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Clayton GROUP SERVICES

June 27, 2003

Mr. Ben Ives
Industrial Properties, Inc.
P.O. Box 546
Black Eagle, Montana 59414

Clayton Project No.75-03092.00

Subject: **Site Remediation Feasibility Study – Industrial Properties, Inc., 2450 Sixth Avenue South, Seattle, Washington (TCP ID# NW1016)**

Mr. Ives:

Clayton Group Services, Inc. (Clayton) is pleased to present this Site Remediation Feasibility Study for the Industrial Properties, Inc. facility located at 2450 Sixth Avenue South, Seattle, Washington (the Subject Property). Figure 1, included in Attachment A, shows a partial topographic map of the area indicating the location of the site. This study summarizes in detail numerous soil and groundwater remediation alternatives potentially capable of remediating petroleum-impacted soil and groundwater at the site, including: 1) Air Sparging with Soil Vapor Extraction; 2) Groundwater Pump and Treat with Soil Vapor Extraction; 3) Dual-Phase Groundwater and Soil Vapor Extraction; 4) OxyVac Chemical Injection/Oxidation and Soil Vapor Extraction 5) In-Situ Soil and Groundwater Treatment using an Oxygen Release Compound; and 6) Monitored Natural Attenuation.

Based on the results of the Feasibility Study, the most economical and efficient strategy to remediate the petroleum-impacted soil and groundwater at the subject property at this time appears to be the OxyVac Chemical Injection/Oxidation and Soil Vapor Extraction alternative.

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BACKGROUND

Clayton performed a Phase I Environmental Site Assessment (ESA) at the subject property during August and September 2001 (Clayton report dated September 6, 2001) that identified at least 3 heating fuel USTs located underneath the warehouse at 2450 Sixth Avenue South. The USTs were reportedly installed in the early- to mid-1950s and were most likely of single-walled steel construction. Clayton recommended that a subsurface investigation be conducted in the vicinity of the USTs in order to determine if leakage to the subsurface had occurred. Figure 2, included in Attachment A, shows the layout of the site, including the location of the 3 USTs and surrounding utilities.

Clayton conducted subsurface and release investigation activities between November 19, 2002 and January 7, 2003 around the 3 heating fuel USTs at the subject property (Clayton report dated February 11, 2003). The activities consisted of locating subsurface utilities, locating and determining the orientation and size of the USTs, and drilling soil borings to collect samples to assess subsurface environmental conditions in the vicinity of the USTs and delineate any impacts to soil and groundwater. The subsurface investigation results confirmed that releases had occurred in the vicinity of 2 of the USTs (UST-1 and UST-3). Soil and groundwater impacted with total petroleum hydrocarbons (TPH) as diesel fuel, TPH as gasoline, benzene, naphthalene, benz(a)anthracene, and chrysene were detected at concentrations above Ecology's MTCA Method A Cleanup Levels. Free product (heating fuel) was detected floating on the water table in a boring (B5) drilled just north of UST-1. A free product recovery well was installed adjacent to B5 and UST-1 on February 28, 2003 and a free product recovery program was initiated on March 7, 2003. Clayton reported the preliminary results (24-hour Notification) of the subsurface investigation activities to Ecology on November 27, 2002 and provided a follow-up '20 Day Report' to Ecology on December 17, 2002.

The 3 heating fuel USTs located beneath the concrete slab floor inside the western portion of the Industrial Properties building were decommissioned in-place by Environmental Tank Services, Inc. (ETS) on March 28, 2003. Clayton selected decommissioning in-place since removal of the USTs was impractical and may have jeopardized the structural integrity of the building.

The majority of soil and groundwater impacts detected at the site are located below the footprint of the warehouse building. Soil contamination in the vicinity of the USTs has been adequately delineated horizontally and is limited to the upper-zone of water table fluctuation (10 to 12 feet bgs inside the building and 7 to 9 feet bgs outside the building). Groundwater contamination in the vicinity of the USTs has been fairly well defined (where access was not limited) and appears to be migrating to the southeast in the vicinity of UST-1 and to the southwest in the vicinity of UST-3. This discrepancy in the direction of petroleum-impacted groundwater migration is likely caused by heterogeneous subsurface soil conditions, and likely reflects different directions of groundwater flow beneath the site. Figures 3 and 4, included in Attachment A, show the extent of petroleum-impacted soil and groundwater at the site, respectively.

Table 1, included in Attachment B, summarizes the photoionization detector (PID) results for the soil samples collected from the site. Table 2, included in Attachment B, summarizes the TPH as diesel, TPH as gasoline, and benzene, toluene, ethylbenzene and xylenes (BTEX) concentrations for soil and groundwater samples collected from the site.

Tables 3 and 4, included in Attachment B, summarize the polycyclic aromatic hydrocarbon (PAH) concentrations detected in soil and groundwater samples, respectively.

Based on the results of the UST decommissioning activities and the subsurface and release investigation, Clayton recommended the following:

- Continue to monitor the free product recovery well and as necessary remove any identified free product.
- Evaluate soil and groundwater remediation alternatives to address the petroleum contamination documented at the site and confer with Ecology to assess the available and recommended remediation alternatives.
- Implement the selected remediation alternative.

It is Clayton's understanding that the owner wishes to remediate the petroleum-impacted soil and groundwater at the subject property to reduce TPH, BTEX and PAH concentrations and obtain a 'no further action' (NFA) determination from Ecology.

The effectiveness of any remediation technology is limited by the subsurface conditions and geology, the depth to groundwater, the direction and rate of groundwater flow, the initial concentration of the contaminants of concern and the desired cleanup goals.

Clayton has reviewed several technologies capable of remediating the soil and groundwater contamination at the site and a detailed discussion of each alternative follows.

REMEDIATION ALTERNATIVES

Regardless of which remediation alternative is selected to address petroleum-impacted soil and groundwater at the site, approximately 10 groundwater monitoring wells (MWs) will need to be installed in the vicinity of the two impacted areas to determine the direction of groundwater flow, the rate of groundwater flow, and to monitor groundwater concentrations and the progress of remediation. Approximately 6 MWs will need to be installed in the impacted area around UST-1 and approximately 4 MWs will need to be installed in the impacted area around UST-3.

Free product recovery from the recovery well (RW), installed just north of UST-1 on February 28, 2003, will also be a significant component of any remedial technology selected to address petroleum-impacted soil and groundwater at the site. The monitoring and removal of free product from the site is currently ongoing.

Alternative 1 Air-Sparging (AS) with Soil Vapor Extraction (SVE)

Air-sparging with soil vapor extraction has been shown to remediate petroleum hydrocarbons in soil and groundwater through volatilization, direct removal of hydrocarbon vapors, and the addition of oxygen that would enhance natural bio-degradation that may be occurring in the subsurface. This remediation strategy would require the installation of multiple air sparging (AS) and soil vapor extraction (SVE) wells at the site. The equipment required to power the air injection and vapor extraction to remediate petroleum hydrocarbons would be housed in a compound that would be constructed at the site. The equipment would consist of at least four blowers (two low volume for air sparging and two high volume for vapor extraction) that would be connected through a series of pipes to the AS and SVE wells. The vapors extracted from the SVE wells would also require treatment, either through a series of activated carbon drums that would need to be changed out on a routine basis, or through a catalytic oxidation unit that would essentially burn any vapors recovered using propane gas.

Approximately 4 AS and 6 SVE wells would need to be installed inside the impacted area in the vicinity of UST-1 and approximately 2 AS and 3 SVE wells would need to be installed inside the impacted area in the vicinity of UST-3. Figure 5, included in Attachment A, shows a map of the site indicating the approximate location of the 10 MWs, 6 AS and 9 SVE wells that would need to be installed.

Based on the site conditions, the estimated time to remediate the petroleum-impacted soil and groundwater at the site to acceptable cleanup levels using air sparging with soil vapor extraction is approximately 4 to 7 years.

The success of the AS w/ SVE remediation alternative would likely be limited due to the fact that air sparging typically raises water table elevations (or causes the water table elevation to mound) in the areas being sparged and may cause impacted groundwater to migrate offsite (without any groundwater control methods in place). Equipment compound location, costs and maintenance, electricity costs, vapor treatment costs, and noise are additional concerns with the AS/SVE remediation alternative. Additional costs would also be incurred to install the AS/SVE wells and to properly abandon them per Ecology guidelines following completion of the project.

Estimated Costs – Alternative 1: Air-Sparging (AS) with Soil Vapor Extraction (SVE)

Task	Cost
Clayton Labor	
Project Management/Fieldwork	$12,800 - $17,800
O&M/Monitoring/Reporting/Expenses	$38,000 - $66,500
Subcontractors	
Drilling/Utility Locating/Well Abandonment	$60,300 - $70,200
Equipment/Install/Breakdown	$56,000 - $88,000

Task	Cost
Drum Disposal	$32,000 - $52,000
VCP Review	$3,200 - $5,600
Electricity	$19,200 - $33,600
Laboratory Analysis	
Soil and Groundwater (initial from MWs)	$10,000 - $10,000
Air (monthly)	$12,000 - $21,000
Groundwater (quarterly)	$40,000 - $70,000
Alternative 1 Estimated Costs (4 to 7 years) =	**$283,500 – $434,700**

<u>Alternative 2</u> Groundwater Pump & Treat with SVE

Groundwater pump and treat with soil vapor extraction has been shown to remediate petroleum hydrocarbons in soil and groundwater through direct removal of petroleum-impacted groundwater and hydrocarbon vapors from the subsurface. This remediation strategy would require the installation of multiple groundwater recovery wells (RWs) and SVE wells at the site. The equipment required to power the recovery well pumps, groundwater treatment system, and soil vapor extraction and treatment system would be housed in a compound that would be constructed at the site. The equipment would consist of at least three blowers (one for treating impacted groundwater and two for soil vapor extraction), multiple groundwater recovery pumps and a groundwater treatment unit. The vapors extracted from the SVE wells would also require treatment, either through a series of activated carbon drums that would need to be changed out on a routine basis, or through a catalytic oxidation unit that would essentially burn any vapors recovered using propane gas.

Approximately 2 RWs and 6 SVE wells would need to be installed inside the impacted area in the vicinity of UST-1 and approximately 1 RW and 3 SVE wells would need to be installed inside the impacted area in the vicinity of UST-3. Figure 6, included in Attachment A, shows a map of the site indicating the approximate location of the 10 MWs, 3 RWs and 9 SVE wells that would need to be installed.

This alternative would essentially de-water the subsurface and allow the extraction of soil vapors down to approximately 20 feet bgs. Groundwater removed from the recovery wells would require onsite treatment and discharge to a remote drainfield, or to the storm or sanitary sewer.

Based on the site conditions, the estimated time to remediate the petroleum-impacted soil and groundwater at the site to acceptable cleanup levels using pump and treat with soil vapor extraction is approximately 4 to 7 years.

The success of the groundwater pump and treat w/ SVE alternative would likely be limited due to the building footprint at the site, essentially eliminating the option of discharging treated groundwater to an onsite drainfield. Equipment compound location, costs and maintenance, electricity costs, groundwater and soil vapor treatment costs, and noise are additional concerns with the groundwater pump and treat w/ SVE remediation alternative. Additional costs would also be incurred to install the RWs and SVE wells and to properly abandon them per Ecology guidelines following completion of the project.

The groundwater pump and treat with soil vapor extraction technology (Alternative 2) will have slightly higher initial and operational costs than Alternative 1, due to additional costs to remove, treat, and discharge recovered groundwater. Also, the groundwater pump and treat technology typically involves additional equipment maintenance and operating costs versus AS/SVE (Alternative 1).

Estimated Costs – Alternative 2: Groundwater Pump & Treat with SVE

Task	Cost
Clayton Labor	
Project Management/Fieldwork	$12,800 - $17,800
O&M/Monitoring/Reporting/Expenses	$41,600 - $72,800
Subcontractors	
Drilling/Utility Locating/Well Abandonment	$54,800 - $65,200
Equipment/Install/Breakdown	$63,000 - $98,000
Drum/Groundwater Disposal	$44,000 - $82,000
VCP Review	$3,200 - $5,600
Electricity	$28,800 - $50,400
Laboratory Analysis	
Soil and Groundwater (initial from MWs)	$10,000 - $10,000
Air/Groundwater (monthly)	$24,000 - $42,000
Groundwater (quarterly)	$40,000 - $70,000
Alternative 2 Estimated Costs (4 to 7 years) =	**$322,200 – $513,800**

Alternative 3 Dual-Phase Groundwater and Soil Vapor Extraction

Dual phase groundwater (GW) and soil vapor extraction (SVE) has been shown to remediate petroleum hydrocarbons in soil and groundwater through direct removal of petroleum-impacted groundwater and hydrocarbon vapors from the subsurface. This remediation strategy would require the installation of multiple GW/SVE wells at the site. Groundwater and soil vapors would be recovered from the same wells. The equipment required to power the groundwater treatment and soil vapor extraction systems would be housed in a compound that would be constructed at the site. The equipment would consist of at least three blowers (one for treating impacted groundwater and two for groundwater and soil vapor extraction). The vapors extracted from the GW/SVE wells would also require treatment, either through a series of activated carbon drums that would need to be changed out on a routine basis, or through a catalytic oxidation unit that would essentially burn any vapors recovered using propane gas.

Approximately 6 GW/SVE wells would need to be installed inside the impacted area in the vicinity of UST-1 and approximately 3 GW/SVE wells would need to be installed inside the impacted area in the vicinity of UST-3. Figure 7, included in Attachment A, shows a map of the site indicating the approximate location of the 10 MWs and 9 GW/SVE wells that would need to be installed.

This alternative would also de-water the subsurface and allow the extraction of soil vapors down to approximately 20 feet bgs. Groundwater removed from the GW/SVE wells would require onsite treatment and discharge to a remote drainfield or to the storm or sanitary sewer.

Based on the site conditions, the estimated time to remediate the petroleum-impacted soil and groundwater at the site to acceptable cleanup levels using dual phase groundwater and soil vapor extraction technology is approximately 4 to 7 years.

The success of the dual-phase groundwater and SVE alternative would likely be limited due to the building footprint at the site, essentially eliminating the option of discharging treated groundwater to an onsite drainfield. Equipment compound location, costs and maintenance, electricity costs, groundwater and soil vapor treatment costs, and noise are additional concerns with the dual-phase soil vapor extraction remediation alternative. Additional costs would also be incurred to install the GW/SVE wells and to properly abandon them per Ecology guidelines following completion of the project.

The dual phase soil vapor extraction alternative will have slightly higher initial and operational costs than Alternative 1 (similar to Alternative 2), due to additional costs to remove, treat, and discharge the recovered groundwater. Also, the dual phase soil vapor extraction technology typically involves more equipment maintenance and operating costs (electricity) versus Alternatives 1 and 2.

<u>Estimated Costs – Alternative 3:</u> Dual-Phase Soil Vapor Extraction

Task	Cost
Clayton Labor	
Project Management/Fieldwork	$12,800 - $17,800
O&M/Monitoring/Reporting/Expenses	$41,600 - $72,800
Subcontractors	
Drilling/Utility Locating/Well Abandonment	$58,800 - $71,200
Equipment/Install/Breakdown	$62,000 - $96,000
Drum/Groundwater Disposal	$44,000 - $82,000
VCP Review	$3,200 - $5,600

Task	Cost
Electricity	$38,400 - $67,200
Laboratory Analysis	
Soil and Groundwater (initial from MWs)	$10,000 - $10,000
Air/Groundwater (monthly)	$24,000 - $42,000
Groundwater (quarterly)	$40,000 - $70,000
Alternative 3 Estimated Costs (4 to 7 years) =	**$334,800 – $534,600**

<u>Alternative 4</u> OxyVac Chemical Injection/Oxidation and Soil Vapor Extraction

OxyVac chemical injection/oxidation and soil vapor extraction (SVE) has been shown to remediate petroleum hydrocarbons in soil and groundwater through the injection of oxidants into the impacted zone to break down the chemical composition of hydrocarbons, adding oxygen to the subsurface to increase natural bio-degradation processes, and through the removal of hydrocarbon vapors from the subsurface. This remediation strategy would require the installation of multiple injection/SVE wells at the site. The equipment required to power the oxidant injection and soil vapor extraction systems would be housed in a compound that would be constructed at the site. The equipment would consist of at least two blowers (for soil vapor extraction) and two pumps (to inject the oxidant into the injection wells). The vapors extracted from the SVE wells would also require treatment, either through a series of activated carbon drums that would need to be changed out on a routine basis, or through a catalytic oxidation unit that would essentially burn any vapors recovered using propane gas.

Approximately 6 injection wells and 6 SVE wells would need to be installed inside the impacted area in the vicinity of UST-1 and approximately 3 injection wells and 3 SVE wells would need to be installed inside the impacted area in the vicinity of UST-3. Figure 8, included in Attachment A, shows a map of the site indicating the approximate location of the 10 MWs, 9 injection wells and 9 SVE wells that would need to be installed.

Based on the site conditions, the estimated time to remediate the petroleum-impacted soil and groundwater at the site to acceptable cleanup levels using OxyVac chemical injection/oxidation and soil vapor extraction technology is approximately 1 to 3 years. The remediation time-frame is based on the amount of time desired to cleanup the site. The site could be cleaned up quicker, which would require a more aggressive approach and additional up-front costs.

The success of the OxyVac chemical injection/oxidation and SVE alternative would likely be limited by the ability of the system to remediate 'heavy-end' diesel fuel and oil impacted soil and groundwater, as well as free product. Equipment compound location, costs and maintenance, electricity costs, soil vapor treatment costs, and noise are additional concerns with the OxyVac chemical injection/oxidation and SVE remediation alternative. Additional costs would also be incurred to install the injection and SVE wells and to properly abandon them per Ecology guidelines following completion of the project.

The OxyVac chemical injection/oxidation and SVE alternative will have slightly higher initial and operational costs than the other alternatives, due to additional costs to install the injection wells and the cost of the oxidant chemical. However, given that the time-frame for cleanup may be considerably less than the other alternatives reviewed, cost savings in the long-term may be realized.

Estimated Costs – Alternative 4: OxyVac Chemical Injection/Oxidation and SVE

Task	Cost
Clayton Labor	
Project Management/Fieldwork	$15,400 - $18,600
O&M/Monitoring/Reporting/Expenses	$10,400 - $31,200
Subcontractors	
Drilling/Utility Locating/Well Abandonment	$81,200 - $87,400
Equipment/Chemicals/Install/Breakdown	$148,000 - $128,000
Drum Disposal	$30,000 - $40,000
VCP Review	$800 - $2,400
Electricity	$4,800 - $14,400
Laboratory Analysis	
Soil and Groundwater (initial from MWs)	$10,000 - $10,000
Air (monthly)	$3,000 - $9,000
Groundwater (quarterly)	$10,000 - $30,000
Alternative 4 Estimated Costs (1 to 3 years) =	**$313,600 – $371,000**

Alternative 5 Enhanced In-Situ Bioremediation Using ORC

Enhanced in-situ bioremediation has been shown to reduce hydrocarbon concentrations in soil and groundwater through biodegradation of dissolved (groundwater) and volatilized (vapors) petroleum constituents. This alternative would use an oxygen release compound (ORC), developed by Regenesis, injected into the subsurface that slowly releases oxygen over time when in contact with water, enhancing the natural aerobic biodegradation of petroleum hydrocarbons. The oxygen that is released is used by microbes naturally occurring in the subsurface that preferentially degrade petroleum hydrocarbons. This is a passive remediation alternative and requires no onsite equipment or maintenance.

The success of the enhanced in-situ bioremediation using ORC alternative would be limited by the presence of free product in the vicinity of UST-1 (microorganisms do not effectively degrade free product) and the direction and rate of groundwater flow at the site.

Based on the site conditions (i.e. soil and groundwater TPH as diesel fuel concentrations and the presence of free product) and preliminary discussions, Regenesis (the maker of ORC) has indicated that they do not feel their product is suitable for remediating the subject property at this time, and thus is not a feasible remediation alternative. However, if the TPH as diesel fuel concentrations in soil and groundwater are reduced and the presence of free product is eliminated by other remedial efforts, and the site requires additional treatment to reach acceptable cleanup levels, ORC may be an option to reconsider in the future.

Alternative 6 Monitored Natural Attenuation

Monitored natural attenuation (MNA) has been shown to be an effective remediation technology at petroleum hydrocarbon impacted sites under favorable conditions, which can reduce mass, toxicity, mobility, volume and/or concentrations of the contaminants of concern through natural processes. Natural attenuation of petroleum constituents in the subsurface can occur via several mechanisms, including: biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation or destruction of contaminants.

For MNA to be evaluated as a viable remediation alternative, the location and concentration of the contaminant must be determined, as well as how the contaminants move in the subsurface environment, including: the depth to groundwater, the direction of groundwater flow, the rate of groundwater flow, and any seasonal fluctuations affecting the direction and rate of groundwater movement. Implementation of MNA at a site also requires a detailed understanding of the subsurface environment and geochemistry, especially where biodegradation processes are involved, including: the amount of oxygen, carbon dioxide, nitrate, sulfate, iron, and nutrients (such as phosphate and ammonia). Other key indicators are pH and the oxidation-reduction potential (ORP). This information is vital to understanding what processes the available microorganisms are using, how fast these processes are occurring, and what the results are likely to be. For any project where MNA will be utilized, it is important to have a routine monitoring plan to determine these subsurface parameters throughout the life of the project to understand the processes occurring and to evaluate the effectiveness of the program.

MNA is a passive remediation alternative and requires no onsite equipment or maintenance. The progress of remediation is measured during routine monitoring and sampling of the site monitoring wells for the contaminants of concern, as well as the list of parameters (oxygen, carbon dioxide, nitrate, sulfate, phosphate, ammonia, pH and ORP) detailed above.

Based on the site conditions, the estimated time to remediate petroleum-impacted soil and groundwater at the site to acceptable cleanup levels using MNA is approximately 40 to 60 years.

The success of the monitored natural attenuation alternative would likely be limited by the direction and rate of groundwater flow at the site and the amount of free product present north of UST-1.

This alternative would have the lowest initial cost of all the technology alternatives reviewed; however, administrative and routine monitoring and sampling costs would add up over the many years it would take to reach soil and groundwater cleanup goals.

Estimated Costs – Alternative 6: Monitored Natural Attenuation

Task	Cost
Clayton Labor	
Project Management/Fieldwork	$12,200 - $17,200
Monitoring/Reporting/Expenses	$66,000 - $99,000
Subcontractors	
Drilling/Utility Locating/Well Abandonment	$30,400 - $36,600
Drum/Groundwater Disposal and Equipment Rental	$40,000 - $59,000
VCP Review	$8,000 - $12,000
Laboratory Analysis	
Soil and Groundwater (initial from MWs)	$10,000 - $10,000
Groundwater (annual)	$150,000 - $225,000
Alternative 6 Estimated Costs (40 to 60 years) =	**$316,600 – $458,800**

EVALUATION OF REMEDIATION ALTERNATIVES

Remediation alternatives 1, 2, 3 and 4 appear to be the most feasible to consider for addressing soil and groundwater contamination at the subject property. Based on the results of the Feasibility Study, the most economical and efficient strategy to remediate the petroleum-impacted soil and groundwater at the subject property at this time appears to be the OxyVac Chemical Injection/Oxidation and Soil Vapor Extraction alternative.

However, based on the lack of site information such as the direction and rate of groundwater flow, permeability of the saturated zone, groundwater recharge rates, and the amount of free product, it is difficult to select the most efficient and economical remediation alternative at this time.

Based on the available soil and groundwater data collected from the site, Clayton has determined that additional site information is required prior to making the remediation technology selection. To make the appropriate selection, Clayton recommends:

- Installing the 10 proposed monitoring wells (MWs) at the site and collecting soil and groundwater samples to be analyzed for TPH as diesel fuel, BTEX, PAHs, extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH);

- Gauging the water levels and surveying the top of casing of each monitoring well to determine the direction and rate of groundwater flow;

- Conducting a pilot study to assess the potential effectiveness of the OxyVac Chemical Injection/Oxidation and Soil Vapor Extraction remediation alternative;

- Based on the location of the site in an industrial area, performing a risk-based assessment using the previous and newly collected data to determine the appropriate cleanup goals for the site;

- Conferring with the Ecology Voluntary Cleanup Program (VCP) project manager to select the appropriate remediation technology for the site based on the calculated cleanup goals;

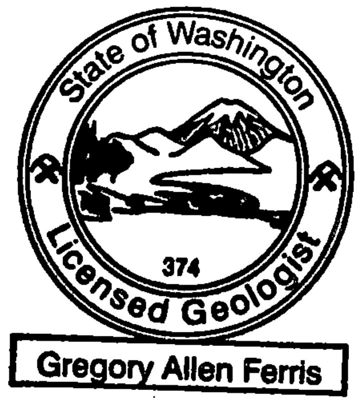
- Preparing a remedial action plan (RAP) using the most economic and efficient alternative based on the site cleanup goals established during the risk-based assessment that will address petroleum-impacted soil and groundwater at the site; and,

- Implementing the remedial action plan.

If you have any questions or comments regarding the project, please feel free to call Mitch Williams or me at (206) 763-7364.

Sincerely,

Greg Ferris, MS
Licensed Geologist
Environmental Services
Seattle Regional Office



Attachment A – Figures
Attachment B – Tables
Attachment C – Estimated Costs Spreadsheet

Cc: Mr. John Houlihan – Short Cressman & Burgess
Ms. Kim Johnston – Industrial Properties, Inc.
[redacted] Cleanup Program Project Manager

Clayton
GROUP SERVICES

ATTACHMENT A

FIGURES

Portion of 7.5–minute Series
Topographic Map
United States Department of the Interior
Geological Survey

Seattle South, Washington Quadrangle
1983
Scale 1:25,000

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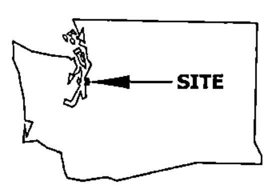


QUADRANGLE LOCATION

Figure 1 Site Location	Clayton GROUP SERVICES	Industrial Properties 2450 Sixth Avenue South Seattle, Washington 98134	
		Clayton Project 75–03092.00	Industrial Properties

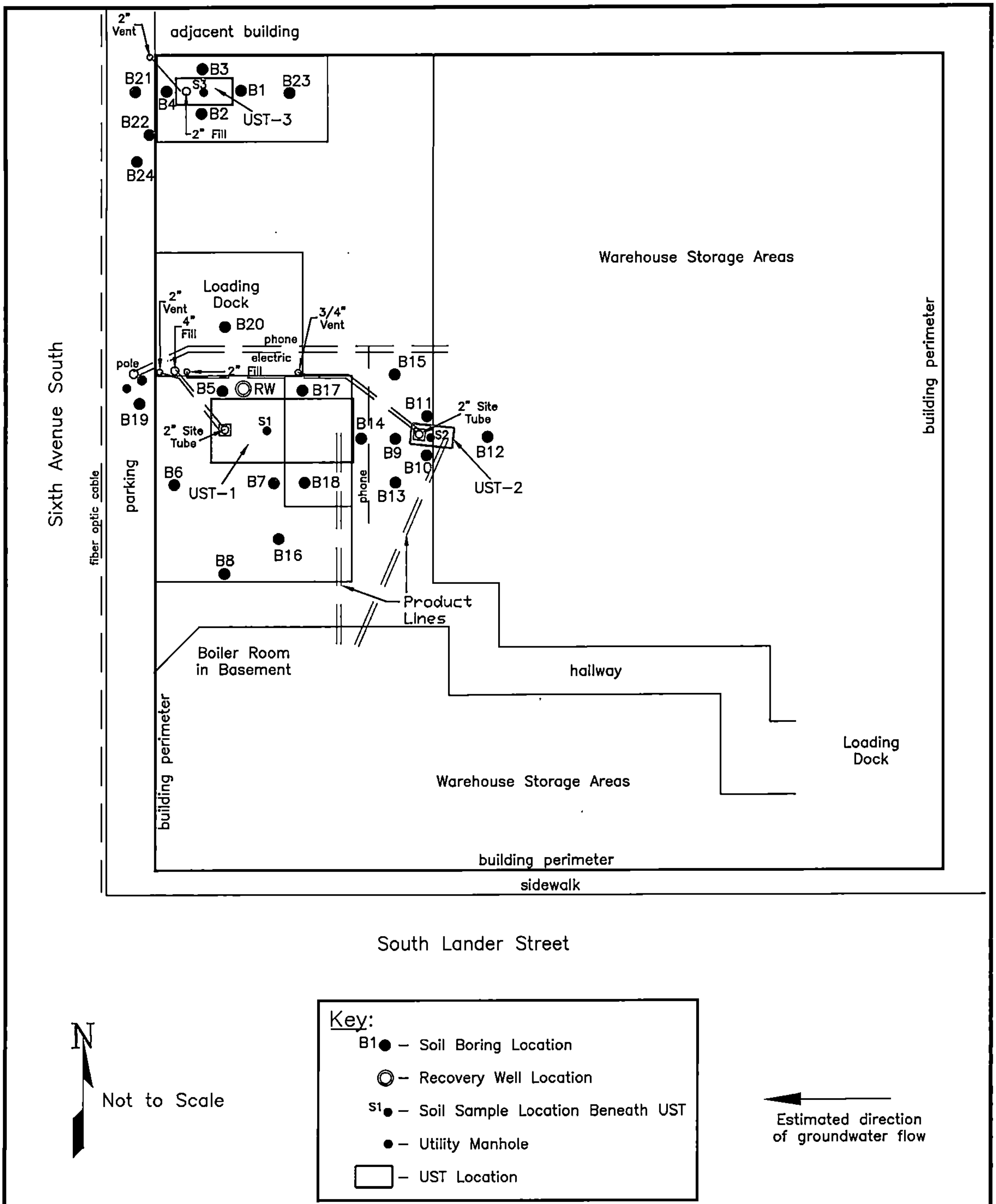


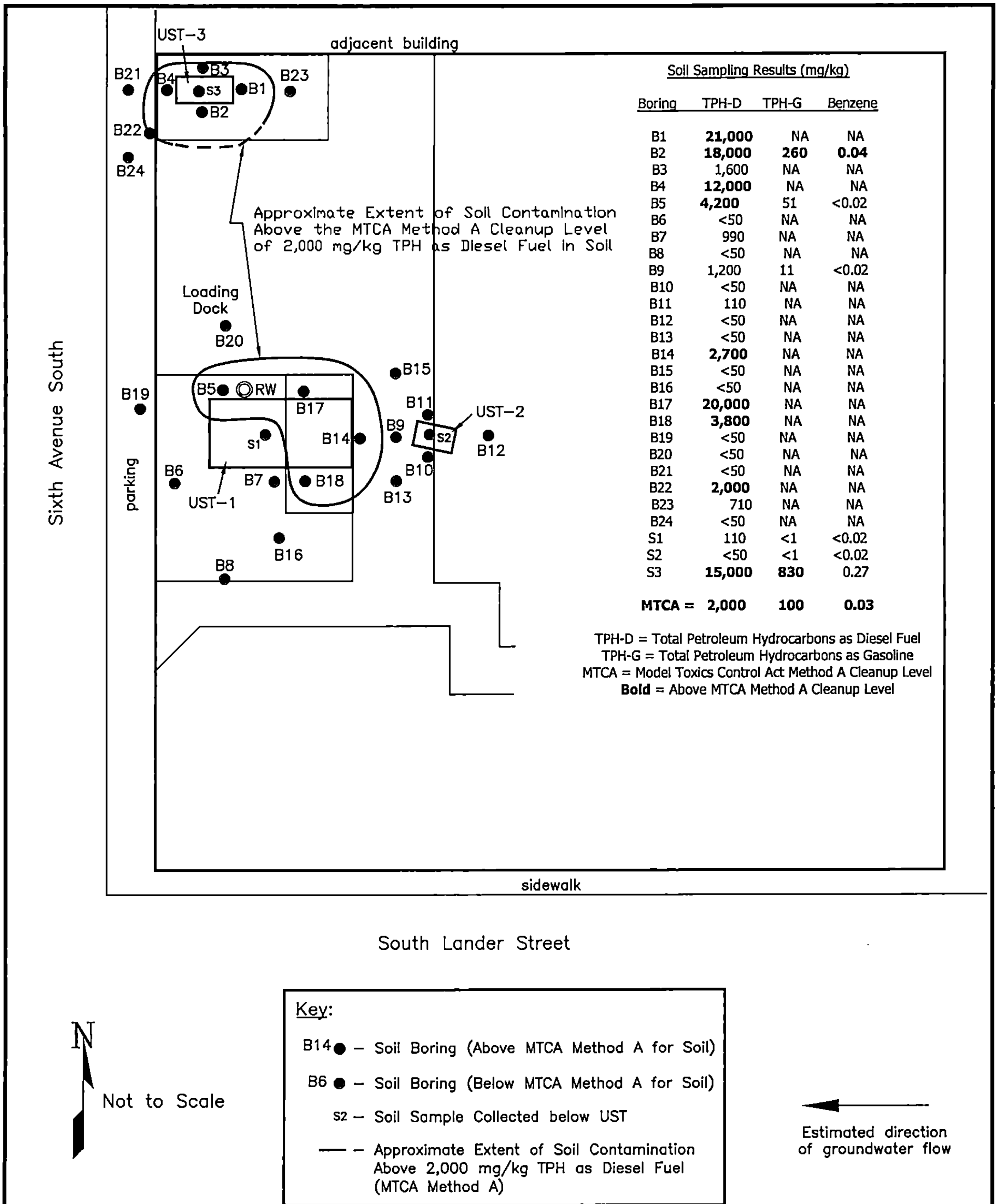
Figure 2

USTs and Borings Location Map

Clayton GROUP SERVICES

Industrial Properties
2450 Sixth Avenue South
Seattle, Washington

Clayton Project No. 75-03092.00	Industrial Properties



Soil Sampling Results (mg/kg)

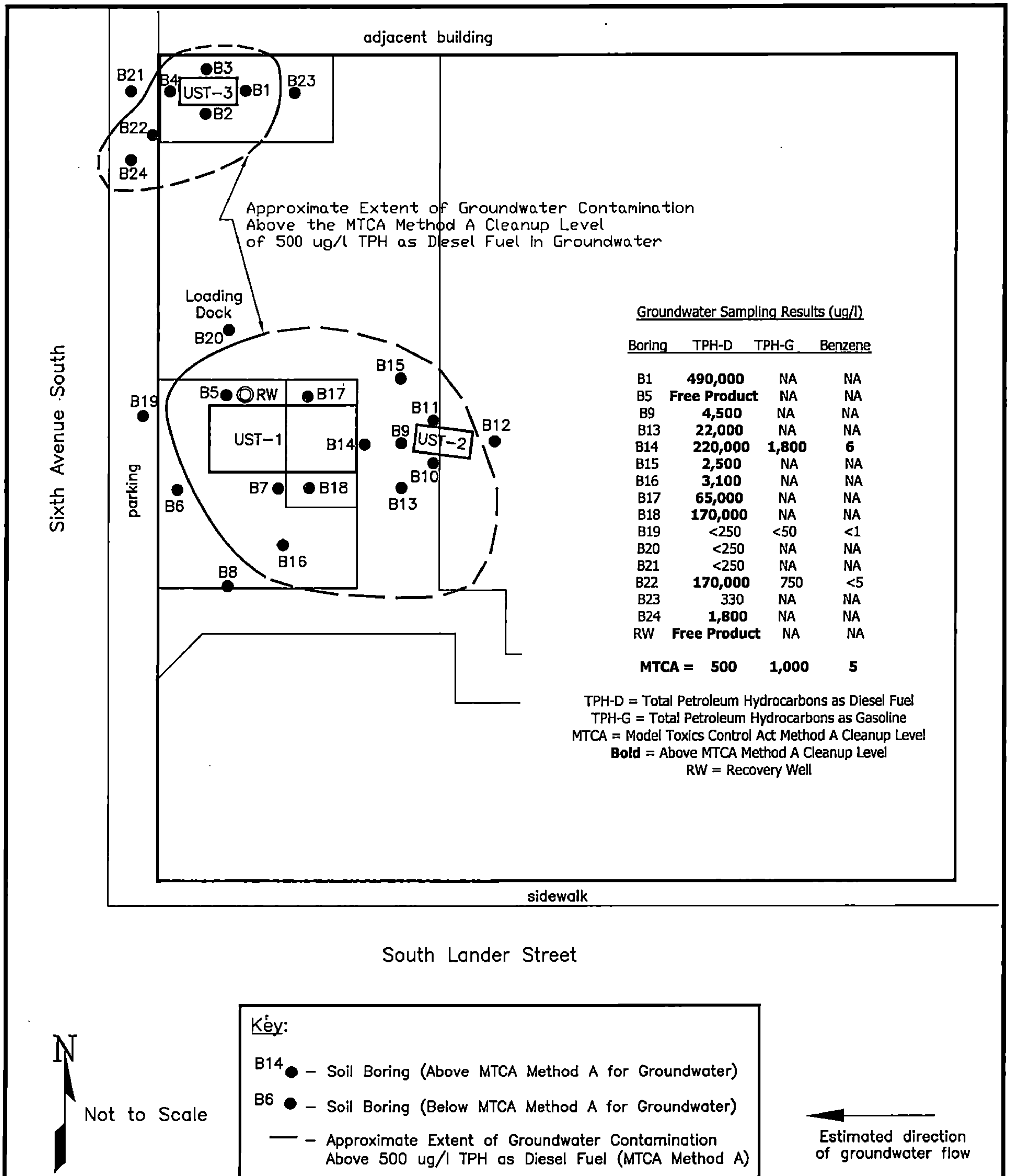
Boring	TPH-D	TPH-G	Benzene
B1	**21,000**	NA	NA
B2	**18,000**	**260**	**0.04**
B3	1,600	NA	NA
B4	**12,000**	NA	NA
B5	**4,200**	51	<0.02
B6	<50	NA	NA
B7	990	NA	NA
B8	<50	NA	NA
B9	1,200	11	<0.02
B10	<50	NA	NA
B11	110	NA	NA
B12	<50	NA	NA
B13	<50	NA	NA
B14	**2,700**	NA	NA
B15	<50	NA	NA
B16	<50	NA	NA
B17	**20,000**	NA	NA
B18	**3,800**	NA	NA
B19	<50	NA	NA
B20	<50	NA	NA
B21	<50	NA	NA
B22	**2,000**	NA	NA
B23	710	NA	NA
B24	<50	NA	NA
S1	110	<1	<0.02
S2	<50	<1	<0.02
S3	**15,000**	**830**	0.27
MTCA =	**2,000**	**100**	**0.03**

TPH-D = Total Petroleum Hydrocarbons as Diesel Fuel
TPH-G = Total Petroleum Hydrocarbons as Gasoline
MTCA = Model Toxics Control Act Method A Cleanup Level
Bold = Above MTCA Method A Cleanup Level

Key:

- B14 ● – Soil Boring (Above MTCA Method A for Soil)
- B6 ● – Soil Boring (Below MTCA Method A for Soil)
- S2 – Soil Sample Collected below UST
- —— – Approximate Extent of Soil Contamination Above 2,000 mg/kg TPH as Diesel Fuel (MTCA Method A)

Figure 3 Diesel Fuel in Soil Concentration Map	Clayton Group Services	Industrial Properties 2450 Sixth Avenue South Seattle, Washington
		Clayton Project No. 75-03092.00 — Industrial Properties

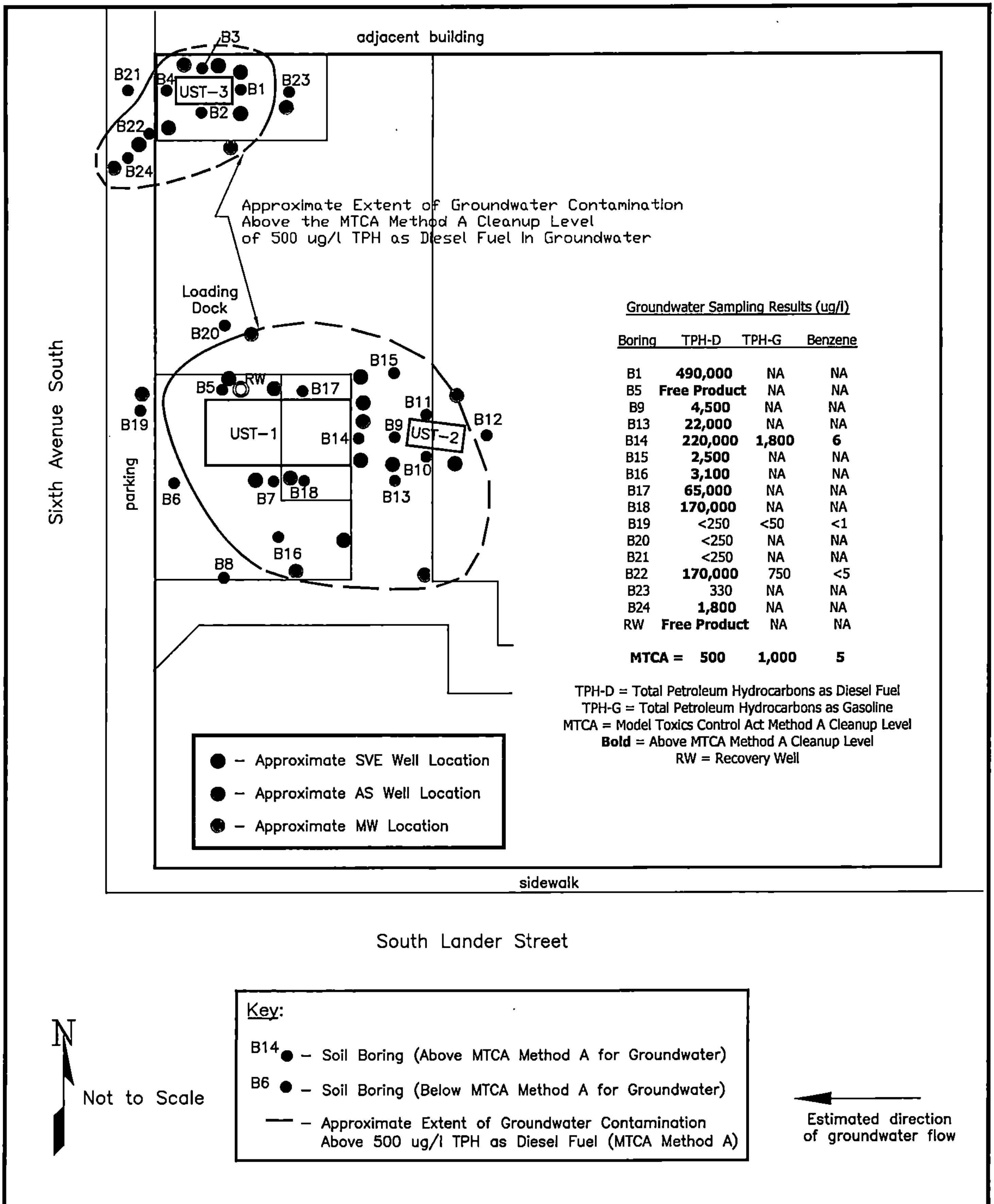


Groundwater Sampling Results (ug/l)

Boring	TPH-D	TPH-G	Benzene
B1	**490,000**	NA	NA
B5	**Free Product**	NA	NA
B9	**4,500**	NA	NA
B13	**22,000**	NA	NA
B14	**220,000**	**1,800**	**6**
B15	**2,500**	NA	NA
B16	**3,100**	NA	NA
B17	**65,000**	NA	NA
B18	**170,000**	NA	NA
B19	<250	<50	<1
B20	<250	NA	NA
B21	<250	NA	NA
B22	**170,000**	750	<5
B23	330	NA	NA
B24	**1,800**	NA	NA
RW	**Free Product**	NA	NA
MTCA =	**500**	**1,000**	**5**

TPH-D = Total Petroleum Hydrocarbons as Diesel Fuel
TPH-G = Total Petroleum Hydrocarbons as Gasoline
MTCA = Model Toxics Control Act Method A Cleanup Level
Bold = Above MTCA Method A Cleanup Level
RW = Recovery Well

Figure 4 Diesel Fuel in Groundwater Concentration Map	Clayton GROUP SERVICES	Industrial Properties 2450 Sixth Avenue South Seattle, Washington
		Clayton Project No. 75–03092.00 / Industrial Properties



Groundwater Sampling Results (ug/l)

Boring	TPH-D	TPH-G	Benzene
B1	**490,000**	NA	NA
B5	**Free Product**	NA	NA
B9	**4,500**	NA	NA
B13	**22,000**	NA	NA
B14	**220,000**	**1,800**	**6**
B15	**2,500**	NA	NA
B16	**3,100**	NA	NA
B17	**65,000**	NA	NA
B18	**170,000**	NA	NA
B19	<250	<50	<1
B20	<250	NA	NA
B21	<250	NA	NA
B22	**170,000**	750	<5
B23	330	NA	NA
B24	**1,800**	NA	NA
RW	**Free Product**	NA	NA
MTCA =	**500**	**1,000**	**5**

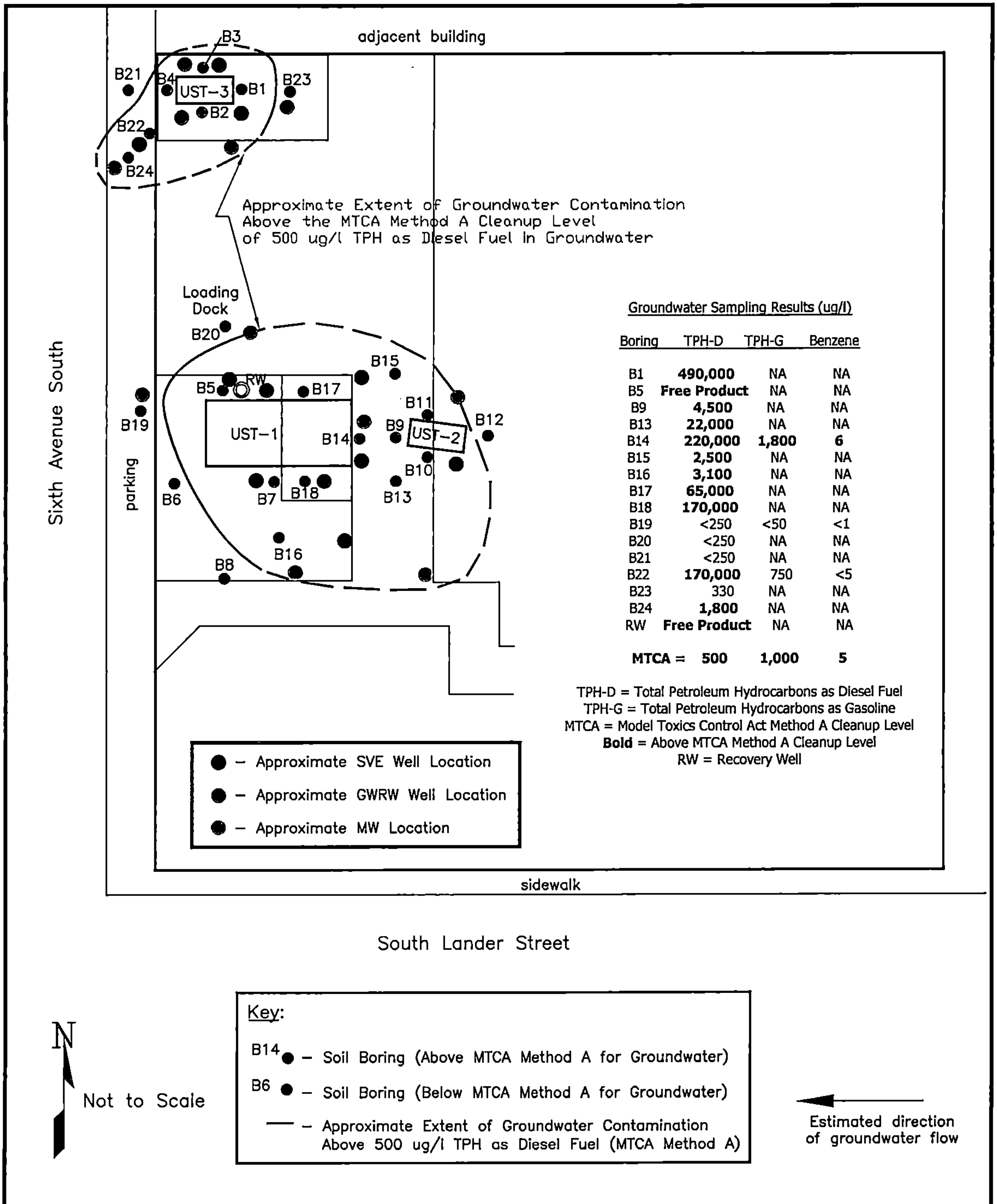
TPH-D = Total Petroleum Hydrocarbons as Diesel Fuel
TPH-G = Total Petroleum Hydrocarbons as Gasoline
MTCA = Model Toxics Control Act Method A Cleanup Level
Bold = Above MTCA Method A Cleanup Level
RW = Recovery Well

Figure 5
Alternative 1
MW, AS and SVE
Well Locations

Clayton GROUP SERVICES

Industrial Properties
2450 Sixth Avenue South
Seattle, Washington

Clayton Project No. 75-03092.00 | Industrial Properties



Groundwater Sampling Results (ug/l)

Boring	TPH-D	TPH-G	Benzene
B1	**490,000**	NA	NA
B5	**Free Product**	NA	NA
B9	**4,500**	NA	NA
B13	**22,000**	NA	NA
B14	**220,000**	**1,800**	**6**
B15	**2,500**	NA	NA
B16	**3,100**	NA	NA
B17	**65,000**	NA	NA
B18	**170,000**	NA	NA
B19	<250	<50	<1
B20	<250	NA	NA
B21	<250	NA	NA
B22	**170,000**	750	<5
B23	330	NA	NA
B24	**1,800**	NA	NA
RW	**Free Product**	NA	NA
MTCA =	**500**	**1,000**	**5**

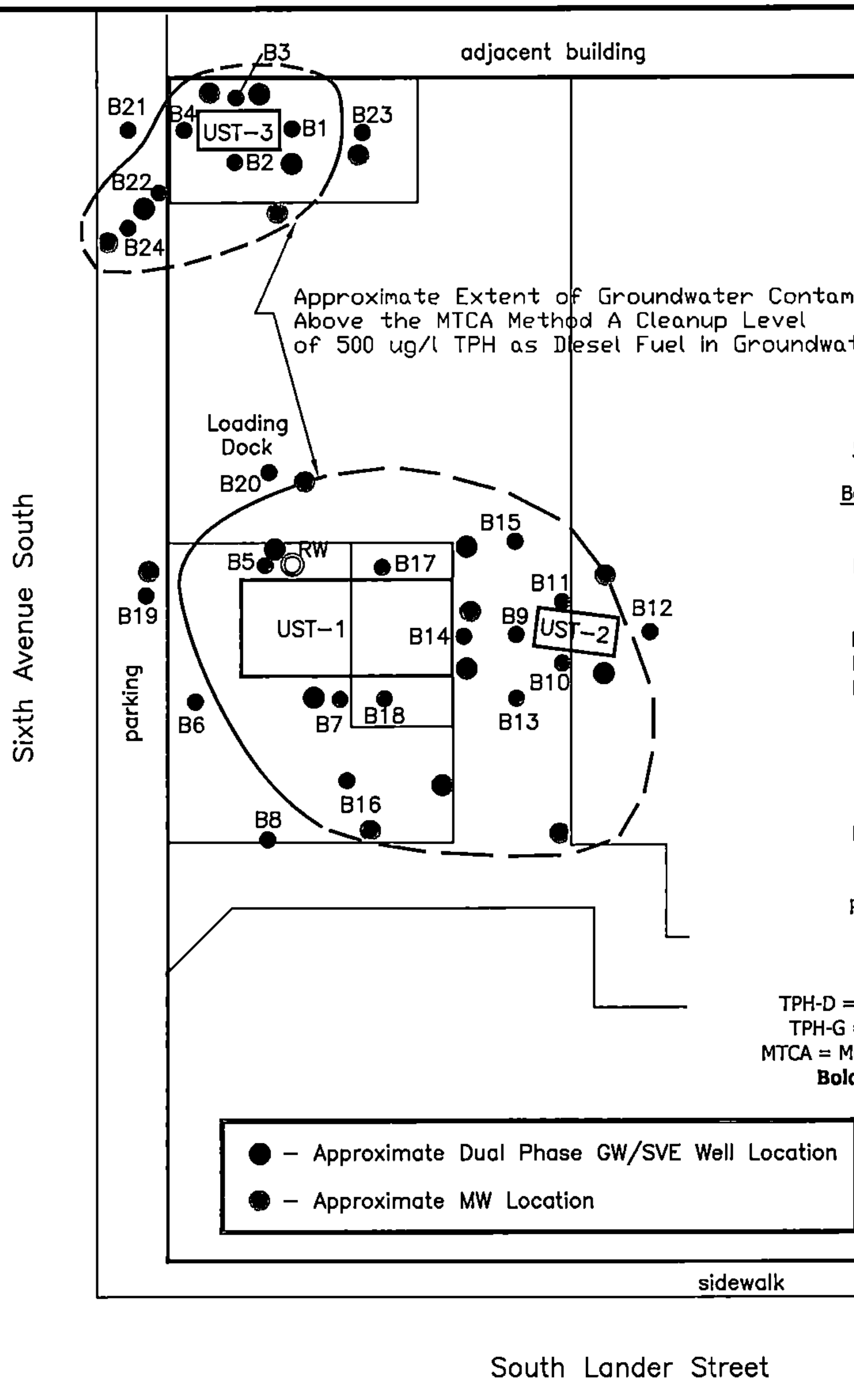
TPH-D = Total Petroleum Hydrocarbons as Diesel Fuel
TPH-G = Total Petroleum Hydrocarbons as Gasoline
MTCA = Model Toxics Control Act Method A Cleanup Level
Bold = Above MTCA Method A Cleanup Level
RW = Recovery Well

Figure 6
Alternative 2
MW, GWRW and SVE
Well Locations

Clayton GROUP SERVICES

Industrial Properties
2450 Sixth Avenue South
Seattle, Washington

Clayton Project No. 75-03092.00 | Industrial Properties



Groundwater Sampling Results (ug/l)

Boring	TPH-D	TPH-G	Benzene
B1	**490,000**	NA	NA
B5	**Free Product**	NA	NA
B9	**4,500**	NA	NA
B13	**22,000**	NA	NA
B14	**220,000**	**1,800**	**6**
B15	**2,500**	NA	NA
B16	**3,100**	NA	NA
B17	**65,000**	NA	NA
B18	**170,000**	NA	NA
B19	<250	<50	<1
B20	<250	NA	NA
B21	<250	NA	NA
B22	**170,000**	750	<5
B23	330	NA	NA
B24	**1,800**	NA	NA
RW	**Free Product**	NA	NA
MTCA =	**500**	**1,000**	**5**

TPH-D = Total Petroleum Hydrocarbons as Diesel Fuel
TPH-G = Total Petroleum Hydrocarbons as Gasoline
MTCA = Model Toxics Control Act Method A Cleanup Level
Bold = Above MTCA Method A Cleanup Level
RW = Recovery Well

N

Not to Scale

Key:

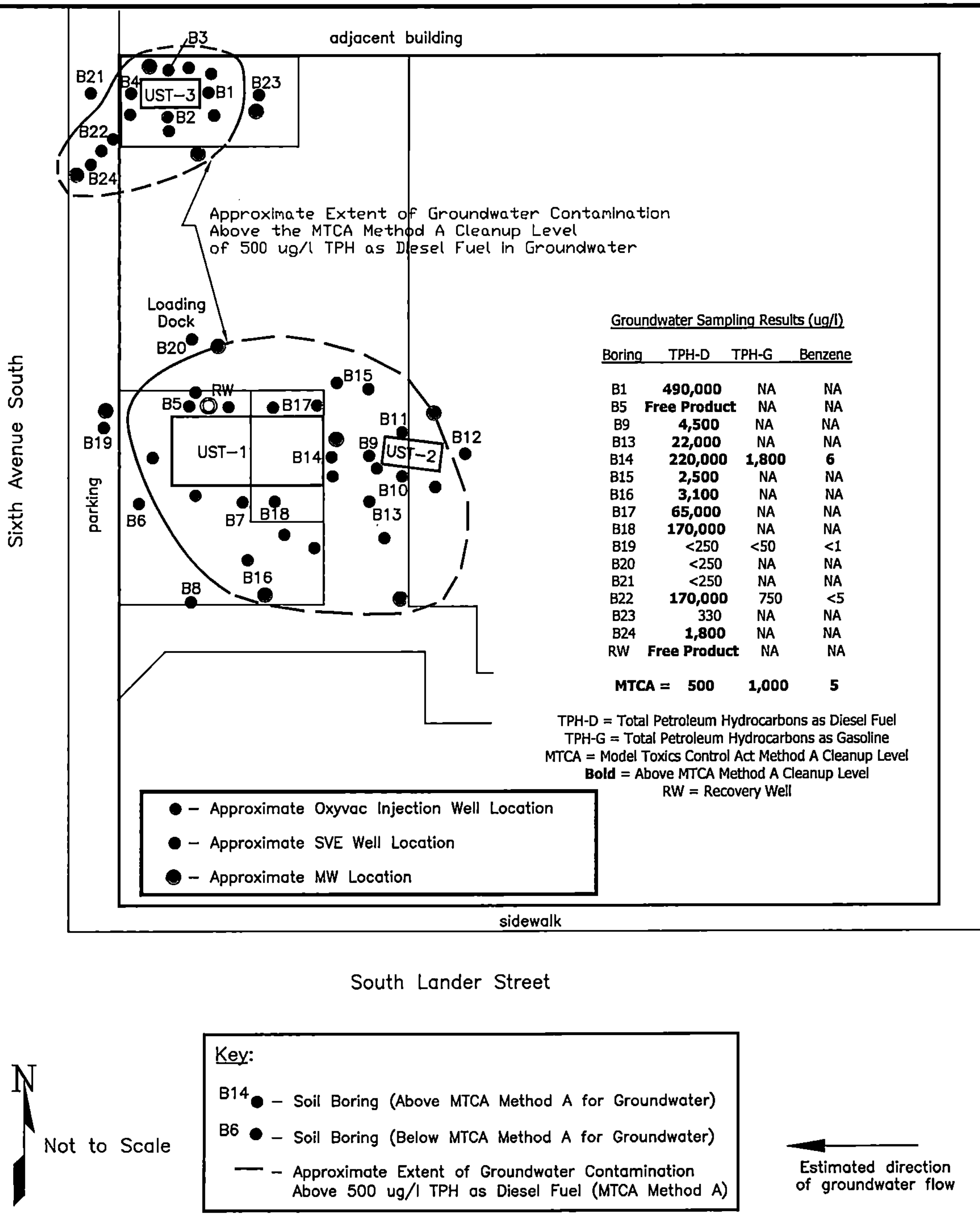
B14 ● – Soil Boring (Above MTCA Method A for Groundwater)

B6 ● – Soil Boring (Below MTCA Method A for Groundwater)

— – Approximate Extent of Groundwater Contamination Above 500 ug/l TPH as Diesel Fuel (MTCA Method A)

← Estimated direction of groundwater flow

Figure 7 Alternative 3 MW and GW/SVE Well Locations	Clayton GROUP SERVICES	Industrial Properties 2450 Sixth Avenue South Seattle, Washington
	Clayton Project No. 75-03092.00	Industrial Properties



Groundwater Sampling Results (ug/l)

Boring	TPH-D	TPH-G	Benzene
B1	**490,000**	NA	NA
B5	**Free Product**	NA	NA
B9	**4,500**	NA	NA
B13	**22,000**	NA	NA
B14	**220,000**	**1,800**	**6**
B15	**2,500**	NA	NA
B16	**3,100**	NA	NA
B17	**65,000**	NA	NA
B18	**170,000**	NA	NA
B19	<250	<50	<1
B20	<250	NA	NA
B21	<250	NA	NA
B22	**170,000**	750	<5
B23	330	NA	NA
B24	**1,800**	NA	NA
RW	**Free Product**	NA	NA
MTCA =	**500**	**1,000**	**5**

TPH-D = Total Petroleum Hydrocarbons as Diesel Fuel
TPH-G = Total Petroleum Hydrocarbons as Gasoline
MTCA = Model Toxics Control Act Method A Cleanup Level
Bold = Above MTCA Method A Cleanup Level
RW = Recovery Well

Figure 8 Alternative 4 OxyVac Injection/SVE Well Locations	Clayton GROUP SERVICES	Industrial Properties 2450 Sixth Avenue South Seattle, Washington
		Clayton Project No. 75-03092.00 — Industrial Properties

ATTACHMENT B

TABLES

Clayton Group Services

TABLE 1. SOIL SAMPLING PHOTOIONIZATION DETECTOR RESULTS.
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Depth (Ft. BGS)	B1 (ppm PID)	B2 (ppm PID)	B3 (ppm PID)	B4 (ppm PID)	B5 (ppm PID)	B6 (ppm PID)
0-3'	0.2	2.1	0.6	0.5	0.4	0.8
3-6'	0.4	2.4	0.4	0.9	0.5	2.0
6-9'	**131**	**157**	**41.2**	**101**	0.9	1.2
9-12'	7.4	-	-	-	**35.1**	**2.6**
12-15'	-	-	-	-	34.2	-

Depth (Ft. BGS)	B7 (ppm PID)	B8 (ppm PID)	B9 (ppm PID)	B10 (ppm PID)	B11 (ppm PID)	B12 (ppm PID)
0-3'	0.7	0.7	0.3	0.4	0.2	0.3
3-6'	1.2	NR	0.9	**4.1**	0.9	0.5
6-9'	1.3	NR	1.2	-	**1.6**	**0.8**
9-12'	**30.4**	**1.4**	**57.5**	-	0.7	0.8
12-15'	-	-	41.2	-	-	-

Depth (Ft. BGS)	B13 (ppm PID)	B14 (ppm PID)	B15 (ppm PID)	B16 (ppm PID)	B17 (ppm PID)	B18 (ppm PID)
0-3'	1.1	1.5	1.4	1.0	1.2	1.3
3-6'	1.1	1.3	1.4	1.5	1.4	1.5
6-9'	0.8	1.3	1.3	1.4	1.8	1.9
9-12'	**2.4**	**6.8**	**2.0**	**2.4**	**79.5**	**88.5**
12-15'	1.8	3.2	1.8	2.1	41.6	49.2

Depth (Ft. BGS)	B19 (ppm PID)	B20 (ppm PID)	B21 (ppm PID)	B22 (ppm PID)	B23 (ppm PID)	B24 (ppm PID)
0-3'	0.6	0.8	0.7	0.4	0.4	0.8
3-6'	0.6	0.7	0.6	0.5	2.8	0.8
6-9'	**0.7**	**0.8**	**0.8**	**40.7**	**46.2**	**1.0**
9-12'	0.5	0.8	0.8	21.2	-	1.0
12-15'	-	-	-	-	-	-

Ft. BGS = feet below ground surface
PID = photoionization detector
B1 = soil boring identification
NR = no recovery
Bold = sample submitted for laboratory analysis

Clayton GROUP SERVICES

TABLE 2. LABORATORY ANALYTICAL RESULTS SUMMARY (TPH and BTEX).
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Soil Sampling Results

Boring Location	Sample ID	Sample Depth (feet bgs)	TPH as Diesel Fuel (mg/kg)	TPH as Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)
UST-1								
B5	112602-S5	9-12'	**4,200**	51	<0.02	<0.02	0.04	<0.02
B6	112602-S6	9-12'	<50	NA	NA	NA	NA	NA
B7	112602-S7	9-12'	990	NA	NA	NA	NA	NA
B8	112602-S8	9-12'	<50	NA	NA	NA	NA	NA
B16	010603-S4	9-12'	<50	NA	NA	NA	NA	NA
B17	010603-S5	9-12'	**20,000**	NA	NA	NA	NA	NA
B18	010603-S6	9-12'	**3,800**	NA	NA	NA	NA	NA
B19	010703-S1	6-9'	<50	NA	NA	NA	NA	NA
B20	010703-S2	6-9'	<50	NA	NA	NA	NA	NA
S1	032803-S1	13-13.5'	110	<1	<0.02	<0.02	<0.02	0.03
UST-2								
B9	112602-S9	9-12'	1,200	11	<0.02	<0.02	<0.02	0.05
B10	112602-S10	3-6'	<50	NA	NA	NA	NA	NA
B11	112602-S11	6-9'	110	NA	NA	NA	NA	NA
B12	112602-S12	6-9'	<50	NA	NA	NA	NA	NA
B13	010603-S1	9-12'	<50	NA	NA	NA	NA	NA
B14	010603-S2	9-12'	**2,700**	NA	NA	NA	NA	NA
B15	010603-S3	9-12'	<50	NA	NA	NA	NA	NA
S2	032803-S2	5.5-6'	<50	<1	<0.02	<0.02	<0.02	<0.02
UST-3								
B1	112602-S1	6-9'	**21,000**	NA	NA	NA	NA	NA
B2	112602-S2	6-9'	**18,000**	**260**	**0.04**	0.03	0.93	0.94
B3	112602-S3	6-9'	1,600	NA	NA	NA	NA	NA
B4	112602-S4	6-9'	**12,000**	NA	NA	NA	NA	NA
B21	010703-S3	6-9'	<50	NA	NA	NA	NA	NA
B22	010703-S4	6-9'	**2,000**	NA	NA	NA	NA	NA
B23	010703-S5	6-9'	710	NA	NA	NA	NA	NA
B24	010703-S6	6-9'	<50	NA	NA	NA	NA	NA
S3	032803-S3	6.5-7'	**15,000**	**830**	**0.27**	<0.02	4.4	**24**
MTCA Method A Cleanup Level =			2,000	100	0.03	7	6	9

TABLE 2. Continued

Groundwater Sampling Results

Boring Location	Sample ID	Sample Depth (feet bgs)	TPH as Diesel Fuel (ug/l)	TPH as Gasoline (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)
UST-1								
B5	112602-GW2	12'	**Free Product**	NA	NA	NA	NA	NA
B16	010603-GW4	12'	**3,100**	NA	NA	NA	NA	NA
B17	010603-GW5	12'	**65,000**	NA	NA	NA	NA	NA
B18	010603-GW6	12'	**170,000**	NA	NA	NA	NA	NA
B19	010703-GW1	9'	<250	<50	<1	<1	<1	<1
B20	010703-GW2	8'	<250	NA	NA	NA	NA	NA
UST-2								
B9	112602-GW3	12'	**4,500**	NA	NA	NA	NA	NA
B13	010603-GW1	10'	**22,000**	NA	NA	NA	NA	NA
B14	010603-GW2	10'	**220,000**	**1,800**	**6**	<5	<5	8
B15	010603-GW3	11'	**2,500**	NA	NA	NA	NA	NA
UST-3								
B1	112602-GW1	8'	**490,000**	NA	NA	NA	NA	NA
B21	010703-GW3	7'	<250	NA	NA	NA	NA	NA
B22	010703-GW4	8'	**170,000**	750	<5	<5	11	11
B23	010703-GW5	7'	330	NA	NA	NA	NA	NA
B24	010703-GW6	7'	**1,800**	NA	NA	NA	NA	NA
MTCA Method A Cleanup Level =			**500**	**1,000**	**5**	**1,000**	**700**	**1,000**

bgs = below ground surface
TPH = total petroleum hydrocarbons
mg/kg = milligrams per kilogram (or parts per million (ppm))
ug/l = micrograms per liter (or parts per billion (ppb))
UST = underground storage tank
B1 = GeoProbe soil boring identification
S1 = soil sample collected below UST prior to decommissioning in-place
Bold = concentration above the above MTCA Mehtod A Cleanup Level
MTCA = State of Washington Department of Ecology Model Toxics Control Act
NA = not analyzed

Clayton GROUP SERVICES

TABLE 3. SOIL PAH LABORATORY RESULTS SUMMARY.
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Soil Sampling Results

Boring Location	Sample ID	Sample Depth (feet bgs)	Naphthalene (mg/kg)	Acenaphthylene (mg/kg)	Acenaphthene (mg/kg)	Fluorene (mg/kg)	Phenanthrene (mg/kg)
UST-1							
B5	112602-S5	9-12'	0.12	<0.05	0.22	0.57	1.5
S1	032803-S1	13-13.5'	0.11	<0.005	0.038	0.085	0.12
UST-2							
B9	112602-S9	9-12'	<0.05	<0.05	0.14	0.31	0.75
S2	032803-S2	5.5-6'	<0.005	<0.005	<0.005	<0.005	<0.005
UST-3							
B2	112602-S2	6-9'	12	<0.5	1.5	3.5	7.3
S3	032803-S3	6.5-7'	19	<0.5	2.1	5.1	11
MTCA Method A Cleanup Level =			**5**	**-**	-	-	-
CLARC Method B Cleanup Level =			**1,600**	**-**	**4,800**	**3,200**	**-**
CLARC Method C Cleanup Level =			**70,000**	**-**	**210,000**	**140,000**	**-**

Boring Location	Sample ID	Sample Depth (feet bgs)	Anthracene (mg/kg)	Fluoranthene (mg/kg)	Pyrene (mg/kg)	Chrysene (carcinogenic) (mg/kg)	Other Carcinogenic PAHs (mg/kg)
UST-1							
B5	112602-S5	9-12'	<0.05	0.051	0.21	<0.05	<0.05
S1	032803-S1	13-13.5'	<0.005	0.006	0.011	<0.005	<0.005
UST-2							
B9	112602-S9	9-12'	<0.05	<0.05	<0.05	<0.05	<0.05
S2	032803-S2	5.5-6'	<0.005	<0.005	<0.005	<0.005	<0.005
UST-3							
B1	112602-S2	6-9'	<0.5	<0.5	0.54	<0.5	<0.5
S3	032803-S3	6.5-7'	<0.5	0.19	1.1	<0.5	<0.5
MTCA Method A Cleanup Level =			**-**	**-**	**-**	**0.1**	**0.1**
CLARC Method B Cleanup Level =			**24,000**	**3,200**	**2,400**	**0.137**	**0.137**
CLARC Method C Cleanup Level =			**1,050,000**	**140,000**	**105,000**	**18**	**18**

bgs = below ground surface
PAH = poly-nuclear aromatic hydrocarbons
mg/kg = milligrams per kilogram
UST = underground storage tank
B1 = GeoProble soil boring identification (11.26.02)
S1 = soil sample collected from below UST prior to decommissioning in-place
Bold = concentration above established Cleanup Level
MTCA = State of Washington Department of Ecology Model Toxics Control Act
CLARC = Cleanup Levels and Risk Calculations (Publication No. 94-145, November 2001)
Method B = direct contact (ingestion only) - unrestricted land use
Method C = direct contact (ingestion only) - industrial land use

Clayton GROUP SERVICES

TABLE 4. GROUNDWATER PAH LABORATORY RESULTS SUMMARY.
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Groundwater Sampling Results

Boring Location	Sample ID	Sample Depth (feet bgs)	Naphthalene (ug/l)	Acenaphthylene (ug/l)	Acenaphthene (ug/l)	Fluorene (ug/l)	Phenanthrene (ug/l)
UST-1 B19	010703-GW1	9'	<0.1	<0.1	<0.1	<0.1	0.3
UST-2 B14	010603-GW2	10'	21	<1	46	140	220
UST-3 B22	010703-GW4	8'	23	<1	32	88	120
MTCA Method A Cleanup Level =			**160**	**-**	**-**	**-**	**-**
CLARC Method B Cleanup Level =			**160**	**-**	**960**	**640**	**-**
CLARC Method C Cleanup Level =			**350**	**-**	**2,100**	**1,400**	**-**

Boring Location	Sample ID	Sample Depth (feet bgs)	Fluoranthene (ug/l)	Pyrene (ug/l)	Benz(a) anthracene (ug/l)	Chrysene (carcinogenic) (ug/l)	Other Carcinogenic PAHs (ug/l)
UST-1 B19	010703-GW1	9'	<0.1	<0.1	<0.1	<0.1	<0.1
UST-2 B14	010603-GW2	10'	5	23	**3**	**5**	<1
UST-3 B22	010703-GW4	8'	8	11	**1**	**2**	<1
MTCA Method A Cleanup Level =			**-**	**-**	**0.1**	**0.1**	**0.1**
CLARC Method B Cleanup Level =			**640**	**480**	**0.012**	**0.012**	**0.012**
CLARC Method C Cleanup Level =			**1,400**	**1,050**	**0.12**	**0.12**	**0.12**

bgs = below ground surface
PAH = poly-nuclear aromatic hydrocarbons
ug/l = micrograms per liter
UST = underground storage tank
B19 = GeoProble soil boring identification (01.07.02)
Bold = concentration above established Cleanup Level
MTCA = State of Washington Department of Ecology Model Toxics Control Act
CLARC = Cleanup Levels and Risk Calculations (Publication No. 94-145, November 2001)
Method B = potable groundwater (Publication No. 94-145, November 2001)
Method C = potable groundwater (Publication No. 94-145, November 2001)

Clayton
GROUP SERVICES

ATTACHMENT C

ESTIMATED COSTS SPREADSHEET

Clayton Group Services

REMEDIATION ALTERNATIVES COST ESTIMATING SPREADSHEET
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Alternative 1 - Air Sparging (AS) with Soil Vapor Extraction (SVE)

	4 Years	7 Years
Clayton Labor		
Project Management (general management and report review)	$ 3,200	$ 5,600
Fieldwork/Project Coordination		
(log installation of 10 MWs)	$ 3,000	$ 4,000
(initial groundwater sampling/surveying)	$ 1,200	$ 1,200
(log installation of 6 AS and 9 SVE wells)	$ 3,000	$ 4,000
(remediation system startup/troubleshooting)	$ 2,400	$ 3,000
Operation & Maintenance/Monitoring		
(monthly system check, MW gauging, air sampling - 3 hr/mo @ $75)	$ 10,800	$ 18,900
(quarterly groundwater sampling - 12 hr/qtr @ $75)	$ 14,400	$ 25,200
Reporting (quarterly summary reports - 8 hr/qtr @ $75)	$ 9,600	$ 16,800
Expenses (mileage, bailers, sampling supplies, etc.)	$ 3,200	$ 5,600
Subcontractors		
Drilling		
(install 10 monitoring wells)	$ 26,000	$ 30,000
(install 6 air sparge and 9 vapor extraction wells)	$ 26,000	$ 30,000
(abandon 6 AS, 9 SVE, 10 MWs and 1 RW)	$ 7,500	$ 9,000
Utility Locating (drilling and trenching)	$ 800	$ 1,200
Installation of Piping (trenches) to connect remediation system(s) to wells	$ 20,000	$ 30,000
Drum Disposal (soil cuttings, spent carbon and groundwater)	$ 32,000	$ 52,000
Ecology VCP Review (2 hr/qtr @ $100)	$ 3,200	$ 5,600
Equipment		
Treatment Compound(s) to house equipment, + piping, valves, gauges, etc.	$ 12,000	$ 16,000
Blowers (two for air sparging, two for vapor extraction)	$ 8,000	$ 12,000
Carbon Drums (for vapor treatment)	$ 12,000	$ 24,000
Remediation equipment and treatment compound removal	$ 4,000	$ 6,000
Electricity (~$400/mo)	$ 19,200	$ 33,600
Laboratory		
Soil and Groundwater from MWs (TPH-Dx, BTEX, PAHs, EPH, VPH)	$ 10,000	$ 10,000
Air (monthly) - TPH-Dx, BTEX and PAHs ($250)	$ 12,000	$ 21,000
Groundwater (quarterly) TPH-Dx, BTEX and PAHs ($2500)	$ 40,000	$ 70,000
Alternative 1 Totals =	**$ 283,500**	**$ 434,700**

REMEDIATION ALTERNATIVES COST ESTIMATING SPREADSHEET (Continued)
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Alternative 2 - Groundwater Pump and Treat with SVE

	4 Years	7 years
Clayton Labor		
Project Management (general management and report review)	$ 3,200	$ 5,600
Fieldwork/Project Coordination		
(log installation of 10 MWs)	$ 3,000	$ 4,000
(initial groundwater sampling/surveying)	$ 1,200	$ 1,200
(log installation of 3 GW Recovery and 9 SVE wells)	$ 3,000	$ 4,000
(remediation system startup/troubleshooting)	$ 2,400	$ 3,000
Operation & Maintenance/Monitoring		
(monthly check, MW gauging, air/water sampling - 4 hr/mo @ $75)	$ 14,400	$ 25,200
(quarterly groundwater sampling - 12 hr/qtr @ $75)	$ 14,400	$ 25,200
Reporting (quarterly summary reports - 8 hr/qtr @ $75)	$ 9,600	$ 16,800
Expenses (mileage, bailers, sampling supplies, etc.)	$ 3,200	$ 5,600
Subcontractors		
Drilling		
(install 10 monitoring wells)	$ 26,000	$ 30,000
(install 3 GW recovery wells and 9 vapor extraction wells)	$ 20,000	$ 24,000
(abandon 4 RWs, 9 SVE and 10 MWs)	$ 8,000	$ 10,000
Utility Locating (drilling and trenching)	$ 800	$ 1,200
Installation of Piping (trenches) to connect system to wells	$ 20,000	$ 30,000
Drum Disposal (soil cuttings and spent carbon)	$ 20,000	$ 40,000
Groundwater Disposal (sanitary sewer)	$ 24,000	$ 42,000
Ecology VCP Review (2 hr/qtr @ $100)	$ 3,200	$ 5,600
Equipment		
Treatment Compound(s) to house equipment, + piping, valves, gauges, etc.	$ 12,000	$ 16,000
Blowers (one for groundwater treatment, two for vapor extraction)	$ 6,000	$ 10,000
Groundwater Pumps and Treatment Unit (air stripper)	$ 9,000	$ 12,000
Carbon Drums (for vapor treatment)	$ 12,000	$ 24,000
Remediation equipment and treatment compound removal	$ 4,000	$ 6,000
Electricity (~$600/mo)	$ 28,800	$ 50,400
Laboratory		
Soil and Groundwater from MWs (TPH-Dx, BTEX, PAHs, EPH, VPH)	$ 10,000	$ 10,000
Air Discharge (monthly) - TPH-Dx, BTEX and PAHs ($250)	$ 12,000	$ 21,000
Groundwater Discharge (monthly) - TPH-Dx, BTEX and PAHs ($250)	$ 12,000	$ 21,000
Groundwater (quarterly) TPH-Dx, BTEX and PAHs ($2500)	$ 40,000	$ 70,000
Alternative 2 Totals =	**$ 322,200**	**$ 513,800**

Clayton Group Services

REMEDIATION ALTERNATIVES COST ESTIMATING SPREADSHEET (Continued)
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Alternative 3 - Dual Phase Groundwater and Soil Vapor Extraction

	4 Years	7 years
Clayton Labor		
Project Management (general management and report review)	$ 3,200	$ 5,600
Fieldwork/Project Coordination		
(log installation of 10 MWs)	$ 3,000	$ 4,000
(initial groundwater sampling/surveying)	$ 1,200	$ 1,200
(log installation of 9 Dual Phase SVE wells)	$ 3,000	$ 4,000
(remediation system startup/troubleshooting)	$ 2,400	$ 3,000
Operation & Maintenance/Monitoring		
(monthly check, MW gauging, air/water sampling - 4 hr/mo @ $75)	$ 14,400	$ 25,200
(quarterly groundwater sampling - 12 hr/qtr @ $75)	$ 14,400	$ 25,200
Reporting (quarterly summary reports - 8 hr/qtr @ $75)	$ 9,600	$ 16,800
Expenses (mileage, bailers, sampling supplies, etc.)	$ 3,200	$ 5,600
Subcontractors		
Drilling		
(install 10 monitoring wells)	$ 26,000	$ 30,000
(install dual phase groundwater and soil vapor extraction wells)	$ 24,000	$ 30,000
(abandon 9 GW/SVE wells, 10 MWs and 1 RW)	$ 8,000	$ 10,000
Utility Locating (drilling and trenching)	$ 800	$ 1,200
Installation of Piping (trenches) to connect system to wells	$ 20,000	$ 30,000
Drum Disposal (soil cuttings and spent carbon)	$ 20,000	$ 40,000
Groundwater Disposal (sanitary sewer)	$ 24,000	$ 42,000
Ecology VCP Review (2 hr/qtr @ $100)	$ 3,200	$ 5,600
Equipment		
Treatment Compound(s) to house equipment, + piping, valves, gauges, etc.	$ 12,000	$ 16,000
Blowers (one for GW treatment, two for GW & vapor extraction)	$ 8,000	$ 12,000
Groundwater Treatment Unit (air stripper)	$ 6,000	$ 8,000
Carbon Drums (for vapor treatment)	$ 12,000	$ 24,000
Remediation equipment and treatment compound removal	$ 4,000	$ 6,000
Electricity (~$800/mo)	$ 38,400	$ 67,200
Laboratory		
Soil and Groundwater from MWs (TPH-Dx, BTEX, PAHs, EPH, VPH)	$ 10,000	$ 10,000
Air Discharge (monthly) - TPH-Dx, BTEX and PAHs ($250)	$ 12,000	$ 21,000
Groundwater Discharge (monthly) - TPH-Dx, BTEX and PAHs ($250)	$ 12,000	$ 21,000
Groundwater (quarterly) TPH-Dx, BTEX and PAHs ($2500)	$ 40,000	$ 70,000
Alternative 3 Totals =	**$ 334,800**	**$ 534,600**

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REMEDIATION ALTERNATIVES COST ESTIMATING SPREADSHEET (Continued)
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Alternative 4 - OxyVac Chemical Injection/Oxidation and SVE

	1 Years	3 years
Clayton Labor		
Project Management (general management and report review)	$ 800	$ 2,400
Fieldwork/Project Coordination		
(log installation of 10 MWs)	$ 3,000	$ 4,000
(initial groundwater sampling/surveying)	$ 1,200	$ 1,200
(log installation of 9 Injection and 9 SVE wells)	$ 8,000	$ 8,000
(remediation system startup/troubleshooting)	$ 2,400	$ 3,000
Operation & Maintenance/Monitoring		
(monthly check, MW gauging, air sampling - 4 hr/mo @ $75)	$ 3,600	$ 10,800
(quarterly groundwater sampling - 12 hr/qtr @ $75)	$ 3,600	$ 10,800
Reporting (quarterly summary reports - 8 hr/qtr @ $75)	$ 2,400	$ 7,200
Expenses (mileage, bailers, sampling supplies, etc.)	$ 800	$ 2,400
Subcontractors		
Drilling		
(install 10 monitoring wells)	$ 26,000	$ 30,000
(install 9 Injection and 9 SVE wells)	$ 42,000	$ 42,000
(abandon 9 Injection and 9 SVE wells, 10 MWs and 1 RW)	$ 12,000	$ 14,000
Utility Locating (drilling and trenching)	$ 1,200	$ 1,400
Installation of Piping (trenches) to connect system to wells	$ 30,000	$ 30,000
Drum Disposal (soil cuttings and spent carbon)	$ 30,000	$ 40,000
Ecology VCP Review (2 hr/qtr @ $100)	$ 800	$ 2,400
Equipment		
Treatment Compound(s) to house equipment, + piping, valves, gauges, etc.	$ 16,000	$ 16,000
Blowers/Pumps (two for vapor extraction/two for chemical injection)	$ 12,000	$ 12,000
Chemical Oxidant (to be injected)	$ 60,000	$ 40,000
Carbon Drums (for vapor treatment)	$ 24,000	$ 24,000
Remediation equipment and treatment compound removal	$ 6,000	$ 6,000
Electricity (~$400/mo)	$ 4,800	$ 14,400
Laboratory		
Soil and Groundwater from MWs (TPH-Dx, BTEX, PAHs, EPH, VPH)	$ 10,000	$ 10,000
Air Discharge (monthly) - TPH-Dx, BTEX and PAHs ($250)	$ 3,000	$ 9,000
Groundwater (quarterly) TPH-Dx, BTEX and PAHs ($2500)	$ 10,000	$ 30,000
Alternative 4 Totals =	**$ 313,600**	**$ 371,000**

REMEDIATION ALTERNATIVES COST ESTIMATING SPREADSHEET (Continued)
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Alternative 5 - In-Situ Soil and Groundwater Treatment Using ORC

	4 Years	7 years
Clayton Labor		
Project Management (general management and report review)	Not Feasible	
Fieldwork/Project Coordination		
(log installation of 10 MWs)	Not Feasible	
(initial groundwater sampling/surveying)	Not Feasible	
(supervise injection of ORC)	Not Feasible	
(semi-annual groundwater sampling - 12 hr/event @ $75)	Not Feasible	
Reporting (semi-annual summary reports - 8 hr/event @ $75)	Not Feasible	
Expenses (mileage, bailers, sampling supplies, etc.)	Not Feasible	
Subcontractors		
Drilling		
(install 10 monitoring wells)	Not Feasible	
(injection of ORC into subsurface)	Not Feasible	
(abandon 10 MWs and 1 RW)	Not Feasible	
Utility Locating (MWs and injections)	Not Feasible	
Drum Disposal (soil cuttings and groundwater)	Not Feasible	
Monitoring Equipment Rental	Not Feasible	
Ecology VCP Review (2 hr/event @ $100)	Not Feasible	
Materials		
ORC	Not Feasible	
Laboratory		
Soil and Groundwater from MWs (TPH-Dx, BTEX, PAHs, EPH, VPH)	Not Feasible	
Groundwater (semi-annual) TPH-Dx, BTEX, and PAHs ($2500)	Not Feasible	
Field Redox Parameters (ORP, pH, DO, Fe, BOD, COD) ($2600)	Not Feasible	
Alternative 5 Totals =	**NOT FEASIBLE**	

Clayton Group Services

REMEDIATION ALTERNATIVES COST ESTIMATING SPREADSHEET (Continued)
Industrial Properties, Inc. - 2450 Sixth Avenue South, Seattle, Washington

Alternative 6 - Monitored Natural Attenuation

	40 Years	60 years
Clayton Labor		
Project Management (general management and report review)	$ 8,000	$ 12,000
Fieldwork/Project Coordination		
(log installation of 10 MWs)	$ 3,000	$ 4,000
(initial groundwater sampling)	$ 1,200	$ 1,200
(annual groundwater sampling - 12 hr/event @ $75)	$ 36,000	$ 54,000
Reporting (annual summary reports - 8 hr/event @ $75)	$ 24,000	$ 36,000
Expenses (mileage, bailers, sampling supplies, etc.)	$ 6,000	$ 9,000
Subcontractors		
Drilling		
(install 10 monitoring wells)	$ 26,000	$ 30,000
(abandon 10 MWs and 1 RW)	$ 4,000	$ 6,000
Utility Locating (MWs)	$ 400	$ 600
Drum Disposal (soil cuttings and groundwater)	$ 32,000	$ 47,000
Monitoring Equipment Rental	$ 8,000	$ 12,000
Ecology VCP Review (2 hr/event @ $100)	$ 8,000	$ 12,000
Laboratory		
Soil and Groundwater from MWs (TPH-Dx, BTEX, PAHs, EPH, VPH)	$ 10,000	$ 10,000
Groundwater (annual) TPH-G, BTEX, TPH-Dx and PAHs ($250)	$ 100,000	$ 150,000
Field Redox Parameters (ORP, pH, DO, Fe, BOD, COD) ($260)	$ 50,000	$ 75,000
Alternative 6 Totals =	**$ 316,600**	**$ 458,800**