

## **Dynamic Field Activity vs. Staged Investigation Costs For A Remedial Investigation Of MCAS Tustin: IRP-12**

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### **Explanation and Analysis of Tables**

The following tables provide an estimate of how much time and money were necessary to conduct a remedial investigation at IRP-12 with a dynamic approach, and how much time and money would have been necessary had the work been completed with a staged approach. This appendix provides documentation that dynamic field activities saved money and time at IRP-12, and to demonstrate for the reader where the savings for this type of project are likely to be found. The tables for the dynamic field activity were created from actual site data, while the tables for the staged approach were developed based on a series of likely scenarios that would have been proposed by a reasonable contractor according to the information they would have had (see discussion in the staged investigation section). Because the findings are grounded in logic, they can be used to illustrate the following key issues in comparing the two approaches:

- The calculations indicate that the dynamic approach would take approximately one-third the time (10 months versus 2 years) and cost 15 percent less (\$496,000 versus \$587,000) than the staged approach. Even if the cost of the staged approach is being over-estimated, the time difference alone favors the use of dynamic field activity. In addition, the four phases of the staged approach is the minimum because of the site's complexity.
- The administrative cost to the Agency in managing the staged investigation is substantially more because each document review requires a minimum of four weeks. Since the staged investigation creates four sets of work plans and reports, Agency personnel would spend about four times as long overseeing the staged investigation.
- The overall amount of time invested in field activities for the two approaches is not significantly different when compared with the time to finish the reports. The dynamic approach required six weeks of field work and the staged approach, as it is described here, required nine weeks. Even if the staged approach required the same amount of time in the field, the overall difference in time would have remained essentially the same.
- Even through there were communication errors in the dynamic approach, resulting in additional off-site analytical costs of over \$10,000, the total analytical costs for the dynamic approach were 40 percent lower than staged (also note that the staged investigation assumed no investigation "errors" that would have resulted in extra expenses).

## Summary of Actual Dynamic Field Activity Costs

Category		Cost	Time (weeks)
Work Plan Development		\$ 64,920.00	14
Field Activities	On-site Analysis	\$ 40,140.00	6
	Off-site Analysis	\$ 107,920.00	
	Sampling Equipment Costs	\$ 93,800.00	
	Prime Contractor's Field Support	\$ 60,620.00	
	Miscellaneous Field Costs	\$ 20,000.00	
Report Writing		\$ 109,200.00	24
<b>Grand Total</b>		<b>\$ 496,600.00</b>	<b>44</b>

## Remedial Investigation Work Plan Development

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team Leader	120	\$ 85.00	\$ 10,200.00
Project Hydrogeologist	200	\$ 70.00	\$ 14,000.00
Chemist	120	\$ 70.00	\$ 8,400.00
Community Relations	40	\$ 55.00	\$ 2,200.00
Risk Assessor	40	\$ 70.00	\$ 2,800.00
Data Manager	40	\$ 60.00	\$ 2,400.00
Statistician	24	\$ 60.00	\$ 1,440.00
Editor	40	\$ 50.00	\$ 2,000.00
Graphics / Word Processing	120	\$ 45.00	\$ 5,400.00
Health and Safety	40	\$ 55.00	\$ 2,200.00
Project Management	20	\$ 105.00	\$ 2,100.00
<i>Work plan writing would require 5 weeks</i>		<b>Initial Total</b>	<b>\$ 53,140.00</b>
<i>EPA would generally need 4 weeks for review</i>			
<b>Response to Comments:</b>			
Team Leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	24	\$ 70.00	\$ 1,680.00
Chemist	8	\$ 70.00	\$ 560.00
Word Processing	16	\$ 25.00	\$ 400.00
<b>Response to Comments Total</b>			<b>\$ 6,040.00</b>
<b>Printing Production</b>			<b>\$ 1,500.00</b>
<b>Contracting:</b>			
Contracts Specialist	24	\$ 50.00	\$ 1,200.00
Team Leader	16	\$ 85.00	\$ 1,360.00
Chemist	24	\$ 70.00	\$ 1,680.00
<b>Contracting Total</b>			<b>\$ 4,240.00</b>
<i>Contractor would require 1 week for revisions</i>		<b>Grand Total</b>	<b>\$ 64,920.00</b>
<i>EPA would likely require 4 weeks for approval</i>			

## Field Activity Cost Tables

### On-site Analysis

Item	# of Days	Cost per Day	Total
2 Chemists @ \$55/hr	22	\$ 1,100.00	\$ 24,200.00
Mobilization			\$ 1,200.00
Lab rental			\$ 2,900.00
Lab Hook Up			\$ 750.00
Consumables	22	25	\$ 550.00
GC rental (2)	22	370	\$ 8,140.00
Oil Analyzer Rental	22	100	\$ 2,200.00
Refrigerators (4)			\$ 200.00
<b>Grand Total</b>			<b>\$ 40,140.00</b>

### Off-site Analytical Costs

Soil Analysis				
Item	# of Samples	# of QC Samples	Cost per sample	Total
VOCs	56	4	\$ 270.00	\$ 16,200.00
PAHs	63	5	\$ 225.00	\$ 15,300.00
Metals ICP	65	5	\$ 200.00	\$ 14,000.00
Metals AA	65	5	\$ 35.00	\$ 2,450.00
Inorganics	18	1	\$ 30.00	\$ 570.00
pH	59		\$ 10.00	\$ 590.00
PCBs	56	5	\$ 250.00	\$ 15,250.00
Total Organic Carbon	2		\$ 55.00	\$ 110.00
Cation Exchange Capacity	2		\$ 15.00	\$ 30.00
<b>Soil Analysis Total</b>				<b>\$ 64,500.00</b>
Water Analysis				
VOCs	85	12	\$ 270.00	\$ 26,190.00
Metals ICP	56	5	\$ 160.00	\$ 9,760.00
Metals AA	56	5	\$ 25.00	\$ 1,525.00
Inorganics	30	3	\$ 15.00	\$ 495.00
PCBs/Pesticides	15	3	\$ 225.00	\$ 4,050.00
<b>Water Analysis Total</b>				<b>\$ 42,020.00</b>
Shipping Cooler Samples	20		\$ 70.00	\$ 1,400.00
<b>Off-site Analytical Cost Grand Total</b>				<b>\$ 107,920.00</b>

### Sampling Equipment Costs – Dual Tube DP Rig

Item	Depth (feet)	# of Holes	Rate (foot) <sup>1</sup>	Total
Soil and Groundwater Sampling	12	29	\$15	\$ 5,220.00
	16	1		\$ 240.00
	18	5		\$ 1,350.00
	19	1		\$ 285.00
	20	4		\$ 1,200.00
	21	34		\$ 10,710.00
	24	6		\$ 2,160.00
	25	2		\$ 750.00
	30	1		\$ 450.00
Grouting Holes				\$ 1,000.00
Mobilization				\$ 300.00
<b>Grand Total</b>				<b>\$ 23,665.00</b>

### Prime Contractor Technical Support: Initial Soil Sampling and Dual Tube DP Rig Sampling

Hand Augering of Initial Sampling Locations			
Personnel	Hours	Rate (hour)	Total
Geologist	144	\$ 50.00	\$ 7,200.00
Technician	144	\$ 25.00	\$ 3,600.00
<b>Total</b>			<b>\$ 10,800.00</b>
Oversight of DP Rig			
Geologist	200	\$ 50.00	\$ 10,000.00
Technician	160	\$ 25.00	\$ 4,000.00
<b>Total</b>			<b>\$ 14,000.00</b>
<b>Grand Total</b>			<b>\$ 24,800.00</b>

<sup>1</sup> Estimated rate based on a cost of \$1800.00/day.

## Equipment Usage Costs for "Drive Point Sampler" Groundwater Sampling

Item	Depth (feet)	# of Holes	Rate	Total
Probing	21	20	\$18 / foot	\$ 7,560.00
	30	1		\$ 540.00
Setup		21	\$95 / move	\$ 1,995.00
Grouting Holes				\$ 500.00
	Hours / samples	Number	Rate (hour)	
Low-Flow Sampling	2	21	\$ 175.00	\$ 7,350.00
<b>Grand Total</b>				<b>\$ 17,945.00</b>

### Prime Contractor Technical Support: "Drive Point Sampler"

Personnel	Hours	Rate	Total
Geologist	56	\$ 50.00	\$ 2,800.00
Technician	56	\$ 25.00	\$ 1,400.00
<b>Total</b>			<b>\$ 4,200.00</b>

### Sampling Equipment Costs: Hollow Stem Auger

Item	Feet	Rate	Total	
Casing	451	\$ 21.00	\$ 9,471.00	
Screen	90	\$ 26.00	\$ 2,340.00	
	Holes	Rate		
Setup	18	\$95.00/move	\$ 1,710.00	
Mobilization			\$ 1,100.00	
<b>Total</b>			<b>\$ 14,621.00</b>	
Additional Activities				
	Amount	Hours	Rate	Total
Development	18 wells	4	\$175.00 / hour	\$ 12,600.00
Sampling		2		\$ 6,300.00
Wellhead Completion	18		\$150.00 / well	\$ 2,700.00
Slug Tests	18		\$90.00 / well	\$ 1,620.00
IDW	7 cubic yds		\$40.00 / cubic yd	\$ 280.00
<b>Total</b>			<b>\$ 23,500.00</b>	
<b>Grand Total</b>			<b>\$ 38,121.00</b>	

**Prime Contractor Technical Support: Hollow Stem Auger**

<b>Personnel</b>	<b>Hours</b>	<b>Rate</b>	<b>Total</b>
Geologist	80	\$ 50.00	\$ 4,000.00
Technician	80	\$ 25.00	\$ 2,000.00
<b>Total</b>			<b>\$ 6,000.00</b>

**Sampling Equipment Costs – Dual Tube Air Percussion**

<b>Item</b>	<b>Number</b>	<b>Rate</b>	<b>Total</b>
Feet	423	\$ 18.00	\$ 7,614.00
Water Samples	14	\$ 70.00	\$ 980.00
Setup	5	\$ 295.00	\$ 1,475.00
Mobilization			\$ 1,500.00
Grouting Holes			\$ 2,500.00
<b>Grand Total</b>			<b>\$ 14,069.00</b>

**Prime Contractor Technical Support: Dual Tube Air Percussion**

<b>Personnel</b>	<b>Hours</b>	<b>Rate</b>	<b>Total</b>
Geologist	40	\$ 50.00	\$ 2,000.00
Technician	40	\$ 25.00	\$ 1,000.00
<b>Total</b>			<b>\$3,000.00</b>

**Miscellaneous Field Costs**

<b>Item</b>	<b>Cost</b>
Geophysical Survey	\$ 12,000.00
Surveyor	\$ 5,000.00
Misc. Field Supplies	\$ 3,000.00
<b>Total</b>	<b>\$ 20,000.00</b>

### Cost of Prime Contractor Field Support

Personnel		Hours	Rate	Total
Team Leader		160	\$ 85.00	\$ 13,600.00
Project Hydrogeologist		40	\$ 70.00	\$ 2,800.00
Data Manager		40	\$ 45.00	\$ 1,800.00
Risk Assessor		16	\$ 70.00	\$ 1,120.00
Community Relations		40	\$ 55.00	\$ 2,200.00
Geophysicist		20	\$ 55.00	\$ 1,100.00
Technical Support:	Dual Tube DP Rig			\$ 24,800.00
	Drive Point Sampler			\$ 4,200.00
	Hollow Stem Auger			\$ 6,000.00
	Dual Tube Air Percussion			\$ 3,000.00
<b>Grand Total</b>				<b>\$ 60,620.00</b>

## Remedial Investigation Report Writing

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team Leader	320	\$ 85.00	\$ 27,200.00
Project Hydrogeologist	240	\$ 70.00	\$ 16,800.00
Geologist	80	\$ 55.00	\$ 4,400.00
Chemist/ Data Validation and PARRC	120	\$ 70.00	\$ 8,400.00
Risk Assessor	120	\$ 70.00	\$ 8,400.00
Data Manager	80	\$ 60.00	\$ 4,800.00
Statistician	24	\$ 60.00	\$ 1,440.00
Editor	40	\$ 50.00	\$ 2,000.00
Modeler	80	\$ 70.00	\$ 5,600.00
Graphics/Word Processing	160	\$ 45.00	\$ 7,200.00
Project Management	24	\$ 105.00	\$ 2,520.00
<i>Report writing would require 12 weeks</i>		<b>Initial Total</b>	<b>\$ 88,760.00</b>
<i>EPA would generally need 8 weeks to review and comment</i>			
<b>Response to Comments:</b>			
Team Leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	40	\$ 70.00	\$ 2,800.00
Geologist	16	\$ 55.00	\$ 880.00
Chemist	16	\$ 70.00	\$ 1,120.00
Risk Assessor	16	\$ 70.00	\$ 1,120.00
Data Manager	10	\$ 60.00	\$ 600.00
Statistician	8	\$ 60.00	\$ 480.00
Editor	24	\$ 50.00	\$ 1,200.00
Modeler	20	\$ 70.00	\$ 1,400.00
Graphics/Word Processing	40	\$ 45.00	\$ 1,800.00
Project Management	8	\$ 105.00	\$ 840.00
<b>Response to Comments Total</b>			<b>\$ 15,640.00</b>
<b>Miscellaneous Project Costs:</b>			
Contracts	40	\$ 35.00	\$ 1,400.00
Accounting	40	\$ 35.00	\$ 1,400.00
Publishing RI			\$ 2,000.00
<b>Miscellaneous Total</b>			<b>\$ 4,800.00</b>
<i>Contractor would require 2 weeks to make revisions</i>		<b>Grand Total</b>	<b>\$ 109,200.00</b>
<i>EPA approval would likely take 2 weeks</i>			

## Summary for Staged Approach

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### Phase I

Wells: Three 2-inch monitoring wells located in an approximately triangular shape to determine gradient. One is placed where the ESI found TCE in the ground water, one is placed in the far northeast corner of the site for background purposes, and one is placed about 75 feet south of a point about the middle of Building 20B, which would be down gradient of the storage area at building 20B and the storage area east of Building 90 (Exhibit 1).

Borings: Three for *in situ* water sampling. One is located nominally down gradient of the well placed in the TCE plume and one is located nominally up gradient to get an idea of the extent of the plume. One other boring is located in the highest ESI TRPH area.

Shallow soil sampling: A combination of 50 foot center samples with, 4 samples on each side of four SWMUs located on site and several 100 foot center samples in areas not believed to be contaminated for a total of 36.

Results: Well in TCE area has TCE in groundwater background and down-gradient wells are clean. Groundwater in the up- and down-gradient borings has TCE. The third boring does not have any fuels/oils at depth but does contain low 6  $\mu\text{g/L}$  TCE. For the most part, shallow soil samples in the area north of building 90 and the SWMUs are clean or have low levels of TRPH. The shallow soil samples between Building 90 and Building 533 show some TCE contamination but not enough to account for the levels in the groundwater. The samples to the east and south of Building 20B are also clean with the exception of a small hit (11  $\mu\text{g/kg}$ ) of TCE to the south of Building 20B.

### Phase II

Given the results of Phase I (Exhibit 2), there are several more places that one could place wells/borings for groundwater sampling; however, investigators decide that this can wait for a subsequent phase while an attempt is made to gather more information on the source of the TCE. So the Phase II investigation is for shallow soils only. A 20 foot centered grid is placed in the area east of Building 533 (which is out of the original area designated for investigation) and 12 soil samples are taken. The 11  $\mu\text{g/kg}$  of TCE south of Building 20B is considerably below the PRG for soil (7 mg/kg) and within the range of laboratory error. However, as a precaution that it is not on the very edge of an unknown source area (this is not one of the three storage areas thought responsible for any contamination) it is decided to place six samples around it to be sure. (This level of contamination could very easily have been ignored; if additional sampling was not done in this area, the source and the plume associated with it by Building 20B would not have been found.)

Results: The grid to the east of Building 533 seems to bound the TCE source with several large hits surrounded by NDs. The grid to east of building 20 uncovers a major source area of TCE (Exhibit 3).

### **Phase III**

Following the results of Phase II, eight wells are planned for Phase III: three will be placed in up and down gradient positions of the Building 90 plume to help delineate it; one will be placed in the contaminated area at Building 20B with an upgradient and downgradient well placed to help delineate the plume and two will be placed perpendicular to the plume to help define lateral extent. Shallow soil samples also will be taken around the eastern part of Building 20B to further delineate the TCE source areas (Exhibit 4).

Results: The well placed down gradient of the Building 90 plume is clean, hence the horizontal down-gradient extent of contamination is defined. However, the well placed outside the soil NDs up gradient of the plume still has TCE, and soil samples taken during drilling show no TCE in the vadose zone. All three of the wells placed at the Building 20B plume show groundwater contamination with the nominal up-gradient well being placed in another, at the time, unknown source area. The shallow soil sampling bounds the TCE shallow contamination source areas. The two wells place perpendicular to the ground water flow direction are clean so the width of the plume has been bounded for those areas.

### **Phase IV**

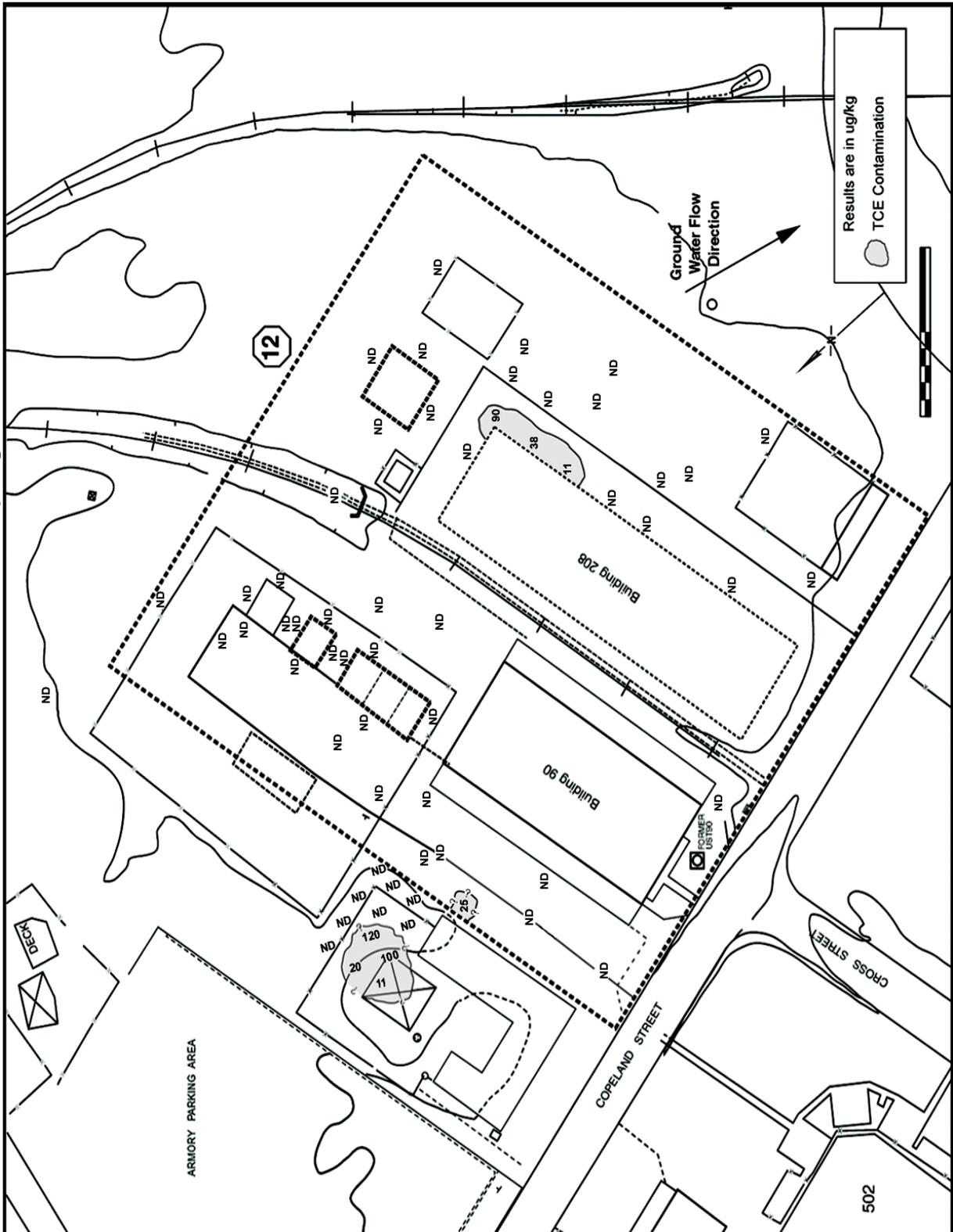
Phase IV is devoted to horizontal and vertical extent of the plume at Building 20B and vertical extent at Building 90. To do this requires one-day turnaround from the laboratory. The plan for the shallow sampling locations is to bore them as wells, place the screen and casing, but only set the sand pack. When the samples results come back, the decision will be made whether to complete the well or abandon it. The number of wells to be placed is not known as the extent of the plume is not known. It requires 15 monitoring points to delineate the horizontal extent and of these 4 are abandoned. Five deep borings are planned with grab samples being taken of the water in each permeable zone encountered to 80 feet. To prevent cross contamination, the wells will have driven casing as they are bored. When the results come back from the laboratory it will be decided whether to complete them as wells and which zone to screen in. The result is to abandon two borings as no deep contamination was found and to complete three wells in the 40-50 foot permeable zone where TCE was found in two of them. As the casing is withdrawn from these borings, they will be pressure-grouted to about 50 feet and then completed as wells (Exhibit 5).

Note that review times for EPA have been assumed to be four weeks for large documents and two for smaller ones. If the Agency's normal two-month review time is used, the time required to complete the work would be longer. Also note that the soil and plume characterization for this approach is not as complete as that for the dynamic approach with fewer soil and groundwater samples being taken.



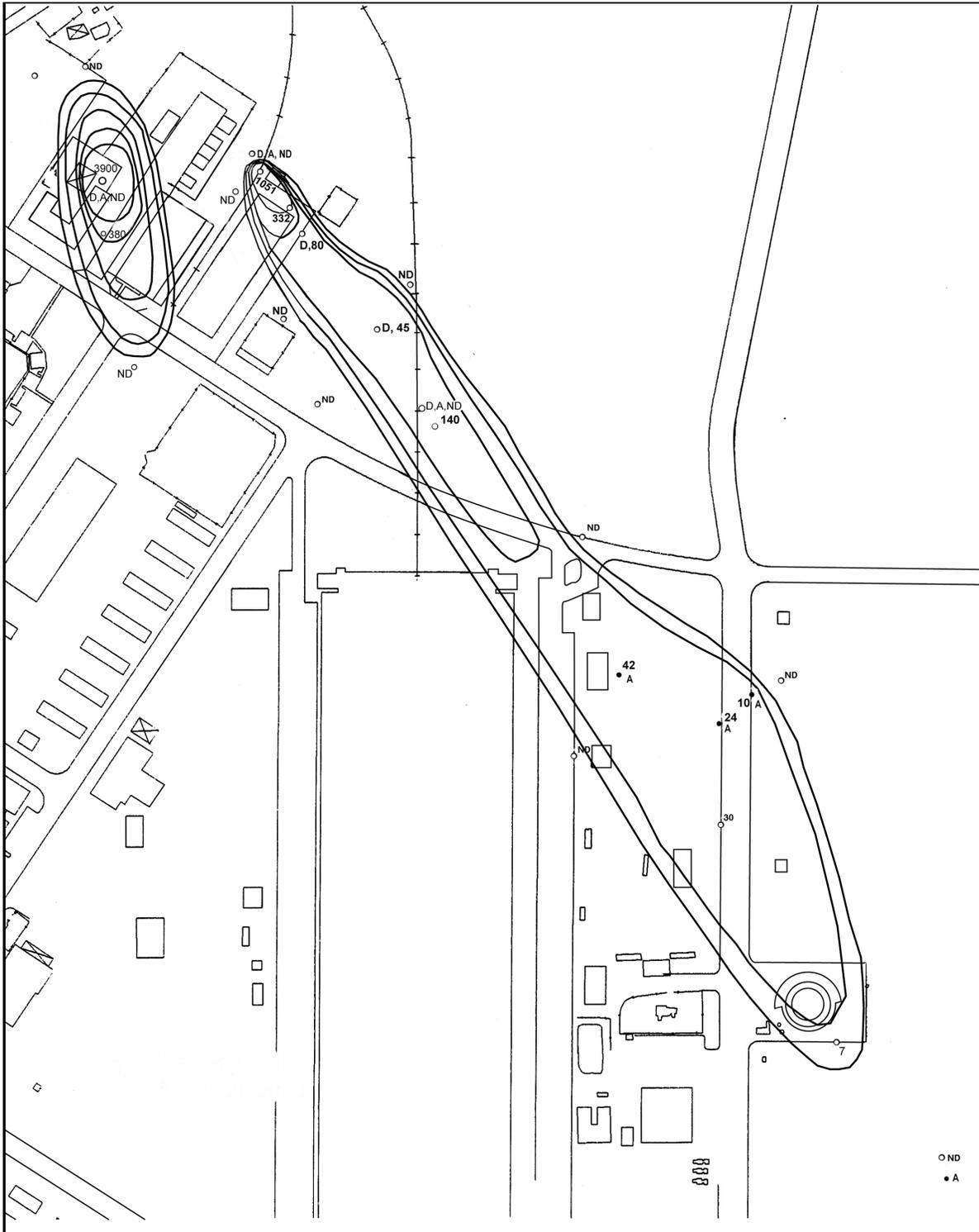


**Exhibit 3**  
**Results of Phase II Sampling**





# Exhibit 5 Phase IV Final TCE Plume Delineation



## Estimated Staged Investigation Costs For IRP-12

### Summary Table of Estimated Project Costs

Phases	Activities	Cost	Time (weeks)
I. Conduct Statistical Sampling and Install Preliminary Monitoring Wells	Work Plan Development	\$ 63,740.00	14
	Sampling Equipment Costs	\$ 9,211.00	1
	Prime Contractor's Field Support	\$ 8,760.00	
	Off-site Analysis	\$ 64,955.00	4-6
	Report Writing	\$ 41,430.00	13
<b>Phase I Totals</b>		<b>\$ 188,096.00</b>	<b>32-34</b>
II. Follow-up Sampling to Confirm and Delineate Identified Source Areas	Work Plan Development	\$ 8,045.00	7
	Prime Contractor's Field Support	\$ 1,350.00	1
	Off-site Analysis	\$ 21,100.00	4-6
	Report Writing	\$ 16,580.00	8
<b>Phase II Totals</b>		<b>\$ 47,075.00</b>	<b>20-22</b>
III. Begin Delineation of Groundwater Plumes with Further Source Investigation	Work Plan Development	\$ 16,130.00	7
	Sampling Equipment Costs	\$ 17,090.00	2
	Prime Contractor's Field Support	\$ 8,410.00	
	Off-site Analysis	\$ 37,000.00	4-6
	Report Writing	\$ 22,460.00	8
<b>Phase III Totals</b>		<b>\$ 101,090.00</b>	<b>21-23</b>
IV. Finalize Plume Delineation	Work Plan Development	\$ 17,380.00	7
	Sampling Equipment Costs	\$ 55,987.00	5
	Prime Contractor's Field Support	\$ 25,790.00	
	Off-site Analysis	\$ 57,230.00	4-6
	Final Report Writing	\$ 94,840.00	21
<b>Phase IV Totals</b>		<b>\$ 251,227.00</b>	<b>37-39</b>

## Phase I: Conduct Statistical Sampling and Install Preliminary Monitoring Wells

### Work Plan Development

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team leader	120	\$ 85.00	\$ 10,200.00
Project Hydrogeologist	160	\$ 70.00	\$ 11,200.00
Chemist	120	\$ 70.00	\$ 8,400.00
Community Relations	40	\$ 55.00	\$ 2,200.00
Risk Assessor	40	\$ 70.00	\$ 2,800.00
Data Manager	40	\$ 60.00	\$ 2,400.00
Statistician	24	\$ 60.00	\$ 1,440.00
Editor	40	\$ 50.00	\$ 2,000.00
Graphics/word processing	120	\$ 45.00	\$ 5,400.00
Health and Safety	40	\$ 55.00	\$ 2,200.00
Project Management	20	\$ 105.00	\$ 2,100.00
<i>Work plan writing would require 5 weeks</i>		<b>Initial Total</b>	<b>\$ 50,340.00</b>
<i>EPA would generally need 4 weeks to review and provide comments</i>			
<b>Response to Comments:</b>			
Team leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	40	\$ 70.00	\$ 2,800.00
Chemist	20	\$ 70.00	\$ 1,400.00
<b>Response to Comments Total</b>			<b>\$ 7,600.00</b>
<b>Contracting:</b>			
Contract Specialist	80	\$ 50.00	<b>\$ 4000.00</b>
Accounting	40	\$ 45.00	<b>\$1800.00</b>
<i>Contractor would require 1 week to make revisions</i>		<b>Grand Total</b>	<b>\$ 63,740.00</b>
<i>EPA approval would take 4 weeks</i>			

### Sampling Equipment Costs: Hollow Stem Auger

Item	Feet	Rate	Total	
Open Hole	63	\$ 18.00	\$ 1,134.00	
Casing	48	\$ 21.00	\$ 1,008.00	
Screen	15	\$ 26.00	\$ 390.00	
	Holes	Rate		
Set up	6	\$ 95.00	\$ 570.00	
Mobilization			\$ 1,100.00	
<b>Total</b>			<b>\$ 4,202.00</b>	
Additional Activities				
	Amount	Hours	Rate	Total
Development	3 wells	4	\$ 175.00	\$ 2,100.00
Sampling		2		\$ 1,050.00
Bailer open hole	3		\$ 15.00	\$ 45.00
Wellhead Completion	3		\$ 150.00	\$ 450.00
Slug Tests	3		\$ 90.00	\$ 270.00
Grouting	63		\$ 8.00	\$ 504.00
Soil Sample	18		\$ 15.00	\$ 270.00
Investigation Derived Waste	8 cubic yds		\$ 40.00	\$ 320.00
<b>Total</b>			<b>\$ 5,009.00</b>	
<b>Grand Total</b>			<b>\$ 9,211.00</b>	

## Prime Contractor Support

Personnel	Holes	Hours	Rate	Total
<b>Hand Augering</b>				
<i><b>Shallow Soil Sampling</b></i> (sampling @ 1-2 feet)				
Geologist	36	1	\$ 50.00	\$ 1,800.00
Technician	36	1	\$ 25.00	\$ 900.00
<i><b>Utility Clearance</b></i> (augering to 5 feet)				
Geologist	6	2	\$ 50.00	\$ 600.00
Technician	6	2	\$ 25.00	\$ 300.00
<b>Total</b>				<b>\$ 5,400.00</b>
<b>Hollow Stem Auger Oversight</b>				
Geologist	6	4	\$ 50.00	\$ 1,200.00
Technician	6	4	\$ 25.00	\$ 600.00
<b>Total</b>				<b>\$ 1,800.00</b>
<b>Home Office Support</b>				
Team Leader		8	\$ 85.00	\$ 680.00
Community Relations		16	\$ 55.00	\$ 880.00
<b>Total</b>				<b>\$ 1,560.00</b>
<i>Field activities would require one week</i>			<b>Grand Total</b>	<b>\$ 8,760.00</b>

## Off-Site Analysis

<b>Soil Analysis</b>				
Item	# of Samples	# of QC Samples	Cost	Total
VOCs	60	6	\$ 270.00	\$ 17,820.00
PAHs	42	4	\$ 225.00	\$ 10,350.00
Metals 6010	60	4	\$ 200.00	\$ 12,800.00
Metals other	60	4	\$ 35.00	\$ 2,240.00
Inorganics	60	4	\$ 30.00	\$ 1,920.00
pH	20		\$ 10.00	\$ 200.00
TRPH	60	4	\$ 50.00	\$ 3,200.00
Pesticides	42	4	\$ 250.00	\$ 11,500.00
Total Organic Carbon	2		\$ 55.00	\$ 110.00
Cation Exchange Capacity	2		25.00	\$ 50.00
			<b>Total</b>	<b>\$ 60,190.00</b>
<b>Water Analysis</b>				
VOCs	6	3	\$ 270.00	\$ 2,430.00
Metals 6010	3	2	\$ 160.00	\$ 800.00
Metals other	3	2	\$ 25.00	\$ 125.00
Inorganics	3	2	\$ 15.00	\$ 75.00
Pesticides	3	2	\$ 225.00	\$ 1,125.00
			<b>Total</b>	<b>\$ 4,555.00</b>
Shipping Sample coolers	3		\$ 70.00	\$210.00
<i>Delivery of data requires 4-6 weeks</i>			<b>Grand Total</b>	<b>\$ 64,955.00</b>

## Report Writing

Personnel	Hours	Rate	Total
<b><i>Initial Draft:</i></b>			
Team leader	120	\$ 85.00	\$ 10,200.00
Project Hydrogeologist	32	\$ 70.00	\$ 2,240.00
Geologist	60	\$ 55.00	\$ 3,300.00
Chemist (data validation)	80	\$ 70.00	\$ 5,600.00
Risk Assessor	8	\$ 70.00	\$ 560.00
Data Manager	8	\$ 60.00	\$ 480.00
Statistician	0	\$ 60.00	\$ 0.00
Editor	24	\$ 50.00	\$ 1,200.00
Modeler	80	\$ 70.00	\$ 5,600.00
Graphics/word processing	80	\$ 45.00	\$ 3,600.00
Project Management	10	\$ 105.00	\$ 1,050.00
<i>Report writing would require 4 weeks</i>		<b>Initial Total</b>	<b>\$ 33,830.00</b>
<i>EPA would generally need 4 weeks to review and provide comments</i>			
<b><i>Response to Comments:</i></b>			
Team leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	40	\$ 70.00	\$ 2,800.00
Chemist	20	\$ 70.00	\$ 1,400.00
<b>Response to Comments Total</b>			<b>\$ 7,600.00</b>
<i>Contractor would require 1 week to make revisions</i>		<b>Grand Total</b>	<b>\$ 41,430.00</b>
<i>EPA would need 4 weeks for approval</i>			

## Phase II: Follow-up Sampling to Confirm and Delineate Identified Source Areas

### Work Plan Development

Personnel	Hours	Rate	Total
<b><i>Initial Draft:</i></b>			
Team leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	8	\$ 70.00	\$ 560.00
Chemist	8	\$ 70.00	\$ 560.00
Community Relations	0	\$ 55.00	\$ 0.00
Risk Assessor	0	\$ 70.00	\$ 0.00
Data Manager	0	\$ 60.00	\$ 0.00
Statistician	0	\$ 60.00	\$ 0.00
Editor	0	\$ 50.00	\$ 0.00
Graphics/word processing	16	\$ 45.00	\$ 720.00
Health and Safety	0	\$ 55.00	\$ 0.00
Project Management	4	\$ 105.00	\$ 420.00
<i>Work plan writing would require 2 weeks</i>		<b>Initial Total</b>	<b>\$ 5,660.00</b>
<i>EPA would generally need 2 weeks to review and provide comments</i>			
<b><i>Response to Comments:</i></b>			
Team leader	16	\$ 85.00	\$ 1,360.00
Project Hydrogeologist	4	\$ 70.00	\$ 280.00
Chemist	4	\$ 70.00	\$ 280.00
Graphics/ word processing	8	\$ 45.00	\$ 360.00
Project Management	1	\$ 105.00	\$ 105.00
<b>Response to Comments Total</b>			<b>\$ 2,385.00</b>
<i>Contractor would require 1 week to make revisions</i>		<b>Grand Total</b>	<b>\$ 8,045.00</b>
<i>EPA would need 2 weeks for approval</i>			

**Prime Contractor Support: Hand Augering Soil Samples (1-2 feet)**

<b>Personnel</b>	<b>Holes</b>	<b>Hours</b>	<b>Rate</b>	<b>Total</b>
Geologist	18	1	\$ 50.00	\$ 900.00
Technician	18	1	\$ 25.00	\$ 450.00
<i>Field activities would require 1 week</i>			<b>Total</b>	<b>\$1,350.00</b>

**Off-Site Analysis (Soil)**

<b>Item</b>	<b># of Samples</b>	<b># of QC Samples</b>	<b>Cost</b>	<b>Total</b>
VOCs	18	3	\$ 270.00	\$ 5,670.00
PAHs	18	2	\$ 225.00	\$ 4,500.00
Metals 6010	18	2	\$ 200.00	\$ 4,000.00
Metals other	18	2	\$ 35.00	\$ 700.00
pH	9		\$ 10.00	\$ 90.00
TRPH	18	2	\$ 50.00	\$ 1,000.00
Pesticides/PCBs	18	2	\$ 250.00	\$ 5,000.00
			<b>Total</b>	<b>\$ 20,960.00</b>
Shipping Sample coolers	2		\$ 70.00	\$ 140.00
<i>Delivery of data requires 4-6 weeks</i>			<b>Grand Total</b>	<b>\$ 21,100.00</b>

## Report Writing

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team Leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	24	\$ 70.00	\$ 1,680.00
Geologist	0	\$ 55.00	\$ 0.00
Chemist (data validation)	40	\$ 70.00	\$ 2,800.00
Risk Assessor	8	\$ 70.00	\$ 560.00
Data Manager	8	\$ 60.00	\$ 480.00
Statistician	0	\$ 60.00	\$ 0.00
Editor	16	\$ 50.00	\$ 800.00
Modeler	16	\$ 70.00	\$ 1,120.00
Graphics/word processing	24	\$ 45.00	\$ 1,080.00
Project Management	10	\$ 105.00	\$ 1,050.00
<i>Report writing would require 3 weeks</i>		<b>Initial Total</b>	<b>\$ 12,970.00</b>
<i>EPA would generally need 2 weeks to review and provide comments</i>			
<b>Response to Comments:</b>			
Team Leader	16	\$ 85.00	\$ 1,360.00
Project Hydrogeologist	16	\$ 70.00	\$ 1,120.00
Chemist	8	\$ 70.00	\$ 560.00
Graphics/word processing	8	\$ 45.00	\$ 360.00
Project Management	2	\$ 105.00	\$ 210.00
		<b>Response to Comments Total</b>	<b>\$ 3,610.00</b>
<i>Contractor would require 1 week to make revisions</i>		<b>Grand Total</b>	<b>\$ 16,580.00</b>
<i>EPA would need 2 weeks for approval</i>			

**Phase III: Begin Delineation of Groundwater Plumes with Further Source Investigation**

**Work Plan Development**

Personnel	Hours	Rate	Total
<b><i>Initial Draft:</i></b>			
Team leader	80	\$ 85.00	\$ 6,800.00
Project Hydrogeologist	40	\$ 70.00	\$ 2,800.00
Chemist	8	\$ 70.00	\$ 560.00
Community Relations	0	\$ 55.00	\$ 0.00
Risk Assessor	0	\$ 70.00	\$ 0.00
Data Manager	0	\$ 60.00	\$ 0.00
Statistician	0	\$ 60.00	\$ 0.00
Editor	16	\$ 50.00	\$ 800.00
Graphics/word processing	24	\$ 45.00	\$ 1,080.00
Health and Safety	0	\$ 55.00	\$ 0.00
Project Management	10	\$ 105.00	\$ 1,050.00
<i>Work plan writing would require 2 weeks</i>		<b>Initial Total</b>	<b>\$ 13,090.00</b>
<i>EPA would generally need 2 weeks to review and comment</i>			
<b><i>Response to Comments:</i></b>			
Team leader	16	\$ 85.00	\$ 1,360.00
Project Hydrogeologist	16	\$ 70.00	\$ 1,120.00
Chemist	8	\$ 70.00	\$ 560.00
		<b>Response to Comments Total</b>	<b>\$ 3,040.00</b>
<i>Contractor would require 1 week to make revisions</i>		<b>Grand Total</b>	<b>\$ 16,130.00</b>
<i>EPA would need 2 weeks for approval</i>			

## Sampling Equipment Costs: Hollow Stem Auger

Item	Feet	Rate	Total	
Casing 2-in	80	\$ 21.00	\$ 1,680.00	
Casing 4-in	48	\$ 26.00	\$ 1,248.00	
Screen 2-in	25	\$ 26.00	\$ 650.00	
Screen 4-in	15	\$ 28.00	\$ 420.00	
	<b>Holes</b>	<b>Rate</b>		
Set up	8	\$ 95.00	\$ 760.00	
Mobilization			\$ 1,100.00	
<b>Total</b>			<b>\$ 5,858.00</b>	
<b>Additional Activities</b>				
	<b>Amount</b>	<b>Hours</b>	<b>Rate</b>	<b>Total</b>
Development	8 wells	4	\$ 175.00	\$ 5,600.00
Sampling	8 wells	2		\$ 2,800.00
Wellhead Completion	8		\$ 150.00	\$ 1,200.00
Slug Tests	8		\$ 90.00	\$ 720.00
Grouting	14		\$ 8.00	\$ 112.00
Soil Sample	24		\$ 15.00	\$ 360.00
Investigation Derived Waste	11 cubic yds		\$ 40.00	\$ 440.00
<b>Total</b>				<b>\$ 11,232.00</b>
<b>Grand Total</b>				<b>\$ 17,090.00</b>

## Prime Contractor Support

Personnel	Holes	Hours	Rate	Total
<b>Hand Augering</b>				
<i><b>Shallow Soil Sampling</b></i> (sampling @ 1-2 feet)				
Geologist	14	1	\$ 50.00	\$ 700.00
Technician	14	1	\$ 25.00	\$ 350.00
<i><b>Utility Clearance</b></i> (augering to 5 feet)				
Geologist	8	2	\$ 50.00	\$ 800.00
Technician	8	2	\$ 25.00	\$ 400.00
<b>Total</b>				<b>\$ 2,250.00</b>
<b>Hollow Stem Auger Oversight</b>				
Geologist (Drilling)	8	3	\$ 50.00	\$ 1,200.00
Technician (Drilling)	8	3	\$ 25.00	\$ 600.00
Geologist (Development)	8	4	\$ 50.00	\$ 1,600.00
Geologist (Sampling)	8	2	\$ 50.00	\$ 800.00
Technician (Sampling)	8	2	\$ 25.00	\$ 400.00
<b>Total</b>				<b>\$ 4,600.00</b>
<b>Home Office Support</b>				
Team Leader		8	\$ 85.00	\$ 680.00
Community Relations		16	\$ 55.00	\$ 880.00
<b>Total</b>				<b>\$ 1,560.00</b>
<i>Field activities would require 2 weeks</i>			<b>Grand Total</b>	<b>\$ 8,410.00</b>

## Off-Site Analysis

<b>Soil Analysis</b>				
Item	# of Samples	# of QC Samples	Cost	Total
VOCs	29	6	\$ 270.00	\$ 9,450.00
PAHs	29	2	\$ 225.00	\$ 6,975.00
Metals 6010	29	2	\$ 200.00	\$ 6,200.00
Metals other	29	2	\$ 35.00	\$ 1,085.00
TRPH	29	2	\$ 50.00	\$ 1,550.00
Pesticides	29	2	\$ 250.00	\$ 7,750.00
			<b>Total</b>	<b>\$ 33,010.00</b>
<b>Water Analysis</b>				
VOCs	8	6	\$ 270.00	\$ 3,780.00
			<b>Total</b>	<b>\$ 3,780.00</b>
Shipping Sample coolers	3		\$ 70.00	\$210.00
Delivery of data requires 4-6 weeks			<b>Grand Total</b>	<b>\$ 37,000.00</b>

## Report Writing

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team leader	60	\$ 85.00	\$ 5,100.00
Project Hydrogeologist	20	\$ 70.00	\$ 1,400.00
Geologist	24	\$ 55.00	\$ 1,320.00
Chemist (data validation)	50	\$ 70.00	\$ 3,500.00
Risk Assessor	8	\$ 70.00	\$ 560.00
Data Manager	16	\$ 60.00	\$ 960.00
Statistician	0	\$ 60.00	\$ 0.00
Editor	16	\$ 50.00	\$ 800.00
Modeler	24	\$ 70.00	\$ 1,680.00
Graphics/word processing	40	\$ 45.00	\$ 1,800.00
Project Management	10	\$ 105.00	\$ 1,050.00
<i>Report writing would require 3 weeks</i>			<b>Initial Total \$ 18,170.00</b>
<i>EPA would generally need 2 weeks to review and provide comments</i>			
<b>Response to Comments:</b>			
Team leader	24	\$ 85.00	\$ 2,040.00
Project Hydrogeologist	16	\$ 70.00	\$ 1,120.00
Chemist	8	\$ 70.00	\$ 560.00
Graphics/word processing	8	\$ 45.00	\$ 360.00
Project Management	2	\$ 105.00	\$ 210.00
<b>Response to Comments Total</b>			<b>\$ 4,290.00</b>
<i>Contractor would require 1 week to make revisions</i>			<b>Grand Total \$ 22,460.00</b>
<i>EPA would need 2 weeks for approval</i>			

## Phase IV: Finalize Plume Delineation

### Work Plan Development

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team Leader	60	\$ 85.00	\$ 5,100.00
Project Hydrogeologist	60	\$ 70.00	\$ 4,200.00
Chemist	8	\$ 70.00	\$ 560.00
Community Relations	0	\$ 55.00	\$ 0.00
Risk Assessor	0	\$ 70.00	\$ 0.00
Data Manager	8	\$ 60.00	\$ 480.00
Statistician	0	\$ 60.00	\$ 0.00
Editor	16	\$ 50.00	\$ 800.00
Graphics/word processing	24	\$ 45.00	\$ 1,080.00
Health and Safety	0	\$ 55.00	\$ 0.00
Project Management	8	\$ 105.00	\$ 840.00
<i>Work plan writing would require 2 weeks</i>			
<b>Total</b>			<b>\$ 13,060.00</b>
<i>EPA would generally need 2 weeks to review and provide comments</i>			
<b>Response to Comments:</b>			
Team Leader	16	\$ 85.00	\$ 1,360.00
Project Hydrogeologist	24	\$ 70.00	\$ 1,680.00
Chemist	8	\$ 70.00	\$ 560.00
Graphics and Word processing	16	\$ 45.00	\$ 720.00
<b>Response to Comments Total</b>			<b>\$ 4,320.00</b>
<i>Contractor would require 1 week to make revisions</i>			
<b>Grand Total</b>			<b>\$ 17,380.00</b>
<i>EPA would need 2 weeks for approval</i>			

## Hollow Stem Auger Well Installation and Sampling Equipment

Shallow Well Installation and Sampling Equipment				
Item	Feet	Price per Foot	Total	
Casing 2-in	240	\$ 21.00	\$ 5,040.00	
Screen 2-in	75	\$ 26.00	\$ 1,950.00	
	Holes	Price per setup		
Set up	15	\$ 90.00	\$ 1,350.00	
<b>Sub-total</b>			<b>\$ 8,340.00</b>	
Additional Activities				
	Amount	Hours	Rate	Total
Development	11 wells	4	\$ 175.00	\$ 7,700.00
Sampling (bailer)	15 borings	2	\$ 15.00	\$ 450.00
Wellhead Completion	11		\$ 150.00	\$ 1,650.00
Slug Tests	11		\$ 90.00	\$ 990.00
Grouting	84 feet		\$ 8.00	\$ 672.00
Soil Sample	6		\$ 15.00	\$ 90.00
IDW	12 cubic yds		\$ 40.00	\$ 480.00
<b>Sub-total</b>			<b>\$ 8,387.00</b>	

<b>Deep Well Installation and Sampling Equipment</b>				
<b>Item</b>	<b>Feet</b>	<b>Price per Foot</b>	<b>Total</b>	
Casing 4-in	135	\$ 28.00	\$ 3,780.00	
Screen 4-in	30	\$ 32.00	\$ 960.00	
Open Hole	250	\$ 25.00	\$ 6,250.00	
	<b>Holes</b>	<b>Price per setup</b>		
Set up	10	\$ 95.00	\$ 950.00	
<b>Sub-Total</b>			<b>\$ 11,940.00</b>	
<b>Additional Activities</b>				
	<b>Amount</b>	<b>Hours</b>	<b>Rate</b>	<b>Total</b>
Development	3 wells	4	\$ 175.00	\$ 2,100.00
Sampling (bailer)	13 wells	2	\$ 15.00	\$ 390.00
Wellhead Completion	3 wells		\$ 150.00	\$ 450.00
Slug Tests	3 wells		\$ 90.00	\$ 270.00
Grouting	250 feet		\$ 8.00	\$ 2,000.00
Soil Samples	14		\$ 15.00	\$ 210.00
IDW	20 cubic yds		\$ 40.00	\$ 800.00
<b>Sub-total</b>				<b>\$ 6,220.00</b>
<b>Total</b>				<b>\$ 18,160.00</b>
Mobilization				\$ 1,100.00
<b>Grand Total</b>				<b>\$ 35,987.00</b>

### Miscellaneous Field Costs

<b>Item</b>	<b>Cost</b>
Geophysical Survey	\$ 12,000.00
Surveyor	\$ 5,000.00
Misc. Field Supplies	\$ 3,000.00
<b>Total</b>	<b>\$ 20,000.00</b>

## Prime Contractor Oversight

Personnel	Holes	Hours	Rate	Total
<b>Hand Augering</b>				
<i>Utility Clearance</i>				
Geologist	20	2	\$ 50.00	\$ 2,000.00
Technician	20	2	\$ 25.00	\$ 1,000.00
<b>Total</b>				<b>\$ 3,000.00</b>
<b>Hollow Stem Auger Oversight</b>				
Geologist (Shallow Drilling)	15	4	\$ 50.00	\$ 3,000.00
Technician (Shallow Drilling)	15	4	\$ 25.00	\$ 1,500.00
Geologist (Deep Drilling)	5	12	\$ 50.00	\$ 3,000.00
Technician (Deep Drilling)	5	12	\$ 25.00	\$ 1,500.00
Geologist (Development)	14	4	\$ 50.00	\$ 2,800.00
<b>Total</b>				<b>\$ 11,800.00</b>
Site-wide groundwater sampling	25 wells	2	\$ 175.00	\$ 8,750.00
<b>Home Office Support</b>				
Team Leader		16	\$ 85.00	\$ 1,360.00
Community Relations		16	\$ 55.00	\$ 880.00
<b>Total</b>				<b>\$ 2,240.00</b>
<i>Field activities would require 5 weeks</i>			<b>Grand Total</b>	<b>\$ 25,790.00</b>

## Off-Site Analysis

Item	# of Samples	# of QC Samples	Cost	Total
<b>Soil Analysis</b>				
VOCs	20	4	\$ 270.00	\$ <b>6,480.00</b>
<b>Water Analysis</b>				
Water Overnight	28	21	\$ 540.00	\$ 26,460.00
Cooler Shipment	7		\$ 30.00	\$ 210.00
VOCs	24	9	\$ 270.00	\$ 8,910.00
Metals 6010	24	2	\$ 160.00	\$ 4,160.00
Metals other	24	2	\$ 25.00	\$ 650.00
Inorganics	96	8	\$ 15.00	\$ 1,560.00
SVOCs	24	6	\$ 270.00	\$ 8,100.00
<b>Total</b>				<b>\$ 50,050.00</b>
Shipping Cooler Samples	10		\$ 70.00	\$ <b>700.00</b>
<i>Delivery of data requires 4-6 weeks</i>			<b>Grand Total</b>	<b>\$ 57,230.00</b>

## Final RI Report

Personnel	Hours	Rate	Total
<b>Initial Draft:</b>			
Team Leader	280	\$ 85.00	\$ 23,800.00
Project Hydrogeologist	160	\$ 70.00	\$ 11,200.00
Geologist	80	\$ 55.00	\$ 4,400.00
Chemist	160	\$ 70.00	\$ 11,200.00
Risk Assessor	120	\$ 70.00	\$ 8,400.00
Data Manager	40	\$ 60.00	\$ 2,400.00
Statistician	16	\$ 60.00	\$ 960.00
Editor	40	\$ 50.00	\$ 2,000.00
Modeler	40	\$ 70.00	\$ 2,800.00
Graphics/word processing	60	\$ 45.00	\$ 2,700.00
Project Management	24	\$ 105.00	\$ 2,520.00
<i>Report writing would require 12 weeks</i>		<b>Initial Total</b>	<b>\$ 72,380.00</b>
<i>EPA generally would need 6 weeks to review and comment</i>			
<b>Response to Comments:</b>			
Team leader	40	\$ 85.00	\$ 3,400.00
Project Hydrogeologist	40	\$ 70.00	\$ 2,800.00
Geologist	16	\$ 55.00	\$ 880.00
Chemist	16	\$ 70.00	\$ 1,120.00
Risk Assessor	16	\$ 70.00	\$ 1,120.00
Data Manager	10	\$ 60.00	\$ 600.00
Statistician	8	\$ 60.00	\$ 480.00
Editor	24	\$ 50.00	\$ 1,200.00
Modeler	20	\$ 70.00	\$ 1,400.00
Graphics/word processing	24	\$ 45.00	\$ 1,080.00
Project Management	8	\$ 105.00	\$ 840.00
		<b>Response to Comments Total</b>	<b>\$ 14,920.00</b>
<b>Printing Production (1 weeks)</b>			<b>\$ 1,500.00</b>
<b>Contracting:</b>			
Contracts Specialist	24	\$ 50.00	\$ 1,200.00
Accounting	40	\$ 45.00	\$ 1,800.00
Team Leader	16	\$ 85.00	\$ 1,360.00
Chemist	24	\$ 70.00	\$ 1,680.00
		<b>Contracting Total</b>	<b>\$ 6,040.00</b>
<i>Contractor would require 2 weeks to make revisions</i>		<b>Grand Total</b>	<b>\$ 94,840.00</b>