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Department of Ecology

***Technical Memorandum 06
Fourth Quarterly Groundwater
Monitoring, Northwest Wire
Rope and Equipment, Inc.
Tacoma, Washington***

July 1993

***Northwest Wire Rope and Equipment, Inc.
Mr. Ron Kline, President
2301 Lincoln Avenue
Tacoma, Washington 98401***



SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

400 N. 34th St. ■ Suite 100
P.O. Box 300303
Seattle, Washington 98103
206 ■ 632 ■ 8020

July 2, 1993

Mr. Ron Kline, President
Northwest Wire Rope and Equipment, Inc.
2301 Lincoln Avenue, P.O. Box 1806
Tacoma, Washington 98401

**RE: TECHNICAL MEMORANDUM 06 : FOURTH QUARTERLY
GROUNDWATER SAMPLING ACTIVITIES FOR NORTHWEST WIRE ROPE
AND EQUIPMENT, INC. LOCATED AT 2301 LINCOLN AVENUE,
TACOMA, WASHINGTON**

Dear Mr. Kline:

Shannon & Wilson, Inc.'s (S&W) report, Technical Memorandum 06, presents fourth quarterly groundwater monitoring activities performed on June 18, 1993 at the above-referenced site.

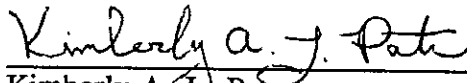
As stated in S&W's August 5, 1992 letter, please submit a copy of this fourth quarterly report to the Tacoma-Pierce County Health Department as addressed below:

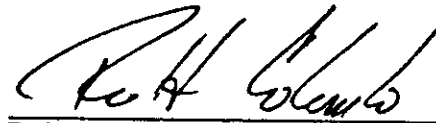
Tacoma-Pierce County Health Department
Attn: Cynthia Wanless, R.S.
Waste Management Section
Environmental Health Division
3629 South D Street
Tacoma, Washington 98408-6897

If you have any questions or comments, please contact us at (206) 632-8020.

Respectfully,

SHANNON & WILSON, INC.


Kimberly A. L. Pate
Engineer


Robert Colombo
Associate

KLP:RC/klp

Enclosures: Technical Memorandum 06

T1336-03.TM6/T1336-lkd/ect

T-1336-03

TECHNICAL MEMORANDUM 06
FOURTH QUARTERLY GROUNDWATER MONITORING
AT 2301 LINCOLN AVENUE, TACOMA, WASHINGTON

EXECUTIVE SUMMARY

Shannon & Wilson, Inc. has completed the fourth of four groundwater sampling activities for Northwest Wire Rope and Equipment, Inc. This work is being performed at the direction of Mr. John Hildenbrand (former project manager) and Ms. Cynthia Wanless (current project manager) of the Tacoma-Pierce County Health Department (TPCHD) as stated in their department letters dated June 12, 1992 and April 21, 1993; respectively.

Analytical results for benzene, toluene, ethylbenzene, total xylene, and total lead concentrations in the three monitoring wells (MW001, MW002, and MW003) were below the state of Washington's Model Toxics Control Act (MTCA) Method "A" regulatory levels (2/91) as presented in Table 1 entitled, "Fourth Quarterly Groundwater Samples : Analyses and Results." Total petroleum hydrocarbons (as) gasoline (WTPH-G) concentrations occurred at an elevated level of 1400 ppb (duplicate at 1800 ppb) in MW001 compared to the MTCA regulatory level of 1000 ppb (1.0 ppm). MW002 and MW003 were in compliance with the regulatory level for WTPH-G concentrations.

This executive summary is a limited synopsis of our own study and should only be used in conjunction with the full report. The submittal of this fourth quarterly groundwater sampling report fulfills our current contract agreement.

As stated in Ms. Cynthia Wanless' letter dated April 21, 1993; if necessary, the need for further investigation or groundwater remediation will be addressed by the TPCHD after submittal of this fourth quarterly monitoring report.

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TECHNICAL MEMORANDUM 06
FOURTH QUARTERLY GROUNDWATER MONITORING
AT 2301 LINCOLN AVENUE, TACOMA, WASHINGTON

1.0 INTRODUCTION

Shannon & Wilson, Inc. has completed the fourth of four groundwater sampling activities for Northwest Wire Rope and Equipment, Inc. This work is being performed at the direction of Mr. John Hildenbrand (former project manager) and Ms. Cynthia Wanless (current project manager) of the Tacoma-Pierce County Health Department (TPCHD) as stated in their department letters dated June 12, 1992 and April 21, 1993, respectively.

2.0 AUTHORIZATION

Shannon & Wilson, Inc. performed this work in accordance with the contract dated August 5, 1992 and authorized by Mr. Ron Kline, owner of Northwest Wire Rope and Equipment, Inc. on August 6, 1992. The submittal of this report fulfills the above-referenced contract.

3.0 SITE LOCATION

The facility is located at 2301 Lincoln Avenue, Tacoma, Washington. The geographical location of the property is illustrated in Figure 1 entitled "Vicinity Map." A U.S. Oil Company storage facility borders this property to the east and other industrial businesses exist in the surrounding area.

4.0 GROUNDWATER SAMPLING ACTIVITIES

4.1 Groundwater Quality Assessment

The fourth groundwater sampling event occurred on June 18, 1993 to characterize groundwater samples for benzene, toluene, ethylbenzene, total xylenes (BTE&X), total petroleum hydrocarbons (as) gasoline (WTPH-G), and total lead concentrations in compliance with the Model Toxics Control Act (MTCA) Method "A" (2/91) regulatory levels.

Groundwater results quantified by Alden Analytical Laboratories, Inc. (Alden) of Seattle, Washington determined benzene, ethylbenzene, toluene, total xylene, and total lead concen-

trations in the three monitoring wells (MW001, -002, and -003) within MTCA regulatory levels as listed in Table 1 entitled "Fourth Quarterly Groundwater Samples: Analyses and Results." Laboratory analytical results reported by Alden are in Appendix B entitled "Laboratory Analytical Documentation."

WTPH-G concentrations occurred at an elevated level of 1400 parts per billion (ppb) in MW001 (MW001's duplicate concentration was 1800 ppb) in comparison to the MTCA regulatory level of 1000 ppb. Groundwater sample concentrations in MW002 and MW003 were below the MTCA regulatory level and/or method reporting limit for WTPH-G.

4.2 Groundwater Elevations

Depth to the groundwater ranged from approximately seven and one-half to nine feet from the top of the well casing. Techniques and equipment utilized to obtain groundwater elevation measurements are contained in the Standard Operating Procedures (SOPs) in Appendix A. Groundwater measurement and elevation contours are listed in Table 3 entitled "Static Groundwater Elevation Measurements" and delineated in Figure 3 as groundwater elevation contours. In addition, Table 4 contains a summary of the four quarterly groundwater elevation measurements.

4.3 Data Interpretation

Groundwater data and associated petroleum compounds reported in Table 1 and Table 2 entitled "Summary of Quarterly Groundwater Samples: Analyses and Results" have been geostatistically contoured utilizing the GOLDEN software package SURFER^R as generally described in Appendix A's SOPs. Total petroleum hydrocarbons (as) gasoline are contoured in Figure 4. Since the analytical results for benzene, toluene, ethylbenzene, total xylene, and total lead were below the regulatory levels in MW001, -002, and -003, these concentrations were not contoured with SURFER^R. Caution should be exercised when interpreting these figures due to the limited amount of data used in their construction.

Groundwater flow was inferred to be in a north to northwesterly direction at the time of measurement. However, the flow is dependant on tidal mechanisms and therefore, the limited data available may not be fully representative of the actual conditions throughout the year.

5.0 SUMMARY

The four groundwater sample results were below MTCA regulatory concentrations for benzene, toluene, ethylbenzene, total xylene, and total lead in the three monitoring wells located on site. WTPH-G concentrations occurred at an elevated level of 1400 ppb in MW001 compared to the MTCA regulatory level of 1000 ppb. As stated in Ms. Cynthia Wanless's letter dated April 21, 1993; if necessary, the need for further investigation or groundwater remediation will be addressed by the TPCHD after submittal of this fourth quarterly monitoring report.

6.0 CLOSURE

The findings we have presented within this technical memorandum are based on limited research at the facility. They should not be construed as a definite statement regarding reported conditions. Shannon & Wilson, Inc. performed this work phase within our best judgement to adequately describe site conditions at the facility.


The data presented in this technical memorandum should be considered representative at the time of our observations. Changes in the conditions of the property can occur with time from both natural processes and human activities. In addition, changes in governmental codes, regulations, or law may occur. Due to such changes, our observations and recommendations applicable to this facility may need to be revised wholly or in part, due to changes beyond our control.

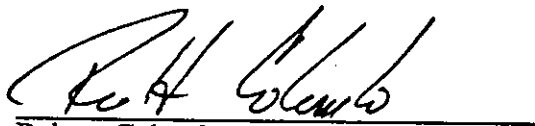
S&W has prepared the attachment in Appendix C, "Important Information About Your Subsurface Waste Management (Remediation) Report", to assist you in understanding the use and limitations of our reports.

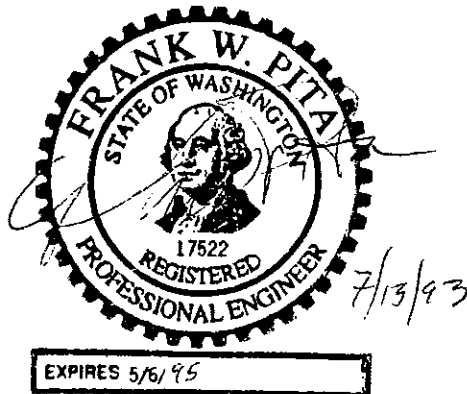
SHANNON & WILSON, INC.

This technical memorandum was prepared for the exclusive use of Mr. Ron Kline in the study of their facility in Tacoma, Washington, and in no way guarantees that an agency or its staff will reach the same conclusions as Shannon & Wilson, Inc.

SHANNON & WILSON, INC.


Kimberly A. L. Pate
Engineer


Robert Colombo
Associate



Frank W. Pita, P.E., P.G.
Vice President
Environmental Services

KLP:RC:FWP/eet

Table 1. Fourth Quarterly Groundwater Samples : Analyses and Results (1)

Northwest Wire Rope and Equipment, Inc. - Tacoma, Washington

Date Sampled : June 18, 1993

Sample Identification	WTPH-G (ppb), (2)	BTE&X				Total Lead (EPA 7421) (ppm), (3)
		Benzene (ppb)	Ethylbenzene (ppb)	Toluene (ppb)	Xylenes (ppb)	
NWR-MW001-037-GW-0	1400	< 1	< 1	< 1	9.1	< 0.002
NWR-MW001-038-GW-1, (4)	1800	< 1	< 1	< 1	8.5	< 0.002
NWR-MW002-035-GW-0	< 250	< 1	< 1	< 1	< 1	0.004
NWR-MW003-036-GW-0	330	< 1	< 1	< 1	< 1	< 0.002
NWR-TB004-039-WA-4, (5)	NA	< 1	< 1	< 1	< 1	NA
Cleanup Levels for Groundwater (6)	1000	5.0	30.0	40.0	20.0	0.005

(1) As reported by Alden Analytical Laboratories, Inc.

(2) Parts per billion, ppb.

(3) Parts per million, ppm.

(4) Duplicate of sample labeled "NWR-MW001-037-GW-0."

(5) QA/QC Trip Blank.

(6) Washington Model Toxics Control Act (MTCA), Method A, February 1991.

< = Below method reporting limit.

NA = Not Applicable.

Table 2. Summary of Quarterly Groundwater Samples : Analyses and Results (1)
First, Second, Third, and Fourth Quarterly Groundwater Sampling Events
Northwest Wire Rope and Equipment, Inc. - Tacoma, Washington

Sample Identification	Quarter Sampled (7),(8),(9),(10)	WTPH-G (ppb), (2)	BTE&X			Total Lead (ppm), (3)
			Benzene (ppb)	Ethylbenzene (ppb)	Toluene (ppb)	
NWR-MW001-021-GW-0	1st	<100	<1	<1	<1	0.022
NWR-MW001-022-GW-2, (4)	1st	<200	<2	<2	<2	0.041
NWR-MW001-026-GW-0	2nd	1800	1.1	2.0	<1.0	0.023
NWR-MW001-027-GW-1, (4)	2nd	1700	1.3	2.3	<1.0	0.028
NWR-MW01-032-GW-0	3rd	4200	1.3	1.0	<1	0.003
NWR-MW01-033-GW-1, (4)	3rd	4200	1.3	<1	<1	0.003
NWR-MW001-037-GW-0	4th	1400	<1	<1	<1	<0.002
NWR-MW001-038-GW-1, (4)	4th	1800	<1	<1	<1	<0.002
NWR-MW002-019-GW-0	1st	<100	<1	<1	<1	<0.005
NWR-MW002-024-GW-0	2nd	<250	<1.0	<1.0	<1.0	0.012
NWR-MW002-030-GW-0	3rd	<250	<1	<1	<1	0.006
NWR-MW002-035-GW-0	4th	<250	<1	<1	<1	0.004
NWR-MW003-020-GW-0	1st	400	1	<1	<1	<0.005
NWR-MW003-025-GW-0	2nd	740	1.3	1.4	<1.0	0.008
NWR-MW03-031-GW-0	3rd	1100	1.7	<1	<1	0.003
NWR-MW003-036-GW-0	4th	330	<1	<1	<1	<0.002
NWR-TB001-023-WA-4, (5)	1st	NA	<1	<1	<1	NA
NWR-TB002-027-GW-0, (5)	2nd	NA	<1.0	<1.0	<1.0	NA
NWR-TB003-034-WA-4, (5)	3rd	NA	<1	<1	<1	NA
NWR-TB004-039-WA-4, (5)	4th	NA	<1	<1	<1	NA
Cleanup Levels for Groundwater (6)		1000	5.0	30.0	40.0	0.005

Notes:

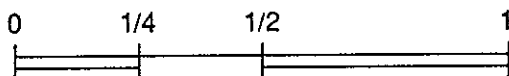
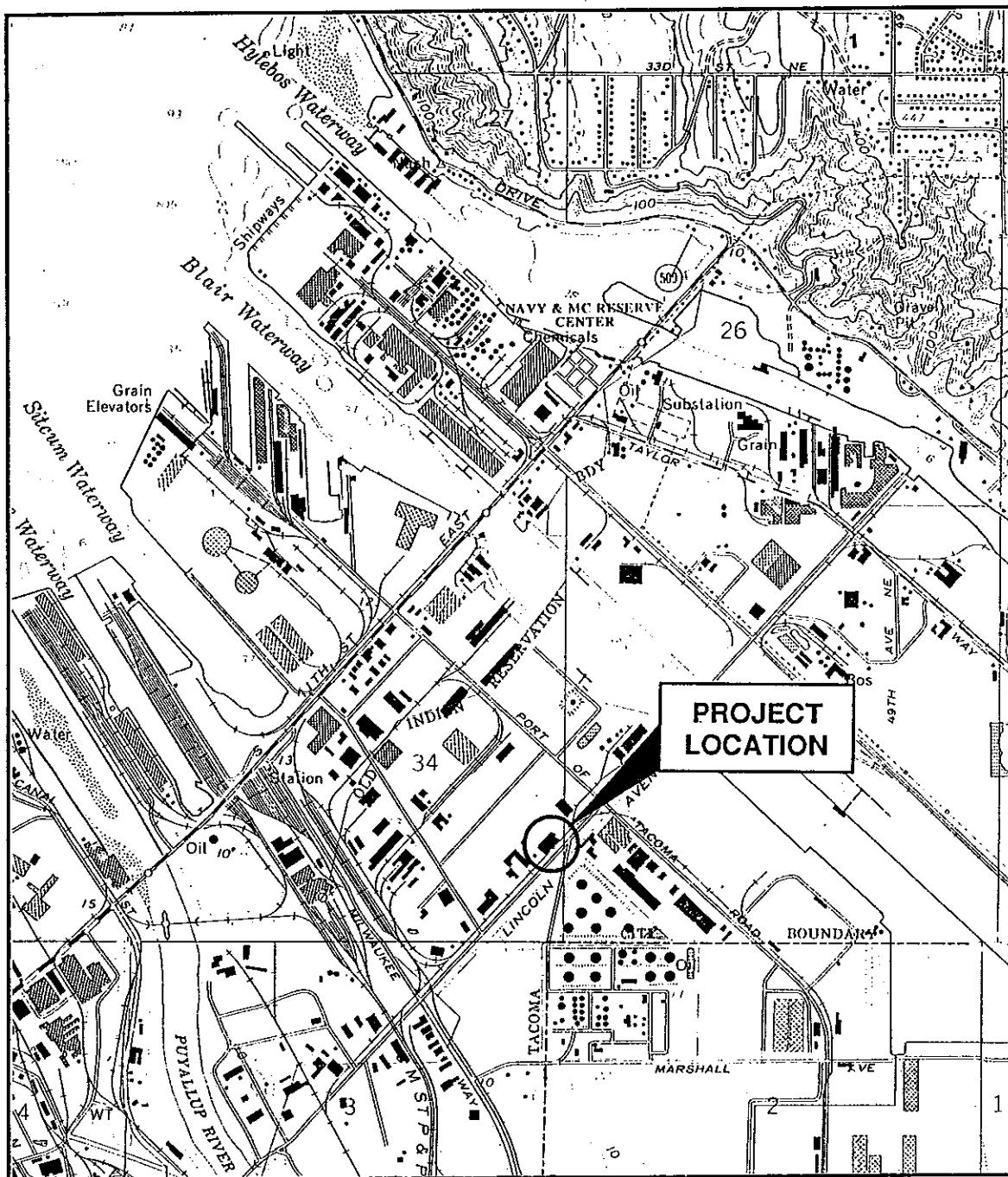
- (1) As reported by Alden Analytical Laboratories, Inc. and Friedman and Bruya, Inc.
 - (2) Parts per billion, ppb.
 - (3) Parts per million, ppm.
 - (4) Duplicate of previously listed sample.
 - (5) QA/QC Trip Blank.
 - (6) Washington Model Toxics Control Act (MTCA), Method A, February 1991
 - (7) First Quarterly Groundwater Sampling Event on September 18, 1992.
 - (8) Second Quarterly Groundwater Sampling Event on December 18, 1992.
 - (9) Third Quarterly Groundwater Sampling Event on March 18, 1993.
 - (10) Fourth Quarterly Groundwater Sampling Event on June 18, 1993.
- < = Below reporting limit.
NA = Not Applicable

Table 3. Static Groundwater Elevation Measurements
 Northwest Wire Rope and Equipment, Inc. - Tacoma, Washington
 Date of Measurements : June 18, 1993

Location	Depth to Water (Feet), (1)	Well Elevation, (2) Top of Casing (Feet)	Groundwater Elevation (Feet)
MW001	8.86	100.00	91.14
MW002	7.68	99.44	91.76
MW003	8.63	100.28	91.65
Notes: (1) Depth measured from north axis of well casing. (2) Measured relative to an established benchmark of 100.00 feet.			

Table 4. Summary of Static Groundwater Elevation Measurements
Northwest Wire Rope and Equipment, Inc. - Tacoma, Washington
Date of Measurements : 9/18/92, 1/18/93, 3/18/93, 6/18/93

Location	Depth to Water (Feet), (1)	Well Elevation, (2) Top of Casing (Feet)	Groundwater Elevation (Feet)	Date Measured
MW001	9.88	100.00	90.12	9/18/92
	8.79	100.00	91.21	1/18/93
	8.51	100.00	91.49	3/18/93
	8.86	100.00	91.14	6/18/93
MW002	8.96	99.44	90.48	9/18/92
	7.88	99.44	91.56	1/18/93
	7.61	99.44	91.83	3/18/93
	7.68	99.44	91.76	6/18/93
MW003	9.81	100.28	90.47	9/18/92
	8.84	100.28	91.44	1/18/93
	8.08	100.28	92.20	3/18/93
	8.63	100.28	91.65	6/18/93
Notes: (1) Depth measured from north axis of well casing. (2) Measured relative to an established benchmark of 100.00 feet.				



Scale in Miles

NOTE

Map adapted from USGS topographic map of Tacoma North, WA. quadrangle, dated 1981.

Northwest Wire Rope & Equipment, Inc.
Tacoma, Washington

VICINITY MAP

July 1993

T-1336-03

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1

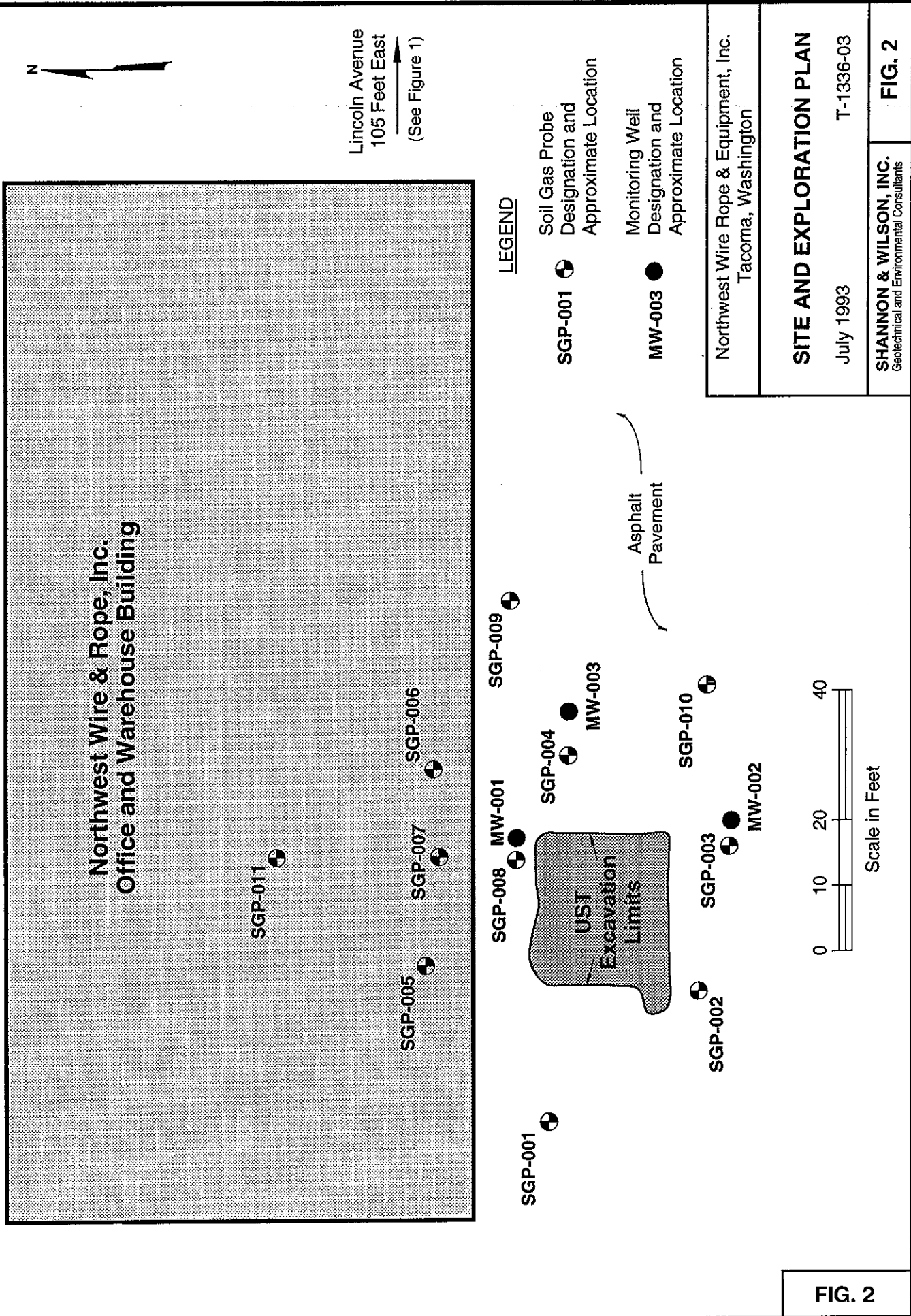
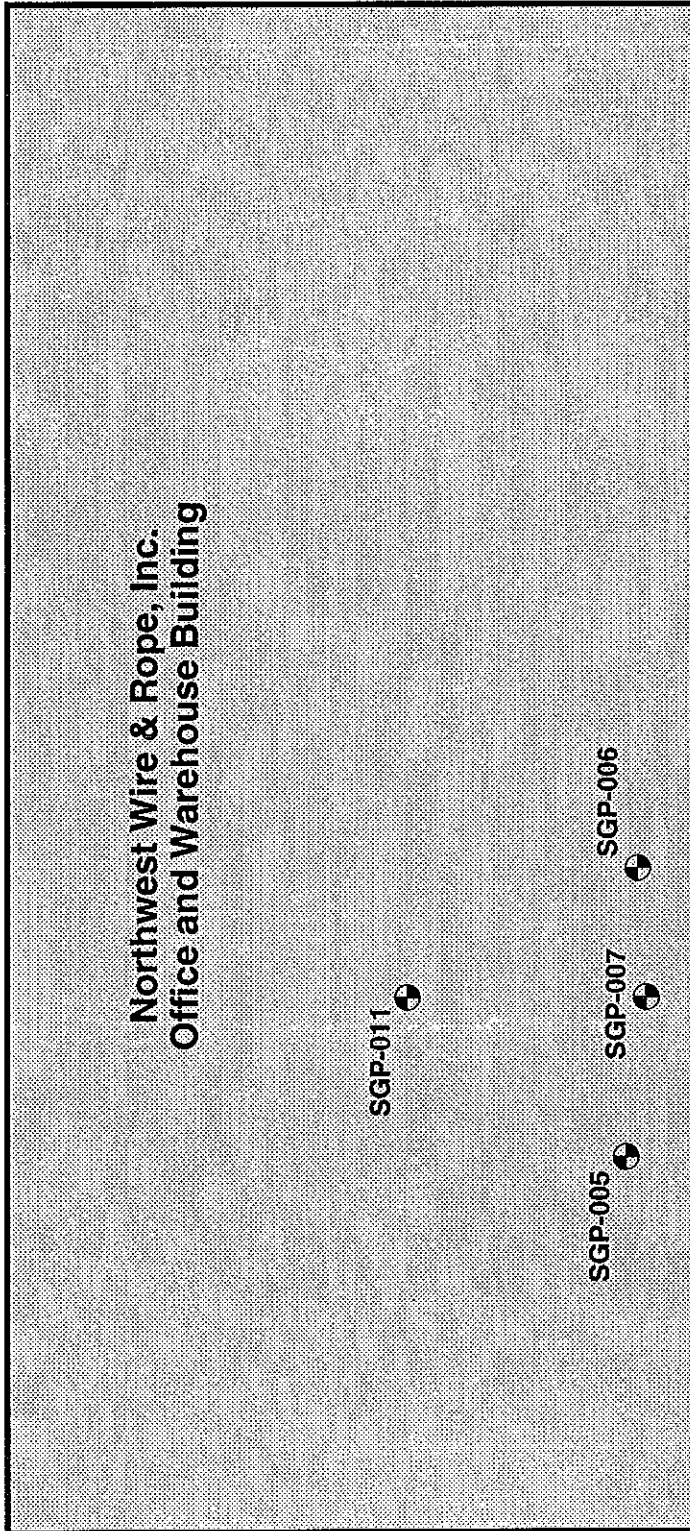


FIG. 2

Northwest Wire & Rope, Inc. Office and Warehouse Building



Lincoln Avenue
105 Feet East
→
(See Figure 1)



LEGEND

- SGP-001 ● Soil Gas Probe Designation and Approximate Location
- MW-003 ● Monitoring Well Designation and Approximate Location
- 91.6 Contour Interval = 0.2 Feet

Northwest Wire Rope & Equipment, Inc.
Tacoma, Washington

GROUNDWATER ELEVATION CONTOURS

July 1993 T-1336-03

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3

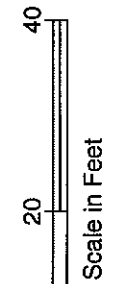
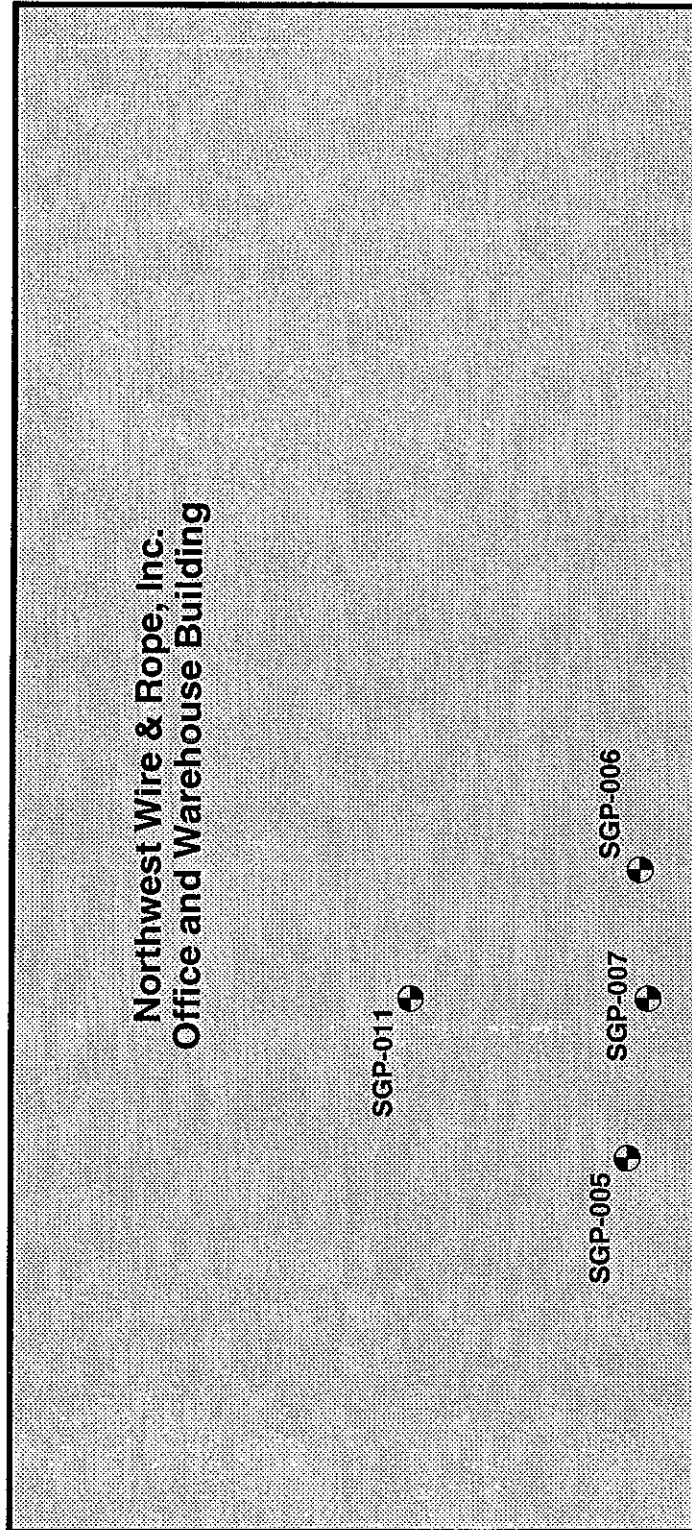


FIG. 3

Northwest Wire & Rope, Inc. Office and Warehouse Building



Lincoln Avenue
105 Feet East
(See Figure 1)



LEGEND

- SGP-001 ● Soil Gas Probe Designation and Approximate Location
- MW-003 ● Monitoring Well Designation and Approximate Location
- 0.1 Contour Interval = 0.5 ppm

Northwest Wire Rope & Equipment, Inc.
Tacoma, Washington

**TOTAL PETROLEUM
HYDROCARBONS (AS)
GASOLINE CONTOURS (PPM)**

July 1993 T-1336-03

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 4

FIG. 4

APPENDIX A

STANDARD OPERATING PROCEDURES (SOPs)

APPENDIX A

STANDARD OPERATING PROCEDURES (SOPs)

A.1 Groundwater Elevation/Sampling

Groundwater elevation is determined using an MMC Oil/Water interface detector. The MMC is aligned with the north axis mark on top of the well casing which serves as the measurement reference point. Prior to each measurement, the MMC detection probe housing is decontaminated using an Alconox solution and thoroughly rinsed with distilled water. Groundwater elevation is determined in each well prior to sampling.

At least three well volumes of groundwater are withdrawn (purged) from each well prior to sampling. Groundwater samples are collected using new VOSS® Technologies single check valve disposable bailers, and placed into sample glassware supplied by the project laboratory.

A.2 Geostatistical Modeling/Surfer

Randomly spaced data, such as groundwater elevations or apparent product thickness measurements are geostatistically contoured with SURFER®, a Golden Software computer program. This approach to statistically contoured data provides for a mathematical "best and reasonable" fit of the available data and does not afford for an "artistic" manipulation of the data set.

The development of a regularly spaced grid, or net, of data points from irregularly spaced data is the basis for producing contour plots, like those presented in this document. Several methods are available for estimating the areas where incomplete information exists, the most accurate of these methods for sparse data sets and the method employed by Shannon & Wilson, is Kriging.

Geostatistical estimation is a powerful technique for site assessment, and may provide insight not otherwise attainable. Kriging techniques are limited by the quality of the known input data, and contour maps should be cautiously evaluated with this limitation in mind.

APPENDIX B

LABORATORY ANALYTICAL DOCUMENTATION
(Includes Chain-of-Custody Forms)



Alden Analytical
Laboratories, Inc.

June 29, 1993

Shannon & Wilson
Attn: Kim Pate
P.O. Box 300303
Seattle, WA 98103

RE: ALDEN PROJECT NUMBER 9306044/1
(SHANNON & WILSON PROJECT NUMBER T1336-03)


Dear Kim:

Enclosed are the analytical results for the water samples submitted to Alden Labs June 18, 1993. The samples were analyzed for TPH using Method WTPH-G, BTEX using Method 8240, and Total Lead using Method 7421.

All samples met Alden's internal QA/QC criteria.

It is Alden's policy to dispose of all samples and extracts after the expiration of their hold time unless notified otherwise. If you have any questions, please do not hesitate to call me at the number below.

Sincerely,



John A. Weakland
Project Manager

Enclosures



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: N/A
Date of Sample Receipt: N/A
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/21/93

Alden Project Number: 9306044/1
Alden Sample Number: Blank
Analysis Method: WTPH-G
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Total Petroleum Hydrocarbons	N/A	250	< RL

<i>Surrogates</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
Trifluorotoluene	85	50 - 150
Bromofluorobenzene	91	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0002



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: NWR-MW002-035-GW-0
Date of Sample Receipt: 06/18/93
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/21/93

Alden Project Number: 9306044/1
Alden Sample Number: 4122
Analysis Method: WTPH-G
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Total Petroleum Hydrocarbons	N/A	250	< RL

<i>Surrogates</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
Trifluorotoluene	74	50 - 150
Bromofluorobenzene	78	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: Duplicate
Date of Sample Receipt: 06/18/93
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/21/93

Alden Project Number: 9306044/1
Alden Sample Number: 4122 Dup
Analysis Method: WTPH-G
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Total Petroleum Hydrocarbons	N/A	250	< RL

<i>Surrogates</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
Trifluorotoluene	71	50 - 150
Bromofluorobenzene	76	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0004



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: NWR-MW003-036-GW-0
Date of Sample Receipt: 06/18/93
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/21/93

Alden Project Number: 9306044/1
Alden Sample Number: 4123
Analysis Method: WTPH-G
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Total Petroleum Hydrocarbons	N/A	250	330

<i>Surrogates</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
Trifluorotoluene	73	50 - 150
Bromofluorobenzene	79	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0005



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: NWR-MW001-037-GW-0
Date of Sample Receipt: 06/18/93
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/21/93

Alden Project Number: 9306044/1
Alden Sample Number: 4124
Analysis Method: WTPH-G
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Total Petroleum Hydrocarbons	N/A	250	1400

<i>Surrogates</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
Trifluorotoluene	63	50 - 150
Bromofluorobenzene	74	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0006



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: NWR-MW001-038-GW-1
Date of Sample Receipt: 06/18/93
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/21/93

Alden Project Number: 9306044/1
Alden Sample Number: 4125
Analysis Method: WTPH-G
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Total Petroleum Hydrocarbons	N/A	250	1800

<i>Surrogates</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
Trifluorotoluene	72	50 - 150
Bromofluorobenzene	83	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0007



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: N/A
Date of Sample Receipt: N/A
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/22/93

Alden Project Number: 9306044/1
Alden Sample Number: BLANK1
Analysis Method: EPA 624
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	100	76-114
d8-Toluene	250 ng	100	88-110
Bromofluorobenzene	250 ng	102	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0008



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: N/A
Date of Sample Receipt: N/A
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/23/93

Alden Project Number: 9306044/1
Alden Sample Number: BLANK2
Analysis Method: EPA 624
Matrix: Water
Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	98	70-121
d8-Toluene	250 ng	100	81-117
Bromofluorobenzene	250 ng	97	74-121

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0009



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Volatiles Matrix Spike/Matrix Spike Duplicate Recoveries

Client: Shannon & Wilson
Client Sample Number: N/A
Date of Sample Receipt: N/A
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/18/93

Alden Project Number: 9306044/1
Alden Sample Number: 4089
Analysis Method: EPA 624
Matrix: Water
Reporting Units: ug/L

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS % Rec.	QC Limits Rec.
1,1-Dichloroethene	50	0	55.20	110	61 - 145
Trichloroethene	50	0	57.45	115	71 - 120
Benzene	50	0	54.10	108	76 - 127
Toluene	50	0	50.45	101	76 - 125
Chlorobenzene	50	0	48.65	97	75 - 130

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD % Rec.	% RPD	QC Limits	
					RPD	REC.
1,1-Dichloroethene	50	51.53	103	6.9	14	61 - 145
Trichloroethene	50	53.28	107	7.5	14	71 - 120
Benzene	50	50.60	101	6.7	11	76 - 127
Toluene	50	51.99	104	3.0	13	76 - 125
Chlorobenzene	50	51.42	103	5.5	13	75 - 130

0010



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon & Wilson</i>	<i>Alden Project Number: 9306044/1</i>
<i>Client Sample Number: NWR-MW002-035-GW-0</i>	<i>Alden Sample Number: 4122</i>
<i>Date of Sample Receipt: 06/18/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 06/22/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	102	76-114
d8-Toluene	250 ng	95	88-110
Bromofluorobenzene	250 ng	99	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0011



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson

Client Sample Number: NWR-MW003-036-GW-0

Date of Sample Receipt: 06/18/93

Date of Sample Extraction: N/A

Date of Sample Analysis: 06/22/93

Alden Project Number: 9306044/1

Alden Sample Number: 4123

Analysis Method: EPA 624

Matrix: Water

Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	103	76-114
d8-Toluene	250 ng	105	88-110
Bromofluorobenzene	250 ng	109	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson

Client Sample Number: NWR-MW001-037-GW-0

Date of Sample Receipt: 06/18/93

Date of Sample Extraction: N/A

Date of Sample Analysis: 06/23/93

Alden Project Number: 9306044/1

Alden Sample Number: 4124

Analysis Method: EPA 624

Matrix: Water

Reporting Units: ug/L

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	9.1
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	106	70-121
d8-Toluene	250 ng	94	81-117
Bromofluorobenzene	250 ng	96	74-121

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0013



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon & Wilson</i>	<i>Alden Project Number: 9306044/1</i>
<i>Client Sample Number: NWR-MW001-038-GW-1</i>	<i>Alden Sample Number: 4125</i>
<i>Date of Sample Receipt: 06/18/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 06/23/93</i>	<i>Reporting Units: ug/L</i>

Compound Name	CAS No.	Reporting Limits(RL)	Reporting Results
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	8.5
o-Xylene	1330-20-7	1	<RL

Surrogates	Amount Added	Percent Recovery	Recovery Limits
d4-1,2-Dichloroethane	250 ng	101	70-121
d8-Toluene	250 ng	97	81-117
Bromofluorobenzene	250 ng	100	74-121

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon & Wilson</i>	<i>Alden Project Number: 9306044/1</i>
<i>Client Sample Number: NWR-TB004-039-WA-1</i>	<i>Alden Sample Number: 4126</i>
<i>Date of Sample Receipt: 06/18/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 06/23/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	104	70-121
d8-Toluene	250 ng	98	81-117
Bromofluorobenzene	250 ng	97	74-121

** m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson
Client Sample Number: See Below
Date of Sample Receipt: 06/18/93
Matrix: Water

Alden Project Number: 9306044/1
Alden Sample Number: See Below
Analysis Method: EPA 7421
Reporting Units: mg/L

<i>Client Sample ID</i>	<i>Alden Sample Number</i>	<i>Digestion Date</i>	<i>Analysis Date</i>	<i>Reporting Limit</i>	<i>Total Lead</i>
N/A	Blank	6/24/93	6/24/93	0.002	< RL
NWR-MW002-035-GW-0	4122	6/24/93	6/24/93	0.002	0.004
NWR-MW003-036-GW-0	4123	6/24/93	6/24/93	0.002	< RL
NWR-MW001-037-GW-0	4124	6/24/93	6/24/93	0.002	< RL
NWR-MW001-038-GW-1	4125	6/24/93	6/24/93	0.002	< RL

Note: Results are reported to two significant figures.



Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Metals Blank Spike/Matrix Spike Recoveries

Client: Shannon & Wilson

Client Sample Number: N/A

Date of Sample Receipt: N/A

Date of Sample Digestion: 06/24/93

Date of Sample Analysis: 06/24/93

Alden Project Number: 9306044/1

Alden Sample Number: 4088

Analysis Method: EPA 7421

Matrix: Water

Reporting Units: mg/L

<i>Compound</i>	<i>Spike Added (mg/L)</i>	<i>Blank Spike Concentration (mg/L)</i>	<i>Blank Spike % Rec.</i>	<i>QC Limits Rec.</i>
Lead	1.00	0.99	99	50 - 135

<i>Compound</i>	<i>Duplicate Concentration (mg/L)</i>	<i>% RPD</i>	<i>Spike Added (mg/L)</i>	<i>Matrix Spike Concentration (mg/L)</i>	<i>Matrix Spike % Recovery</i>	<i>QC Limits</i>	
						<i>RPD</i>	<i>REC.</i>
Lead	< RL	0	1.00	0.93	93	20	50 - 135

0017



Date: 6/18/93

Page 1 of 1

Company/Address SFW

Fax:

816

Sample ID #

Matrix

WMP- MW002-035-644-0

MM003-036.6W-0

9-M5-750-100MW

MW001-038.GW-1

✓ TB004 - 039.WA-1

Date Time

Date Time:

Please note that samples received after 3PM are considered received **SAM** the following business day.

Analyses Requested

5-HILL
STIX 8240
TOMAL LEAD

TAT

4122 A-E

4123 A-E

4124 A-E

9-12611

4126

Remarks

100

10

1000

1000

1

Special Instructions/Comments:

TAT Codes

A Standard

C 48 hr

B 24hr

D 72hr

F Other:

Shannon & Wilson, Inc.

400 N. 34th Street, Suite 100 11500 Olive Blvd., Suite 276
Seattle, WA 98103 St. Louis, MO 63141
(206) 632-8020 (314) 872-8170

2055 Hill Road
Fairbanks, AK 99707
(907) 479-0600

5430 Fairbanks Street, Suite 3
Anchorage, AK 99518
(907) 561-2120

Chain of Custody Record:

Page 1 of 1
Laboratory Alden
Attn: J.W.

Analysis Parameters/Sample Container Description (include preservative if used)

(include preservative if used)

[illegible]

Project Information		Sample Receipt	
Project Number:	T 13310-03	Total Number of Containers	21
Project Name:	N.W.R	COC Seals/Intact?	Y/N/A
Contact:	KIM FERTZKE	Received Good Cond./Cold	Y
Ongoing Project?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Delivery Method:	HAND
Sampler:	T. FORKER	(attach shipping bill, if any)	
Instructions			
Requested Turn Around Time:	NORMAL		
Special Instructions:	FAY Deliminary		
Distribution: White - w/shipment - returned to Shannon & Wilson w/ Laboratory report Yellow - w/shipment - for consignee files Pink - Shannon & Wilson - Job File			

Relinquished By: 1.		Relinquished By: 2.		Relinquished By: 3.	
Signature:	Time: 1547	Signature:	Time:	Signature:	Time:
Printed Name:	Date: 6/11/92	Printed Name:	Date:	Printed Name:	Date:
Company:	Shannon & Wilson	Company:		Company:	
Received By: 1.		Received By: 2.		Received By: 3.	
Signature:	Time: 1400	Signature:	Time:	Signature:	Time:
Printed Name:	Date: 6/11/92	Printed Name:	Date:	Printed Name:	Date:
Company:	David Barmeister	Company:		Company:	

Distribution: White - w/shipment - returned to Shannon & Wilson w/ Laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - Job File

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR SUBSURFACE WASTE MANAGEMENT
(REMEDIATION) REPORT



Important Information About Your Geotechnical Engineering/ Subsurface Waste Management (Remediation) Report

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS.

Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer/geoscientist.

AN ENGINEERING REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical engineering/subsurface waste management (remediation) report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, have the consulting engineer(s)/scientist(s) evaluate how any factors which change subsequent to the date of the report, may affect the recommendations. Unless your consulting geotechnical/civil engineer and/or scientist indicates otherwise, your report should not be used: 1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); 2) when the size, elevation, or configuration of the proposed project is altered; 3) when the location or orientation of the proposed project is modified; 4) when there is a change of ownership; or 5) for application to an adjacent site. Geotechnical/civil engineers and/or scientists cannot accept responsibility for problems which may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural changes or human influence. Because a geotechnical/waste management engineering report is based on conditions which existed at the time of subsurface exploration, construction decisions should not be based on an engineering report whose adequacy may have been affected by time. Ask the geotechnical/waste management consultant to advise if additional tests are desirable before construction starts. For example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/waste management report. The geotechnical/civil engineer and/or scientist should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST GEOTECHNICAL RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help minimize their impact. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your geotechnical engineer's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Because actual

subsurface conditions can be discerned only during earthwork, you should retain your geotechnical engineer to observe actual conditions and to finalize conclusions. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE GEOTECHNICAL ENGINEERING/SUBSURFACE WASTE MANAGEMENT (REMEDIATION) REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical engineering/subsurface management (remediation) report. To help avoid these problems, the geotechnical/civil engineer and/or scientist should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological and waste management findings and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE ENGINEERING/WASTE MANAGEMENT REPORT.

Final boring logs developed by the geotechnical/civil engineer and/or scientist are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical engineering/waste management reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To minimize the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/waste management report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical engineering/subsurface waste management (remediation) is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical/waste management consultants. To help prevent this problem, geotechnical/civil engineers and/or scientists have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the engineer's or scientist's liabilities to other parties; rather, they are definitive clauses which identify where the engineer's or scientist's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your engineer/scientist will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland