dispersivity	Low	□ Dispersivity - □ Transport distance

Summary of Contaminant Fate and Transport Model Sensitivity

#### K.3.3.3 Contaminant Fate and Transport Model Limitations

Limitations of the contaminant fate and transport model were directly related to the model assumptions listed in Section K.3.1.3 and Attachment K-3. These limitations included a single concentration value within each cell, equilibrium-controlled adsorption/desorption, and irreversible linear decay rates. The most significant limitations for the FTP fate and transport model included:

- The dissolved VOC decay rates used for model input were calculated from historical sitespecific analytical data and not model-calculated over time as the natural attenuation capacity of the aquifer (e.g., assimilative capacity) may change.
- The dissolved VOC decay rates calculated from chemicals within the sump monitoring well SA-99-1 appeared to be significantly impacted by anaerobic conditions in the sump monitoring well.
- Target VOC plume calibration was limited to the Spring 2003 interpreted plume concentrations and extent.

These limitations were compensated for by using very conservative initial VOC concentration inputs (i.e., likely overestimating initial mass).

#### K.3.3.4 Baseline Contaminant Fate and Transport Modeling Results Summary

After model calibration and sensitivity analysis indicated the model reasonably predicted contaminant fate and transport, the model was used to predict baseline contaminant fate and transport conditions for the Spring 2003 VOC plumes. This evaluation included estimating future VOC concentrations at potential exposure points in groundwater over a 70-year human health risk evaluation period. Model-predicted VOC concentrations in general areas of interest over time are detailed in Table K-6. Figure K-13 presents the baseline VOC fate and transport modeling results over time at the FTP. The figures present model-predicted VOC concentrations

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in model Layer 1 (shallow groundwater) for Spring 2003 conditions, 10 years, 20 years, and 50 years in the future. Layer 1 results were presented because they correspond to the hydrostratigraphic layer in which the FTP shallow groundwater monitoring wells are screened. The model-predicted change in contaminant mass over time is presented in **Table K-7**. Full graphical documentation of the contaminant fate and transport results is presented in Attachment K-5.

The FTP baseline contaminant fate and transport modeling results are shown on Figure K-13 and **Table K-6**. Key results are summarized as follows:

- The baseline contaminant fate and transport modeling results indicated that the benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plume concentrations are at their highest predicted concentrations. Most of the VOC plume concentrations will decline below the IAAAP regulatory standards in about 15 to 25 years due to the naturally occurring processes of dispersion and degradation. The benzene plume will decline below the IAAAP regulatory standard (5 µg/L) in about 15 to 20 years, while TCE and 1,1-DCE will take about 20 to 25 years to decline below the standard (7 µg/L). vinyl chloride will take about 50 to 55 years to decline below the regulatory standard (2 µg/L). Chloroethane will be reduced to below the IAAAP regulatory standard (4.6 µg/L) in greater than 70 years.
- The modeling results indicated that the VOC plumes in the high concentration areas would not be transported downgradient any significant distance away from the sources (i.e., the sump monitoring well area).
- The modeling results indicated that the low concentrations of 1,1-DCE and vinyl chloride at the distal edges of the FTP VOC plume will attenuate to below IAAAP regulatory standards in less than 20 years.

# K.3.4 Contaminant Fate and Transport Modeling Remedial Alternatives Evaluation

After model calibration and sensitivity analysis indicated the model reasonably predicted contaminant fate and transport, the baseline model was used to help evaluate the effectiveness of the groundwater remediation alternatives previously analyzed using the groundwater flow model. Five different groundwater remediation alternative scenarios were evaluated with MT3DMS (Zheng and Wang 1998). The five alternatives included:

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation
- Alternative 3: Focused Extraction/MNA
- Alternative 4: ISCO/MNA
- Alternative 5: Enhanced Degradation/MNA

The objective of the fate and transport modeling remedial alternative evaluations was to estimate general time frames required to reduce groundwater concentrations of VOCs below their sitespecific, risk-based PRGs (see Section 9 and Table 9-7). For comparative purposes, model-

predicted results for VOCs are presented on Figures K-14 through K-17. Changes in mass over time for each of the five VOCs modeled for each alternative are presented in Table K-7, and times required for reduction of VOCs to below various concentrations are presented on Table K-8.

The contaminant fate and transport evaluations used the baseline steady-state groundwater flow model (calibrated to Spring 2003 conditions) for Alternatives 1 and 2. The Focused Extraction flow model (discussed in Section K.2.4.3) was used for the contaminant fate and transport evaluation of Alternative 3. The ISCO flow model was used for Alternatives 4 and 5.

#### K.3.4.1 Alternative 1: No Action

The No Action contaminant fate and transport model was constructed using the VOC concentrations and extents interpreted from the Spring 2003 groundwater sampling results. Modeling results indicated VOC concentrations less than the site-specific, risk based PRGs for the five chemicals modeled can be achieved in 50 to 55 years due to natural attenuation processes (Figure K-14). Modeling results for the individual chemicals are presented on Table K-8.

The modeling results indicated about 53 percent of the total VOC mass would be removed in the first five years. At 10 years, 73 percent of the total VOC mass would be removed (**Table K-7**).

#### K.3.4.2 Alternative 2: Monitored Natural Attenuation

The contaminant fate and transport model and results for Alternative 2 was the same as Alternative 1.

#### K.3.4.3 Alternative 3: Focused Extraction/MNA

The focused extraction alternative was evaluated to simulate the extraction of groundwater through SA-99-1 at a flow rate of 0.25 gpm.

Modeling results indicated VOC concentrations less than the site-specific, risk based PRG of the five chemicals modeled can be achieved in 15 to 20 years due to extraction through SA-99-1 and MNA (Figure K-15). Modeling results for the individual chemicals are presented on Table K-8.

The modeling results indicated about 90 percent of the total VOC mass would be removed in the first five years. At 10 years, 97 percent of the total VOC mass would be removed (**Table K-7**).

#### K.3.4.4 Alternative 4: ISCO/MNA

The ISCO alternative was evaluated to simulate the performance of four vertical injection wells and one vertical extraction well located inside the excavated sump area (near SA-99-1).

Modeling results indicated that VOC concentrations less than the site-specific, risk-based PRGs of the five chemicals modeled can be achieved in 15 to 20 years due to ISCO, sump extraction,

and MNA (Figure K-15). Modeling results for the individual chemicals are presented on Table K-8.

The modeling results indicated about 85 percent of the total VOC mass would be removed in the first five years. At 10 years, 95 percent of the total VOC mass would be removed (**Table K-7**).

#### K.3.4.5 Alternative 5: Enhanced Degradation/MNA

The enhanced degradation alternative was evaluated to simulate the injection of a substrate to stimulate the degradation (e.g., biotic or abiotic) of VOC. This was simulated in the contaminant fate and transport model by doubling the VOC degradation rates (e.g., decreasing the dissolvedphase half-life by half) in the treated area.

Modeling results indicated VOC concentrations less than the site-specific, risk based PRG of the five chemicals modeled can be achieved in 15 to 20 years due to enhanced degradation, ISCO, sump extraction, and MNA (Figure K-15). Modeling results for the individual chemicals are presented on Table K-8.

The modeling results indicated about 91 percent of the VOC mass would be removed in the first five years. At 10 years, 97 percent of the VOC mass would be removed (**Table K-7**).

#### K.3.4.6 Contaminant Fate and Transport Modeling Remedial Alternatives Evaluation **Conclusions**

The groundwater contaminant fate and transport modeling evaluation of the various remedial alternatives is summarized below:

- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 50 to 55 years for the No Action and MNA remedial alternatives.
- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 15 to 20 years for the Focused Extraction, ISCO, and Enhanced Degradation remedial alternatives.

#### **K.4 SUMMARY**

Setup and calibration of the FTP groundwater model consisted of incorporating as much of the field investigation data as possible. The initial parameter estimation included all values that were measured or calculated (e.g., hydraulic conductivity, hydraulic gradient, TOC, source chemicals, and initial discretized plume concentrations). These parameters, and others, were estimated to create a conservative model. This model was then used to give a conservative prediction of future contaminant transport.

The groundwater flow modeling and the contaminant fate and transport modeling results are summarized below.

# K.4.1 Groundwater Flow Modeling Summary

The groundwater flow model results indicated:

- The overall baseline groundwater flow model calibration was statistically excellent, with model-predicted heads calibrated to within 2.19 percent normalized root mean squared error and 1.64 percent absolute residual mean error.
- The mass balance of the model had a 0.01 percent discrepancy.
- The calibrated baseline groundwater flow model predicted flow directions and hydraulic gradients similar to the flow directions interpreted from the Spring 2003 potentiometric surface maps.
- Advective particle tracking results for the No Action and MNA Alternatives indicated that water particles originating from the sump monitoring well area would be transported to the south, southeast, and east.
- Advective particle tracking results for the Focused Extraction Alternative indicated the extraction well effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for the ISCO and Enhanced Degradation Alternatives indicated the extraction and injection wells effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for all of the alternatives also indicated particles traveling in the FTP shallow groundwater plume area would not be transported into the bedrock groundwater.

# K.4.2 Contaminant Fate and Transport Modeling Summary

The groundwater contaminant fate and transport baseline modeling and evaluation of the various remedial alternatives are summarized below:

- The baseline contaminant fate and transport modeling results indicated that the benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plume concentrations are at their highest predicted concentrations. Most of the VOC plume concentrations will decline below the IAAAP regulatory standards in about 15 to 25 years due to the naturally occurring processes of dispersion and degradation. The benzene plume will decline below the IAAAP regulatory standard (5 µg/L) in about 15 to 20 years, while TCE and 1,1-DCE will take about 20 to 25 years to decline below the standard (7 µg/L). Vinyl chloride will take about 50 to 55 years to decline below the regulatory standard (2 µg/L). Chloroethane will be reduced to below the IAAAP regulatory standard (4.6 µg/L) in greater than 70 years.
- The modeling results indicated that the VOC plumes in the high concentration areas would not be transported downgradient any significant distance away from the sources (i.e., the sump monitoring well area).

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- The modeling results indicated that the low concentrations at the distal edges of the FTP VOC plume will attenuate to below IAAAP regulatory standards in less than 20 years.
- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 50 to 55 years for the No Action and MNA remedial alternatives.
- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 15 to 20 years for the Focused Extraction, ISCO, and Enhanced Degradation remedial alternatives.

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TABLE K-1
GROUNDWATER FLOW MODEL INPUT PARAMETERS
FIRE TRAINING PIT GROUNDWATER MODELING

Model Layer	Geologic Profile	Base of Unit (ft msl)	Layer Thickness (ft)	Horizontal Hydraulic Conductivity $K_x$ , $K_y$ (ft/day) <sup>1</sup>	Vertical Hydraulic Conductivity $K_z$ (ft/day)	K <sub>x</sub> ,K <sub>y</sub> :K <sub>z</sub> Ratio	Effective Porosity (%)	Recharge (in/yr)
Layer 1	Shallow Till/Fill	615-655	5-65	0.02-2	0.002-0.2	10:1	0.32	$0 \text{ to } 0.7^2$
	Spring Creek Alluvium	013-033	5-05	0.4	0.04	10:1	0.32	0
Layer 2	Upper Bedrock			0.001-0.15	0.0001-0.015	10:1	0.22	NA
	Spring Creek Upper Bedrock	605-645	10	0.2	0.02	10:1	0.22	NA
	Intermediate Till			0.01	0.001	10:1	0.32	NA
Layer 3	Bedrock	595-635	10	$1 \times 10^{-6} - 0.001$	$1 \times 10^{-7} - 0.0001$	10:1	0.20	NA
	Deep Till	373 033	10	$1 \times 10^{-5}$	$1x10^{-6}$	10:1	0.32	NA
Layer 4	Bedrock	575-615	20	0.001-0.002	0.0001-0.0002	10:1	0.20	NA
	Deep Till	373-013	20	0.001	0.0001	10:1	0.32	NA
Layer 5	Bedrock	555-595	20	0.0001-0.0005	0.00001-0.00005	10:1	0.20	NA
	Deep Till	333-373	20	0.001	0.0001	10:1	0.32	NA
Layer 6	Bedrock	535-575	20	0.0005	0.00005	10:1	0.20	NA
	Deep Till	333-313	20	0.006	0.0006	10:1	0.32	NA
Layer 7	Bedrock	515-555	20	0.0005	0.00005	10:1	0.20	NA

% = Percent

ft = Foot or Feet

in = Inch(es)

 $K_x$  = hydraulic conductivity in the x direction

 $K_y$  = hydraulic conductivity in the y direction

 $K_z$  = hydraulic conductivity in the z direction

msl = Mean Sea Level

yr = Year

<sup>&</sup>lt;sup>1</sup> Hydraulic conductivity values for Layers 1, 2, and 4 were based on calculated values from field measurements and model calibration. Field measurements were not available for Layers 3, 5, 6, and 7; therefore, hydraulic conductivity values were based on literature values, other values at IAAAP, and model calibration.

<sup>&</sup>lt;sup>2</sup> Recharge values ranged from 0 to 0.7 inches per year in most areas of the model. Localized groundwater mounds were simulated with 1 to 20 inches per year based on model calibration.

# TABLE K-2 COMPARISON OF MEASURED GROUNDWATER ELEVATIONS AND MODEL-PREDICTED GROUNDWATER ELEVATIONS FIRE TRAINING PIT GROUNDWATER MODELING

Model Location Groundwater Model-Predicted						
Observation Well Name	Layer	Row	Column	Groundwater Elevation May 2003 (ft msl)	Baseline Groundwater Elevation (ft msl)	Model-Predicted Head Difference (ft)
EBP-MW3	1	54	239	685.32	685.25	-0.07
EDA-01	1	20	256	688.57	688.51	-0.06
EDA-02(B)	1	98	212	656.39	656.48	0.09
EDA-04	1	40	309	678.87	678.01	-0.86
FTA-99-1	1	198	72	659.93	660.45	0.52
FTP-MW1	1	212	69	654.42	655.09	0.67
FTP-MW2	1	200	91	652.40	652.00	-0.40
FTP-MW5	1	163	86	663.36	663.44	0.08
FTP-MW7	1	216	19	669.36	669.86	0.50
G-29	1	93	275	679.94	680.67	0.73
			192			-0.98
JAW-04(B)	1	113		648.91	647.93	
JAW-05	1	80	297	682.42	681.15	-1.27
JAW-06	1	37	319	672.34	672.13	-0.21
JAW-07	1	62	316	679.69	678.86	-0.83
JAW-23	1	100	87	649.10	648.54	-0.56
JAW-24	1	106	136	636.60	635.84	-0.76
JAW-25	1	130	76	684.15	682.97	-1.18
JAW-58	1	164	55	683.16	681.72	-1.44
JAW-59	1	185	39	673.78	673.65	-0.13
JAW-60	1	176	58	671.44	673.68	2.24
JAW-61	1	180	30	679.61	677.46	-2.15
JAW-62	1	170	28	681.66	682.33	0.67
JAW-63	1	156	32	684.27	683.47	-0.80
JAW-64	1	13	294	680.48	680.24	-0.24
JAW-68	1	140	95	675.57	675.70	0.13
JAW-80	1	205	46	668.27	666.56	-1.71
M-01	1	236	53	661.16	660.77	-0.39
SA-99-1(SUMP)	1	166	40	683.45	683.82	0.37
WBP-99-1	1	135	59	666.34	667.24	0.90
WBP-99-2	1	109	56	658.70	657.96	-0.74
WBP-99-3(B)	1	138	143	644.89	643.61	-1.28
EBP-MW4(B)	2	82	183	645.04	646.45	1.41
EBP-MW5(B)	2	148	189	636.73	637.00	0.27
FTP-MW3(B)	2	179	108	642.25	644.69	2.44
G-30(B)	2	162	114	644.43	645.04	0.61
JAW-614(B)	2	121	236	654.96	653.96	-1.00
WBP-99-4(B)	2	97	58	655.48	656.03	0.55
WBP-99-5(B)	2	100	110	640.49	642.83	2.34
EBP-MW1(B)	4	171	242	636.39	636.98	0.59
EBP-MW6(B)	4	147	188	640.96	639.42	-1.54
FTA-99-2(B)	4	198	71	650.09	650.44	0.35
FTP-MW4(B)	4	186	40	665.73	665.67	-0.06
FTP-MW4(B)	4	163	87	647.47	647.15	-0.32
FTP-MW8(B)		216	20	666.67	666.23	-0.32 -0.44
, ,	4					
WBP-99-6(B)	4	100	87	639.24	641.70	2.46

# TABLE K-2 COMPARISON OF MEASURED GROUNDWATER ELEVATIONS AND MODEL-PREDICTED GROUNDWATER ELEVATIONS FIRE TRAINING PIT GROUNDWATER MODELING

	N	Iodel Loca	tion	Groundwater	Model-Predicted	Model-Predicted	
Observation Well Name	Layer	Row	Column	Elevation May 2003 (ft msl)	Baseline Groundwater Elevation (ft msl)	Head Difference (ft)	
WBP-99-7(B)	4	141	142	641.58	641.46	-0.12	
WBP-MW1(B)	4	100	111	640.32	640.86	0.54	
WBP-MW2(B)	4	105	137	643.80	640.40	-3.40	
EBP-MW2	6	110	300	637.95	638.45	0.50	
					Absolute Residual Mean	0.86	

Notes:

ft = Foot or Feetmsl = Mean Sea Level

TABLE K-3
SUMMARY OF BASELINE GROUNDWATER FLOW MODEL CALIBRATION STATISTICS
FIRE TRAINING PIT GROUNDWATER MODELING

Observation Location	Number of Calibration Data Points	Absolute Residual Mean (feet)	Root Mean Squared (RMS) (feet)	Total Head Change Within Flow Region (feet)	Absolute Residual Mean as a Percentage of Total Head Change (%)	Normalized RMS (%)
Layer 1	31	0.74	0.94	51.97	1.43%	1.80%
Layer 2	7	1.23	1.47	18.88	6.53%	7.81%
Layer 4	10	0.98	1.45	30.07	3.27%	4.83%
Layer 6	1	0.50	0.50	NA	NA	NA
Total Model	49	0.86	1.14	52.18	1.64%	2.19%

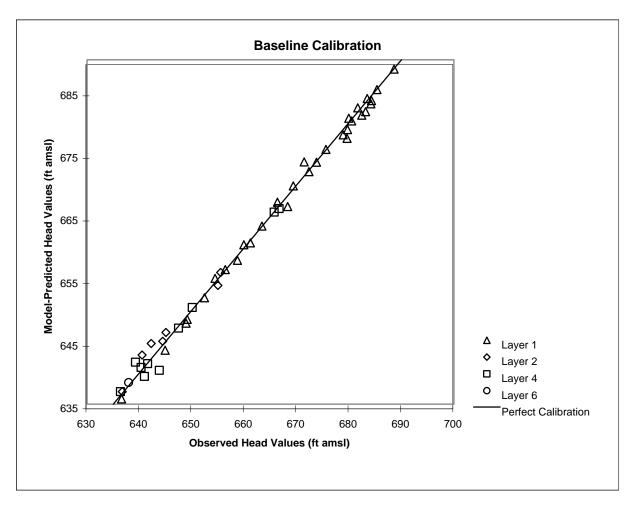


TABLE K-4
GROUNDWATER FLOW MODEL SENSITIVITY ANALYSIS
FIRE TRAINING PIT GROUNDWATER MODELING

	Hydraulic	
	Conductivity	Normalized RMS
Area of Interest	(ft/day) <sup>1</sup>	(All model layers)
Layer 1	(=0, 0.003)	(======================================
High Hydraulic Conductivity	1	2.28%
	2	2.19%
	4	2.27%
Low Hydraulic Conductivity	0.015	6.36%
	0.03	2.19%
	0.06	5.43%
Layer 4		
Hydraulic Conductivity	0.001	2.31%
	0.002	2.19%
	0.004	2.26%
	Recharge Value	Normalized RMS
Area of Interest	$(in/yr)^2$	(All model layers)
Area near JAW-25	10	2.3%
	20	2.19%
	40	2.26%
Area near the sump (SA-99-1)	2.5	3.43%
, , , , , , , , , , , , , , , , , , ,	5	2.19%
	10	4.39%
Area near EDA-01	2.5	2.62%
	5	2.19%
	10	3.16%

ft/day = Foot or Feet Per Day

in/yr = Inch(es) Per Year

RMS = Root Mean Squared

 $<sup>^{1}</sup>$  **Bold** indicates values used in final calibrated groundwater flow model.

<sup>&</sup>lt;sup>2</sup> See **Figure K-4** for aerial distribution of recharge zones.

TABLE K-5 CONTAMINANT FATE AND TRANSPORT MODEL INPUT PARAMETERS FIRE TRAINING PIT GROUNDWATER MODELING

Geologic Profile	Chemical	Sorbed Degradation Half-Life $(t_{1/2}$ - years) <sup>1</sup>	Dissolved Degradation Half-Life $(t_{1/2}  ext{ - years})^1$	Dissolved First Order Rate Constant $(k - 1/\text{day})^2$	Total Organic Carbon (TOC) (% by weight)	Sorption Coefficient $(K_d - mL/g)^3$	Bulk Density (g/cc)	Retardation Factor (R) <sup>4</sup>	Dispersivity $(D_I, \text{feet})^5$	Dispersivity Ratio (D <sub>1</sub> :D <sub>1</sub> :D <sub>1</sub> ) <sup>6</sup>
Shallow Till	Benzene	100	2.2	8.6E-04	0.10%	0.17	1.7	1.88	10-80	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.10%	0.02	1.7	1.13	10-80	100:20:1
	TCE	100	3.9	4.9E-04	0.10%	0.07	1.7	1.36	10-80	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.10%	0.04	1.7	1.19	10-80	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.10%	0.02	1.7	1.13	10-80	100:20:1
Intermediate Till	Benzene	100	2.2	8.6E-04	0.10%	0.17	1.7	1.88	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.10%	0.02	1.7	1.13	10	100:20:1
	TCE	100	4.5	4.2E-04	0.10%	0.07	1.7	1.36	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.10%	0.04	1.7	1.19	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.10%	0.02	1.7	1.13	10	100:20:1
Deep Till	Benzene	100	2.2	8.6E-04	0.10%	0.17	1.7	1.88	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.10%	0.02	1.7	1.13	10	100:20:1
	TCE	100	4.5	4.2E-04	0.10%	0.07	1.7	1.36	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.10%	0.04	1.7	1.19	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.10%	0.02	1.7	1.13	10	100:20:1
Upper Bedrock	Benzene	100	2.2	8.6E-04	0.05%	0.08	2.1	1.79	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.05%	0.01	2.1	1.11	10	100:20:1
	TCE	100	4.5	4.2E-04	0.05%	0.03	2.1	1.32	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.05%	0.02	2.1	1.17	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.05%	0.01	2.1	1.11	10	100:20:1
Bedrock	Benzene	100	2.2	8.6E-04	0.03%	0.05	2.2	1.55	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.03%	0.01	2.2	1.08	10	100:20:1
	TCE	100	4.5	4.2E-04	0.03%	0.02	2.2	1.22	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.03%	0.01	2.2	1.12	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.03%	0.01	2.2	1.08	10	100:20:1

% = Percent 
<sup>1</sup> Site-specific half-life values were calculated from historical data and can be found in **Appendix K**.

1,1-DCE = 1,1-Dichloroethene  $^{2}k = \ln(2)/t_{1/2}$ 

g/cc = Grams Per Cubic Centimeter  ${}^3K_d = K_{oc} * TOC$ ; See **Table 8-1** 

mL/g = Milliliters Per Gram  ${}^{4}R = 1 + (\rho b * K_{d})/\eta$ 

TCE = Trichloroethene  $^{5}$  Assumed  $D_{I}$  value based on 1/10 transport distance (Gelhar 1992, Anderson 1979)

 $<sup>^{6}</sup>D_{t}$  and  $D_{y}$  based on existing and calibrated model-predicted plume geometries.

TABLE K-6
BASELINE CONTAMINANT FATE AND TRANSPORT MODELING RESULTS
FIRE TRAINING PIT GROUNDWATER MODELING

			IAAAP Regulatory	Model-	Predicted Cor	ncentrations (i	n μg/L)
<b>Groundwater Plume</b>	Location	Chemical	Standard (in µg/L)	@0-years1	@10-years	@20-years	@70-years
FTP VOC Plumes	- groundwater near SA-99-1 (Sump Area)	Benzene	5	110	18	3	<1
		Chloroethane	4.6	3700	1470	582	<1
		TCE	5	3	1	<1	<1
		1,1-DCE	7	28	6	<1	<1
		Vinyl Chloride	2	360	135	43	<1
	- groundwater near JAW-60 and JAW-61	Benzene	5	11	5	1	<1
		Chloroethane	4.6	<3	8	27	7
		TCE	5	74/120	27	4	<1
		1,1-DCE	7	380/190	22	1	<1
		Vinyl Chloride	2	<3	3	7	<1
	- groundwater near JAW-58	1,1-DCE	7	81/2800	120	5	<1
	- groundwater near FTP-MW1	Vinyl Chloride	2	19	2	<2	<2

 $\mu g/L = Micrograms \ Per \ Liter$ 

1,1-DCE = 1,1-Dichloroethene

FTP = Fire Training Pit

TCE = Trichloroethene

VOC = Volatile Organic Compound

<sup>&</sup>lt;sup>1</sup> Concentration values at 0 years were based upon Spring 2003 groundwater monitoring results (URS 2003, HGL 2003b). This information can be found in **Table 5-2**.

TABLE K-7
MODEL-PREDICTED CHANGE IN TOTAL VOC MASS OVER TIME FOR REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER MODELING

Baseline and Alternatives 1 & 2
No Action/MNA

Remedial Alternative 3
Focused Extraction/MNA

Remedial Alternative 4 ISCO/MNA Remedial Alternative 5 Enhanced Degradation/MNA

No Action/MINA				
Time	Mass Re	emaining <sup>1</sup>		
Elapsed	lb	% of Initial		
(years)	10	Mass		
$0^2$	53.0	100.0%		
1	44.7	84.4%		
5	25.0	47.1%		
10	14.4	27.1%		
15	9.3	17.5%		
20	6.3	11.9%		
25	4.4	8.3%		
30	3.1	5.8%		
35	2.2	4.1%		
40	1.6	2.9%		
45	1.1	2.1%		
50	0.8	1.5%		
55	0.6	1.0%		
60	0.4	0.7%		
65	0.3	0.5%		
70	0.2	0.4%		

m·	Time 25 P 1 1					
Time	Mass Re	emaining <sup>1</sup>				
Elapsed	lb	% of Initial				
(years)	10	Mass				
$0^2$	53.0	100.0%				
1	17.3	32.6%				
5	5.6	10.5%				
10	1.6	3.0%				
15	0.5	1.0%				
20	0.2	0.4%				
25	0.1	0.2%				
30	0.0	0.1%				
35	0.0	0.0%				
40	0.0	0.0%				
45	0.0	0.0%				
50	0.0	0.0%				
55	0.0	0.0%				
60	0.0	0.0%				
65	0.0	0.0%				
70	0.0	0.0%				

Time	Mass Re	emaining <sup>1</sup>
Elapsed (years)	lb	% of Initial Mass
$0^2$	53.0	100.0%
1	24.4	46.1%
5	8.2	15.5%
10	2.6	4.9%
15	1.0	1.9%
20	0.5	0.9%
25	0.2	0.5%
30	0.2	0.3%
35	0.1	0.2%
40	0.1	0.1%
45	0.0	0.1%
50	0.0	0.1%
55	0.0	0.0%
60	0.0	0.0%
65	0.0	0.0%
70	0.0	0.0%

Time	Mass R	emaining <sup>1</sup>
Elapsed (years)	lb	% of Initial Mass
$0^2$	53.0	100.0%
1	21.4	40.4%
5	4.9	9.3%
10	1.3	2.5%
15	0.5	1.0%
20	0.2	0.4%
25	0.1	0.2%
30	0.1	0.1%
35	0.0	0.1%
40	0.0	0.1%
45	0.0	0.0%
50	0.0	0.0%
55	0.0	0.0%
60	0.0	0.0%
65	0.0	0.0%
70	0.0	0.0%

Notes:

% = Percent

1,1-DCE = 1,1-Dichloroethene

ISCO = In-Situ Chemical Oxidation

lb = Pound(s)

MNA = Monitored Natural Attenuation

Q:\1616\9421\Six Sites\FTP\Rev1\FTP\_RAA\_Tables1\_Rev1.xls [K-7]

TCE = Trichloroethene

<sup>&</sup>lt;sup>1</sup> Percent of initial mass was calculated using the model-predicted mass at the respective time period, divided by the mass in the initial (0 year) time period. The initial mass used was the total benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride mass in the model at 1 day.

<sup>&</sup>lt;sup>2</sup> Mass at 0 years was based on Spring 2003 groundwater monitoring results (URS 2003, HGL 2003b).

TABLE K-8
SUMMARY OF CONTAMINANT FATE AND TRANSPORT MODELING RESULTS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER MODELING

	Amount of time for plume concentration to be reduced below:				
Alternative	Benzene <6 µg/L	Chloroethane <110 µg/L	TCE <30 μg/L	1,1-DCE <920 μg/L	Vinyl Chloride <2 μg/L
Alternatives 1 and 2 - No Action and MNA	15-20	35-40	5-10	<5	50-55
Alternative 3 - Focused Extraction/MNA	10-15	5-10	5-10	<5	15-20
Alternative 4 - ISCO/MNA	10-15	5-10	5-10	<5	15-20
Alternative 5 - Enhanced Degradation/MNA	10-15	5-10	5-10	<5	15-20

< = Less than

 $\mu g/L = Micrograms per liter$ 

DCE = Dichloroethene

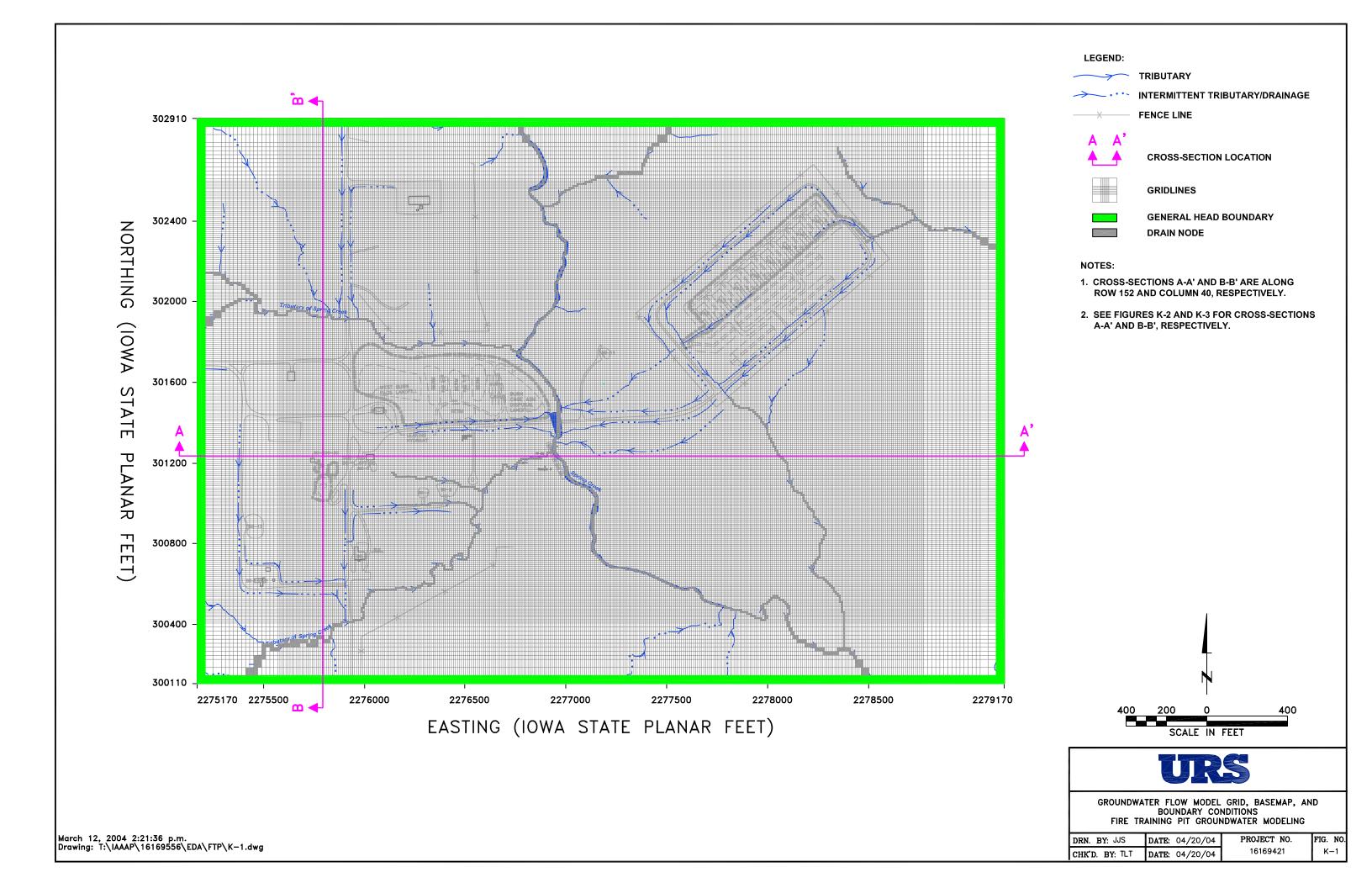
ISCO = In-Situ Chemical Oxidation

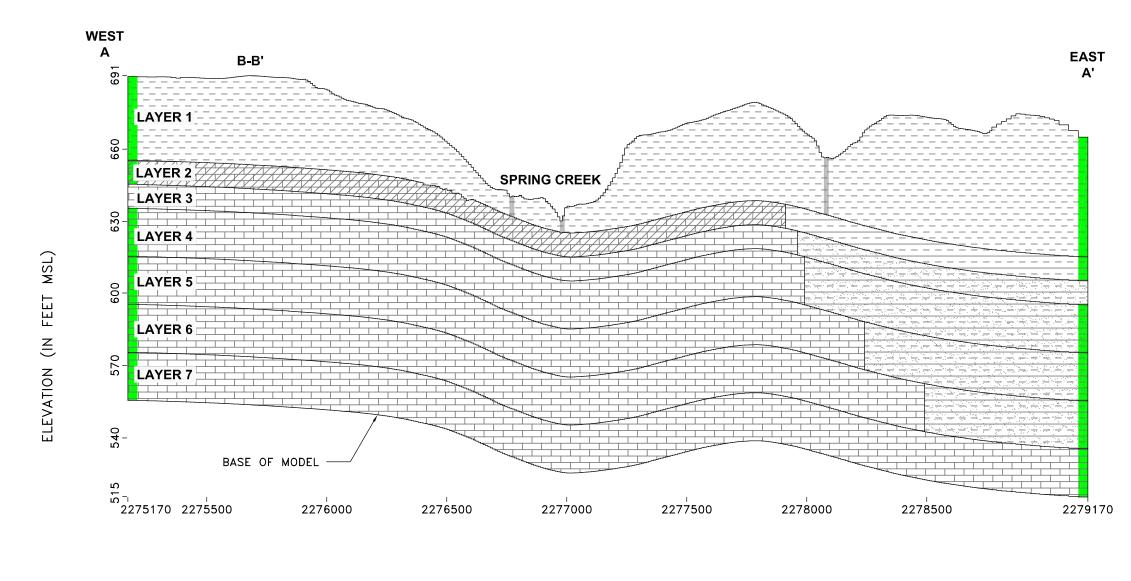
MNA = Monitored Natural Attenuation

TCE = Trichloroethene

VC = Vinyl Chloride

See Figures K-13 to K-17 for the model-predicted extent of chemicals in groundwater for each alternative.





# EASTING (IOWA STATE PLANAR FEET)

2. CROSS-SECTION A-A' IS ALONG ROW 152.

3. SEE FIGURE K-1 FOR CROSS-SECTION LOCATION.

# LAYER 1 - SHALLOW TILL, FILL, AND WEATHERED BEDROCK (CL-CH) LAYER 2 - INTERMEDIATE TILL (CL-CH) LAYER 2 - UPPER BEDROCK LAYERS 3, 4, 5, AND 6 - DEEP TILL (CL) LAYERS 3, 4, 5, 6, AND 7 - BEDROCK DRAIN NODE GENERAL HEAD BOUNDARY NOTES: 1. VERTICAL EXAGGERATION IS 10:1

VERTICAL SCALE IN FEET

400 200 0 400

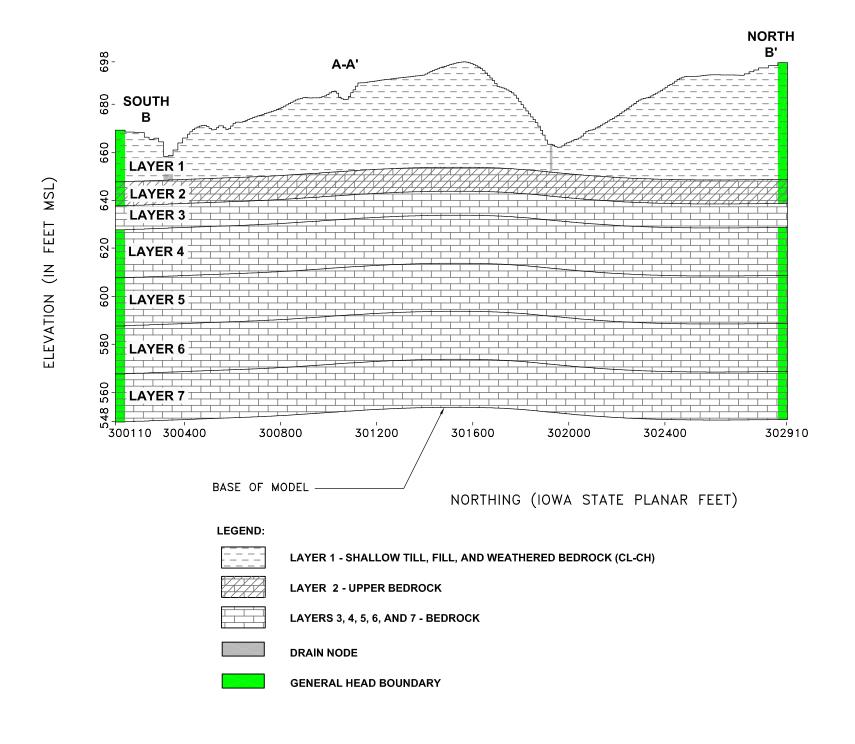
HORIZONTAL SCALE IN FEET



MODEL-GENERATED CROSS-SECTION A-A' FIRE TRAINING PIT GROUNDWATER MODELING

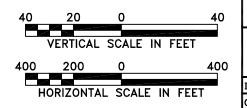
FIG. NO.

DRN. BY: DAC	DATE: 12/17/03	PROJECT NO.
CHK'D. BY: TLT	DATE: 05/05/04	16169421



#### NOTES:

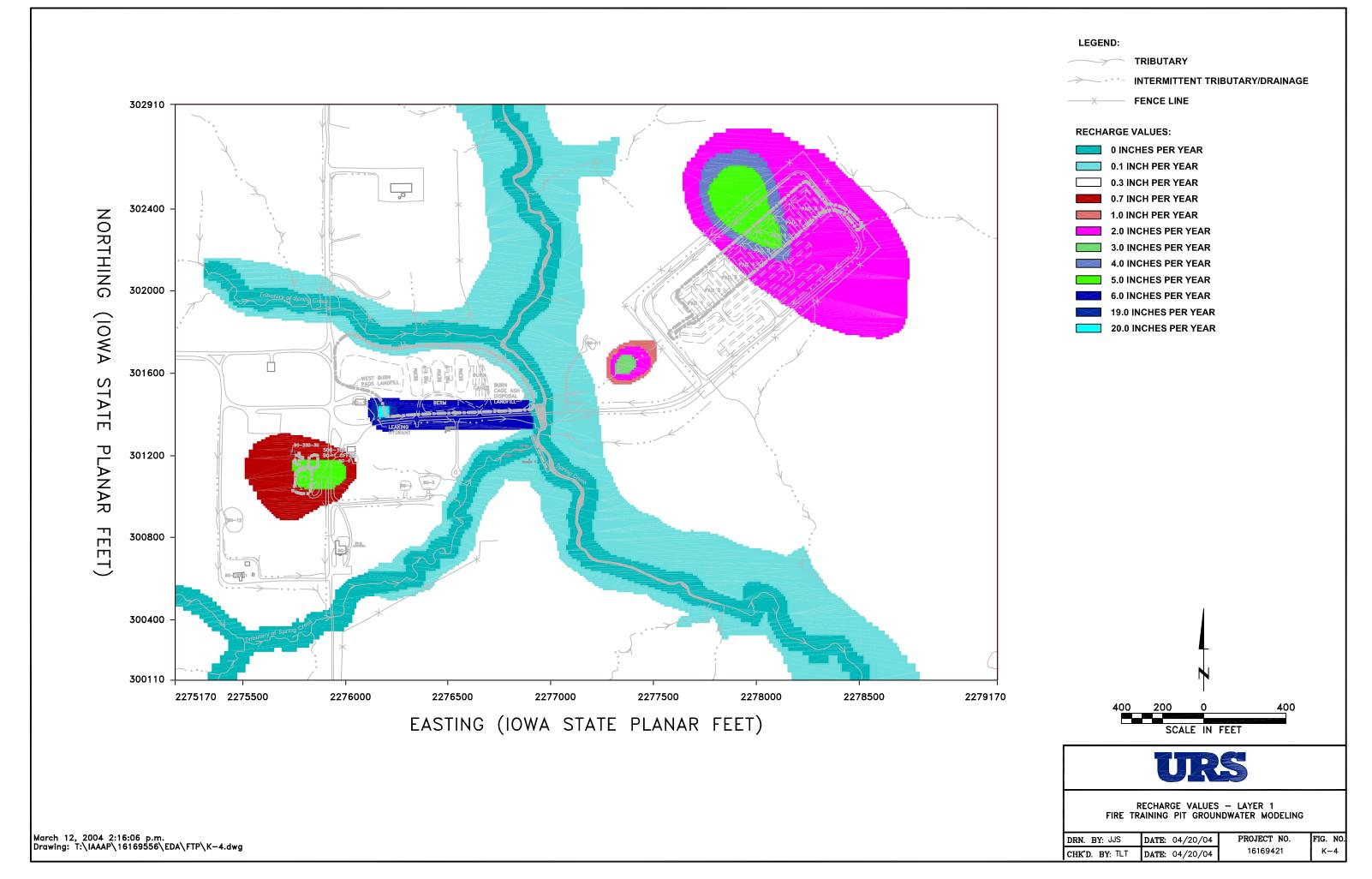
- 1. VERTICAL EXAGGERATION IS 10:1
- 2. CROSS-SECTION B-B' IS ALONG COLUMN 40.
- 3. SEE FIGURE K-1 FOR CROSS-SECTION LOCATION.

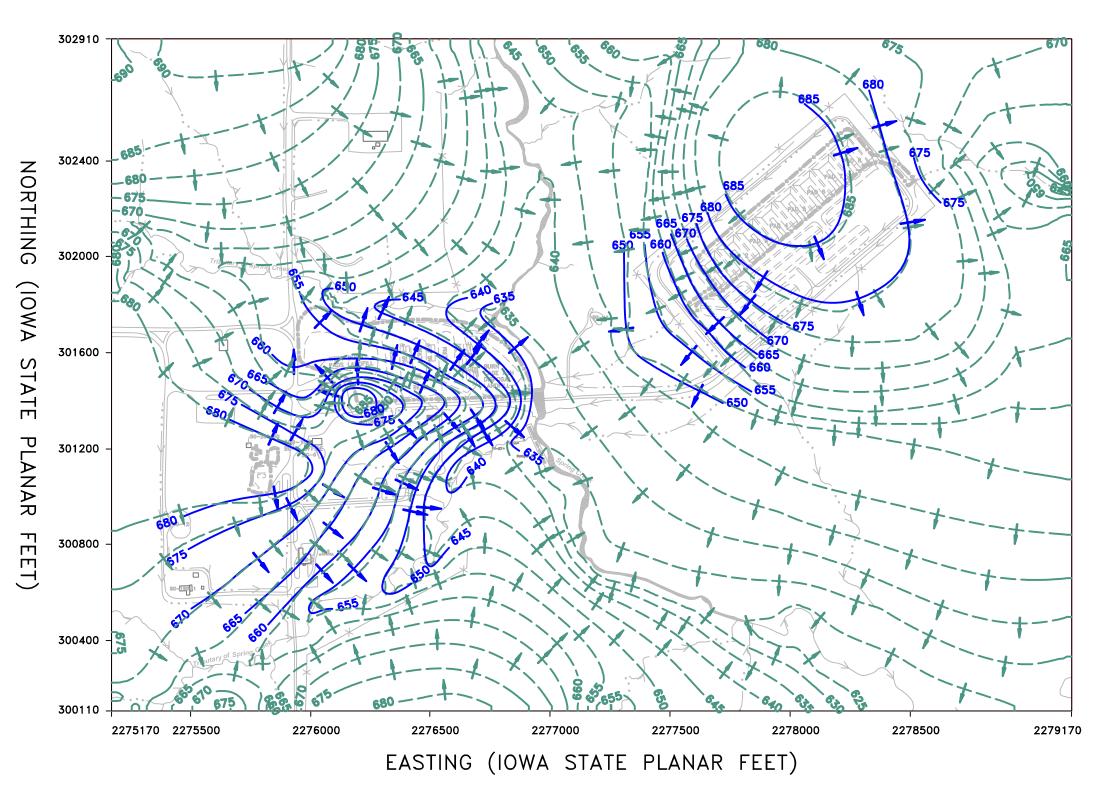


# URS

MODEL-GENERATED CROSS-SECTION B-B' FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: DAC	DATE: 12/17/03	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 05/05/04	16169421	K-3





#### LEGEND:

TRIBUTARY



----- FENCE LINE

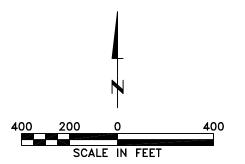
GROUNDWATER FLOW DIRECTION

INTERPRETED SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE - JUNE 2003

680--- MODEL-PREDICTED SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE

#### NOTES:

- 1. POTENTIOMETRIC SURFACE ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).
- 2. THE CONTOUR INTERVAL FOR THE POTENTIOMETRIC SURFACES IS 5 FEET.



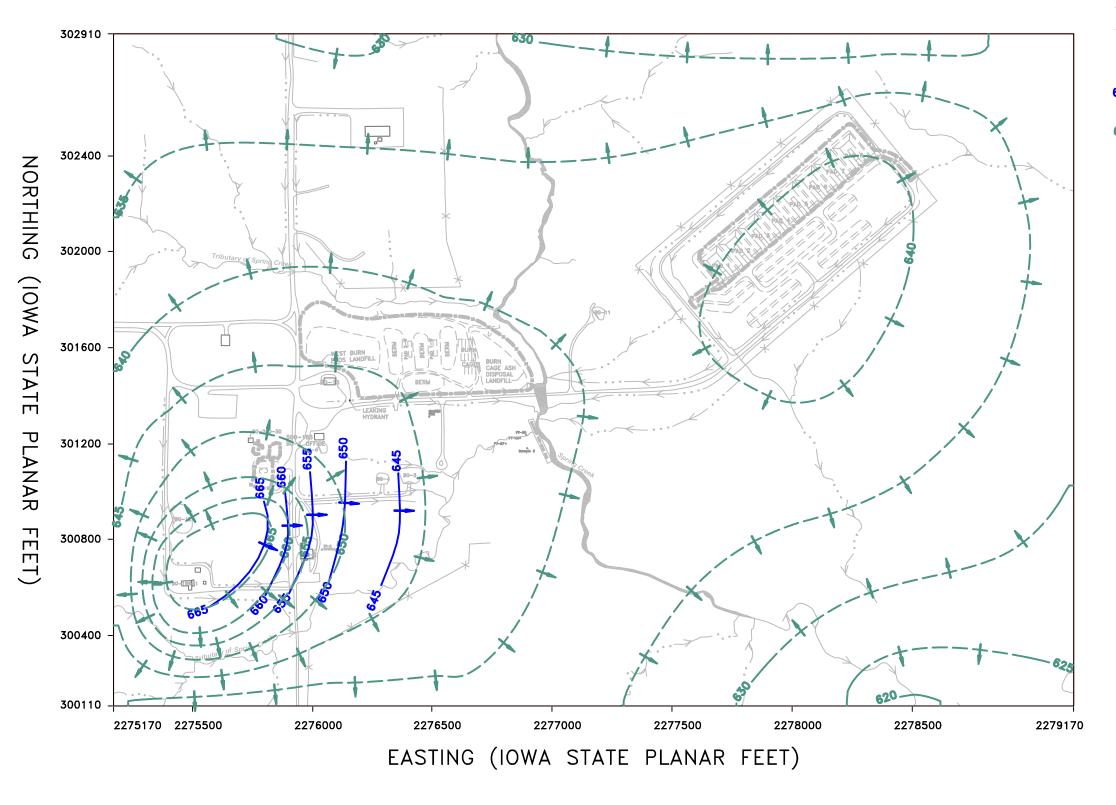
URS

MODEL-PREDICTED AND INTERPRETED SHALLOW GROUNDWATER POTENTIOMETRIC SURFACES FIRE TRAINING PIT GROUNDWATER MODELING

 DRN. BY: JJS
 DATE: 04/20/04
 PROJECT NO.

 CHK'D. BY: TLT
 DATE: 04/20/04
 16169421

March 15, 2004 10:53:38 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodbase2.dwg





TRIBUTARY



-X FENCE LINE

GROUNDWATER FLOW DIRECTION

683—

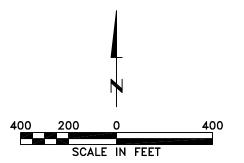
INTERPRETED BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE-JUNE 2003

680-\_-

MODEL-PREDICTED BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE

# NOTES:

- 1. POTENTIOMETRIC SURFACE ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).
- 2. THE CONTOUR INTERVAL FOR THE POTENTIOMETRIC SURFACES IS 5 FEET.



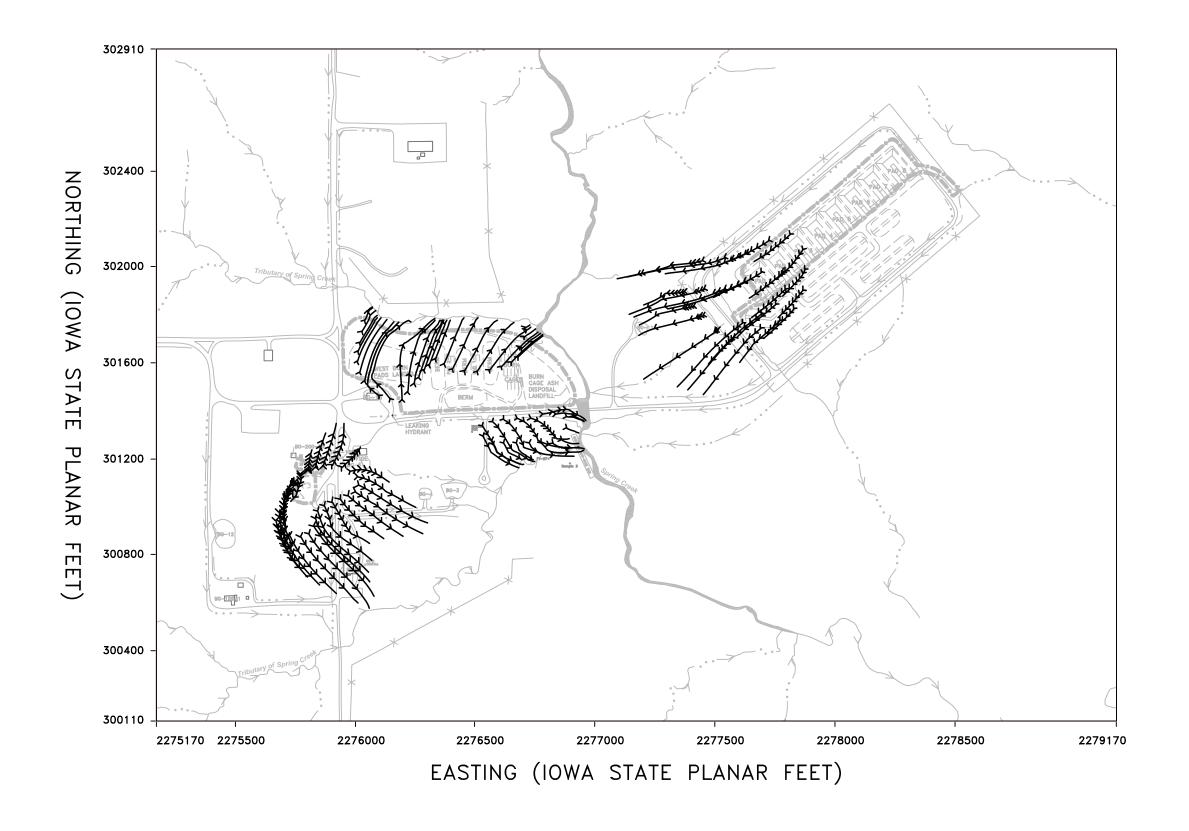
URS

MODEL-PREDICTED AND INTERPRETED BEDROCK GROUNDWATER POTENTIOMETRIC SURFACES FIRE TRAINING PIT GROUNDWATER MODELING

 DRN. BY: JJS
 DATE: 04/20/04
 PROJECT NO.

 CHK'D. BY: TLT
 DATE: 04/20/04
 16169421

March 15, 2004 10:53:38 a.m. Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodbase2.dwg



#### LEGEND:

**TRIBUTARY** 



INTERMITTENT TRIBUTARY/DRAINAGE

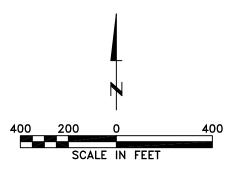


FENCE LINE

ADVECTIVE PARTICLE PATHS (10-YEAR TICK MARKS)

#### NOTES:

- 1. ADVECTIVE PARTICLES WERE STARTED IN LAYER 1 AROUND THE INTERPRETED SOURCE LOCATIONS AND MODELED FOR 70 YEARS.
- 2. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH FLOW PATH.
- 3. CROSS-SECTIONAL VIEW OF PARTICLE FLOW PATHS CAN BE FOUND ON FIGURE K-8.

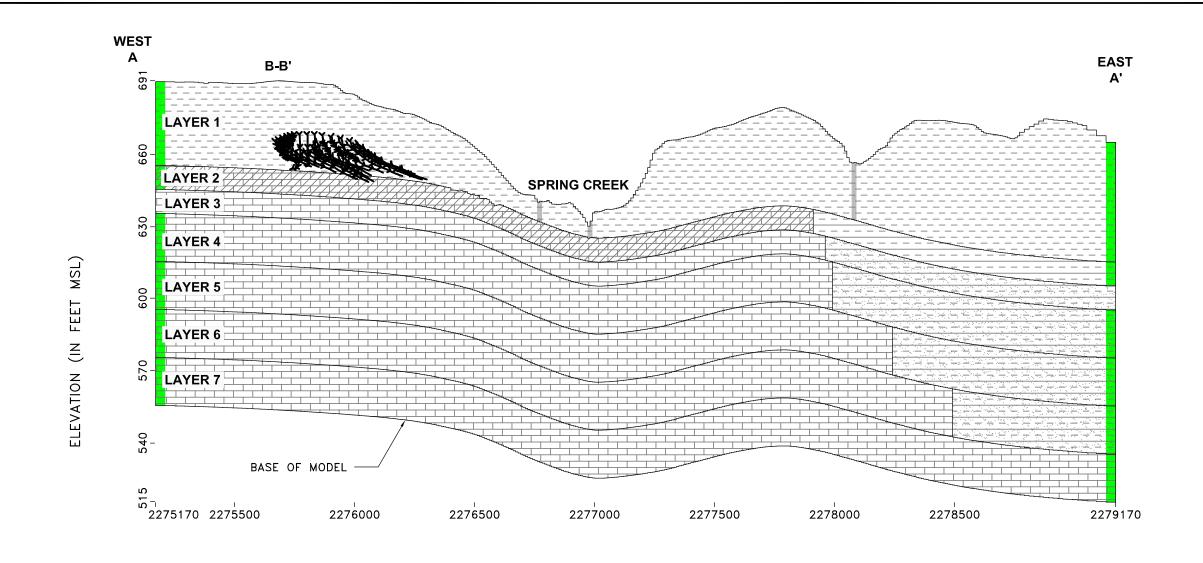


MODEL-PREDICTED ADVECTIVE PARTICLE TRANSPORT-BASELINE FLOW MODEL FIRE TRAINING PIT GROUNDWATER MODELING

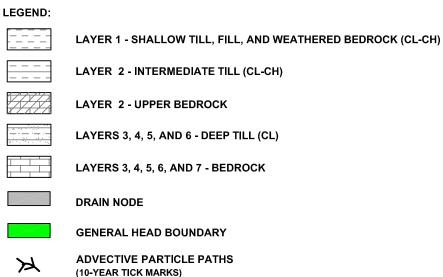
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PROJECT NO. 16169421

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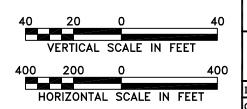


### EASTING (IOWA STATE PLANAR FEET)



#### NOTES:

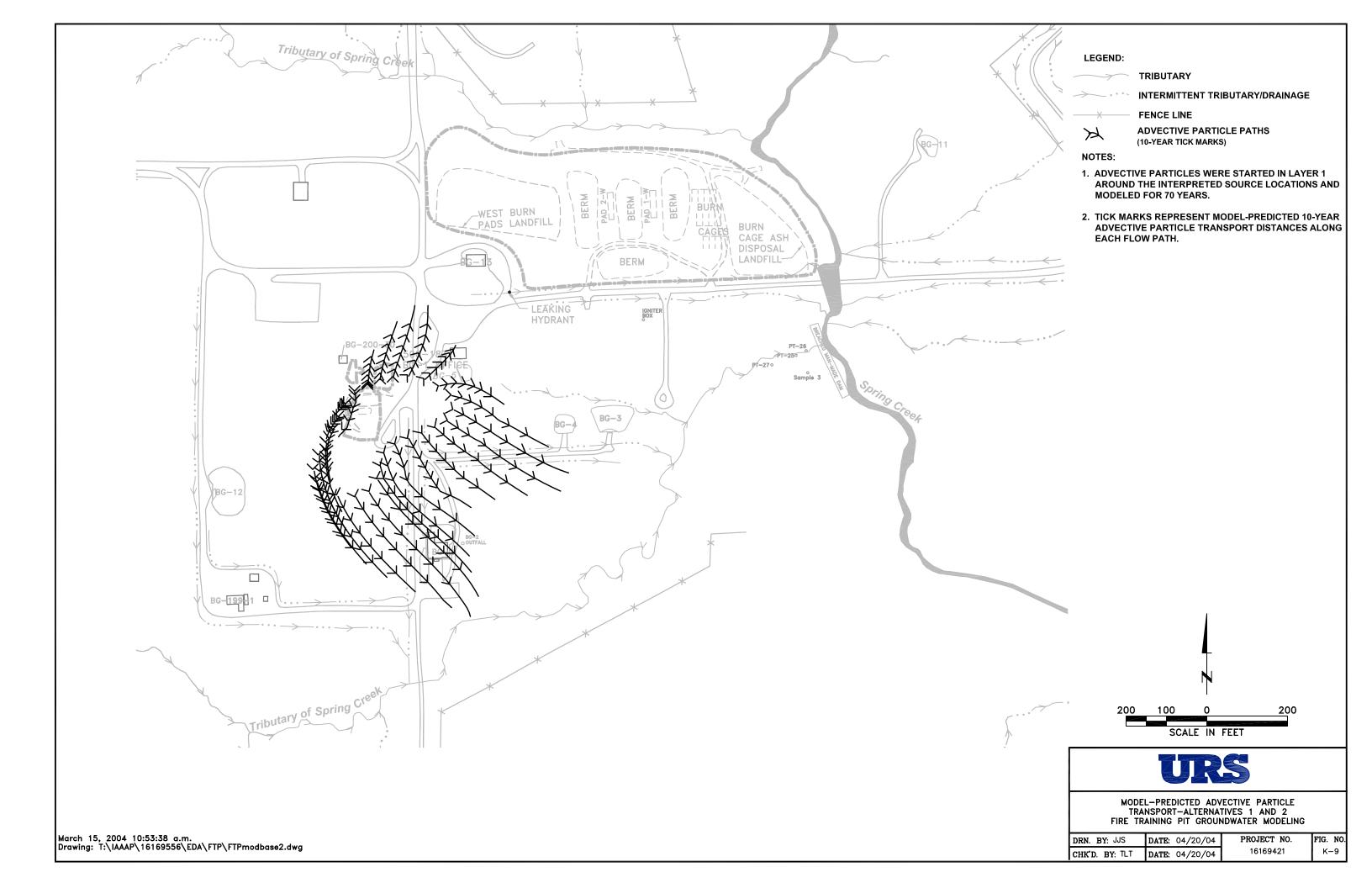
- 1. VERTICAL EXAGGERATION IS 10:1
- 2. CROSS-SECTION A-A' IS ALONG ROW 152. SEE FIGURE K-1 FOR CROSS-SECTION LOCATION.
- 4. ADVECTIVE PARTICLES WERE STARTED NEAR THE EXISTING PLUME SOURCES AND MODELED FOR 70 YEARS.
- 5. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH PATH.
- 6. PARTICLE PATHS SHOWN ARE ALL PATHS THROUGHOUT THE MODEL (NOT JUST THOSE IN ROW 152).
- 7. HORIZONTAL VIEW OF PARTICLE PATHS CAN BE FOUND ON FIGURE K-6.

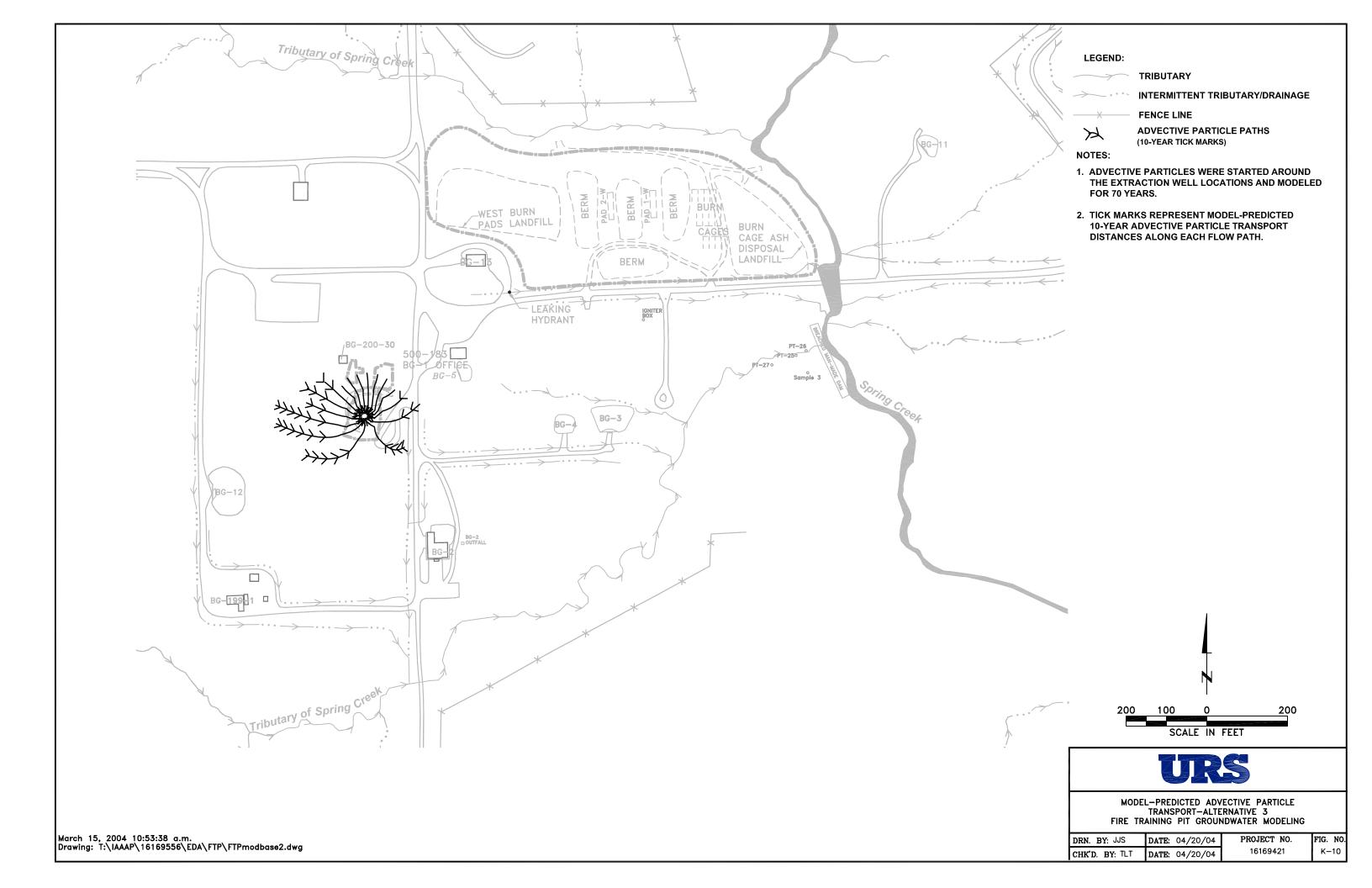


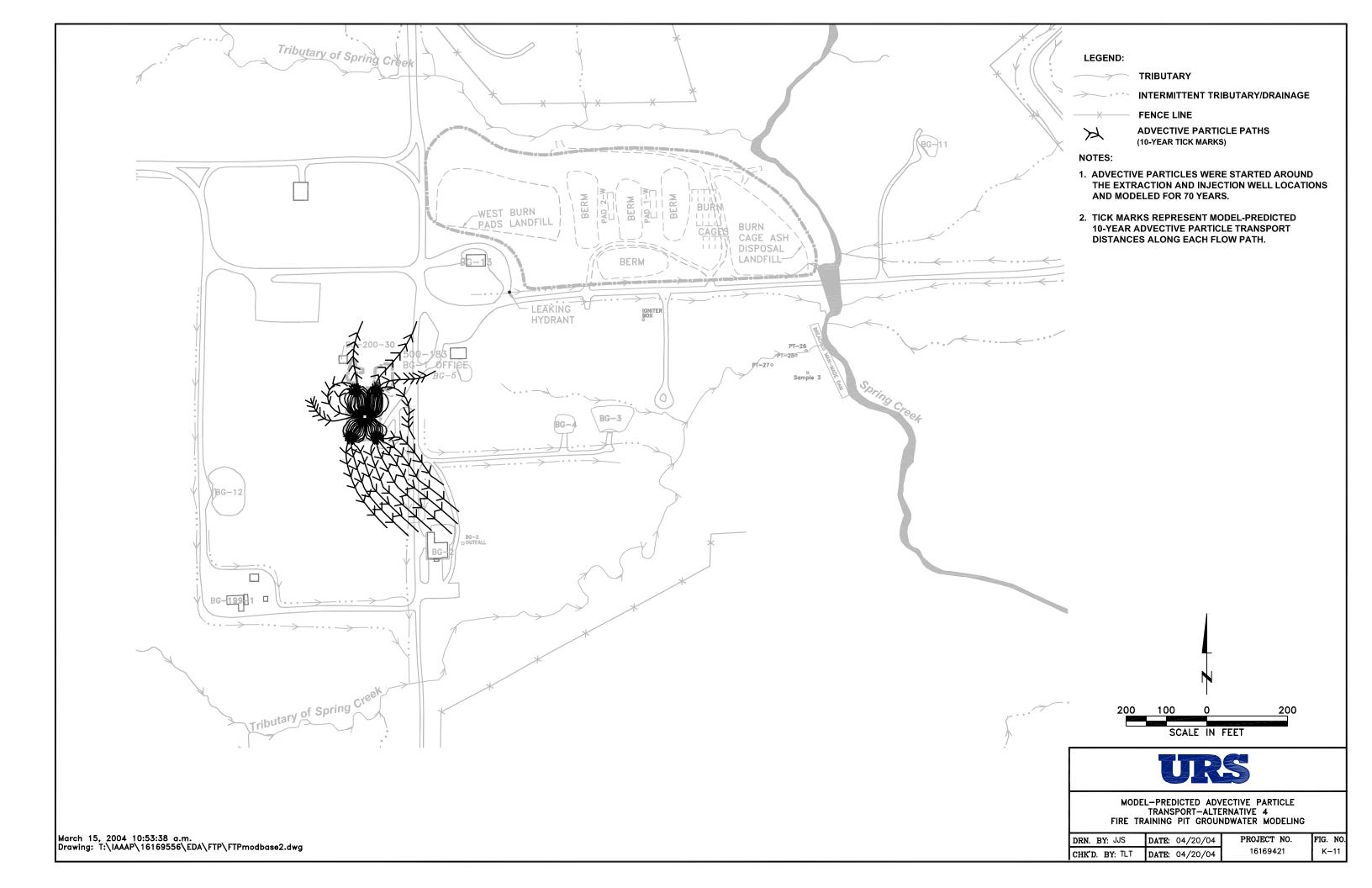


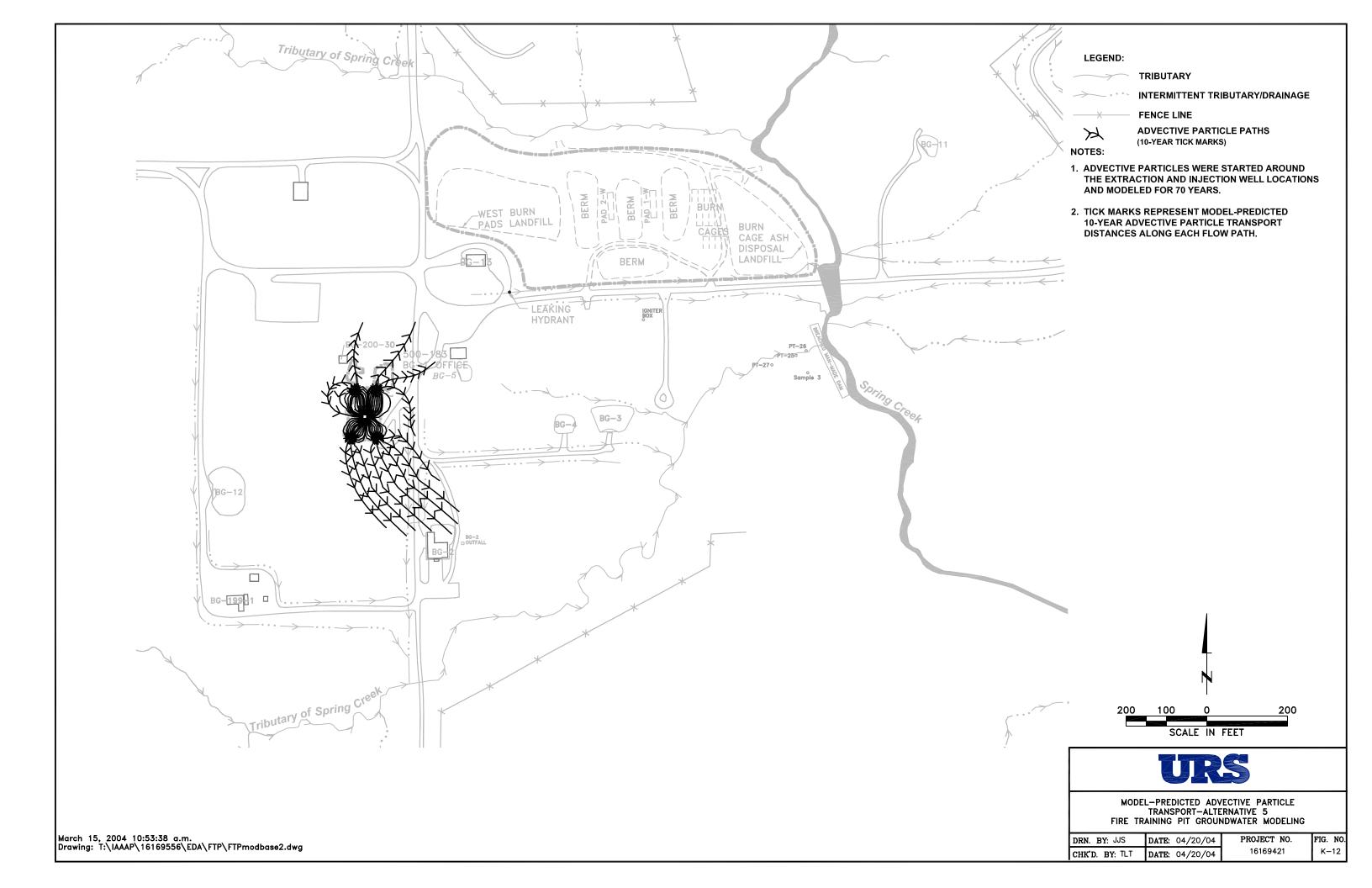
MODEL-PREDICTED ADVECTIVE PARTICLE TRANSPORT IN CROSS-SECTION/BASELINE FLOW MODEL FIRE TRAINING PIT GROUNDWATER MODELING

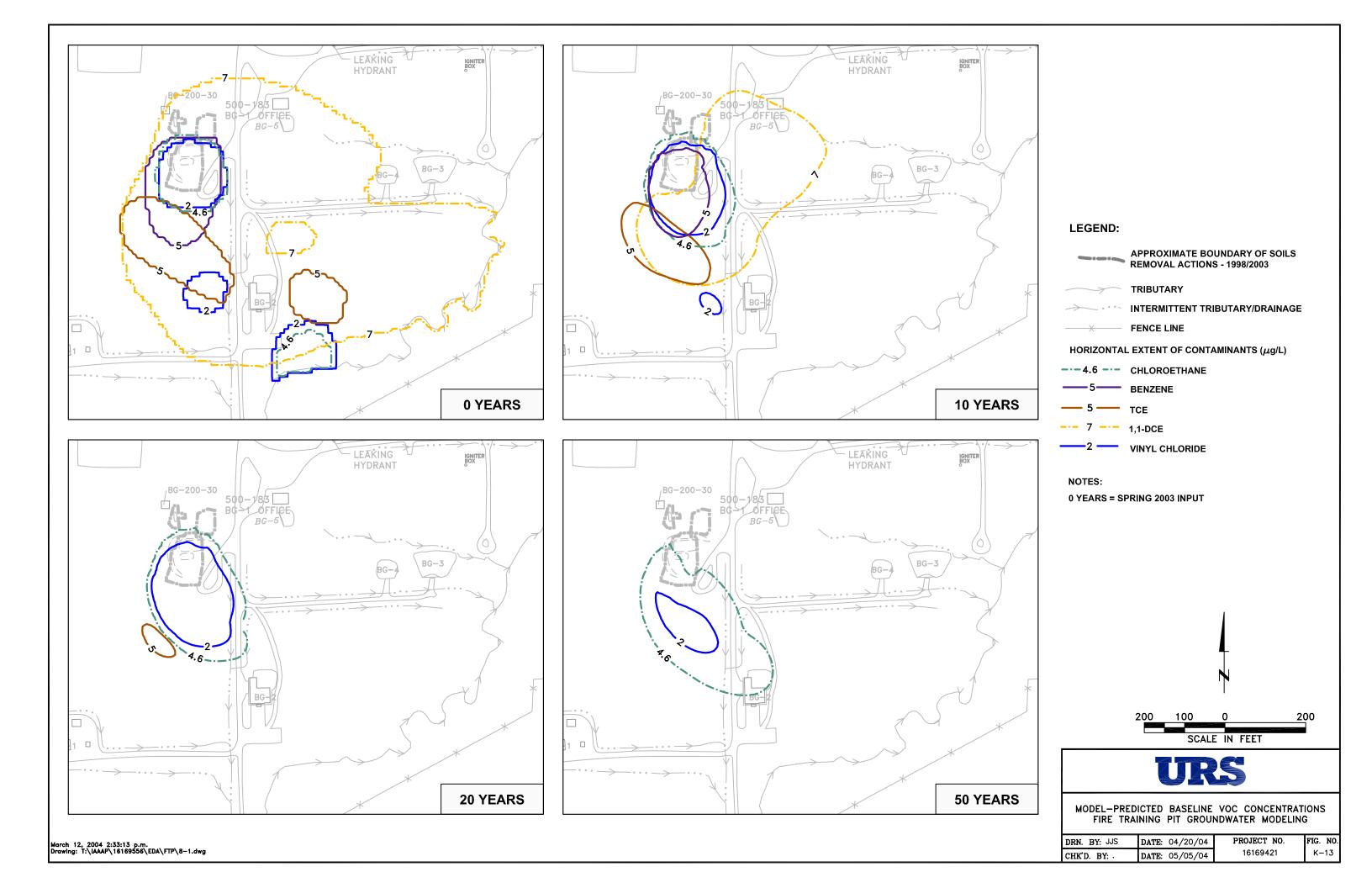
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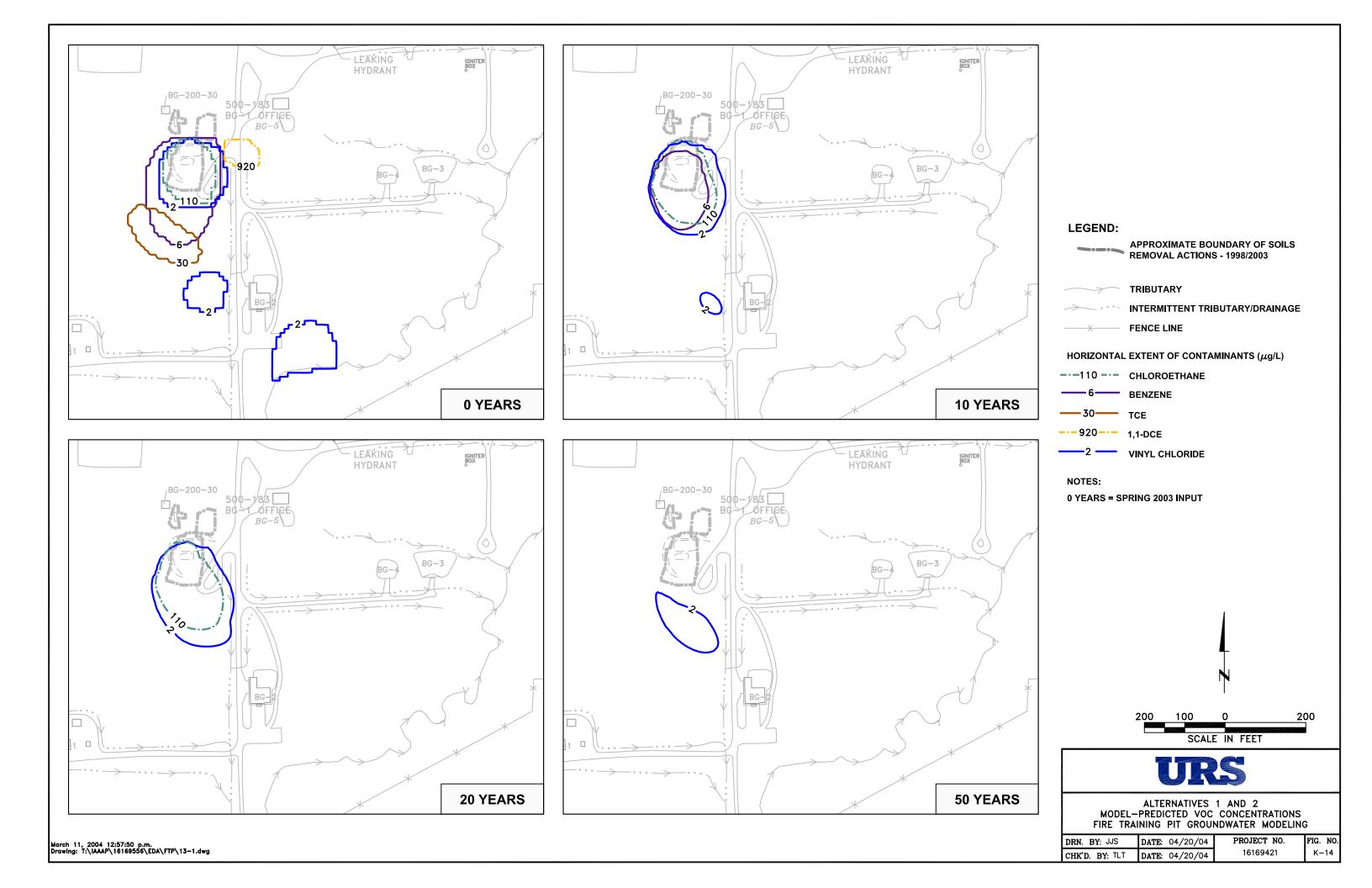


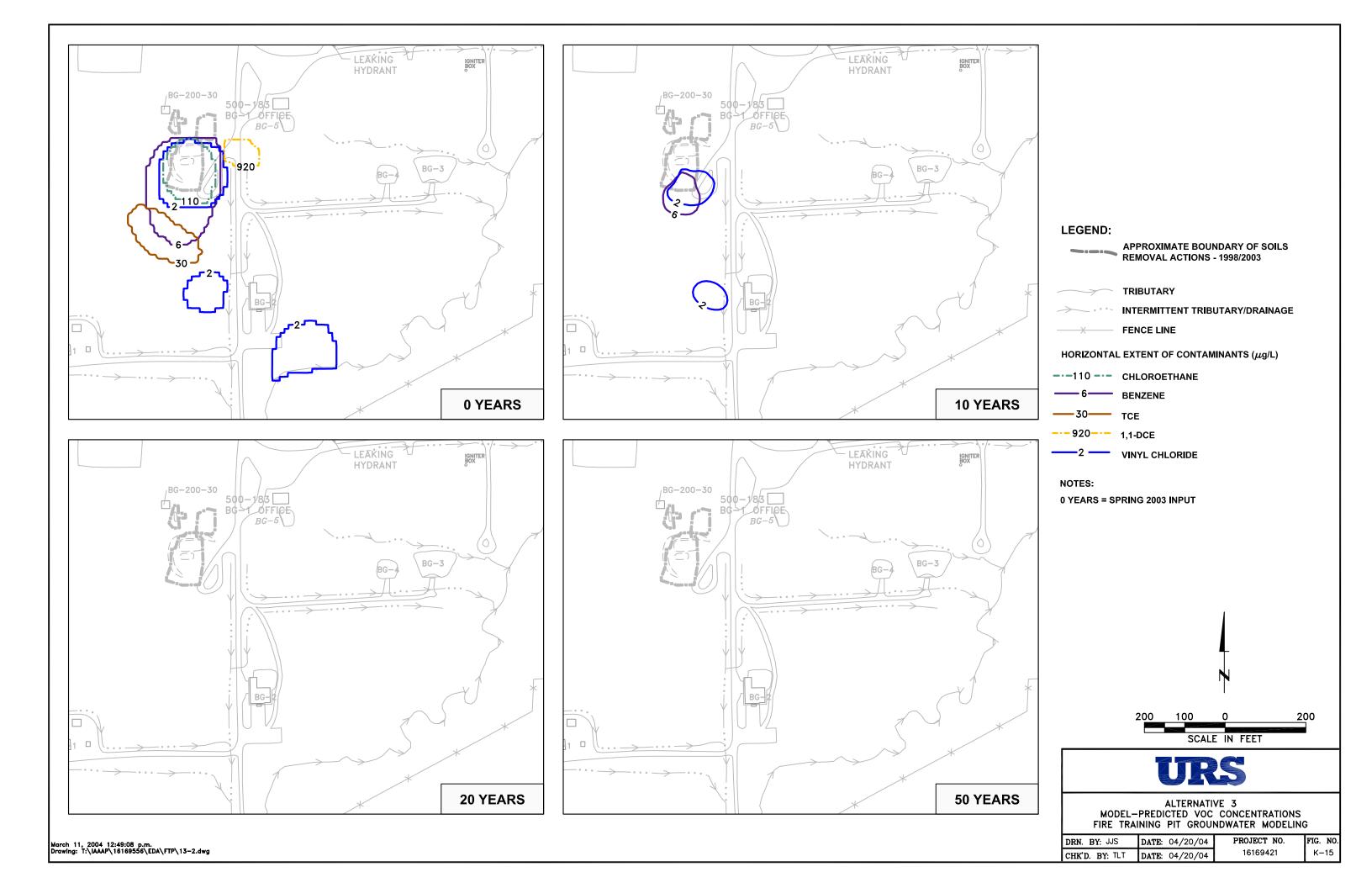


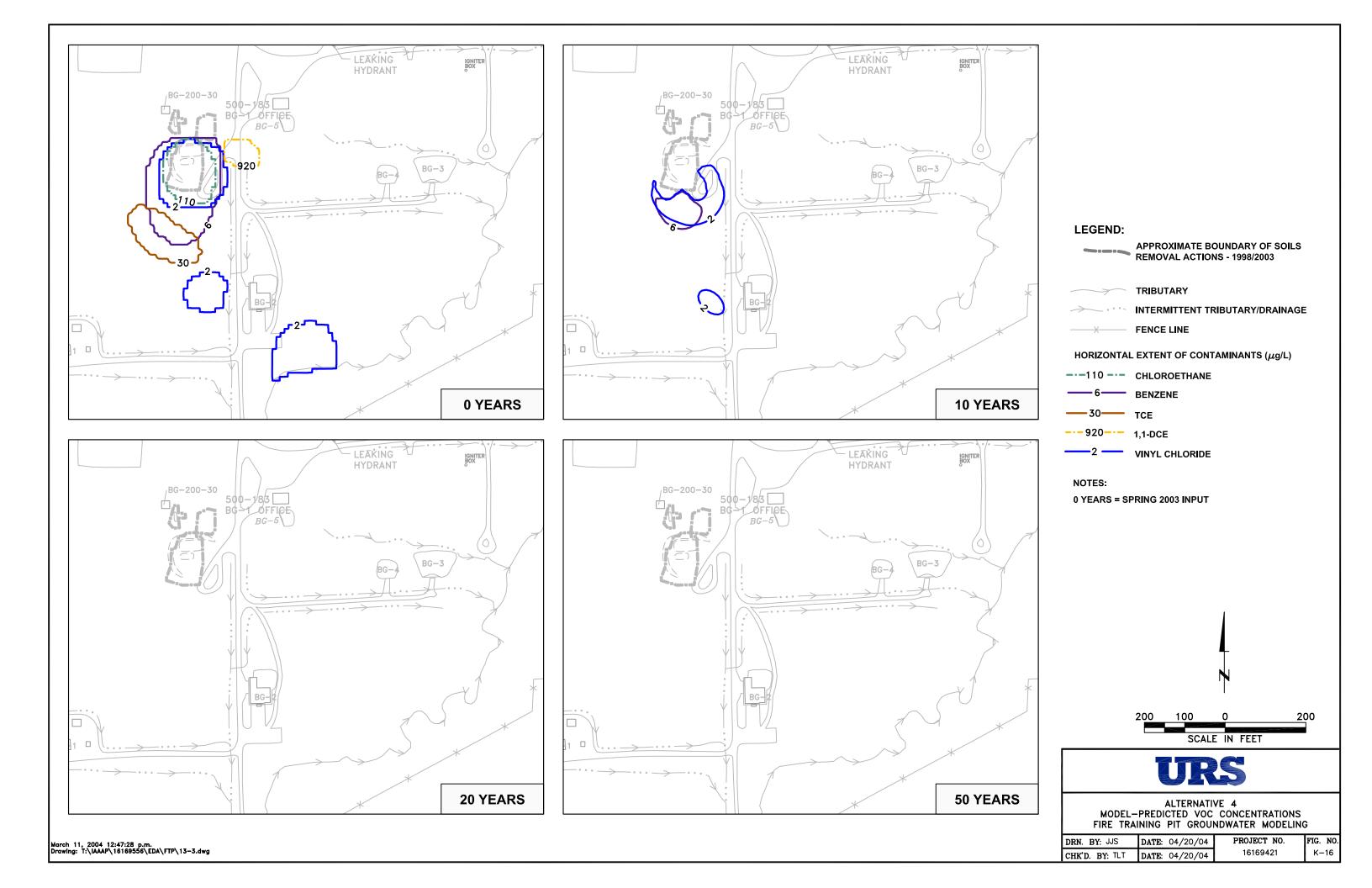


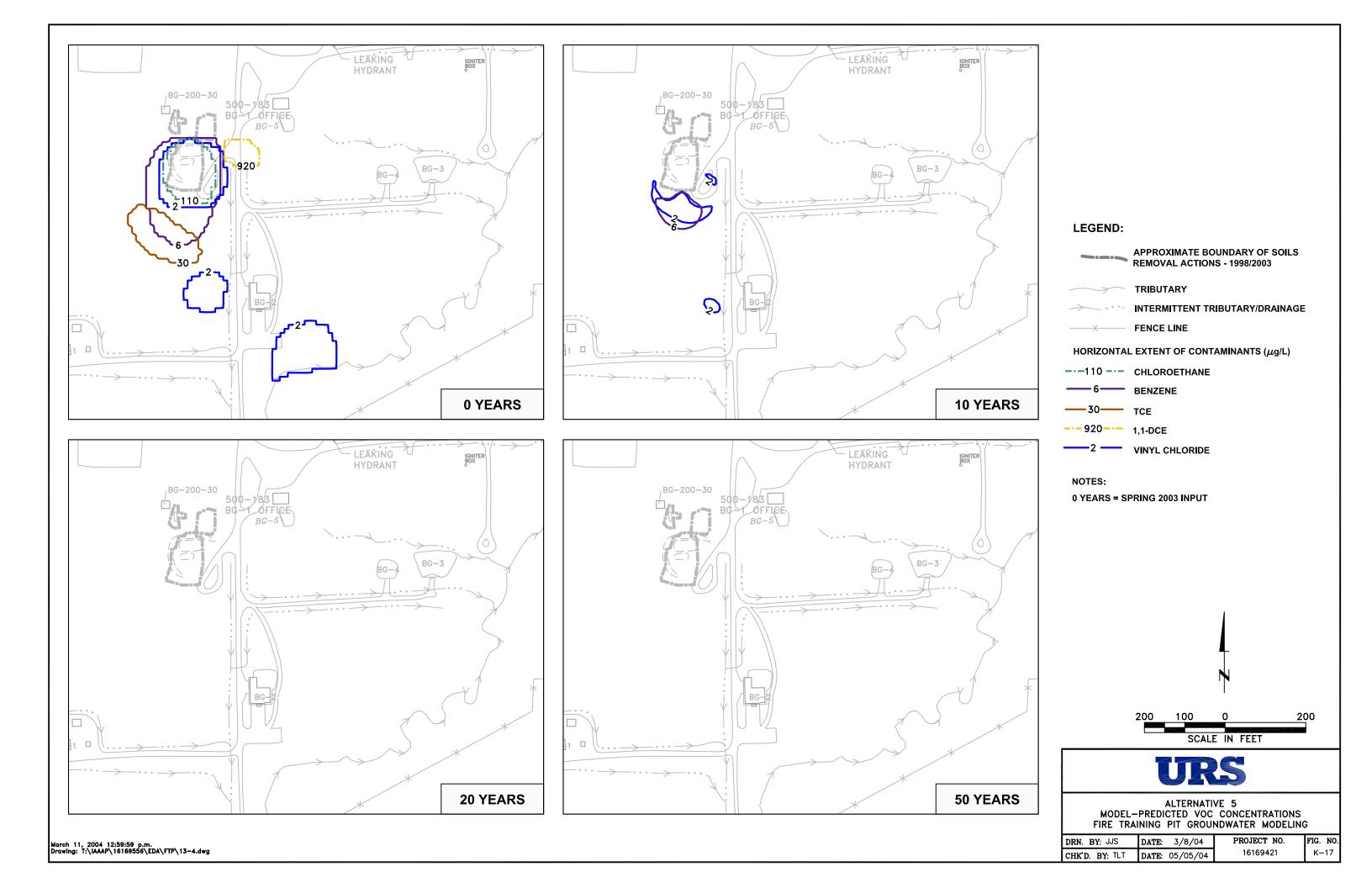














# ATTACHMENT K-1 Groundwater Flow Model – Related Calculations and Input

Calibrated Baseline Flow Model Volumetric Water Budget

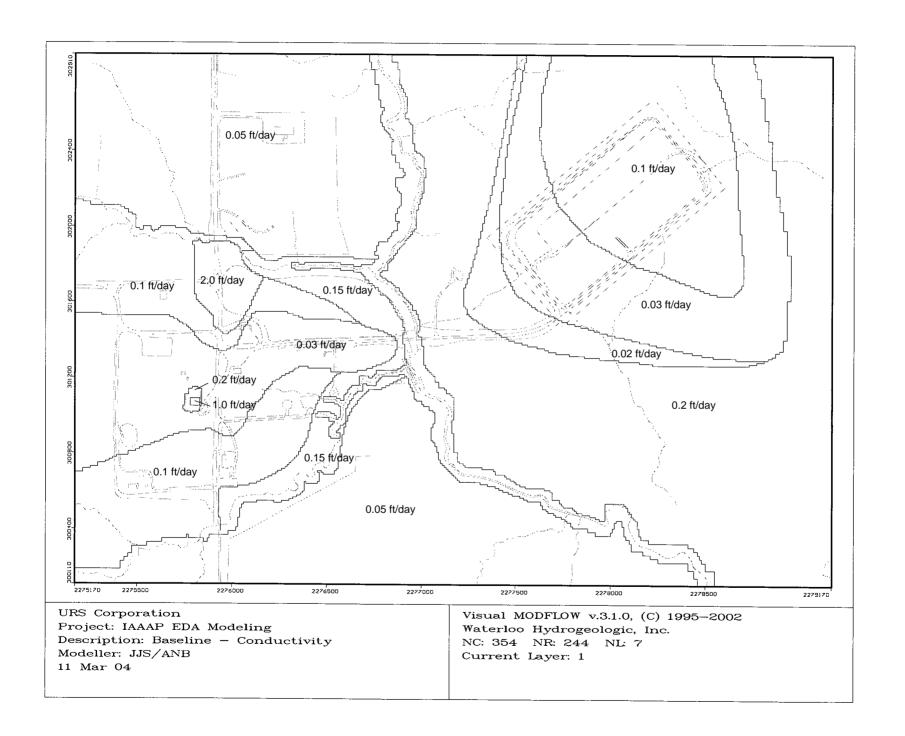
# ATACHMENT K-1 CALIBRATED BASELINE FLOW MODEL VOLUMETRIC WATER BUDGET FIRE TRAINING PIT GROUNDWATER MODELING

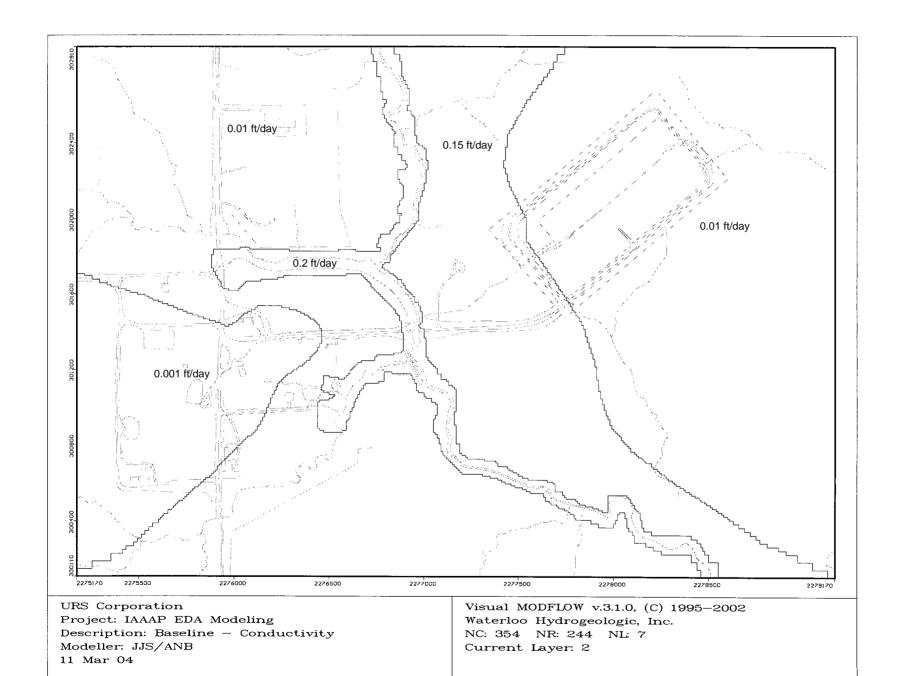
# CUMULATIVE

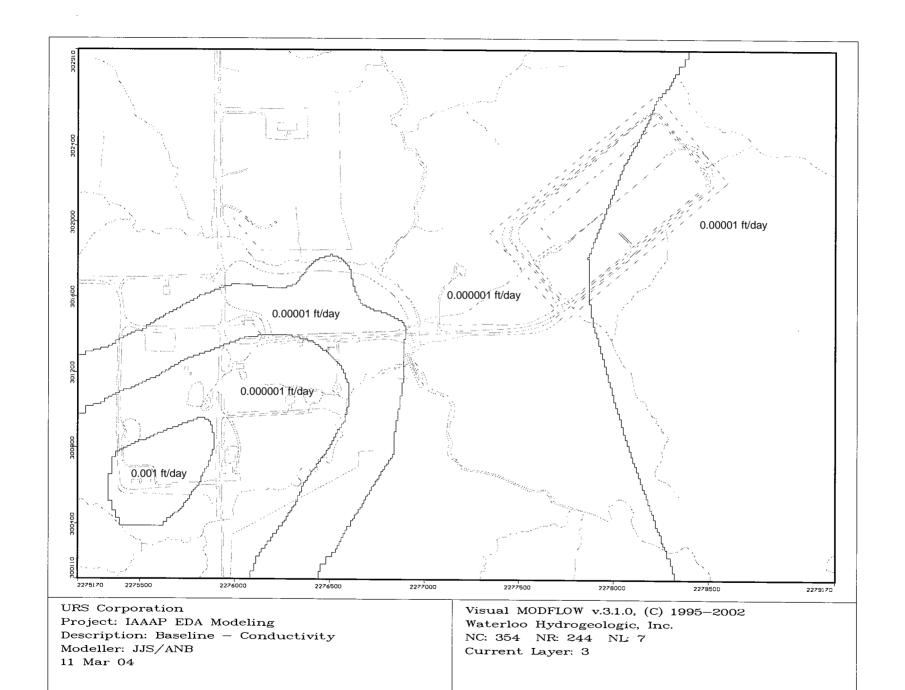
	VOLUMES (ft <sup>3</sup> )			
	Inflow	Outflow		
Drains	0.0	1844.0		
Recharge	1257.3	0.0		
General Head	1670.6	1084.2		
Total	2927.88	2928.19		
In - Out =	-0.31			
% Discrepancy =	0.01%			

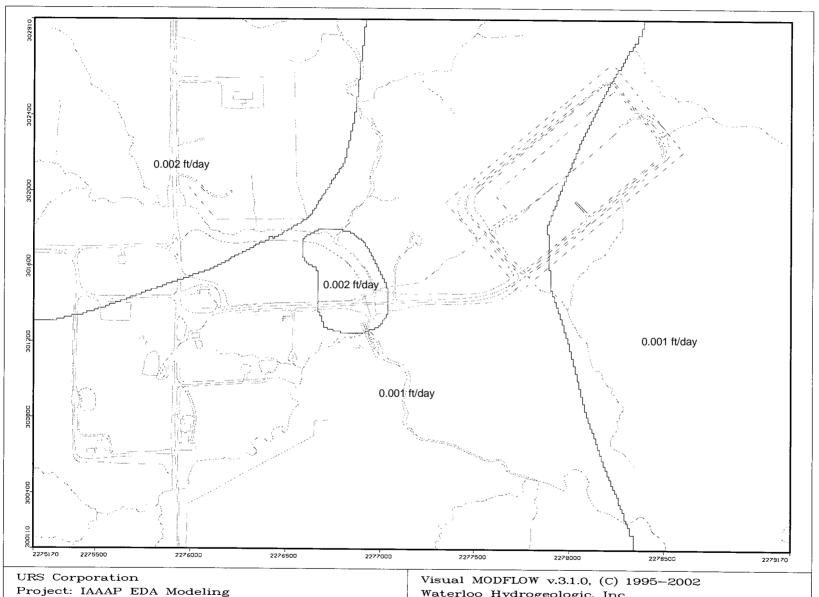
# ATTACHMENT K-1 Groundwater Flow Model – Related Calculations and Input

**Hydraulic Conductivity Fields** 









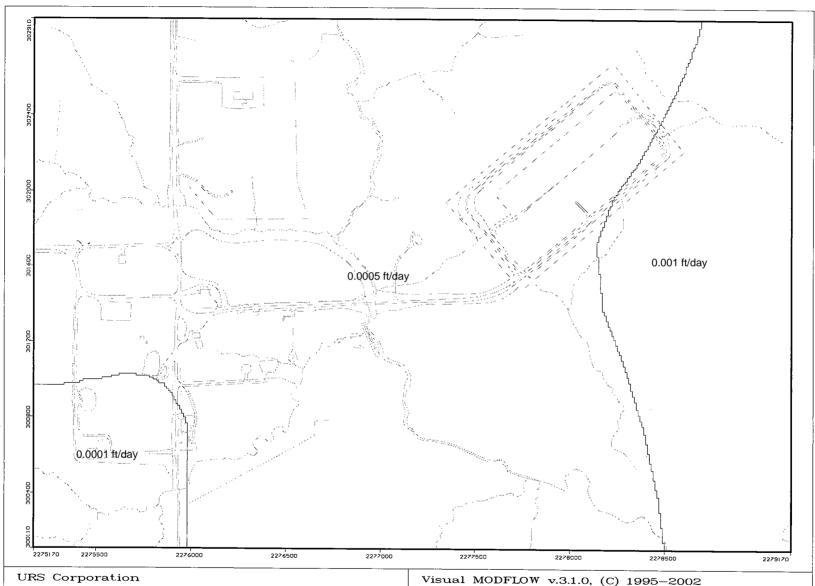
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Modeller: JJS/ANB

11 Mar 04

Waterloo Hydrogeologic, Inc.

NC: 354 NR: 244 NL: 7

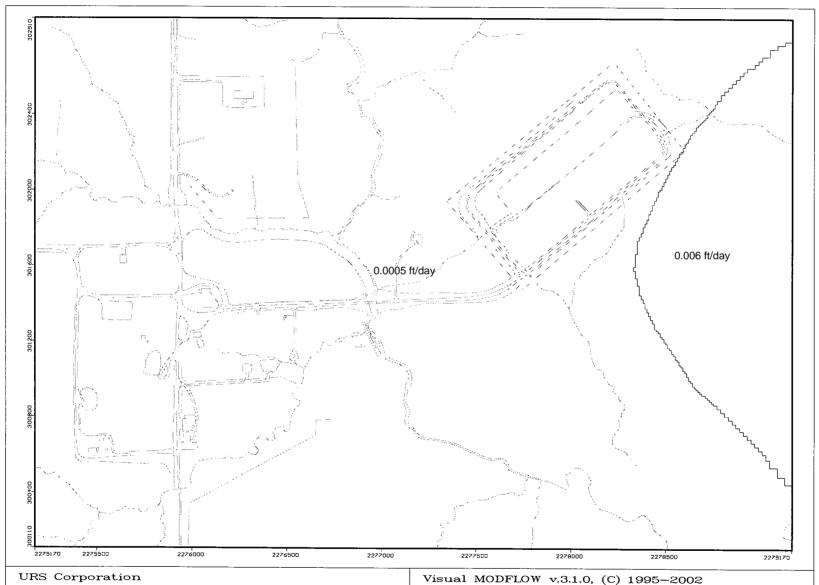


Description: Baseline - Conductivity

Modeller: JJS/ANB

11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995-200 Waterloo Hydrogeologic, Inc. NC: 354 NR: 244 NL: 7



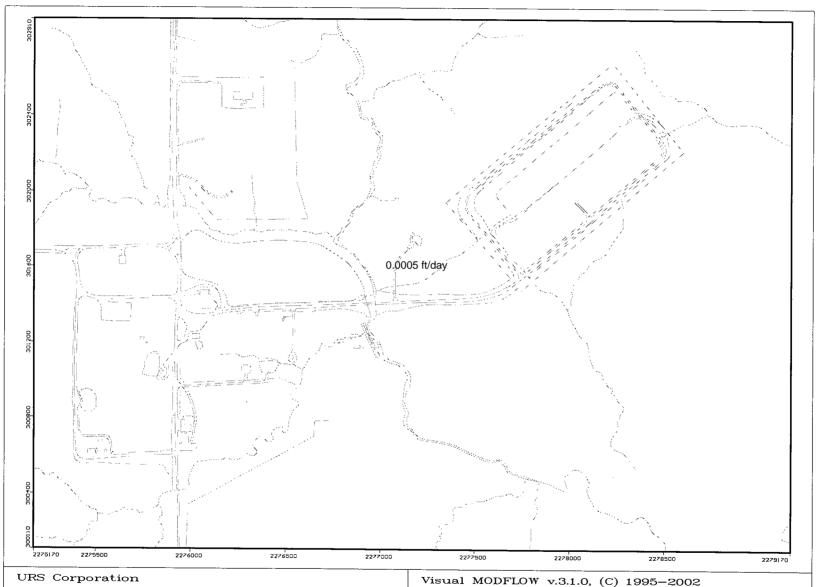
Description: Baseline - Conductivity

Modeller: JJS/ANB

11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995-2002 Waterloo Hydrogeologic, Inc.

NC: 354 NR: 244 NL: 7



Description: Baseline - Conductivity

Modeller: JJS/ANB

11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995-2002 Waterloo Hydrogeologic, Inc.

NC: 354 NR: 244 NL: 7

# ATTACHMENT K-2 MODFLOW and MODPATH Documentation

MODFLOW (Harbaugh, et al. 2000) and MODPATH (Pollock 1989) were used to evaluate groundwater flow patterns for the baseline groundwater flow model.

#### K-2.1 MODFLOW GROUNDWATER FLOW MODEL DOCUMENTATION

#### **MODFLOW Model Description and Assumptions** K-2.1.1

MODFLOW is a modular three-dimensional, finite difference flow code developed by the United States Geological Survey (USGS) to solve the governing equation of groundwater flow. MODFLOW has been used extensively for groundwater flow modeling and has been available since 1983. MODFLOW can simulate the effects of wells, rivers, drains, evapotranspiration, and recharge of three-dimensional groundwater systems with heterogeneous, anisotropic aquifer properties and complex boundary conditions. Aquifers may be simulated as confined, unconfined, or a combination of both. The code permits the user to select a series of packages (or modules) to simulate hydrologic processes for wells, drains, rivers, evapotranspiration from the water table, surface recharge, and general head boundaries.

Model development typically requires calibration of input parameters, and a common calibration criterion is the comparison of simulated and observed heads. MODFLOW provides simulated head values at user specified intervals for every cell in the model. This calibration test gives an excellent indication of how well a model is simulating head changes at a particular location.

General assumptions related to MODFLOW model applications include:

- All hydraulic properties are uniform across the length, width, and depth of each individual cell. Solution nodes are only calculated at the center of each cell.
- Aguifer materials are uniformly porous (i.e., no fracture flow is considered).
- Wells/sinks/sources are completely efficient and fully penetrate the individual cells in which they are placed.
- Assumed constant head boundaries remain constant through time.
- Recharge is only applied to the uppermost active cell in the model.

#### K-2.1.2 **MODFLOW Model Equations and Implementation**

The governing equation of groundwater flow of constant density through porous earth material may be described by the partial-differential equation:

$$\frac{\partial}{\partial x} \left( K_x \frac{\partial h}{\partial x} \right) + \frac{\partial}{\partial y} \left( K_y \frac{\partial h}{\partial y} \right) = W + S_s \frac{\partial h}{\partial t}$$

where:

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- $K_{x}$ denotes hydraulic conductivity along the x axis (ft/day)
- $K_{v}$ denotes hydraulic conductivity along the y axis which is assumed to be parallel to the major axis of hydraulic conductivity (ft/day)
- denotes hydraulic conductivity along the z axis (ft/day)  $K_{7}$
- h is the hydraulic head (feet)
- Wis a volumetric flux per unit volume and represents sources or sinks of water (per day)
- $S_{s}$ is the specific storage of the porous material (per foot)
- t is time (days)

The governing equation is approximated by a set of algebraic equations which are solved by an iteration or matrix solution technique. The solution algorithms to the partial differential equation of flow include two iteration techniques, the Strongly Implicit Procedure (SIP) and the Slice-Successive Overrelaxation method (SSOR). SIP utilizes certain general concepts of matrix algebra and numerical analysis to solve large systems of simultaneous equations by iteration.

MODFLOW uses a block-centered finite-difference grid for numerical formulation. In the block-centered formulation, the blocks formed by the sets of parallel lines are the cells; the solution nodes are at the center of the cells. The model equations are based on the assumption that hydraulic properties are uniform within individual cells. In confined layers, transmissivity (the product of hydraulic conductivity and layer thickness) is specified; and the storage coefficient (the product of specific storage and layer thickness) is also used. For an unconfined layer, aquifer bottom elevation and hydraulic conductivity are input for each cell. Saturated thickness is calculated as the difference between head and bottom elevation, and transmissivity is then calculated as the product of the hydraulic conductivity and saturated thickness. Thus, transmissivity can vary from cell to cell depending on bottom elevation and head.

The cells in the model can be defined as constant head, variable head, or inactive (no-flow) cells. Constant head cells are those for which the head is specified in advance and is held at this specified value through all time steps of the simulation. Inactive or no-flow cells are those for which no flow into or out of the cell is permitted, in any time step of the simulation. Variablehead cells are characterized by heads that are unspecified and free to vary with time. Constanthead and no-flow cells are used in the model to represent conditions along various hydrologic boundaries. Other boundary conditions, such as areas of constant inflow or areas where inflow varies with head, can be simulated using external source terms or through a combination or noflow cells and external source terms.

The model simulates groundwater flow using both spatial and temporal discretization. Spatial discretization is handled in the horizontal direction by reading the number of rows, the number of columns and the width of each row and column (that is, the width of the cells in the direction transverse to the row or column). Discretization of space in the vertical direction is handled in the model by specifying the number of layers to be used and by specifying hydraulic parameters

### **APPENDIXK**

which contain or embody the layer thickness. Vertical discretization can be used to represent individual aquifers or less permeable zones by individual layers of the model.

The program handles temporal discretization by dividing the simulation time into stress periods, time intervals during which all external stresses are constant, which can be subdivided into time steps. Within each stress period, the time steps form a linear or geometric progression. The user specifies the length of the stress period; the number of time steps into which it is to be divided; and the time step multiplier or ratio of the length of each time step to that of the preceding time step. Using these terms, the program calculates the length of each time step in the stress period.

#### K-2.2 MODPATH PARTICLE TRACKING MODEL DOCUMENTATION

#### **MODPATH Model Description and Assumptions** K-2.2.1

MODPATH is an advective particle tracking post-processing package developed by the USGS to compute three-dimensional path lines using steady-state simulation output from the USGS MODFLOW numerical groundwater flow model. MODPATH uses a semi-analytical particle tracking scheme to simulate three-dimensional path lines and particle positions at specified points in time in groundwater. MODPATH also can compute particle discharge point coordinates and total travel time.

General assumptions related to MODPATH model applications include:

- Head potential flow terms are from a block-centered, finite-difference, groundwater flow model (e.g., USGS MODFLOW). All standard assumptions related to the flow model are applicable (i.e., discretization effects, uniform properties within cells, completely efficient sinks/sources/wells, etc.).
- All simulations use steady-state flow conditions only (i.e., no transient conditions).
- Particle tracking simulates nonreactive, advective transport only. Dispersion, retardation, and decay cannot be accounted for.

#### K-2.2.2 **MODPATH Model Equation and Implementation**

Once the USGS MODFLOW flow model solves the governing equation for groundwater flow for heads and intercell flow rates, MODPATH computes values for principal components of the velocity vector at all points in the flow field using the MODFLOW-derived intercell flow rates.

MODPATH uses simple linear interpolation to compute the velocity components at points within a cell. Linear interpolation produces a continuous velocity vector field within each individual cell that identically satisfies the differential conservation of mass equation everywhere within the cell. Linear interpolation of the six-cell face velocity components results in a velocity vector field within the cell that automatically satisfies the conservation of mass equation at every point inside the cell, if it is assumed that internal sources or sinks are considered to be uniformly distributed within the cell.

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The change in a particle's velocity with time as it moves through a three-dimensional, finitedifference cell is given by:

$$\left(\frac{\partial v_x}{\partial t}\right) + \left(\frac{\partial v_y}{\partial t}\right) + \left(\frac{\partial v_z}{\partial t}\right) = \left(\frac{\partial v_x}{\partial x}\right) \left(\frac{\partial x}{\partial t}\right) + \left(\frac{\partial v_x}{\partial x}\right) \left(\frac{\partial y}{\partial t}\right) + \left(\frac{\partial v_z}{\partial z}\right) \left(\frac{\partial z}{\partial t}\right)$$

where:

 $v_x = x$ -component of velocity

 $v_y = y$ -component of velocity

 $v_z = z$ -component of velocity

x = x-location of a particle

y = y-location of a particle

z = z-location of a particle

t = time

MODPATH calculates the coordinates of a particle (p) at any time (t) within a cell using the following solutions:

$$x_p(t_1) = x_o + (1/A_x)[v_x(t_o)\exp(A_xDt) - v_{xo}]$$

$$y_p(t_1) = y_o + (1/A_y)[v_y(t_o)\exp(A_yDt) - v_{yo}]$$
 2

$$z_p(t_1) = z_0 + (1/A_z)[v_z(t_0)\exp(A_zDt) - v_{z_0}]$$
 3

where:

 $x_p(t_1) = x$ -location of particle p at time  $t_1$ 

 $y_p(t_1) = y$ -location of particle p at time  $t_1$ 

 $z_p(t_1) = z$ -location of particle p at time  $t_1$ 

 $v_x(t_0) = x$ -component of the particle's velocity at time  $t_0$ 

 $v_y(t_o) = y$ -component of the particle's velocity at time  $t_o$ 

 $v_z(t_o) = z$ -component of the particle's velocity at time  $t_o$ 

 $A_x$  = velocity gradient in the x-direction or  $\partial v_x/\partial x$ 

 $A_{v}$  = velocity gradient in the y-direction or  $\partial v_{v}/\partial y$ 

 $A_z$  = velocity gradient in the z-direction or  $\partial v_z/\partial z$ 

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 $t_o = \text{time (original)}$  $t_1 = time (future)$ 

MODPATH calculates the time required for a particle to travel from any point within a cell to a boundary face of the cell. The calculations are repeated, cell-by-cell, until the future time  $(t_I)$  of analysis.

# ATTACHMENT K-3 MT3DMS Model Documentation

MT3DMS (Zheng and Wang 1998) is a modular three-dimensional multi-species transport model for simulation of advection, dispersion, and chemical reactions of dissolved constituents The model program uses a modular structure similar to that in groundwater systems. implemented in MODFLOW (Harbaugh, et al. 2000). This modular structure makes it possible to simulate advection, dispersion, sink/source mixing, and chemical reactions independently without reserving computer memory space for unused options.

The MT3DMS transport model is intended to be used in conjunction with any block-centered finite difference flow model, such as MODFLOW (Harbaugh, et al. 2000), and is based on the assumption that changes in the concentration field will not affect the flow field measurably. This allows the user to construct and calibrate a flow model independently. MT3DMS retrieves the hydraulic heads and the various flow and sink/source terms saved by the flow model, automatically incorporating the specified hydrologic boundary conditions. Currently, MT3DMS accommodates the following spatial discretization capabilities and transport boundary conditions: (1) confined, unconfined or variably confined/unconfined aquifer layers; (2) inclined model layers and variable cell thickness within the same layer; (3) specified concentration or mass flux boundaries; and (4) the solute transport effects of external sources and sinks such as wells, drains, rivers, aerial recharge and evapotranspiration.

General assumptions related to MT3DMS model applications include the following:

- Constituent concentrations are uniform across the length, width, and depth of each individual cell in each layer. Solution nodes are only calculated at the center of each
- Constituents are dissolved in groundwater and adsorbed onto aquifer materials (i.e., no modeling of nonaqueous-phase liquids).
- Equilibrium-controlled or rate-limited sorption and first-order irreversible or reversible kinetic reactions (e.g., biodegradation) are occurring.
- General concentration boundary conditions must be specified around a boundary (Dirichlet Condition) or across a boundary (Neumann Condition), and must remain unchanged throughout the simulation.

#### MT3DMS Model Equations and Implementation

The governing equation for contaminant transport is described by the partial-differential equation:

$$R\frac{\partial C}{\partial t} = \frac{\partial}{\partial x_i} \left( D_{ij} \frac{\partial C}{\partial x_j} \right) - \frac{\partial}{\partial x_i} \left( v_i C \right) + \frac{q_s}{\theta} C_s - \lambda \left( C + \frac{\rho_b}{\theta} \overline{C} \right)$$

Where *R* is called the retardation factor, defined as:

$$R = I + \frac{\rho_b}{\theta} \frac{\partial \overline{C}}{\partial C}$$

Where:

Cis the concentration of contaminants dissolved in groundwater, (pounds per cubic foot [pcf])

 $\overline{C}$ is the concentration of contaminants adsorbed on the porous medium (pounds per pound)

t is time (days)

is the distance along the respective Cartesian coordinate axis (feet)  $\chi_i$ 

is the hydrodynamic dispersion coefficient (ft<sup>2</sup>/day)  $D_{ii}$ 

is the seepage or linear pore water velocity (ft/day)  $v_i$ 

 $\theta$ is the effective porosity of the porous medium (unitless)

is the volumetric flux of water per unit volume of aquifer representing  $q_s$ sources (positive) and sinks (negative) (per day)

 $C_s$ is the concentration of the sources or sinks (pcf)

is the bulk density of the porous medium (pcf)  $\rho_{\scriptscriptstyle b}$ 

λ is the rate constant of the first-order decay rate reactions (per day)

The transport equation is linked to the flow equation through the relationship:

$$v_i = -\frac{K_{ii}}{\theta} \frac{\partial h}{\partial x_i}$$

Where:

is a principal component of the hydraulic conductivity tensor (ft/day)  $K_{ii}$ 

h is hydraulic head (feet)

The hydraulic head is obtained from the solution of the three-dimensional groundwater flow equation:

$$\frac{\partial}{\partial x_i} \left( K_{ii} \frac{\partial h}{\partial x_i} \right) + q_s = S_s \frac{\partial h}{\partial t}$$

Where  $S_s$  is the specific storage of the porous material (per foot).

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MT3DMS includes three major classes of transport solution techniques: the standard finite difference method, the particle-tracking-based Eulerian-Lagrangian methods, and the higherorder finite-volume total-variation-diminishing (TVD) method. Since no single numerical technique has been shown to be effective for all transport conditions, the combination of these solution techniques, each having its own strengths and limitations, is believed to offer the best approach for solving the most wide-ranging transport problems with desired efficiency and accuracy.

In addition to the explicit formulation of the original MT3D code, MT3DMS includes an implicit formulation that is solved with an efficient and versatile solver. The iterative solver is based on generalized conjugate gradient (GCG) methods with three preconditioning options and the Lanczos/ORTHOMIN acceleration scheme for non-symmetrical matrices. If the GCG solver is selected, dispersion, sink/source, and reaction terms are solved implicitly without any stability constraints. For the advection term, the user has the option to select any of the solution schemes available, including the standard finite-difference method, the particle tracking based Eulerian-Langrangian methods, and the third-order TVD method. The finite-difference method can be fully implicit without any stability constraint to limit transport step-size. The particle tracking based Eulerian-Langrangian methods and the third- order TVD method still have time step constraints associated with the particle tracking and TVD methodology. If the GCG solver is not selected, the explicit formulation is automatically used in MTDMS with the usual stability constraints. The explicit formulation is efficient for solving advection-dominated problems in which the transport step-sizes are restricted by accuracy considerations. It is also useful when the implicit solver requires a large number of iterations to converge or when the computer system does not have enough memory to use the implicit solver.



# ATTACHMENT K-4 Contaminant Fate and Transport Model Input Justification

**Contaminant Half-Life Estimations and Model Input** 

### **APPENDIXK**

This section discusses the calculation of the site-specific half-lives for contaminants of potential concern at FTP.

#### **DFFINITIONS:**

The following terms are used in the calculations below.

- $C_t$ Contaminant concentration at time (t) (µg/L)
- $C_0$ Contaminant concentration at time (0) ( $\mu$ g/L)
- Estimated first order decay constant (1 per day) k
- Time between samples (days)
- Target compound half-life (days)  $t_{0.5}$
- L Distance between wells (feet)
- Average linear groundwater flow velocity (ft/day)  $V_{gw}$
- $V_c$ Velocity of target compound in groundwater (ft/day)
- K Hydraulic conductivity based on aquifer tests (ft/day)
- Hydraulic gradient calculated water level data (feet per foot) i
- Effective porosity of aquifer based on geotechnical analysis η
- Target compound retardation factor in groundwater R
- Water-organic carbon partition coefficient of target compound in groundwater Koc (mL/g)
- Total organic carbon content of aquifer TOC
- Dry bulk density of the aquifer from geotechnical analysis ob

#### **DEGRADATION HALF-LIVES:**

From Graves (1995), target compound half-lives can be estimated using measured concentrations over time. Half-lives can be estimated using data from one monitoring well over time, or multiple wells (along the groundwater flow path in a single event), using the following equations.

$$C_t = C_0 \cdot e^{-k \cdot t}$$

#### **Solving for k gives:**

$$k = \frac{-\ln\left(\frac{C_t}{C_0}\right)}{t}$$

#### **Use k to calculate the degradation half-life:**

$$t_{0.5} = \frac{\ln(2)}{k}$$

#### For single wells:

at 
$$t = 0$$
 ( $C_0$ ) and  $t = t$  ( $C_t$ )

t = time between sample events

#### For multiple wells:

$$t = \frac{L}{\left(V_{c}\right)}$$

$$K \cdot i$$

$$V_c = \frac{\frac{K \cdot i}{\eta}}{R}$$

$$R = 1 + \frac{K_d \cdot \rho b}{\eta_e}$$

At the FTP, wells JAW-58, JAW-59, JAW-60, JAW-80, FTA-99-1, SA-99-1 were used for this analysis. Selection of these wells were based on:

- These wells were the only wells at FTP that were installed before the FTP, EBP, and WBPA FS data collections with contaminants currently (Spring 2003) detected above the IAAAP regulatory standards.
- There have been a sufficient number of sampling events to demonstrate an overall decline in contaminant concentrations over time.

Additionally, the wells used have not demonstrated a large transport distance, therefore the single well over-time method was used. The multiple well method was not used because of the limited transport of the plumes.

Supporting target compound concentration data and concentration versus time plots are included on the attached table.

#### **REFERENCES:**

Graves, D. Test Protocols for Evaluating Natural Attenuation in Groundwater. Biotechnologies Applications Center. Knoxville, Tennessee. August.

### ATTACHMENT K-4 HALF-LIFE ESTIMATES OVER TIME SINGLE WELL METHOD (GRAVES 1995)

#### FIRE TRAINING PIT GROUNDWATER MODELING

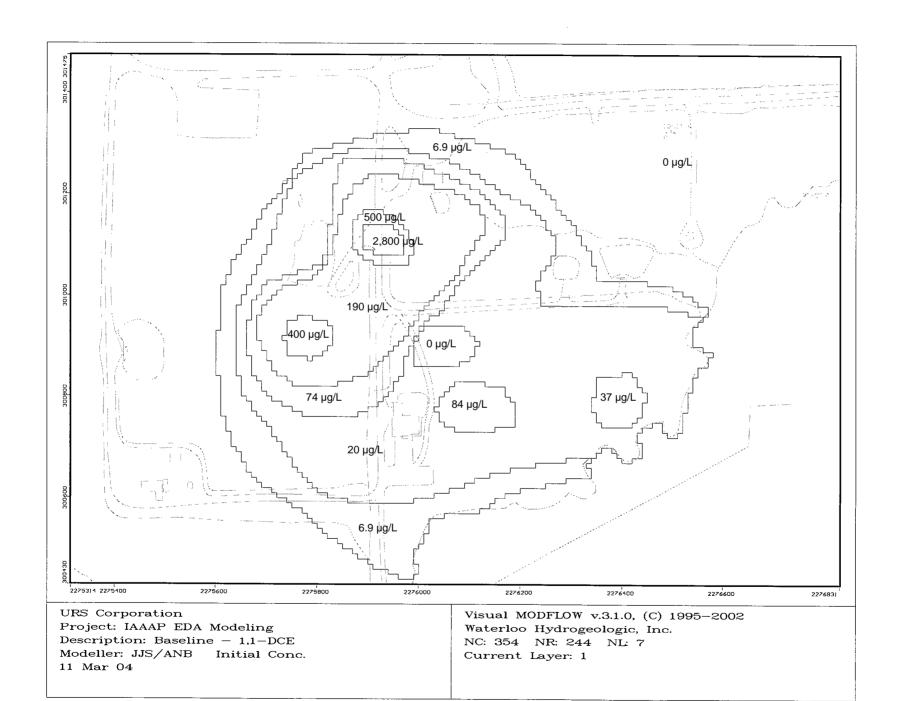
	Initial	Initial	Ending	Ending	Elapsed		
	Concentration	Concentration	Concentration	Concentration	Time	<b>Rate Constant</b>	Half-life
	$\mathbf{C_0}$	Sampling	$\mathbf{C_t}$	Sampling	t	k	$t_{1/2}$
Well	<b>(n</b> g/L)	Event	<b>(n</b> g/L)	Event	(years)	(1/year)	(years)
Benzene							
JAW 60	32	Fall 2000	11	Spring 2003	2.5	0.43	1.6
SA-99-1	250	Fall 2000	110	Spring 2003	2.5	0.33	2.1
						Average	1.9
Chloroetha							
SA-99-1	4,500	Fall 2000	3,700	Spring 2003	2.5	0.08	8.9
<u>PCE</u>							
JAW-59	11	Fall 2000	5	Spring 2003	2.5	0.32	2.20
SA-99-1	14	Spring 2001	3	Spring 2003	2	0.77	0.90
						Average	1.55
<u>TCE</u>					_		
JAW-60	94	Spring 2001	74	Spring 2003	2	0.12	5.8
JAW-80	9	Spring 2001	2	Spring 2003	2	0.75	0.9
FTA-99-1	9	Spring 2000	7	Spring 2003	3	0.08	8.3
SA-99-1	96	Fall 2000	3	Spring 2003	2.5	1.39	0.5
						Average	3.9
1,1-DCE	0.50	<b>a</b> : 1005	0.4	g : 2002	_	0.24	
JAW 58	860	Spring 1996	81	Spring 2003	7	0.34	2.1
JAW 80	150	Spring 2001	17	Spring 2003	2	1.09	0.6
SA-99-1	930	Fall 2000	28	Spring 2003	2.5	1.40	0.5
WC						Average	1.1
VC	3	Ci 2002	1 5	S	1	0.60	1.00
JAW-60		Spring 2002	1.5	Spring 2003	1	0.69	1.00
SA-99-1	10	Fall 2000	390	Spring 2002	1.5	-2.44	-0.28
SA-99-1	390	Spring 2002	360	Spring 2003	1	0.08	8.66
DDV						Average	3.13
RDX	0	Ci 2002	6.0	G	1	0.27	2.6
FTA-99-1	9	Spring 2002	6.9	Spring 2003	1	0.27	2.6

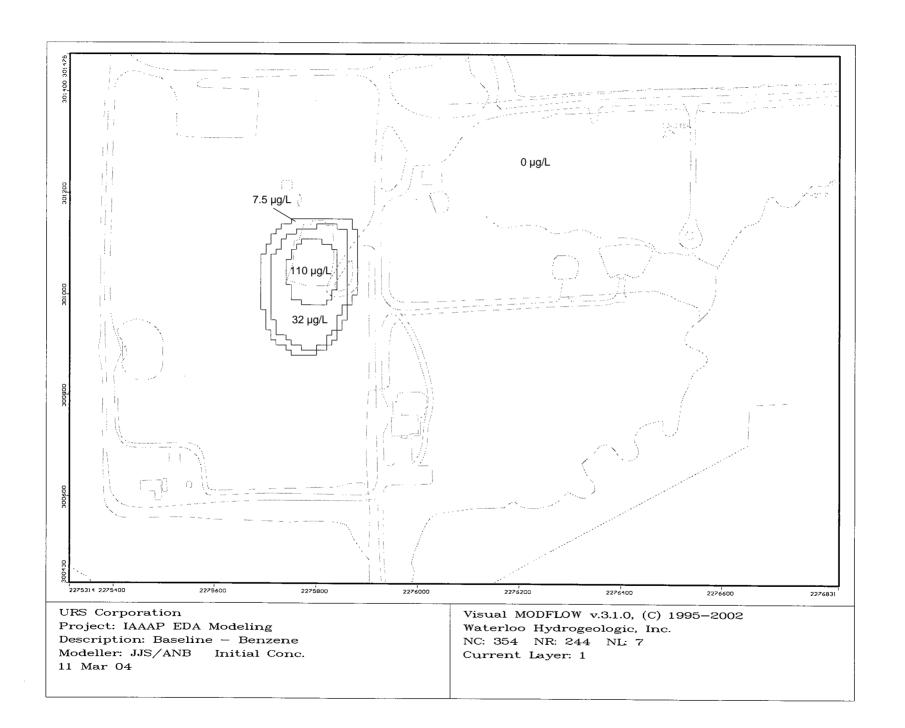
Notes:  $k=-ln(C_0/C_t)/t$  $t_{1/2}=ln(2)/k$ 

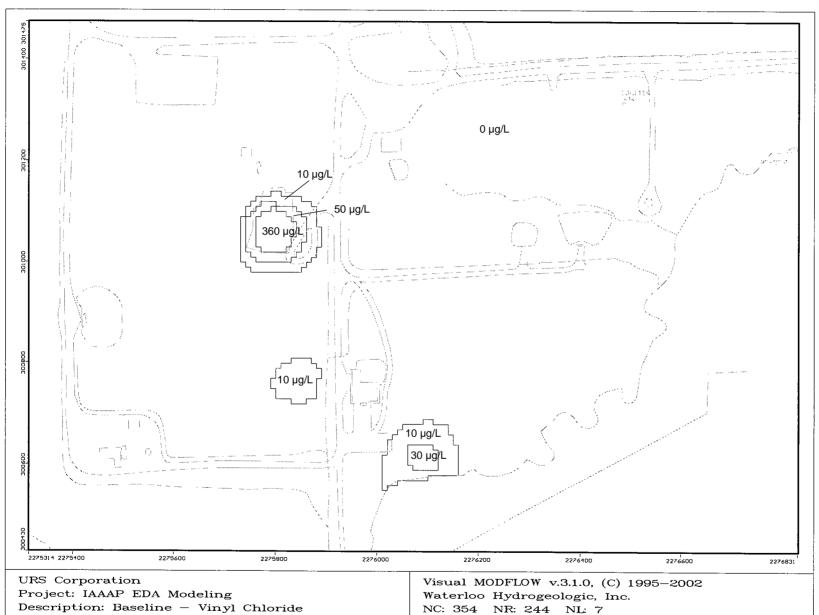


# ATTACHMENT K-4 Contaminant Fate and Transport Model Input Justification

**Initial Target Compound Concentrations Input** 

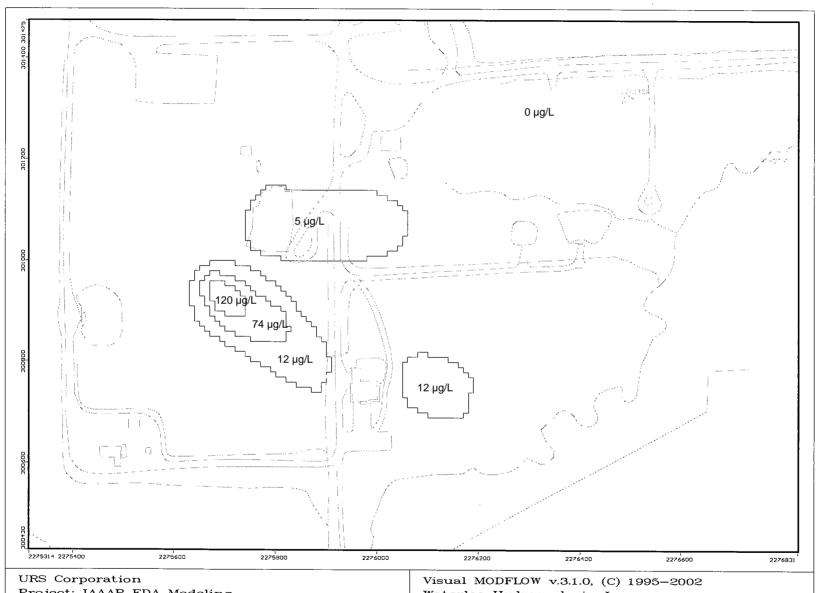






Modeller: JJS/ANB Initial Conc.

11 Mar 04



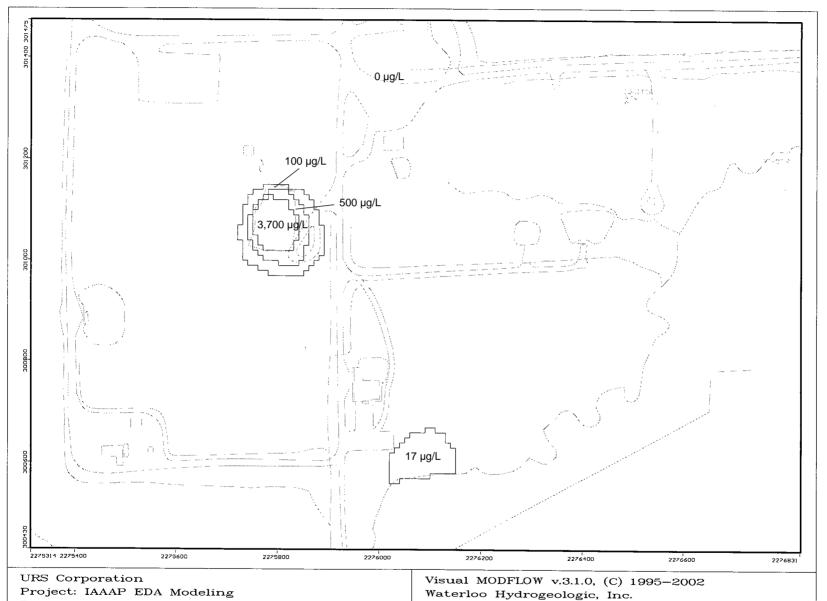
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Modeller: JJS/ANB Initial Conc.

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Waterloo Hydrogeologic, Inc.

NC: 354 NR: 244 NL: 7



Description: Baseline - Chloroethane

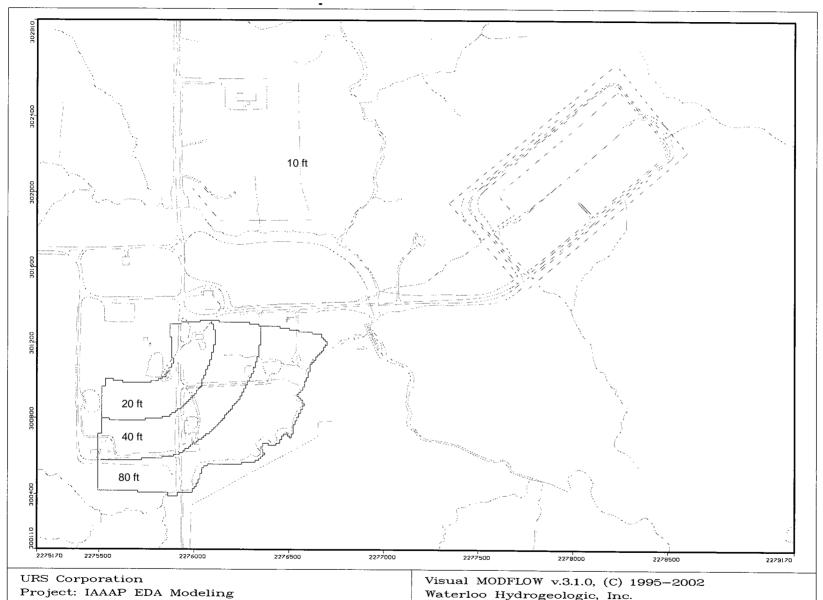
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NC: 354 NR: 244 NL: 7

# ATTACHMENT K-4 Contaminant Fate and Transport Model Input Justification

**Dispersivity Input** 

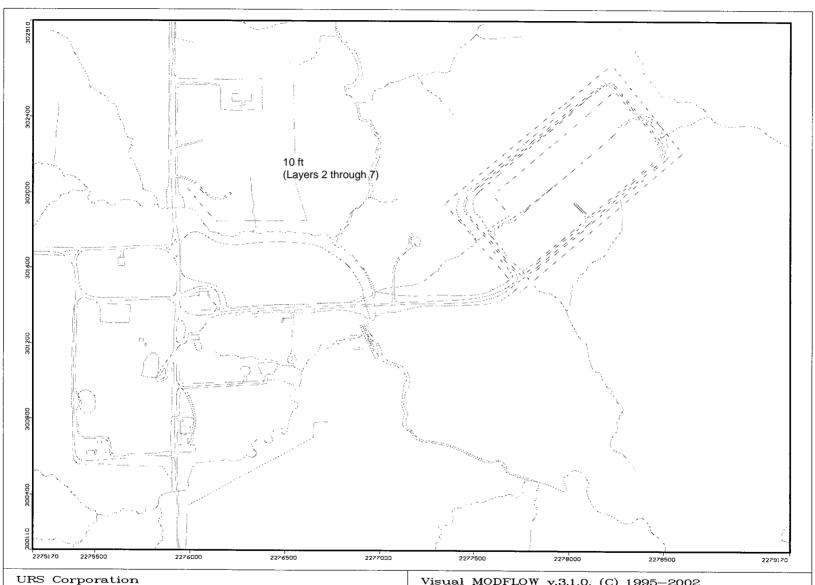


Description: Baseline - Dispersivity

Modeller: JJS/ANB

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NC: 354 NR: 244 NL: 7



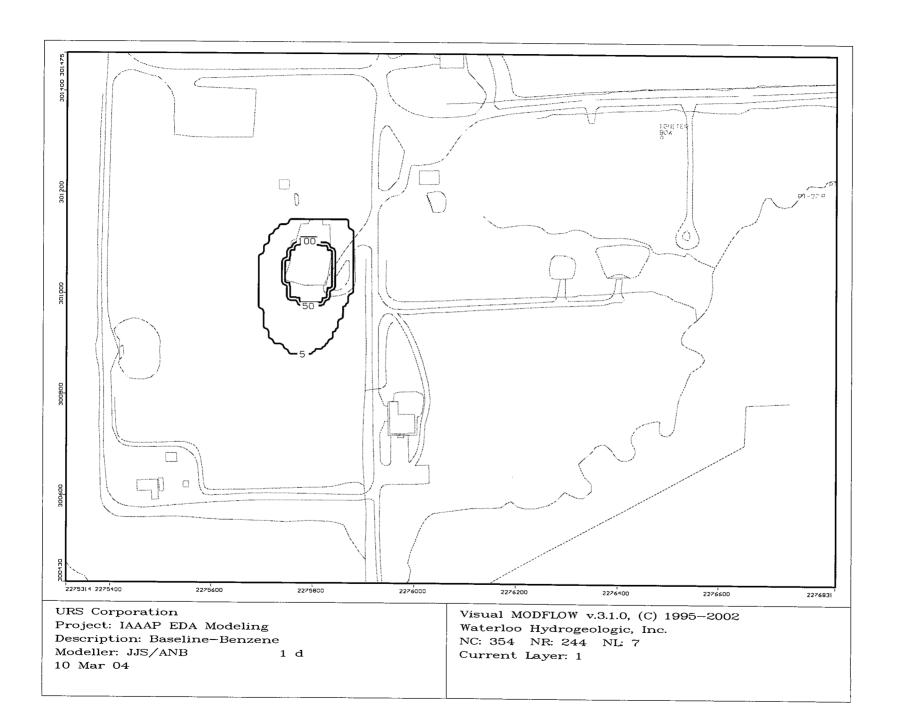
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline — Dispersivity
Modeller: JJS/ANB Layers 2 thru' 7
11 Mar 04

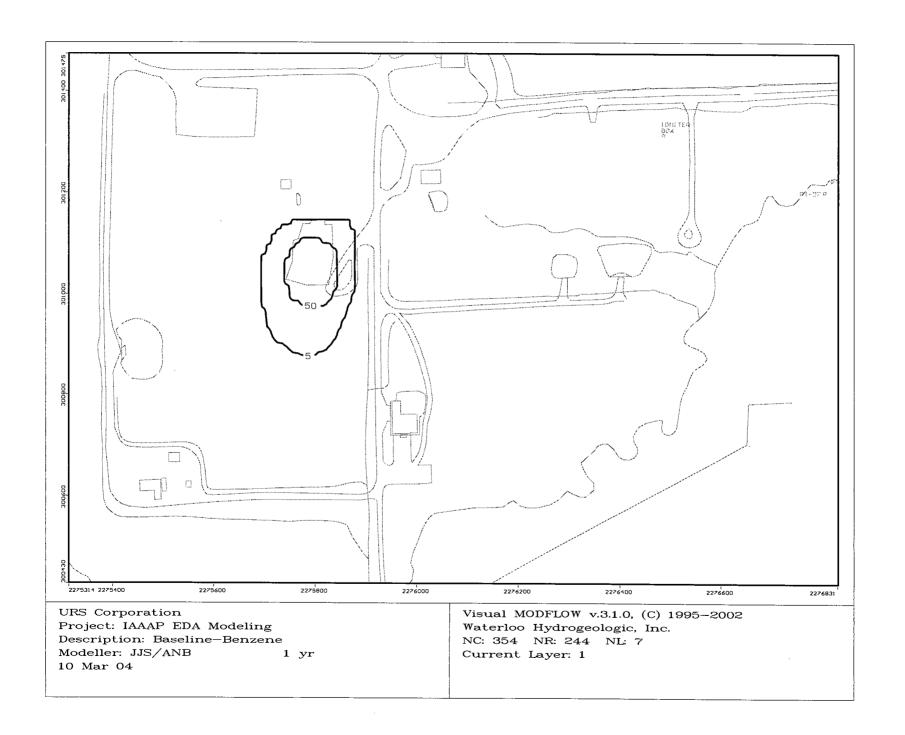
Visual MODFLOW v.3.1.0, (C) 1995-2002 Waterloo Hydrogeologic, Inc. NC: 354 NR: 244 NL: 7

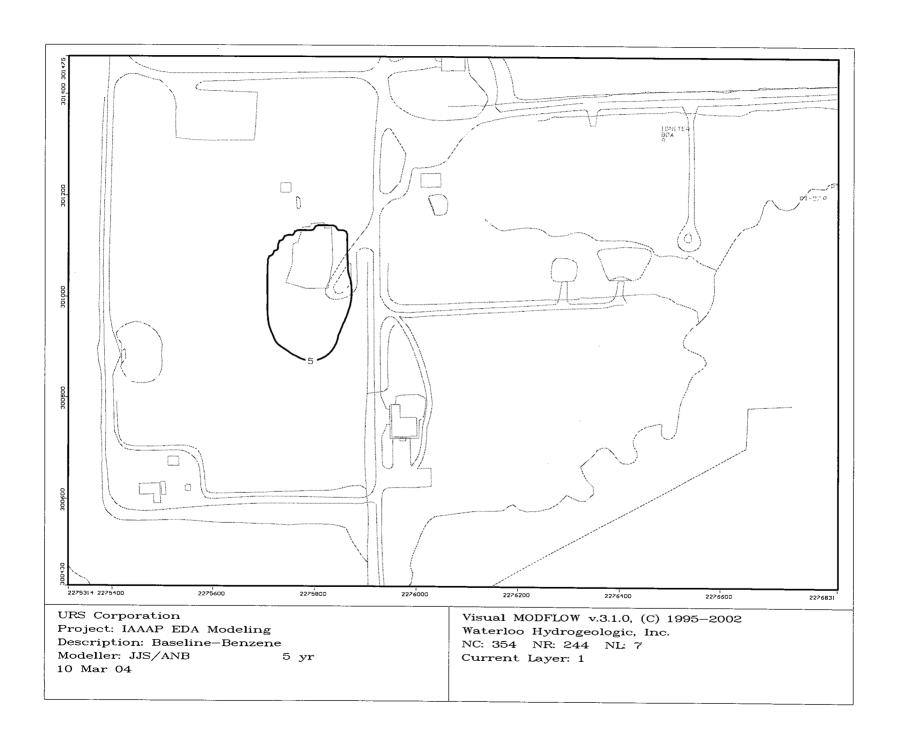


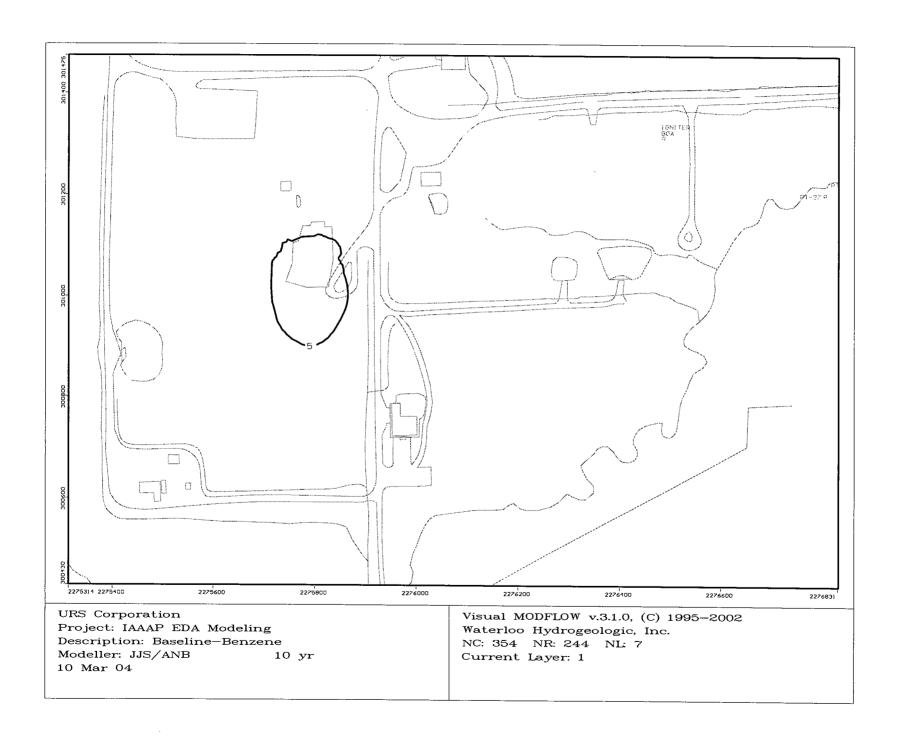
# ATTACHMENT K-5 Contaminant Fate and Transport Modeling Results

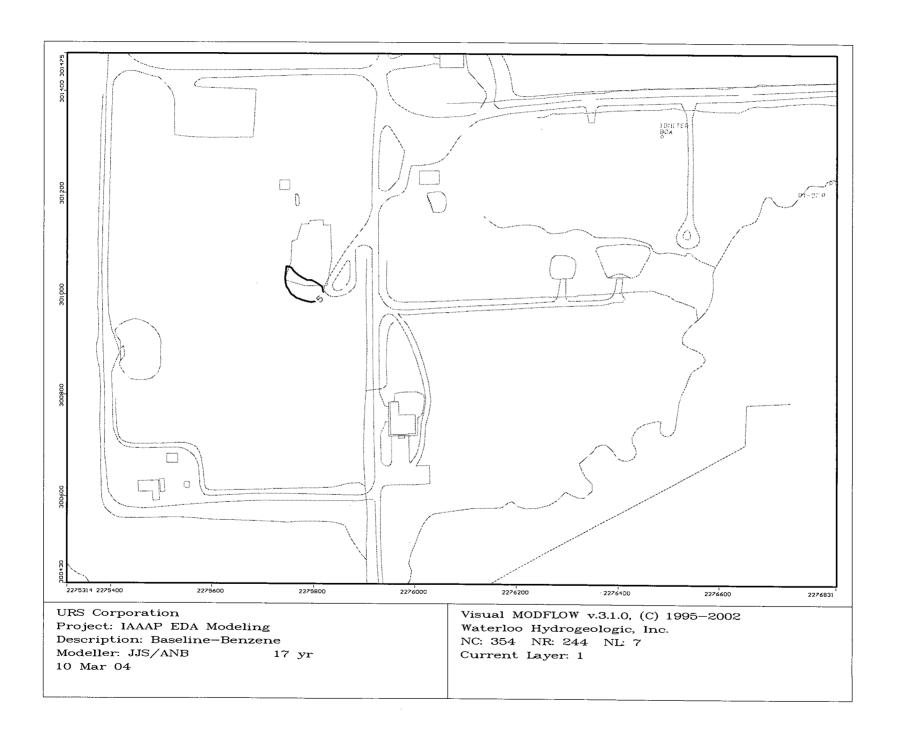
**Baseline Fate and Transport Model** 

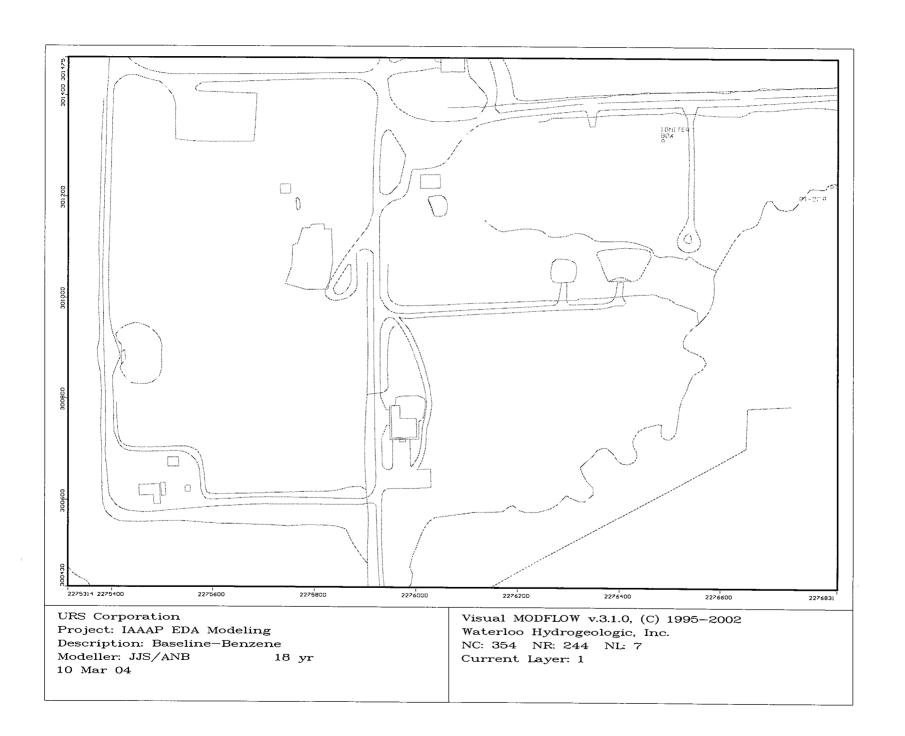


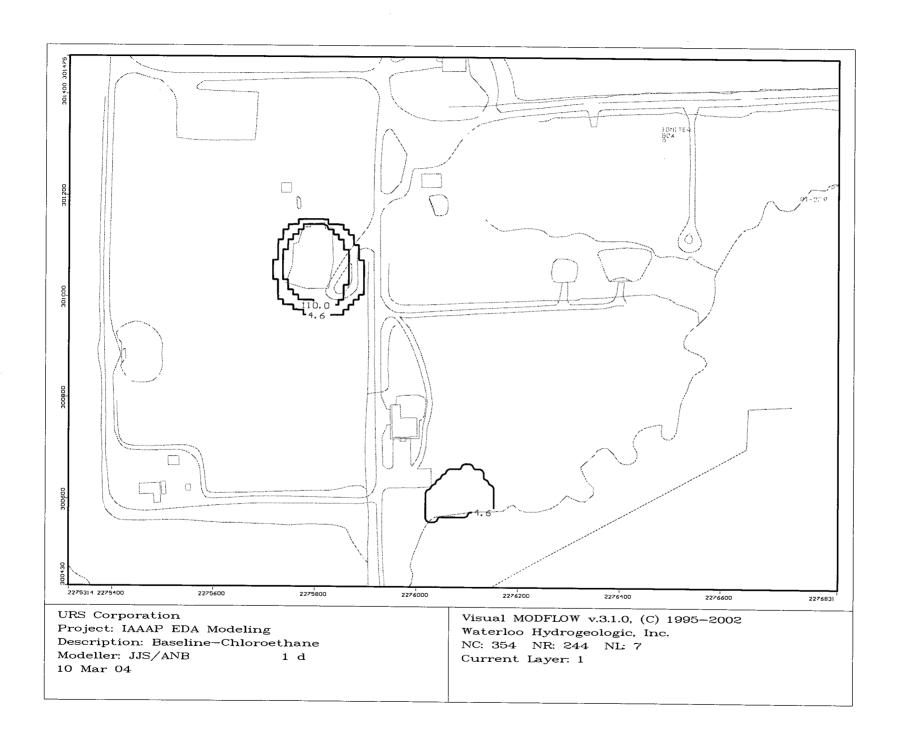


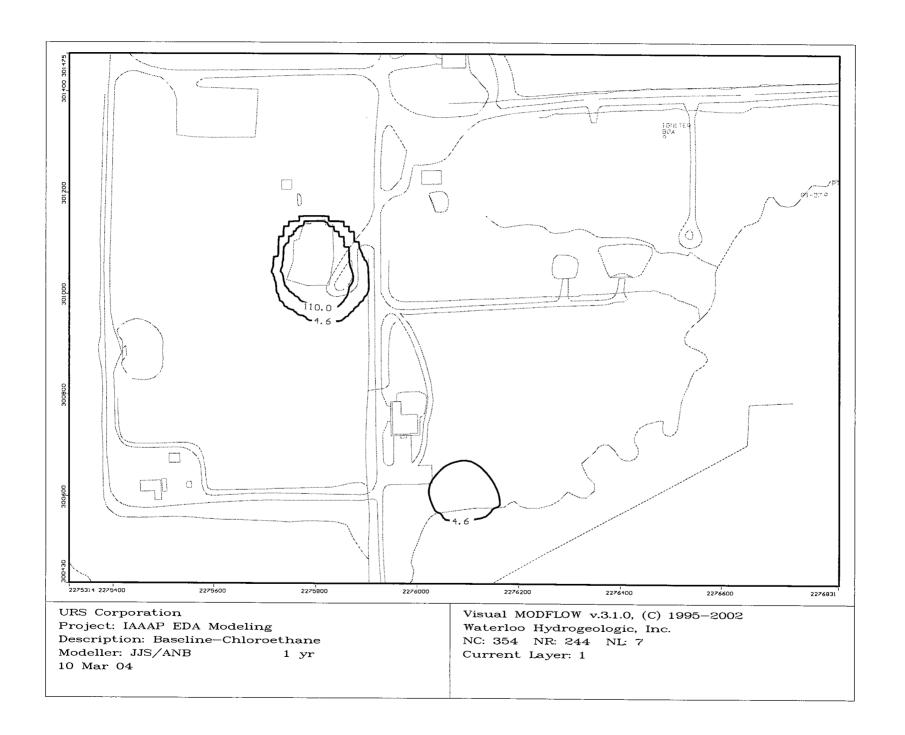


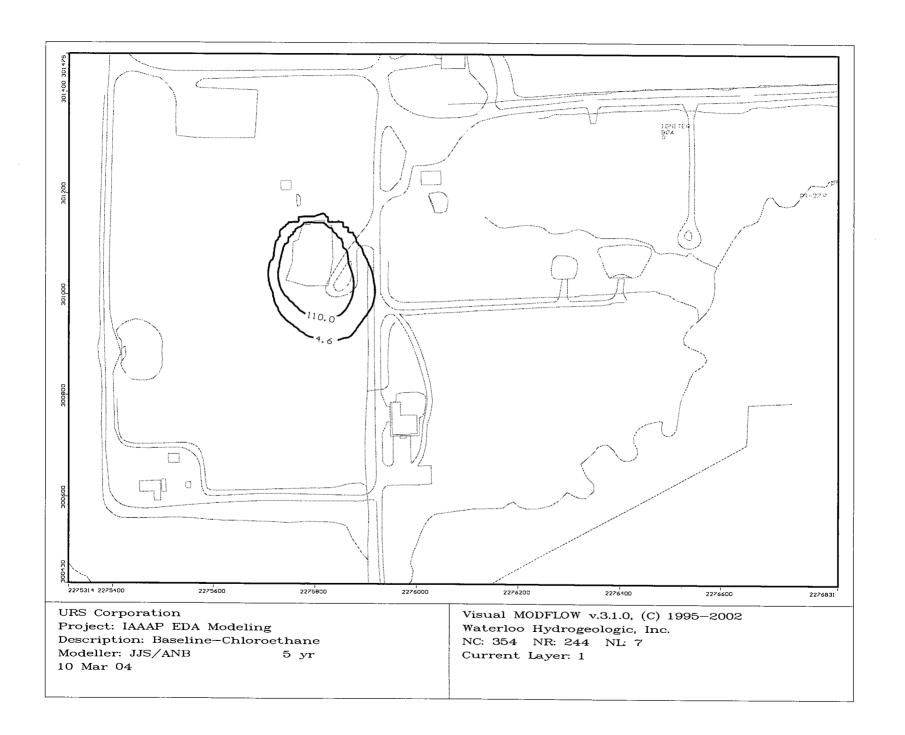


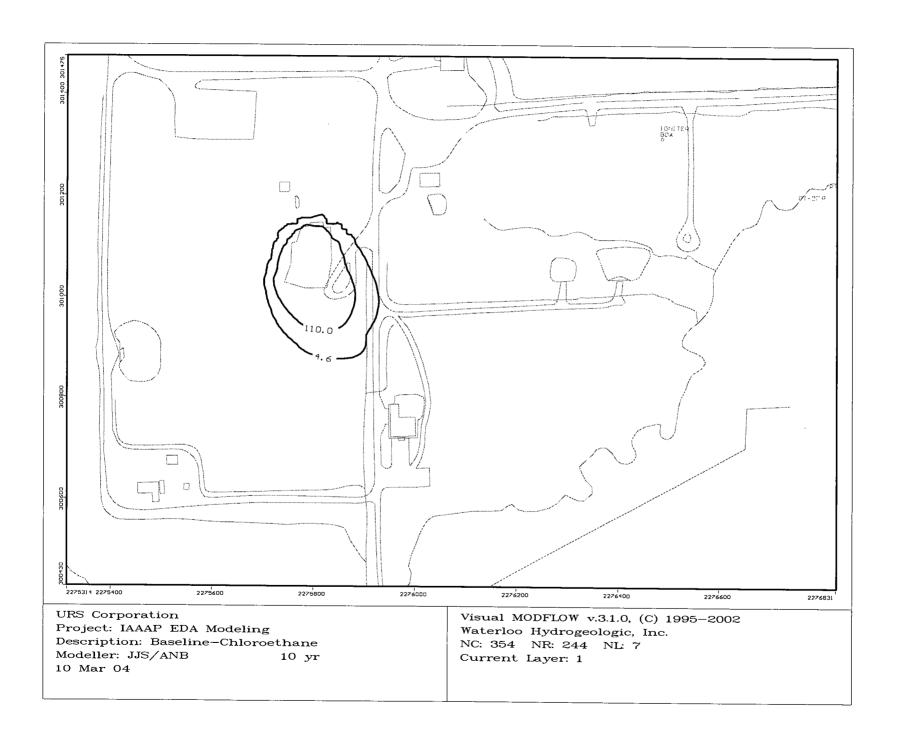


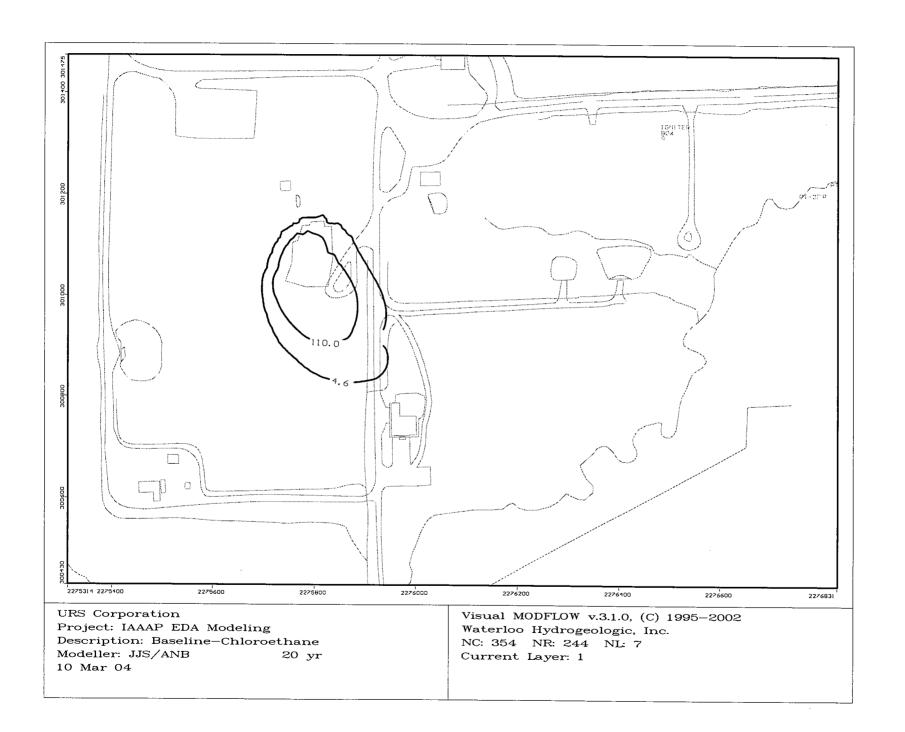


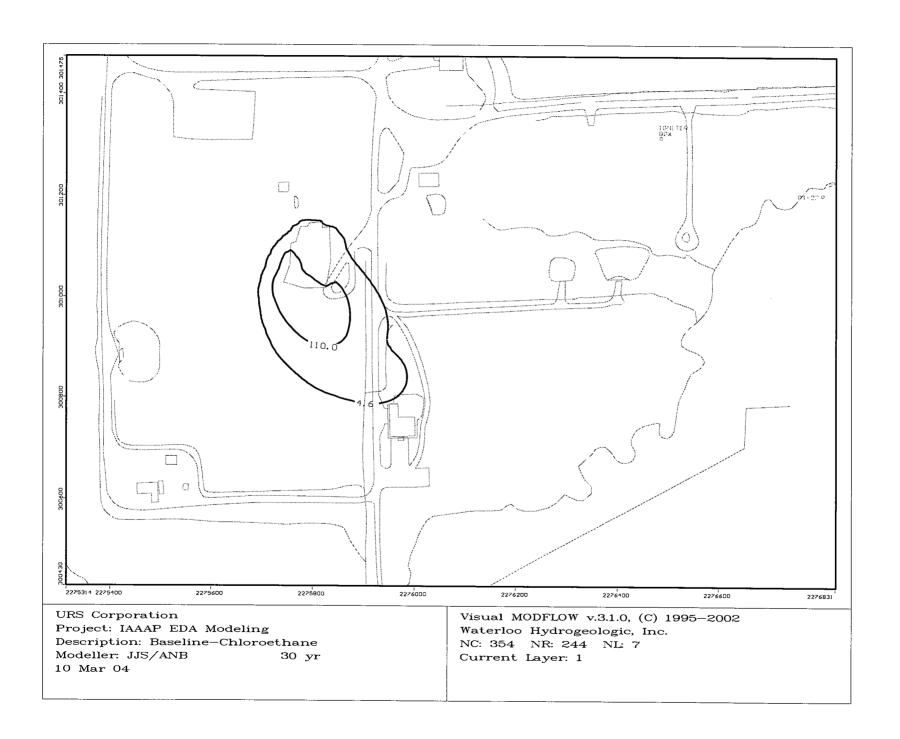


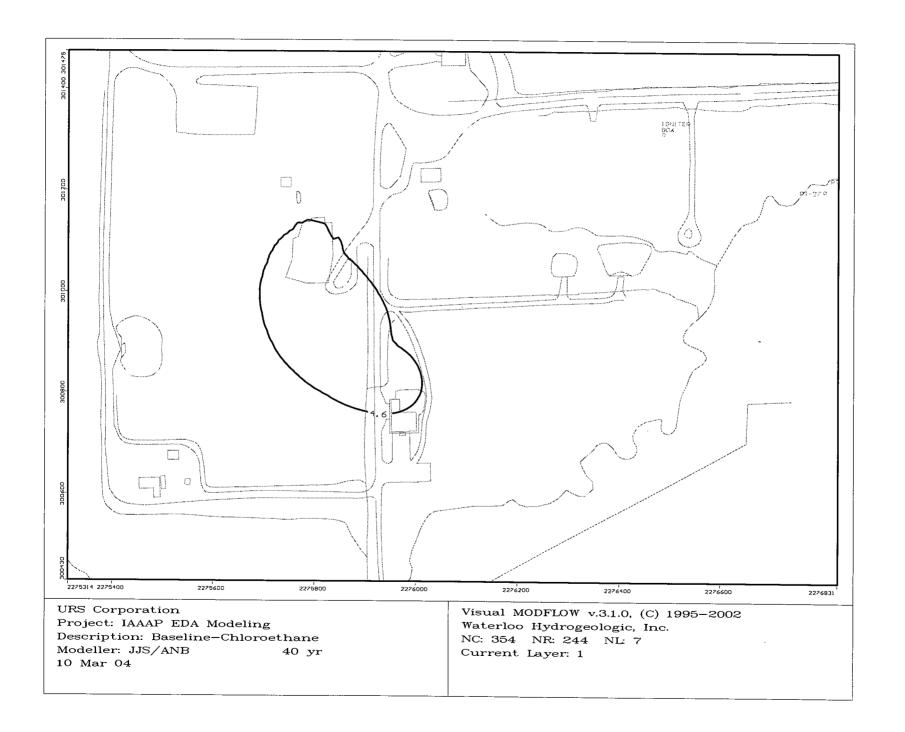


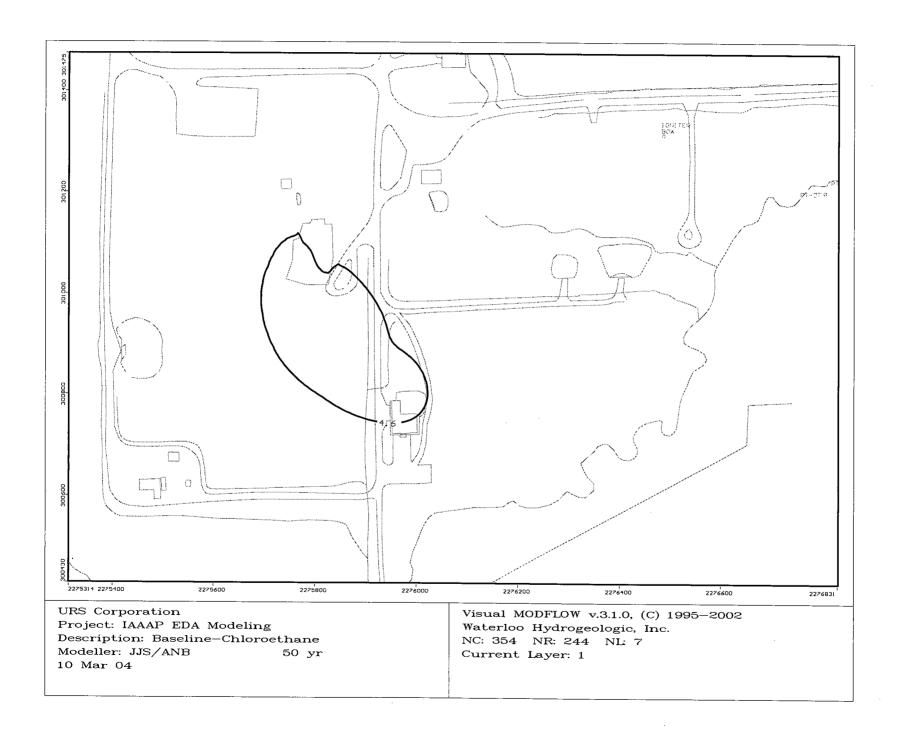


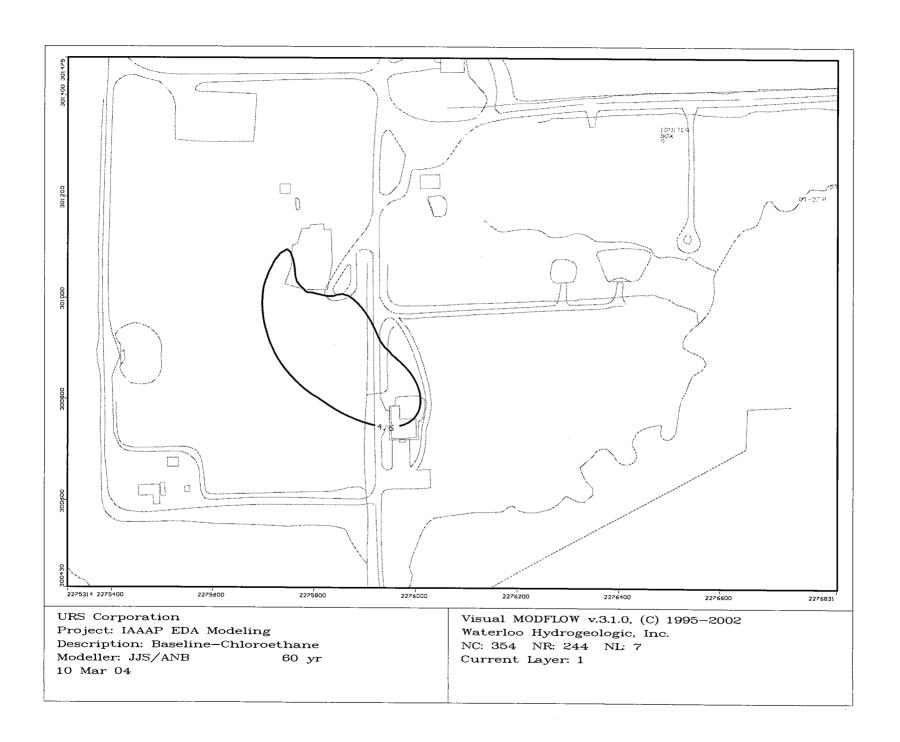


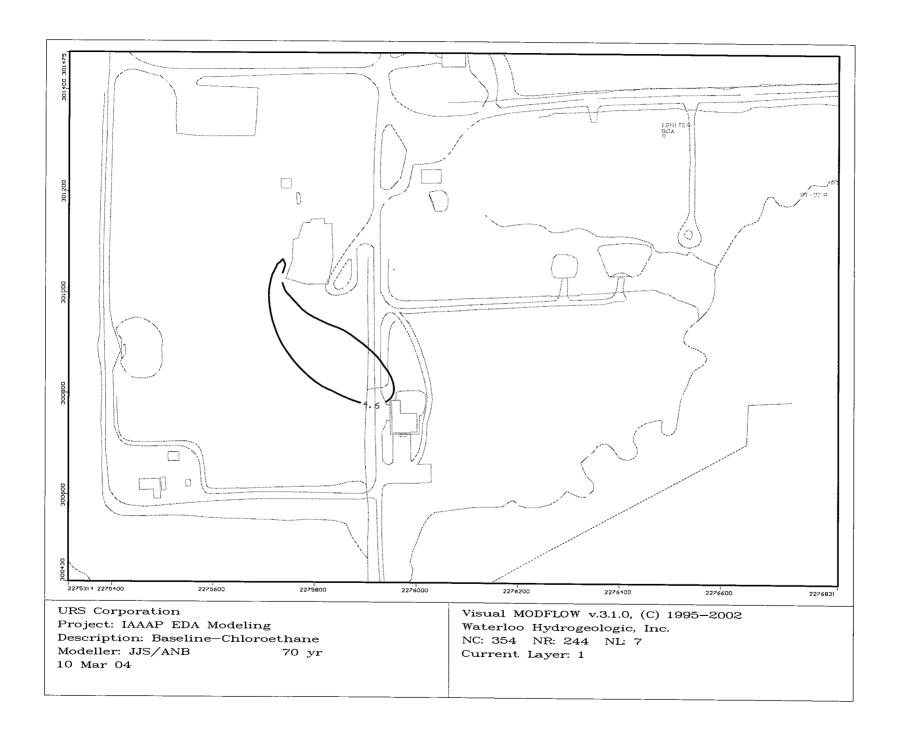


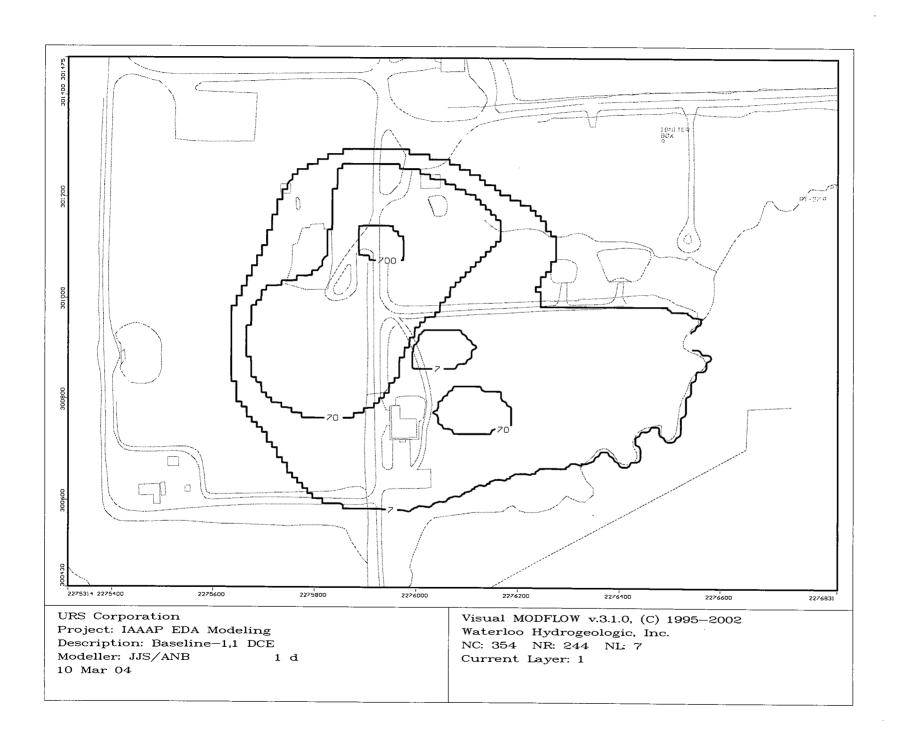


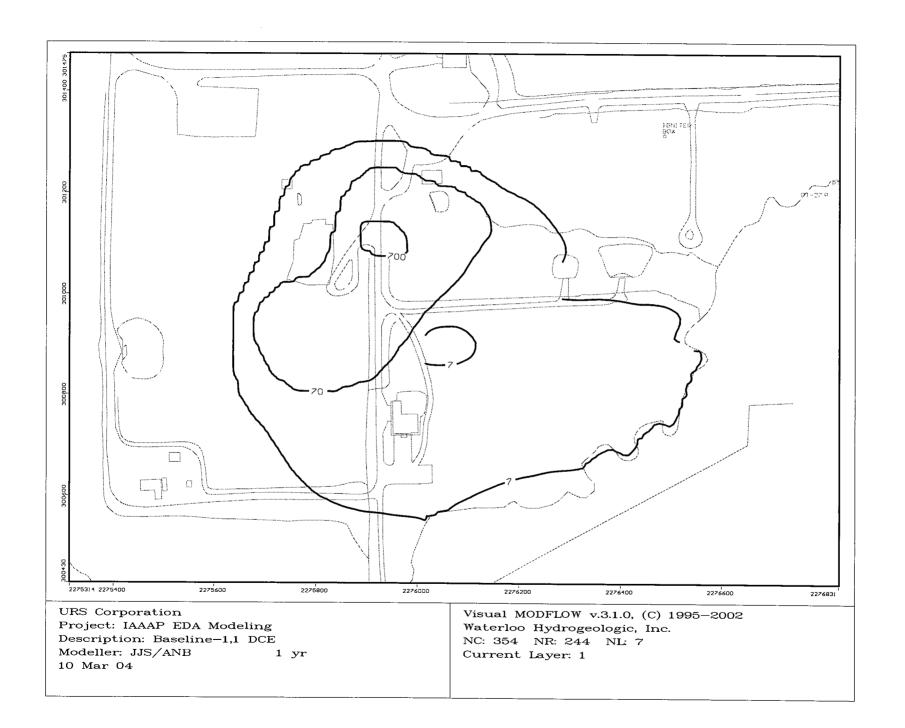


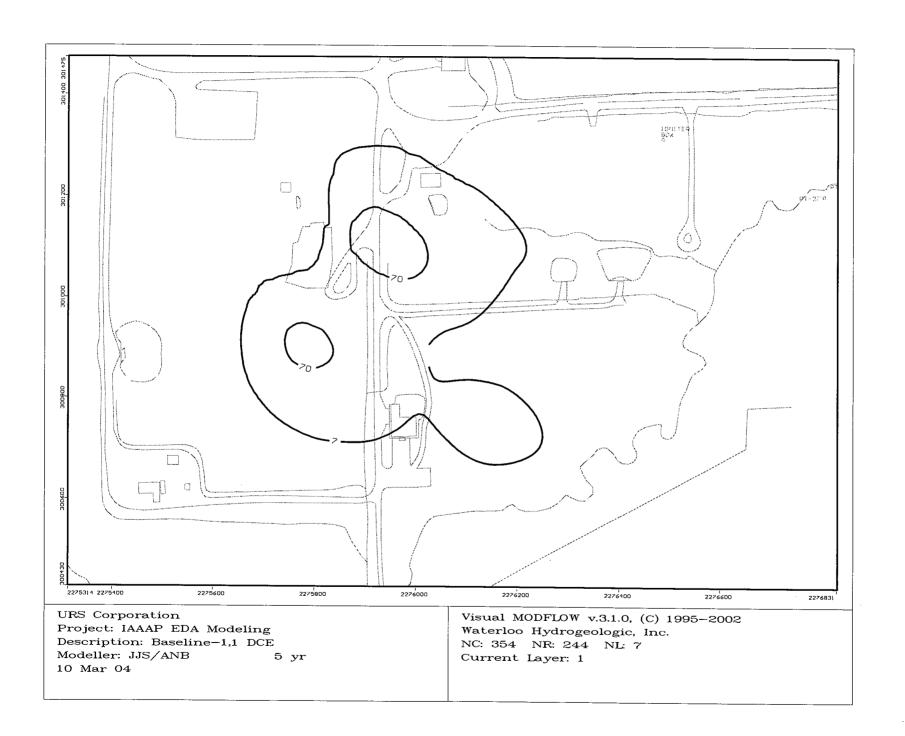


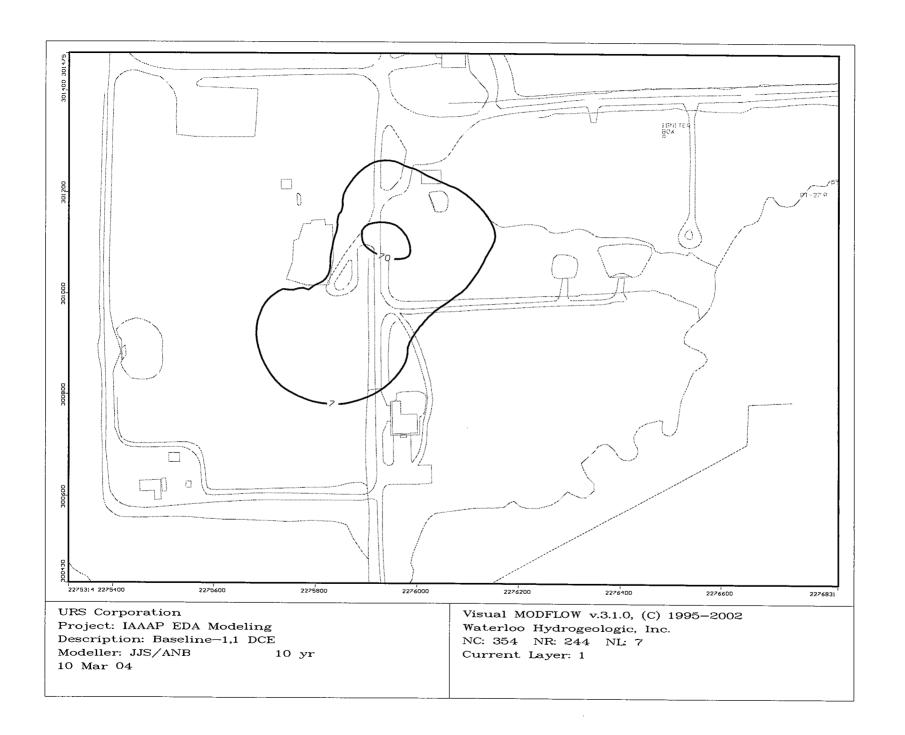


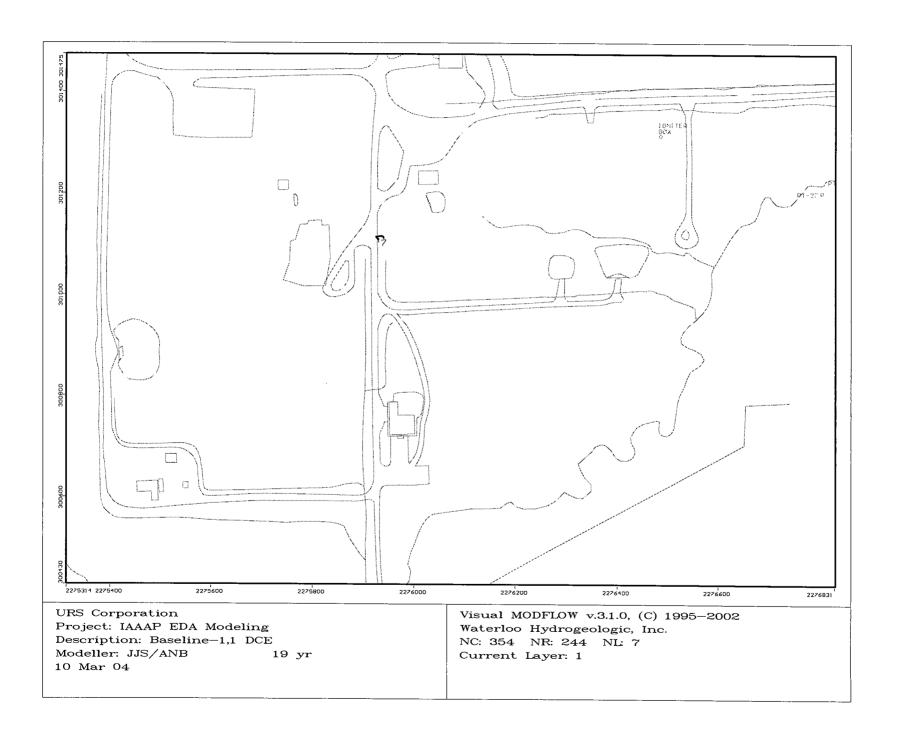


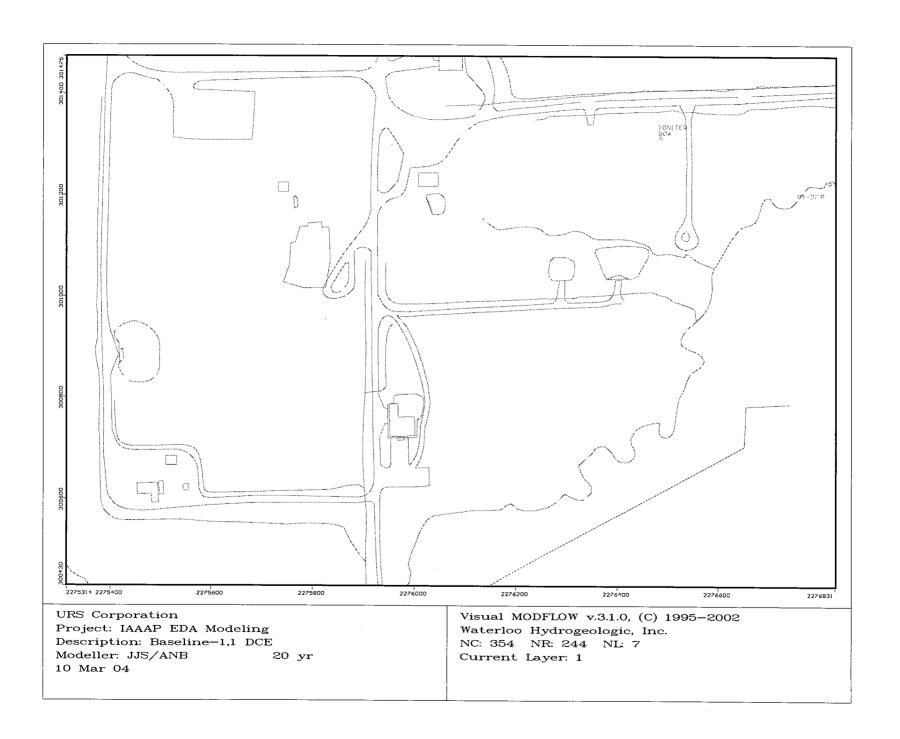


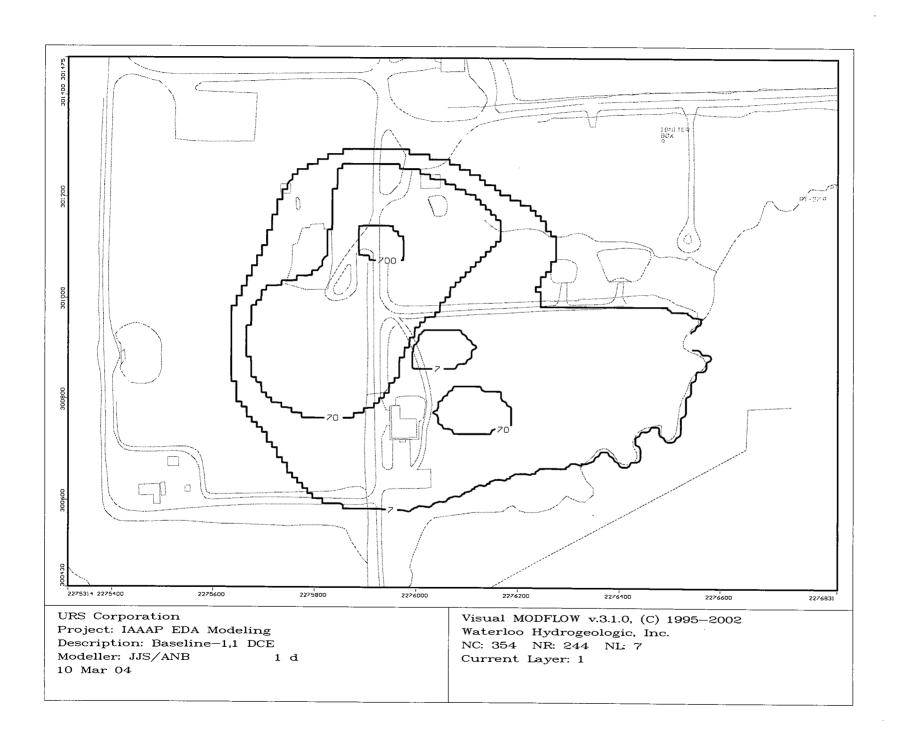


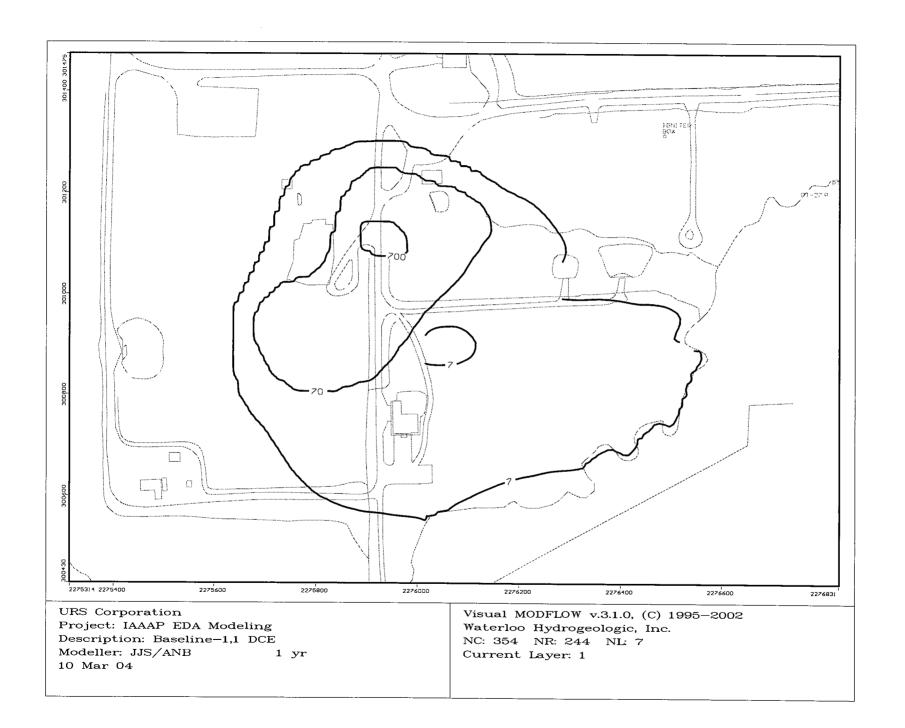


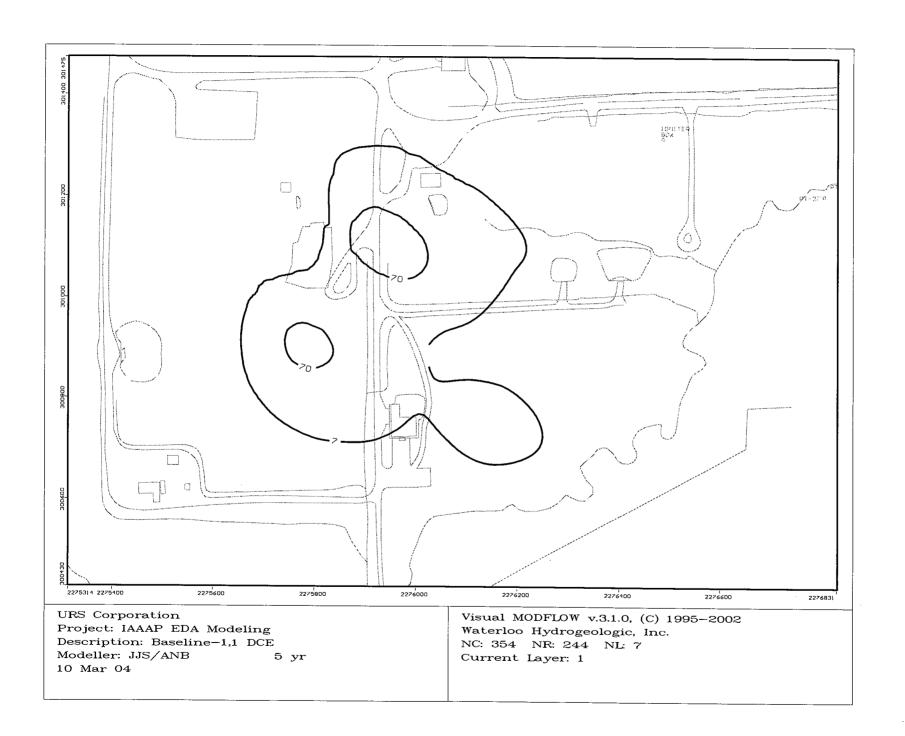


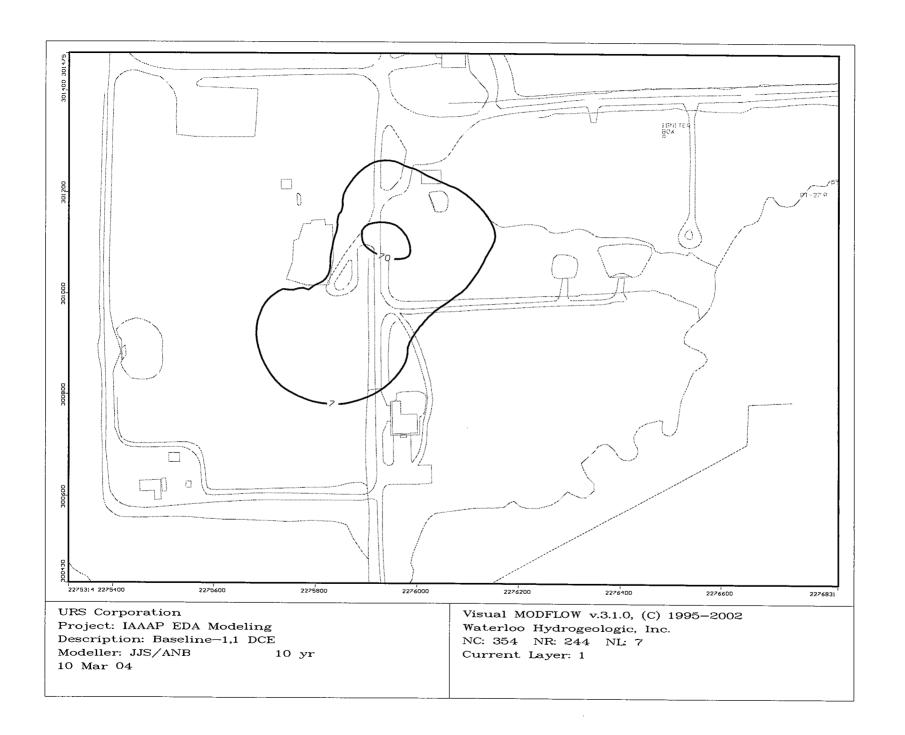


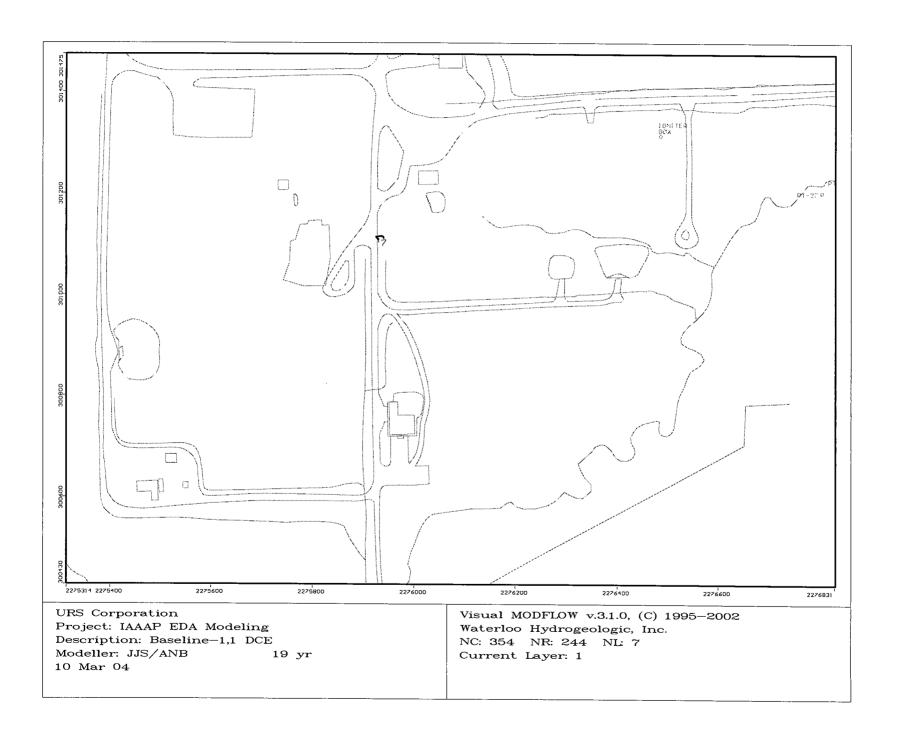


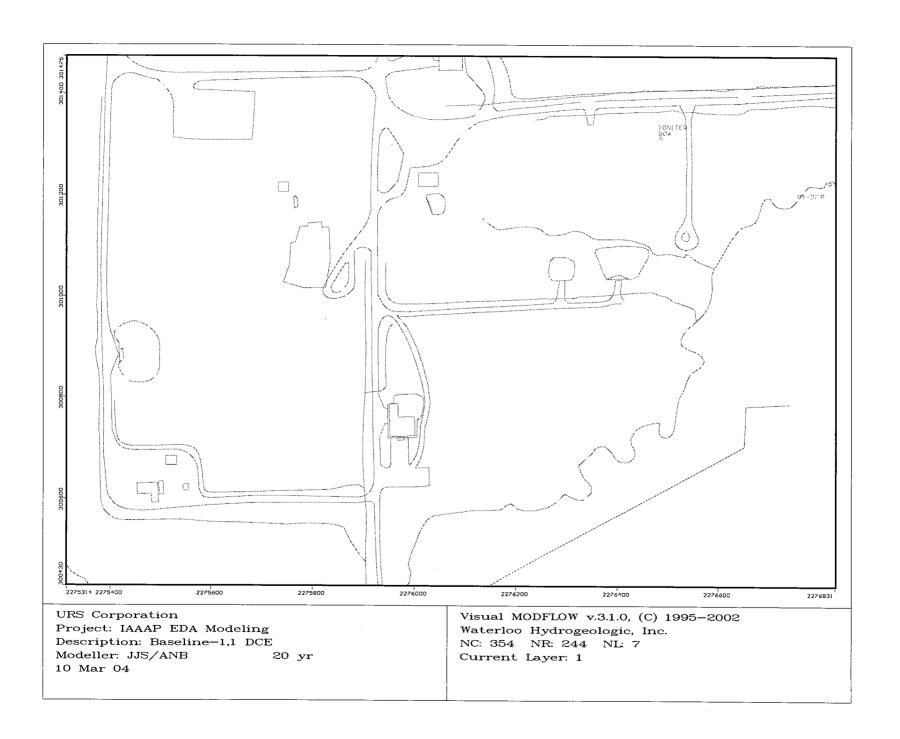


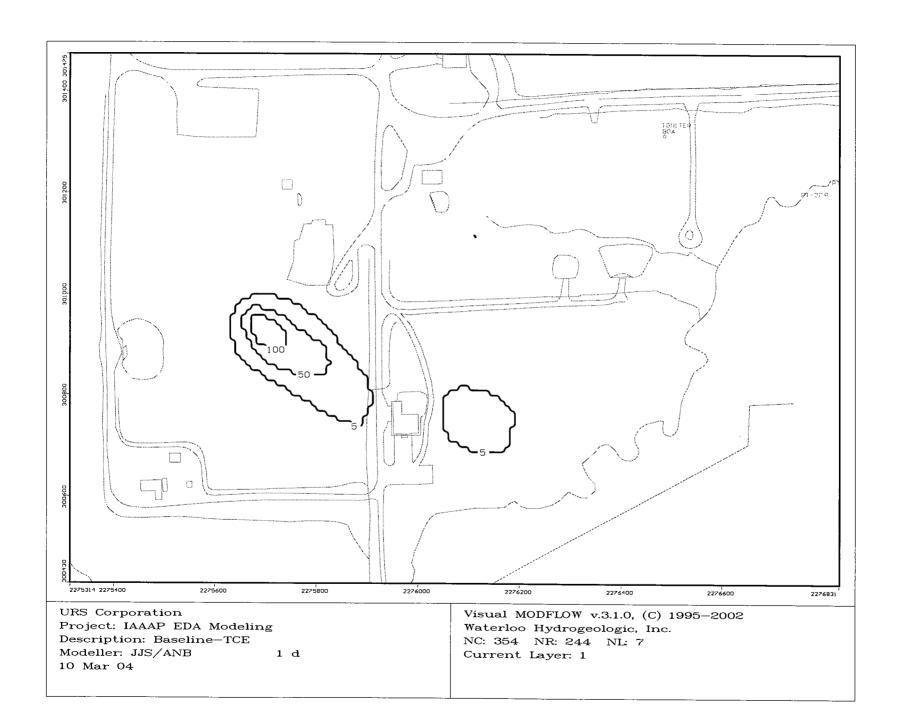


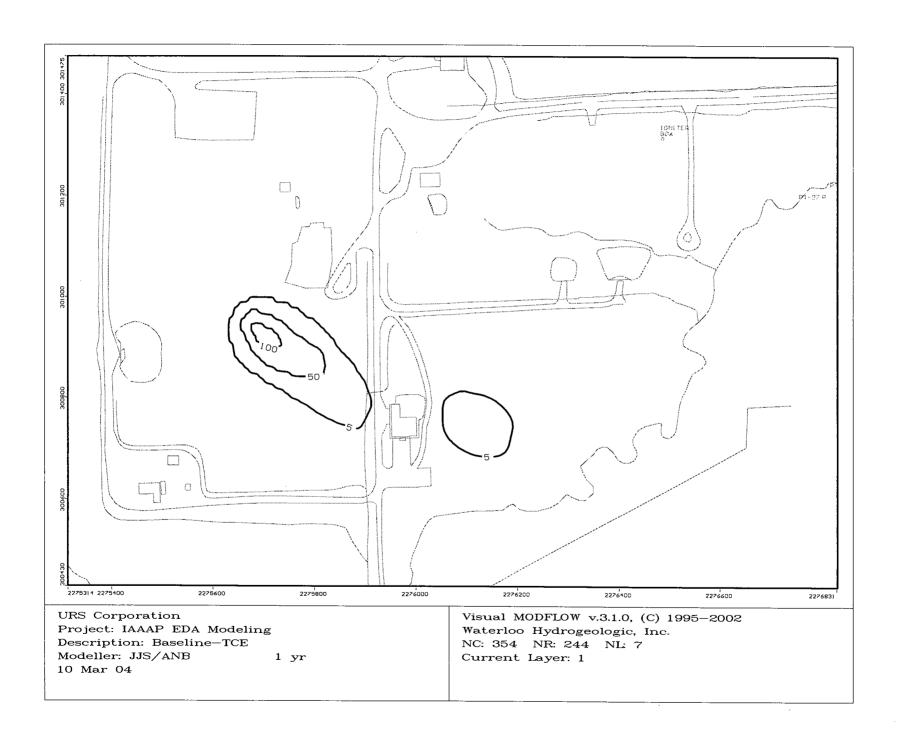


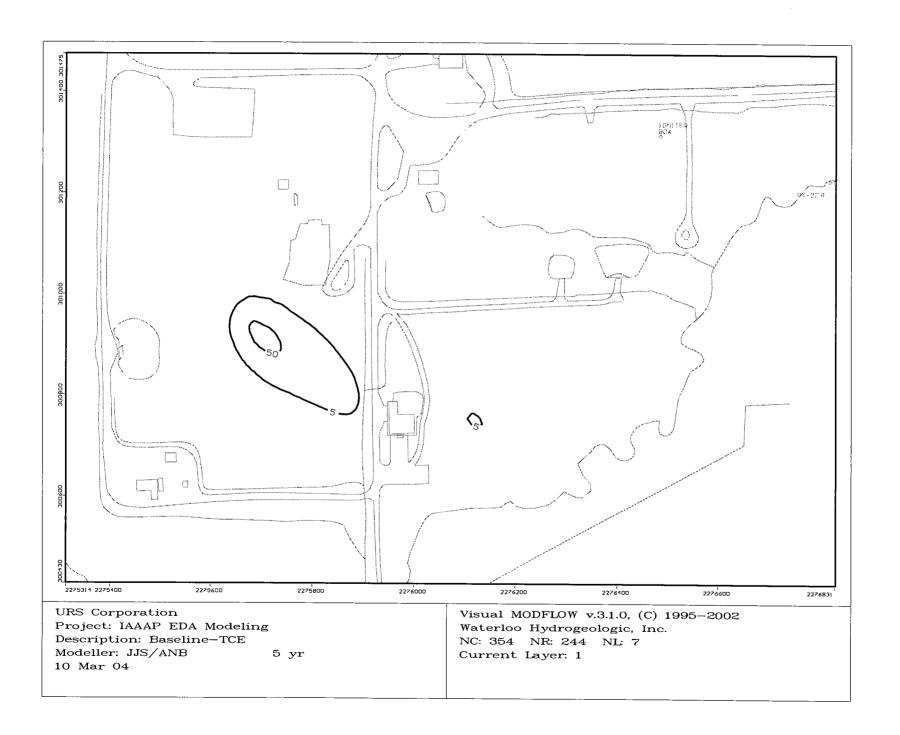


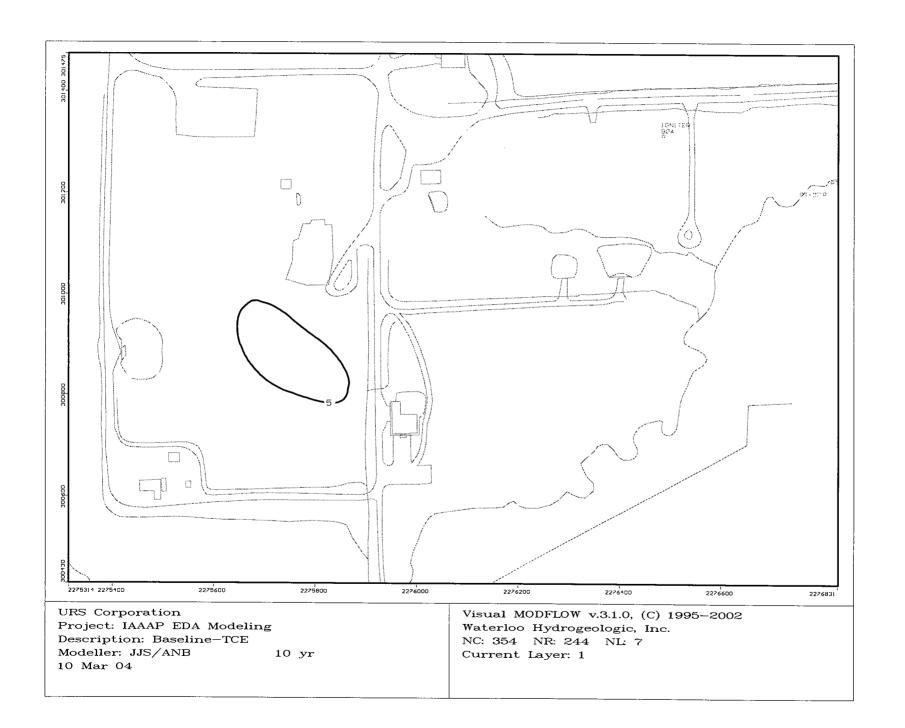


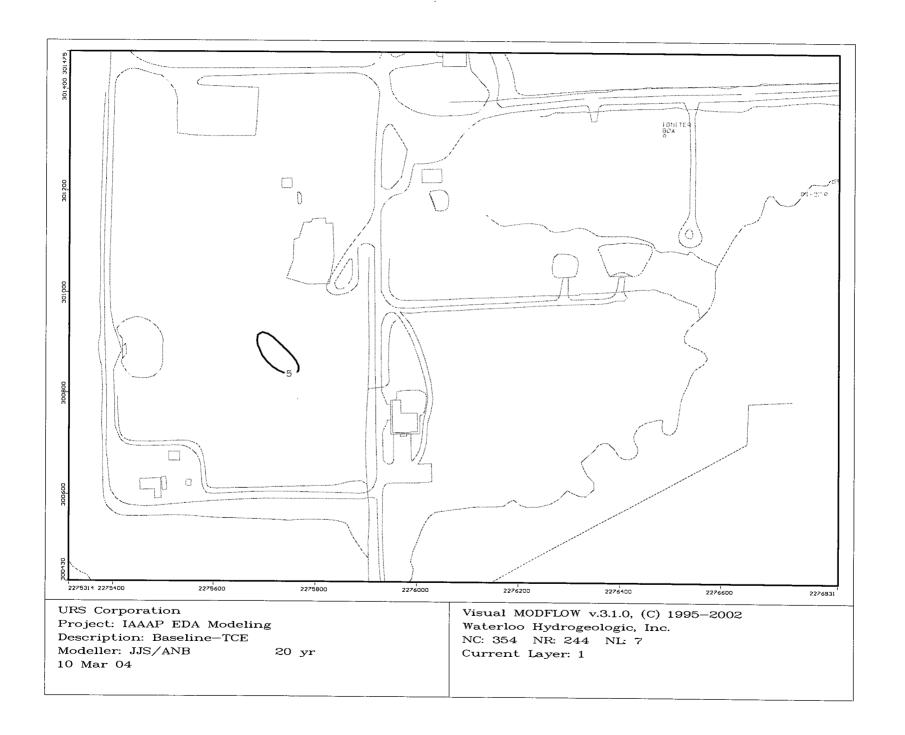


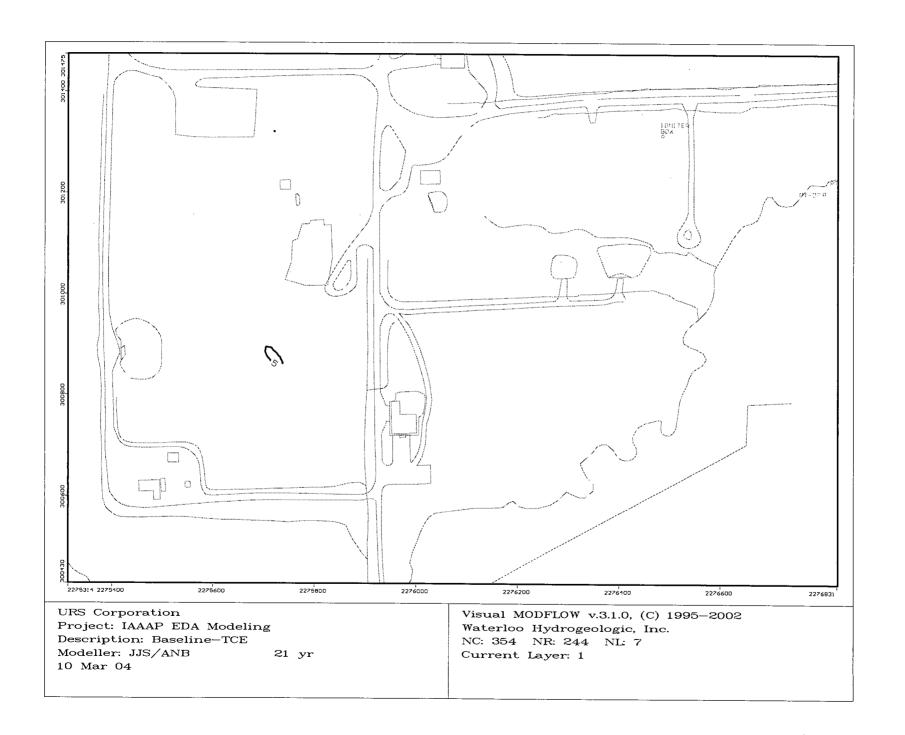


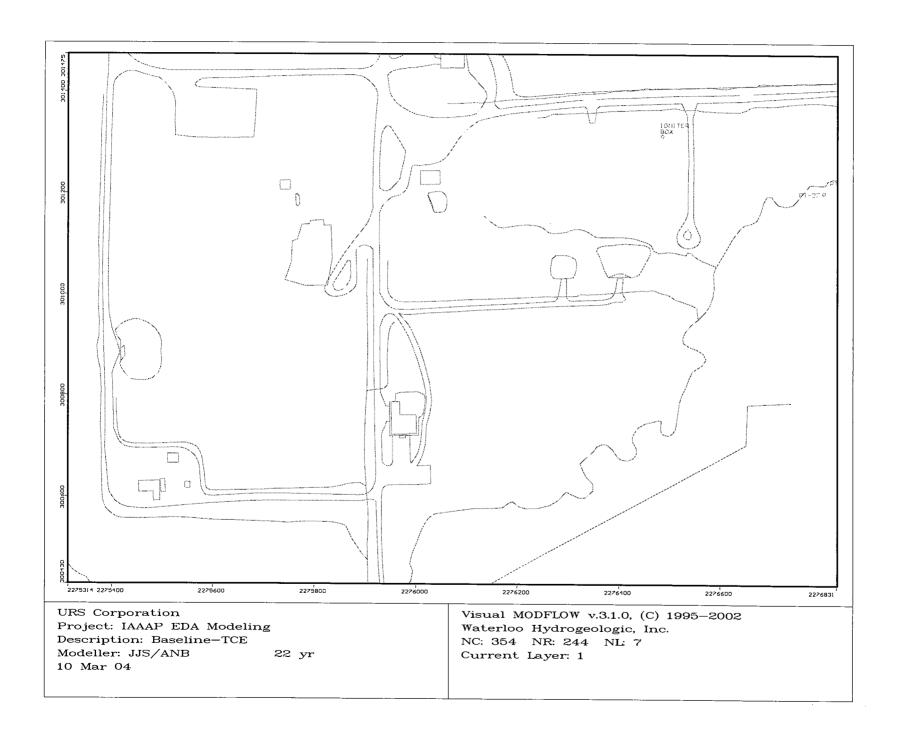


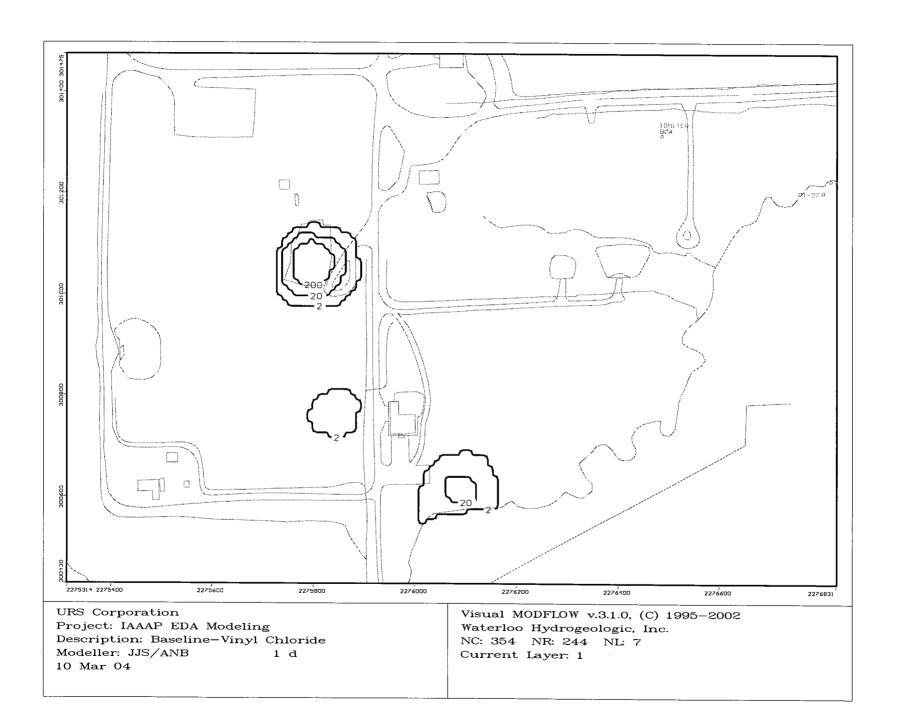


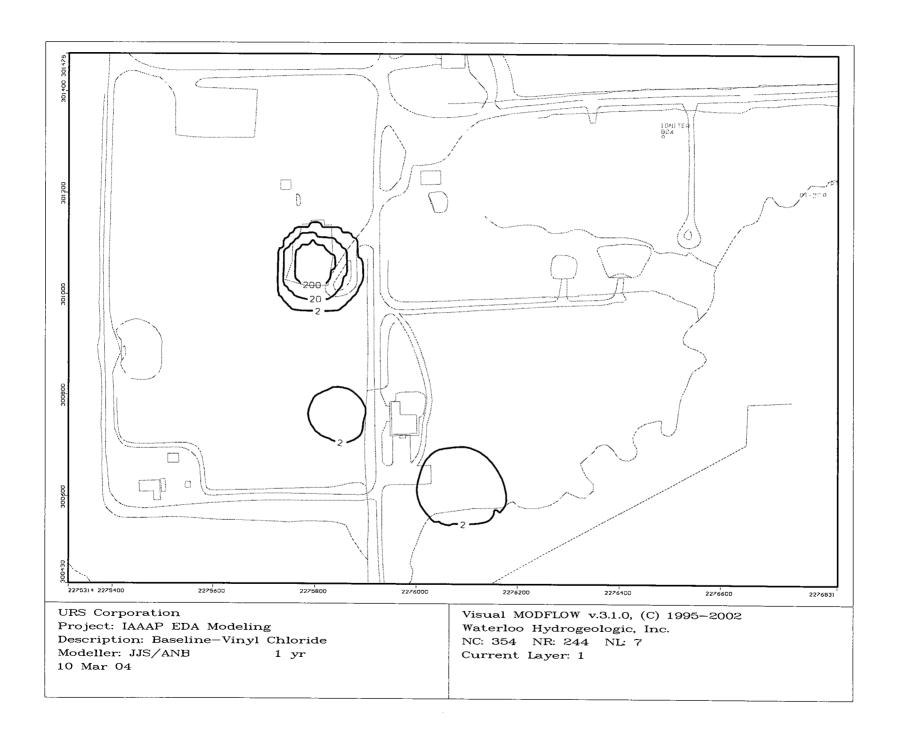


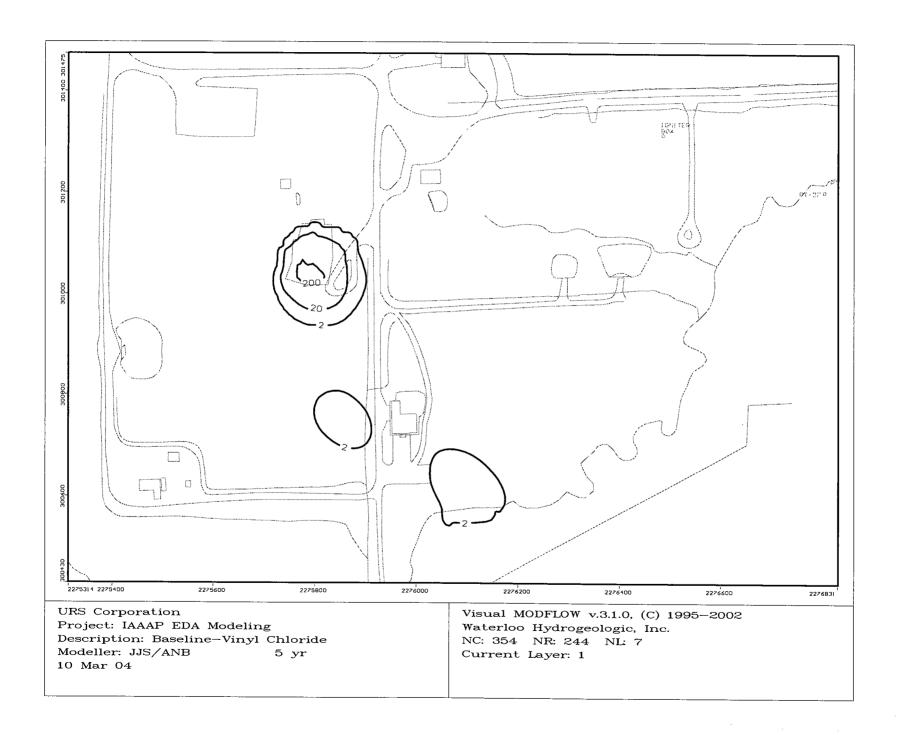


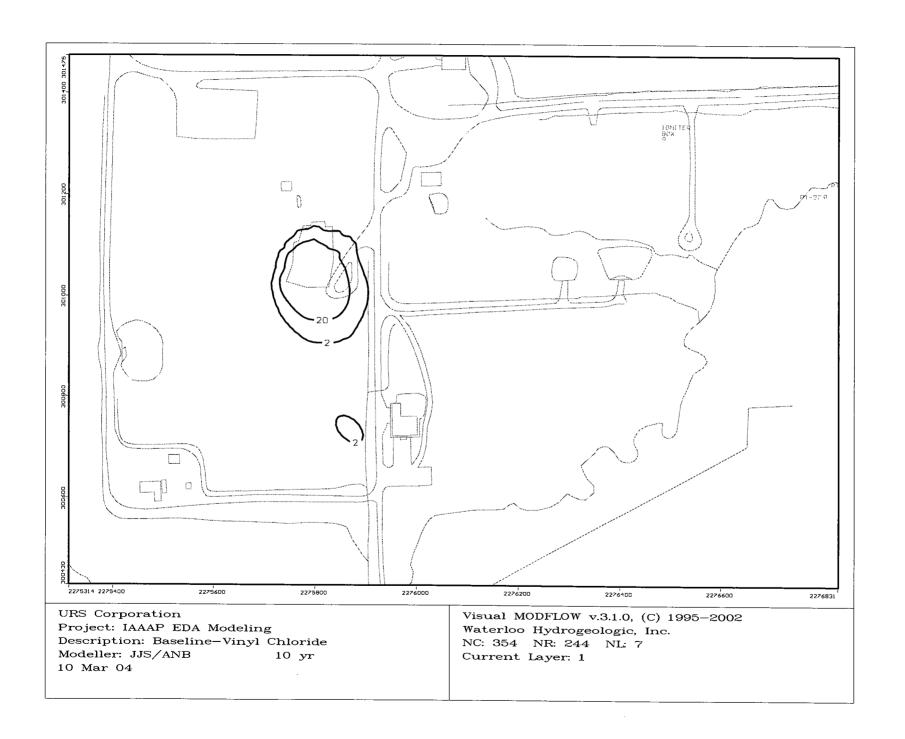


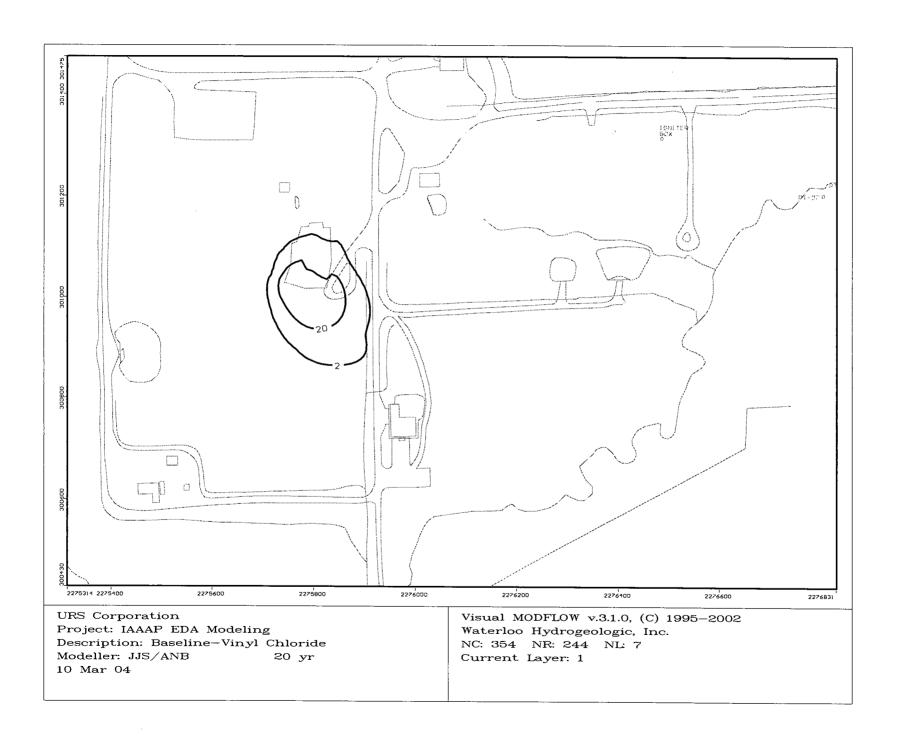


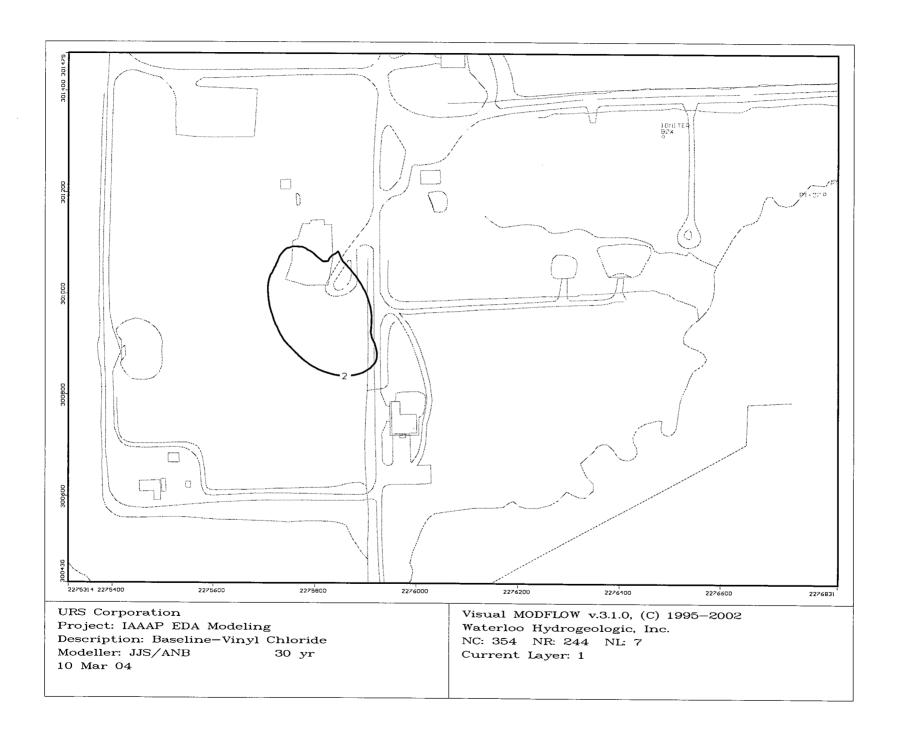


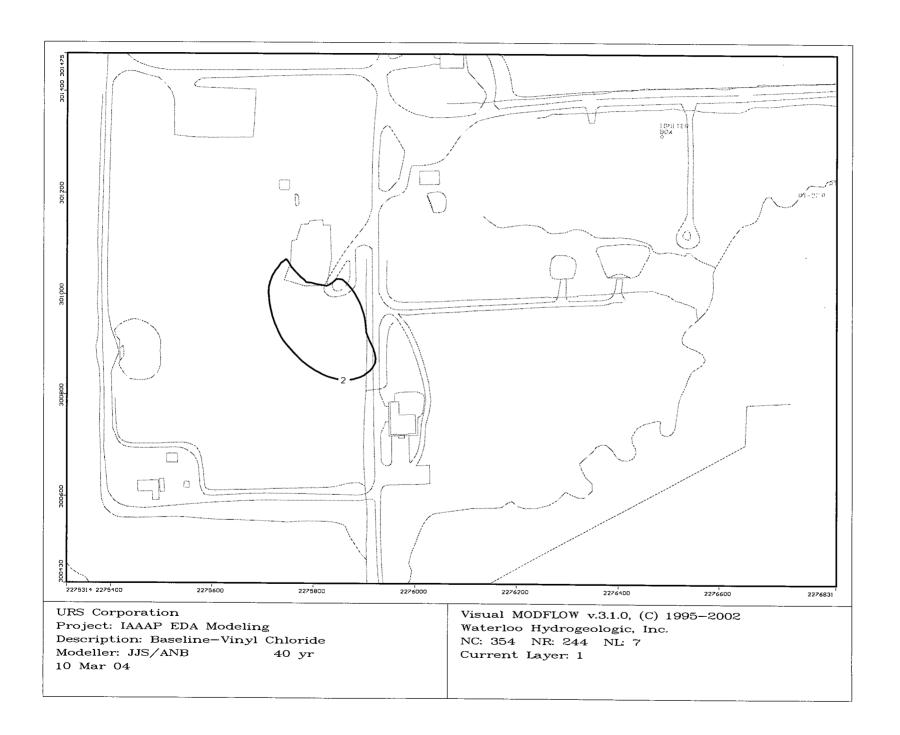


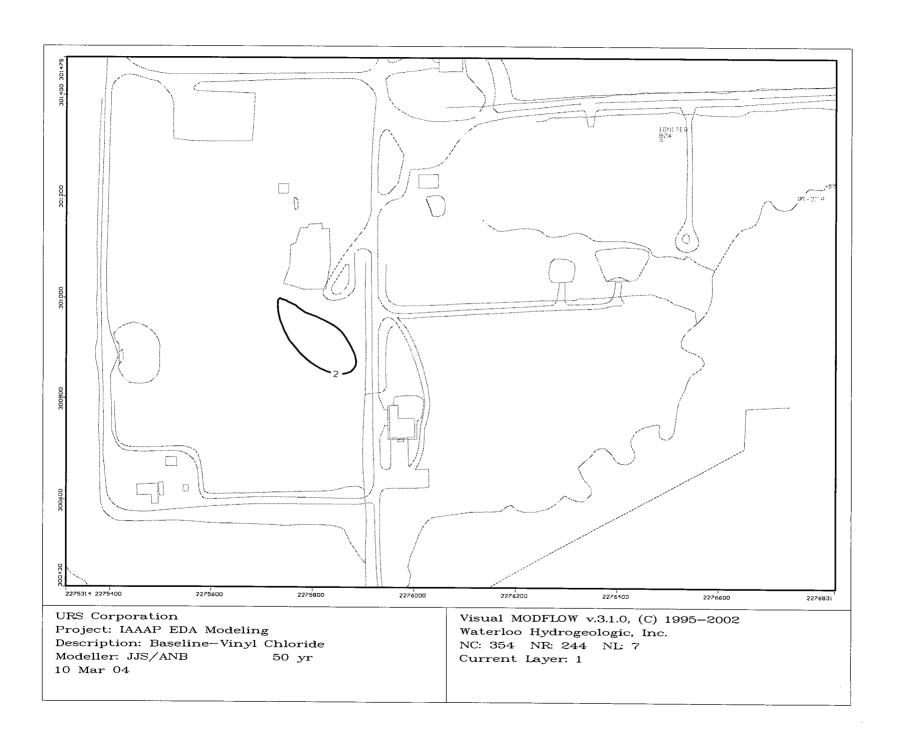


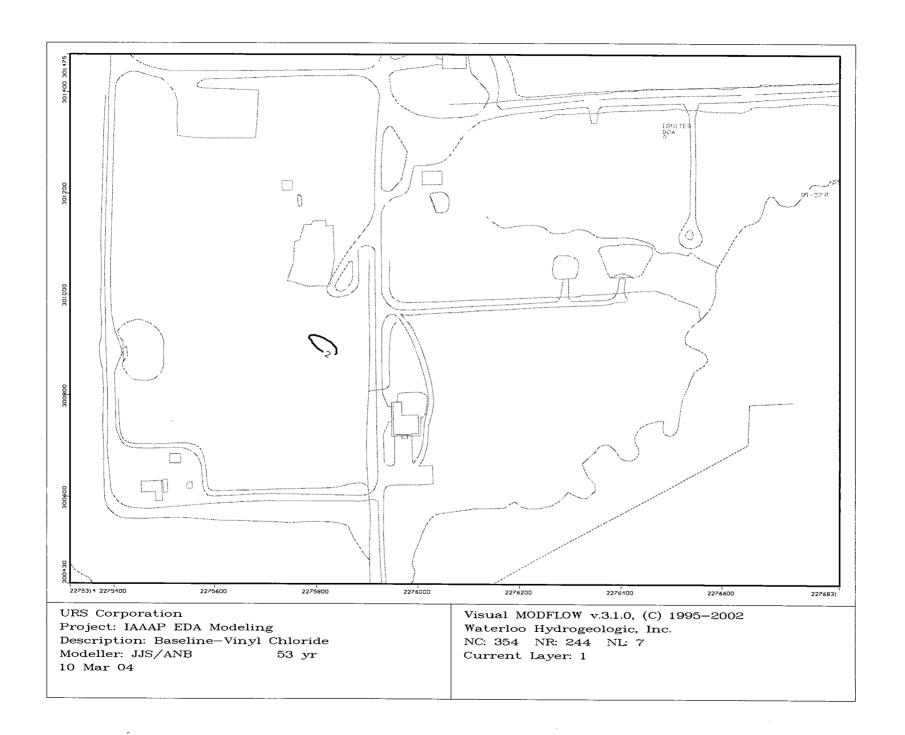


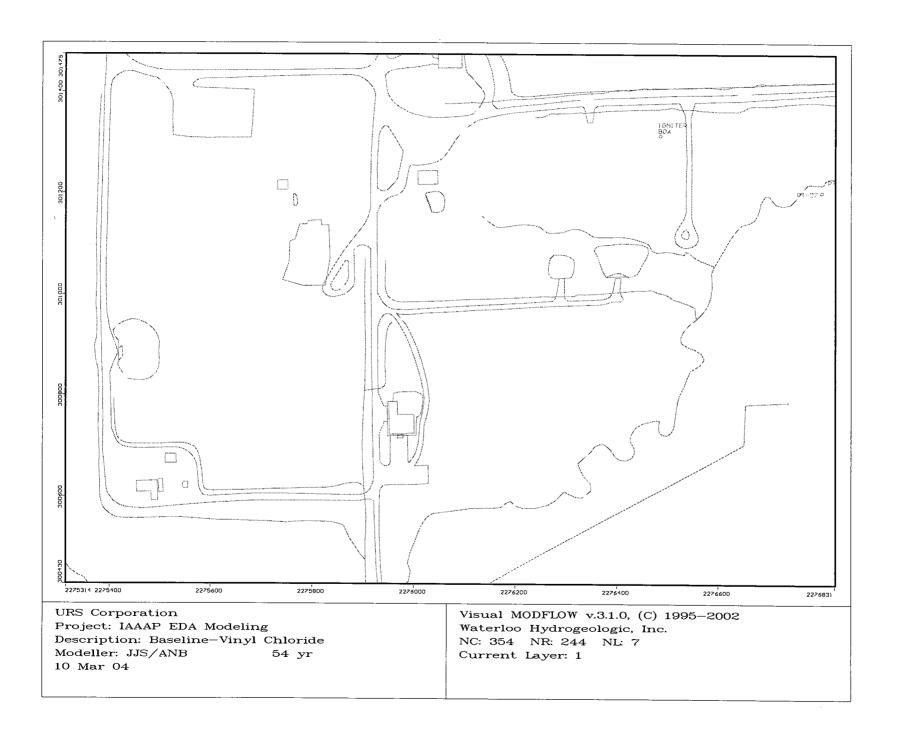






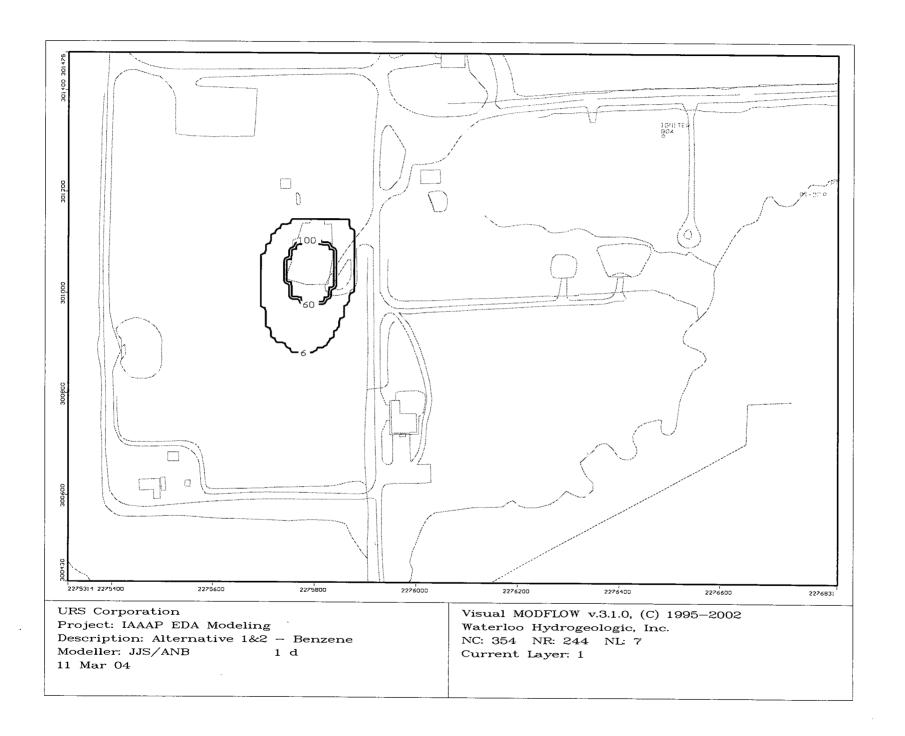


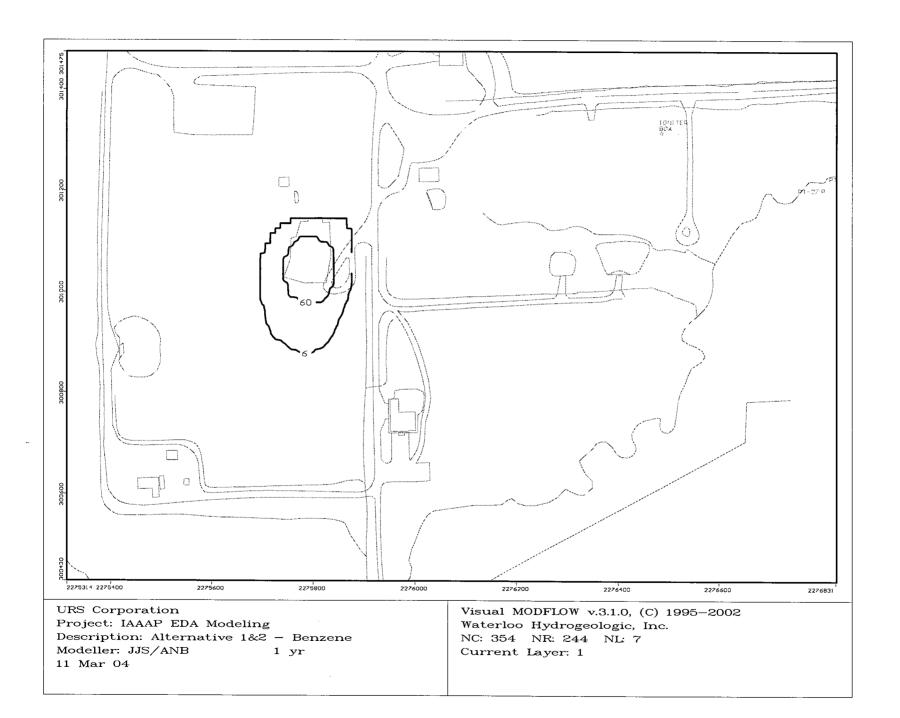


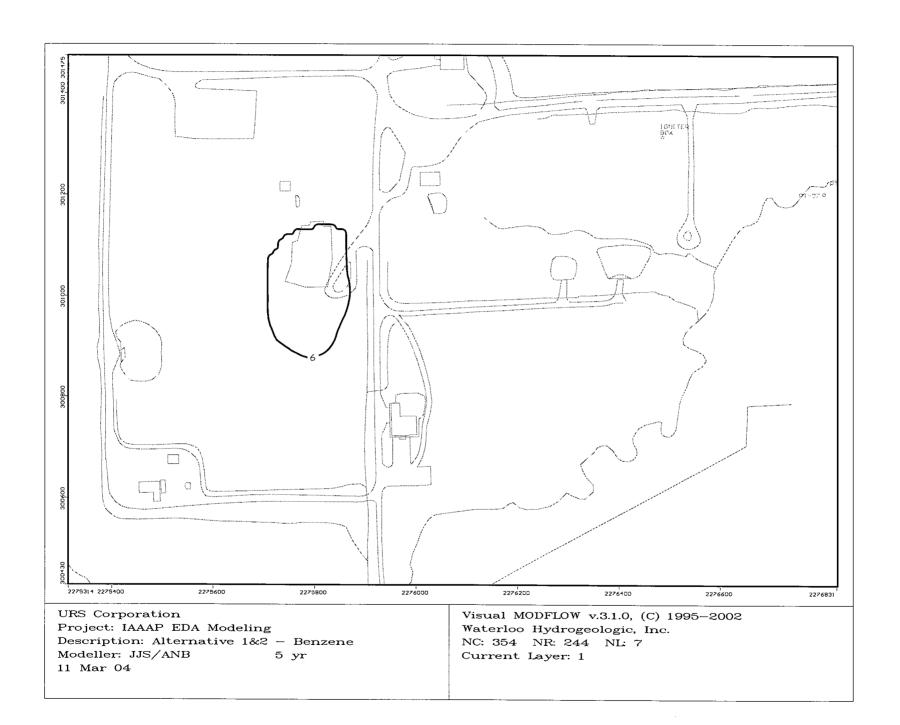


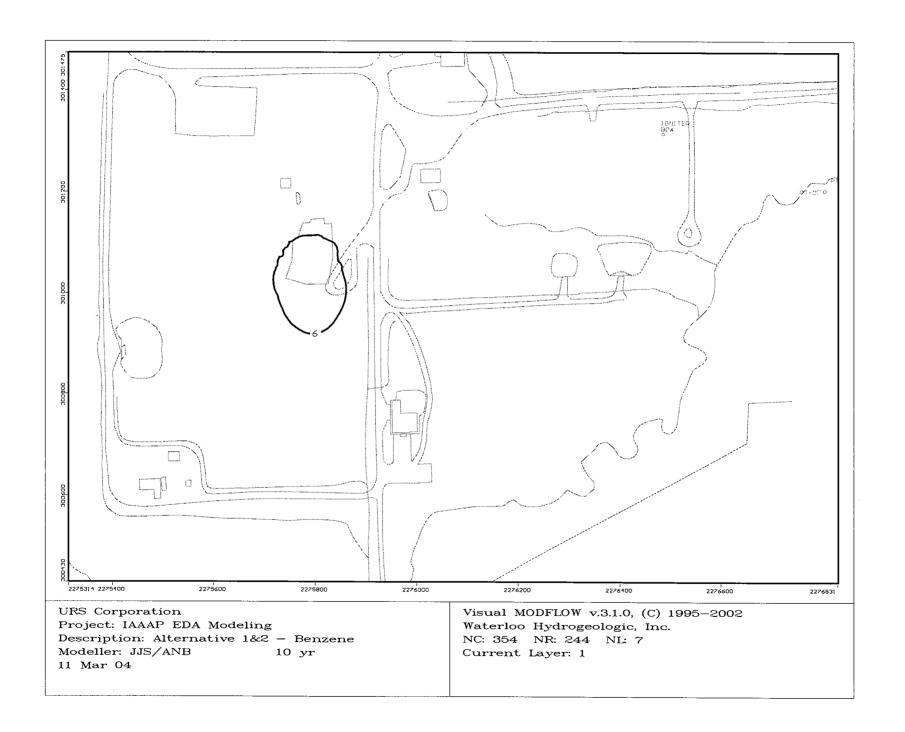
## ATTACHMENT K-5 Contaminant Fate and Transport Modeling Results

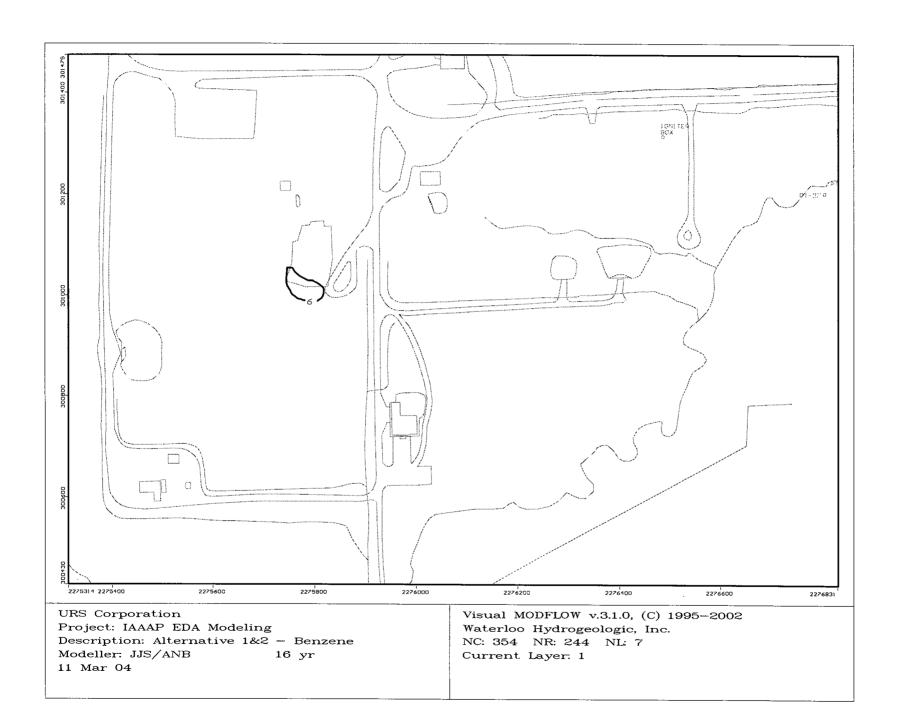
Alternatives 1 and 2 – No Action/MNA

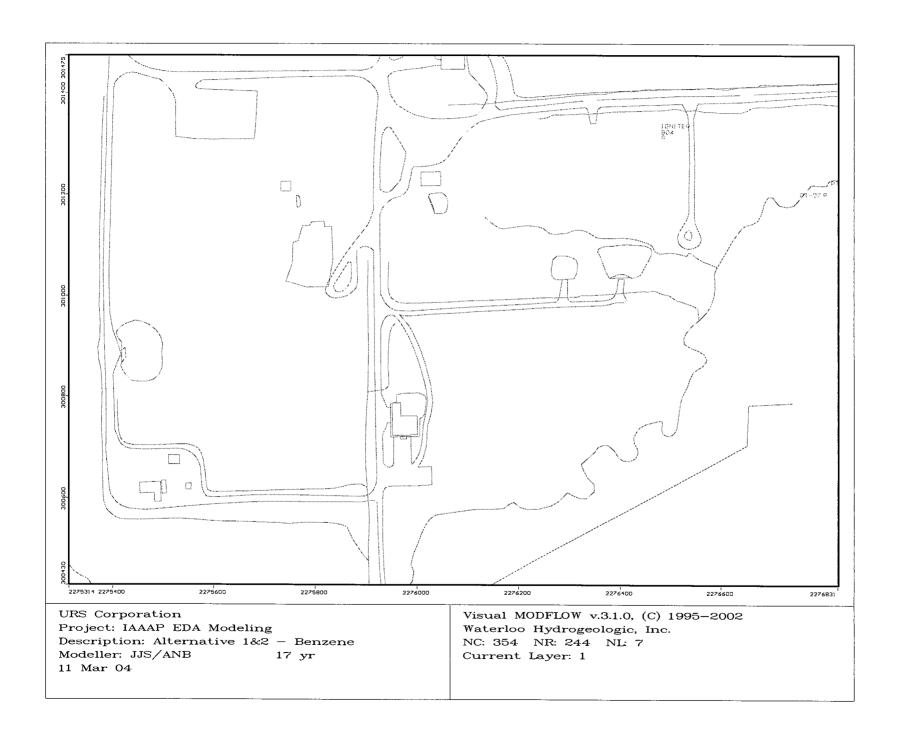


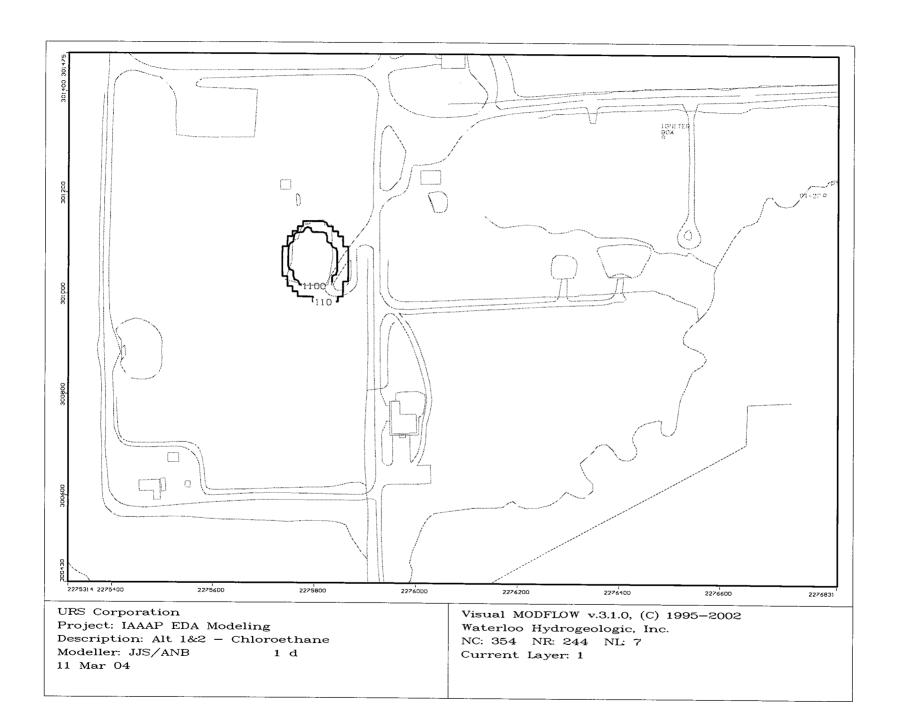


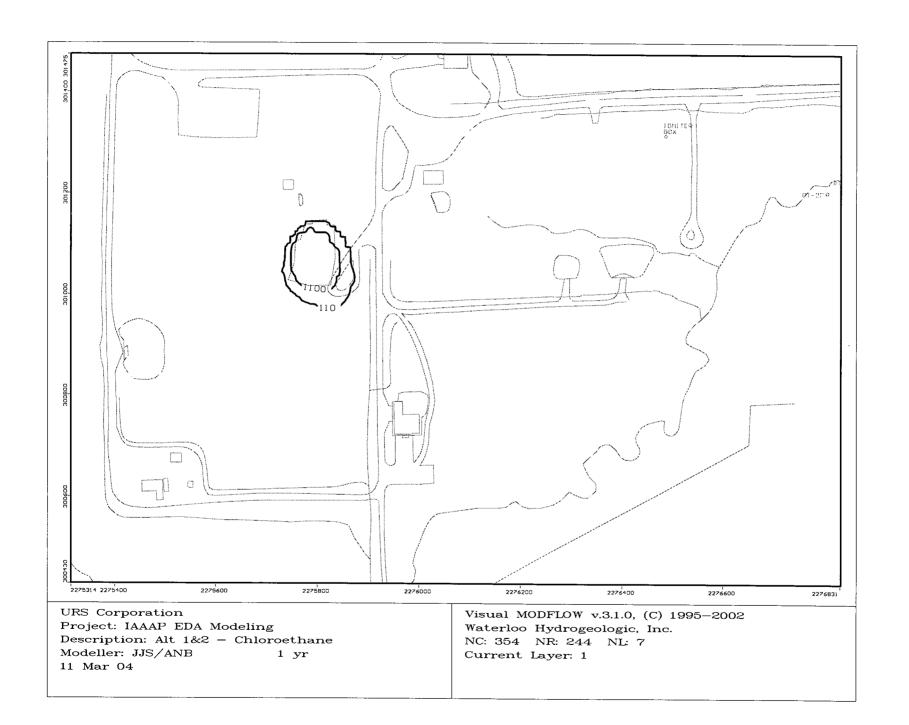


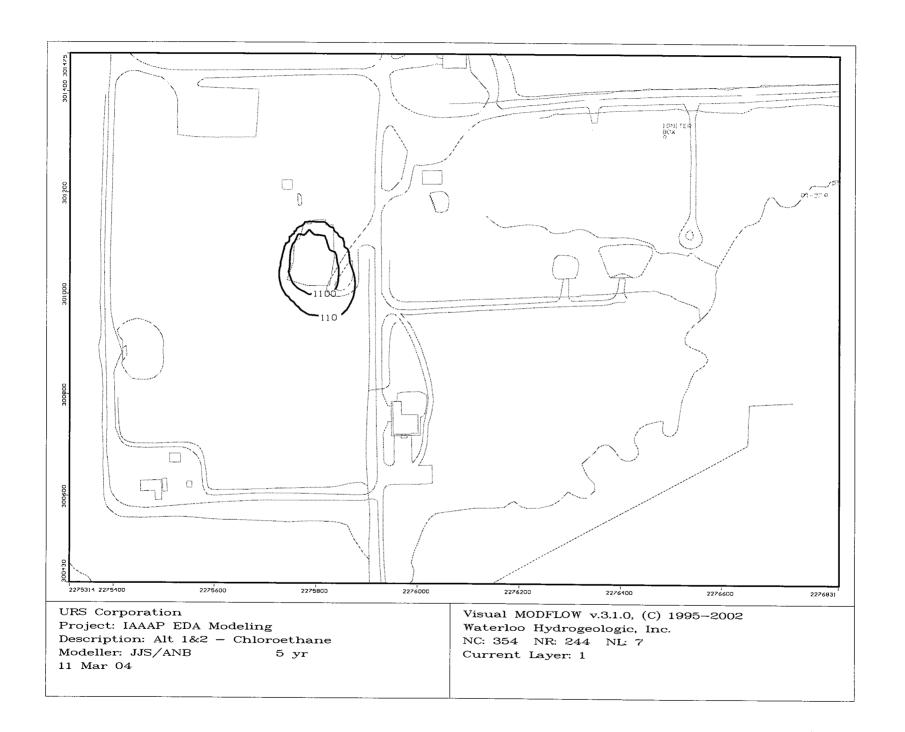


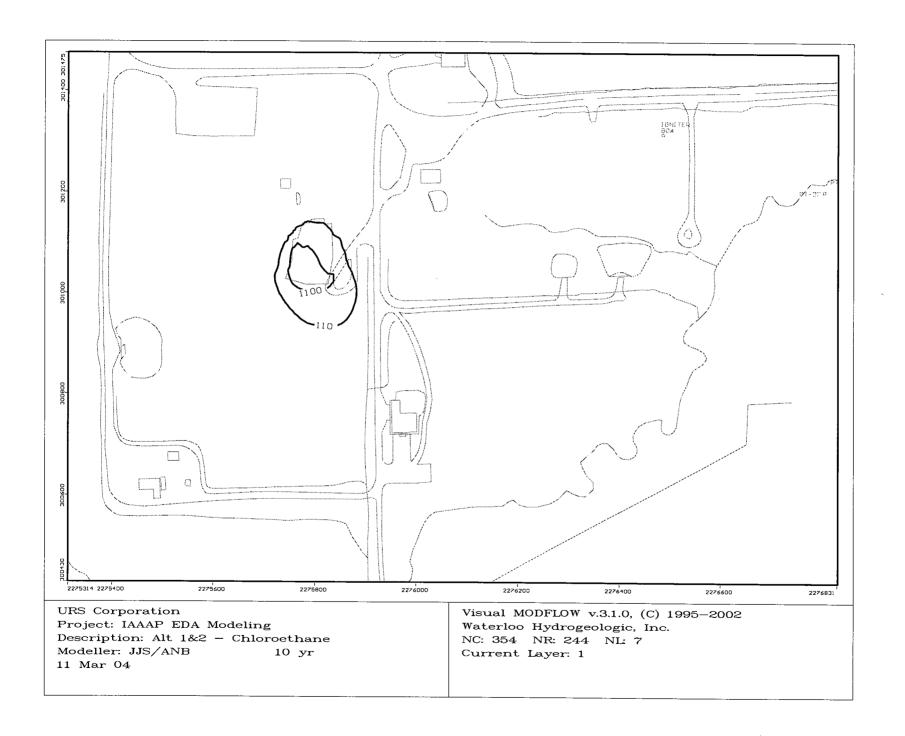


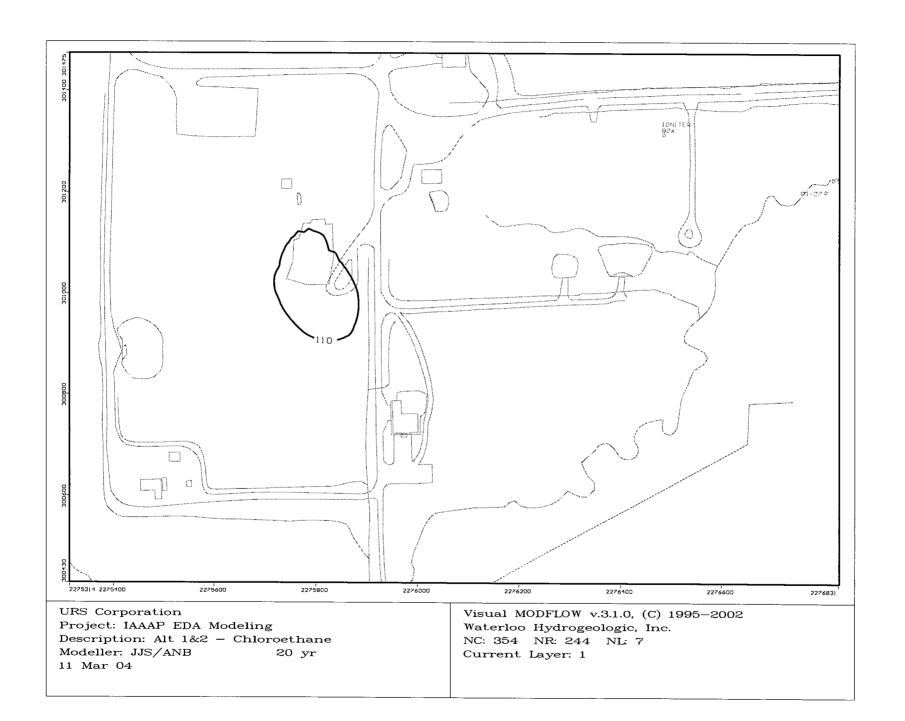


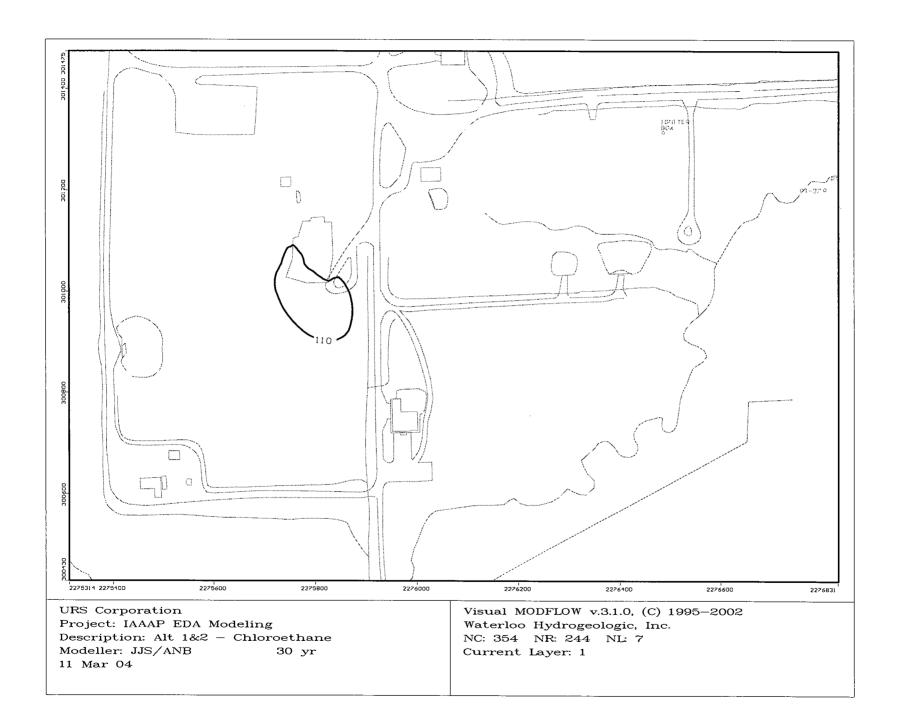


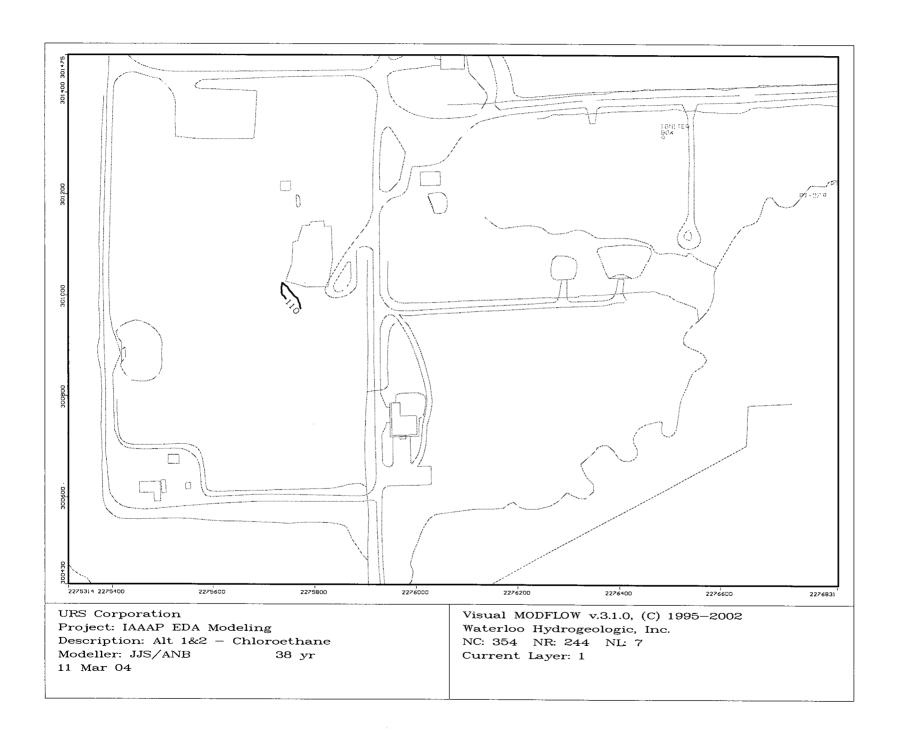


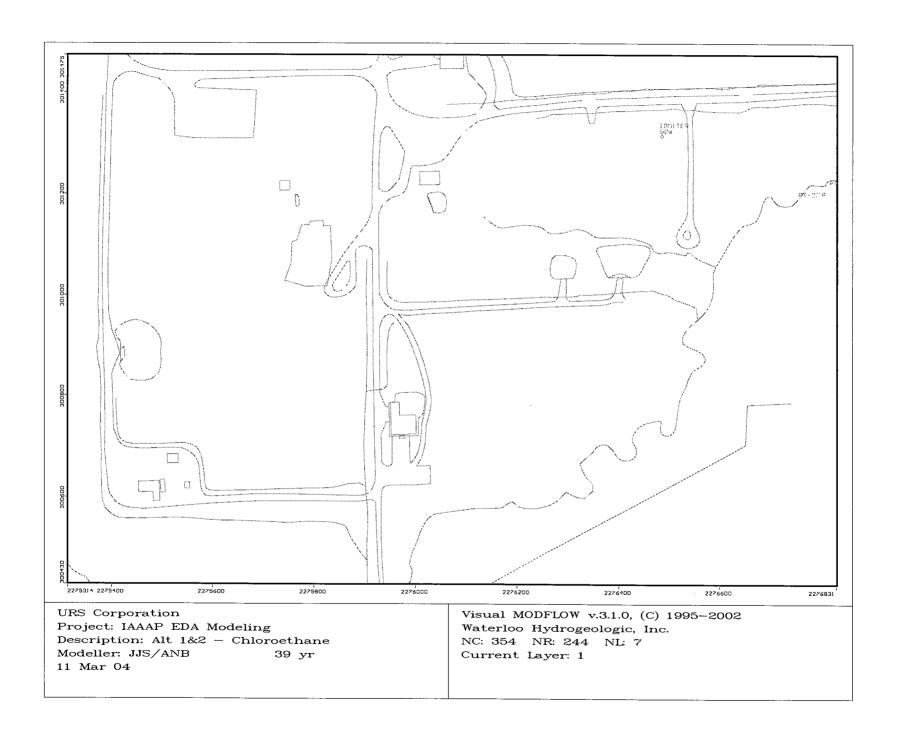


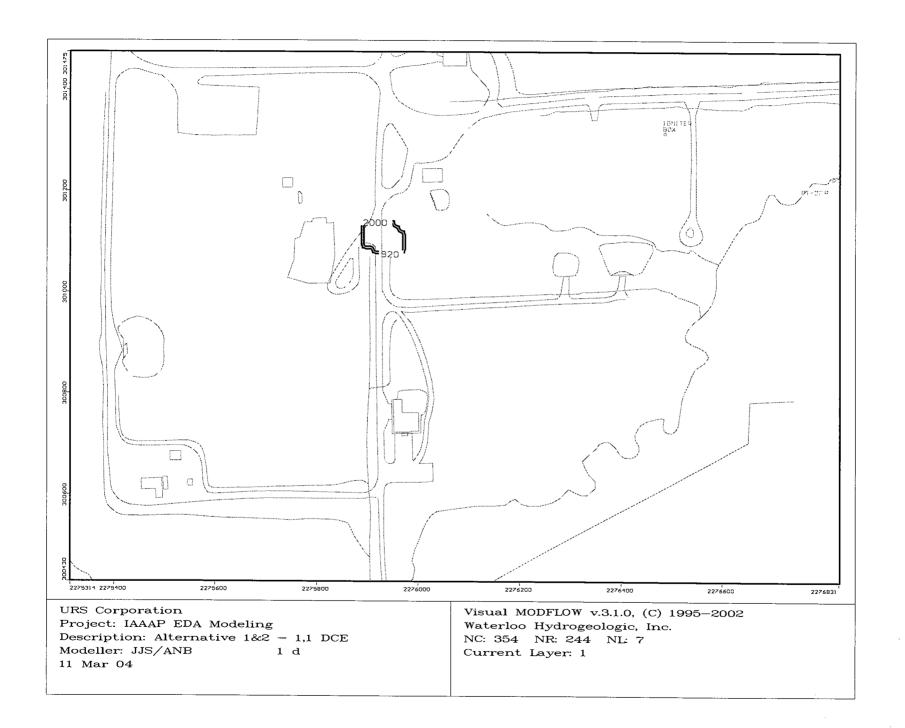


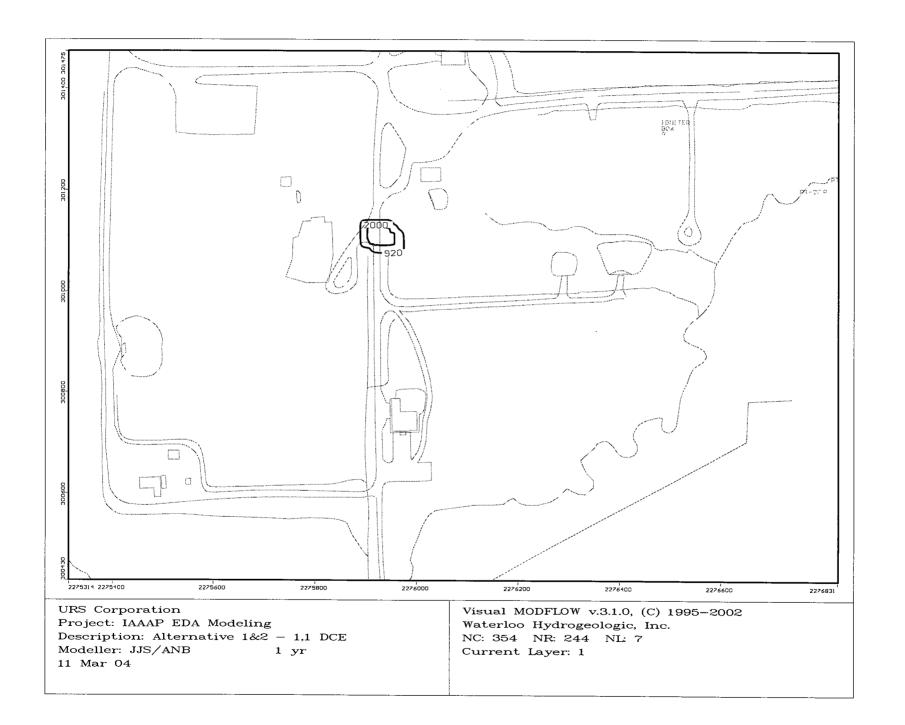


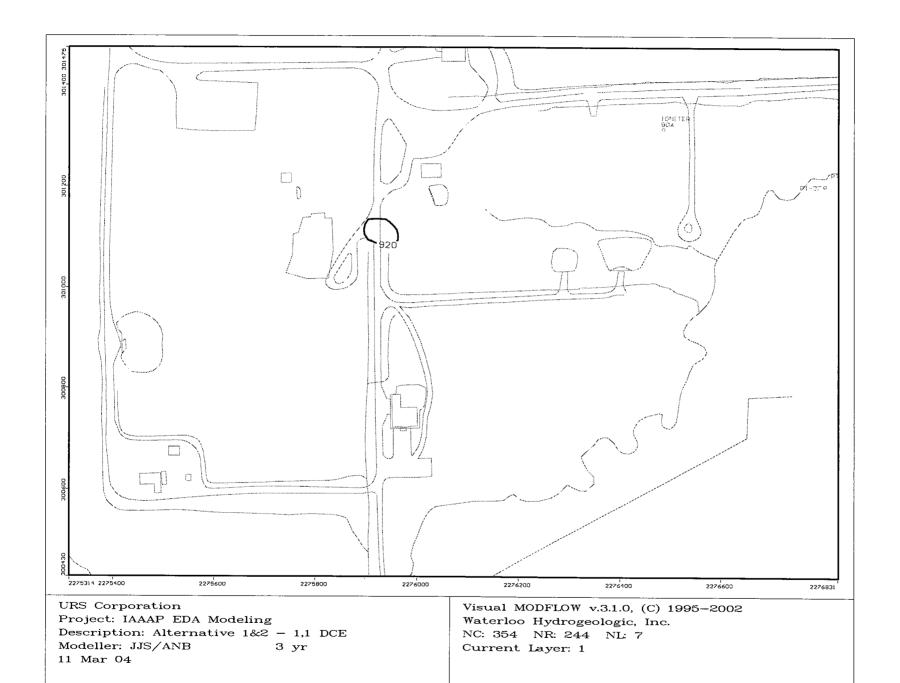


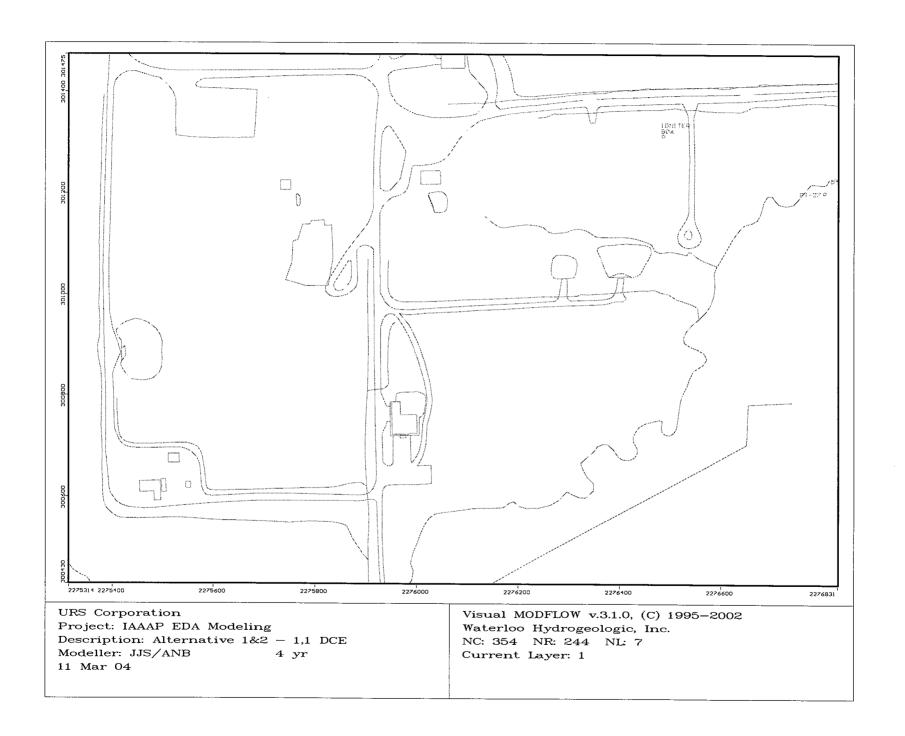


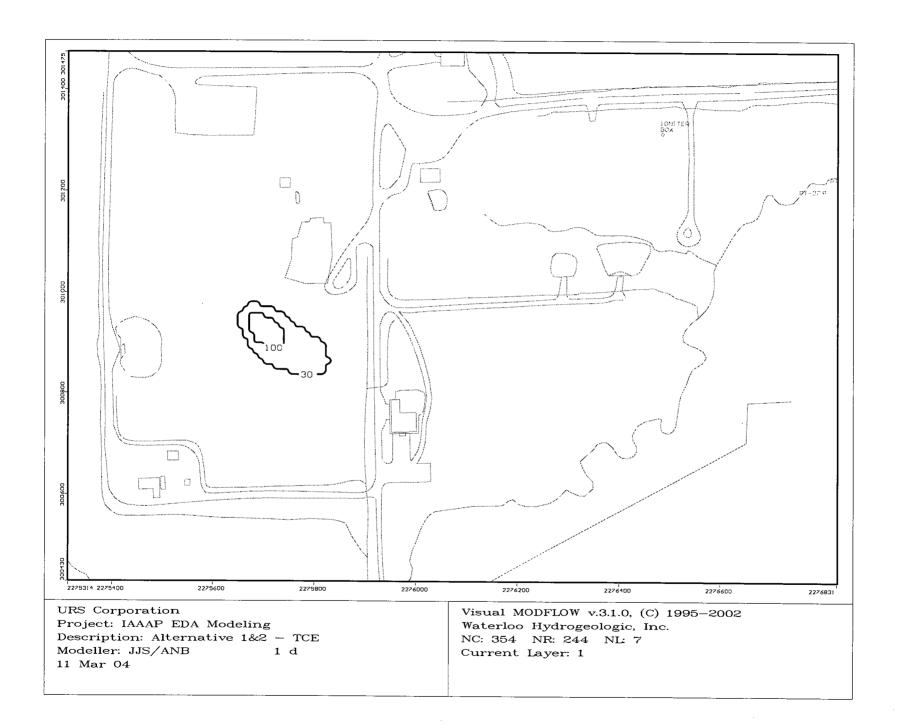


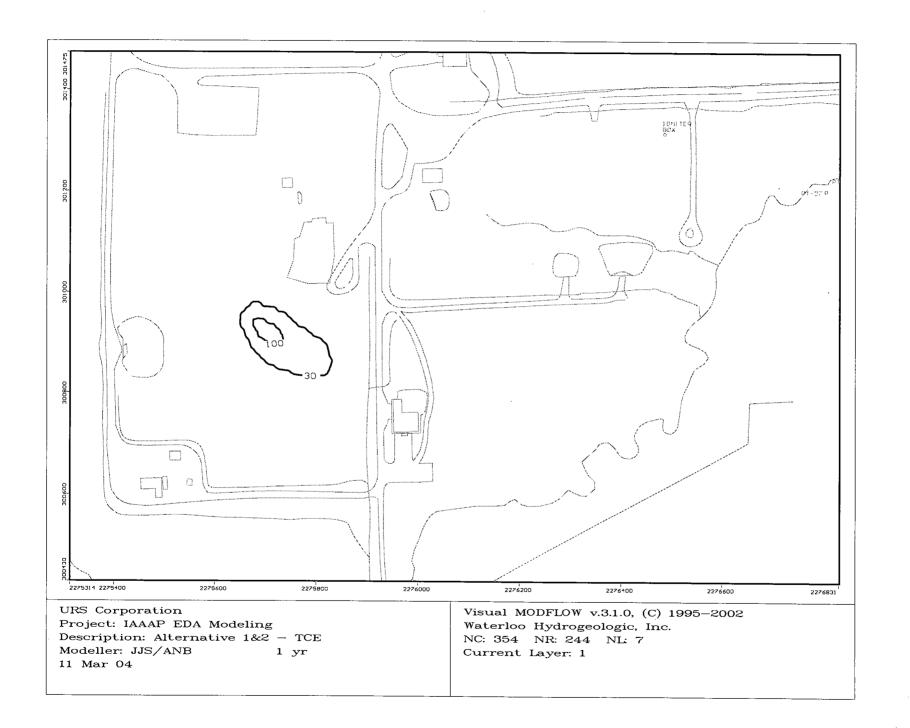


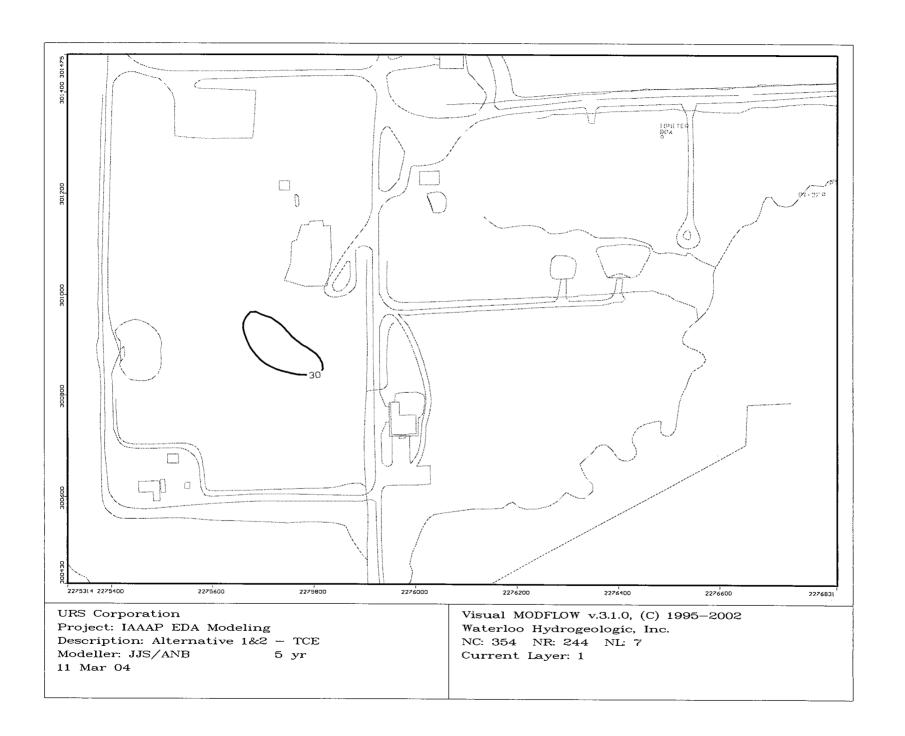


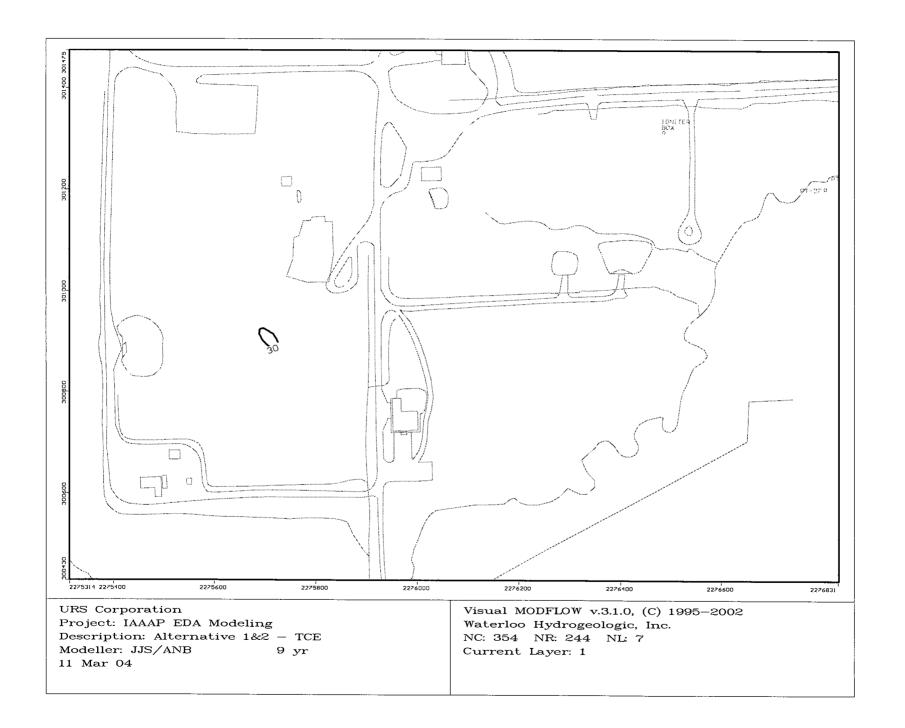


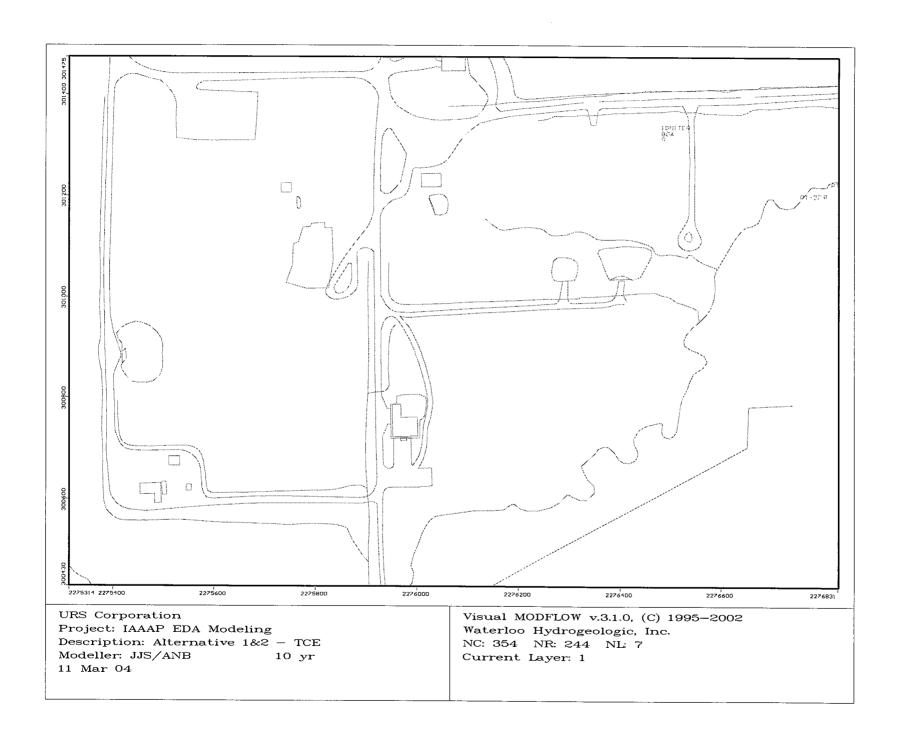


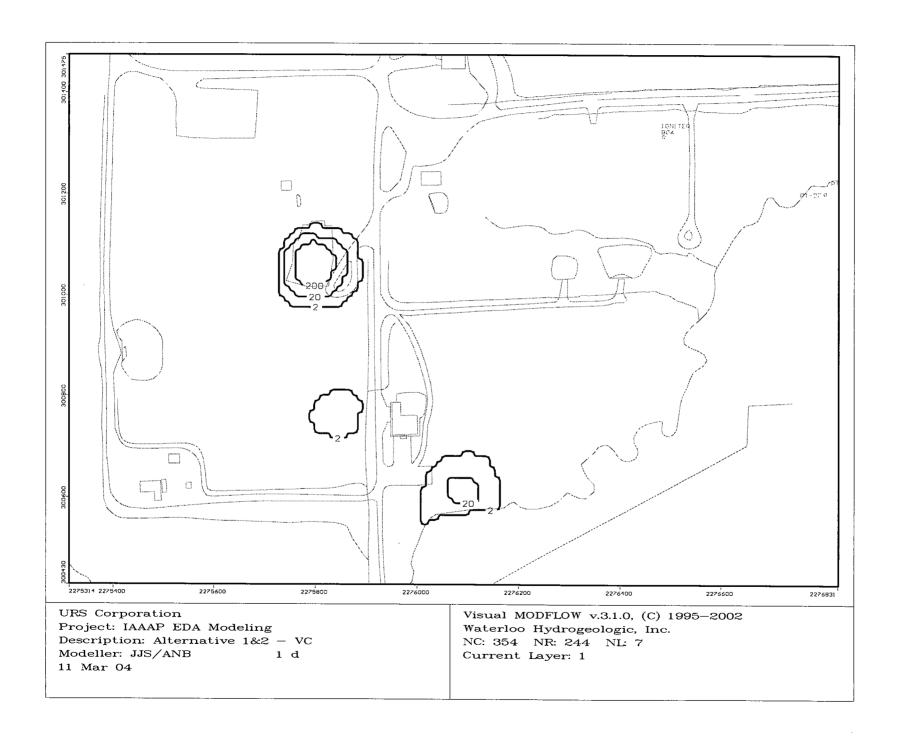


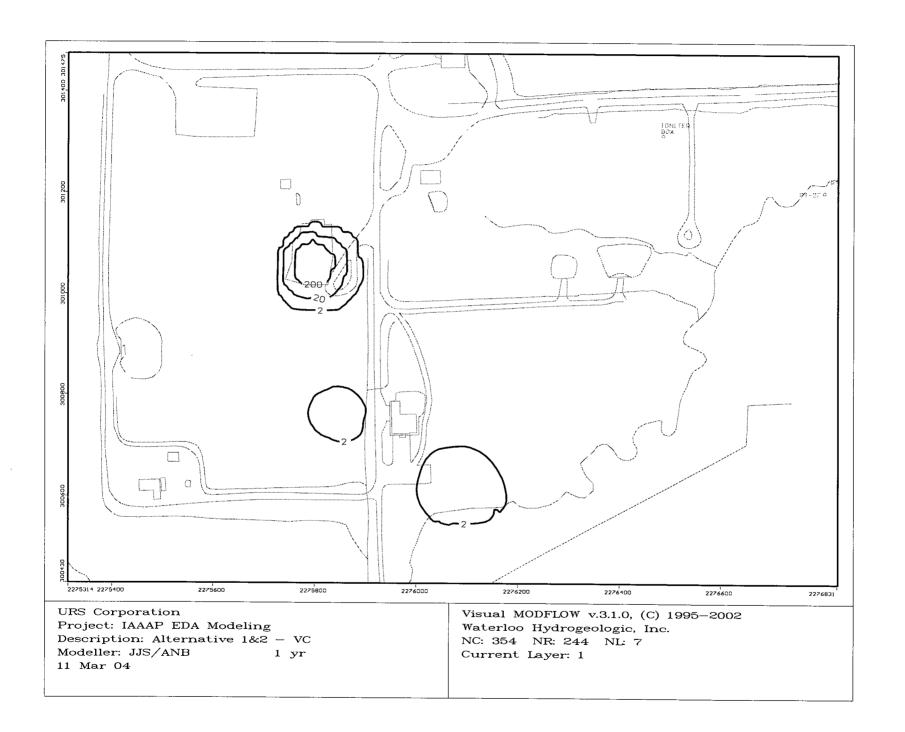


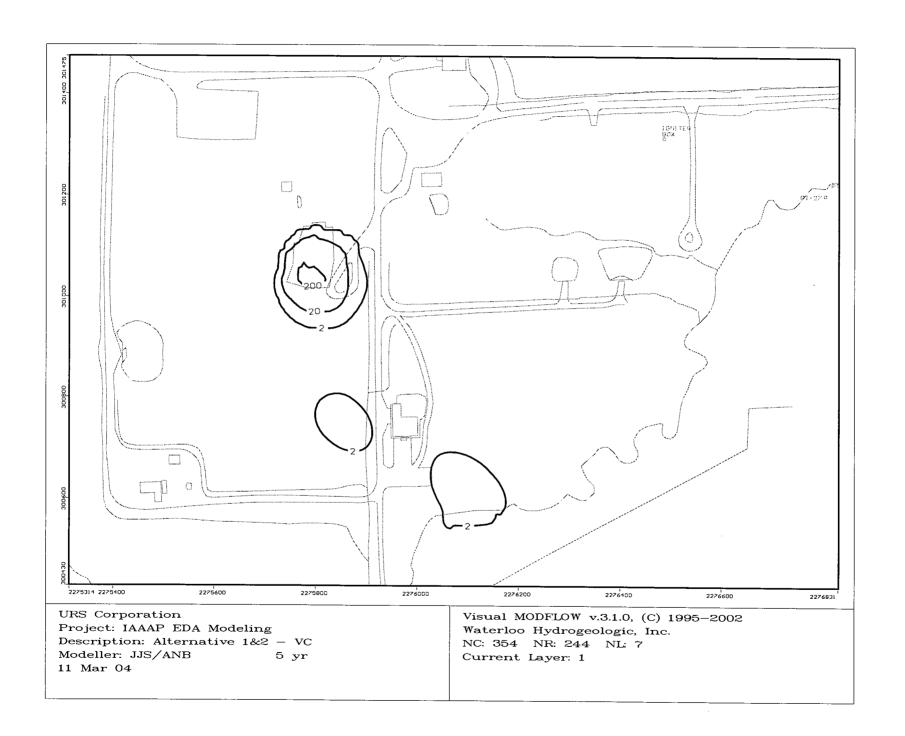


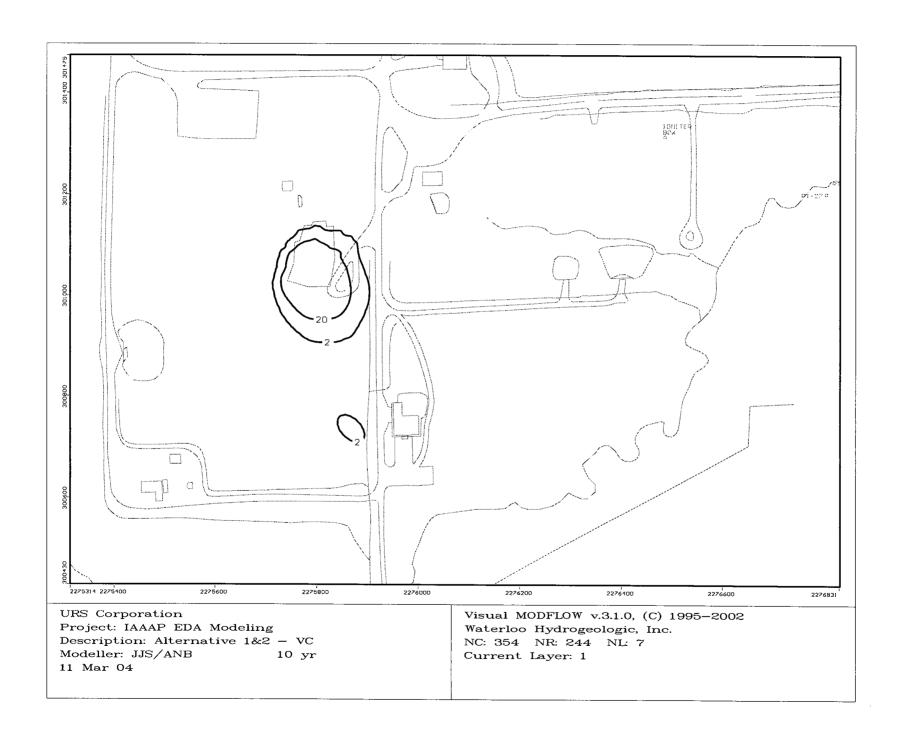


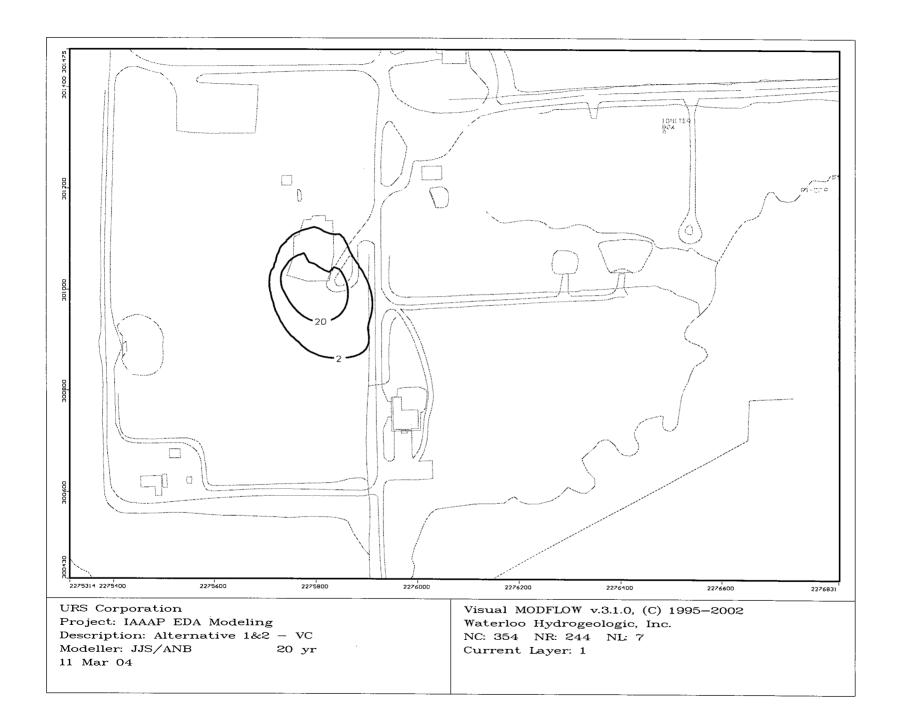


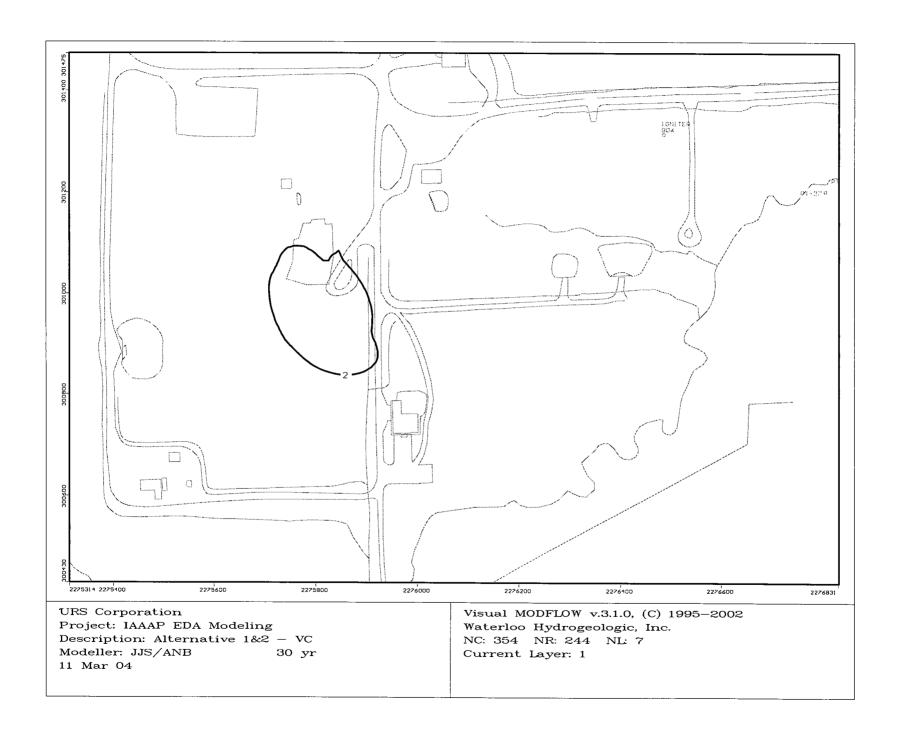


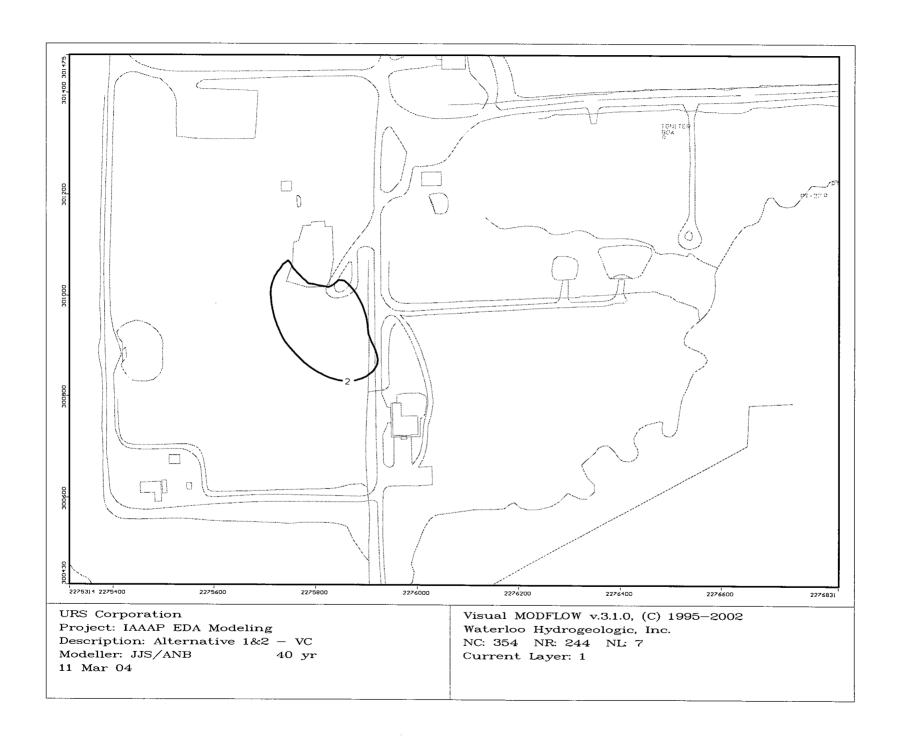


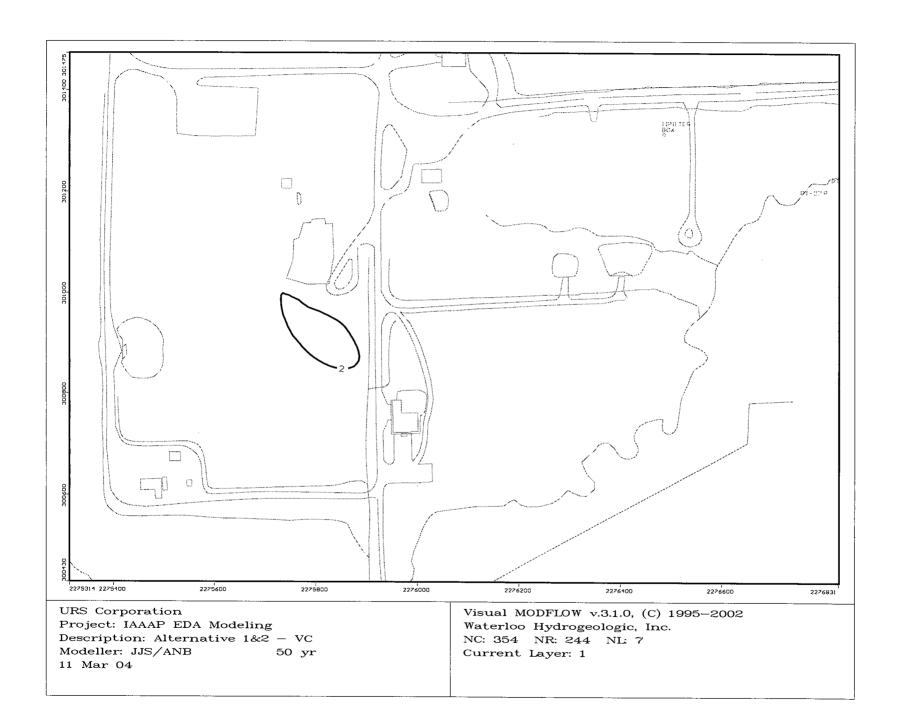


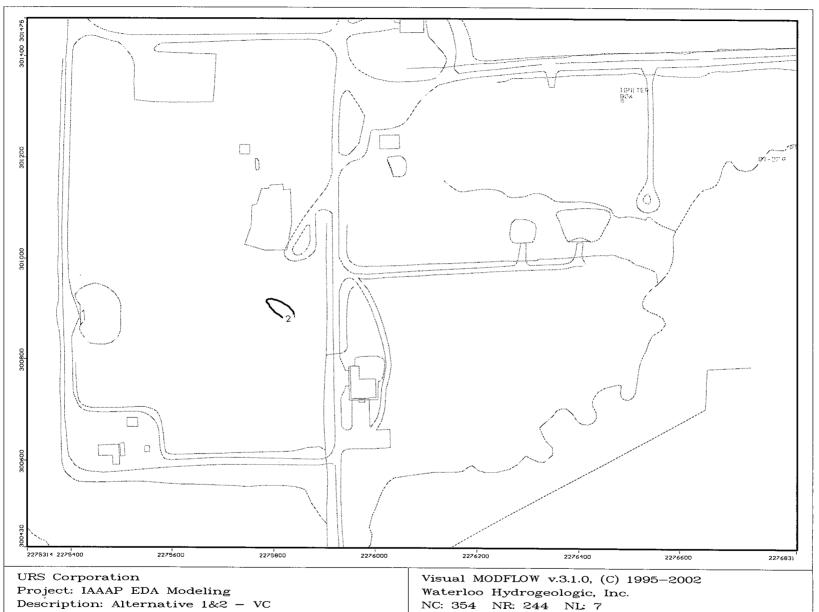






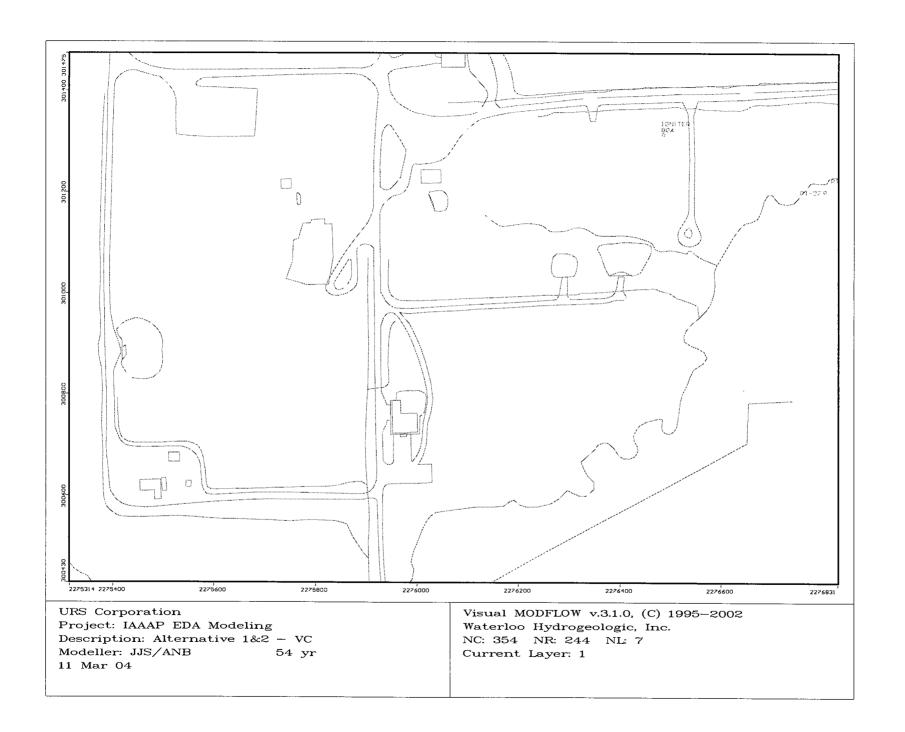






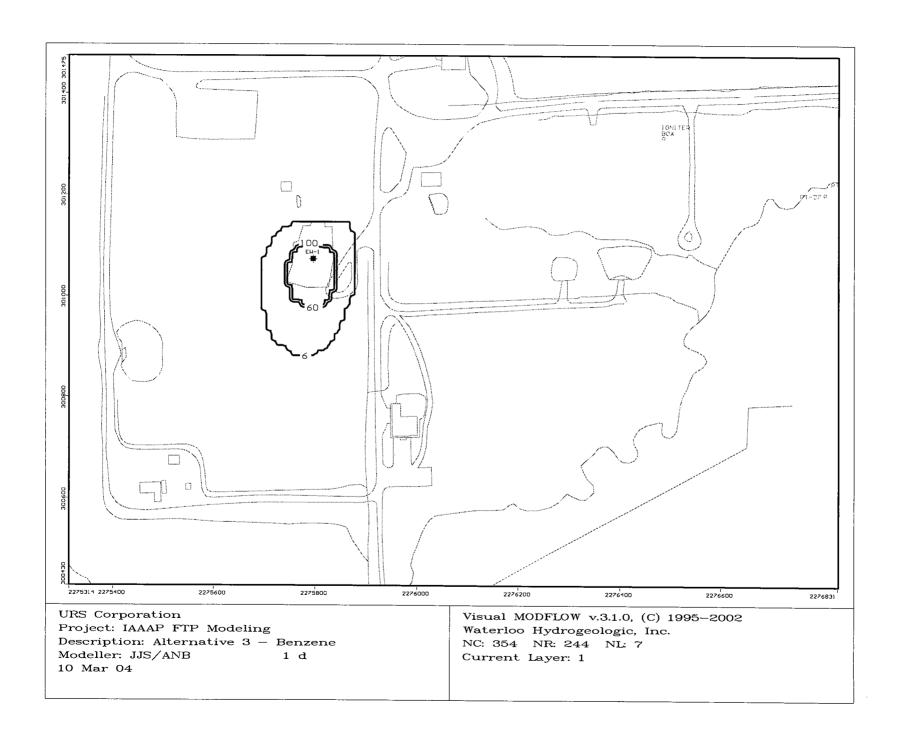
Modeller: JJS/ANB 53 yr 11 Mar 04

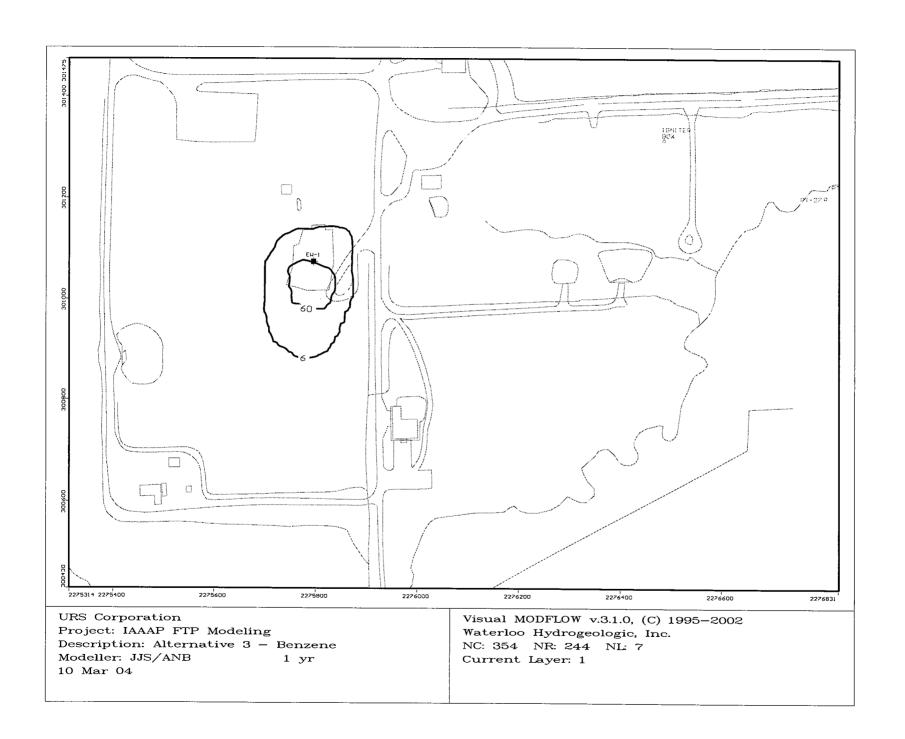
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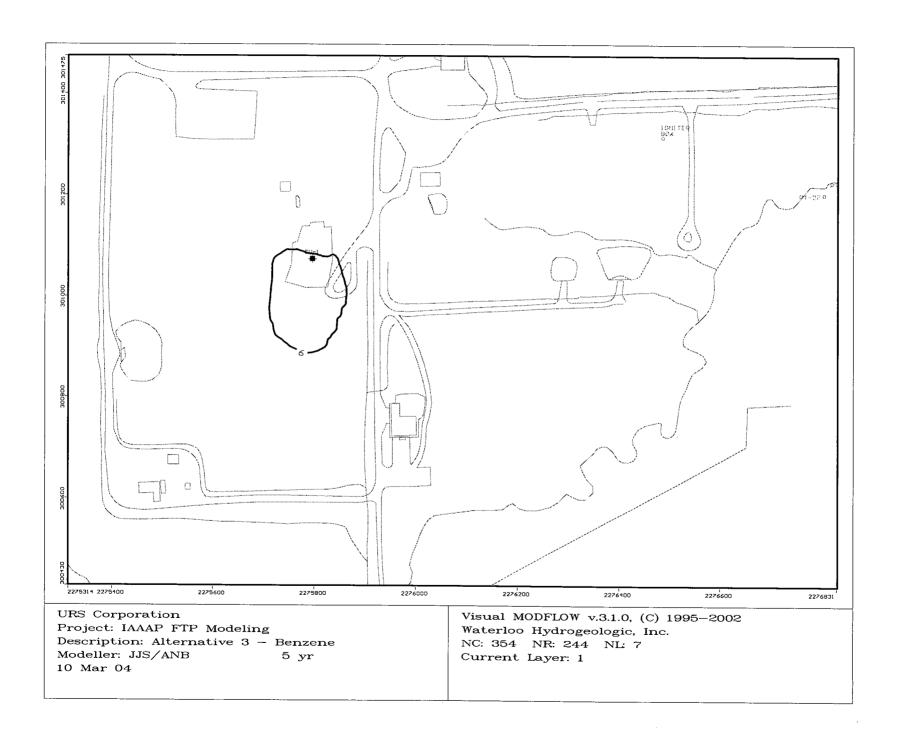


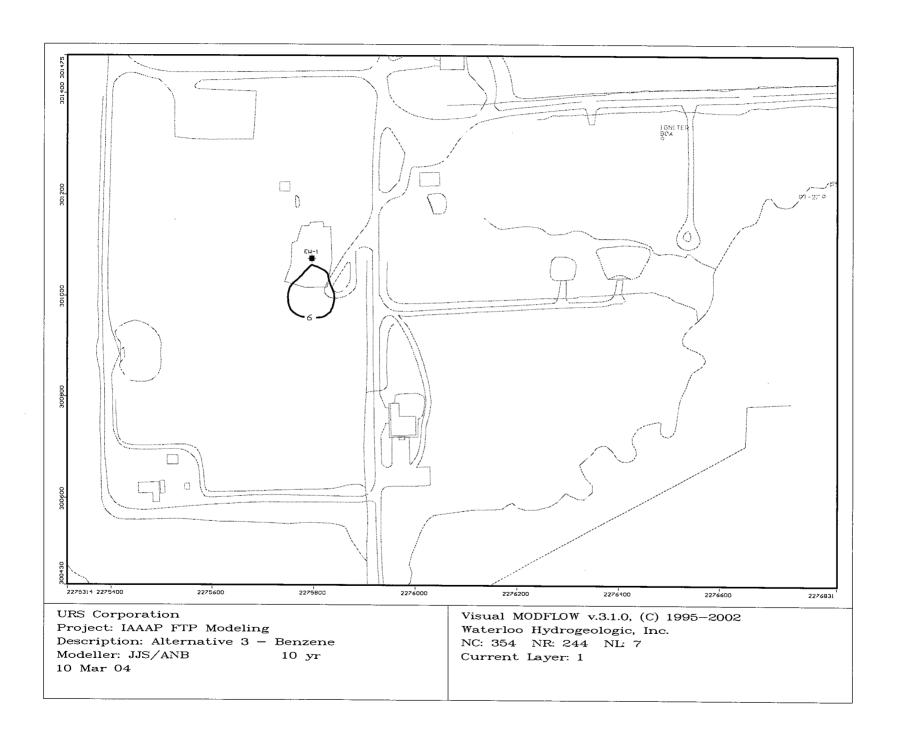
## ATTACHMENT K-5 Contaminant Fate and Transport Modeling Results

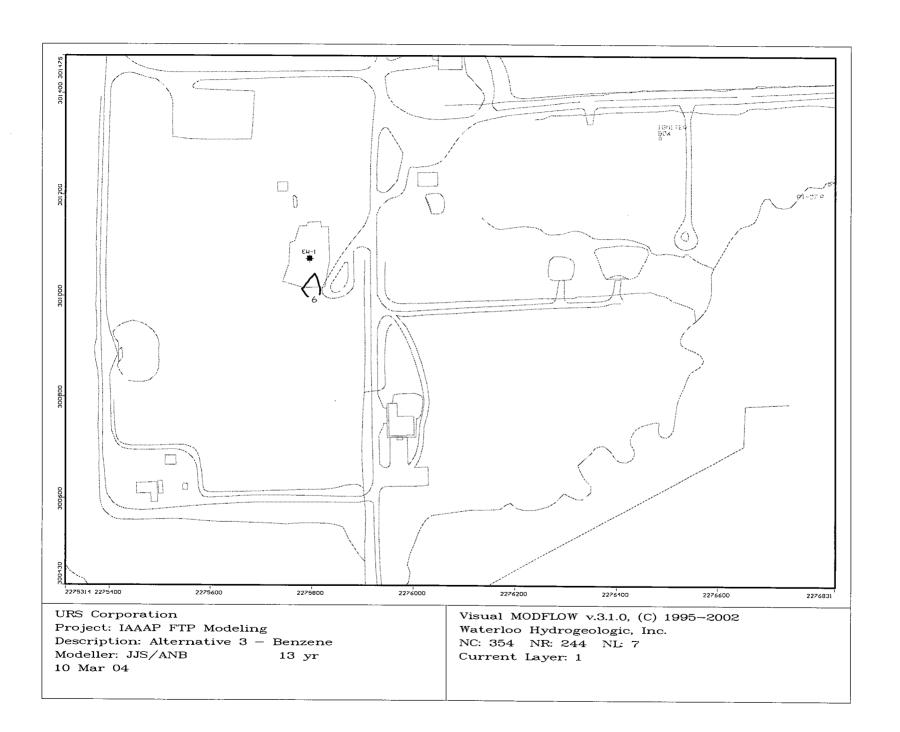
Alternative 3 – Focused Extraction/MNA

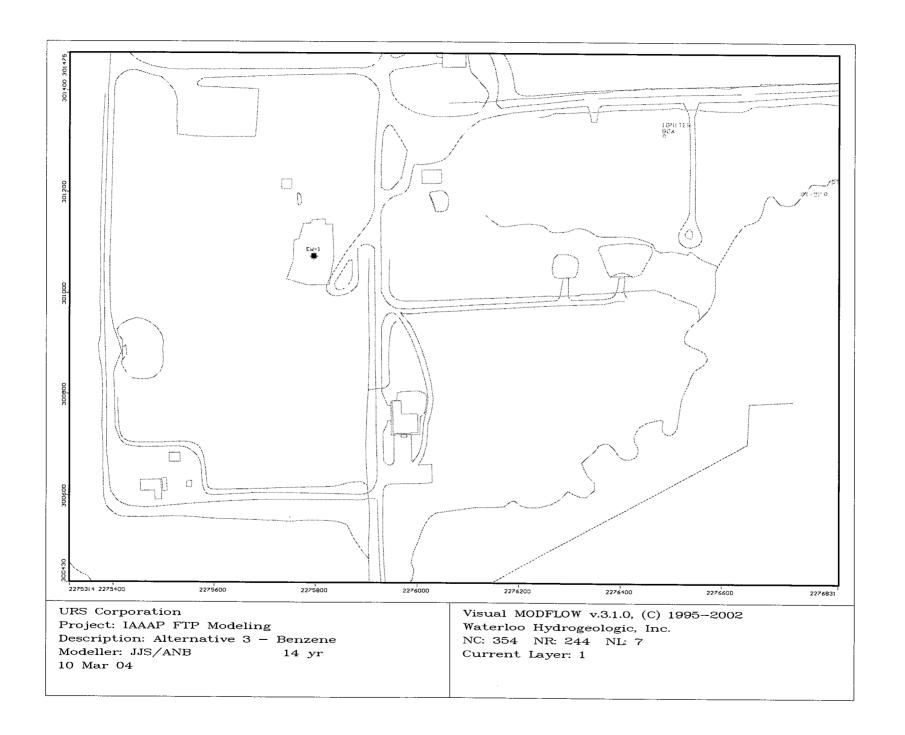


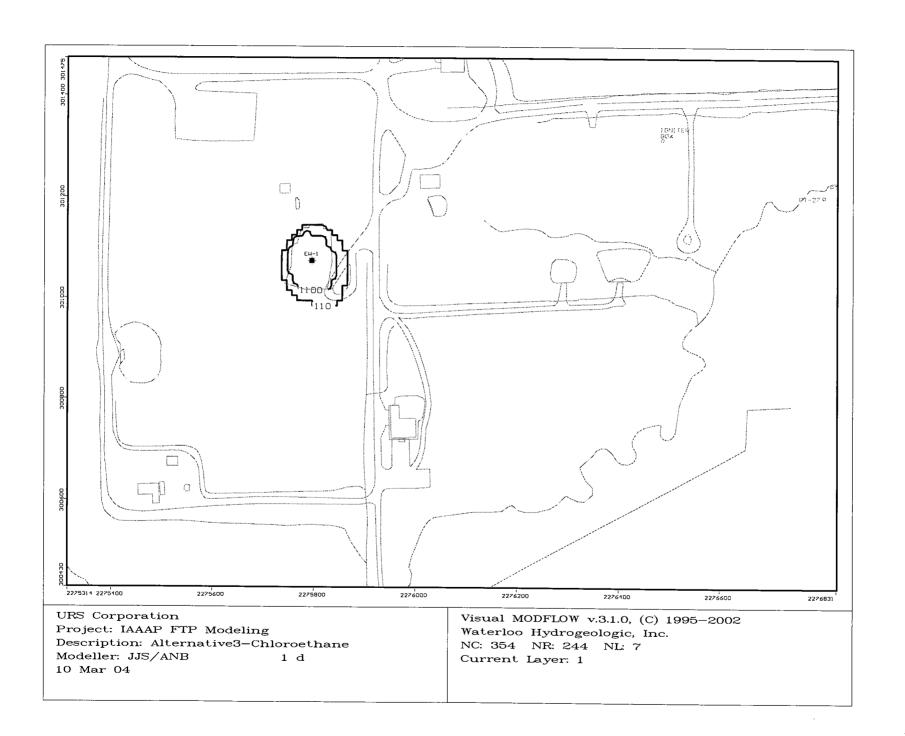


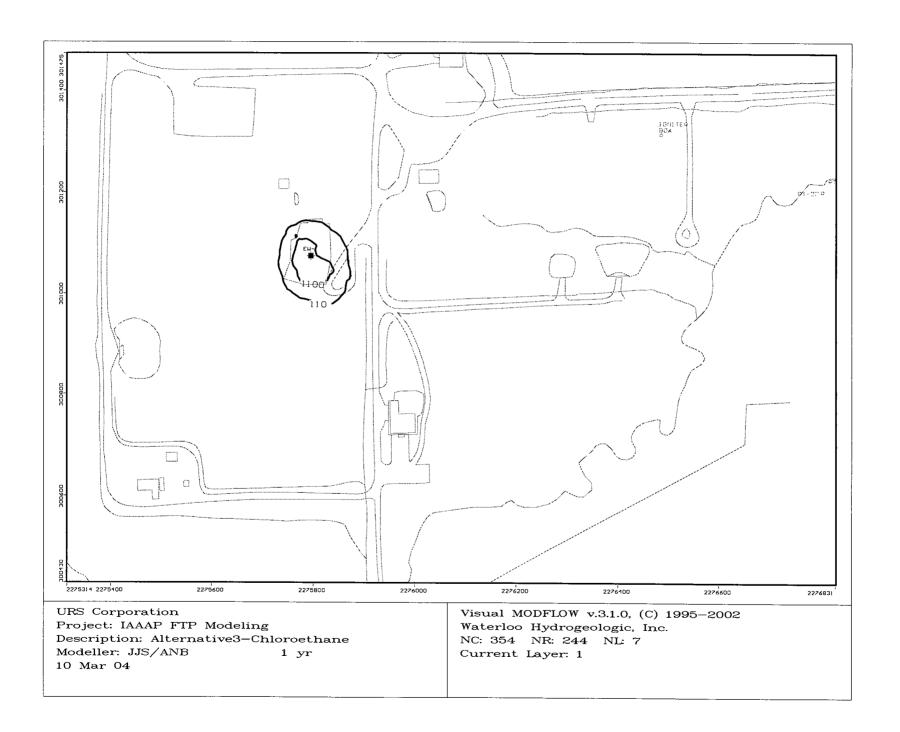


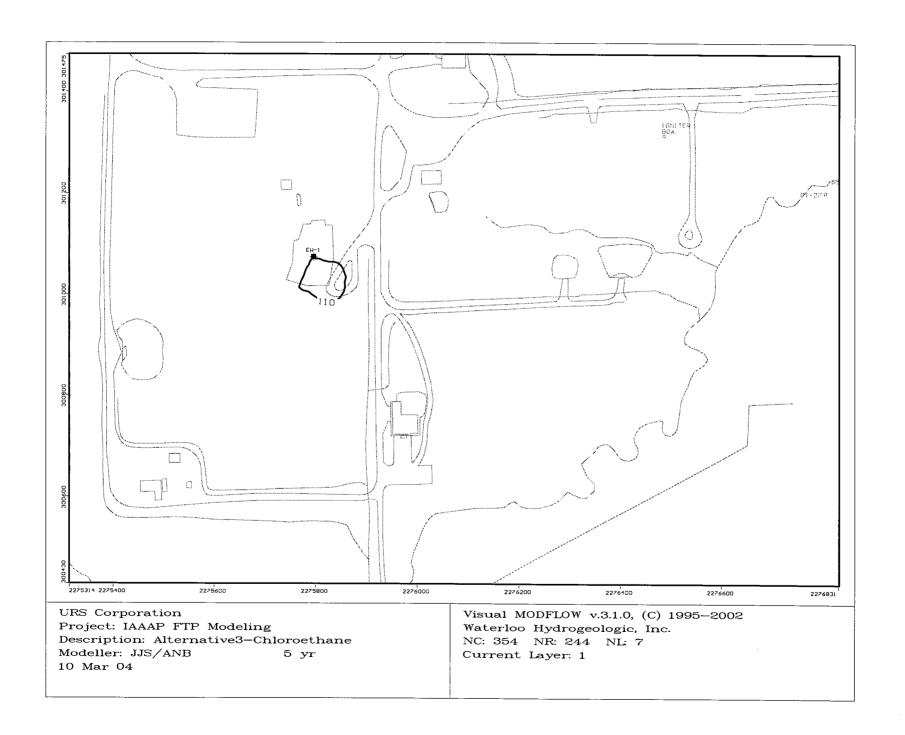


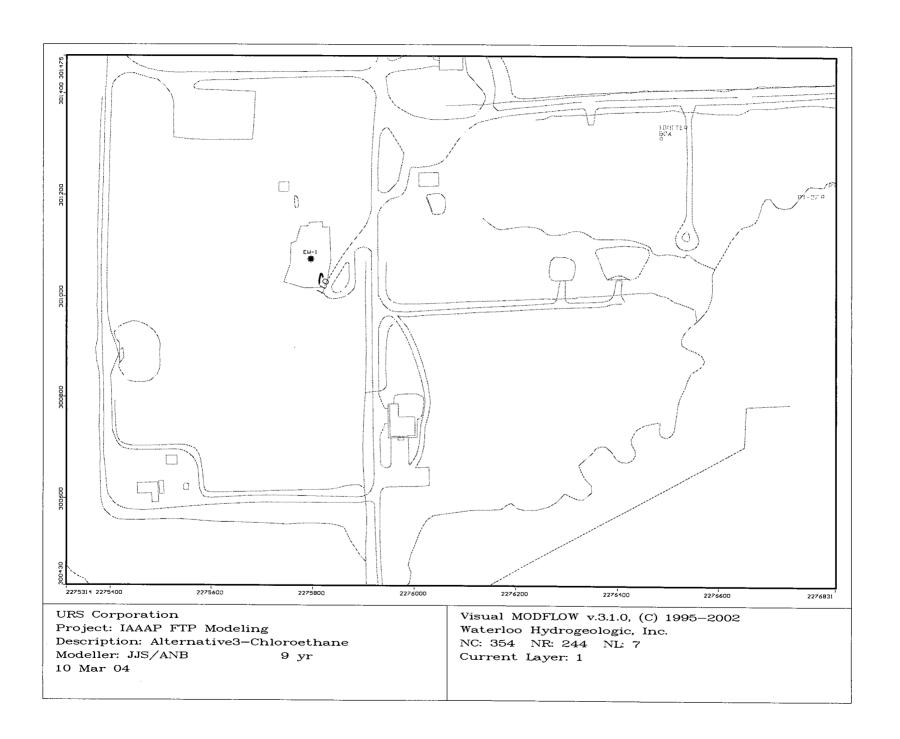


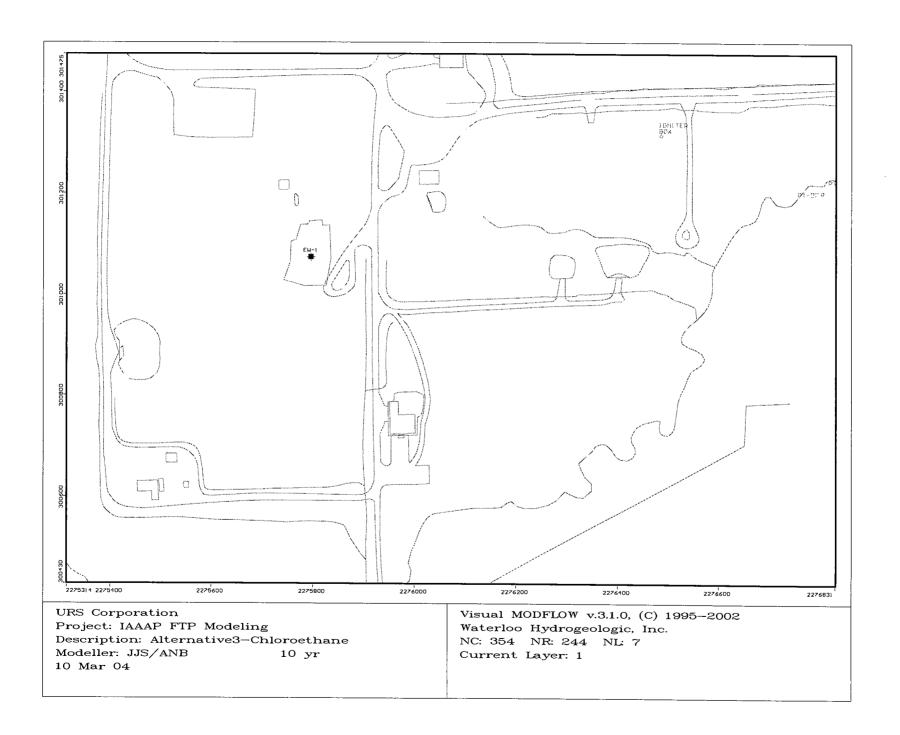


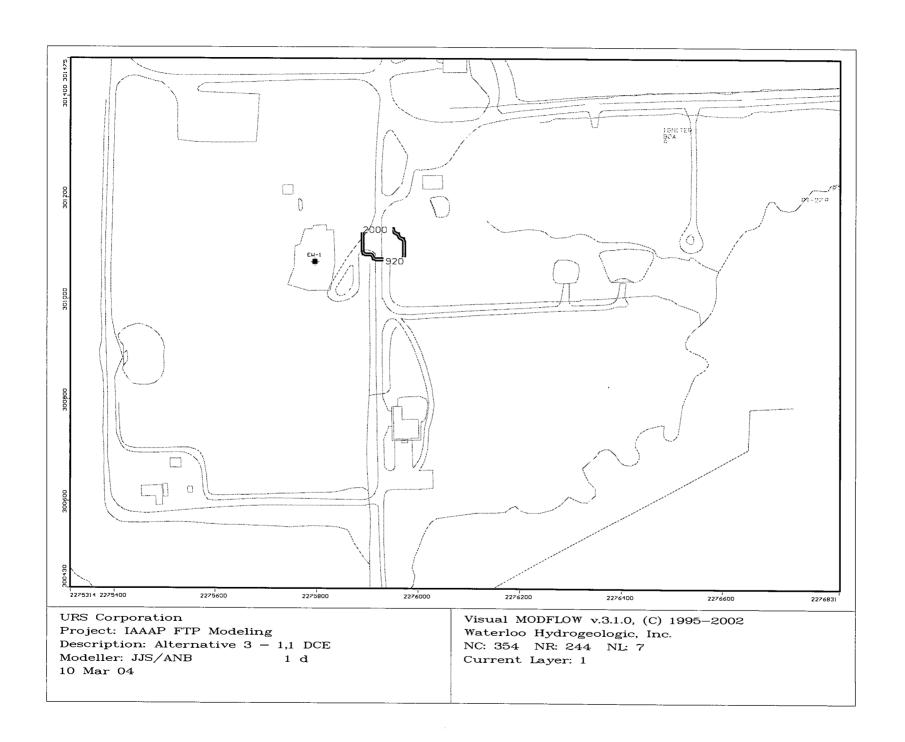


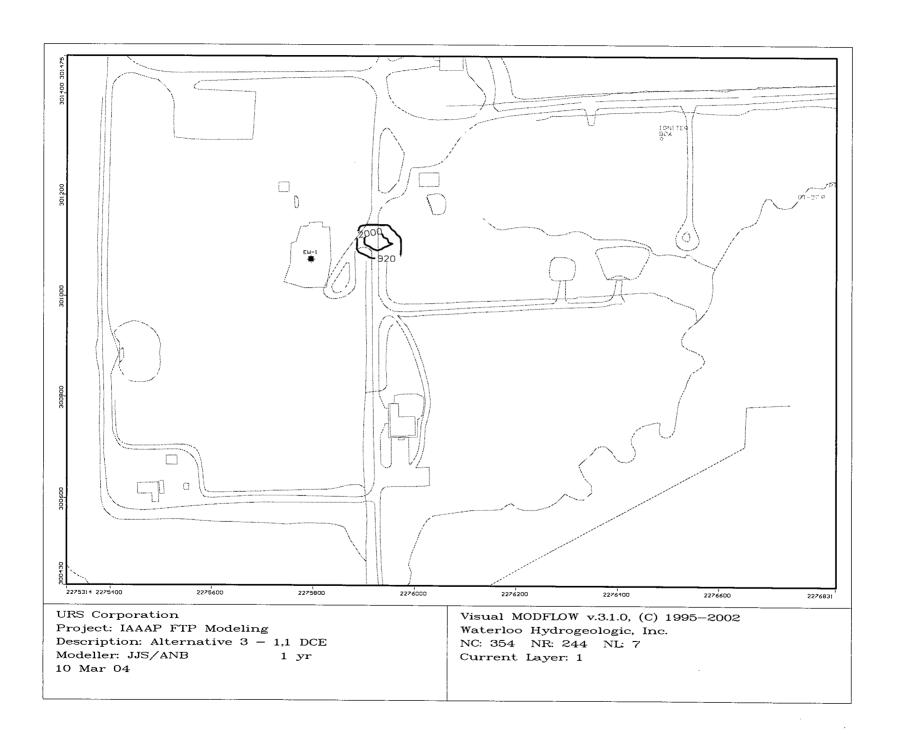


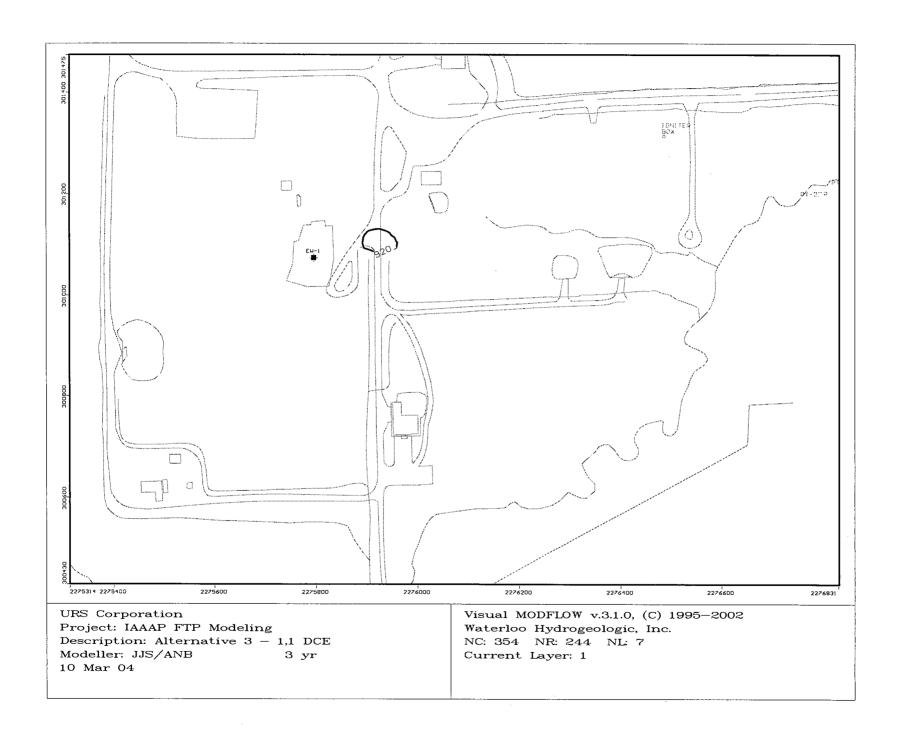


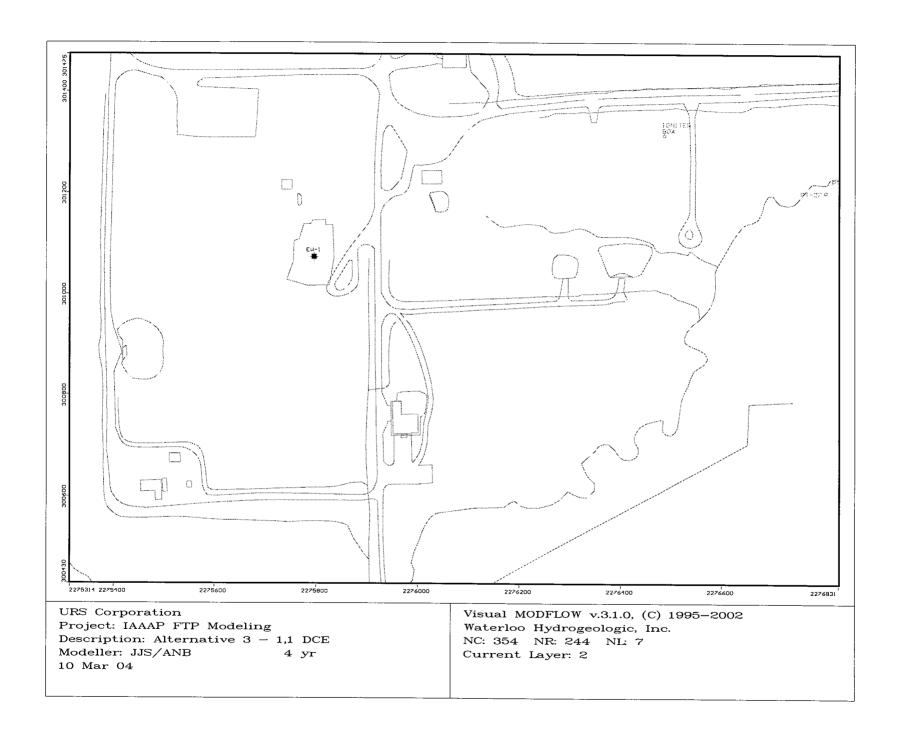


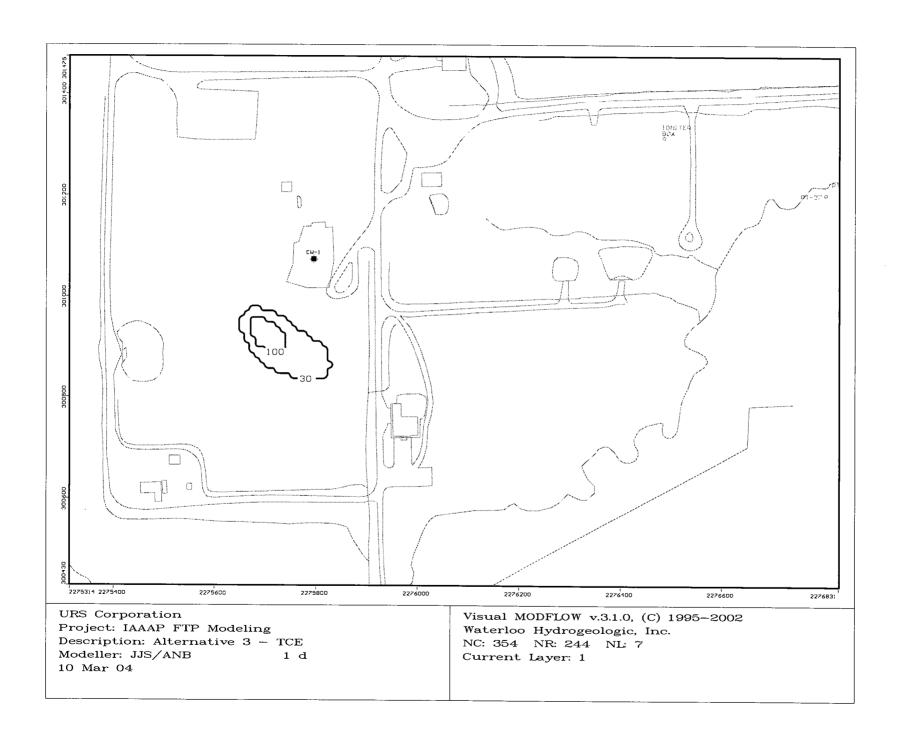


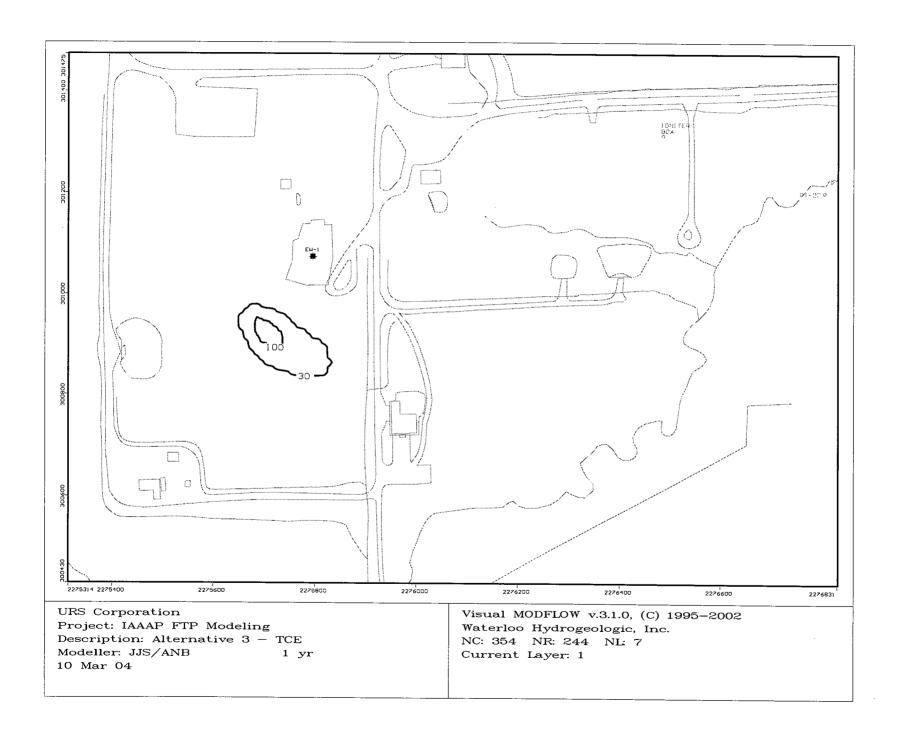


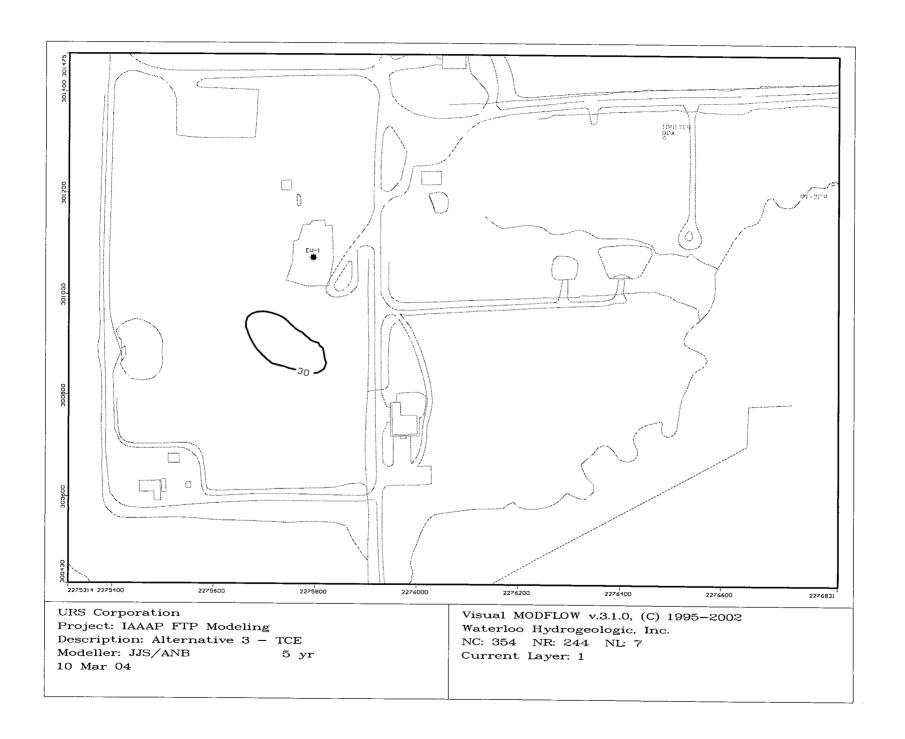


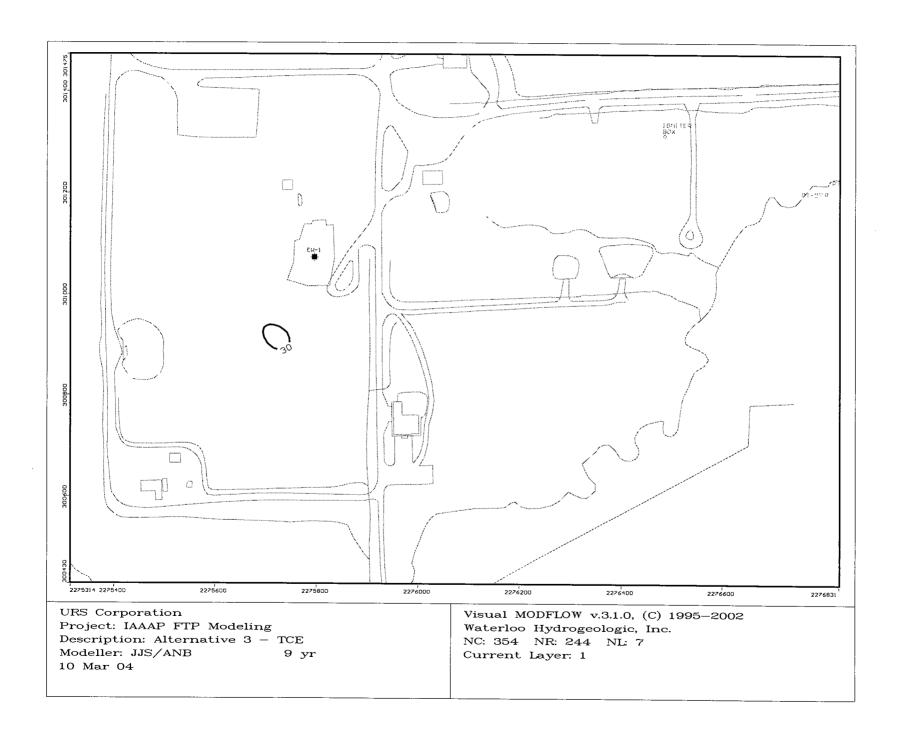


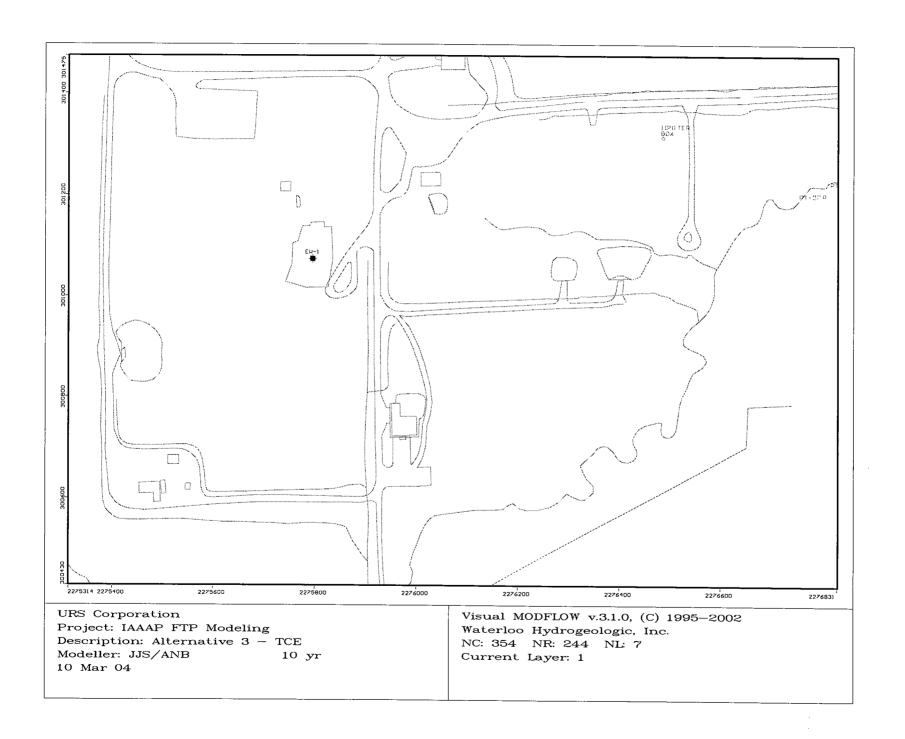


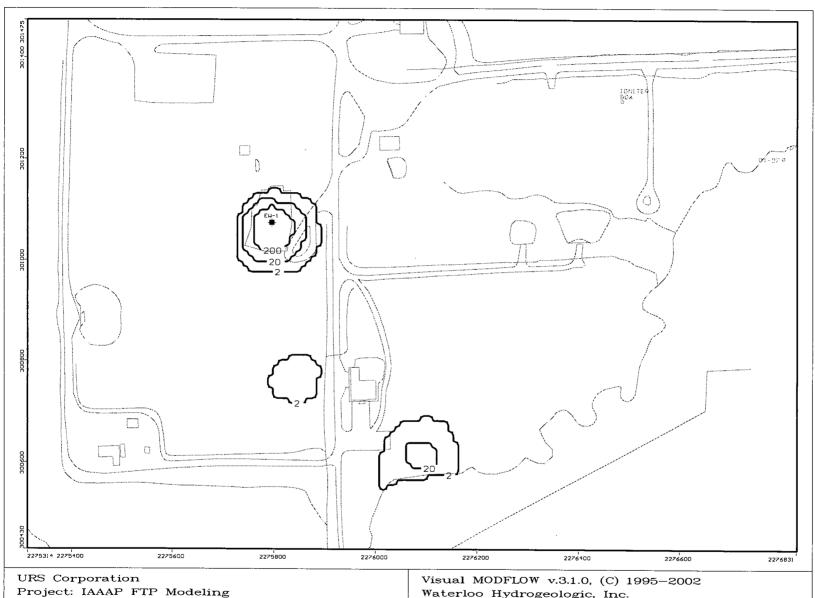












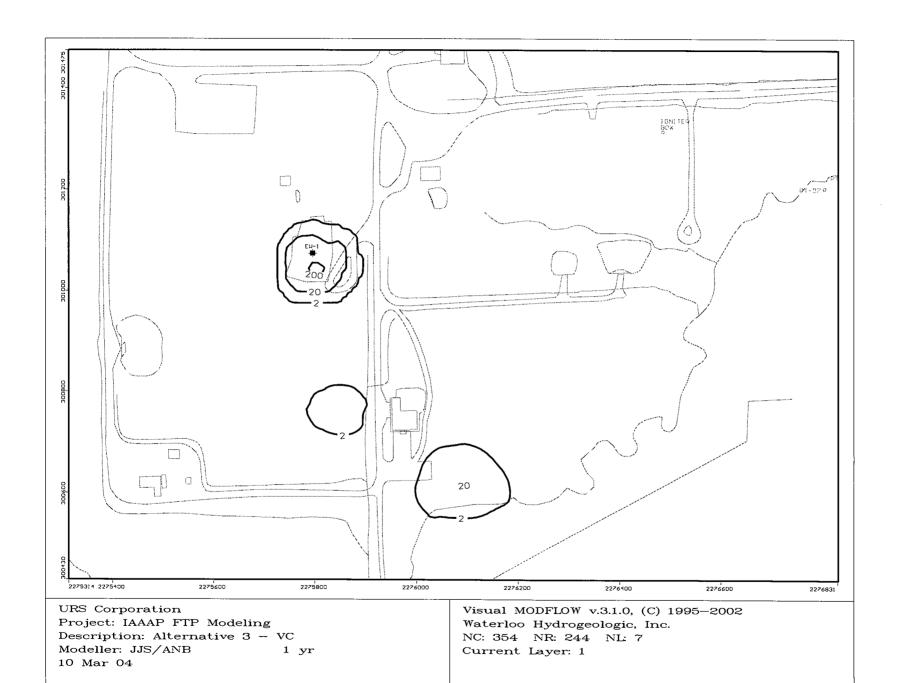
Description: Alternative 3 - VC Modeller: JJS/ANB 1 d

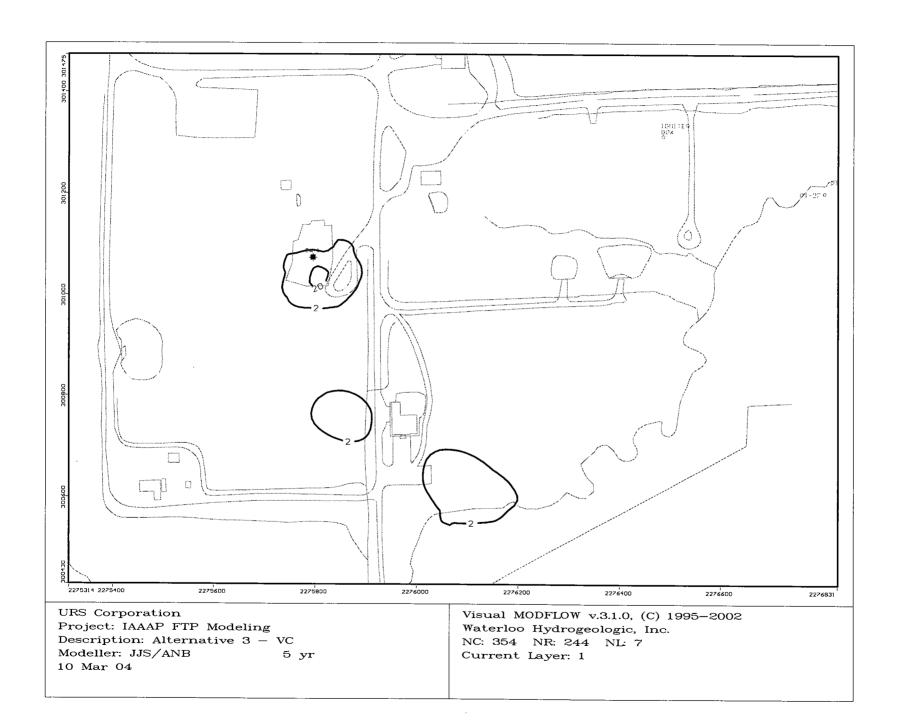
10 Mar 04

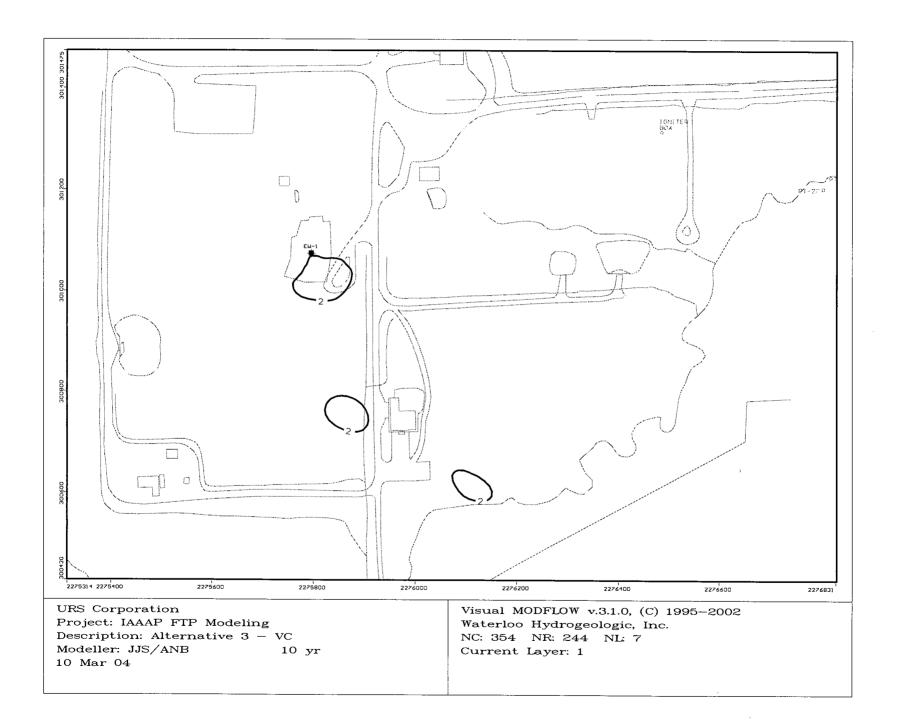
Waterloo Hydrogeologic, Inc.

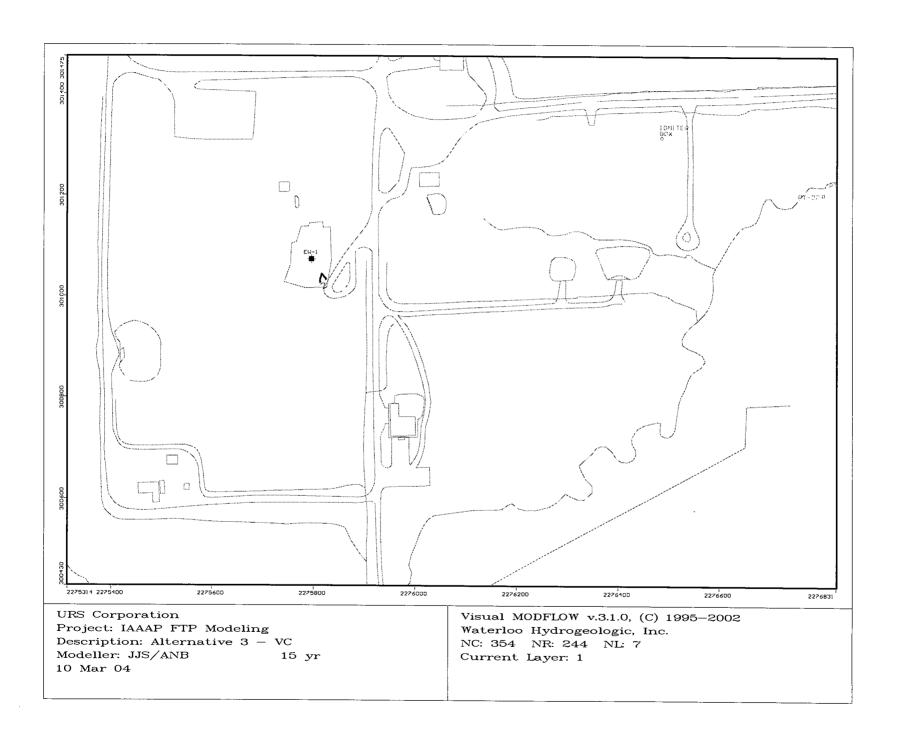
NC: 354 NR: 244 NL: 7

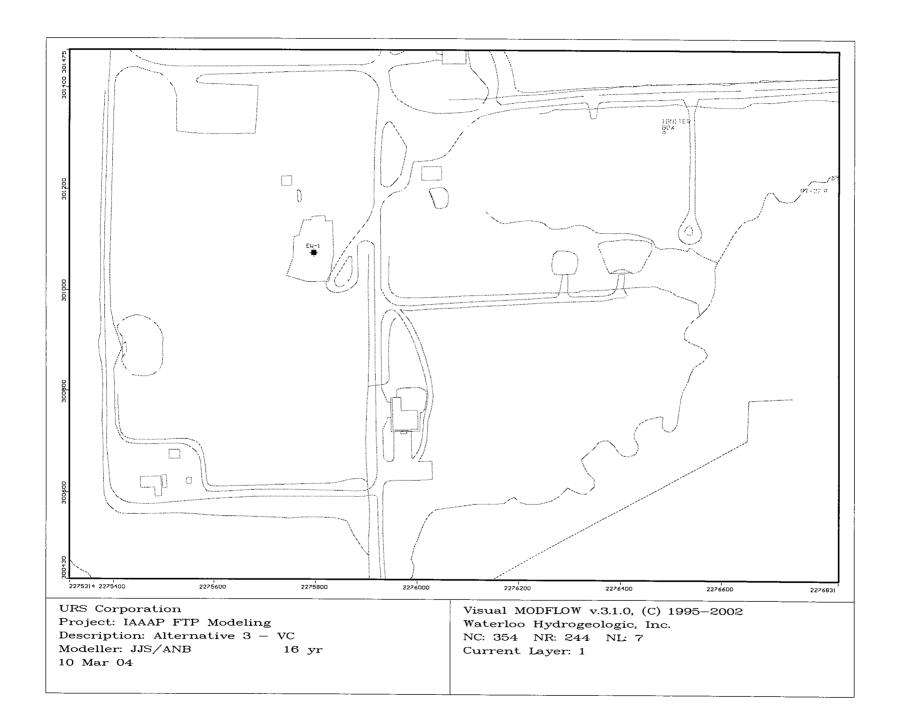
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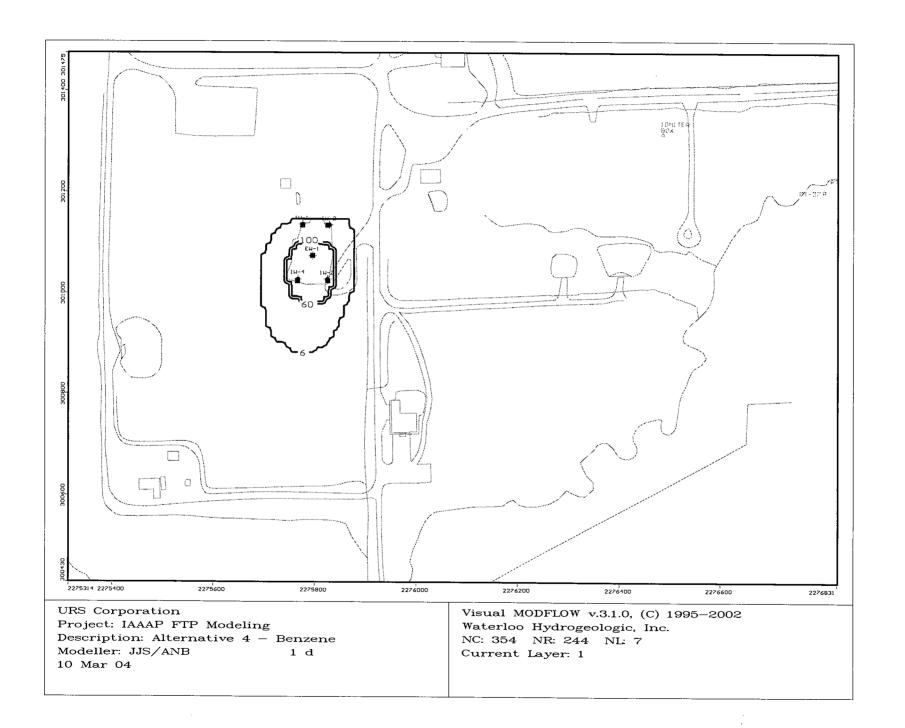


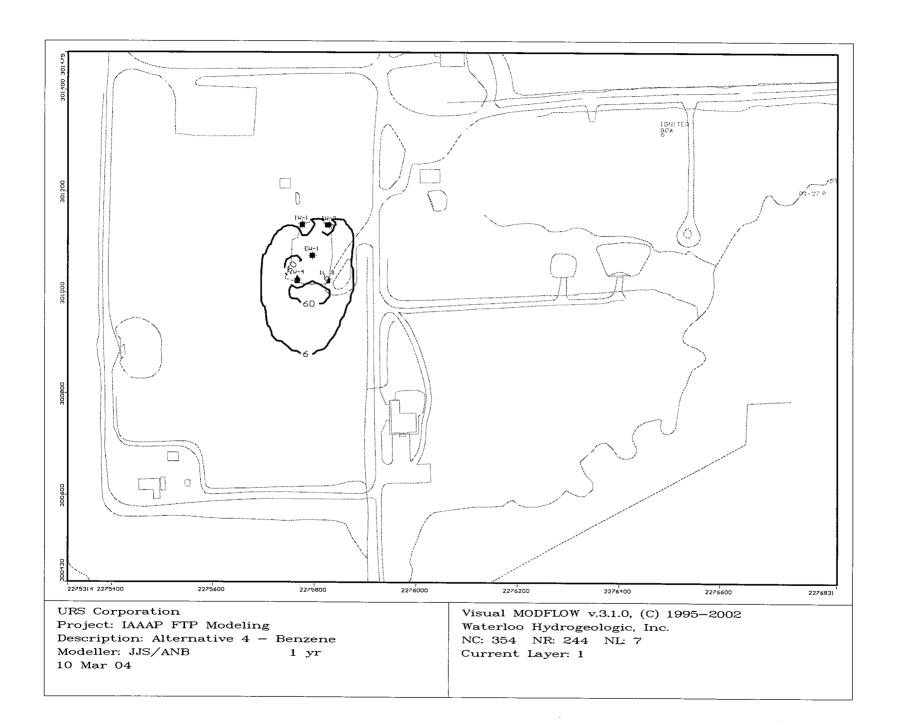


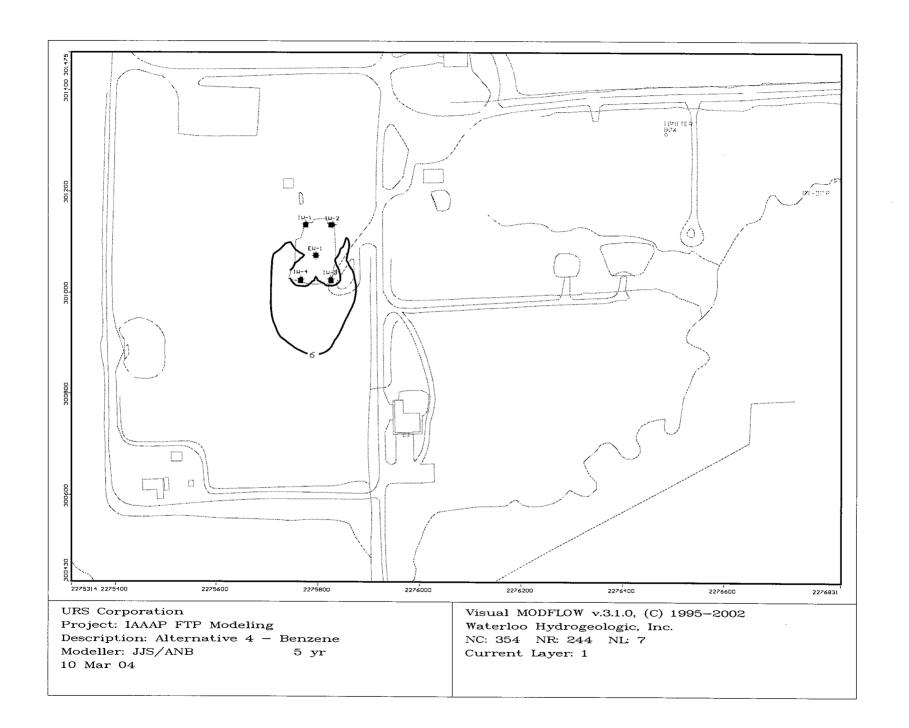


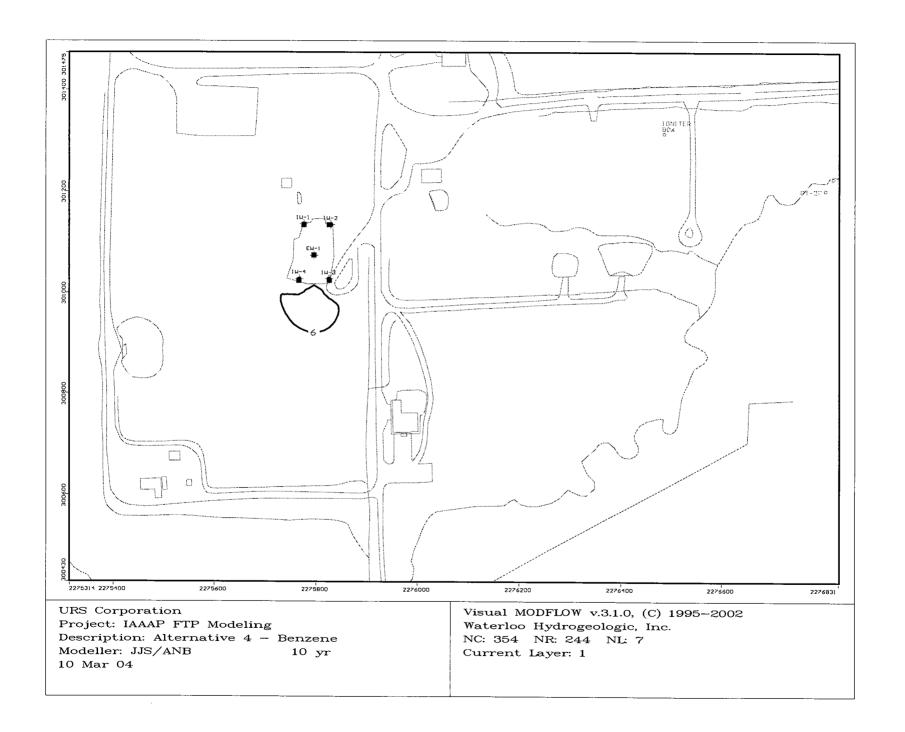
## ATTACHMENT K-5 Contaminant Fate and Transport Modeling Results

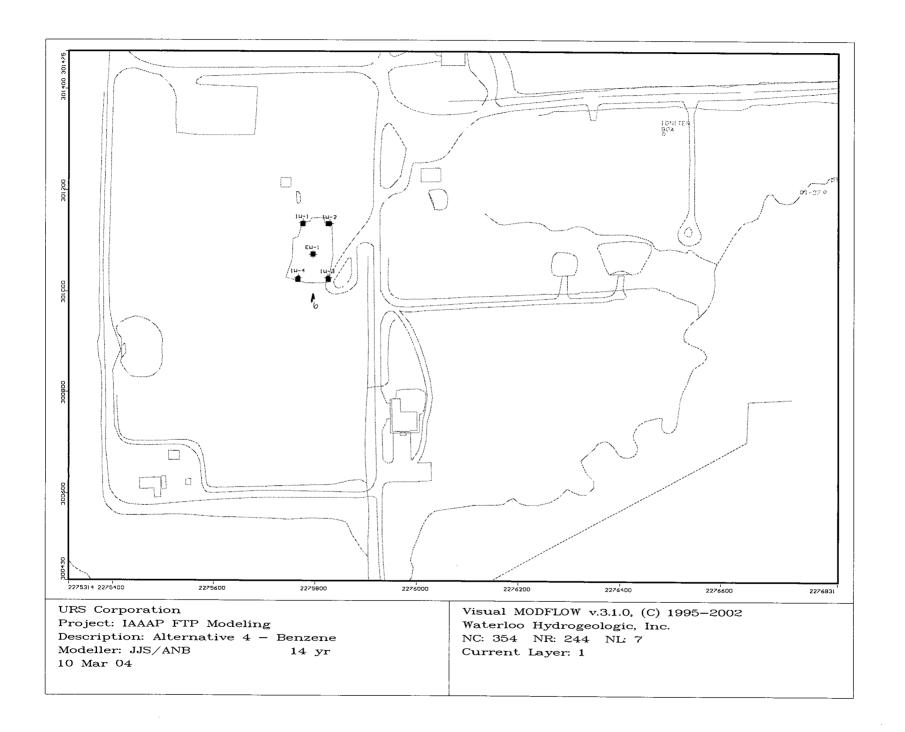
Alternative 4 – ISCO/MNA

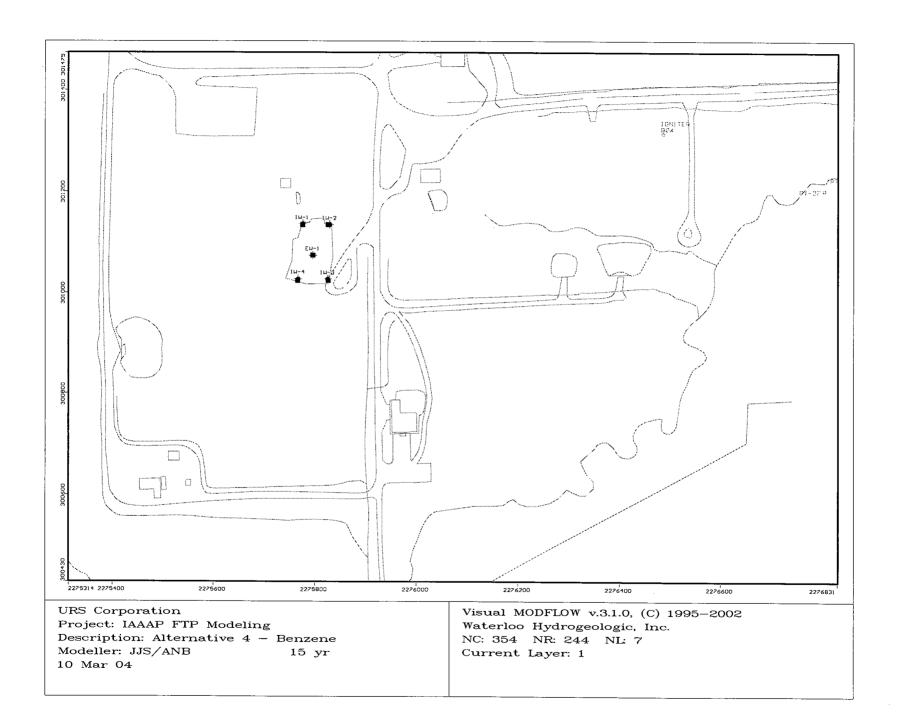


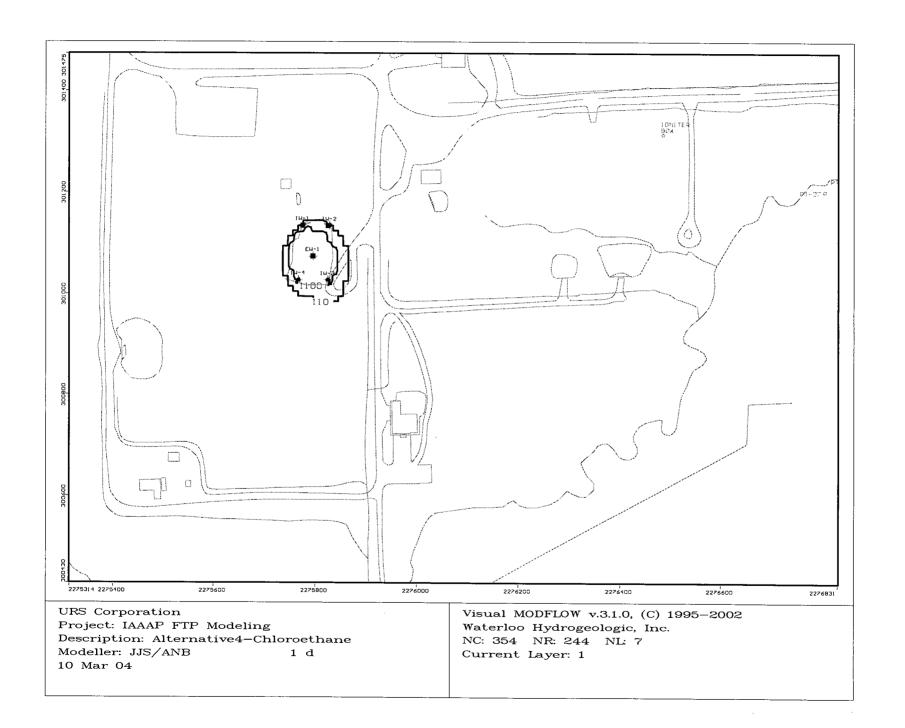


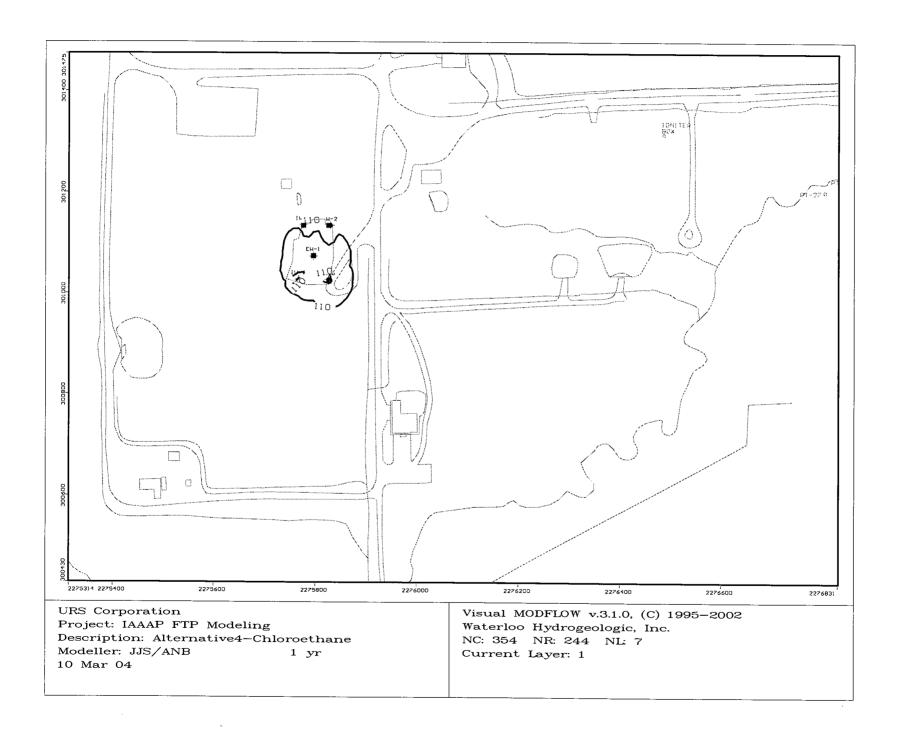


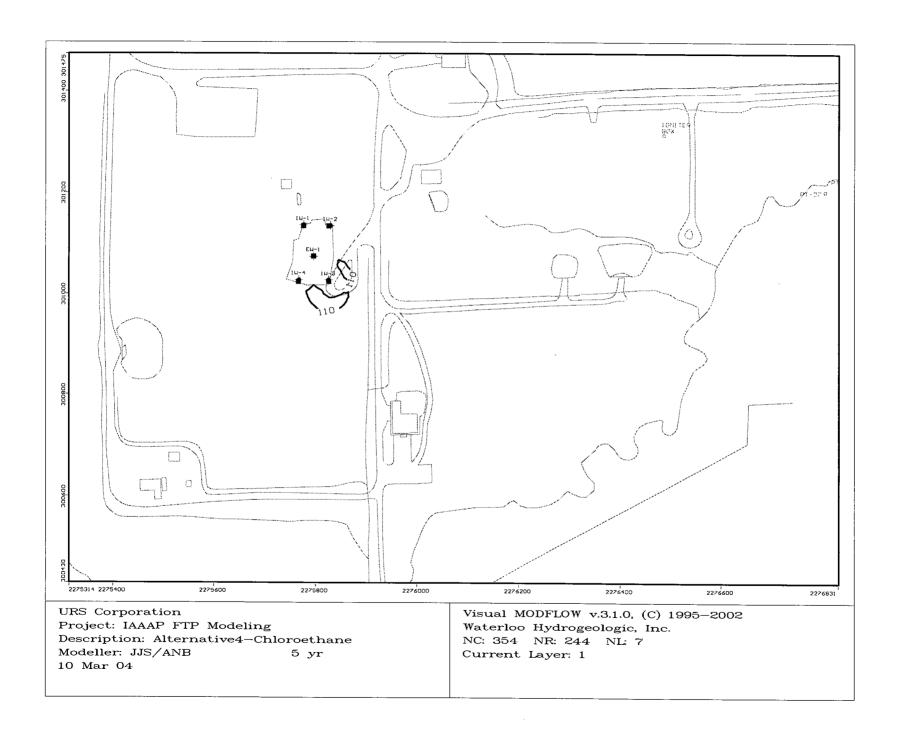


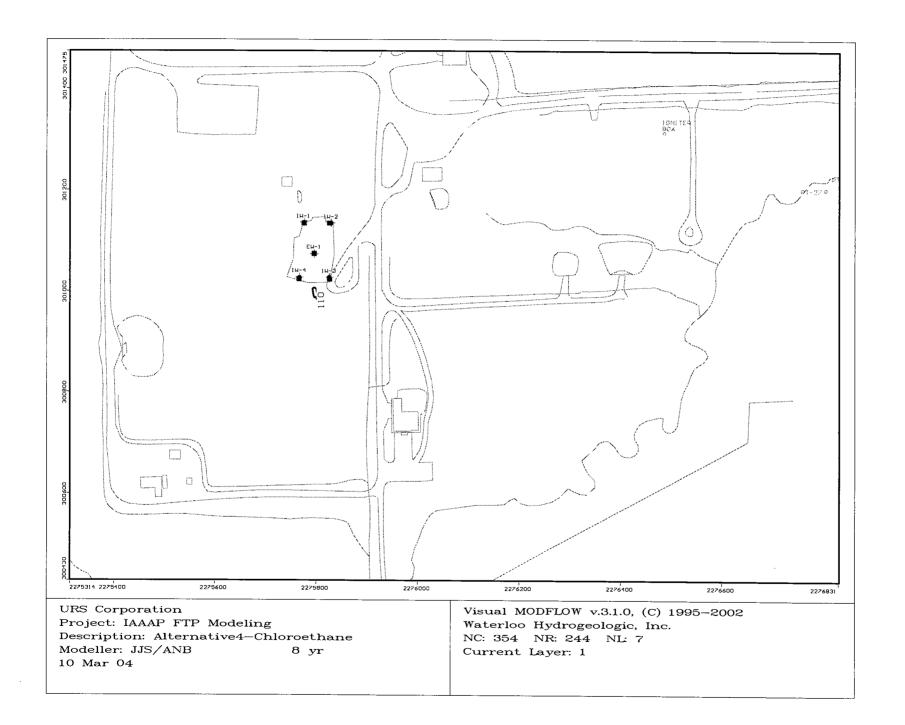


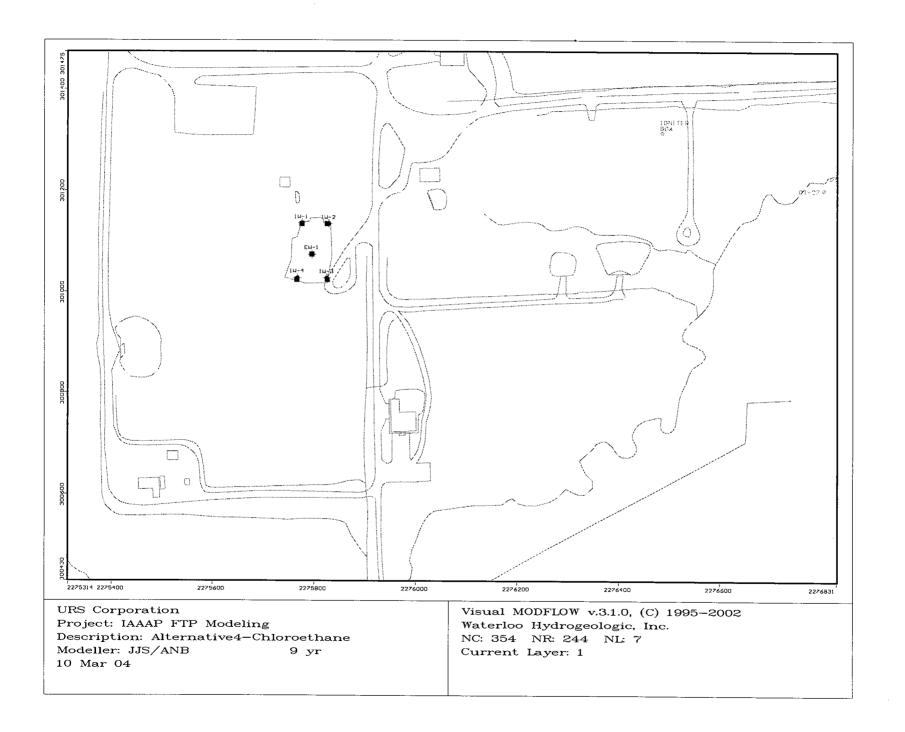


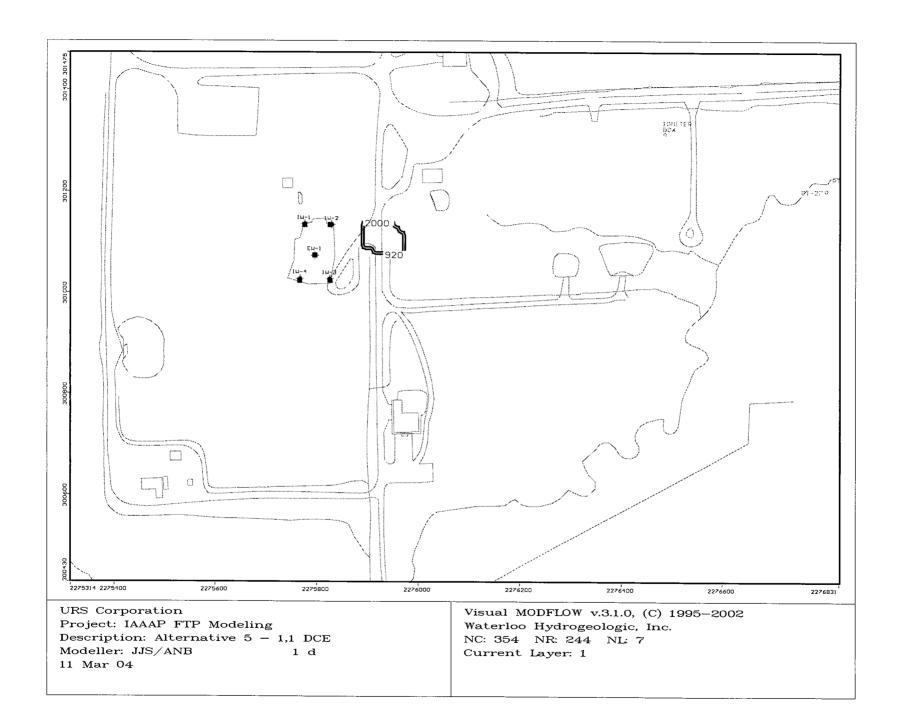


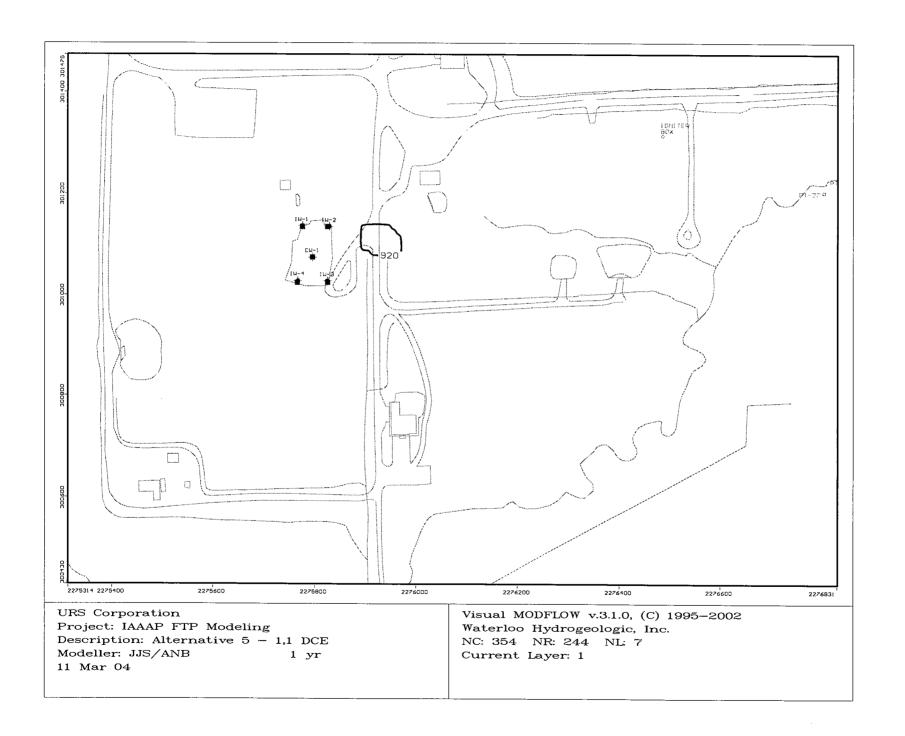


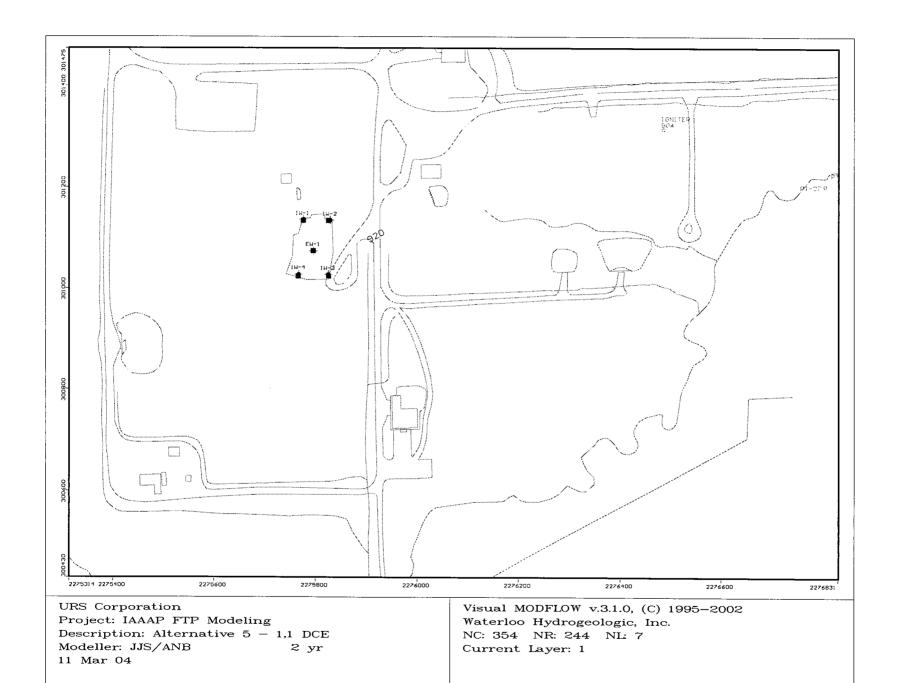


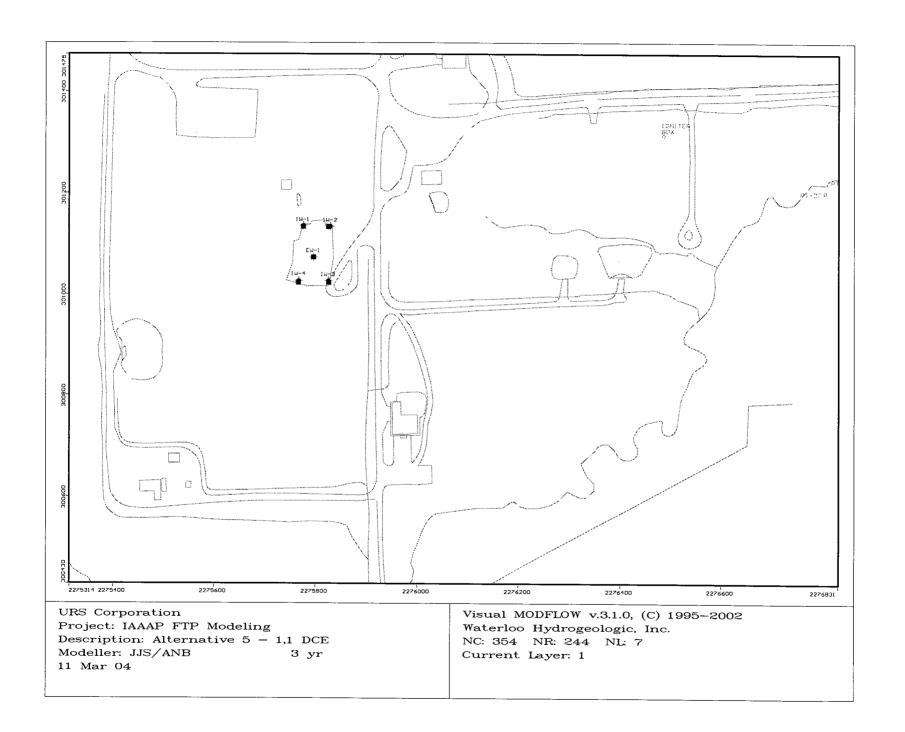


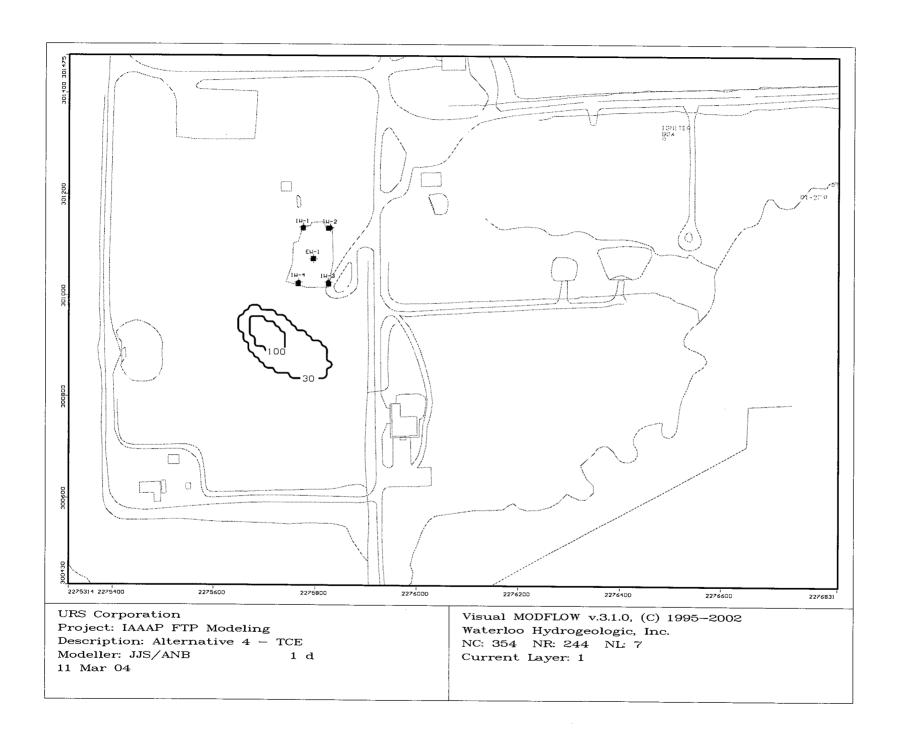


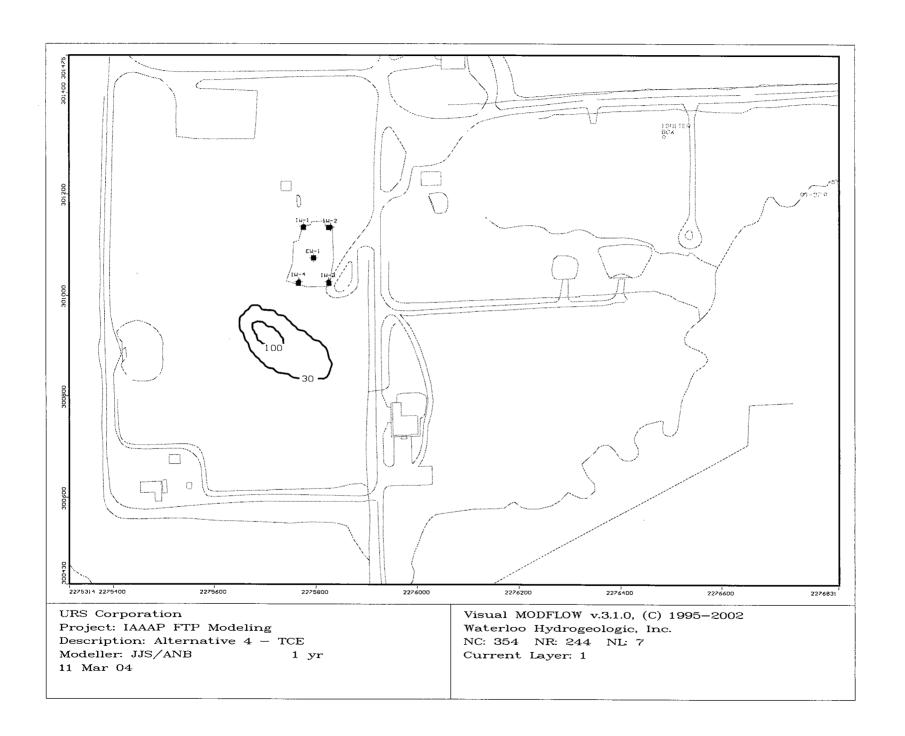


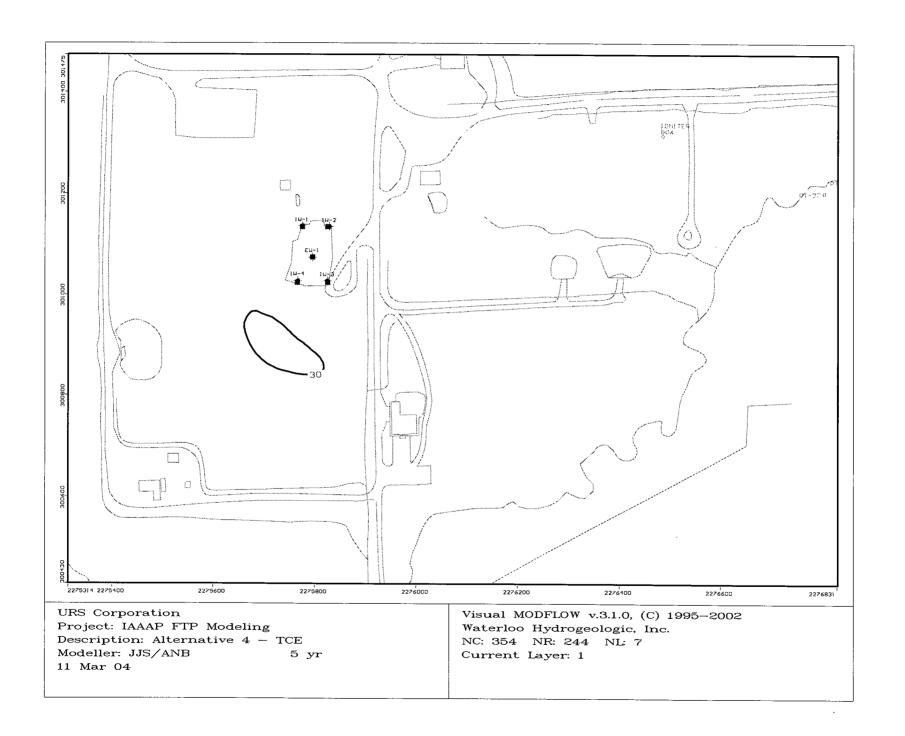


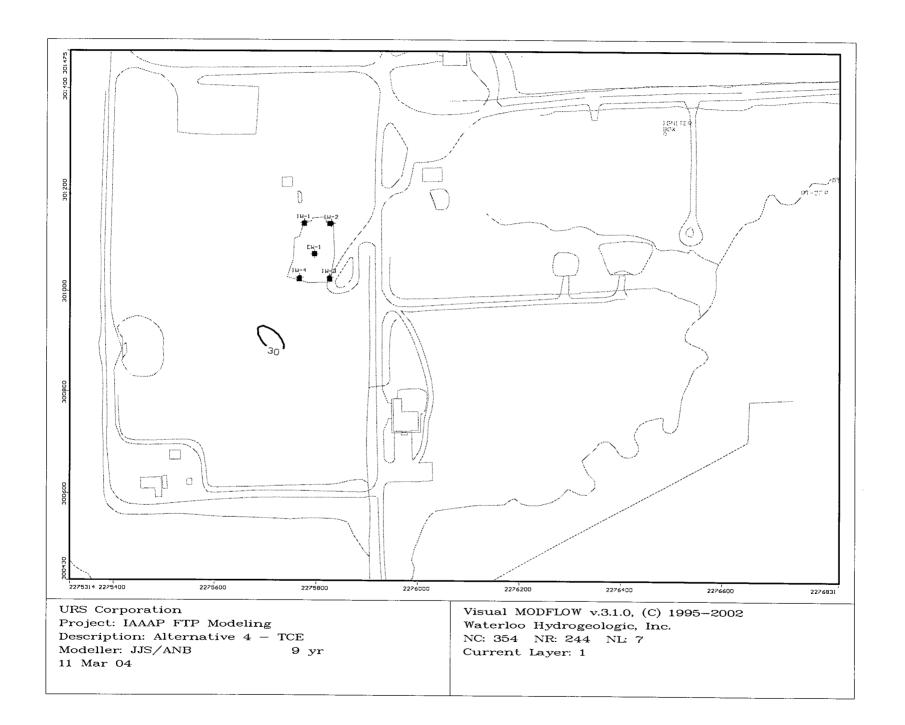


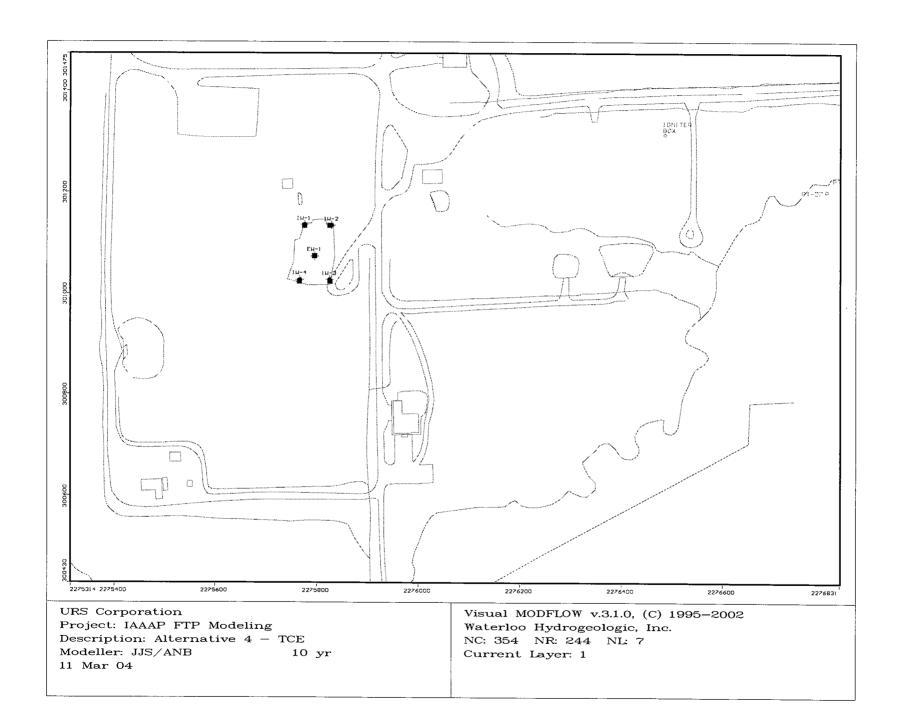


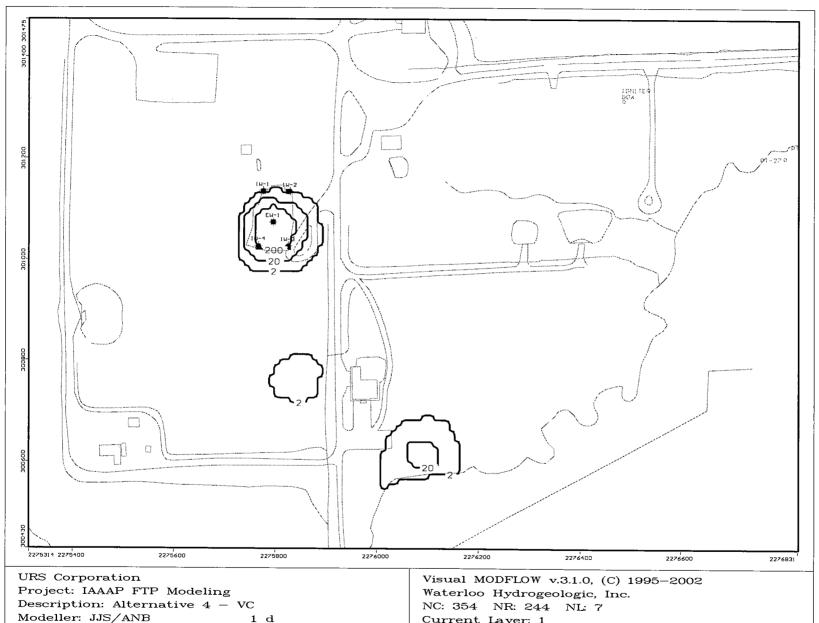






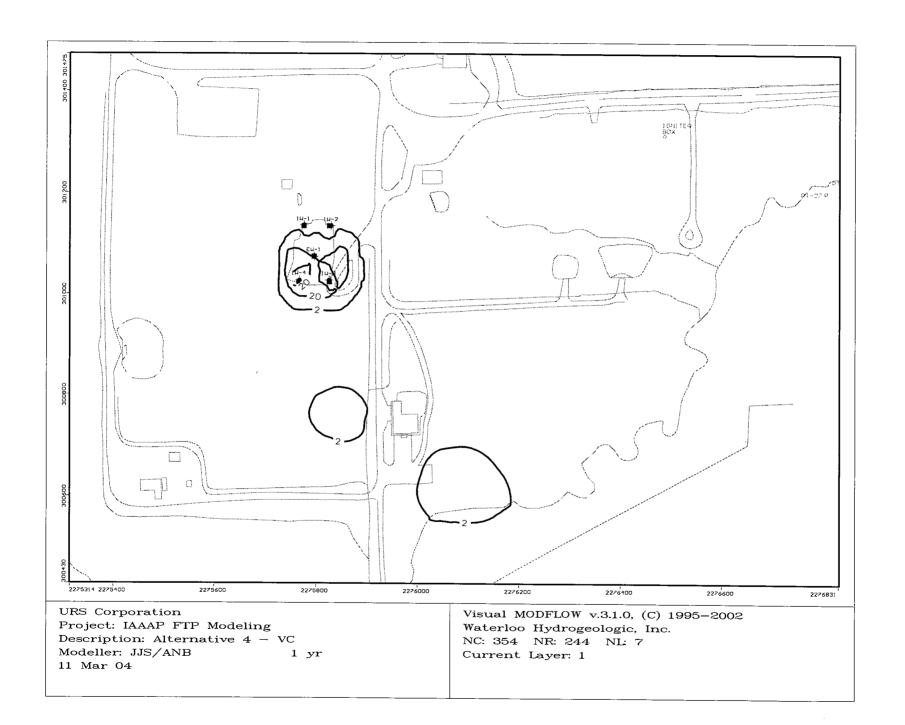


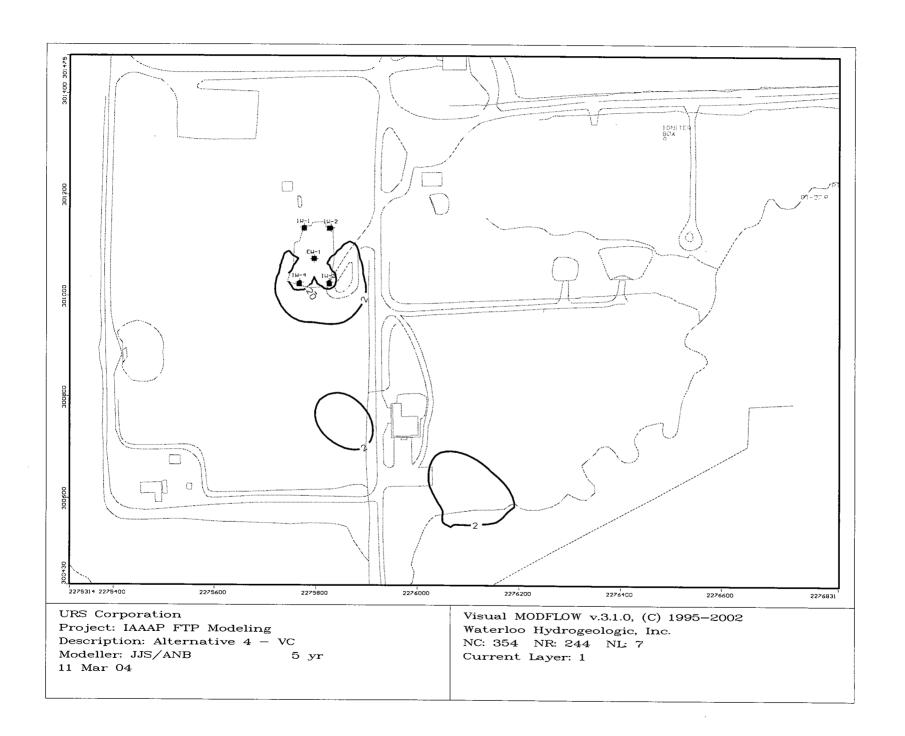


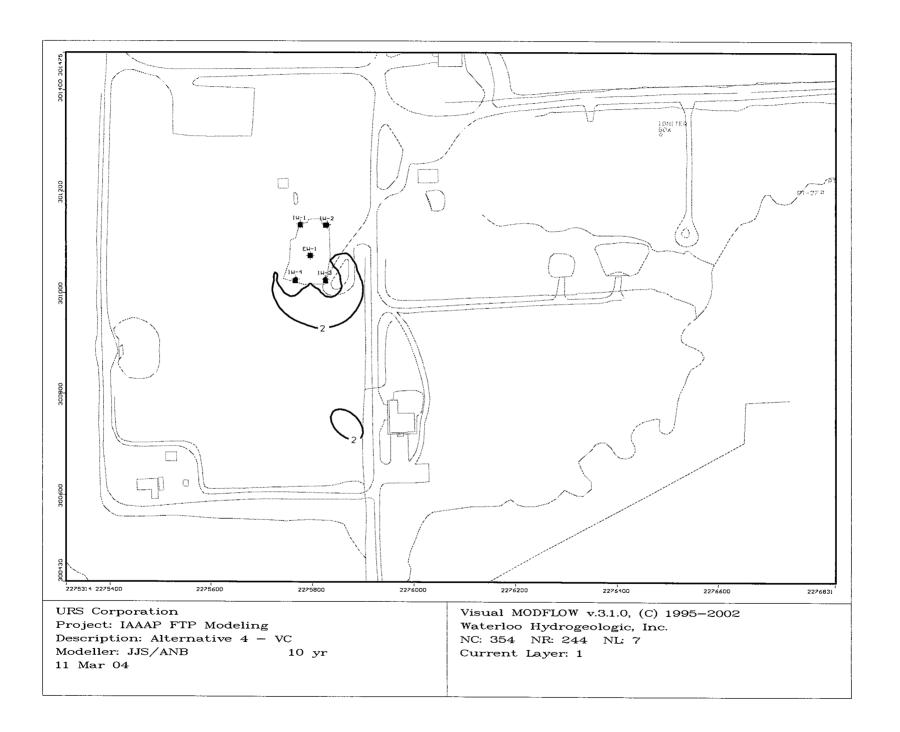


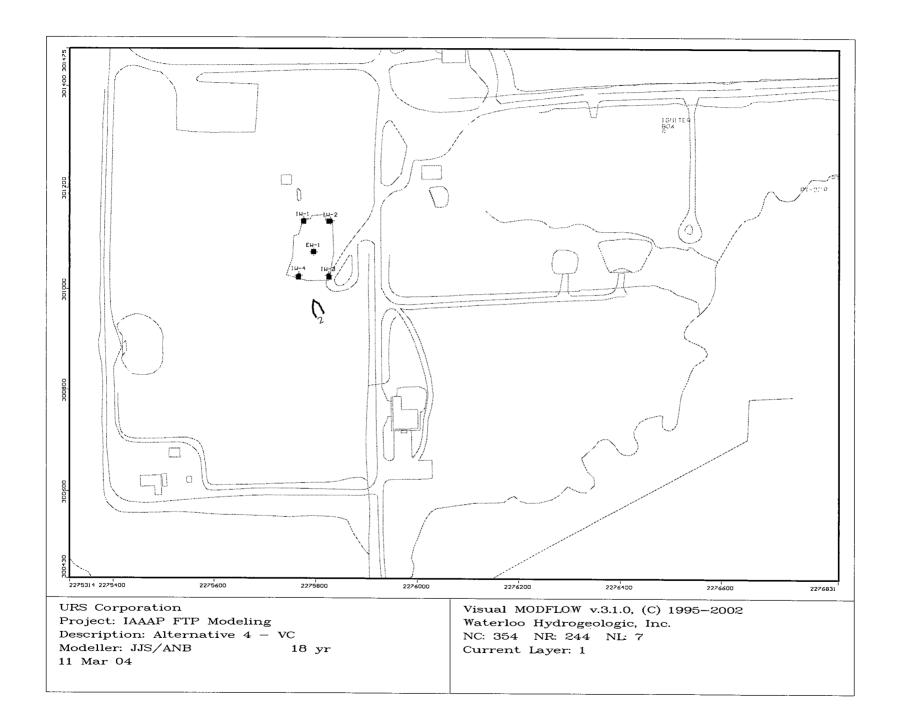
11 Mar 04

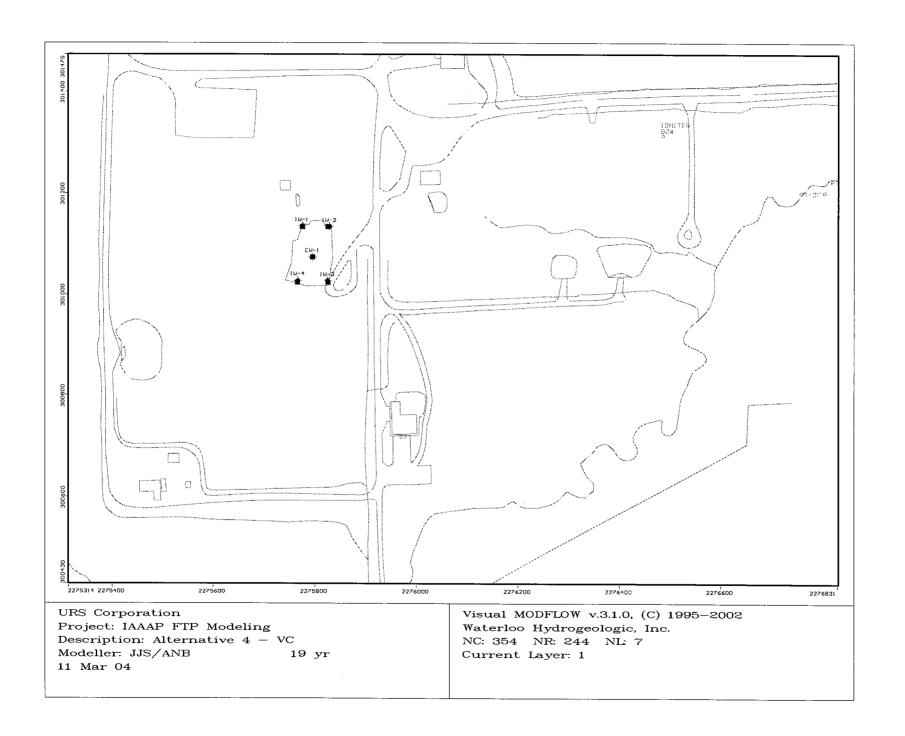
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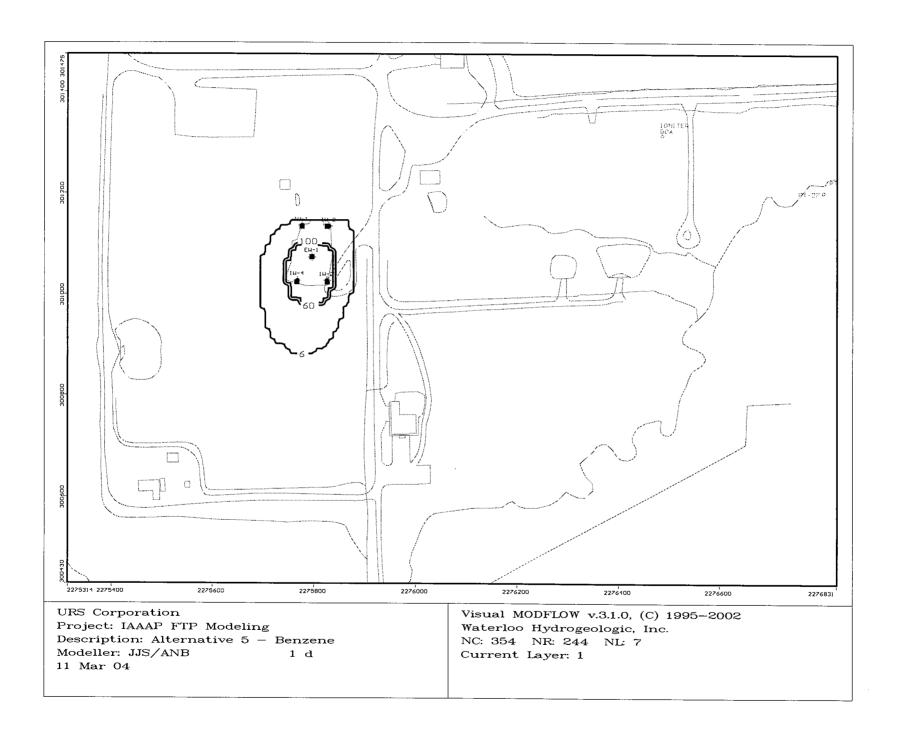


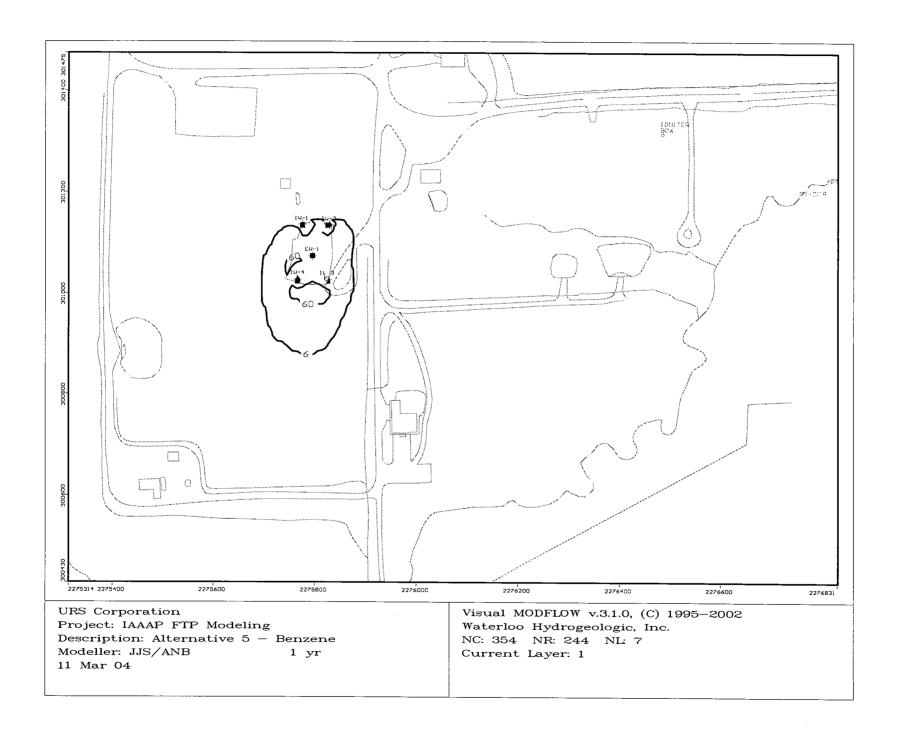


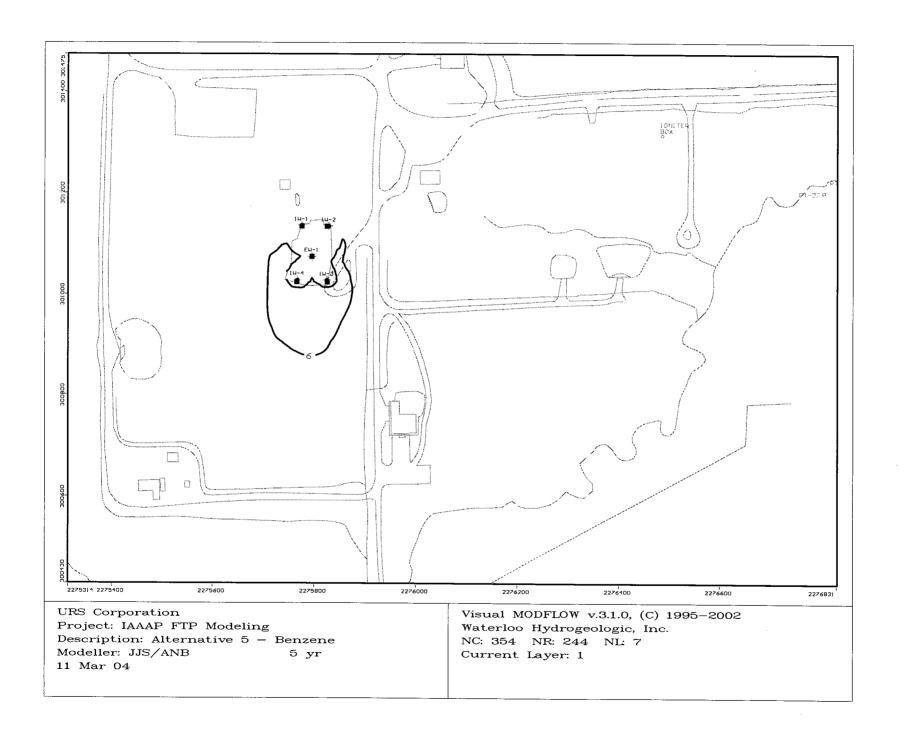


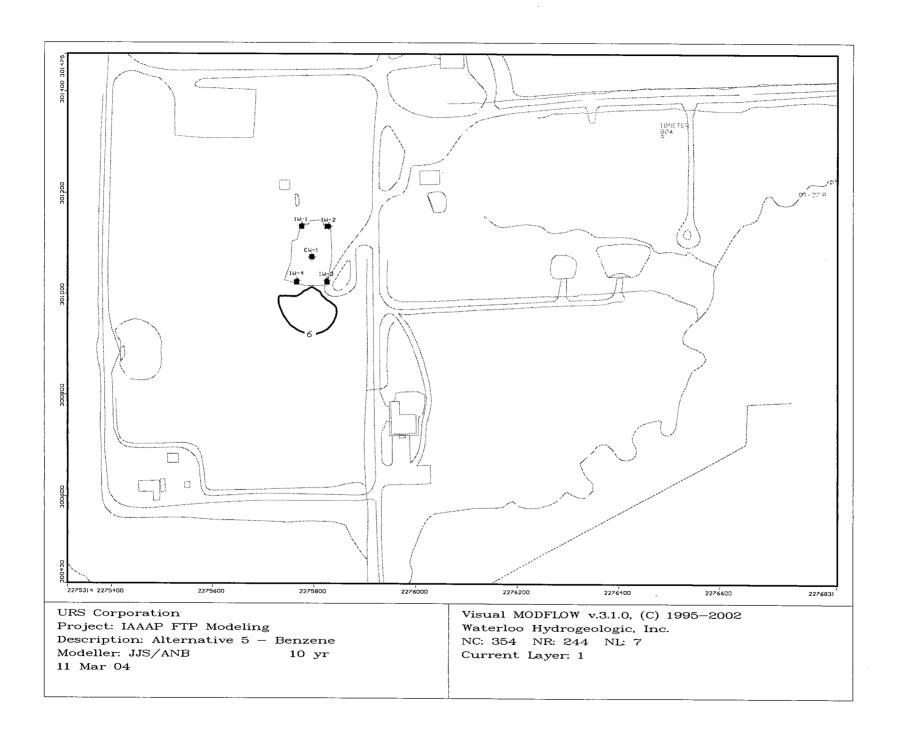
## ATTACHMENT K-5 Contaminant Fate and Transport Modeling Results

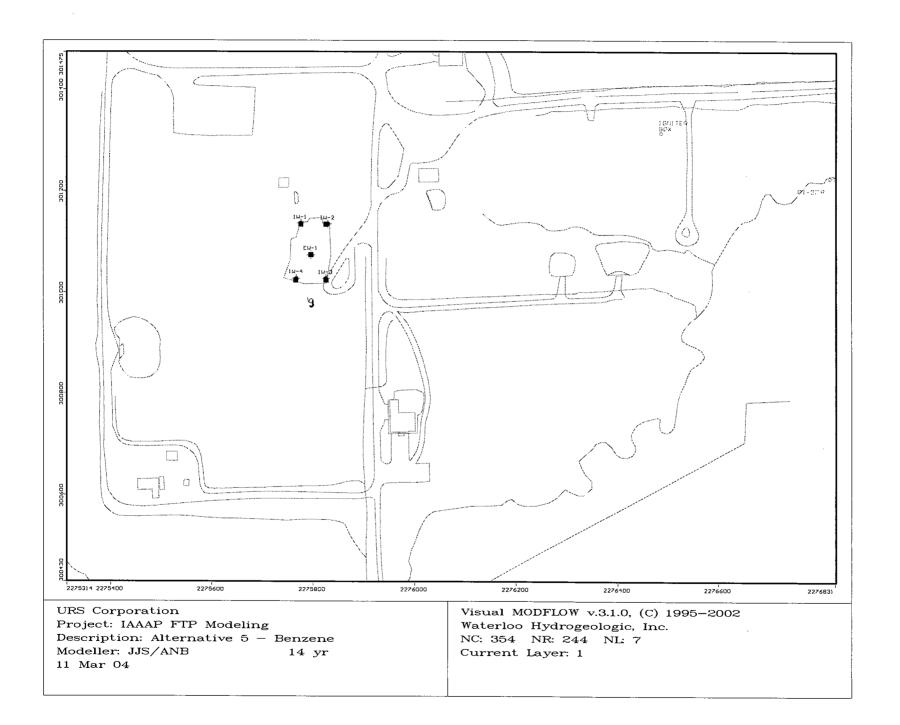
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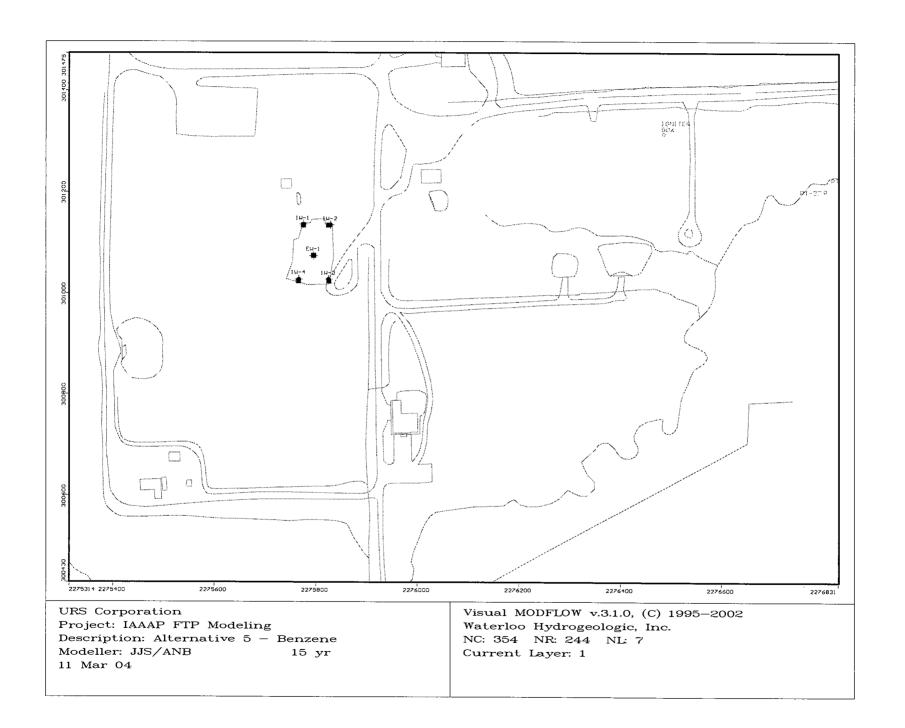


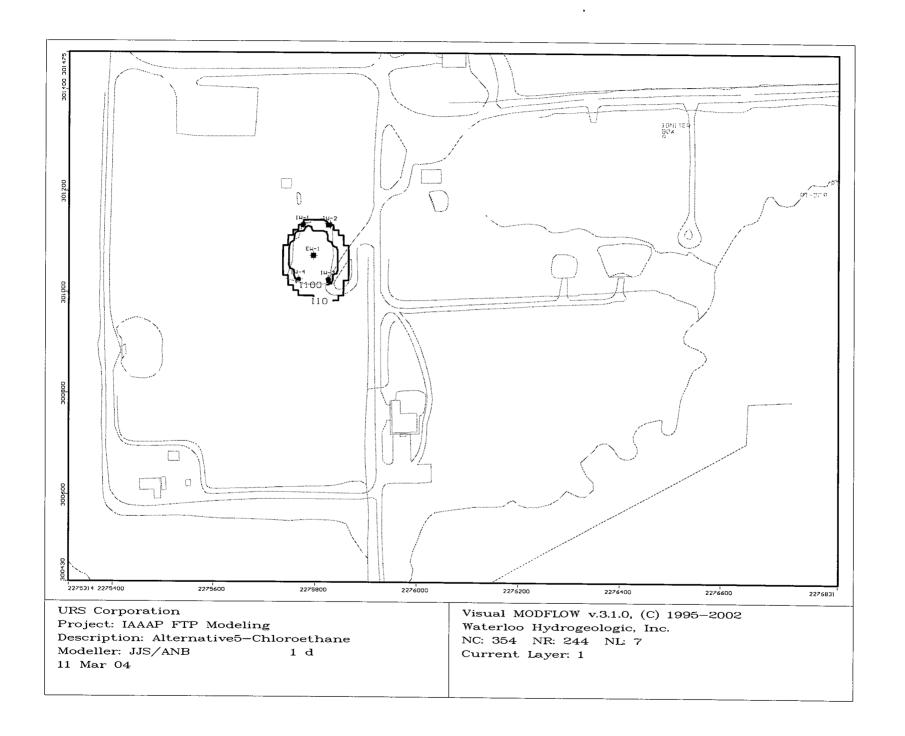


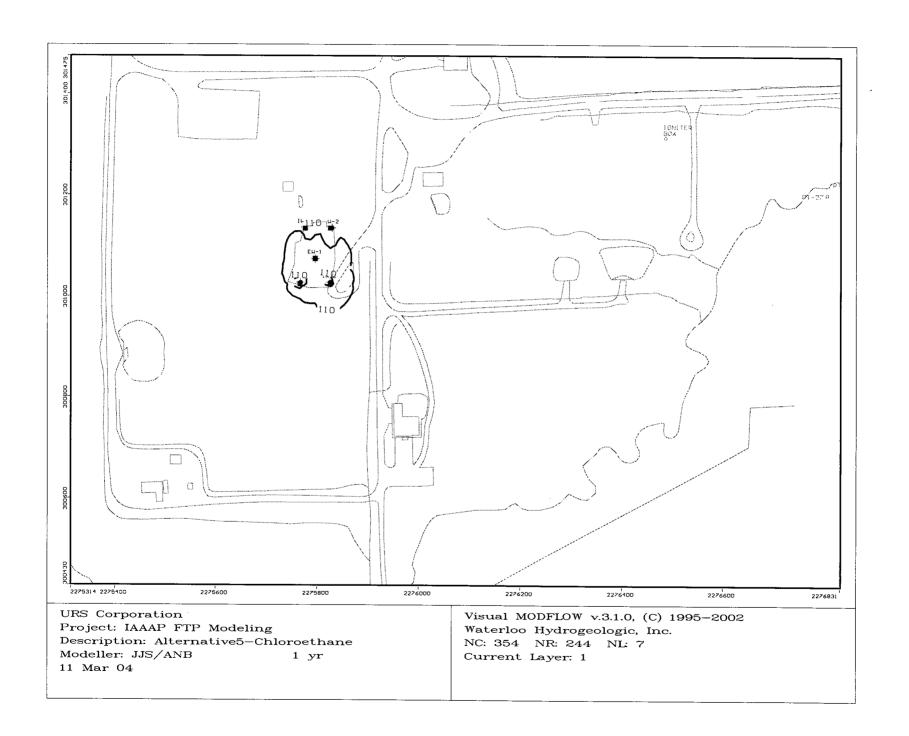


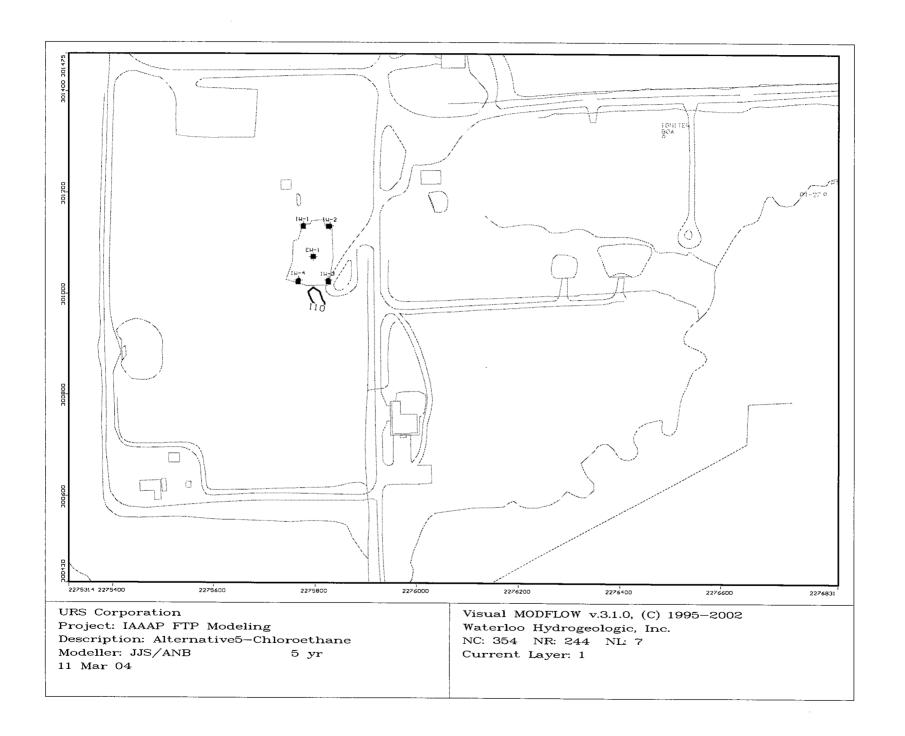


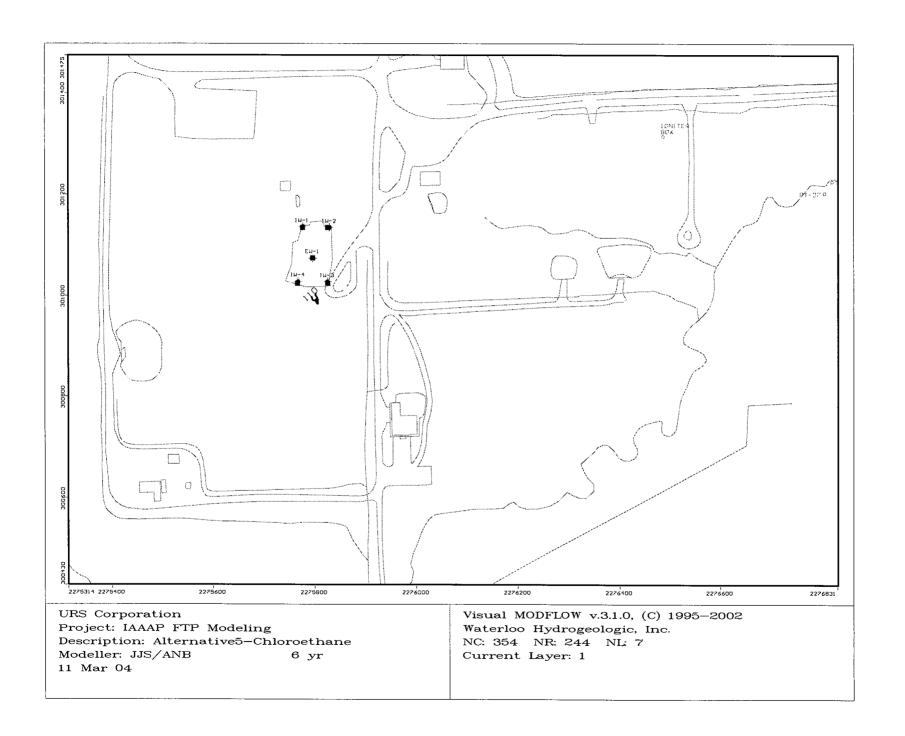


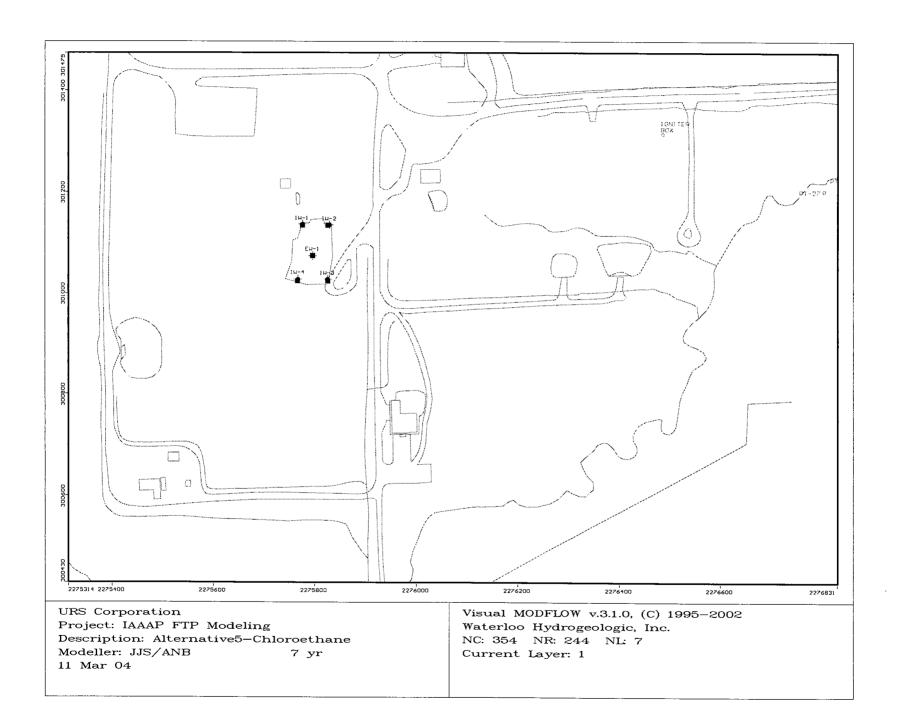


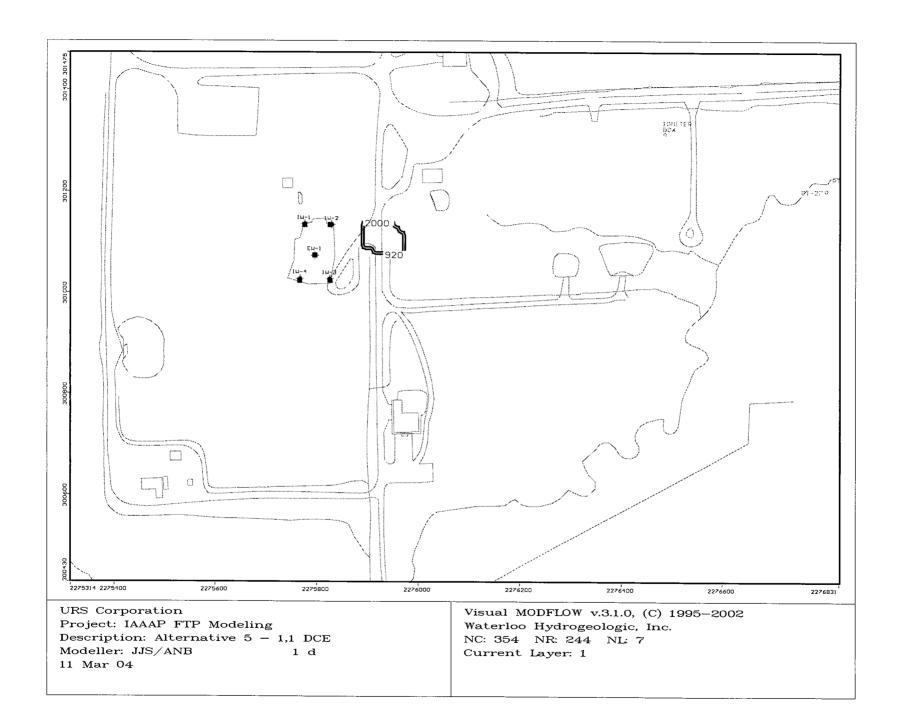


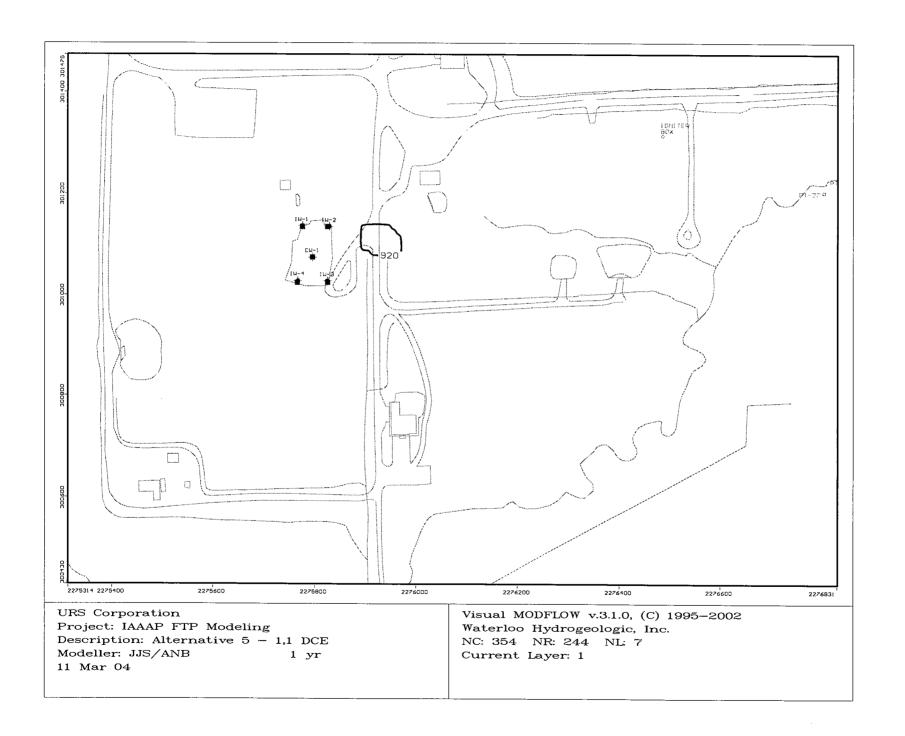


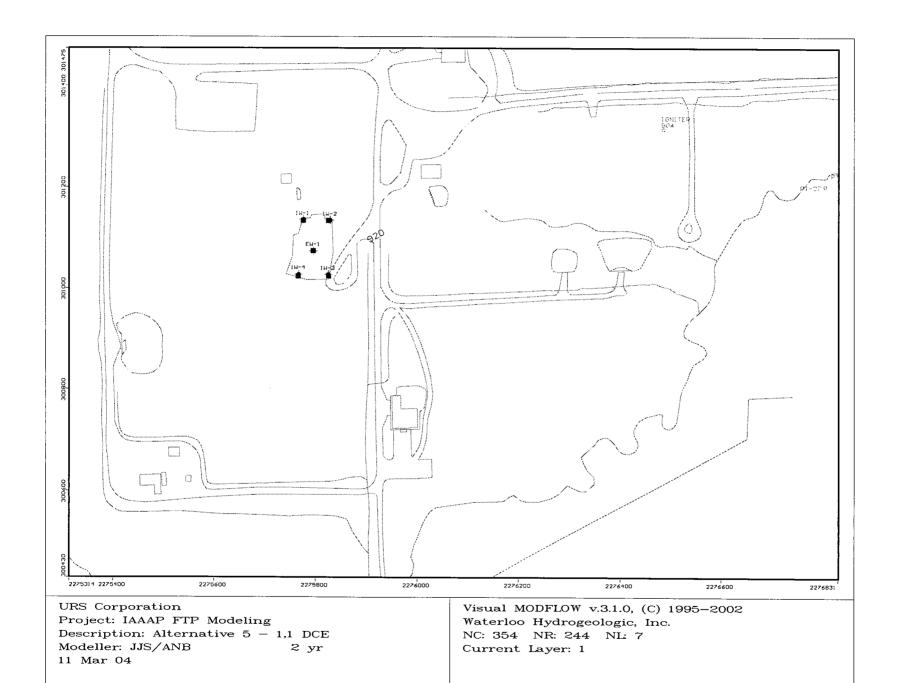


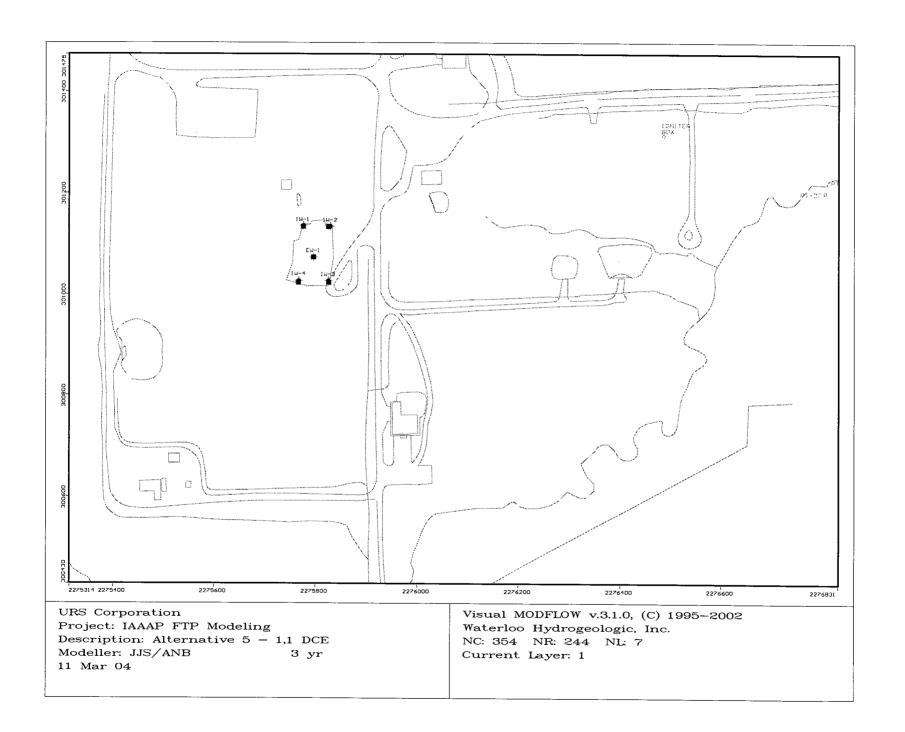


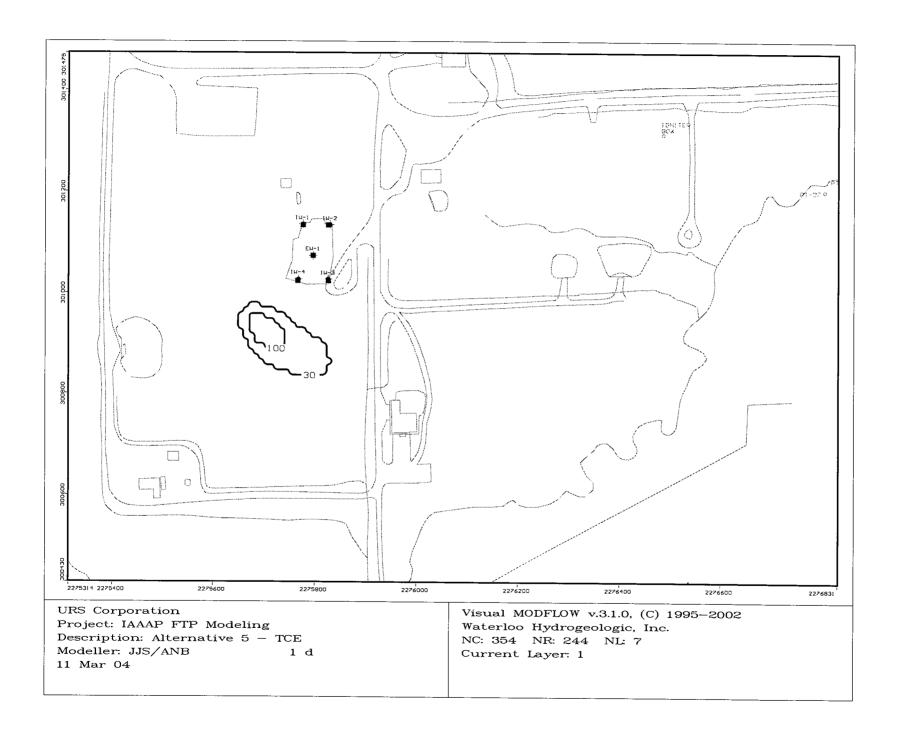


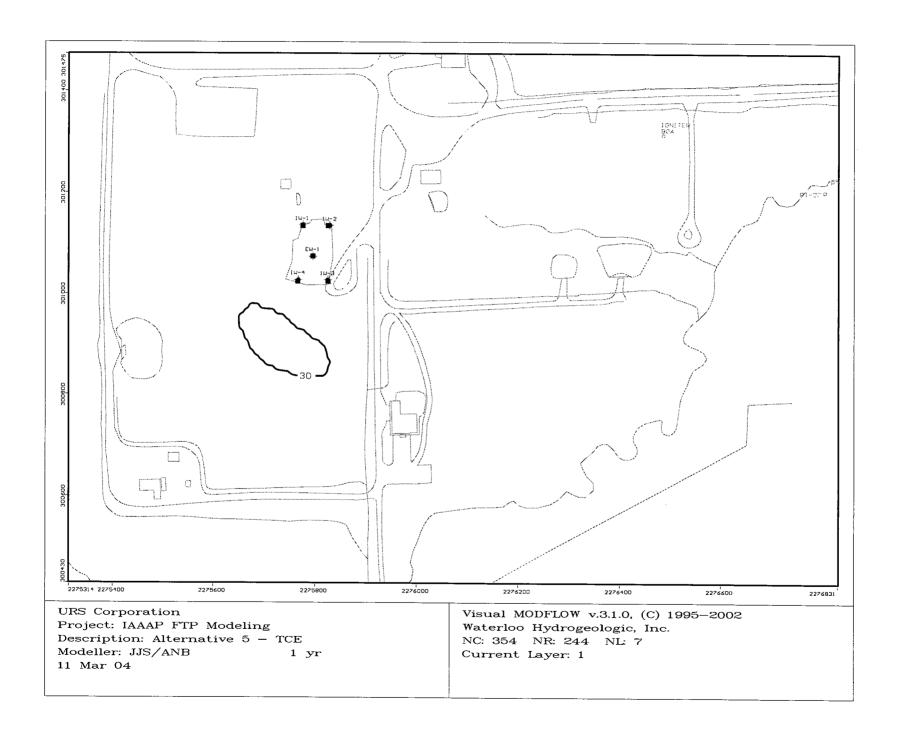


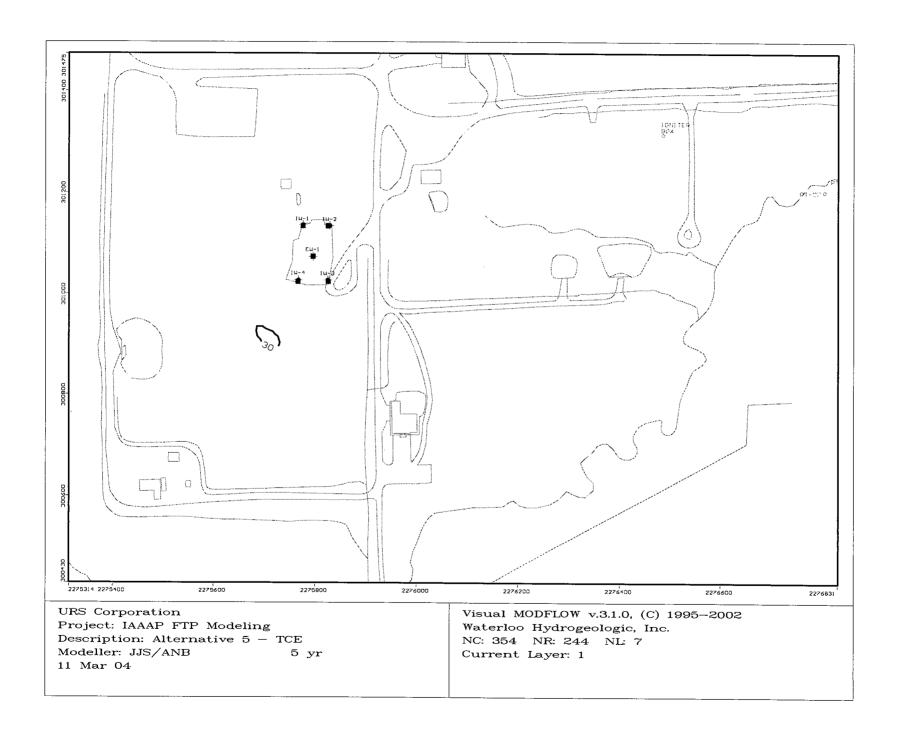


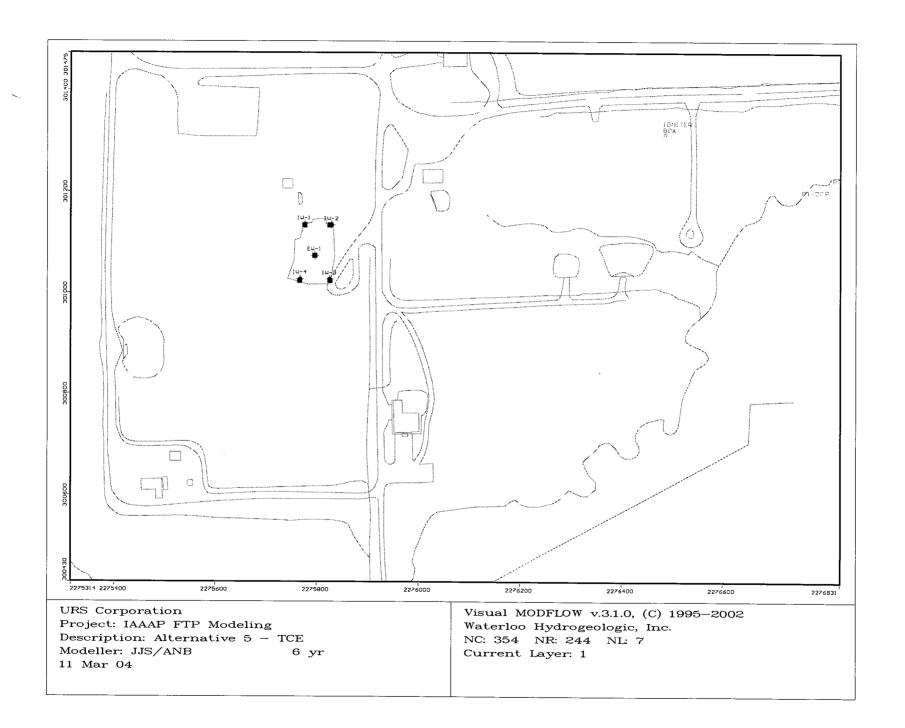


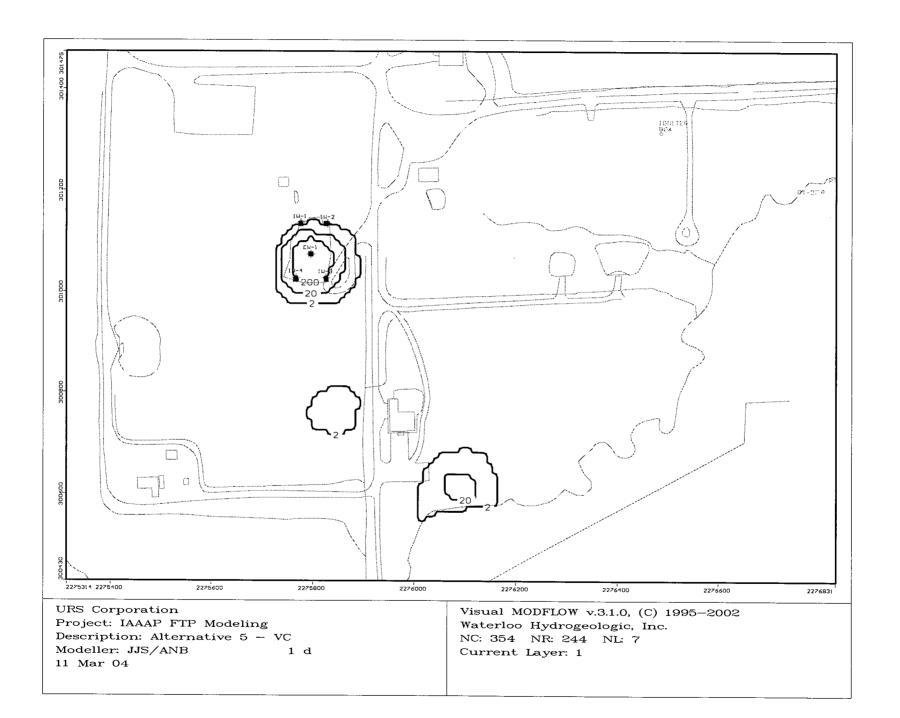


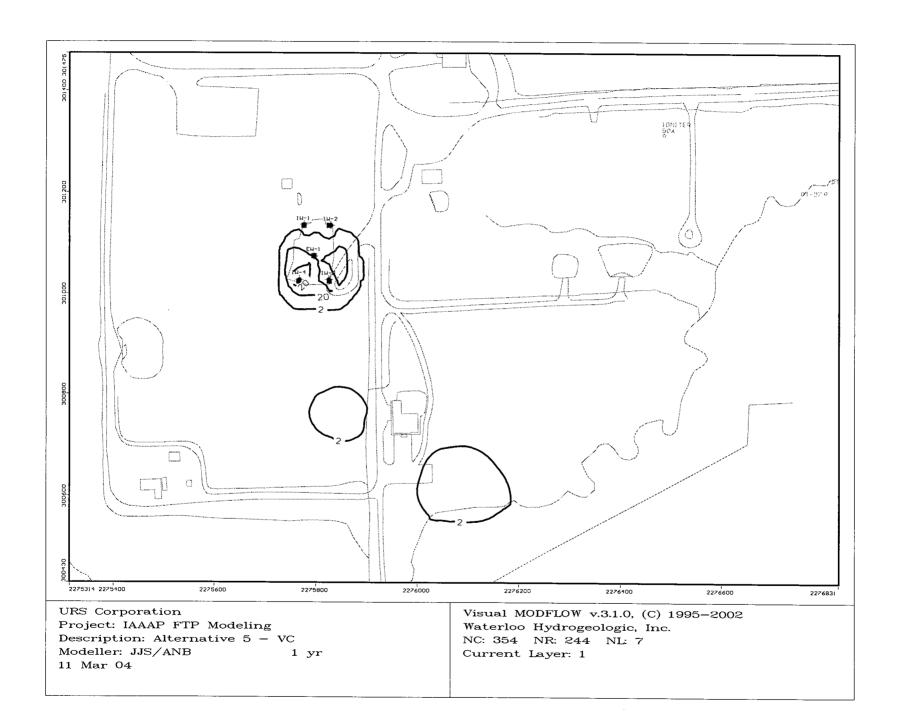


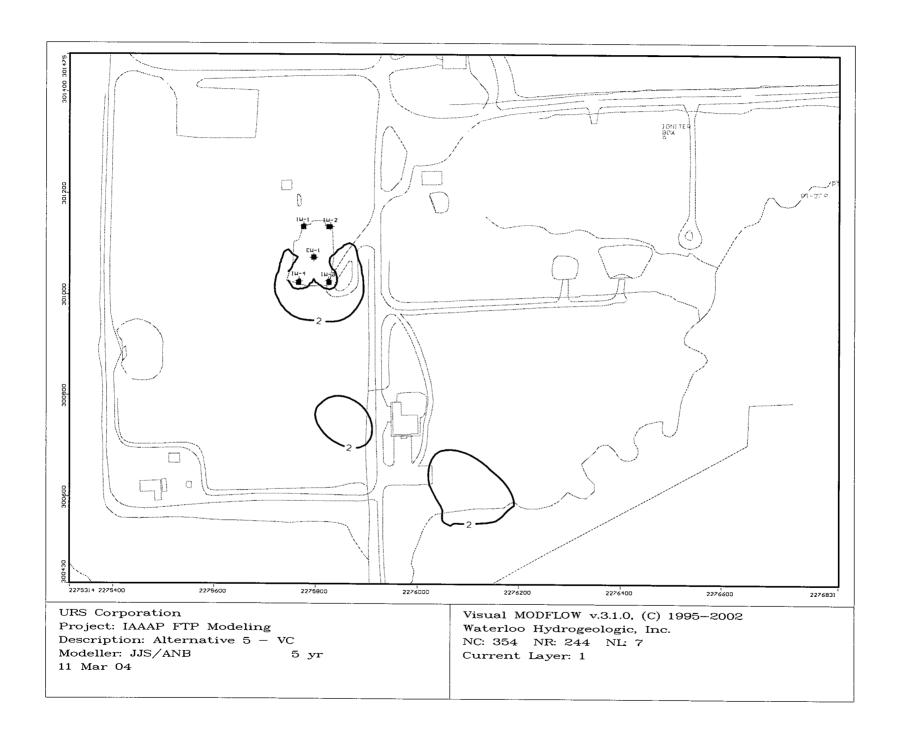


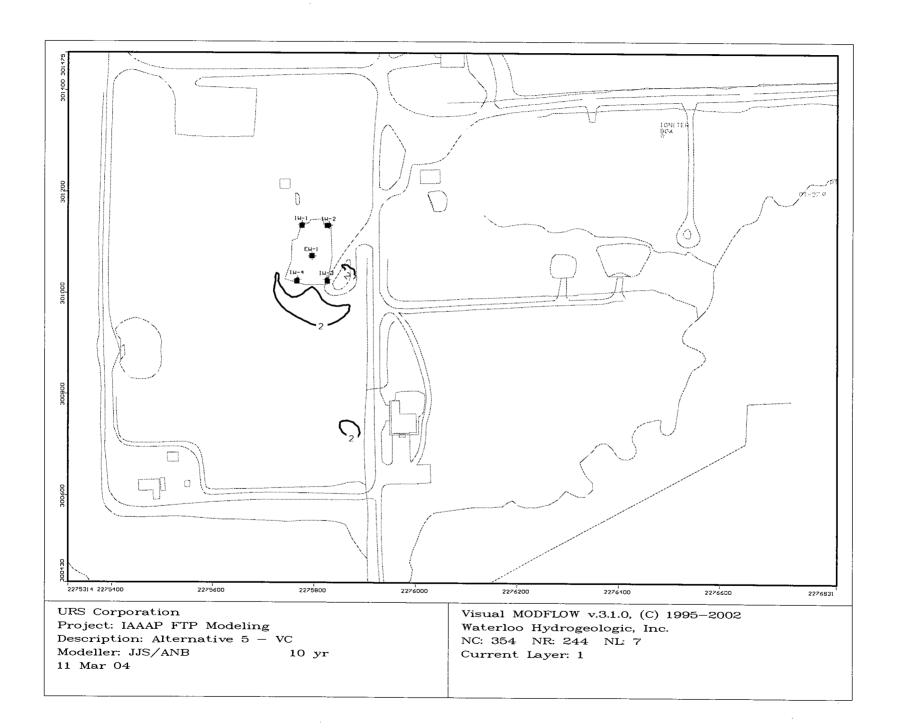


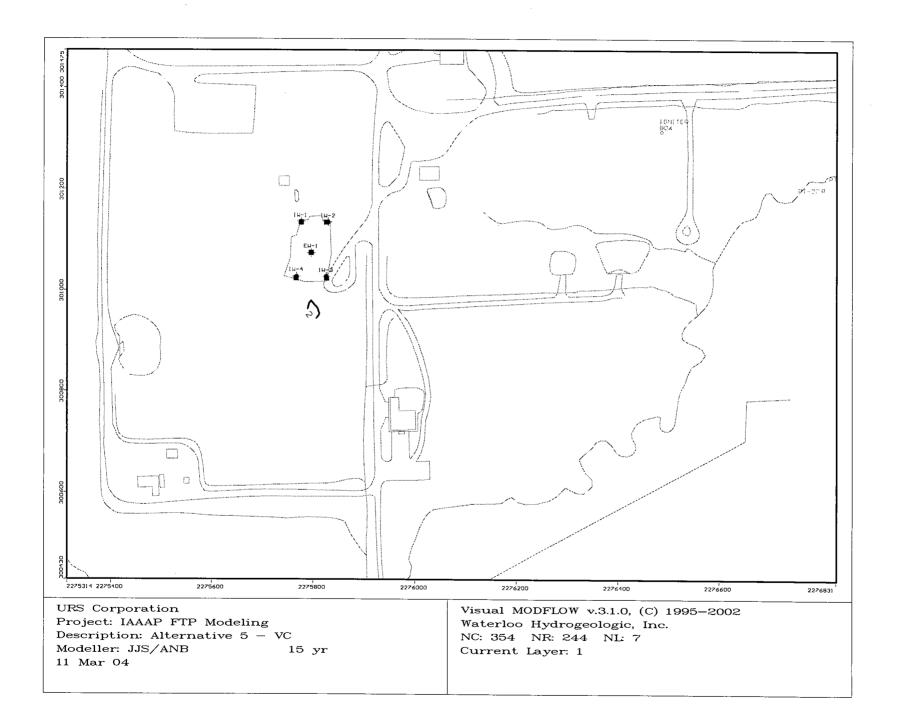


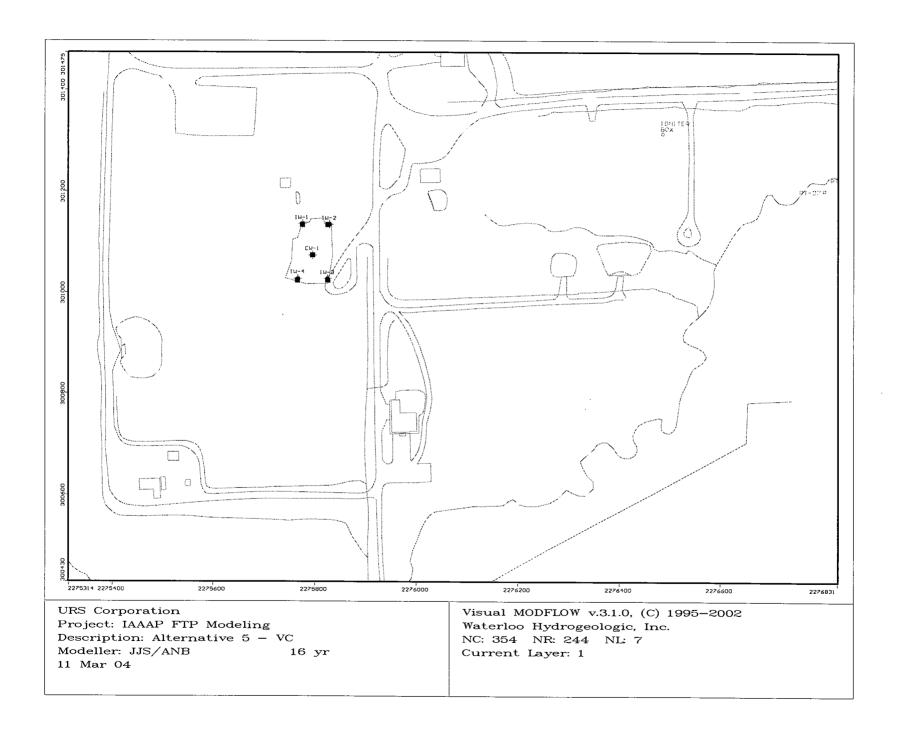












This site visit report presents the results of a vegetation/land use survey at the IAAAP FTP. A general vegetation survey was conducted from October 11 through October 12, 2002. Existing vegetation reflects past and present land use within the area surveyed. Species identification and an orthometric photograph from 1998 were used to classify the FTP vegetation types/land uses. Due to the size of the area, vegetation identification efforts focused on areas potentially impacted by remedial action alternatives. The community types/land uses identified and described below include cropland, idle grassland, and woodland. The FTP is indicated on **Figure 4-1** by the line labeled "Approximate Boundary of Previous Soil Removal Action" in the map legend. Photographs from each community/land use type are shown in **Figures L-1** and **L-2**.

Present land use patterns are very different from the time of pre-European settlement. Horton, et al. (1996) stated that by 1937 (when the first aerial photographs of the area were taken), all natural vegetation within the IAAAP had been disturbed, primarily by grazing and farming. While only scattered trees were present in 1937, tree cover has expanded dramatically since that time. With cessation of grazing after the IAAAP area was acquired by the DoD in 1940 and fire suppression since the early 1900s (Horton, et al. 1996), stands of unevenly aged trees (presumably ranging from seedling to around 100 years) now dominate the areas along the creeks and upland unfarmed areas.

The native tall-grass prairies that would have dominated the area in pre-European settlement era are now rare (most were destroyed by farming practices), and no prairie remnant areas were encountered in the 2002 vegetation/land use survey. In addition, a comprehensive survey of the IAAAP was conducted in 1994 and 1995 that included vascular plants, bryophytes, vertebrates, and invertebrates (Horton, et al. 1996). The report stated that approximately 19 percent of the vascular plants at the IAAAP were introduced in the United States from other regions of the world, and approximately one percent were species that had been introduced from elsewhere in the United States. The 2002 site visit confirmed the presence of many non-native vascular plants, especially in the more disturbed areas.

#### L.1 VEGETATION TYPES/LAND USE

## L.1.1 Cropland

Tilled cropland was identified to the west and southeast of the previous soil removal action. In 2002, all of the tilled cropland was planted with soybeans. Because the majority of the farmland in this area is on a corn–soybean rotation and varies from year to year, the type of crop is not specified on **Figure 4-1**.

### L.1.2 Grassland – Reseeded Non-Native Species

The area directly surrounding the previous soil removal action boundary was classified as a nonnative grassland community. This unmoved grassland community had significant past disturbance. Brome grasses (planted sometime in the past) and goldenrod species dominated the area's vegetation, but many non-native and immature trees (sun-loving, invading species) were also encountered. West of Spring Creek, the reseeded non-native grassland community contained a stand of poplar trees that appeared to have been planted within the last five years.

#### L.1.3 Woodland

Woodland areas were located south and east of the previous soil removal action at the FTP.

A number of different woodland communities may occur in southeast Iowa. Lammers (1983) identified three forest communities in Des Moines County (where the IAAAP is located): floodplain, maple-basswood, and oak-hickory. Horton, et al. (1996) identified three forest communities at the IAAAP: lowland/floodplain, upland (oak-hickory), and disturbed.

To a certain degree, all woodland areas at the IAAAP have been previously disturbed (Horton, et al. 1996). Species encountered in the forested areas around the FTP included several non-native (native to the United States but not to Iowa) trees such as Osage-orange and black locust, both of which were a significant component of the vegetation. Horton, et al. (1996) stated that black locust, honey locust, eastern red cedar, Osage-orange, and shingle oak are tree species characteristic of sites with considerable human disturbance. Another indication that the woodland areas had been previously disturbed was the presence of a dense shrub layer (Horton, et al. 1996).

In 2002, the forest communities around the FTP contained a mixture of vegetation common to disturbed, lowland, and upland communities. For this reason, the "Woodland" category was used rather than attempting to differentiate community types. Trees encountered that are common to lowland areas included cottonwood, American elm, and slippery elm. One area of more "upland" forest vegetation was southeast of the previous soil removal action, adjacent to Spring Creek. More oaks and hickories were present in this area, including shagbark hickory, bitternut hickory, and white oak. However, this area was not differentiated on Figure 4-1 as an upland forest community because no obvious boundary existed between community types, and trees common to disturbed lowland forests (e.g., Osage-orange, black locust, honey locust) were also frequently encountered. Other tree species commonly encountered in the woodland areas included black cherry, dogwood species, and American hackberry. Generally, a dense shrub layer was present in the forested areas, with multiflora rose, Missouri gooseberry, common blackberry, and black raspberry being the most common. Common vines and herbaceous species encountered in the woodland communities included poison ivy, Virginia Creeper, stinging nettles, white avens, and black snakeroot. A summary of the dominant species identified in this area is presented in **Table L-1**.

#### L.2 THREATENED AND ENDANGERED SPECIES

None of the state or federal listed T&E vascular plants were identified during the 2002 vegetation/land use survey, and no surveys of bryophytes, vertebrates, or invertebrates were conducted. However, a natural habitat and biota assessment of the IAAAP conducted in 1994 and 1995 did identify the orangethroat darter (a state threatened species) in the Spring Creek tributary southwest of the FTP at plant road P (Horton, et al. 1996). This comprehensive survey included plants, bryophytes, vertebrates and invertebrates.

The forested areas adjacent to Spring Creek and its tributaries provide potential roosting and foraging habitat for the federally endangered Indiana bat (*Myotis sodalis*). Indiana bats use distinctly different habitats during summer and winter. In winter, bats congregate in a few large caves and mines for hibernation. Nearly 85 percent of the known population winters in only seven caves and mines in Missouri, Indiana, and Kentucky, and approximately one-half of the population uses only two of these hibernacula (IDNR 2001).

In spring, females migrate north from their hibernacula and form maternity colonies in predominantly agricultural areas of Missouri, Iowa, Illinois, Indiana, and Michigan. These colonies, consisting of 50 to 150 adults and their young, normally roost under the loose bark of dead, large-diameter trees (including but not limited to shagbark hickory, bitternut hickory, and white oak) throughout summer. Living shagbark hickories and tree cavities are also used occasionally (Humphrey 1977). Females tend to forage around water, over floodplain trees, and in and around wooded areas. Males forage more frequently among trees. The Indiana bat is an insectivore, eating mostly moths, caddisflies, leafhoppers, planthoppers, and beetle larvae (IDNR 2001).

Considering the Indiana bat's ecology, Spring Creek and its tributaries provide potential foraging habitat for female bats. The woodland area southeast of the previous soil removal action contains some hickory and oak tree species that may provide potential roosting habitat.

#### L.3 REFERENCES

- Horton, D., et al. 1996. An assessment of the natural habitats and biota of the Iowa Army Ammunition Plant, Middletown, Iowa. Unpublished report. 93 pp.
- Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy, 58:334-346.
- Iowa Department of Natural Resources (IDNR). 2001. Biodiversity of Iowa: Aquatic Habitats CD-ROM.
- Lammers, T.G. 1983. The vascular flora of Des Moines County, Iowa. Proceedings of the Iowa Academy of Science, 90:55-71.

# TABLE L-1

# SUMMARY OF VEGETATION/LAND USE SURVEY OCTOBER 11-12, 2002, FIRE TRAINING PIT AND ADJACENT AREA FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

bron	·	Comments
bron	·	C 1
		Corn or soybeans.
Grassland - Reseeded Non-Native Species  row sum hone easte blac	denrod species (Solidago spp.) sture thistle (Cirsium discolor) sen annes lace (Daucus carota) sy fleabane (Erigeron annuus) swn vetch (Coronilla varia) nac (Rhus sp.) ney locust (Gleditsia triacanthos) tern red cedar (Juniperus virginiana) ck cherry (Prunus serotina)	Vegetation dominated by planted brome grasses and invading immature tree species.  Generally lowland forest vegetation with scattered oaks and hickories.
slipp cottot blace hone Ame shin, dogs Osag Ame multi blace com Woodland Miss Virg whit white sweet brond beds shag shin, white blace cora pois	tonwood (Populus deltoides) ck locust (Robina pseudo-acacia) ney locust (Gleditsia triacanthos) nerican hackberry (Celtis occidentalis) ngle oak (Quercus imbricaria) gwood species (Cornus spp.) age-orange (Maclura pomifera) nerican basswood (Tilia americana) lberry (Morus spp.) tern red cedar (Juniperus virginiana) ltiflora rose (Rosa multiflora) ck raspberry (Rubus occidentalis) nmon blackberry (Rubus allegheniensis) ssouri Gooseberry (Ribes missouriense) rginia creeper (Parthenocissus quinquefolia) ite snakeroot (Eupatorium rugosum) ite avens (Geum canadense) eet cicely (Osmorhiza claytoni) ome species (Bromus spp.) ldstraw (Galium sp.) agbark hickory (Carya ovata) nngle oak (Quercus imbricaria) ite oak (Quercus alba) ternut hickory (Carya cordiformis) ck walnut (Juglans nigra) nnbeam (Ostrya virginiana) allberry (Symphoricarpos orbiculatus) son ivy (Toxicodendron radicans) aging nettles (Urtica dioia)	



CROPLAND - SOYBEANS



GRASSLAND - RESEEDED NON-NATIVE SPECIES



VEGETATION/LAND USE PHOTO LOG FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

March 02, 2004 2:25:14 p.m. Drawing: T:\IAAAP\16169421\00301\site 1 - FTP\FTP\_veg-landuse.dwg

DRN. BY: DAC DATE: 01/31/03
CHK'D. BY: TLT DATE: 01/02/04

PROJECT NO. 16169421 FIG. NO. L-1



WOODLAND



WOODLAND

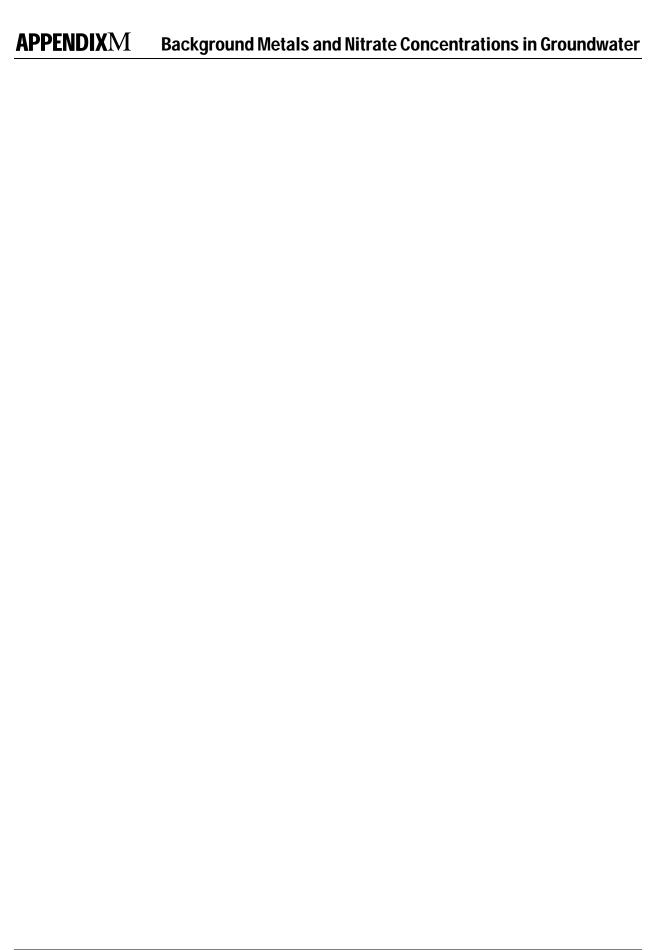


VEGETATION/LAND USE PHOTO LOG FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

e.dwg DRN. BY: DAC CHK'D. BY: TLT

**DATE**: 01/31/03 **DATE**: 01/02/04

PROJECT NO. 16169421 FIG. NO. L-2



During the Spring 2003 field activities, groundwater samples were collected from 47 monitoring wells across the EDA for characterization of metals and NO<sub>3</sub> concentrations in ground water. The statistical analysis of these data is presented in this appendix.

#### M.1 STATISTICAL ANALYSIS APPROACH

The analytical data for the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and NO<sub>3</sub> (**Table 5-2**) were separated into two data groups: clean monitoring wells (i.e., nondetect for explosives and less than 5  $\mu$ g/L VOCs) and contaminated monitoring wells (i.e., explosives detected or greater than 5  $\mu$ g/L VOCs).

Barium was detected in all monitoring wells sampled at the EDA. Because the barium analytical data were normally distributed (skewness greater than 1), the 95% UTL was calculated using the equation for establishing tolerance limits given in the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Addendum to Interim Final Guidance (USEPA 1992b). The barium values and method of calculation are presented in **Table M-1**.

The remaining data sets contained a significant number of nondetects (greater than 15 percent). Due to the large number of nondetects in these data sets, the data could not be assumed or proven to be normally or lognormally distributed. Therefore, based on USEPA guidance (USEPA 1992b), the nonparametric method of establishing the UTL was used. That is, the 95% UTL for these compounds within each data set was assigned the maximum detected concentration. It should also be noted that, for the purpose of analysis, concentrations flagged with a **J** qualifier (estimated concentration, as indicated on **Table 5-2**) were treated in the same manner as nonqualified data. Sample concentrations reported as nondetect (below the laboratory reporting limit) were given a value of one-fifth the reporting limit for that analyte. The means and standard deviations were calculated with and without nondetect values for each data set that contained a significant number of nondetects. These values are presented in **Tables M-1** through **M-8**.

Analytical data from the contaminated monitoring wells were compared to the 95% UTL for the background concentration established for each of the clean monitoring well data sets. The results of these comparisons are presented and discussed in **Section M.2**.

#### M.2 RESULTS OF THE STATISTICAL ANALYSIS

#### M.2.1 Barium

Barium was detected in all monitoring wells sampled at the EDA. The background 95% UTL calculated for barium in groundwater was 382  $\mu$ g/L. Three monitoring wells (JAW-23, JAW-24, and WBP-99-5) from the contaminated well data set exceeded the background 95% UTL for barium with concentrations of 2,460  $\mu$ g/L, 1,510  $\mu$ g/L and 1,140  $\mu$ g/L, respectively. Also, one well (EBP-MW2) from the clean monitoring well data set exceeded the 95% UTL with a value of 612  $\mu$ g/L. The data are presented in **Table M-1**.

#### M.2.2 Arsenic, Cadmium, Chromium, Lead, Mercury, and Selenium

Arsenic, cadmium, chromium, lead, mercury, and selenium were all represented by a statistically significant number of nondetects (greater than 15 percent). Therefore, in accordance with USEPA (1992b), the 95% UTLs were assigned the maximum detected concentration for each analyte. The 95% UTLs taken from the clean monitoring well data set were:

Constituents	95% UTL (μg/L)
Arsenic	40.3
Cadmium	0.9
Chromium	68.6
Lead	35.5
Mercury	0.077
Selenium	9.5

Notes:

 $\mu$ g/L = Micrograms Per Liter UTL = Upper Tolerance Limit

Two monitoring wells (SA-99-1 and JAW-24) in the contaminated well data set exceeded the background 95% UTL for arsenic with concentrations of 58  $\mu$ g/L and 99.8  $\mu$ g/L. respectively. One monitoring well (JAW-23) in the contaminated well data set exceeded the background 95% UTL for cadmium, with a concentration of 5.1  $\mu$ g/L. No monitoring wells in the contaminated well data set exceeded the background 95% UTL for chromium. No monitoring wells in the contaminated well data set exceeded the background 95% UTL for lead (35.5  $\mu$ g/L). One monitoring well (JAW-614) in the contaminated well data set exceeded the background 95% UTL for mercury, with a concentration of 0.2  $\mu$ g/L. One monitoring well (FTP-MW3) in the contaminated well data set exceeded the background 95% UTL for selenium, with a concentration of 16.2  $\mu$ g/L. The data are presented in Table **M-2** through **M-7**.

#### M.2.3 Silver

All clean well sample results for silver were nondetect. Therefore, these data were not analyzed statistically, and "nondetect" was assumed to be the background level for these constituents. No monitoring wells from the contaminated well data sets exceeded nondetect for silver.

#### M.2.4 Nitrate

 $NO_3$  was detected in 35 of the 52 wells sampled for  $NO_3$ .  $NO_3$  was represented by a statistically significant number of nondetects (greater than 15 percent). Therefore, in accordance with USEPA (1992), the 95% UTL was assigned the maximum detected concentration. The background 95% UTL assigned to  $NO_3$  was 500  $\mu$ g/L. Fifteen monitoring wells from the contaminated well data set exceeded the background 95% UTL for  $NO_3$ , with concentrations ranging from 690  $\mu$ g/L to 13,000  $\mu$ g/L. The data are presented in **Table M-8**.

#### M.3 STATISTICAL ANALYSIS SUMMARY

Two monitoring wells (SA-99-1 and JAW-24) in the contaminated well data set exceeded the background 95% UTL for arsenic, with concentrations of 58  $\mu$ g/L and 99.8  $\mu$ g/L, respectively.

# **APPENDIXM** Background Metals and Nitrate Concentrations in Groundwater

Three monitoring wells (JAW-23, JAW-24, and WBP-99-5) exceeded the background 95% UTL for barium, with concentrations of 2,460  $\mu$ g/L, 1,510  $\mu$ g/L, and 1,140  $\mu$ g/L, respectively. Cadmium was detected in one monitoring well (JAW-23) in the contaminated well data set at a concentration (5.1  $\mu$ g/L) exceeding the background 95% UTL. No monitoring wells in the contaminated well data set exceeded the background 95% UTLs for chromium (68.6  $\mu$ g/L) and lead (35.5  $\mu$ g/L). One monitoring well (JAW-614) in the contaminated well data set exceeded the background 95% UTL for mercury with a concentration of 0.2  $\mu$ g/L. One monitoring well (FTP-MW3) in the contaminated well data set exceeded the background 95% UTL for selenium with a concentration of 16.2  $\mu$ g/L. Fifteen monitoring wells from the contaminated well data set exceeded the background 95% UTL for NO<sub>3</sub> with concentrations ranging from 690  $\mu$ g/L to 13,000  $\mu$ g/L. No other monitoring wells from the contaminated well data set exceeded the background 95% UTLs. The 95% UTLs (i.e., background levels) and the IAAAP regulatory standards for the RCRA metals and NO<sub>3</sub> are presented the table below.

Analyte	95% UTL (μg/L)	IAAAP Regulatory Standard (µg/L)
Arsenic	40.3	10 (a)
Barium	382	2000 (a)
Cadmium	0.9	5 (a)
Chromium	68.6	100 (a)
Lead	35.5	15 (a)
Mercury	0.077	2 (a,b)
Selenium	9.5	50 (a)
Silver	ND	100 (b)
NO <sub>3</sub>	500	10000 (a,c)

#### Notes:

μg/L = Micrograms Per Liter

95% UTL = 95 Percent Upper Tolerance Limit

ND = Nondetect

(a) Maximum Contaminant Level (MCL)

(b) Health Advisory Level (HAL)

(c) Region 9 Preliminary Remediation Goal (PRG)

A comparison of the background UTLs and IAAAP regulatory standards indicated that arsenic and lead background UTLs at the EDA exceeded the IAAAP regulatory standards. The arsenic and lead background UTLs were considered in the COPC screening process presented in **Section 6**.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR BARIUM EXPLOSIVES DISPOSAL AREA GROUNDWATER

# REMEDIAL ALTERNATIVES ANALYSIS

Clean MW Contaminated I		Contaminated MW
FIELD ID		
ETA 00 1	Баги	ım ( <b>ng</b> /L)
FTA-99-1 FTA-99-2	54.0	151
JAW-58	54.9	85.4
JAW-59		133
JAW-60		219
JAW-61	<b>70.0</b>	93.5
JAW-62	70.8	
JAW-63	79.2	100
JAW-80	221	189
M-01	231	252
SA-99-1		353
FTP-MW1		142
FTP-MW2		88.6
FTP-MW3		106
FTP-MW4	71.6	
FTP-MW5		55.6
FTP-MW6	67.4	
FTP-MW7		130
FTP-MW8	86.8	
EBP-MW2	612	
EBP-MW3		44.9
EDA-01	66.9	
EDA-02		111
EDA-03		96.5
EDA-04		59.5
G-29	55.5	
JAW-04	123	
JAW-05	74.5	
JAW-06		167
JAW-07	75.7	
JAW-64	150	
JAW-614		127
G-30		53.8
JAW-23		2460
JAW-24		1510
JAW-25		17.8
JAW-68		64.6
WBP-99-1		84.8
WBP-99-2		53.6
WBP-99-3		258
WBP-99-4		73.4
WBP-99-5		1140
WBP-99-6		62.2
WBP-99-7	251	
WBP-MW1	48.7	
WBP-MW2	38.4	
WBP-MW3	257	

Sample Size (n)	18
Skewness <sup>1</sup>	2.74
Average (x)	134.13
Standard Deviation (s)	138.25
$t17_{,0.05}^{2}$	1.74
$k^3$	1.79
UTL <sup>4</sup>	382

<sup>&</sup>lt;sup>1</sup> Skewness >1 indicates normality of the data set

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

G = Government Well

ID = Identification

JAW = JAYCOR Well

MW/M = Monitoring Well

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump\ well$ 

UTL = Upper Tolerance Limit

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

<sup>&</sup>lt;sup>2</sup> From Johnson, R.A. & Bhattacharyya, G.K. (1996) Statistics: Principles and Methods, 3rd ed. United States: John Wiley and Sons, Inc., p. 666

<sup>&</sup>lt;sup>3</sup> Where  $k = t17_{.0.05}(1+1/n-1)^0.5$ 

<sup>&</sup>lt;sup>4</sup> Where UTL = x + k(s)

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR ARSENIC EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

EIELD ID	Clean MW	Contaminated MW
FIELD ID	Arsei	nic ( <b>ng</b> /L)
FTA-99-1		< 2.0
FTA-99-2	3.4	
JAW-58		< 2.0
JAW-59		< 2.0
JAW-60		3.3
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	< 2.0	
SA-99-1		58
FTP-MW1		< 2.0
FTP-MW2		< 2.0
FTP-MW3		< 2.0
FTP-MW4	< 2.0	
FTP-MW5		< 2.0
FTP-MW6	< 2.0	
FTP-MW7		< 2.0
FTP-MW8	< 2.0	
EBP-MW2	16.8	
EBP-MW3		2.5
EDA-01	< 2.0	
EDA-02		< 2.0
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	< 2.0	
JAW-05	< 2.0	
JAW-06		< 2.0
JAW-07	4.0	
JAW-64	< 2.0	
JAW-614		2.5
G-30		2.5
JAW-23		23
JAW-24		99.8
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		6.1
WBP-99-2		< 2.0
WBP-99-3		< 2.0
WBP-99-4		< 2.0
WBP-99-5		5.8
WBP-99-6		< 2.0
WBP-99-7	2.9	
WBP-MW1	2.0	
WBP-MW2	2.0	
WBP-MW3	40.3	

Sample Size (n)	18
Average without ND	13.48
Average with ND	5.19
Standard Deviation without ND	16.08
Standard Deviation with ND	9.42
UTL 1	40.3

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

G = Government Well

ID = Identification

JAW = JAYCOR Well

 $MW/M = Monitoring \ Well$ 

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump\ well$ 

UTL = Upper Tolerance Limit

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR CADMIUM EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Clean MW	Contaminated MW
FIELD ID		ium (ng/L)
FTA-99-1	Cudin	< 1.0
FTA-99-2	< 1.0	
JAW-58		< 1.0
JAW-59		< 1.0
JAW-60		< 1.0
JAW-61		< 1.0
JAW-62	< 1.0	
JAW-63	< 1.0	
JAW-80		< 1.0
M-01	< 1.0	
SA-99-1		< 1.0
FTP-MW1		< 1.0
FTP-MW2		< 1.0
FTP-MW3		< 1.0
FTP-MW6	0.11	
FTP-MW5		0.16
FTP-MW4	0.11	
FTP-MW7		0.06
FTP-MW8	< 1.0	
EBP-MW2	< 1.0	
EBP-MW3		< 1.0
EDA-01	< 1.0	
EDA-02		< 1.0
EDA-03		< 1.0
EDA-04		< 1.0
G-29	< 1.0	
JAW-04	< 1.0	
JAW-05	< 1.0	
JAW-06		< 1.0
JAW-07	< 1.0	
JAW-64	< 1.0	
JAW-614		< 1.0
G-30		< 1.0
JAW-23		5.1
JAW-24		< 1.0
JAW-25		< 1.0
JAW-68		< 1.0
WBP-99-1		< 1.0
WBP-99-2		< 1.0
WBP-99-3		< 1.0
WBP-99-4		< 1.0
WBP-99-5		< 1.0
WBP-99-6		< 1.0
WBP-99-7	< 1.0	
WBP-MW1	< 1.0	
WBP-MW2	< 1.0	
WBP-MW3	0.9	

Sample Size (n)	18
Average without ND	0.37
Average with ND	0.90
Standard Deviation without ND	0.46
Standard Deviation with ND	0.29
UTL 1	0.9

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

G = Government Well

ID = Identification

JAW = JAYCOR Well

 $MW/M = Monitoring \ Well$ 

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump \ well$ 

 $UTL = Upper \ Tolerance \ Limit$ 

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR CHROMIUM EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Clean MW	Contaminated MW
FIELD ID		ium (ng/L)
FTA-99-1	- CIII OIII	1.7
FTA-99-2	< 2.0	
JAW-58		< 2.0
JAW-59		1
JAW-60		< 2.0
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	0.75	
SA-99-1		0.78
FTP-MW1		< 2.0
FTP-MW2		< 2.0
FTP-MW3		< 2.0
FTP-MW4	< 2.0	
FTP-MW5		< 2.0
FTP-MW6	< 2.0	
FTP-MW7		< 2.0
FTP-MW8	< 2.0	
EBP-MW2	14.9	
EBP-MW3		0.76
EDA-01	< 2.0	
EDA-02		< 2.0
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	< 2.0	
JAW-05	< 2.0	
JAW-06		6.7
JAW-07	< 2.0	
JAW-64	< 2.0	
JAW-614		< 2.0
G-30		< 2.0
JAW-23		42.3
JAW-24		< 2.0
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		7.8
WBP-99-2		1.4
WBP-99-3		< 2.0
WBP-99-4		< 2.0
WBP-99-5		< 2.0
WBP-99-6		< 2.0
WBP-99-7	< 2.0	
WBP-MW1	< 2.0	
WBP-MW2	< 2.0	
WBP-MW3	68.6	

Sample Size (n)	18
Average without ND	7.83
Average with ND	2.69
Standard Deviation without ND	10.01
Standard Deviation with ND	3.16
UTL 1	14.9

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

G = Government Well

ID = Identification

JAW = JAYCOR Well

 $MW/M = Monitoring \ Well$ 

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump \ well$ 

 $UTL = Upper \ Tolerance \ Limit$ 

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR LEAD

# EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Clean MW	Contaminated MW
FIELD ID		(ng/L)
FTA-99-1	Leau	< 2.0
FTA-99-2	< 2.0	
JAW-58		< 2.0
JAW-59		< 2.0
JAW-60		< 2.0
JAW-61		< 2.0
JAW-62	< 2.0	1 210
JAW-63	< 2.0	
JAW-80	2.0	< 2.0
M-01	< 2.0	\ 2.0
SA-99-1	2.0	< 2.0
FTP-MW1		< 2.0
FTP-MW2		< 2.0
FTP-MW3		< 2.0
FTP-MW4	< 2.0	< 2.0
FTP-MW5	₹ 2.0	< 2.0
FTP-MW6	< 2.0	< 2.0
FTP-MW7	₹ 2.0	< 2.0
FTP-MW8	< 2.0	< 2.0
EBP-MW2	< 2.0	
EBP-MW3	< 2.0	< 2.0
EDA-01	< 2.0	< 2.0
EDA-01	< 2.0	< 2.0
EDA-02 EDA-03		< 2.0
EDA-03 EDA-04		< 2.0
G-29	< 2.0	< 2.0
JAW-04	< 2.0	
JAW-04 JAW-05	< 2.0	
JAW-05 JAW-06	< 2.0	< 2.0
JA W-00	< 2.0	< 2.0
JAW-64	< 2.0 < 2.0	
	< 2.0	. 2.0
JAW-614		< 2.0
G-30		< 2.0
JAW-23		27
JAW-24		< 2.0
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		< 2.0
WBP-99-2		< 2.0
WBP-99-3		< 2.0
WBP-99-4		< 2.0
WBP-99-5		< 2.0
WBP-99-6		< 2.0
WBP-99-7	< 2.0	
WBP-MW1	< 2.0	
WBP-MW2	< 2.0	
WBP-MW3	35.5	

Sample Size (n)	18
Average without ND	35.50
Average with ND	3.86
Standard Deviation without ND	NA
Standard Deviation with ND	7.90
UTL 1	35.5

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

G = Government Well

ID = Identification

JAW = JAYCOR Well

 $MW/M = Monitoring \ Well$ 

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump \ well$ 

UTL = Upper Tolerance Limit

WBP = West Burn Pads Area

Concentrations in  $\boldsymbol{bold}$  typeface indicate detected values.

Nondetect values represent one-fifth the RL.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR MERCURY EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Clean MW	Contaminated MW
FIELD ID		ım ( <b>ng/</b> L)
FTA-99-1		< 0.04
FTA-99-2	< 0.04	
JAW-58		< 0.04
JAW-59		< 0.04
JAW-60	< 0.04	< 0.04
JAW-61	< 0.04	< 0.04
JAW-62	< 0.04	
JAW-63	< 0.04	
JAW-80		< 0.04
M-01	< 0.04	
SA-99-1		< 0.04
FTP-MW1		< 0.04
FTP-MW2		< 0.04
FTP-MW3		< 0.04
FTP-MW4	< 0.04	
FTP-MW5		< 0.04
FTP-MW6	< 0.04	
FTP-MW7		< 0.04
FTP-MW8	0.022	
EBP-MW2	< 0.04	
EBP-MW3		< 0.04
EDA-01	< 0.04	
EDA-02		< 0.04
EDA-03		0.048
EDA-04		0.027
G-29	< 0.04	
JAW-04	< 0.04	
JAW-05	< 0.04	
JAW-06		< 0.04
JAW-07	0.077	
JAW-64	< 0.04	
JAW-614		0.2
G-30		< 0.04
JAW-23		< 0.04
JAW-24		< 0.04
JAW-25		< 0.04
JAW-68		0.023
WBP-99-1		< 0.04
WBP-99-2		< 0.04
WBP-99-3		< 0.04
WBP-99-4		< 0.04
WBP-99-5		< 0.04
WBP-99-6		0.022
WBP-99-7	< 0.04	
WBP-MW1	< 0.04	
WBP-MW2	< 0.04	
WBP-MW3	0.059	

Sample Size (n)	18
Average without ND	0.05
Average with ND	0.04
Standard Deviation without ND	0.03
Standard Deviation with ND	0.01
UTL 1	0.077

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

G = Government Well

ID = Identification

JAW = JAYCOR Well

MW/M = Monitoring Well

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump\ well$ 

UTL = Upper Tolerance Limit

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR SELENIUM EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Clean MW	Contaminated MW
FIELD ID		· (ng/L)
FTA-99-1	2	< 2.0
FTA-99-2	< 2.0	
JAW-58		5.9
JAW-59		< 2.0
JAW-60		< 2.0
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	< 2.0	
SA-99-1		3.7
FTP-MW1		0.44
FTP-MW2	_	0.16
FTP-MW3		16.2
FTP-MW4	1.5	
FTP-MW5		0.26
FTP-MW6	6.1	
FTP-MW7		1
FTP-MW8	4.1	
EBP-MW2	< 2.0	
EBP-MW3		3.0
EDA-01	3.5	
EDA-02		5
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	9.5	
JAW-05	< 2.0	
JAW-06		< 2.0
JAW-07	< 2.0	
JAW-64	< 2.0	
JAW-614		< 2.0
G-30		< 2.0
JAW-23		3.4
JAW-24		5.7
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		< 2.0
WBP-99-2		2.9
WBP-99-3		4.2
WBP-99-4		< 2.0
WBP-99-5		< 2.0
WBP-99-6		2.0
WBP-99-7	< 2.0	
WBP-MW1	1.6	
WBP-MW2	0.66	
WBP-MW3	9	

Sample Size (n)	18
Average without ND	4.50
Average with ND	3.11
Standard Deviation without ND	3.40
Standard Deviation with ND	2.53
UTL 1	9.5

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

 $G = Government \ Well$ 

ID = Identification

JAW = JAYCOR Well

MW/M = Monitoring Well

ND = Nondetect(s)

RL = Reporting Limit

 $SA = Sump\ well$ 

 $UTL = Upper \ Tolerance \ Limit$ 

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

# BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR NITRATE EXPLOSIVES DISPOSAL AREA GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	KEVIEDIAL ALTE		
FIELD ID	Clean MW	Contaminated MW	
	Nitra	te (mg/L)	
FTA-99-1		1600	
FTA-99-2	130		
JAW-58		90	
JAW-59		180	
JAW-60		80	
JAW-61	210	380	
JAW-62	310		
JAW-63	380	1000	
JAW-80	=0	1900	
M-01	70	. 10.0	
SA-99-1		< 10.0	
FTP-MW1		360	
FTP-MW2		160	
FTP-MW3	. 10.0	< 10.0	
FTP-MW4	< 10.0	. 10.0	
FTP-MW5	100	< 10.0	
FTP-MW6	190	2000	
FTP-MW7	. 10.0	2000	
FTP-MW8	< 10.0		
EBP-MW1 EBP-MW2	<b>500</b> < 10		
EBP-MW3	< 10	2800	
EBP-MW4		100	
EBP-MW5	- 10	770	
EBP-MW6 EDA-01	< 10 <b>200</b>		
EDA-01 EDA-02	200	2000	
EDA-02 EDA-03		1300	
EDA-03		690	
G-29	500	050	
JAW-04	< 10		
JAW-05	60		
JAW-06		< 10	
JAW-07	470	< 10	
JAW-64	200		
JAW-614	200	1100	
G-30		< 10.0	
JAW-23		9400	
JAW-24		< 10.0	
JAW-25		1900	
JAW-68		< 10.0	
WBP-99-1		12000	
WBP-99-2		13000	
WBP-99-3		1000	
WBP-99-4		8100	
WBP-99-5		180	
WBP-99-6		< 10.0	
WBP-99-7	< 10.0		
WBP-MW1	< 10.0		
WBP-MW2	< 10.0		
WBP-MW3	210		

Sample Size (n)	20
Average without ND	268.33
Average with ND	191.25
Standard Deviation without ND	160.39
Standard Deviation with ND	178.19
UTL 1	500

<sup>&</sup>lt;sup>1</sup> UTL = maximum detected value

Notes:

 $\mu g/L = Micrograms Per Liter$ 

EBP = East Burn Pads

EDA = Explosives Disposal Area

FTA = Fire Training Area

FTP = Fire Training Pit

 $G = Government \ Well$ 

ID = Identification JAW = JAYCOR Well

MW/M = Monitoring Well

ND = Nondetect(s)

RL = Reporting Limit

SA = Sump well

UTL = Upper Tolerance Limit

WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

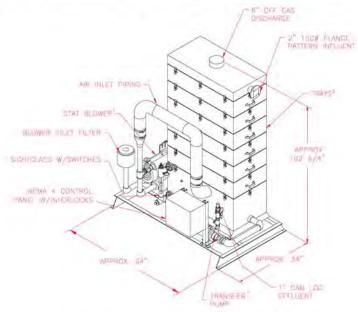
Nondetect values represent one-fifth the RL.

#### **ALTERNATIVE 3**



#### STAT Series Low Profile Air Stripper

STAT 30



Note: Actual dimensions and orientations may vary slightly than shown above.

#### Vessel Specifications

Influent Flow (gpm):	1 - 35	Options
Air Flow (cfm):	100 - 150	Hose Kits
Required Incoming Power:	230V, 1 Phase	Air Flow Measurement Kit
Maximum Total Amperage (Amp	s): 31	Air Temperature Measurement Kit
Recommended Minimum Generator Performance (kVA³): 20	Water Flow Measurement Kit	
	20	Water Temperature Measurement Ki
Evalusion proof blower motor and numn motor available		Service Rated Disconnect

MINNESOTA: (corp hdqrtrs) Carbonair 2731 Nevada Ave. N. New Hope, MN 55427 PH:800.526.4999 763.544.2154 FAX:763.544.2151 Homepage: www.carbonair.com

FLORIDA: Carbonair 4710 Dignan Street Jacksonville, FL 32254 PH:800.241,7833 904.387.4465 FAX:904.387.5058

VIRGINIA: Carbonair 4328 West Main St. Salem, VA 24153 PH:800.204.0324 540.380,5913 FAX:540.380.5920

TEXAS: Carbonair 4889 Hunter Rd. Bldg 1-C San Marcos, TX 78666 PH:800.893.5937 512.392.0085 FAX:512.392.0066

Taken from: http://www.carbonair.com/rental%20spec%20sheets/STATs/STAT%2030.pdf

Explosion proof blower motor and pump motor available.

Six trays are standard. Deduct 10" from the overall height for each tray removed.

<sup>&</sup>lt;sup>3</sup> Generator sizing is estimated. Contact generator supplier for generator selection.

 $Q_{w}C_{w}$ 

 $H_2O$ 

 $H_2O_2$ 

50%

**EXTRACTED** 

WATER

## **ALTERNATIVE 4**

## Goal

Determine  $H_2O_2$  dosage rate  $(Q_P)$  required to achieve an injection concentration of 1,000 mg  $(H_2O_2)$  per liter.

**INJECTION** 

## **Assumptions**

- Conditions are steady state (no storage).
- $C_I = 1,000 \text{ mg/L } (H_2O_2)$
- $C_P = 598,000 \text{ mg/L } (H_2O_2) \text{ (vendor provided)}$
- $Q_I = 2 \text{ gpm} = 7.6 \text{ L/min}$
- $C_W = 0 \text{ mg/L } (H_2O_2)$
- No H<sub>2</sub>O<sub>2</sub> will be created or destroyed prior to injection.

## Solution

$$\begin{array}{rcl} Q_{I}C_{I} & = & (Q_{W}C_{W}) + (Q_{P}C_{P}) & (\text{mass balance @ steady state}) \\ Q_{P} & = & \underline{Q_{I}C_{I}} \\ Q_{P} & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text{ mg/L } (\text{H}_{2}\text{O}_{2}))} \\ & = & \underline{(7.6 \text{ L/min})(1,000 \text$$

## **ALTERNATIVE 4**

## INTRODUCTION TO HYDROGEN PEROXIDE

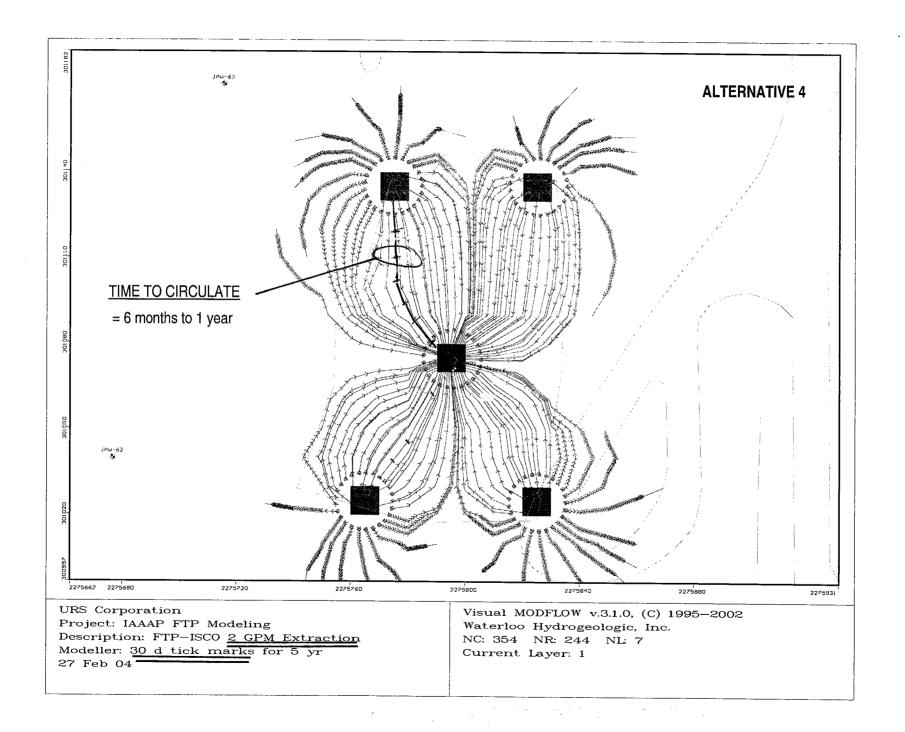
## physical and chemical properties - summary

Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>) solutions are clear, colorless, water-like in appearance, and can be mixed with water in any proportion. At high concentrations, it has a slightly pungent or acidic odor.

H<sub>2</sub>O<sub>2</sub> has a molecular weight of 34.02 and is **nonflammable at any concentration**. Its Chemical Abstracts Service Registry Number is 7722-84-1. Other physical and chemical properties of the two standard industrial strengths follow.

${\rm H_2O_2}$ Concentration	35%	50%
Active oxygen content, wt.%	16.5	23.5
Density @ 68°: Specific gravity Ibs per gallon gms-100% per mL Apparent pH	1.132 9.45 0.397 2-3	1.196 9.98 0.598 1-2
Acidity, mg/L (as H <sub>2</sub> SO <sub>4</sub> )	< 50	< 50
Total heavy metals, mg/L	< 1	< 1
Freezing point, °	-27	-62
Boiling point, °	226	237
Vapor pressure @ 86°, mm Hg	23	18
Viscosity: @ 32°, cp @ 68°, cp	1.81 1.11	1.87 1.17
Heat of decomposition, cal/gm	233	335
Mole fraction	0.22	0.346

Taken from http://www.h2o2.com/intro/properties/summary.html





US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (East plume), Initial Application

Location: Middleton, Iowa

Consultant: URS

#### Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction) Length of plume (parallel to gw flow direction) Depth to contaminated zone

Thickness of contaminated saturated zone

Nominal aquifer soil (gravel, sand, silty sand, silt, clay)

Total porosity

Hydraulic conductivity

Hydraulic gradient

Seepage velocity

Treatment Zone Pore Volume

155 230 20 10	ft = ft	35,650	sq. ft.
clay			
0.3	Eff. porosity:	0.3	
0 00			
0.06	ft/day =	2.1E-05	cm/sec
0.078	ft/ft	2.1E-05	cm/sec
0.078			ft/day,

#### **Dissolved Phase Electron Donor Demand**

Tetrachloroethene (PCE) Trichloroethene (TCE) cis-1,2-dichloroethene (DCE) Vinyl Chloride (VC) Carbon tetrachloride

Chloroform 1,1,1-Trichloroethane (TCA)

1,1-Dichlorochloroethane (DCA)

Hexavalent Chromium

User added, also add stoichiometric demand

Contaminant		Stoich. (wt/wt)
Conc (mg/L)	Mass (lb)	contam/H <sub>2</sub>
0.04	0.2	20.7
0.00	0.0	21.9
0.00	0.0	24.2
0.00	0.0	31.2
0.00	0.0	19.2
0.00	0.0	19.9
2.10	14.0	22.2
0.72	4.8	24.7
0.00	0.0	17.3
0.00	0.0	20.0
0.00	0.0	0.0

#### Sorbed Phase Electron Donor Demand

Soil bulk density

Fraction of organic carbon: foc

$1.5  \text{g/cm}^3 =$	94 lb/cf
0.0007 range: 0.0001 to 0	.01

Stoich. (wt/wt)

elec acceptor/H<sub>2</sub>

12.4

27.5

55.9

12.0

(Values are estimated using Soil Conc=foc*Koc*Cgw)
(Adjust Koc as nec. to provide realistic estimates)
Tetrachloroethene (PCE)
Trichloroethene (TCE)
cis-1,2-dichloroethene (DCE)
Vinyl Chloride (VC)
Carbon tetrachloride
Chloroform
1,1,1-Trichloroethane (TCA)
1,1-Dichlorochloroethane (DCA)
RDX

User added, also add stoichiometric demand

Koc	Conta	Contaminant		
(L/kg)	Conc (mg/kg)	Mass (lb)	contam/H <sub>2</sub>	
263	0.01	0.2	20.7	
107	0.00	0.0	21.9	
80	0.00	0.0	24.2	
2.5	0.00	0.0	31.2	
110	0.00	0.0	19.2	
34	0.00	0.0	19.9	
183	0.27	9.0	22.2	
183	0.09	3.1	24.7	
108	0.00	0.0	20.0	
0	0.00	0.0	0.0	

Electron Acceptor

Conc (mg/L)

#### **Competing Electron Acceptors**

Oxygen

Est. Mn reduction demand (potential amt of Mn2+ formed) Est. Fe reduction demand (potential amt of Fe2+ formed) Estimated sulfate reduction demand

0.09	1	
1.00	7	
0.01	0	
35.00	233	

Mass (lb)

**Microbial Demand Factor** Safety Factor

Injection Point Spacing and Dose:

Injection spacing within rows (ft) Injection spacing between rows (ft) Advective travel time bet. rows (days)

3	Recommend 1-4x
3	Recommend 1-4x

10.0	# points per row:	16	
20.0	# of rows:	12	
1282	Total # of points:	192	
М	inimum req. HRC dose per foot (lb/ft)	4.0	<-Minumum Dose Override



US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (East plume), Initial Application

Location: Middleton, Iowa

Consultant: URS

Project Summary			1
Number of HRC delivery points (adjust as nec. for	r site)	192	
HRC Dose in lb/foot (adjust as nec. for site)		4.0	<-Minumum Dose Override
Corresponding amount of HRC per point (lb)		40	
Number of 30 lb HRC Buckets per injection point		1.3	
Total Number of 30 lb Buckets		256	
Total Amt of HRC (lb)		7,680	
HRC Cost		\$ 5.50	List Price has been adjusted
Total Material Cost		\$ 42,240	•
Shipping and Tax Estimates in US Dollars			
Sales Tax	rate: 7%	\$ -	
Total Matl. Cost		\$ 42,240	
Shipping of HRC (call for amount)		\$ -	
Total Regenesis Material Cost		\$ 42,240	1

HRC Installation Cost Est. (responsibility of customer to contract work)		Other Project Costs	
Footage for each inj. point = uncontaminated + HRC inj. interval (ft)	30	Design and regulatory issues	\$ -
Total length for direct push for project (ft)	5,760	Groundwater monitoring and rpt	\$ -
Estimated daily installation rate (ft per day: 500 for push, 200 for drilling)	400	Other	\$ -
Estimated points per day (10 to 20 is typical for direct push)	13.3	Other	\$ -
Required number of days	15	Other	\$ -
Mob/demob cost for injection subcontractor	\$ -	Other	\$ -
Daily rate for inj. Sub. (\$1-2K for push \$3-4K for drill rig)	\$ -	Other	\$ -
Total injection subcontrator cost for application	\$ -	Other	\$ -
Total Install Cost (not inc. consultant, lab, etc.)	\$ 42,240	Total Project Cost	\$ 42,24



US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (South plume), Initial Application

Location: Middleton, Iowa

Consultant: URS

#### Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction) Length of plume (parallel to gw flow direction) Depth to contaminated zone

Thickness of contaminated saturated zone

Nominal aquifer soil (gravel, sand, silty sand, silt, clay)

Total porosity

Hydraulic conductivity
Hydraulic gradient
Seepage velocity

Treatment Zone Pore Volume

100 260 15	ft	=	26,000	sq. ft.
10 clay				
0.3		ff. porosity:		
	ft/day	=	3.9E-05	cm/sec
0.03				ı
	ft/yr	=		ft/day,
78,000	ft <sup>3</sup>	=	583,518	gallons

Stoich. (wt/wt)

#### **Dissolved Phase Electron Donor Demand**

Tetrachloroethene (PCE)
Trichloroethene (TCE)
cis-1,2-dichloroethene (DCE)
Vinyl Chloride (VC)
Carbon tetrachloride
Chloroform
4.4.1 Trichloroethene (TCA)

1,1,1-Trichloroethane (TCA)

1,1-Dichlorochloroethane (DCA)

Hexavalent Chromium

RDX

User added, also add stoichiometric demand

Conc (mg/L)	Mass (lb)	contam/H <sub>2</sub>
0.08	0.4	20.7
0.12	0.6	21.9
0.02	0.1	24.2
0.00	0.0	31.2
0.00	0.0	19.2
0.00	0.0	19.9
0.27	1.3	22.2
0.00	0.0	24.7
0.00	0.0	17.3
0.00	0.0	20.0
0.00	0.0	0.0

Contaminant

#### Sorbed Phase Electron Donor Demand

Soil bulk density

Fraction of organic carbon: foc

$1.5  \text{g/cm}^3 =$	94 lb/cf
0.0007 range: 0.0001 to 0	.01

RDX								
User	added,	also	add	stoic	hiom	etric	dema	nc

Koc	Contai	Contaminant				
(L/kg)	Conc (mg/kg)	Mass (lb)	contam/H <sub>2</sub>			
263	0.01	0.3	20.7			
107	0.01	0.2	21.9			
80	0.00	0.0	24.2			
2.5	0.00	0.0	31.2			
110	0.00	0.0	19.2			
34	0.00	0.0	19.9			
183	0.03	0.8	22.2			
183	0.00	0.0	24.7			
108	0.00	0.0	20.0			
0	0.00	0.0	0.0			

#### **Competing Electron Acceptors**

Oxygen Nitrate

Est. Mn reduction demand (potential amt of Mn2+ formed) Est. Fe reduction demand (potential amt of Fe2+ formed)

Estimated sulfate reduction demand

Electron	Stoich. (wt/wt)			
Conc (mg/L)	Mass (lb)	elec acceptor/H <sub>2</sub>		
0.23	1	8.0		
0.08	0	12.4		
1.00	5	27.5		
0.02	0	55.9		
39.00	190	12.0		

#### Microbial Demand Factor Safety Factor

Injection Point Spacing and Dose:

Injection spacing within rows (ft)
Injection spacing between rows (ft)

Advective travel time bet. rows (days)

10.0	# points per row:	10	
20.0	# of rows:	13	
1818	Total # of points:	130	
M	inimum req. HRC dose per foot (lb/ft)	4.0	<-Minumum Dose Override

3 Recommend 1-4x

3 Recommend 1-4x

Q:\Iol6\(\frac{1}{2}\)\[Six Sixes\FTP\Rev\Thrc grid south.xls [HRC Grid Eval]\] Page 1 of 2 5/14/2004



US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (South plume), Initial Application

Location: Middleton, Iowa

Consultant: URS

Project Summary			1
Number of HRC delivery points (adjust as nec. for s	ite)	130	
HRC Dose in lb/foot (adjust as nec. for site)	,	4.0	<-Minumum Dose Override
Corresponding amount of HRC per point (lb)		40	
Number of 30 lb HRC Buckets per injection point		1.3	
Total Number of 30 lb Buckets		174	
Total Amt of HRC (lb)		5,220	
HRC Cost		\$ 5.50	List Price has been adjusted
Total Material Cost		\$ 28,710	•
Shipping and Tax Estimates in US Dollars			
Sales Tax	rate: 7%	\$ _	
Total Matl. Cost		\$ 28,710	
Shipping of HRC (call for amount)		\$ _	
Total Regenesis Material Cost		\$ 28,710	

Total Regenesis Material Cost	\$ 28,710		
HRC Installation Cost Est. (responsibility of customer to contract work)		Other Project Costs	
Footage for each inj. point = uncontaminated + HRC inj. interval (ft)	25	Design and regulatory issues	\$ -
Total length for direct push for project (ft)	3,250	Groundwater monitoring and rpt	\$ -
Estimated daily installation rate (ft per day: 500 for push, 200 for drilling)	400	Other	\$ -
Estimated points per day (10 to 20 is typical for direct push)	16.0	Other	\$ -
Required number of days	9	Other	\$ -
Mob/demob cost for injection subcontractor	\$	Other	\$ -
Daily rate for inj. Sub. (\$1-2K for push \$3-4K for drill rig)	\$ -	Other	\$ -
Total injection subcontrator cost for application	\$ -	Other	\$ -
Total Install Cost (not inc. consultant, lab, etc.)	\$ 28,710	Total Project Cost	\$ 28,710

## List of Tables

Table O-1	Comparison of Total Cost of Remedial Alternatives
Γable O-2	Cost Estimate Summary – Alternative 2
Гable O-3	Cost Estimate Summary – Alternative 3
Γable O-4	Cost Estimate Summary – Alternative 4
Γable O-5	Cost Estimate Summary – Alternative 5

## **Cost Worksheets**

Monitoring Well Installation and Development

Focused Extraction – Treatment System Pumps/Piping/Controls/Electrical

Groundwater Sampling and Analysis

ISCO – Treatment System Pumps/Piping/Controls/Electrical

Injection Well Installation and Development

HRC™ Injection

## **TABLE 0-1** COMPARISON OF TOTAL COST OF REMEDIAL ALTERNATIVES FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

2004 Site: FTP Groundwater Base Year: **Location:** IAAAP Middletown, Iowa

Phase: RAA (-30% to +50%) Date: 5/17/2004

**Alternative 1 Alternative 2 Alternative 3 Alternative 4 Alternative 5** Focused Enhanced **Description** No Action MNA Extraction/MNA ISCO/MNA Degradation/MNA Total Project Duration (Years) 55 55 20 20 20 \$0 Capital Cost \$114,000 \$208,000 \$225,000 \$504,000 Total O&M Cost \$0 \$1,849,000 \$1,037,000 \$822,000 \$822,000 Total Periodic Cost \$0 \$113,000 \$49,000 \$105,000 \$305,000 Total Cost of Alternative \$0 \$2,075,000 \$1,295,000 \$1,152,000 \$1,631,000 **\$0** \$711,000 \$882,000 \$773,000 **Total Present Value of Alternative** \$1,228,000

# TABLE O-2 COST ESTIMATE SUMMARY - ALTERNATIVE 2 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

## MONITORED NATURAL ATTENUATION

Site: FTP Groundwater Description: No active remediation systems used. Intall 10 new monitoring wells. Annual groundwater

**Location:** IAAAP Middletown, Iowa **Phase:** RAA (-30% to +50%)

**Base Year:** 2004 **Date:** 5/17/2004

sampling at 19 wells in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 11 to 55. Institutional and engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 55; periodic costs in Years 5,10,15,20,25,30,35,40,45,50, and 55.

III Teats 1 to 55, periodic costs III Teats 5,10,15,20,25,50,55,40,45,50, and 55.

## CAPITAL COSTS:

<b>Description</b>	<u>Oty</u>	<u>Unit</u>	<b>Unit Cost</b>	Cost	<u>Notes</u>
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	\$8,000	\$8,000	FSP, QAPP, SSHP
Subtotal				\$8,000	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	\$3,521	\$35,209	See cost worksheet
GW Sampling, Analysis - Initial	1	LS	\$23,817	\$23,817	See cost worksheet
Surveying	1	LS	\$1,200	\$1,200	9 MWs
Subtotal				\$60,225	
Subtotal 1				\$68,225	
Contingency	25%		_	\$17,056	10% scope + 15% bid
Subtotal 2				\$85,281	
Project Management	10%			\$8,528	
Remedial Design	20%			\$17,056	
Construction Management	15%			\$12,792	
Subtotal				\$25,584	
Institutional Controls	1	LS	\$3,000	\$3,000	Implementation plan
TOTAL CAPITAL COST:				\$113,866	

## ANNUAL O&M COSTS (YEARS 1-10):

<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Cost</u>	Cost	<u>Notes</u>
Site Monitoring					
GW Sampling, Analysis	19	EA	\$1,254	\$23,817	See cost worksheet
Data Management	1	LS	\$2,000	\$2,000	
Reporting	1	LS	\$8,000	\$8,000	Annual reporting
Subtotal				\$33,817	
Contingency	25%		_	\$8,454	10% scope + 15% bid
Subtotal				\$42,271	
Project Management	10%			\$4,227	
Technical Support	15%			\$6,341	
Subtotal				\$10,568	
TOTAL ANNUAL O&M COST (YEARS 1-10):				\$52,838	

# TABLE O-2 COST ESTIMATE SUMMARY - ALTERNATIVE 2 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Description		<u>Qty</u>	<u>Unit</u>	<b>Unit Cost</b>	Cost	Notes
Site Monitoring		<del></del>				
GW Sampling, Analysis		9	EA	\$1,254	\$11,282	See cost worksheet per well cost
Data Management		1	LS	\$1,500	\$1,500	•
Reporting		1	LS	\$6,000	\$6,000	Annual reporting
Subtotal				-	\$18,782	
Contingency		25%		-	\$4,695	10% scope + 15% bid
Subtotal					\$23,477	
Project Management		10%			\$2,348	
Technical Support		15%		_	\$3,522	
Subtotal				•	\$5,869	
TOTAL ANNUAL O&M COST (	VEADE 11 E	z)•		ſ	\$29,346	
PERIODIC COSTS:	1 EARS 11-5:	<del></del>			Ψ2>,010	
		_		** ** **		
Description	<u>Year</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Cost</u>	Cost	<u>Notes</u>
Five-Year Review Report	5 to 55	1	EA	\$8,000	\$8,000	
MW Maintenance	5 to 55	1	EA	\$1,500	\$1,500	Repair damage, redevelop
Subtotal					\$9,500	
MW Abandonment	55	25	EA	\$300	\$7,500	25 MWs
Remedial Action Report	55	1	EA	\$10,000	\$10,000	
Subtotal					\$17,500	
PRESENT VALUE ANALYSIS:						
			<b>Total Cost</b>	Discount		
Cost Type	<u>Year</u>	Total Cost	Per Year	Factor <u>(7%)</u>	Present Value	<u>Notes</u>
Capital Cost	0	\$113,866	\$113,866	1.000	\$113,866	
O&M Cost	1-10	\$528,383	\$52,838	7.024	\$371,114	
O&M Cost	11-55	\$1,320,575	\$29,346	6.916	\$202,968	
Periodic Cost	5	\$9,500	\$9,500	0.713	\$6,773	
Periodic Cost	10	\$9,500	\$9,500	0.508	\$4,829	
Periodic Cost	15	\$9,500	\$9,500	0.362	\$3,443	
Periodic Cost	20	\$9,500	\$9,500	0.258	\$2,455	
Periodic Cost	25	\$9,500	\$9,500	0.184	\$1,750	
Periodic Cost	30	\$9,500	\$9,500	0.131	\$1,248	
Periodic Cost	35	\$9,500	\$9,500	0.094	\$890	
Periodic Cost	40	\$9,500	\$9,500	0.067	\$634	
	45	\$9,500	\$9,500	0.048	\$452	
Periodic Cost		\$9,500	\$9,500	0.034	\$323	
Periodic Cost Periodic Cost	50	Ψ,500				
	50 55	\$17,500	\$17,500	0.024	\$424	
Periodic Cost			\$17,500	0.024	\$424 <b>\$711,170</b>	
Periodic Cost	55	\$17,500 \$2,075,324	\$17,500	0.024		

## **TABLE 0-3 COST ESTIMATE SUMMARY - ALTERNATIVE 3** FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

## FOCUSED EXTRACTION/MNA

2004

5/17/2004

Site: FTP Groundwater Description: Intall 10 new monitoring wells. Install a submersible pump in SA-99-1 to remove and treat

contaminated groundwater for Years 1 to 5. Annual groundwater sampling at 19 wells in Years 1 **Location:** IAAAP Middletown, Iowa RAA (-30% to +50%) to 10. Annual groundwater sampling at 9 wells in Years 11 to 20. Institutional and engineering Phase: controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 20; periodic costs in Base Year:

Years 5,10,15, and 20.

Date:

CAPITAL COSTS:					
<u>Description</u>	<u>Oty</u>	<u>Unit</u>	<b>Unit Cost</b>	Cost	<u>Notes</u>
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	\$10,000	\$10,000	FSP, QAPP, SSHP
Subtotal				\$10,000	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	\$3,521	\$35,209	See cost worksheet
GW Sampling, Analysis - Initial	19	EA	\$1,254	\$23,817	See cost worksheet
Photo Ionization Detector	1	LS	\$4,000	\$4,000	For off-gas monitoing
Surveying	1	LS	\$1,300	\$1,300	10 MWs
Subtotal			_	\$64,325	
Extraction System Installation					
Submersible Pump Install	1	EA	\$2,500	\$2,500	4-in diameter pneumatic
Equilization Tank	1	EA	\$300	\$300	300-gal poly
Air Stripper	1	EA	\$7,700	\$7,700	3 tray, 210 cfm
Air Compressor	1	EA	\$250	\$250	5-hp, 30-gal
Electric Heater	1	EA	\$150	\$150	
Pumps/Piping/Controls/Electrical	1	LS	\$13,791	\$13,791	See cost worksheet
Steel Building	1	EA	\$10,000	\$10,000	15-ft x 15-ft with slab
Subtotal				\$34,691	
Subtotal 1				\$109,016	
Contingency	30%			\$32,705	15% scope + 15% bid
Subtotal 2			_	\$141,721	
Project Management	10%			\$14,172	
Remedial Design	20%			\$28,344	
Construction Management	15%			\$21,258	
Subtotal				\$63,774	
Institutional Controls	1	LS	\$3,000	\$3,000	Implementation plan
TOTAL CAPITAL COST:				\$208,495	

# TABLE O-3 COST ESTIMATE SUMMARY - ALTERNATIVE 3 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

FOCUSED EXTRACTION/MN	I <b>A</b>				
ANNUAL O&M COSTS (YEARS 1-5	5):				
<b>Description</b>	<u>Oty</u>	<u>Unit</u>	<b>Unit Cost</b>	Cost	<u>Notes</u>
Site Monitoring					
GW Sampling, Analysis	19	EA	\$1,254	\$23,817	
Data Management	1	EA	\$2,000	\$2,000	
Reporting	1	EA	\$8,000	\$8,000	Annual reporting
Subtotal			_	\$33,817	
Treatment System Monitoring, Maintena	ance				
O&M Labor	12	MO	\$1,000	\$12,000	3 day/wk, includes sampling
Equipment/Repair	1	LS	\$1,000	\$1,000	
Power Usage	12	MO	\$500	\$6,000	Process, \$0.07/Kwh
Water Sampling, Analysis	4	QTR	\$400	\$1,600	1 sample for VOCs, explosives, metals, incl shippir
Data Management	4	QTR	\$750	\$3,000	
Reporting	4	QTR	\$1,000	\$4,000	
Subtotal			_	\$27,600	
Subtotal 1				\$61,417	
Contingency	25%			\$15,354	10% scope + 15% bid
Subtotal 2			_	\$76,771	•
Project Management	10%			\$7,677	
Technical Support	15%			\$11,516	
			_		
Subtotal				\$19,193	
	ADS 1-5).		Γ		
TOTAL ANNUAL O&M COST (YEA				\$19,193	
TOTAL ANNUAL O&M COST (YEAR ANNUAL O&M COSTS (YEARS 6-10)	:			\$95,963	
		<u>Unit</u>	Unit Cost		<u>Notes</u>
TOTAL ANNUAL O&M COST (YEAR ANNUAL O&M COSTS (YEARS 6-10)  Description  Site Monitoring	Qty			\$95,963 <u>Cost</u>	<del></del>
TOTAL ANNUAL O&M COST (YEAR ANNUAL O&M COSTS (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis	Otv 19	EA	\$1,254	\$95,963 <u>Cost</u> \$23,817	Notes  See cost worksheet per well cost
TOTAL ANNUAL O&M COST (YEAR ANNUAL O&M COSTS (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management	Qty	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000	See cost worksheet per well cost
TOTAL ANNUAL O&M COST (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management Reporting	Otv 19	EA	\$1,254	\$95,963  Cost  \$23,817 \$2,000 \$8,000	<del></del>
TOTAL ANNUAL O&M COST (YEAR ANNUAL O&M COSTS (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management	Oty 19 1	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000	See cost worksheet per well cost
TOTAL ANNUAL O&M COST (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management Reporting	Oty 19 1	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000 \$8,000	See cost worksheet per well cost
TOTAL ANNUAL O&M COST (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management Reporting Subtotal	Oty 19 1	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000 \$8,000 \$33,817	See cost worksheet per well cost Annual reporting
TOTAL ANNUAL O&M COST (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management Reporting Subtotal Contingency	Oty 19 1	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000 \$8,000 \$33,817 \$8,454	See cost worksheet per well cost Annual reporting
TOTAL ANNUAL O&M COST (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management Reporting Subtotal Contingency Subtotal	Oty  19 1 1 25%	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000 \$8,000 \$33,817 \$8,454 \$42,271	See cost worksheet per well cost Annual reporting
TOTAL ANNUAL O&M COST (YEARS 6-10)  Description  Site Monitoring GW Sampling, Analysis Data Management Reporting Subtotal Contingency  Subtotal Project Management	Oty 19 1 1 25%	EA LS	\$1,254 \$2,000	\$95,963  Cost  \$23,817 \$2,000 \$8,000 \$33,817 \$8,454 \$42,271 \$4,227	See cost worksheet per well cost Annual reporting

# TABLE O-3 COST ESTIMATE SUMMARY - ALTERNATIVE 3 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

FOCUSED EXTRACTION	N/MNA					
ANNUAL O&M COSTS (YEAR						
<b>Description</b>		<u>Qty</u>	<u>Unit</u>	Unit Cost	Cost	Notes
Site Monitoring		<del></del>			<u></u>	
GW Sampling, Analysis		9	EA	\$1,254	\$11,282	See cost worksheet per well cost
Data Management		1	LS	\$1,500	\$1,500	See cost worksheet per wen cost
Reporting		1	LS	\$6,000		Annual reporting
Subtotal				, -,	\$18,782	
Contingency		25%			\$4,695	10% scope + 15% bid
Subtotal					\$23,477	
Project Management		10%			\$2,348	
Technical Support		15%			\$3,522	
Subtotal					\$5,869	
TOTAL ANNUAL O&M COST	(YEARS 11-	-20):			\$29,346	
PERIODIC COSTS:						
Description	Year	<u>Oty</u>	<u>Unit</u>	Unit Cost	Cost	<u>Notes</u>
Five-Year Review Report	5,10,15	1	EA	\$8,000	\$8,000	
Well Maintenance	5,10,15	1	EA	\$1,500	\$1,500	Repair damage, redevelop
Subtotal					\$9,500	
Dismantle Treatment System	20	1	EA	\$2,500	\$2,500	
Well Abandonment	20	26	EA	\$300	\$7,800	25 MWs, and 1 EW
Remedial Action Report	20	1	EA	\$10,000	\$10,000	
Subtotal					\$20,300	
PRESENT VALUE ANALYSIS	S:					
			T . 1.C	Discount		
Cost Type	Year	Total Cost	Total Cost Per Year	Factor <u>(7%)</u>	Present Value	Notes
Capital Cost	0	\$208,495	\$208,495	1.000	\$208,495	<del></del>
O&M Cost	1-5	\$479,817	\$95,963	4.100	\$393,469	
O&M Cost	6-10	\$264,192	\$52,838	2.923	\$154,467	
O&M Cost	11-20	\$293,461	\$29,346	3.570	\$104,778	
Periodic Cost	5	\$9,500	\$9,500	0.713	\$6,773	
Periodic Cost	10	\$9,500	\$9,500	0.508	\$4,829	
Periodic Cost	15	\$9,500	\$9,500	0.362	\$3,443	
Periodic Cost	20	\$20,300	\$20,300	0.258	\$5,246	
	•	\$1,294,765	,		\$881,501	

# TABLE O-4 COST ESTIMATE SUMMARY - ALTERNATIVE 4 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

		GROUNI	) WAIE	K KENIE	DIAL ALI	ERNATIVES ANALYSIS		
ISCO/MNA	4							
Site: Location: Phase: Base Year: Date:	FTP Groundwater IAAAP Middletown, Iowa RAA (-30% to +50%) 2004 5/17/2004	<b>Description:</b> Install 1 extraction well and 4 injection wells to circulate H <sub>2</sub> O <sub>2</sub> throughout the sump area groundwater for one year. Intall 10 new monitoring wells. Annual groundwater sampling at 19 wells in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 10 to 20. Institutional and engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 20; periodic costs in Years 1,5,10,15, and 20.						
CAPITAL C	OSTS:							
Des	scription	<u>Oty</u>	Unit	Unit Cost	Cost	Notes		
	Demobilization	_ <del></del>						
Submittals/Subtotal	Implementation Plans	1	LS	\$10,000	\$10,000 <b>\$10,000</b>	FSP, QAPP, SSHP		
Monitoring, Sa	ampling, Testing, Analysis							
MW Installa	ation, Development	10	EA	\$3,521	\$35,209	See cost worksheet		
_	ng, Analysis - Initial	19	EA	\$1,254	\$23,817	See cost worksheet		
Surveying		1	LS	\$1,300	\$1,300	10 MWs		
Subtotal	. 6				\$60,325			
ISCO Treatme		1	EΛ	\$2.500	\$2.500	A in diameter proumetic		
Equilization	e Pump Install	1 1	EA EA	\$2,500 \$300	\$2,500 \$300	4-in diameter pneumatic 300-gal poly for extracted water collection		
Injection W		4	EA	\$3,920	\$15,682	See cost worksheet		
Air Compre		1	EA	\$250	\$250	5-hp, 30-gal		
	ng/Controls/Electrical	1	LS	\$12,679	\$12,679	See cost worksheet		
Trailer		1	EA	\$5,000	\$5,000			
Subtotal					\$36,411			
Subtotal 1				-	\$106,736			
Contingenc	у	30%		_	\$32,021	15% scope + 15% bid		
Subtotal 2					\$138,757			
Project Mar		10%			\$13,876			
	Investigation	15%			\$20,814	Pump test, bench and field scale treatability testing		
Remedial D	on Management	20% 15%			\$27,751 \$20,814			
Subtotal	ii ivianagement	1370		-	\$83,254			
Institutional	l Controls	1	LS	\$3,000	\$3,000	Implementation plan		
TOTAL CAP	PITAL COST:			Γ	\$225,011			
	AM COSTS (YEARS 1-10):			L	, ,,,			
AINIUAL OX	MI CODID (IEARD I-10);							
Des	<u>scription</u>	<u>Oty</u>	<u>Unit</u>	<u>Unit Cost</u>	Cost	<u>Notes</u>		
Site Monitorin	~							
GW Samplin		19	EA	\$1,254	\$23,817	See cost worksheet per well cost		
Data Manag	gement	1	LS	\$2,000	\$2,000			
Reporting Subtotal		1	LS	\$8,000	\$8,000 <b>\$33,817</b>	Annual reporting		
	o,	25%				10% scope + 15% bid		
Contingency	y	23%		_	\$8,454	10/0 scope + 15/0 via		
Subtotal					\$42,271			
Project Man	•	10%			\$4,227			
Technical St	upport	15%		=	\$6,341			
Subtotal				-	\$10,568			
TOTAL ANN	UAL O&M COST (YEARS 1	1-10):		L	\$52,838			

# TABLE O-4 COST ESTIMATE SUMMARY - ALTERNATIVE 4 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

<b>Description</b>		<u>Oty</u>	<u>Unit</u>	<u>Unit Cost</u>	Cost	<u>Notes</u>
Site Monitoring						
GW Sampling, Analysis		9	EA	\$1,254	\$11,282	See cost worksheet per well cost
Data Management		1	LS	\$1,500	\$1,500	
Reporting		1	LS	\$6,000	\$6,000	Annual reporting
Subtotal					\$18,782	
Contingency		25%			\$4,695	10% scope + 15% bid
Subtotal					\$23,477	
Project Management		10%			\$2,348	
Technical Support		15%			\$3,522	
Subtotal					\$5,869	
TOTAL ANNUAL O&M COST (	YEARS 11-	-20):			\$29,346	
PERIODIC COSTS:						
Description	<u>Year</u>	Oty	<u>Unit</u>	Unit Cost	Cost	<u>Notes</u>
Treatment System Monitoring, M	aintenance					
O&M Labor	1	12	MO	\$1,000	\$12,000	3 day/wk, includes sampling
Equipment/Repair	1	1	LS	\$1,000	\$1,000	
Power Usage	1	12	MO	\$500	\$6,000	Process, \$0.07/Kwh
Hydrogen Peroxide	1	1	LS	\$25,869	\$25,869	50% solution, 32-500lb drums/yr
Hydrogen Peroxide Shipping	1	16000	LB	\$0.1	\$1,600	32-500lb drums
Water Sampling, Analysis	1	4	QTR	\$400	\$1,600	1 sample for VOCs, explosives, metals, incl shipping
Data Management	1	4	QTR	\$750	\$3,000	
Reporting	1	4	QTR	\$1,000	\$4,000	
Subtotal					\$55,069	
Five-Year Review Report	5,10,15	1	EA	\$8,000	\$8,000	
Well Maintenance	5,10,15	1	EA	\$1,500	\$1,500	Repair damage, redevelop
Subtotal					\$9,500	
Dismantle Treatment System	20	1	EA	\$2,500	\$2,500	
Well Abandonment	20	30	EA	\$300	•	25 MWs, 4 IWs, 1 EW,
Remedial Action Report	20	1	EA	\$10,000	\$10,000	, ,
Subtotal				,	\$21,500	
PRESENT VALUE ANALYSIS	<b>i:</b>					
			Total Cart	Discount		
Cost Type	Voor	<b>Total Cost</b>	Total Cost Per Year	Factor <u>(7%)</u>	Present Value	Notes
<u>Cost Type</u>	<u>Year</u>			<u> </u>		<u>Notes</u>
Capital Cost	0	\$225,011	\$225,011	1.000	\$225,011	
O&M Cost	1-10	\$528,383	\$52,838	7.024	\$371,114	
O&M Cost	11-20	\$293,461	\$29,346	3.570	\$104,778	
Periodic Cost	1	\$55,069	\$55,069	0.935	\$51,466	
Periodic Cost	5	\$9,500	\$9,500	0.713	\$6,773	
Periodic Cost	10	\$9,500	\$9,500	0.508	\$4,829	
Periodic Cost	15	\$9,500	\$9,500	0.362	\$3,443	
Periodic Cost	20	\$21,500	\$21,500	0.258	\$5,556	
		\$1,151,924			\$772,972	

## TABLE O-5 COST ESTIMATE SUMMARY - ALTERNATIVE 5 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

## ENHANCED DEGRADATION/MNA

5/17/2004

Site: FTP Groundwater Description: Install 1 extraction well and 4 injection wells to circulate H<sub>2</sub>O<sub>2</sub> throughout the sump area

Location:IAAAP Middletown, Iowagroundwater for one year. Use direct push to inject  $HRC^{TM}$  into CVOC plume outside the sump area.Phase:RAA (-30% to +50%) $HRC^{TM}$  re-applied once. Intall 10 new monitoring wells. Annual groundwater sampling at 19 wellsBase Year:2004in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 10 to 20. Institutional and

engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 20; periodic

costs in Years 1,2,5,10,15, and 20.

#### CAPITAL COSTS:

Date:

<b>Description</b>	<u>Qty</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Cost</u>	<u>Notes</u>
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	\$10,000	\$10,000	FSP, QAPP, SSHP
Subtotal				\$10,000	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	\$3,521	\$35,209	See cost worksheet
GW Sampling, Analysis - Initial	19	EA	\$1,254	\$23,817	See cost worksheet
Surveying	1	LS	\$1,300	\$1,300	10 MWs
Subtotal			_	\$60,325	
ISCO Treatment System					
Submersible Pump Install	1	EA	\$2,500	\$2,500	4-in diameter pneumatic
Equilization Tank	1	EA	\$300	\$300	300-gal poly for extracted water collection
Injection Wells	4	EA	\$3,920	\$15,682	See cost worksheet
Air Compressor	1	EA	\$250	\$250	5-hp, 30-gal
Pumps/Piping/Controls/Electrical	1	LS	\$12,679	\$12,679	See cost worksheet
Trailer	1	EA	\$5,000	\$5,000	
Subtotal			_	\$36,411	
HRC Injection	1	LS	\$162,787	\$162,787	See cost worksheet
Subtotal 1			_	\$269,523	
Contingency	30%			\$80,857	15% scope + 15% bid
Subtotal 2			_	\$350,380	
Project Management	8%			\$28,030	
Pre-Design Investigation	10%			\$35,038	Pump test, bench and field scale treatability testing
Remedial Design	15%			\$52,557	
Construction Management	10%			\$35,038	
Subtotal			_	\$150,663	
Institutional	1	LS	\$3,000	\$3,000	Implementation plan
TOTAL CAPITAL COST:				\$504,043	

## ANNUAL O&M COSTS (YEARS 1-10):

<b>Description</b>	<u>Qty</u>	<u>Unit</u>	<b>Unit Cost</b>	Cost	<u>Notes</u>
Site Monitoring					
GW Sampling, Analysis	19	EA	\$1,254	\$23,817	See cost worksheet per well cost
Data Management	1	LS	\$2,000	\$2,000	
Reporting	1	LS	\$8,000	\$8,000	Annual reporting
Subtotal				\$33,817	
Contingency	25%			\$8,454	10% scope + 15% bid
Subtotal				\$42,271	
Project Management	10%			\$4,227	
Technical Support	15%			\$6,341	
Subtotal			_	\$10,568	
TOTAL ANNUAL O&M COST (YI	EARS 1-10):			\$52,838	

# TABLE O-5 COST ESTIMATE SUMMARY - ALTERNATIVE 5 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ANNUAL O&M COSTS (YEAR	RS 11-20):					
<b>Description</b>		<u>Oty</u>	<u>Unit</u>	<b>Unit Cost</b>	Cost	<u>Notes</u>
Site Monitoring						
GW Sampling, Analysis		9	EA	\$1,254	\$11,282	See cost worksheet per well cost
Data Management		1	LS	\$1,500	\$1,500	
Reporting		1	LS	\$6,000	\$6,000	Annual reporting
Subtotal				-	\$18,782	
Contingency		25%			\$4,695	10% scope + 15% bid
Subtotal				_	\$23,477	
Project Management		10%			\$2,348	
Technical Support		15%			\$3,522	
Subtotal		- 7-		_	\$5,869	
TOTAL ANNUAL O&M COST	(YEARS 1	1-20):		Γ	\$29,346	
PERIODIC COSTS:						
Description	Year	Qty	Unit	Unit Cost	Cost	Notes
Treatment System Monitoring, N						<del></del>
O&M Labor	1	12	MO	\$1,000	\$12,000	3 day/wk, includes sampling
Equipment/Repair	1	1	LS	\$1,000	\$1,000	5 day, wk, includes sampling
Power Usage	1	12	MO	\$500	\$6,000	Process, \$0.07/Kwh
Hydrogen Peroxide	1	1	LS	\$25,869	\$25,869	50% solution, 32 500-lb drums/Year
Hydrogen Peroxide Shipping	1	16000	LB	\$0.1	\$1,600	32 500-lb drums
Water Sampling, Analysis	1	4	QTR	\$400	\$1,600	1 sample for VOCs, explosives, metals, incl shipping
Data Management	1	4	QTR	\$750	\$3,000	1 sample for voes, explosives, metals, mer simpping
Reporting	1	4	QTR	\$1,000	\$4,000	
HRC Performance Sampling	1	3	EA	\$6,268	\$18,803	Qrtly, 5 wells (excl annual)
Subtotal	•	3	221	Ψ0,200_	\$73,872	Quay, o would (e.t.) amount
HRC Performance Sampling	2	3	EA	\$6,268	\$18,803	Qrtly, 5 wells (excl annual)
HRC Re-Injection	2	1	EA	\$162,787	\$162,787	See cost worksheet
Subtotal				_	\$181,589	
Five-Year Review Report	5,10,15	1	EA	\$8,000	\$8,000	
Well Maintenance	5,10,15	1	EA	\$1,500	\$1,500	Repair damage, redevelop
Subtotal				_	\$9,500	
Dismantle Treatment System	20	1	EA	\$2,500	\$2,500	
Well Abandonment	20	30	EA	\$300	\$9,000	25 MWs, 4 IWs, 1 EW,
Remedial Action Report	20	1	EA	\$10,000	\$10,000	
1				-	\$21,500	

# TABLE O-5 COST ESTIMATE SUMMARY - ALTERNATIVE 5 FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ENHANCED DEGRA	ENHANCED DEGRADATION/MNA						
PRESENT VALUE ANAL	YSIS:			D:			
Cost Type	<u>Year</u>	Total Cost	Total Cost <u>Per Year</u>	Discount Factor (7%)	Present <u>Value</u>	<u>Notes</u>	
Capital Cost	0	\$504,043	\$504,043	1.000	\$504,043		
O&M Cost	1-10	\$528,383	\$52,838	7.024	\$371,114		
O&M Cost	11-20	\$293,461	\$29,346	3.570	\$104,778		
Periodic Cost	1	\$73,872	\$73,872	0.935	\$69,039		
Periodic Cost	2	\$181,589	\$181,589	0.873	\$158,607		
Periodic Cost	5	\$9,500	\$9,500	0.713	\$6,773		
Periodic Cost	10	\$9,500	\$9,500	0.508	\$4,829		
Periodic Cost	15	\$9,500	\$9,500	0.362	\$3,443		
Periodic Cost	20	\$21,500	\$21,500	0.258	\$5,556		
		\$1,631,348			\$1,228,184		
TOTAL PRESENT VALU	E OF ALTE	RNATIVE:			\$1,228,000		

## **COST WORKSHEET**

## MONITORING WELL INSTALLATION AND DEVELOPMENT

Site:FTP GroundwaterPrepared By: DRHChecked By: JMRLocation:IAAAP Middletown, IowaDate: 5/17/2004Date: 5/17/2004

**Phase:** RAA (-30% to +50%)

Base Year: 2004

#### **Work Statement:**

Install (5 days), develop (2 days), and slug test (2 days) additional LTM monitoring wells. Assume 10 shallow (25-foot) wells. Install includes drilling with 4.25-inch HSAs, continuous soil sampling, install of 2-inch Schedule 40 PVC blank and factory-slotted screen, and aboveground completions.

#### Cost Analysis:

Cost Alialysis:								
DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Field Preparation	4	HR	43	-	-	43	172	\$43/hr tech
Digging Permits	4	HR	43	-	-	43	172	\$43/hr tech
Drilling Oversight	100	HR	113	-	-	113	11300	\$70/hr geo+\$43/hr tech (incl travel time)
SUBTOTAL							\$11,644	<del></del>
Supplies, Rental, and Travel								
PPE/Decon/Misc Suppiles	1	EA	-	-	150	150	150	
Hermit Transducer and Logger	2	DAY	-	100	-	100	200	Slug testing
Horiba U-10	2	DAY	-	21	-	21	42	Development
Submersible Pump	2	DAY	-	63	-	63	126	
Polyethylene Tubing	100	LF	-	-	0.25	0.25	25	
Water Level Probe	9	DAY	-	40	-	40	360	
Minirae PID	9	DAY	-	35	-	35	315	
Per Diem (2-man crew)	9	DAY	-	-	-	170	1530	(\$30+\$55) x 2
Mileage	1150	MI	-	-	-	0.36	414	800 mi mob/demob+50 mi/day x 9 days
SUBTOTAL							\$3,162	
G&A Markup						5.0%	158	
SUBTOTAL						_	\$3,320	<del>_</del>
Subcontract								
Drillers Mob/Demob	1	LS	-	-	-	500	500	
Drillers Per Diem (3-man crew)	3	DAY	-	-	-	150	450	
Install Temp Decon Pads	1	EA	-	-	-	200	200	
Overburden Drilling (2-in SS)	250	LF	-	-	-	18	4500	4.25-in HSA
2-in PVC Sched 40 Riser	170	LF	-	-	-	8.7	1479	10-ft sections
2-in PVC Sched 40 Fact-Slot Scrn	100	LF	-	-	-	12.25	1225	10-ft sections
Filter Pack Sand	120	LF	-	-	-	9	1080	Colorado silica
Bentonite Seal	10	EA	-	-	-	33.5	335	0.375-in chips
Annular Seal	110	LF	-	-	-	5	550	Bentonite grout
Completions/Protective Cover	9	EA	-	-	-	250	2250	
55-gal Drums, Filled and Staged	20	EA	-	-	-	65	1300	Includes drums
Off-site IDW Transport	1	LS	-	-	-	495	495	Subcontract disposal service
Off-site IDW Disposal	20	EA	-	-	-	45	900	Subcontract disposal service
SUBTOTAL							\$15,264	
Prime Contractor Overhead						15.0%	2290	Applies to subcontract only
SUBTOTAL							\$32,518	
Prime Contractor Profit						10.0%	2691	Applies to labor and subcontract only
TOTAL COST						Γ	\$35,209	
						OR	\$3,521	Per monitoring well
0 00 10 1						-		

### **Source of Cost Data:**

Previous experience with drilling in 2003. RSMeans 2004, Environmental Remediation Cost Data, 10th Annual Edition.

### **Cost Adjustment Checklist:**

☑ Escalation to Base Year Current year (2004) is base year

☑ Area Cost Factor 0.86 based on area code (RS Means data only)

☑ Subcontractor Overhead and Profit Included in cost

## **COST WORKSHEET**

## FOCUSED EXTRACTION - TREATMENT SYSTEM PUMPS/PIPING/CONTROLS/ELECTRICAL

Site:FTP GroundwaterPrepared By: DRHChecked By: JMRLocation:IAAAP Middletown, IowaDate: 5/17/2004Date: 5/17/2004

**Phase:** RAA (-30% to +50%)

Base Year: 2004

#### **Work Statement:**

Subcontractors supply and install pipes, meters, electrical, and controls hookup.

Cost	Anal	vsis:
Cost	Alla	Ly SIS.

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Exterior Pipe Install								
Mob/Demob	1	LS	-	-	-	250	250	
Trenching	1	DAY	100	300	-	400	400	Chain trencher
0.75-in Poly	50	LF	-	-	-	1.2	60	Air to submersible pump
1-in PVC	50	LF	-	-	-	2	100	Influent
2-in PVC	80	LF	-	-	-	2.6	208	Effluent
SUBTOTAL							\$1,018	
Process Pumps Install								
Transfer, 0.5-hp, 10-gpm	2	EA	-	-	-	2500	5000	
SUBTOTAL							\$5,000	_
Interior Process Pipe Install								
1-in PVC	20	LF	-	-	-	8.7	174	Includes fittings
2-in PVC	20	LF	-	-	-	7.6	152	Includes fittings
4-in PVC	30	LF	-	-	-	10.8	324	Off-gas
SUBTOTAL	'						\$650	
Interior Process Pipe Install								
1-in Ball Valve	1	EA	12	-	34	46	46	
2-in Ball Valve	2	EA	81	-	16	97	194	
4-in Ball Valve	2	EA	262	-	25	287	574	
1-in Check Valve	1	EA	40	-	12	52	52	
2-in Check Valve	2	EA	93	-	16	109	218	
1-in Flow Meter	1	EA	-	-	-	100	100	
2-in Flow Meter	2	EA	-	-	-	200	400	
Pressure Gauge	3	EA	-	-	-	25	75	
Temp Gauge	3	EA	-	-	-	25	75	<u></u>
SUBTOTAL							\$1,734	
Electrical Hookup	1	LS	-	-	-	2500	2500	Includes controls, process, building
SUBTOTAL	'						\$2,500	<del></del>
SUBTOTAL							\$10,902	
Prime Contractor Overhead						15.0%	1635	Applies to all
SUBTOTAL						_	\$12,537	
Prime Contractor Profit						10.0%	1254	
						_		

#### Source of Cost Data:

TOTAL COST

RSMeans 2004. Environmental Remediation Cost Data, 10th Annual Edition.

#### **Cost Adjustment Checklist:**

☑ Escalation to Base Year Current year (2004) is base year

Area Cost Factor 0.86 based on area code (RS Means data only)

☑ Subcontractor Overhead and Profit Included in cost

✓ Prime Contractor Overhead and Profit
Includes 15% overhead and 10% profit

\$13,791

## **Cost Sub-Element**

## **COST WORKSHEET**

## GROUNDWATER SAMPLING AND ANALYSIS

Site:FTP GroundwaterPrepared By: DRHChecked By: JMRLocation:IAAAP Middletown, IowaDate: 5/17/2004Date: 5/17/2004

**Phase:** RAA (-30% to +50%)

Base Year: 2004

#### **Work Statement:**

Groundwater sampling cost per event (19 wells total). Assume 2.5 hours per well by a 2-person team (47.5 hours total). VOCs, explosives, metals, and natural attenuation parameters analyzed in the laboratory.

#### **Cost Analysis:**

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Technician	57.5	HR	43	-	-	43	2473	includes travel time
Geo/Chem/Eng	57.5	HR	70	-	-	70	4025	includes travel time
SUBTOTAL							\$6,498	
Supplies, Rental, and Travel								
PPE/Decon/Misc Suppiles	1	EA	-	-	150	150	150	
Horiba U-10	5	DAY	-	21	-	21	105	
Peristaltic Pump	5	DAY	-	63	-	63	315	
Polyethylene Tubing	450	LF	-	-	0.25	0.25	113	
Water Level Probe	5	DAY	-	8	-	8	40	
Minirae PID	5	DAY	-	35	-	35	175	
Per Diem (2-man crew)	5	DAY	-	-	-	170	850	(\$30+\$55) x 2
Package and Ship	5	EA	-	-	-	90	450	
Mileage	1050	MI	-	-	-	0.36	378	800 mi mob/demob+50 mi/day x 5 days
SUBTOTAL							\$2,576	
G&A Markup						5.0%	129	
SUBTOTAL							\$2,704	
Subcontract								
Lab Analysis								
VOCs	21	EA	-	-	-	140	2940	Includes 10% duplicates
Explosives	21	EA	-	-	-	145	3045	Includes 10% duplicates
Metals	21	EA	-	-	-	70	1470	Includes 10% duplicates
Natural Attenuation Parameters	21	EA	-	-	-	177	3717	Includes 10% duplicates
SUBTOTAL							\$11,172	
Prime Contractor Overhead						15.0%	1676	applies to subcontract only
SUBTOTAL						<del>-</del>	\$22,050	
Prime Contractor Profit						10.0%	1767	applies to labor and subcontract only
TOTAL COST						Г	\$23,817	7
TOTAL COST						L		╡
						OR	\$1,254	per monitoring well

#### **Source of Cost Data:**

Previous experience with drilling in 2003. RSMeans 2004, Environmental Remediation Cost Data, 10th Annual Edition.

### **Cost Adjustment Checklist:**

FACTOR: NOTES:

✓ H&S Productivity (labor and equipment only) Level D

✓ Escalation to Base Year Current year (2004) is base year

☑ Area Cost Factor 0.86 based on area code (RS Means data only)

☑ Subcontractor Overhead and Profit Included in cost

## **COST WORKSHEET**

## ISCO - TREATMENT SYSTEM PUMPS/PIPING/CONTROLS/ELECTRICAL

Site:FTP GroundwaterPrepared By: DRHChecked By: JMRLocation:IAAAP Middletown, IowaDate: 5/17/2004Date: 5/17/2004

**Phase:** RAA (-30% to +50%)

Base Year: 2004

#### **Work Statement:**

Subcontractors supply and install pipes, meters, electrical, and controls hookup.

#### **Cost Analysis:**

Cost Allalysis.								
DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Exterior Pipe Install								
Mob/Demob	1	LS	-	-	-	250	250	
0.75-in Poly	50	LF	-	-	-	1.2	60	Air to submersible pump
1-in SS SCH 40	220	LF	-	-	-	11.7	2574	To injection wells
SUBTOTAL							\$2,884	
Process Equipment								
Injection Pump	1	EA	-	-	-	1287	1287	Adjustable, 0 to 20 gpm, 200 psi
Feed Tank, Regulator, Injector	1	EA	-	-	-	2368	2368	Peroxide mixture/controls
SUBTOTAL							\$3,655	
Interior Process Pipe Install	1							
1-in SS SCH 40	20	LF	-	-	-	11.7	234	Includes fittings
1-in Flow Meter	5	EA	-	-	-	100	500	
Pressure Gauge	5	EA	-	-	-	25	125	
Temp Gauge	5	EA	-	-	-	25	125	<u></u>
SUBTOTAL							\$984	
Electrical Hookup	1	LS	-	-	-	2500	2500	Includes controls, process, trailer
SUBTOTAL							\$2,500	
SUBTOTAL							\$10,023	
Prime Contractor Overhead						15.0%	1503	Applies to all
SUBTOTAL							\$11,526	
Prime Contractor Profit						10.0%	1153	
TOTAL COST						Г	\$12,679	$\neg$
TOTAL COST						<u>L</u>	φ12 <sub>9</sub> 019	

#### Source of Cost Data:

RSMeans 2004. Environmental Remediation Cost Data, 10th Annual Edition.

#### **Cost Adjustment Checklist:**

☑ Escalation to Base Year Current year (2004) is base year

Area Cost Factor 0.86 based on area code (RS Means data only)

☑ Subcontractor Overhead and Profit Included in cost

## **COST WORKSHEET**

## INJECTION WELL INSTALLATION AND DEVELOPMENT

Site:FTP GroundwaterPrepared By: DRHChecked By: JMRLocation:IAAAP Middletown, IowaDate: 5/17/2004Date: 5/17/2004

**Phase:** RAA (-30% to +50%)

Base Year: 2004

#### **Work Statement:**

Install (2 days) and develop (1 day) ISCO injection wells. Assume 4 shallow (15-foot) wells. Install includes drilling with 4.25-inch HSAs, continuous soil sampling, install of 2-inch stainless steel blank and factory-slotted screen, and below ground completions.

#### **Cost Analysis:**

Cost Analysis:								
DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Field Preparation	4	HR	43	-	-	43	172	\$43/hr tech
Digging Permits	4	HR	43	-	-	43	172	\$43/hr tech
Drilling Oversight	40	HR	113	-	-	113	4520	\$70/hr geo+\$43/hr tech (incl travel time)
SUBTOTAL							\$4,864	<u> </u>
Supplies, Rental, and Travel								
PPE/Decon/Misc Suppiles	1	EA	-	_	150	150	150	
Hermit Transducer and Logger	1	DAY	-	100	-	100	100	Slug testing
Horiba U-10	1	DAY	_	21	-	21	21	Development
Submersible Pump	1	DAY	_	63	-	63	63	-
Polyethylene Tubing	100	LF	-	_	0.25	0.25	25	
Water Level Probe	3	DAY	-	40	-	40	120	
Minirae PID	3	DAY	-	35	-	35	105	
Per Diem (2-man crew)	3	DAY	-	-	-	170	510	(\$30+\$55) x 2
Mileage	950	MI	-	-	-	0.36	342	800 mi mob/demob+50 mi/day x 3 days
SUBTOTAL							\$1,436	<del>_</del>
G&A Markup						5.0%	72	
SUBTOTAL						•	\$1,508	<del></del>
Subcontract								
Drillers Mob/Demob	1	LS	-	-	-	500	500	
Drillers Per Diem (3-man crew)	1	DAY	-	_	-	150	150	
Install Temp Decon Pads	1	EA	-	-	-	200	200	
Overburden Drilling (2-inch SS)	60	LF	-	-	-	18	1080	4.25-in HSA
2-in SS Riser	40	LF	-	-	-	21.9	876	10-ft sections
2-in SS Screen	20	LF	-	-	-	18.6	372	5-ft sections
Filter Pack Sand	28	LF	-	-	-	9	252	Colorado silica
Bentonite Seal	4	EA	-	-	-	33.5	134	0.375-in chips
Annular Seal	24	LF	-	-	-	5	120	Bentonite grout
Completions/Protective Cover	4	EA	-	-	-	500	2000	24-in diameter CMP vault with lid
55-gal Drums, Filled and Staged	8	EA	-	-	-	65	520	Includes drums
Off-site IDW Transport	1	LS	-	-	-	495	495	Subcontract disposal service
Off-site IDW Disposal	8	EA	-	-	-	45	360	Subcontract disposal service
SUBTOTAL							\$7,059	
Prime Contractor Overhead						15.0%	1059	Applies to subcontract only
SUBTOTAL							\$14,490	
Prime Contractor Profit						10.0%	1192	Applies to labor and subcontract only
TOTAL COST							\$15,682	]
						OR	\$3,920	Per injection well

### **Source of Cost Data:**

Previous experience with drilling in 2003. RSMeans 2004, Environmental Remediation Cost Data, 10th Annual Edition.

### **Cost Adjustment Checklist:**

FACTOR: NOTES:

☑ H&S Productivity (labor and equipment only) Level D

☑ Escalation to Base Year Current year (2004) is base year

☑ Area Cost Factor 0.86 based on area code (RS Means data only)

☑ Subcontractor Overhead and Profit Included in cost

FTP Groundwater

## HRC INJECTION

Site:

**COST WORKSHEET** 

Prepared By: DRH Checked By: JMR

 Location:
 IAAAP Middletown, Iowa
 Date: 5/17/2004
 Date: 5/17/2004

 Phase:
 RAA (-30% to +50%)
 Properties of the control

Base Year: 2004

#### **Work Statement:**

Inject HRC<sup>TM</sup> into the contaminant plume using direct push injection. Treatment zone covers areas east and south od SA-99-1. Estimated 12 days to complete using two rigs.

#### **Cost Analysis:**

000011111111111111111111111111111111111								
DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Field Preparation	8	HR	43	-	-	43	344	\$43/hr tech
Digging Permits	8	HR	43	-	-	43	344	\$43/hr tech
Drilling Oversight	130	HR	140	-	-	140	18200	\$70/hr geo/eng x 2 (incl travel time)
SUBTOTAL							\$18,888	
Supplies, Rental, and Travel								
HRC Product	12900	LB	-	-	5.5	5.5	70950	see HRC <sup>TM</sup> design sheets (App. N)
HRC Tax	1	LS	-	-	-	6.50%	4612	6.50%
HRC Shipping	12900	LB	-	-	0.1	0.1	1290	
PPE/H&S Setups	1	LS	-	250	-	250	250	
Minirae PID	12	DAY	-	70	-	70	840	x 2
Oversight Per Diem (2-man crew)	12	DAY	-	-	-	170	2040	(\$30+\$55) x 2
Mileage	1400	MI	-	-	-	0.36	504	800 mi mob/demob+50 mi/day x 12 days
SUBTOTAL							\$80,486	
G&A Markup						5.0%	4024	
SUBTOTAL						_	\$84,510	
Subcontract								
Direct Push Mob/Demob	2	LS	-	-	-	1000	2000	2 rigs and 2 crews
Direct Push	11	DAY	-	-	-	4000	44000	\$2000/day/rig
SUBTOTAL							\$46,000	<del>_</del>
Prime Contractor Overhead						15.0%	6900	applies to subcontract only
SUBTOTAL						_	\$156,298	
Prime Contractor Profit						10.0%	6489	applies to labor and subcontract only
TOTAL COST							\$162,787	

#### **Source of Cost Data:**

Regenesis HRC Grid Design Versino 3.1 and cost information from Regenesis sales rep.

#### **Cost Adjustment Checklist:**

☑ Escalation to Base Year Current year (2004) is base year

☑ Area Cost Factor 0.86 based on area code (RS Means data only)

☑ Subcontractor Overhead and Profit Included in cost