

# TECHNICAL MEMORANDUM

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**To:** Nevada Environmental Response Trust

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**Cc:** Nevada Division of Environmental Protection  
United States Environmental Protection Agency

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**From:** Chris Hayes

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**Date:** March 8, 2022

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**Subject:** Unit 4 Source Area In-Situ Bioremediation Treatability Study Monthly Progress Report

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At the direction of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this memorandum to summarize Tetra Tech's progress during January 2022 toward successfully implementing the Unit 4 Source Area In-Situ Bioremediation (ISB) Treatability Study.

## Task Progress Update: January 2022

### Task M21 – Unit 4 Source Area ISB Treatability Study

- Current Status
  - Phase 2 of the Unit 4 Source Area ISB Treatability Study is ongoing. The following activities were completed as part of the design and implementation:
    - Groundwater sampling of the four newly installed Area 2 pilot wells was completed on November 16, 2021. A layout map and construction details of the Area 2 pilot wells are provided on Figure 1 and Table 1. Groundwater analytical results are provided in Table 2. As expected, Area 2 concentrations are generally lower than the Area 1 concentrations. Perchlorate concentrations ranged from 313 mg/L to 1,260 mg/L and total dissolved solids concentrations ranged from 10,800 mg/L to 22,400 mg/L in groundwater samples collected from the pilot wells.
    - Aquifer testing of the four newly installed pilot wells began in November 2021 to determine baseline hydraulic conditions. Slug tests were completed on November 20, 2021 and the data evaluation was completed in January 2022. The hydraulic conductivity observed in the intermediate zone from 83 to 98 feet below ground surface (bgs) at U4-E-06I and U4-E-10I averaged 0.6 feet/day, which is slightly lower than those observed at intermediate wells in Area 1 during Phase 1 activities (average of 1.4 feet/day). The hydraulic conductivity observed in the deep zone from 103 to 118 feet bgs at U4-E-06D and U4-E-10D averaged 0.2 feet/day, which is consistent with the previous Phase 1 results from Area 1.
    - Step-drawdown pumping tests were completed on newly installed Area 2 pilot wells (namely, U4-E-06I, U4-E-06D, U4-E-10I, and U4-E-10D) on December 4, 2021. Step-rate injection tests were completed on newly installed Area 2 pilot wells (U4-E-06I, U4-E-06D, U4-E-10I, and U4-E-10D) and select wells in Area 1 (U4-E-05I, U4-E-05D, U4-E-04I and

Tetra Tech, Inc.

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Tel 702-854-2295 [tetratech.com](http://tetratech.com)

- U4-E-04D) on December 16, 2021. Results from the pumping and injection tests are being evaluated and will be incorporated into the final injection/extraction system design.
- Drilling activities for the remaining Area 1 and Area 2 injection/extraction and monitoring wells began on January 4, 2022 and are on-going. A final layout map and construction details of all injection/extraction and monitoring wells will be provided in future monthly progress reports upon completion of the drilling effort. As of January 31, 2022, the following has been completed:
    - A geophysical survey of the Area 1 and Area 2 injection/extraction and monitoring wells was completed on January 4, 2022.
    - Concrete coring was completed at 27 injection/extraction and monitoring well locations on January 9, 2022.
    - 27 borings were cleared of subsurface utilities by advancing the boreholes to a depth of approximately 10 feet below ground surface utilizing a hydrovac unit on January 9, 2022.
    - A request for waiver for 48 new wells was approved by the Nevada Division of Water Resources on January 14, 2022.
    - Two sonic drill rigs were mobilized on January 24, 2022. One injection/extraction well was completed during January 2022. A final layout map and construction details of all injection and monitoring wells will be provided in future monthly progress reports upon completion of the drilling effort.
  - A fee request letter from the Nevada Division of Water Resources for final review of the Water Appropriation Permit Application package for the Unit 4 Source Area In-Situ Bioremediation Treatability Study was received on January 14, 2022.
- Schedule and Progress Updates
    - Installation of Area 1 and Area 2 injection/extraction and monitoring wells will continue through March 2022.
    - A geotechnical evaluation of the truck route from the Unit 4 building to the GWETS Process Tanks formerly used for AP-5 Pond closure is scheduled to be conducted in February 2022. The GWETS Process Tanks will be used to receive extracted groundwater (up to 4x daily) generated through operations associated with the Unit 4 Source Area ISB Treatability Study. This extracted groundwater will subsequently be processed by Envirogen Technologies, Inc, (ETI), operator of the GWETS, consistent with an agreement between ETI and the Trust.
    - Well development of completed injection/extraction and monitoring wells is scheduled to begin in February 2022.
    - Payment will be made to the Nevada Division of Water Resources for final review of the Water Appropriation Permit Application package for the Unit 4 Source Area In-Situ Bioremediation Treatability Study in February 2022.
  - Health and Safety
    - There were no health and safety incidents related to Task M21 during January 2022.

## CERTIFICATION

### Unit 4 Source Area In-Situ Bioremediation Treatability Study Monthly Progress Report

**Nevada Environmental Response Trust Site  
(Former Tronox LLC Site)  
Henderson, Nevada**

**Nevada Environmental Response Trust (NERT) Representative Certification**

I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the systems(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

**Signature:** Jay A. Steinberg Not Individually, but Solely as President of the Trustee, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

**Name:** Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

**Title:** Solely as President and not individually

**Company:** Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee


**Date:** 3/8/22

## CERTIFICATION

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I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been prepared in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.

**Description of Services Provided:** Prepared Unit 4 Source Area In-Situ Bioremediation Treatability Study Monthly Progress Report.



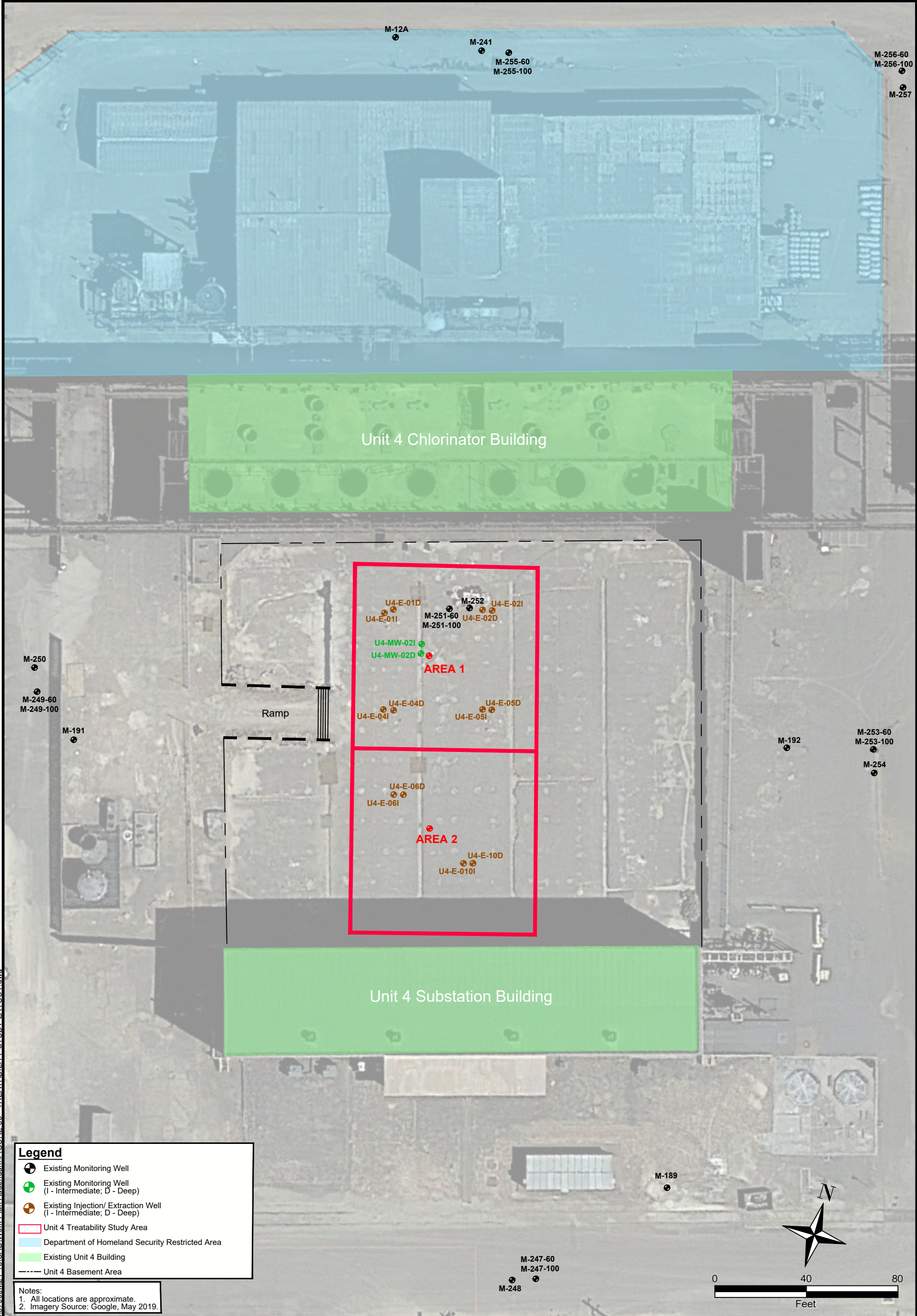
**David S. Wilson, CEM**  
Principal Engineer  
Tetra Tech, Inc.

March 8, 2022

Date

Nevada CEM Certificate Number: 2385  
Nevada CEM Expiration Date: September 19, 2022

# Figures



**Legend**

- Existing Monitoring Well
- Existing Monitoring Well (I - Intermediate; D - Deep)
- Existing Injection/ Extraction Well (I - Intermediate; D - Deep)
- Unit 4 Treatability Study Area
- Department of Homeland Security Restricted Area
- Existing Unit 4 Building
- Unit 4 Basement Area

Notes:  
 1. All locations are approximate.  
 2. Imagery Source: Google, May 2019.

NEVADA ENVIRONMENTAL RESPONSE TRUST SITE  
 UNIT 4 SOURCE AREA IN-SITU BIOREMEDIATION TREATABILITY STUDY  
 HENDERSON, NEVADA

**AREA 2 PILOT WELL LOCATIONS**

Project No.: 117-7502021  
 Date: MARCH 8, 2022  
 Designed By: AC

Figure No.  
1



**TETRA TECH**

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 150 S. 4th Street, Unit A  
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 Phone: (702) 854-2293

\\its318fs3.tl.local\ICES\Projects\87600\21-18\CAD\Work Plan Addendum\FIGURE 35 - TREATABILITY STUDY LAYOUT.dwg

# Tables

**Table 1**  
**Well Construction Details**  
 Unit 4 Source Area In-Situ Bioremediation Treatability Study

Well ID	Northing <sup>1</sup>	Easting <sup>1</sup>	Ground Surface Elevation	Top of Casing Elevation	Construction Type	Casing Material	Screen Material	Slot Size	Filter Pack Gradation	Borehole Diameter	Borehole Total Depth	Well Diameter	Nominal Screen Length	Well Total Depth	Bottom of Screen	Top of Screen
			feet amsl	feet amsl				inches		inches	feet bgs	inches	feet	feet bgs	feet bgs	feet bgs
<b>Phase 2 Pilot Wells</b>																
<b>U4-E-06I</b>	26717252.60	828227.99	TBD	TBD	Single	Schedule 80 PVC	Stainless Steel Wire-Wrap	0.010	#2/16	8	92.5	4	15	91	90	75
<b>U4-E-06D</b>	26717253.22	828232.15	TBD	TBD	Single	Schedule 80 PVC	Stainless Steel Wire-Wrap	0.010	#2/16	8	112	4	15	111	110	95
<b>U4-E-10I</b>	2617277.51	828262.60	TBD	TBD	Single	Schedule 80 PVC	Stainless Steel Wire-Wrap	0.010	#2/16	8	92	4	15	91	90	75
<b>U4-E-10D</b>	26717228.09	828266.74	TBD	TBD	Single	Schedule 80 PVC	Stainless Steel Wire-Wrap	0.010	#2/16	8	110	4	15	111	110	95

Notes

amsl - above mean sea level

bgs - below ground surface<sup>2</sup>

bTOC - below top of casing

TBD - to be determined

PVC - polyvinyl chloride

--- Not Applicable

1. Locations are approximate. Pilot wells will be surveyed following completion of Phase 2 drilling and well installation activities.

2. The surface of the basement of the former Unit 4 cell building is approximately 8 feet below the surrounding ground surface. Depths indicated as feet bgs reference the surface of the basement.



**Table 2**  
**Groundwater Analytical Results**  
 Unit 4 Source Area In-Situ Bioremediation Treatability Study

Parameter			Well				
			U4-E-06D	U4-E-06I			U4-E-10D
Sample ID			U4-E-6D-BL01	U4-E-6I-BL01	U4-E-6I-BL01-FD	U4-E-10D-BL01	U4-E-10I-BL01
Sample Date			11/16/2021	11/16/2021	11/16/2021	11/16/2021	11/16/2021
QC Type			N	N	FD	N	N
USEPA Method 314.0	Perchlorate	µg/L	943,000	313,000	307,000	924,000	1,260,000
USEPA Method 300.1B	Chlorate	µg/L	12,700,000	5,670,000	5,270,000	7,540,000	8,480,000
USEPA Method 300.0	Nitrate (as N)	µg/L	28,800 J-	17,200	17,200	19,900	24,400
USEPA Method SW7199	Chromium, Hexavalent	µg/L	40,000 J-	22,500 J-	23,500 J-	21,600 J-	36,600 J-
Method SM2540C	Total Dissolved Solids	µg/L	22,400,000	10,800,000	10,800,000	15,600,000	17,900,000
USEPA Method SW8260B	1,1,1,2-Tetrachloroethane	µg/L	<0.147	<0.147	<0.147	<0.147	<0.147
	1,1,1-Trichloroethane	µg/L	<0.149	<0.149	<0.149	<0.149	<0.149
	1,1,2,2-Tetrachloroethane	µg/L	<0.133	<0.133	<0.133	<0.133	<0.133
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	<0.180	<0.180	<0.180	<0.180	<0.180
	1,1,2-Trichloroethane	µg/L	<0.158	<0.158	<0.158	<0.158	<0.158
	1,1-Dichloroethane	µg/L	<0.100	<0.100	<0.100	<0.100	<0.100
	1,1-Dichloroethene	µg/L	0.255 J	0.277 J	0.244 J	<0.188	0.238 J
	1,1-Dichloropropene	µg/L	0.160 J	0.236 J	0.235 J	<0.142	0.235 J
	1,2,3-Trichlorobenzene	µg/L	<0.230	<0.230	<0.230	<0.230	<0.230
	1,2,3-Trichloropropane	µg/L	<0.237	<0.237	<0.237	<0.237	0.316 J
	1,2,3-Trimethyl Benzene	µg/L	<0.104 UJ	<0.104	<0.104	<0.104	<0.104
	1,2,4-Trichlorobenzene	µg/L	<0.481	<0.481	<0.481	<0.481	<0.481
	1,2,4-Trimethylbenzene	µg/L	<0.322	<0.322	<0.322	<0.322	<0.322
	1,2-Dibromo-3-Chloropropane	µg/L	<0.276	<0.276	<0.276	<0.276	<0.276
	1,2-Dibromoethane	µg/L	<0.126	<0.126	<0.126	<0.126	<0.126
	1,2-Dichlorobenzene	µg/L	<0.107	<0.107	<0.107	<0.107	<0.107
	1,2-Dichloroethane	µg/L	<0.0819	<0.0819	<0.0819	<0.0819	0.112 J
	1,2-Dichloropropane	µg/L	<0.149	<0.149	<0.149	<0.149	<0.149
	1,3,5-Trimethylbenzene (Mesitylene)	µg/L	<0.104 UJ	<0.104	<0.104	<0.104	<0.104
	1,3-Dichlorobenzene	µg/L	<0.110	<0.110	<0.110	<0.110	<0.110
	1,3-Dichloropropane	µg/L	<0.110	<0.110	<0.110	<0.110	<0.110
	1,4-Dichlorobenzene	µg/L	<0.120	<0.120	<0.120	<0.120	<0.120
	2,2-Dichloropropane	µg/L	<0.161	<0.161	<0.161	<0.161	<0.161
	2-Butanone (MEK)	µg/L	<1.19	<1.19	<1.19	<1.19	<1.19
	2-Chlorotoluene	µg/L	<0.106	<0.106	<0.106	<0.106	<0.106
	4-Chlorotoluene	µg/L	<0.114	<0.114	<0.114	<0.114	<0.114
	4-Methyl-2-Pentanone	µg/L	<0.478	<0.478	<0.478	<0.478	<0.478
	Acetone	µg/L	<11.3	<11.3	<11.3	<11.3	<11.3
	Acrolein	µg/L	<2.54 R	<2.54 R	<2.54 R	<2.54 R	<2.54 R
	Acrylonitrile	µg/L	<0.671	<0.671	<0.671	<0.671	<0.671
	Benzene	µg/L	<0.0941	<0.0941	<0.0941	<0.0941	<0.0941
	Bromobenzene	µg/L	<0.118	<0.118	<0.118	<0.118	<0.118
	Bromodichloromethane	µg/L	1.31	1.49	1.57	0.648 J	1.53
	Bromoform	µg/L	0.626 J	0.558 J	0.534 J	0.320 J	0.654 J
	Bromomethane	µg/L	<0.605	<0.605	<0.605	<0.605	<0.605
	Carbon Tetrachloride	µg/L	0.890 J	1.35	1.07	0.602 J	1.38
	Chlorobenzene	µg/L	<0.116	<0.116	<0.116	<0.116	<0.116
	Chloroethane	µg/L	<0.192	<0.192	<0.192	<0.192	<0.192
	Chloroform	µg/L	3,400	3,080	3,120	1,340	2,530
	Chloromethane	µg/L	<0.960	<0.960	<0.960	<0.960	<0.960
cis-1,2-Dichloroethene	µg/L	<0.126	<0.126	<0.126	<0.126	<0.126	
cis-1,3-Dichloropropene	µg/L	<0.111	<0.111 UJ	<0.111 UJ	<0.111 UJ	<0.111 UJ	
Dibromochloromethane	µg/L	0.456 J	0.480 J	0.495 J	0.245 J	0.590 J	
Dibromomethane	µg/L	<0.122	<0.122	<0.122	<0.122	<0.122	
Dichlorodifluoromethane	µg/L	<0.374	<0.374	<0.374	<0.374	<0.374	
Diisopropyl Ether (DIPE)	µg/L	<0.105	<0.105	<0.105	<0.105	<0.105	
Ethylbenzene	µg/L	<0.137	<0.137	<0.137	<0.137	<0.137	
Hexachlorobutadiene	µg/L	<0.337	<0.337	<0.337	<0.337	<0.337	
Isopropylbenzene	µg/L	<0.105	<0.105	<0.105	<0.105	<0.105	
Methylene Chloride	µg/L	<0.430	<0.430	<0.430	<0.430	<0.430	
Naphthalene	µg/L	<1.00	<1.00	<1.00	<1.00	<1.00	
n-Butylbenzene	µg/L	<0.157	<0.157	<0.157	<0.157	<0.157	

**Table 2**  
**Groundwater Analytical Results**  
 Unit 4 Source Area In-Situ Bioremediation Treatability Study

Parameter			Well				
			U4-E-06D	U4-E-06I		U4-E-10D	U4-E-10I
USEPA Method SW8260B	n-Propylbenzene	µg/L	<0.0993	<0.0993	<0.0993	<0.0993	<0.0993
	p-Cymene (p-Isopropyltoluene)	µg/L	<0.120	<0.120	<0.120	<0.120	<0.120
	sec-Butylbenzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125
	Styrene	µg/L	<0.118 R	<0.118	<0.118	<0.118	<0.118
	tert-Butyl Methyl Ether (MTBE)	µg/L	<0.101	<0.101	<0.101	<0.101	<0.101
	tert-Butylbenzene	µg/L	<0.127	<0.127	<0.127	<0.127	<0.127
	Tetrachloroethene (PCE)	µg/L	<0.300	0.321 J	<0.300	<0.300	<0.300
	Toluene	µg/L	<0.278	<0.278	<0.278	<0.278	<0.278
	trans-1,2-Dichloroethene	µg/L	<0.149	<0.149	<0.149	<0.149	<0.149
	trans-1,3-Dichloropropene	µg/L	<0.118	<0.118	<0.118	<0.118	<0.118
	Trichloroethene (TCE)	µg/L	0.373 J	0.491 J	0.516 J	0.217 J	0.513 J
	Trichlorofluoromethane	µg/L	<0.160	<0.160	<0.160	<0.160	<0.160
	Vinyl Chloride	µg/L	<0.234	<0.234	<0.234	<0.234	<0.234
	Xylenes, Total	µg/L	<0.174	<0.174	<0.174	<0.174	<0.174
	Field Tests	Conductivity	mS/cm	20.541	11.610	---	11.514
Dissolved Oxygen		mg/L	1.78	2.84	---	3.44	2.05
Oxidation-Reduction Potential		mV	176.4	173.8	---	188.9	182.9
pH		SU	7.47	7.38	---	8.04	7.33
Temperature		C	23.7	23.2	---	20.5	23.6
	Turbidity	NTU	19.2	9.0	---	9.8	71.2

Notes:

- not tested
- µg/L micrograms per liter
- mg/L milligrams per liter
- mS/cm milliSiemens per cmper centimeter
- mV millivolts
- SU standard units
- mL/min milliliter per minute
- C degrees Celsius
- NTU nephelometric turbidity units
- J- The result is an estimated quantity, but the result may be biased low.
- J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The result is an estimated quantity, but the result may be biased high.
- < The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
- R The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.