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Development of Model Toxics Control Act Cleanup Standards for the Former Chevron Bulk Storage Facility in Pullman, Washington

Prepared for

Chevron U.S.A. Products Company
San Ramon, California

April 1993

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ENVIRONMENTAL SERVICES
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Prepared for

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
BTEX	benzene, toluene, ethylbenzene, and xylenes
Chevron	Chevron U.S.A.
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
LOAEL	lowest-observed-adverse-effect level
MTCA	Model Toxics Control Act
OSWER	Office of Solid Waste and Emergency Response
PAH	polycyclic aromatic hydrocarbon
RME	reasonable maximum exposure
TEC	toxic equivalent concentration
TEF	toxicity equivalence factor
TPH	total petroleum hydrocarbons
TPH-D	TPH, diesel fraction
TPH-G	TPH, gasoline fraction
WAC	Washington Administrative Code
WSU	Washington State University

1. INTRODUCTION

This document describes the development of site-specific cleanup standards for a site located at 815 East College Street in Pullman, Washington, which was operated by Chevron U.S.A. (Chevron) as a bulk storage facility until approximately 1981. In 1981, Chevron donated the property to Washington State University (WSU), who currently uses the site to store excess coal and incinerated coal ash associated with the coal power plant located adjacent to the site. While conducting a geotechnical assessment for replacement of the existing State Highway 270 bridge in August 1991, Washington State Department of Transportation personnel discovered soil and groundwater containing petroleum hydrocarbons in the southern portion of the site, within the bridge project right-of-way. Soil and groundwater samples were collected from this area and from the northern portion of the site during subsequent site investigations undertaken by RZA-AGRA, Inc. (RZA-AGRA 1993a,b). These data were used in developing cleanup standards following the requirements of Washington State's Model Toxics Control Act (MTCA).

To ensure that site soil and groundwater will meet MTCA requirements for protection of public health and the environment, soil and groundwater cleanup standards were developed using MTCA Method B, the Washington Department of Ecology's (Ecology) standard procedure for establishing cleanup standards for sites being evaluated under MTCA. Method B requires a comprehensive review of several categories of potential cleanup standards including 1) federal and state standards regulating chemical concentrations in environmental media; 2) risk-based concentrations for environmental media derived using protective estimates of potential site exposures; and 3) concentrations designed to protect against cross-media contamination (e.g., groundwater concentrations that are protective of surface water). In applying Method B, site-specific characteristics and conditions, as well as chemical-specific environmental mobility and toxicity information, were evaluated. For each substance found at this site, the most stringent of the potential cleanup standards was chosen as the proposed cleanup goal for the site. In determining the appropriate approach for site cleanup, factors in addition to proposed numerical cleanup goals (e.g., potential aesthetic concerns) were also considered.

2. DEVELOPMENT OF CLEANUP STANDARDS

MTCA provides three methods for developing cleanup standards: Method A (routine method), Method B (standard method), and Method C (conditional method). Each method includes a different process for developing cleanup standards. As stated in Washington Administrative Code (WAC) 173-340-705, Method B is the standard method intended for use at all sites and "shall be used to develop cleanup levels unless one or more of the conditions for using Method A or Method C are demonstrated to exist and the person conducting the cleanup elects to utilize that method." MTCA Method B was selected for use at this site.

In developing cleanup standards for the Pullman site under Method B, the following types of potential cleanup standards were considered:

- Applicable state and federal laws (applicable or relevant and appropriate requirements [ARARs])
- Risk-based concentrations
- Concentrations in soil and groundwater that are protective of surface water.

Relevant values from these categories were collected or developed for each substance detected at the site, as described below. The most stringent of these values for each substance was then compiled into the list of proposed cleanup standards presented in Table 1. This table also provides the basis for each standard. Potential concerns for aesthetic qualities of groundwater and surface water were also considered in developing these standards, as required by MTCA.

As will be discussed below, available site information indicates that it is unlikely that site groundwater could be used as a drinking water supply. Thus, cleanup standards based on such uses of groundwater are not appropriate for this site. Instead, cleanup standards for groundwater are based on protection of surface water quality.

2.1 SUMMARY OF FIELD INVESTIGATIONS

In applying MTCA Method B, cleanup standards have been developed for each of the individual substances detected at the site for which necessary data (e.g., ARARs or toxicity information) were available. The list of substances identified in site groundwater and soil samples was derived from data collected during field investigations conducted in March and December 1992 and February 1993. These data are summarized in

TABLE 1. PROPOSED CLEANUP STANDARDS FOR THE PULLMAN SITE

Substance	Cleanup Standard at Point of Compliance[a]	Basis for Standard
Groundwater (point of compliance—river)	mg/L	
Benzene	0.005	SWP (ARAR)
Ethylbenzene	0.03	SWP (ARAR)
Toluene	0.04	SWP (ARAR)
Xylenes	0.02	SWP (ARAR)
Naphthalene	0.03	SWP (ADJ RBC)
Lead	0.0032	SWP (ARAR)
Soil (point of compliance—onsite)	mg/kg	
Benzene	35	ADJ RBC
Ethylbenzene	960	ADJ RBC
Toluene	1,900	ADJ RBC
Xylenes	8,000	ADJ RBC
Acenaphthene	580	ADJ RBC
Anthracene	12,000	ADJ RBC
Benzo[a]pyrene-TEC[b] 0.1 [illegible]	0.6	BKGD
Fluoranthene	380	ADJ RBC
Fluorene	800	ADJ RBC
Naphthalene	140	ADJ RBC
Phenanthrene	NA	--
Pyrene	290	ADJ RBC
Lead	500	OSWER

Note:		
	--	not applicable
	ADJ RBC	RBC standard adjusted to account for multiple exposures
	ARAR	standard based on applicable or relevant and appropriate requirement
	BKGD	standard based on background concentrations in rural areas
	NA	not available due to the lack of ARARs and toxicity factors for this substance
	OSWER	standard based on directive from the U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response as adopted by Washington Department of Ecology
	RBC	standard based on risk-based concentration
	SWP	standard based on surface water protection (basis for target surface water concentration in parentheses)
	TEC	toxic equivalent concentration

[a] Because shallow groundwater is not a current or potential future source of drinking water, the point of compliance is the point(s) where groundwater flows into the south fork of the Palouse River.

[b] The benzo[a]pyrene-TEC cleanup standard applies to the sum of the benzo[a]pyrene-TECs (calculated as described in Section 2.4) for all carcinogenic PAH compounds at the site (i.e., benz[a]anthracene and chrysene).

Tables 2, 3, and 4 and are presented in more detail in RZA-AGRA (1993a,b). The March 1992 field investigation focused on the southern portion of the site within the highway right-of-way for the bridge expansion project. During the December 1992 field investigation, environmental media were sampled in both the northern and southern portions of the site. In February 1993, additional sampling was conducted in the southern portion and in two downgradient offsite monitoring wells. These investigations focused on petroleum-related substances (including total petroleum hydrocarbons [TPH]; benzene, toluene, ethylbenzene, and xylenes [BTEX]; polycyclic aromatic hydrocarbon [PAH] compounds; and lead) and provide data that best reflect the current geographic distribution of petroleum-related substances at the Pullman site.

As noted above, the southern portion of the site, as defined by the proposed bridge width and fill embankment boundary (see Figure 1), is the highway right-of-way for the bridge expansion project. Soil currently in the southern portion of the site will be covered either by the highway bridge supports or fill soil when the bridge expansion project is completed, essentially preventing the potential for direct contact with the soil in this area. Currently, the northern portion of the site is predominantly unpaved and will likely continue to be used as a storage area for the WSU coal power plant. Site data are presented for the site as a whole, as well as separately for each of these two areas.

During the March and December 1992 and February 1993 investigations, a total of 35 soil samples were collected from 24 locations and analyzed for petroleum-related substances. In addition, 18 groundwater samples collected from 12 monitoring wells were analyzed for petroleum-related substances. The location of the soil boreholes and monitoring wells installed during these investigations, as well as other sampling locations, are shown in Figure 1. Significant findings of these investigations are summarized below.

Significant findings of investigations of the entire site are as follows:

- Samples from 14 of the 23 soil sample locations contained one or more components of BTEX. Benzene was detected in 10 of the locations at concentrations ranging from 0.006 to 25 mg/kg. Soil samples from offsite locations MW-4, MW-7, MW-11, and MW-12 had no detectable levels of BTEX.
- Benzene was detected in 7 of 12 monitoring wells at concentrations ranging from 0.169 to 7.2 mg/L. No BTEX components were detected in wells MW-3, MW-4, MW-5, MW-11, and MW-12.
- PAH compounds were detected in 4 of the 13 soil samples analyzed for these compounds (i.e., MW-9, CB-1, CB-3, and CB-5). Several noncarcinogenic PAH compounds and two carcinogenic PAH compounds (i.e., benz[a]anthracene and chrysene) were detected in the soil sample from Borehole CB-5. Detected concentrations of benz[a]anthracene and chrysene were 0.014 and 0.052 mg/kg, respectively. Naphthalene was detected in four of the soil samples at a maximum concentration of

TABLE 2. DATA SUMMARY FOR THE PULLMAN SITE

Substance	Groundwater		Soil	
	Concentration (mg/L)	Locations with Detects/ Sampled Locations	Concentration (mg/kg)	Locations with Detects/ Sampled Locations
TPH				
TPH (418.1)[a]	<1–270 (<1)	7/12	<10–1,500 (400)	9/14
TPH-D (diesel)[b]	<0.3–200 (<1)	7/12	<10–3,200 (270)	13/18
TPH-G (gasoline)[c]	<0.05–66 (<3.9)	7/12	<1–15,000 (41)	11/16
BTEX[d]				
Benzene	<0.0005–7.2 (0.2)	7/12	<0.005–25 (<0.005)	10/23
Ethylbenzene	<0.0005–5.4 (0.17)	7/12	<0.005–360 (<0.005)	9/23
Toluene	<0.0005–1.5 (0.02)	7/12	<0.005–27 (<0.005)	9/23
Xylenes	<0.0005–16 (0.014)	6/12	<0.005–1,100 (0.079)	11/23
PAH Compounds[e]				
Acenaphthene	ND	0/7	<0.1–0.35	1/13
Anthracene	ND	0/7	<0.014–0.031	1/13
Benzo[a]pyrene-TEC[f]	ND	0/7	<0.0015–0.0019	1/13
Benzo[a]pyrene-TEC[g]	ND	0/7	<0.028–0.066	1/13
Benz[a]anthracene	ND	0/7	<0.014–0.014	1/13
Chrysene	ND	0/7	<0.014–0.052	1/13
Fluoranthene	ND	0/7	<0.025–2.3	1/13
Fluorene	ND	0/7	<0.027–0.6	1/13
Naphthalene	<0.005–0.24 (0.053)	6/7	<0.1–7.3 (<0.1)	4/13
Phenanthrene	ND	0/7	<0.014–1.1	1/13
Pyrene	ND	0/7	<0.014–0.12	1/13
Inorganic Compounds[h]				
Dissolved lead	<0.002–0.024 (0.0026)	6/10	NA	--
Total lead	0.022–2.5 (0.14)	10/10	<15–170 (20)	13/18

Note: Data collected during the March and December 1992 and February 1993 field investigations conducted and summarized by RZA-AGRA (1993).

Values in parentheses are median concentration values.

--	-	not applicable
BTEX	-	benzene, toluene, ethylbenzene, and xylenes
NA	-	not analyzed
ND	-	not detected
PAH	-	polycyclic aromatic hydrocarbon

TABLE 2. (cont.)

TEC	-	toxic equivalent concentration
TPH	-	total petroleum hydrocarbon

[a] TPH (418.1) - total recoverable petroleum hydrocarbons extracted and analyzed by WTPH-418.1 Modified.

[b] TPH-D (diesel) - diesel fraction of TPH compounds extracted and analyzed by WTPH-D (EPA Method 3550/8015 Modified [soils] and EPA Method 3510/8015 Modified [water]). Diesel not detected in sample locations MW-2 through MW-5 and B-8 when screened for in HCID-EPA 8015 Modified Method.

[c] TPH-G (gasoline) - gasoline fraction of TPH compounds extracted and analyzed by WTPH-G (EPA Method 5030/8015/8020). Gasoline not detected in sample locations MW-2 through MW-5 and B-7 through B-9 when screened for in HCID-EPA 8015 Modified Method.

[d] BTEX extracted and analyzed by EPA Method 8020 (soils)/602 (water).

[e] PAH compounds extracted and analyzed by EPA Method 3550/8310 (soils) and EPA Metod 3510/8310 (water).

[f] Total carcinogenic PAH concentrations (i.e., benz[a]anthracene and chrysene) were calculated using the benzo[a]pyrene toxic equivalent factor approach recently adopted by U.S. EPA Region 4 (U.S. EPA 1992b).

[g] Total carcinogenic PAH concentrations (i.e., benz[a]anthracene and chrysene) were calculated assuming that all EPA Class B2 carcinogenic PAH compounds are equal in carcinogenic potency to benzo[a]pyrene.

[h] Dissolved lead analyzed for by EPA Method 7421; total lead in soil analyzed for by EPA Method 7420.

TABLE 3. DATA SUMMARY FOR THE NORTHERN PORTION OF THE PULLMAN SITE

	Groundwater		Soil	
Substance	Concentration (mg/L)	Locations with Detects/ Sampled Locations	Concentration (mg/kg)	Locations with Detects/ Sampled Locations
TPH				
TPH (418.1)[a]	<1-270 (4.6)	6/9	<10-1,500 (230)	8/10
TPH-D (diesel)[b]	<0.3-200 (1.6)	6/9	<10-3,200 (320)	7/11
TPH-G (gasoline)[c]	<0.05-66 (2.2)	6/9	<1-15,000 (23)	8/10
BTEX[d]				
Benzene	<0.0005-7.2 (0.95)	6/9	<0.008-25 (<0.025)	5/12
Ethylbenzene	<0.0005-5.4 (0.36)	6/9	<0.008-360 (<0.008)	5/12
Toluene	<0.0005-1.5 (0.053)	6/9	<0.008-27 (0.008)	5/12
Xylenes	<0.0005-16 (0.16)	5/9	<0.015-1,100 (0.079)	7/12
PAH Compounds[e]				
Naphthalene	<0.005-0.24 (0.067)	5/6	<0.1-1.9 (<0.1)	3/9
Inorganic Compounds[f]				
Dissolved lead	<.002-0.024 (0.0026)	3/7	NA	6/10
Total lead	0.029-2.5 (0.17)	7/7	<15-170 (17)	

Note: Sample locations included in this data summary for the northern portion of the Pullman site are MW-2, MW-4, MW-6 through MW-12, CB-1 through CB-4, and DTS (see Figure 1).

Data collected during the March and December 1992 and February 1993 field investigations conducted and summarized by RZA-AGRA (1993).

Values in parentheses are median concentration values.

--	-	not applicable
BTEX	-	benzene, toluene, ethylbenzene, and xylenes
NA	-	not analyzed
PAH	-	polycyclic aromatic hydrocarbon
TPH	-	total petroleum hydrocarbon

[a] TPH (418.1) - total recoverable petroleum hydrocarbons extracted and analyzed by WTPH-418.1 Modified.

[b] TPH-D (diesel) - diesel fraction of TPH compounds extracted and analyzed by WTPH-D (EPA Method 3550/8015 Modified [soils] and EPA Method 3510/8015 Modified [water]). Diesel not detected in other sample locations when screened for in HCID-EPA 8015 Modified Method.

[c] TPH-G (gasoline) - gasoline fraction of TPH compounds extracted and analyzed by WTPH-G (EPA Method 5030/8015/8020). Gasoline not detected in other sample locations when screened for in HCID-EPA 8015 Modified Method).

[d] BTEX extracted and analyzed by EPA Method 8020 (soils)/602 (water).

[e] PAH compounds extracted and analyzed by EPA Method 3550/8310 (soils) and EPA Method 3510/8310 (water). No PAH compounds, except naphthalene, were detected in soil or groundwater samples.

[f] Dissolved lead analyzed for by EPA Method 7421; total lead in soil analyzed for by EPA Method 7420.

TABLE 4. DATA SUMMARY FOR THE SOUTHERN PORTION OF THE PULLMAN SITE

	Groundwater		Soil	
Substance	Concentration (mg/L)	Locations with Detects/ Sampled Locations	Concentration (mg/kg)	Locations with Detects/ Sampled Locations
TPH				
TPH (418.1)[a]	<1–50	1/3	<27–870	1/4
TPH-D (diesel)[b]	<1–15	1/3	<14–1,889 (428)	6/7
TPH-G (gasoline)[c]	<0.05–3.9	1/3	<7–2,400 (20)	3/6
BTEX[d]				
Benzene	<0.0005–0.20	1/3	<0.005–5.4 (<0.005)	5/11
Ethylbenzene	<0.0005–0.26	1/3	<0.005–9 (<0.005)	4/11
Toluene	<0.0005–0.015	1/3	<0.005–2.9 (<0.005)	4/11
Xylenes	<0.001–0.032	1/3	<0.005–21 (<0.005)	4/11
PAH Compounds[e]				
Acenaphthene	ND	0/1	<0.14–0.35	1/4
Anthracene	ND	0/1	<0.014–0.031	1/4
Benzo[a]pyrene-TEC[f]	ND	0/1	<0.0015–0.0019	1/4
Benzo[a]pyrene-TEC[g]	ND	0/1	<0.028–0.066	1/4
Benz[a]anthracene	ND	0/1	<0.014–0.014	1/4
Chrysene	ND	0/1	<0.014–0.052	1/4
Fluoranthene	ND	0/1	<0.027–2.3	1/4
Fluorene	ND	0/1	<0.027–0.6	1/4
Naphthalene	0.053	1/1	<0.14–7.3	1/4
Phenanthrene	ND	0/1	<0.014–1.1	1/4
Pyrene	ND	0/1	<0.014–0.12	1/4
Inorganic Compounds[h]				
Dissolved lead	<0.002–0.0042 (0.003)	3/3	NA	--
Total lead	0.022–0.081 (0.045)	3/3	15.3–52.7 (20)	7/8

Note: The southern parcel of the Pullman site includes sample locations MW-1, MW-3, MW-5, B-7 through B-9, TP-9, CB-5, CB-6, HA-1, and HA-2 (see Figure 1).

Data collected during the March and December 1992 and February 1993 field investigations conducted and summarized by RZA-AGRA (1993).

Values in parentheses are median concentration values.

--	not applicable
BTEX	benzene, toluene, ethylbenzene, and xylenes
NA	not analyzed
ND	not detected
PAH	polycyclic aromatic hydrocarbon
TEC	toxic equivalent concentration
TPH	total petroleum hydrocarbon

[a] TPH (418.1) - total recoverable petroleum hydrocarbons extracted and analyzed by WTPH-418.1 Modified.

[b] TPH-D (diesel) - diesel fraction of TPH compounds extracted and analyzed by WTPH-D (EPA Method 3550/8015 Modified [soils] and EPA Method 3510/8015 Modified [water]). Diesel not detected in other sample locations when screened for in HCID-EPA 8015 Modified Method.

[c] TPH-G (gasoline) - gasoline fraction of TPH compounds extracted and analyzed by WTPH-G (EPA Method 5030/8015/8020). Gasoline not detected in other sample locations when screened for in HCID-EPA 8015 Modified Method).

[d] BTEX extracted and analyzed by EPA Method 8020 (soils)/602 (water).

[e] PAH compounds extracted and analyzed by EPA Method 3550/8310 (soils) and EPA Method 3510/8310 (water). No PAH compounds, except naphthalene, were detected in soil or groundwater samples.

[f] Total carcinogenic PAH concentrations (i.e., benz[a]anthracene and chrysene) were calculated using the benzo[a]pyrene toxic equivalent factor approach recently adopted by U.S. EPA Region 4 (U.S. EPA 1992b).

[g] Total carcinogenic PAH concentrations (i.e., benz[a]anthracene and chrysene) were calculated assuming that all EPA Class B2 carcinogenic PAH compounds are equal in carcinogenic potency to benzo[a]pyrene.

[h] Dissolved lead analyzed for by EPA Method 7421; total lead in soil analyzed for by EPA Method 7420.

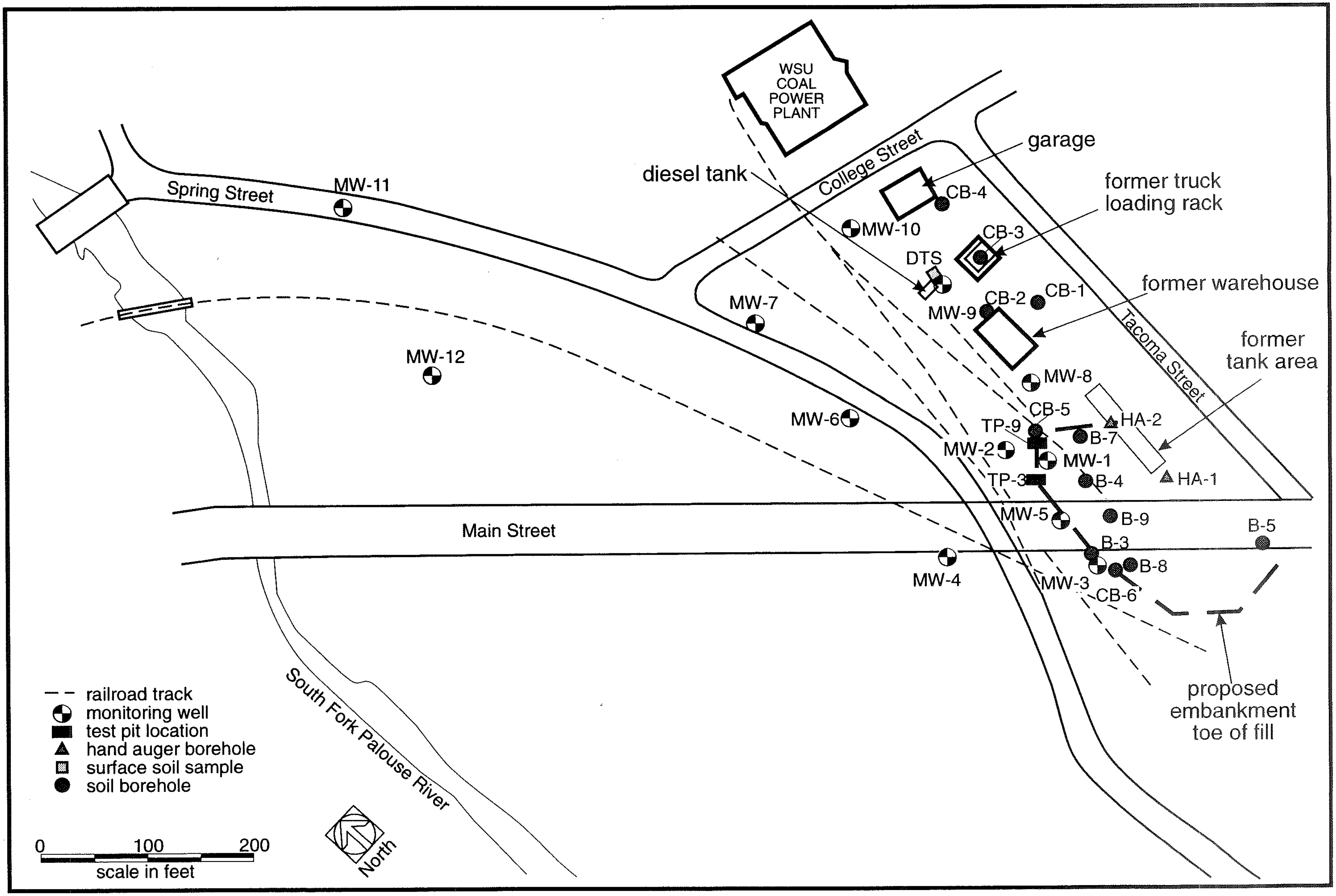

Figure 1. Site map of the former Chevron bulk storage facility and vicinity, Pullman, WA.

C139-09-01 0393

7.3 mg/kg. Of the PAH compounds analyzed for, only naphthalene was detected in groundwater at a maximum concentration of 0.24 mg/L. Detectable concentrations were reported in the same monitoring wells as the BTEX compounds were found (except MW-7).

- TPH, characterized as gasoline (TPH-G) or diesel (TPH-D) fractions, was detected in soil samples from 11 of 16 (TPH-G) or 13 of 18 (TPH-D) sample locations at concentrations ranging from 3.4 to 15,000 mg/kg for TPH-G and 18 to 3,200 mg/kg for TPH-D. Both fractions of TPH were detected in seven of the sampled monitoring wells at concentrations ranging up to 66 mg/L for TPH-G and 200 mg/L for TPH-D.
- Lead was detected in soil at concentrations ranging from 15.3 to 170 mg/kg. Dissolved and total lead in groundwater were detected at levels ranging from 0.0022 to 0.024 mg/L and 0.022 to 2.5 mg/L, respectively.

For the southern portion of the site (defined as the area that will be covered by fill during the bridge replacement project), the frequency of detection, as well as number of locations where detectable concentrations were found, was often proportionally less compared to the northern portion (defined as the area of the site north of the proposed fill area). Furthermore, detected concentrations were lower for most site-related compounds in the southern portion. Significant findings of the investigation for the southern portion of the site are as follows:

- With the exception of lead, detectable groundwater concentrations of site-related chemicals were found in only one of the three southern portion monitoring wells, MW-1, which is located in the northern-most area of the fill embankment boundary. Similarly, site-related chemicals in soil were predominantly found in the northern-most corner of the fill embankment boundary at MW-1, B-7, B-9, TP-9, CB-5, HA-1, and HA-2.
- BTEX compounds were detected in the southern portion at concentrations generally 1–2 orders of magnitude less than those found in the northern portion. Benzene levels were several times less in the southern portion than in the northern portion of the site, while ethylbenzene, toluene, and xylenes concentrations were generally 1–2 orders of magnitude less in the southern portion.
- Several PAH compounds, including two carcinogenic compounds (i.e., benz[a]anthracene and chrysene), were detected in one of four locations (CB-5) sampled for PAHs. Concentrations ranged from 0.014 mg/kg (benz[a]anthracene) to 7.3 mg/kg (naphthalene). Naphthalene was the only PAH compound detected in groundwater samples collected from the southern portion at concentrations 4–10 times less than those detected in the northern portion.

- TPH-D and TPH-G were detected in both soil and groundwater at concentrations generally 1 order of magnitude less than those found in the northern portion of the site. The highest TPH levels were found at sampling locations CB-5, MW-1, and TP-9.
- Detected lead concentrations in soil range from 15.3 to 52.7 mg/kg. Dissolved and total lead in groundwater were detected at concentrations ranging from 0.0022 to 0.0042 mg/L and 0.022 to 0.081 mg/L, respectively, with the highest levels found at sampling location MW-1.

Additional information on these findings is presented in RZA-AGRA (1993).

2.2 SELECTION OF CHEMICALS FOR DEVELOPING CLEANUP STANDARDS

As noted in Section 2.1, cleanup standards have been developed for each of the individual substances detected at the site for which necessary data (e.g., ARARs or toxicity information) were available. In accordance with WAC 173-340-740(3)(a)(ii)(B), cleanup standards were developed for individual toxic TPH components (i.e., BTEX and toxic or carcinogenic PAH compounds) rather than for TPH compounds as a group of chemicals. This section of the WAC states that in developing site-specific cleanup standards using MTCA Method B, "the person undertaking the cleanup may elect to make this determination [of appropriate cleanup goals] on the basis of data on individual hazardous substances that comprise the total petroleum hydrocarbon."

Addressing individual petroleum constituents present at a specific site allows consideration of site-specific differences in the composition of and resulting potential risks posed by the group of chemicals detected using analytical measures of TPH. In particular, TPH includes individual components that range in toxicity from nonhazardous chemicals to those presenting carcinogenic risks. As a result, sites with mostly nonhazardous TPH components present lower potential health risks than otherwise similar sites with mostly carcinogenic TPH components. Under Method B, separate risk-based standards may be derived for each component substance, so that standards more accurately reflect the degree of risk posed by each substance present in a particular TPH mixture and, therefore, more accurately reflect the human health and environmental risks present at specific sites than would the generic TPH standard provided by Method A. Method B also allows a more thorough consideration of site-specific factors that influence the nature of the risk posed by a site (e.g., land use) and site-specific factors that affect the movement of chemicals in the environment (e.g., soil type, depth to groundwater, and rainfall).

TPH components for which individual cleanup standards were developed were selected based on information on the composition of the types of materials handled at the site as well as data on toxicity and environmental mobility of individual TPH constituents.

Gasoline, diesel fuel, and lube oils are among the materials reported to have been handled at the Pullman site (RZA-AGRA 1993a). The primary constituents of these types of materials are three categories of hydrocarbon compounds: paraffins (saturated open-chain compounds), naphthenes (saturated cyclic compounds), and aromatics (aromatic ring-containing compounds). The paraffins and naphthenes are generally not highly toxic (Amdur et al. 1991; Clayton and Clayton 1981) and are not typically included as substances of concern in risk assessments.

The substances of primary concern for risk assessment are contained in the aromatic fraction. The most toxic known compounds found in the aromatic fraction are benzene and the carcinogenic PAH compounds. Noncarcinogenic compounds that may also be of concern include toluene, ethylbenzene, xylenes, naphthalene, and other noncarcinogenic PAH compounds. In addition to their potential toxic effects, BTEX compounds are of concern because of their volatility and mobility in the environment, properties that increase the likelihood of exposure. Naphthalene is also relatively mobile, but the higher molecular weight PAH compounds (including the carcinogenic PAH compounds) are much less volatile and mobile than the BTEX compounds.

BTEX and PAH compounds are typically used in characterizing potential risks and cleanup requirements for petroleum sites because this group of chemicals includes the most toxic known constituents that may be present in TPH and exhibits a broad range of physical and chemical properties influencing environmental mobility (Kostecki and Calabrese 1989). Thus, these compounds can serve as indicators of overall site risk and cleanup needs. Including the most toxic known components in such evaluations allows for consideration of worst-case risks and cleanup needs. Moreover, cleanup methods addressing these compounds will also result in cleanup of other substances with similar environmental fate properties. For example, because benzene is highly mobile in the environment, it can serve as a conservative indicator of the likely maximum extent of chemical transport and distribution of other petroleum compounds.

Because a broad range of physical and chemical properties are represented by BTEX and PAH compounds, cleanup based on standards for these individual TPH constituents will address a correspondingly broad range of such properties in other TPH components for which individual cleanup standards are not developed because they are not known to be toxic. This approach reduces the possibility of any unacceptable risks being presented by any individual TPH constituents not directly addressed by individual cleanup standards. In addition, Section 2.4 of this document discusses the potential risks posed by residual hydrocarbons for which chemical-specific standards cannot be developed because of insufficient toxicological or other information.

2.3 COMPILATION OF ARARs

ARARs for the substances detected at the site are listed in Table 5. Possible ARARs include federal or state standards, proposed standards, and other criteria for substances in groundwater, surface water, or soil.

TABLE 5. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SUBSTANCES DETECTED AT THE PULLMAN SITE

	Water ARARs					
Substance	MCL (mg/L)	Proposed MCL (mg/L)	Proposed Secondary MCL[a] (mg/L)	MCLG (mg/L)	AWQC (mg/L)	Soil ARARs (mg/kg)
Benzene	0.005	--	--	--	5.3	--
Ethylbenzene	0.7	--	0.03	0.7	32	--
Toluene	1	--	0.04	1	17.5	--
Xylenes	10	--	0.02	10	--	--
Acenaphthene	--	--	--	--	NA	--
Anthracene	--	--	--	--	NA	--
Benz[a]anthracene	--	0.0001	--	--	NA	--
Benzo[a]pyrene	--	0.0002	--	--	NA	--
Chrysene	--	0.0002	--	--	NA	--
Fluoranthene	--	--	--	--	NA	--
Fluorene	--	--	--	--	--	--
Naphthalene	--	--	--	--	0.62	--
Phenanthrene	--	--	--	--	NA	--
Pyrene	--	--	--	--	NA	--
Lead	--	0.015[b]	--	--	0.0032[c]	500[d]

Note:		
--	-	ARARs not available
ARAR	-	applicable or relevant and appropriate requirement
AWQC	-	ambient water quality criteria
MCL	-	maximum contaminant level
MCLG	-	maximum contaminant level goal
NA	-	not applicable (these substances were detected only in soil)

[a] The U.S. Environmental Protection Agency (EPA) has deferred promulgating the proposed secondary MCLs for ethylbenzene, toluene, and xylenes. However, these values have been used by the Washington Department of Ecology (Ecology) in establishing Method A cleanup levels.

[b] This level is not an MCL per se, but is a target tap water concentration provided in promulgated drinking water regulations for lead. This level has been adopted for use at Superfund sites by EPA (U.S. EPA 1990).

[c] Value based on water hardness of 100 mg/L $CaCo_3$.

[d] Longest and Diamond (1989) and Clay (1991) as adopted by Ecology (Voytilla 1991, pers. comm.).

As described below in Section 2.5, MTCA Method B requires consideration of cross-media contamination when developing cleanup standards. For example, soil concentrations that protect groundwater against chemical contamination or groundwater concentrations that are protective of surface water must be evaluated. ARARs are one possible basis for establishing target concentrations in the medium that is to be protected. As discussed in Section 2.4, the shallow groundwater encountered beneath the site is not considered to be a current or potential future source of drinking water. As a result, drinking water standards are not appropriate ARARs or target concentrations for groundwater at this site. However, drinking water standards, as well as other surface water ARARs for fresh water, were compiled for all substances found in groundwater to address potential concerns with groundwater discharge to surface water in the south fork of the Palouse River, located approximately 0.5 miles downgradient (i.e., northwest) of the site. The river flows generally westward, but near the site the river flows to the north. As discussed in Section 2.4, this surface water body is conservatively evaluated as a potential future source of drinking water. To prevent surface water contamination via groundwater discharge, MTCA requires that groundwater concentrations meet relevant target surface water concentrations at the point of groundwater discharge to surface water.

As shown in Table 5, available surface water ARARs include ambient water quality criteria (AWQC) for fresh water for benzene, ethylbenzene, toluene, lead, and naphthalene. Both the lead and naphthalene AWQC are based on chronic lowest-observed-adverse-effect levels (LOAELs) in freshwater aquatic life. For benzene, ethylbenzene, and toluene, only AWQC based on acute LOAELs for freshwater aquatic life are available. Because fishing at the river in Pullman is negligible (see Section 2.4), AWQC based on protection of humans consuming fish are not considered applicable to this site. These criteria are also less protective of human health than drinking water standards, which are included in Table 5. AWQC are not available for xylenes.

No soil ARARs are available for any of the substances detected at the site. The value presented in Table 5 for lead in soil is based on a range of soil lead concentrations (500–1,000 mg/kg) presented as interim guidance from the U.S. Environmental Protection Agency's (EPA) Office of Solid Waste and Emergency Response (OSWER) regarding soil lead cleanup concentrations at Superfund sites (Longest and Diamond 1989; Clay 1991). The lower end of this range has been adopted by the Policy Group at Ecology for use at MTCA sites, reflecting the Policy Group's professional judgment regarding potential health risks associated with ingestion of lead-containing soil (Voytilla 1991, pers. comm.).

2.4 CALCULATION OF RISK-BASED CONCENTRATIONS

Risk-based concentrations were calculated using the risk equations and assumptions required by Method B of MTCA. Two sets of risk-based concentrations for both soil and surface water are presented in Table 6. Values listed as *Unadjusted Risk-Based Concentrations* were derived assuming exposure only to a single chemical; values listed

TABLE 6. RISK-BASED SURFACE WATER AND SOIL CONCENTRATIONS

	Unadjusted Risk-Based Concentrations		Adjusted Risk-Based Concentrations[a]	
Substance	Surface Water (mg/L)	Soil (mg/kg)	Surface Water (mg/L)	Soil (mg/kg)
Carcinogenic Health Effects				
Benzene	0.0015	35	--[b]	--[b]
Benzo[a]pyrene-TEC	0.000008	0.14	--[b]	--[b]
Noncarcinogenic Health Effects				
Ethylbenzene	0.8	8,000	0.13	960
Toluene	1.6	16,000	0.19	1,900
Xylenes	16	160,000	0.8	8,000
Acenaphthene	0.96	4,800	0.12	580
Anthracene	4.8	24,000	2.4	12,000
Fluoranthene	0.64	3,200	0.08	380
Fluorene	0.64	3,200	0.16	800
Naphthalene	0.064	320	0.03	140
Phenanthrene	NA	NA	NA	NA
Pyrene	0.48	2,400	60	290
Lead	NA	NA	NA	NA

Note: Surface water concentrations calculated assuming use of surface water as a drinking water supply; soil concentrations calculated assuming residential site exposures.

-- - not applicable
NA - not available due to lack of toxicity factor
TEC - toxic equivalent concentration

[a] Adjusted to reflect exposures to multiple contaminants.

[b] Not adjusted because the unadjusted cleanup standards do not exceed the target total risk level.

as *Adjusted Risk-Based Concentrations* have been adjusted as described below to account for exposures to multiple chemicals via multiple exposure routes. As discussed below, standard risk-based concentrations cannot be calculated for lead.

Several aspects of the MTCA risk algorithm for exposure to soil are highly conservative (i.e., health protective). As required by MTCA, soil concentrations were calculated assuming incidental soil ingestion on a daily basis by a young child in a residential setting (the reasonable maximum exposure [RME] case presented in WAC 173-340-740(3)(a)). Because the northern portion of the site is likely to remain a storage area for coal and incinerated coal ash, risk-based soil concentrations calculated using the standard residential scenario will be highly protective for likely future site users (i.e., workers). Covering the southern portion of the site with bridge structures and fill soil will virtually eliminate the potential for direct contact with site soil in this area. As a result, actual exposures to site soils would be negligible compared to the exposure levels assumed in the generic MTCA risk algorithms used to calculate risk-based soil concentrations. Because of the numerous safety factors built into the standard MTCA risk calculations, these risk-based concentrations are protective for even the most highly exposed receptors, including someone who might reside at the site during the age range of concern for soil ingestion exposures (i.e., 6 years as a young child).

According to WAC 173-340(3)(a), risk-based surface water concentrations may be derived based on 1) ingestion of chemicals that have bioaccumulated in fish or shellfish, or 2) ingestion of surface water as a drinking water source. As discussed below, neither exposure pathway is likely to apply to the south fork of the Palouse River in Pullman. However, risk-based surface water concentrations were developed using the MTCA risk algorithm for drinking water ingestion as a protective measure in evaluating cleanup goals for this site. Drinking water in Pullman is currently obtained from deep aquifers found between basalt layers at approximately 100 ft below ground surface. Future development of the river as a drinking water source is unlikely because of the high silt load, low water flow during summer months, and water rights issues (Hudak 1993, pers. comm.; Skiles 1993, pers. comm.). Also, sewage overflow, storm drain discharges, and non-point sources such as agricultural runoff have contributed chemical and bacterial pollutants. In Pullman, the river does not support any game fish and very few non-game fish because of the lack of sustaining plant life; thus, fish consumption is considered negligible (Hisata 1993, pers. comm.).

Use of shallow groundwater as a domestic water supply is unlikely at this site because site groundwater is not currently being used as a drinking water supply and a municipal water supply is available. Furthermore, the groundwater is present in insufficient quantity to yield greater than 0.5 gallons per minute on a sustainable basis, as determined by a shallow aquifer yield test (RZA-AGRA 1993a). According to WAC 173-340-720(1)(a), groundwater is not a potential source of drinking water if this yield cannot be sustained. Although deep aquifers are currently used as a source of drinking water, RZA-AGRA (1993a) concludes that shallow groundwater is not a part of the deeper, regional aquifer system. Instead, groundwater encountered beneath the site represents an aquifer perched above basalt bedrock that is located at depths ranging from approximately 12 to 20 ft below ground surface. Therefore, it is unlikely that site-related chemicals in the shallow aquifer will migrate into the deeper aquifer system. In a letter to John Sherman (supervisor for the City of Pullman), Ecology supports the conclusion that surface contamination at the site does not pose a threat to the deeper aquifer system (Goldstein 1992, pers. comm.).

For the reasons noted above, potential cleanup levels based on groundwater use as a drinking water supply were not developed, consistent with WAC 173-340-720(1)(a). Instead, risk-based concentrations for surface water were calculated as described above. Then, to protect surface water (as discussed in Section 2.5), these surface water concentrations were used to evaluate groundwater concentrations that would be required at the point of discharge to the south fork of the Palouse River. This approach, which is required by MTCA, is highly protective of health because it conservatively ignores the reductions in chemical concentrations that would occur as discharged groundwater mixes with river water.

As noted above, the concentrations derived using the risk assessment procedures presented in MTCA were adjusted to reflect consideration of potential additive risks due to exposures to multiple substances via multiple exposure routes. Such adjustments ensure that total risks presented by site exposures following cleanup do not exceed the target risk levels established in MTCA. Under MTCA Method B, the total target risk level presented by exposures to all carcinogenic substances present at a site following cleanup should not exceed 1×10^{-5} (i.e., a one-in-one-hundred-thousand incremental risk of developing cancer over a lifetime of exposure). The potential for noncarcinogenic health effects is evaluated by comparing estimated exposure levels with EPA reference doses, which represent daily exposure levels at which no adverse effects are expected to occur over a lifetime of exposure. The ratio of the estimated exposure level to the reference dose is termed a hazard index. The target hazard index specified in MTCA is 1.0 (i.e., an estimated exposure level equal to the reference dose at which no adverse effects are expected to occur) for combined exposures to all noncarcinogenic substances producing the same type of toxic response or affecting the same target organ.

Toxicity factors and health endpoints of concern for each substance detected at the site are presented in Table 7. Compiled from standard EPA reference sources as required by MTCA, this information was used in calculating and adjusting the risk-based concentrations. In accordance with MTCA guidance (Kissinger 1991, pers. comm.), Table 7 includes the health effect that forms the basis for the toxicity factor (*Health Endpoint for Toxicity Factor*) as well as other health effects that have been associated with similar dose levels as the dose used in deriving the toxicity factor (*Secondary Health Endpoints*).

EPA has developed toxicity factors for all of the individual substances detected at the site, with the exception of lead and phenanthrene. A standard toxicity factor has not been developed for lead because of unique issues in evaluating lead exposure and toxicity. As described in Section 2.3 above, Ecology has adopted a soil cleanup value

TABLE 7. SUMMARY OF TOXICITY FACTORS AND HEALTH ENDPOINTS OF CONCERN

Substance	Toxicity Factor[a]	Health Endpoint for Toxicity Factor	Secondary Health Endpoints
Carcinogenic Health Effects			
Benzene	0.029	Leukemia	--
Benzo[a]pyrene	7.3	Stomach tumors	--
Noncarcinogenic Health Effects			
Ethylbenzene	0.1	Liver and kidney toxicity	--
Toluene	0.2	Changes in liver and kidney weights	--
Xylenes	2	Hyperactivity, decreased body weight, increased mortality	Fetotoxicity[b]
Acenaphthene	0.06	Liver toxicity	--
Anthracene	0.3	No effect level	--
Fluoranthene	0.04	Liver, kidney, and blood effects	--
Fluorene	0.04	Decrease in red blood cell count	--
Naphthalene	0.004	Decrease in body weight gain	--
Phenanthrene	NA		
Pyrene	0.03	Kidney effects	--
Lead	NA		

Source: Toxicity information from U.S. EPA (1992a, 1993) except as noted.

Note: -- - not evaluated by the U.S. Environmental Protection Agency
NA - not available; data inadequate for quantitative risk assessment of compound (U.S. EPA 1992a, 1993)

[a] Toxicity factor for carcinogenic health effects is the oral carcinogenic slope factor in units of (mg/kg-day)$^{-1}$. The toxicity factor for noncarcinogenic health effects is the oral reference dose in units of mg/kg-day.

[b] ATSDR (1990).

for lead that is based on lead exposure and risk modeling performed by EPA. This cleanup value serves as a benchmark for evaluating the need for remediation of lead in soil at MTCA sites. For phenanthrene, even if the most stringent proposed cleanup standard developed for any of the other noncarcinogenic PAH compounds is assumed to apply to this compound, the one detection of phenanthrene in soil at the site would not exceed the proposed cleanup standard. Although toxicological data for individual PAH compounds are limited, available studies indicate that the toxicity of phenanthrene is similar to that of other PAH compounds, including naphthalene and pyrene (Sax and Lewis 1989). Furthermore, phenanthrene was not detected in groundwater. Thus, the lack of a cleanup standard for phenanthrene is unlikely to result in any adverse health risks not being addressed at the site.

Another toxicological issue considered in evaluating cleanup standards for this site is evolving approaches for evaluating the carcinogenicity of PAH compounds. Currently, sufficient data for quantitatively estimating carcinogenic potency in humans are available for only one PAH compound (benzo[a]pyrene); however, based on available data, EPA has qualitatively classified other PAH compounds as potential human carcinogens (i.e., EPA has assigned them Class B2 [potential human] carcinogen status). In the past, EPA has recommended that the carcinogenicity of these PAH compounds be incorporated into quantitative risk estimates by assuming that these PAH compounds possess the same carcinogenic potency as benzo[a]pyrene (Hurst 1990). To apply this approach, EPA has recommended calculating benzo[a]pyrene-toxic equivalent concentrations (TECs) for use in estimating exposures and risks by summing the concentrations of all PAH compounds classified as B2 carcinogens. For this site, the benzo[a]pyrene-TEC is derived from the detected concentrations of benz[a]anthracene and chrysene.

Alternative approaches that quantitatively account for observed differences in carcinogenic potency among PAH compounds have been under development and review by EPA for many years. The central feature of these approaches is the use of quantitative toxicity equivalence factors (TEFs) that reflect the carcinogenic potency of each PAH compound relative to that of benzo[a]pyrene. To derive the benzo[a]pyrene-TEC corresponding to a measured concentration of a given carcinogenic PAH, the measured concentration for that compound is multiplied by its TEF. A total benzo[a]pyrene-TEC can then be derived by summing the TECs derived for each carcinogenic PAH (in this case, benz[a]anthracene and chrysene).

Recently, EPA Region 4 adopted a TEF approach for PAH compounds for use in risk assessment (U.S. EPA 1992b; Akin 1992, pers. comm.). These TEFs (shown in Table 8) were developed based on analyses of the results of various toxicity assays in which benzo[a]pyrene and other PAH compounds were tested. Pending release of final agency guidance, EPA Region 10 has also endorsed use of this approach to better accommodate the recognized differential carcinogenic potency among PAH compounds in risk estimates (Sweeney 1992, pers. comm.). Both this approach and EPA's previously recommended approach were applied in estimating benzo[a]pyrene-TECs at the Pullman site (e.g., as shown in Table 2).

TABLE 8. TOXICITY EQUIVALENCE FACTORS FOR PAH COMPOUNDS

Substance	TEF
Benz[a]anthracene	0.1
Benzo[b]fluoranthene	0.1
Benzo[k]fluoranthene	0.1
Benzo[a]pyrene	1
Chrysene	0.01
Dibenz[a,h]anthracene	1
Indeno[1,2,3-cd]pyrene	0.1

Source: U.S. EPA (1992b)

Note: PAH - polycyclic aromatic hydrocarbon
TEF - toxicity equivalence factor

In adjusting the total target risk to reflect multiple chemical exposures, exposures via both surface water and soil were considered. For carcinogens, the unadjusted risk-based cleanup standards calculated for individual chemicals correspond to a 1×10^{-6} (i.e., a one-in-one-million) risk of developing cancer. Two carcinogens (benzene and benzo[a]-pyrene-TECs) were detected at this site; only benzene was detected in both soil and groundwater (the medium of concern for surface water protection and prevention of risks resulting from ingestion of surface water as a drinking water source). Even if exposures occurred to both surface water and soil containing both carcinogenic substances at concentrations equal to their respective unadjusted risk-based concentrations, a total incremental cancer risk of 4×10^{-6} (less than the target total of 1×10^{-5} specified in MTCA) would result. Thus, no adjustments to risk-based concentrations for substances associated with carcinogenic health effects are necessary at this site to protect against exposures to multiple carcinogenic chemicals.

Table 9 shows the adjustments made to the risk-based concentrations based on noncarcinogenic health effects. The hazard index corresponding to the unadjusted risk-based concentration for each individual chemical equals 1. According to MTCA procedures, the total risk for each target organ can be apportioned among the contributing exposures in any combination as long as the target risk levels are met (WAC 173-340-708(6)). For most health effects, the total target risk (including exposures via both surface water and soil) was apportioned approximately equally among all chemicals affecting each target organ. For these calculations, it was conservatively assumed that all substances present at the site in either soil or groundwater could potentially contribute to total site risks via soil and surface water ingestion. This assumption provides an additional element of protectiveness in the derived cleanup standards because those substances detected only in one medium would not be contributing to risks related to the medium in which they were not found. These substances are noted in Table 9.

The most stringent of the adjusted risk-based concentrations are listed in Table 6. These concentrations were used in all subsequent analyses.

2.5 CALCULATION OF CONCENTRATIONS THAT PROTECT AGAINST CROSS-MEDIA CONTAMINATION

As previously noted, MTCA requires that concentrations that are protective against cross-media contamination (e.g., soil and groundwater concentrations that are protective of surface water) be considered in developing Method B cleanup standards. As discussed in Section 2.4, groundwater concentrations that are protective of surface water were determined by assuming that groundwater concentrations at the point of discharge to surface water would have to meet appropriate surface water target concentrations. However, a review of site conditions indicates that it is highly unlikely that surface water will ever be affected by the chemicals present in shallow groundwater. Concentrations were below detection limits in downgradient offsite monitoring wells (MW-11 and MW-12) despite the high hydraulic conductivity measured in the onsite monitoring wells and the fact that the bulk storage facility began operating approximately 80 years ago and

TABLE 9. ADJUSTMENT OF RISK-BASED CONCENTRATIONS TO REFLECT MULTIPLE EXPOSURES

	Target Hazard Quotient		Adjusted Risk-Based Concentrations	
Substance	Surface Water	Soil	Surface Water (mg/L)	Soil (mg/kg)
Effects on the Liver				
Ethylbenzene	0.16	0.12	0.13	960
Toluene	0.12	0.12	0.19	1,900
Acenaphthene[a]	0.12	0.12	0.12	580
Fluoranthene[a]	0.12	0.12	0.08	380
Effects on the Kidney				
Ethylbenzene	0.16	0.12	0.13	960
Toluene	0.12	0.12	0.19	1,900
Fluoranthene[a]	0.12	0.12	0.08	380
Pyrene[a]	0.12	0.12	0.06	290
Effects on the Blood				
Fluoranthene[a]	0.25	0.25	0.16	800
Fluorene[a]	0.25	0.25	0.16	800
Effects on Body Weight				
Xylenes	0.05	0.05	0.8	8,000
Naphthalene	0.45	0.45	0.03	140
Other Effects				
Anthracene[a] (no effect level)	0.5	0.5	2.4	12,000

[a] Compound detected in soil only.

has not operated for over 10 years. In addition, fate and transport analyses presented in Appendix A indicate that BTEX and naphthalene plumes are in steady state; therefore, constituent concentrations are not expected to increase with time. In fact, BTEX and naphthalene concentrations should decrease with time due to biodegradation and dispersion processes.

To ensure that soil concentrations are protective of groundwater, WAC presents a default approach in which target groundwater concentrations are multiplied by a factor of 100 to calculate protective soil concentrations. For example, a soil concentration of 100 mg/kg is considered protective for a chemical with a target groundwater concentration of 1 mg/L. However, as noted above, the point of compliance for target groundwater concentrations at this site is at the river, and groundwater data indicate that surface water will not be affected by chemicals present in shallow groundwater. Therefore, chemical concentrations detected in groundwater are sufficiently protective of surface water. Furthermore, chemical concentrations in soil are not expected to result in further degradation of groundwater at the site based on fate and transport analyses described in Appendix A. Thus, for this site it is unnecessary to explicitly calculate soil concentrations that are protective of groundwater.

In addition to the standard risk assessment considerations required by MTCA, the potential for health risks due to inhalation of chemicals volatilizing from soil into buildings constructed at the site was also evaluated. Appendix B describes the approach used to model chemical vapor movement from groundwater through unsaturated soil and to estimate vapor entry into a basement via cracks in basement walls. The results of the modeling demonstrate that groundwater concentrations of volatile chemicals (i.e., BTEX) reported at this site are well below levels that would pose a threat to human health due to inhalation of vapors. The modeling undertaken to support these conclusions is based on highly conservative assumptions regarding potential inhalation exposures to chemical vapors that may accumulate in basement air. These assumptions and the results of the modeling are described in Appendix B.

2.6 COMPILATION OF CLEANUP STANDARDS

After developing potential cleanup standards using the above approaches, these values were compiled and the most stringent value was selected for each substance present at the site. Values shown in Table 10, based on direct soil contact or protection of surface water as a potential drinking water source, were used to develop the site cleanup standards summarized in Table 1.

As shown in Table 10, applicable potential groundwater cleanup standards available for the site include those based on ARARs (for benzene, ethylbenzene, toluene, and lead only) and risk-based concentrations designed to protect surface water quality. To meet MTCA requirements, these surface water concentrations must be met at the point at which groundwater discharges to surface water. With the exception of naphthalene, all potential cleanup standards for groundwater are based on surface water protection using

TABLE 10. COMPILATION OF POTENTIAL CLEANUP STANDARDS FOR THE PULLMAN SITE

Substance	Most Stringent ARAR	Most Stringent Risk-Based Concentration (Unadjusted)[a]	Most Stringent Risk-Based Concentration (Adjusted)[a]	Cleanup Standard at Point of Compliance
Groundwater (point of compliance—river) (mg/L)				
Benzene	0.005	0.0015	0.0015	0.005
Ethylbenzene	0.03	0.8	0.13	0.03
Toluene	0.04	1.6	0.19	0.04
Xylenes	0.02	16	0.8	0.02
Naphthalene	NA	0.064	0.03	0.03
Lead	0.0032	NA	--	0.0032
Soil (point of compliance—onsite) (mg/kg)				
Benzene	--	35	35	35
Ethylbenzene	--	8,000	960	960
Toluene	--	16,000	1,900	1,900
Xylenes	--	160,000	8,000	8,000
Acenaphthene	--	4,800	580	580
Anthracene	--	24,000	12,000	12,000
Benzo[a]pyrene-TEC[b]	--	0.14	0.14	0.6[d]
Fluoranthene	--	3,200	380	380
Fluorene	--	3,200	800	800
Naphthalene	--	320	140	140
Phenanthrene	--	NA	NA	NA
Pyrene	--	2,400	290	290
Lead	500	NA	NA	500

Note:	
--	not applicable
ARAR	applicable or relevant and appropriate requirement
MTCA	Model Toxics Control Act
NA	not available based on Washington Department of Ecology guidance or because of lack of ARAR or toxicity factor
NC	not calculated
PAH	polycyclic aromatic hydrocarbon
TEC	toxic equivalent concentration

[a] Risk-based concentrations listed for groundwater are surface water values calculated assuming surface water use as a drinking water supply by requiring groundwater concentrations to equal target surface water concentrations at the point of discharge to surface water.

[b] The benzo[a]pyrene-TEC value applies to the sum of the benzo[a]pyrene-TECs (calculated as described in Section 2.4) for all carcinogenic PAH compounds at the site (i.e., benz[a]anthracene and chrysene).

[c] Application of the default factor of 100 to target groundwater concentrations as provided in MTCA results in soil concentrations exceeding unity (i.e., one million parts per million).

[d] Because the most stringent potential soil cleanup standard for carcinogenic PAH compounds (0.14 mg/kg) is lower than the typical background concentration for these compounds (0.6 mg/kg), the background soil concentration was selected as the cleanup standard in accordance with WAC 173-340-700(4)(d).

the ARAR as a target surface water concentration. For naphthalene, the groundwater cleanup standard is based on surface water protection, reflecting the target risk-based surface water concentration. Although the risk-based groundwater cleanup standard based on surface water protection for benzene is slightly lower (by approximately a factor of 3) than the surface water ARAR (MCL), the latter value was selected as the cleanup standard for this substance. This is because Ecology allows the use of MCLs or other ARARs in preference to lower risk-based values where the ARAR is adequately protective (defined for carcinogens as presenting a risk of 1×10^{-5} or less) (Bradley 1991, pers. comm.).

The risk-based concentrations based on direct contact with and incidental ingestion of soil were the most stringent soil cleanup standards for all of the organic chemicals at the site. In addition, the most stringent potential soil cleanup standard (0.14 mg/kg) for carcinogenic PAH compounds (calculated as the benzo[a]pyrene-TEC) is lower than typical background concentrations of these substances. Therefore, in accordance with WAC 173-340-700(4)(d), the typical background soil concentration of benzo[a]pyrene is used as the cleanup standard for these substances (ATSDR 1990). Specifically, a concentration of 0.6 mg/kg (the midpoint of the range of typical background concentrations from 0.1 to 1 mg/kg) was selected as the cleanup goal.

As described above, the lead cleanup standard for soil presented in Tables 1 and 10 is based on soil lead cleanup guidance provided by OSWER (Longest and Diamond 1989; Clay 1991) as adopted by Ecology (Voytilla 1991, pers. comm.). This cleanup standard is designed to protect against potential adverse health effects associated with ingesting lead-containing soil. Risk-based cleanup standards for lead cannot be calculated using the standard procedures provided in MTCA because no toxicity factor is currently available for lead. In addition, no soil standard based on surface water protection was developed for lead. This decision is based on the professional judgment of the Policy Group at Ecology, which determined that lead migration into groundwater was not as significant an issue at most sites where lead is present as the risks from ingestion of lead in soil (Bradley 1991, pers. comm.).

Several aspects of these standards suggest that applying them at the site will be highly protective of potential exposures. Virtually all of the cleanup standards for groundwater are based on the protection of surface water as a potential drinking water source. Because surface water is not used as a drinking water supply in Pullman and is not expected to be a drinking water source in the future, use of these standards provides public health protection for exposures that are likely to never occur. In addition, these standards do not account for the reductions in chemical concentrations that would occur as discharged groundwater mixes with river water. Moreover, these cleanup standards were calculated assuming that substances not currently reported in groundwater could potentially contribute to total health risks associated with surface water exposures.

The proposed cleanup standards for soil will also be highly protective of potential exposures. All of the soil cleanup standards, including the lead standard for OSWER, are based on protecting children having direct contact with soil in a residential setting.

This conservative scenario is highly unlikely to occur at the site because of its proximity to the highway and its projected continued use by WSU as a storage area for coal and incinerated coal ash. Furthermore, as previously described, the placement of fill material for the bridge expansion project will virtually eliminate the potential for direct contact with site soil in the southern portion of the site.

An additional issue considered in evaluating site cleanup standards is whether residual hydrocarbons at the site (as reflected in TPH measurements) present the potential for future contacts or aesthetic concerns. As discussed above, substantial margins of safety are inherently incorporated into cleanup standards for both groundwater and surface water because the proposed cleanup standards are based on exposure scenarios that are highly unlikely to occur at the site. Contact with groundwater at the site is unlikely because a municipal water supply is available and the shallow aquifer cannot sustain a yield of 0.5 gallons per minute as determined by a shallow aquifer yield test (RZA-AGRA 1993a). Surface water is also unlikely to be used as a source of drinking water. The lack of detections in downgradient wells MW-11 and MW-12 indicates that petroleum-related substances are not expected to impact surface water, provided that the system is in steady state, which is supported by the fate and transport analyses presented in Appendix A. Because the northern portion of the site is likely to remain a storage area and the southern portion will be covered by bridge structures and fill soil, the likelihood of substantial contact with soil at the site is also low. As a result, residual hydrocarbons at the site that are not specifically addressed by chemical-specific cleanup standards are unlikely to present aesthetic concerns or pose any unacceptable health risks.

3. CONCLUSIONS

This report presents cleanup standards for the Pullman site derived using the methods described in MTCA Method B. Cleanup standards based on protection of surface water as a potential drinking water source or direct contact with soil were developed for this site. These cleanup standards are highly protective of public health because it is unlikely that surface water will be used as a drinking water source or that the site will be used for residential development. Of the 13 substances that were detected at the site for which cleanup standards were developed (as presented in Table 1), no substances are known or expected to exceed the proposed site-specific cleanup standards. No soil cleanup standards were exceeded in any soil sample. Fate and transport analyses described in Appendix A indicate that BTEX and naphthalene detected in groundwater are unlikely to exceed groundwater cleanup standards at the point of compliance (i.e., at the point of discharge to surface water).

To assess compliance with the groundwater cleanup standard for lead, dissolved lead analyses should provide a more representative and reliable indicator of site concentrations than total lead analyses. RZA-AGRA (1993a) noted that total lead concentrations were likely the result of high sediment content in the samples due to the fine-grained nature of the surrounding formation. Also, no correlation was observed between total lead and dissolved lead concentrations. In 4 of 10 monitoring wells, dissolved lead concentrations exceed the lead cleanup standard for protection of surface water (0.0032 mg/L). However, lead strongly absorbs to particles and is generally of low mobility in groundwater. The fact that dissolved concentrations of lead in offsite downgradient monitoring wells (MW-6 and MW-7) were below the detection limit (0.002 mg/L) indicates that lead is of low mobility in the groundwater at the site and will not impact surface water.

4. REFERENCES

Akin, E. 1992. Personal communication (telephone conversation with D. Nelson, PTI Environmental Services, Bellevue, WA, on June 4, 1992, regarding PAH RPE approach). U.S. Environmental Protection Agency Region 4, Atlanta, GA.

Amdur, M.O., J. Doull, and C.D. Klaassen (eds). 1991. Casarett and Doull's toxicology: the basic science of poisons. Fourth Edition. Pergamon Press, New York, NY.

ATSDR. 1990. Toxicological profile for benzo[a]pyrene. Agency for Toxic Substances and Disease Registry, Atlanta, GA.

Bradley, D. 1991. Personal communication (telephone conversation with T. Michelsen, PTI Environmental Services, Bellevue, WA, on April 17, 1991). Washington Department of Ecology, Lacey, WA.

Clay, D.R. 1991. Memorandum regarding update on OSWER soil lead cleanup guidance. August 29, 1991. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

Clayton, G.D., and F.E. Clayton (eds). 1981. Patty's industrial hygiene and toxicology. Volume 2B Toxicology. Third Revised Edition. John Wiley & Sons, New York, NY.

Goldstein, F. 1992. Personal communication (letter to J. Sherman, City Supervisor, City of Pullman, dated October 15, 1992, regarding State Route 270 bridge, project in Pullman, WA). Washington Department of Ecology, Spokane, WA.

Hisata, J. 1993. Personal communication (telephone conversation with C. Evans, PTI Environmental Services, on March 9, 1993, regarding fish populations at the south fork of the Palouse River). Washington Department of Wildlife Region 1, Spokane, WA.

Hudak, J. 1993. Personal communication (telephone conversation with C. Evans, PTI Environmental Services, Bellevue, WA, on March 10, 1993, regarding water quality at the south fork of the Palouse River). City of Pullman, Department of Public Works, Pullman, WA.

Hurst, P.F. 1990. Memorandum to U.S. EPA Region 10 regarding slope factors for PAHs. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Criteria and Assessment Office, Cincinnati, OH.

Voytilla, M.K. 1991. Personal communication (telephone conversation with T. Michelsen, PTI Environmental Services, Bellevue, WA, on November 5, 1991, regarding Ecology's agreement to the preliminary lead standard for the Ruston/North Tacoma Superfund site). U.S. Environmental Protection Agency Region 10, Superfund Branch, Seattle, WA.

APPENDIX A

Documentation of Fate and Transport Analyses for the Former Chevron Bulk Storage Facility, Pullman, Washington

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

BTEX	benzene, toluene, ethylbenzene, and xylenes
MTCA	Model Toxics Control Act
TPH	total petroleum hydrocarbons

1. INTRODUCTION

Hydrogeologic and chemical data from RZA-AGRA (1993a,b) were used to evaluate the potential downgradient transport of petrochemical constituents in the groundwater at the former Chevron bulk storage facility in Pullman, Washington. The chemicals evaluated include the aromatic hydrocarbons benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene. Washington's State Model Toxics Control Act (MTCA) states that groundwater cleanup levels must be protective of surface water at sites where affected groundwater flows into nearby surface water. Where surface water protection is the basis of the groundwater cleanup level, the point of compliance where the cleanup levels must be attained is the point at which groundwater enters the surface water (WAC 173-340-720(6)(d)). In accordance with MTCA, the potential for chemicals in site groundwater to influence downgradient water quality or to reach the south fork of Palouse River were evaluated at the Pullman site.

2. ANALYSIS OF SITE CONDITIONS

2.1 HYDROGEOLOGY

Geologic materials at the site are described as fill, silt, sandy silt, and clay in the first 8–10 ft below ground surface. Underlying this layer is gravel and sand ranging from approximately 2- to 6-ft thick (RZA-AGRA 1993a). This permeable gravel and sand layer was found in all boreholes, indicating that this layer is continuous across the site. The region between the site and the south fork of the Palouse River is underlain by a continuous basalt layer (RZA-AGRA 1993a). Interpretive geologic cross sections A–A' and B–B' (Figure A-1), following the approximate groundwater flow path are presented in Figures A-2 through A-3.

A pumping test of the gravel aquifer conducted in Well MW-1 yielded hydraulic conductivity estimates of 0.07, 0.10, and 0.14 ft/min based on observed drawdown from wells MW-2, MW-3, and MW-5 (RZA-AGRA 1992). The report characterizes these values as representative of the hydraulic conductivity of the sand and gravel layer, which it states is a semi-confined aquifer that is bounded below by a basalt layer at approximately 20 ft below the surface and above by a clay and silt zone. On December 16, 1992, Well MW-8 was pumped at a rate of 0.5 gpm for 10 hours; pumping at this rate could not be sustained after this time. The recharge of this well following cessation of pumping was analyzed as a slug test, and indicated a hydraulic conductivity of 7.4×10^{-7} ft/min. This test was considered representative of the hydraulic conductivity of the silt and clay layer, due to the rapid recharge in the sand layer followed by an extended recharge period for groundwater originating in the clay and silt layer (RZA-AGRA 1993a). These results indicate that the silt and clay layer is at least 5 orders of magnitude less conductive than the gravel and sand. Thus, the gravel and sand layer is the primary zone where aromatic hydrocarbons are transported horizontally.

In evaluating transport, the sand and gravel layer was assumed to be 4 ft thick and to have a hydraulic conductivity of 0.10 ft/min (the geometric mean of the three measured hydraulic conductivities in this zone). The layers bounding the sand and gravel aquifer (i.e., the silt and clay above and the basalt below) were assumed to be impermeable.

2.2 ESTIMATION OF SOURCE LOCATION

Because of the lack of documentation of the location or timing of any spills or releases at the site, it is difficult to accurately quantify the source of BTEX and naphthalene. However, based on the observed distribution of BTEX and naphthalene in groundwater and soils at the site, there appear to be two general source areas, one near MW-8 and

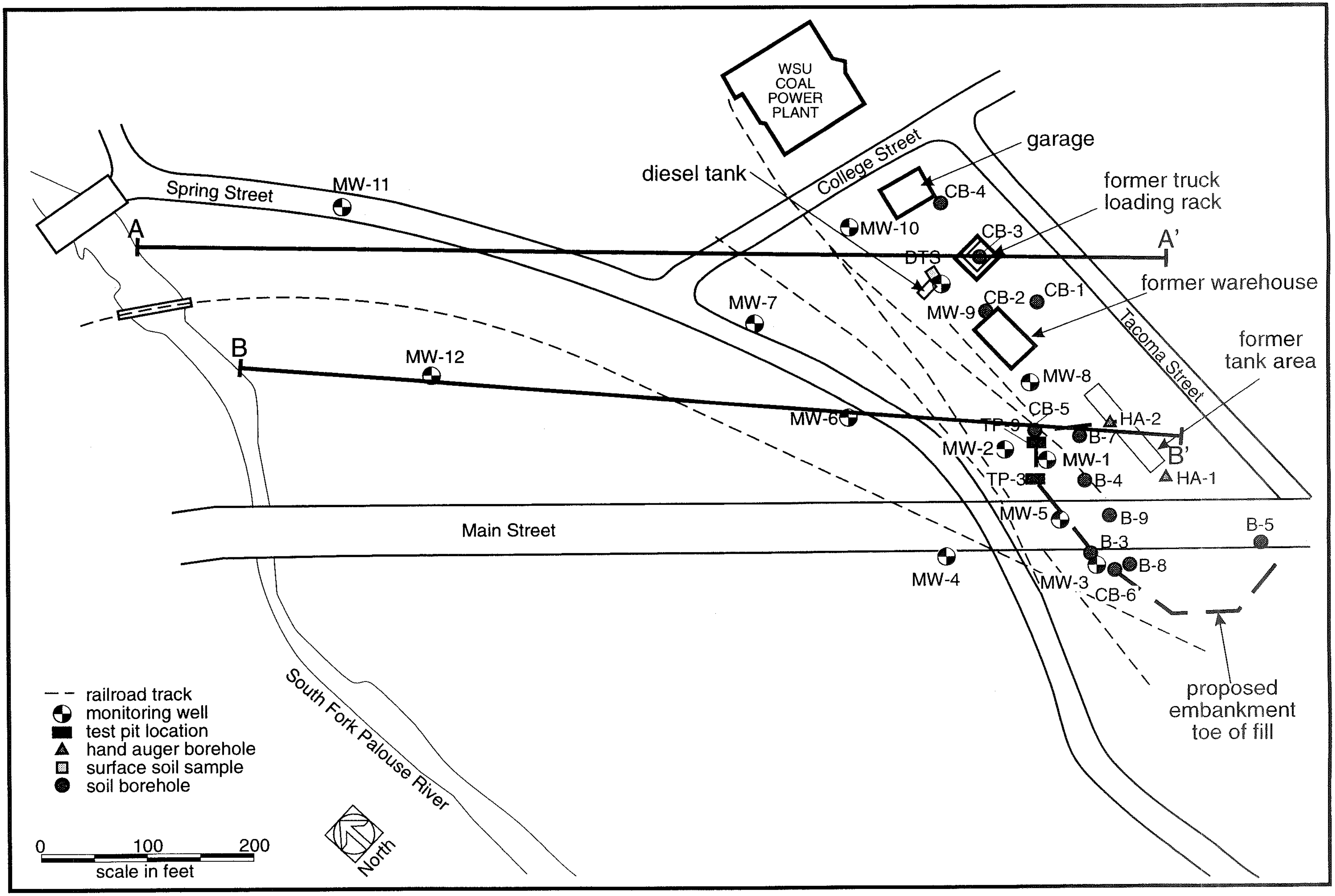

Figure A-1. Site map and cross section locations at the former Chevron bulk storage facility and vicinity, Pullman, WA.

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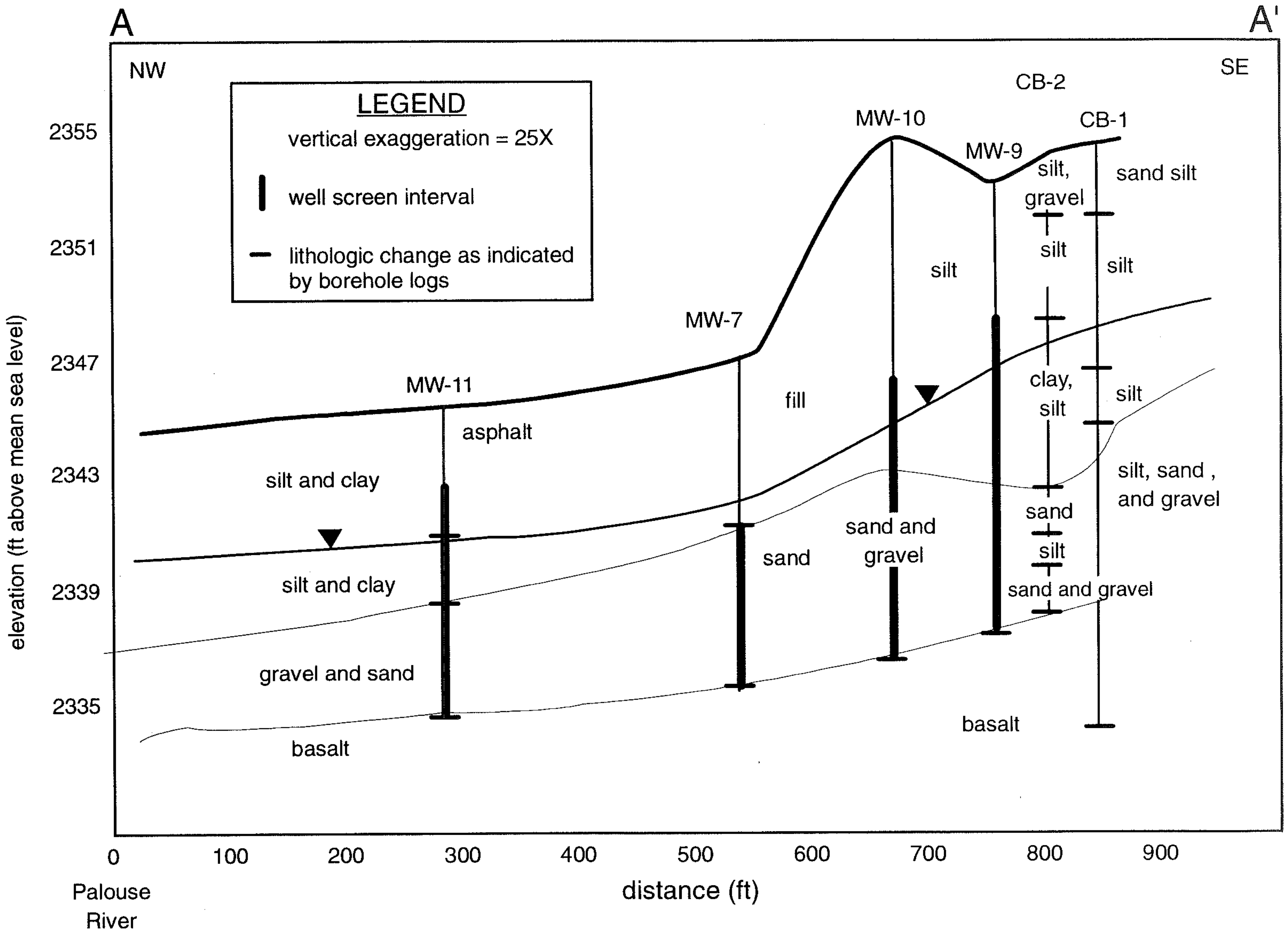

Figure A-2. Hydrogeologic cross section A-A' - former Chevron bulk storage facility, Pullman, WA.

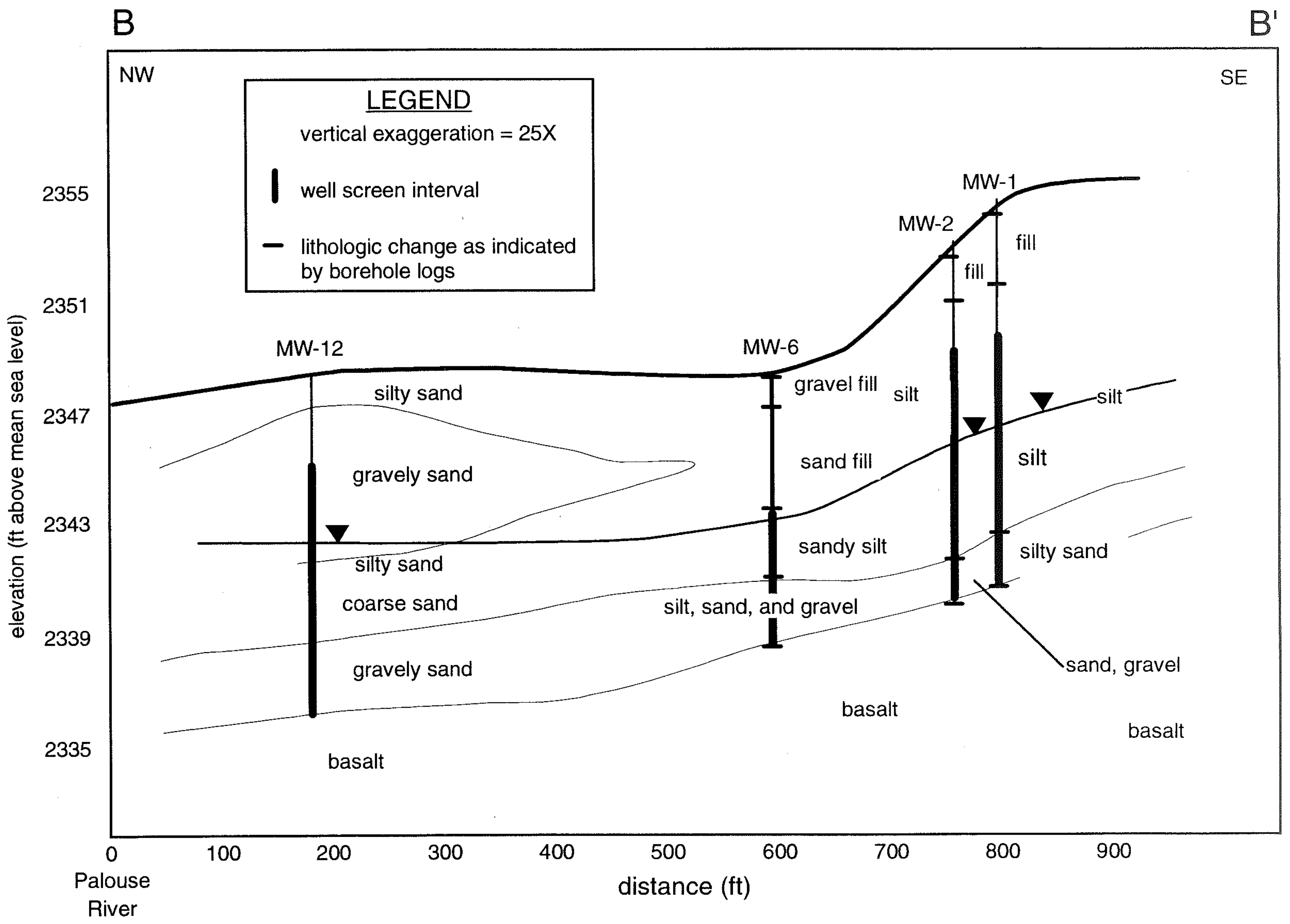

Figure A-3. Hydrogeologic cross section B-B' - former Chevron bulk storage facility, Pullman, WA.

one near MW-9 and MW-10, which are separated by the low levels of BTEX and naphthalene in Boreholes CB-1 and CB-2. These apparent source areas are approximately 750 feet upgradient of the south fork of the Palouse River. The interpreted groundwater concentrations of BTEX and naphthalene in groundwater at the site are presented in Figures A-4 through A-8.

2.3 BIODEGRADATION AND DISPERSION

At least two processes (i.e., biodegradation and dispersion) will reduce the concentration of BTEX and naphthalene as these constituents are transported downgradient with the groundwater flow. Biodegradation may be an important process for decreasing concentrations of petroleum-related constituents in the environment, particularly in oxygenated systems (Smith 1990; Karison and Frankenberger 1989). Groundwater in shallow, conductive aquifers, such as those at the Pullman site, is typically oxygenated (Hadley and Armstrong 1991; Chiang et al. 1989).

An extensive study of biodegradation in a shallow aquifer in Michigan was selected as an appropriate source for estimating benzene, toluene, and xylene degradation rates for at the Pullman site (Chiang et al. 1989). The Michigan site aquifer was composed of sand and gravel, had a depth to the water table of 10–25 ft, was unconfined, and contained benzene, toluene, and xylenes in groundwater at concentrations ranging to 16,000 μg/L. Thus, the Michigan site is similar to the Pullman site in depth to groundwater, type of aquifer material, and concentrations of aromatic hydrocarbons. The Michigan aquifer was found to be regionally oxygenated, and benzene, toluene, and xylenes were degraded with a half-life of 5–20 days in oxygenated zones (i.e., with dissolved oxygen concentrations >2.0 mg/L) and 20–60 days in less oxygenated areas (i.e., with dissolved oxygen concentrations between 0.5 mg/L and 2.0 mg/L). For ethylbenzene and naphthalene, which were not included in the Michigan study, published literature survey for oxygenated groundwater (Howard et al. 1991) indicate groundwater biodegradation rates in the same range. Aerobic degradation half-lives presented in this work ranged from 3 to 10 days for ethylbenzene and from 0.5 to 20 days for naphthalene. The relatively sharp decrease in concentrations of petrochemical constituents at the Pullman site with distance downgradient, despite estimates of rapid groundwater velocities at the site, indicates that the rate of biodegradation at the Pullman site is rapid, which is consistent with the literature values.

Even in the absence of biodegradation, solute concentrations will decrease due to dispersive mixing. Dispersion in aquifers has been shown to be a scale-dependent process, with greater effective longitudinal (i.e., in the direction of flow) and transverse (i.e., perpendicular to flow) dispersion occurring at greater distances from the source. The process of dispersion has resulted in the lateral spreading of the plume observed at the site.

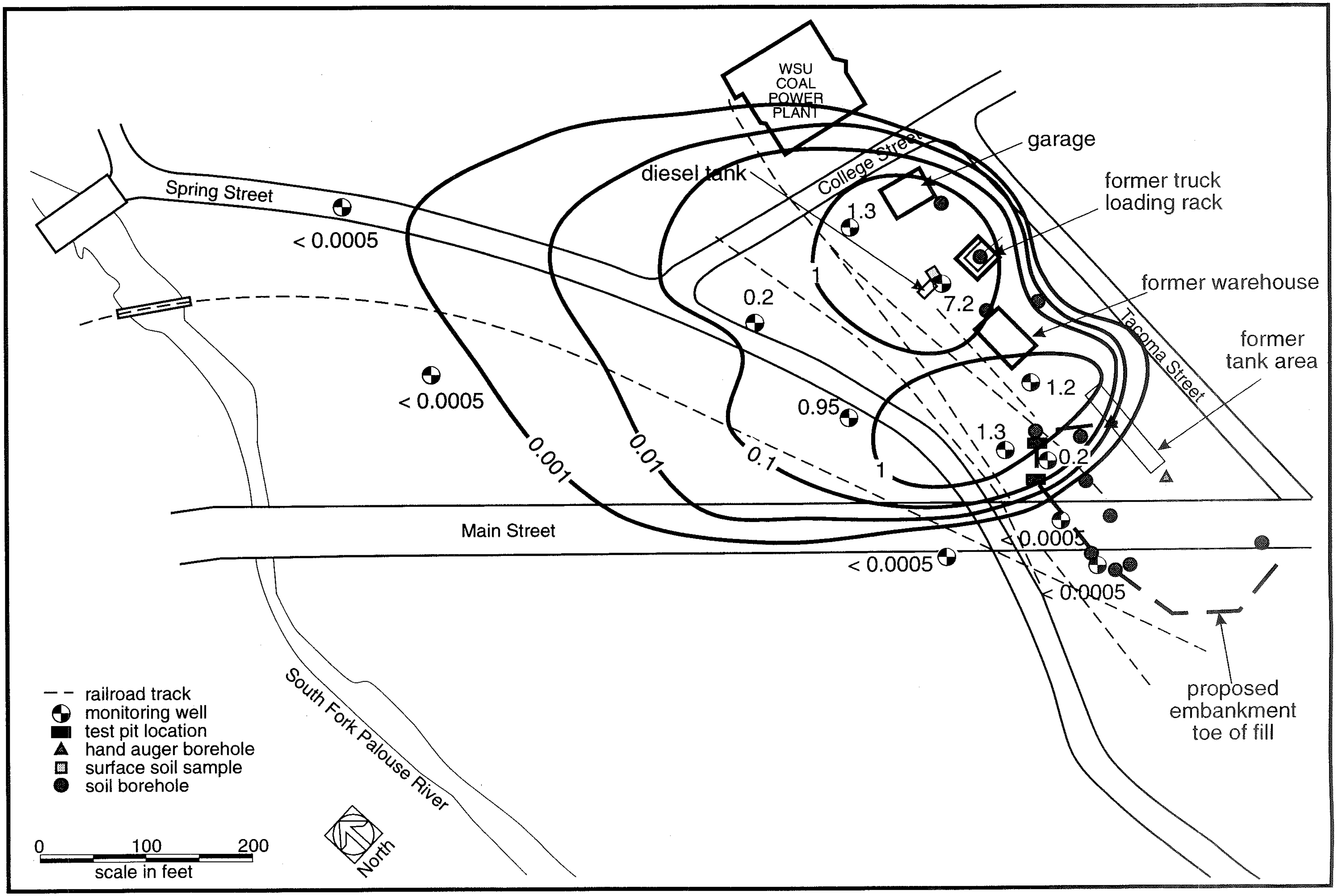

Figure A-4. Interpreted groundwater benzene concentrations (mg/L) based on analytical results from February 23, 1993 (MW-11 and MW-12) and December 17 and 18, 1992 (MW-1 through MW-10).

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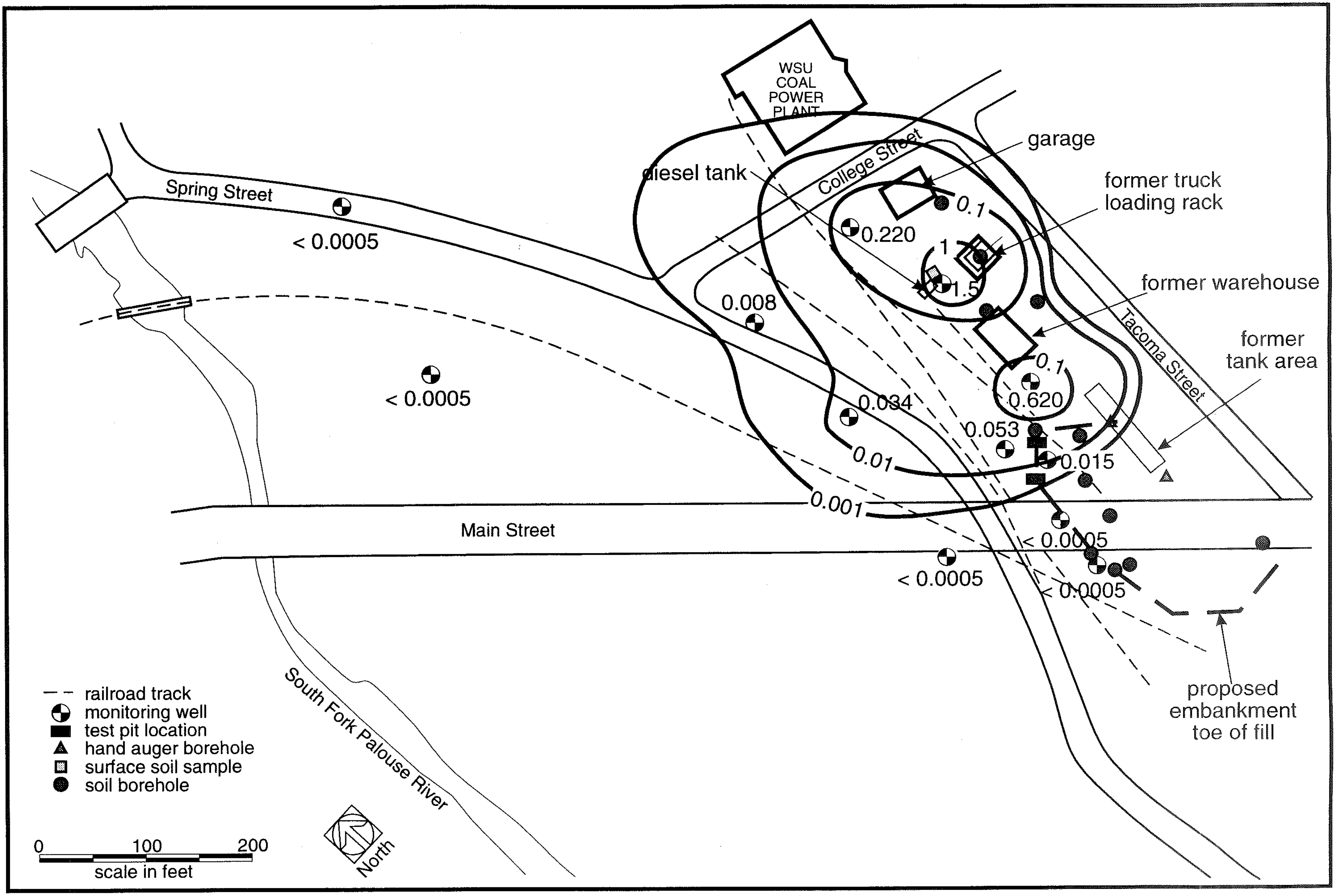

Figure A-5. Interpreted groundwater toluene concentrations (mg/L) based on analytical results from February 23, 1993 (MW-11 and MW-12) and December 17 and 18, 1992 (MW-1 through MW-10).

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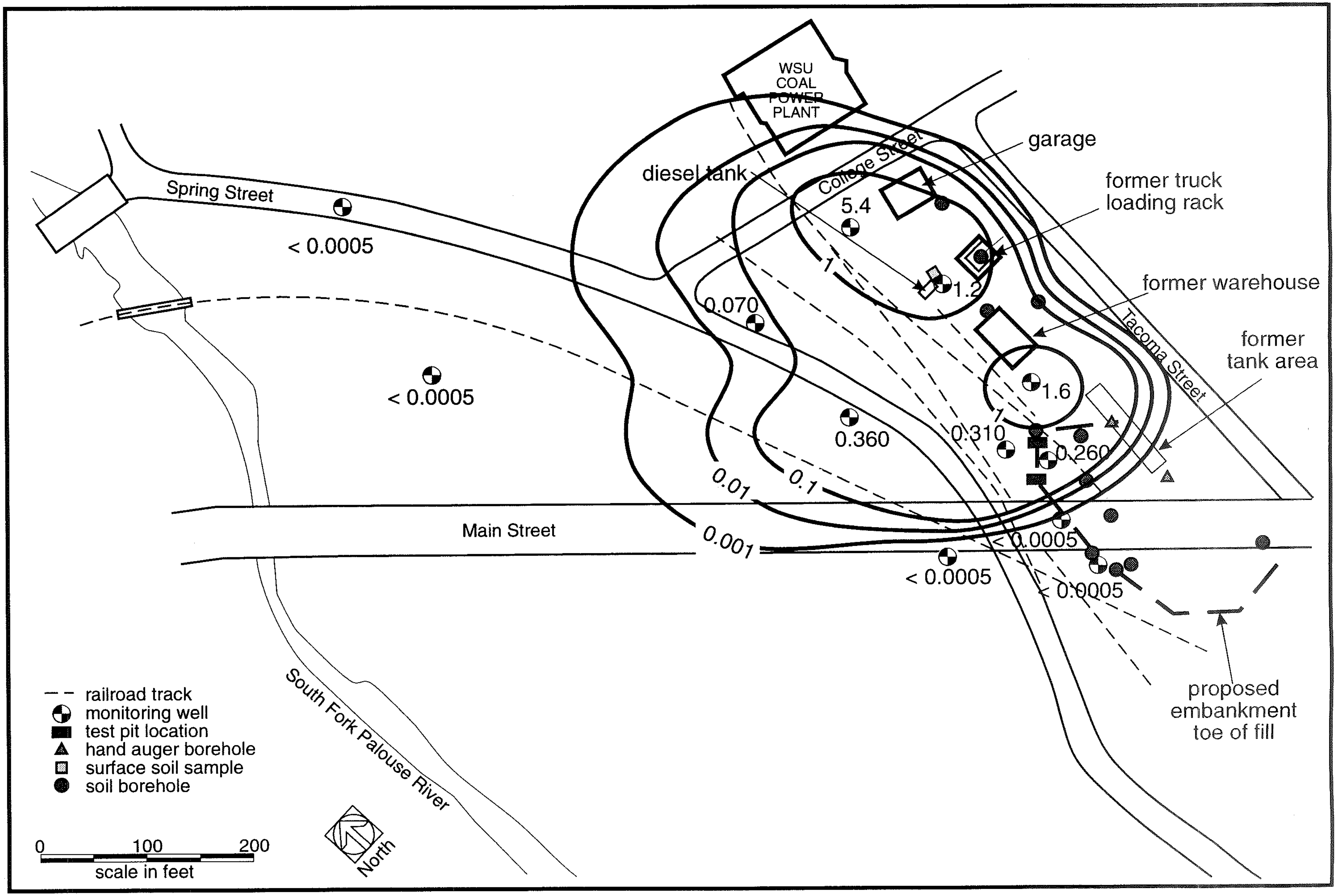

Figure A-6. Interpreted groundwater ethylbenzene concentrations (mg/L) based on analytical results from February 23, 1993 (MW-11 and MW-12) and December 17 and 18, 1992 (MW-1 through MW-10).

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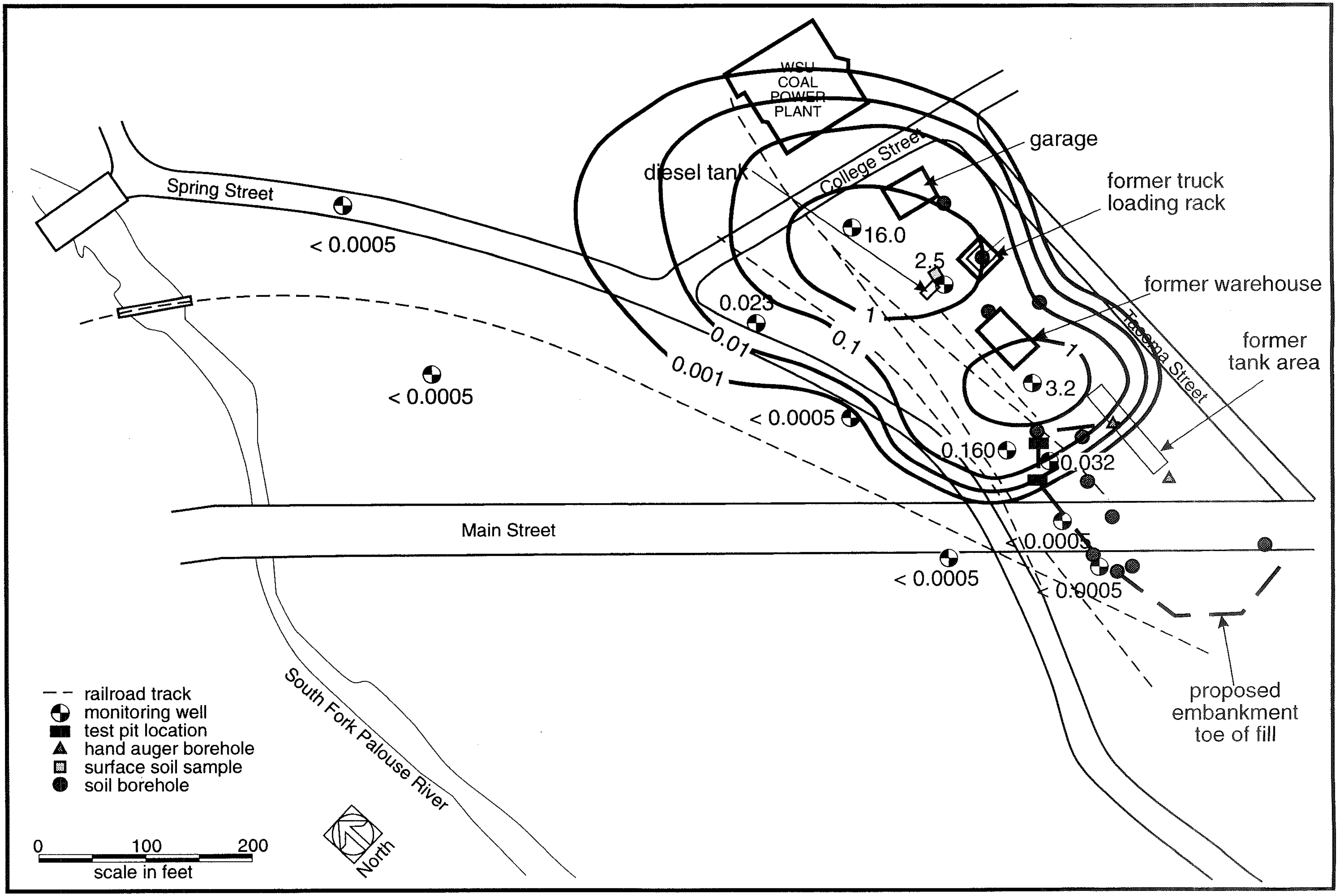

Figure A-7. Interpreted groundwater xylene concentrations (mg/L) based on analytical results from February 23, 1993 (MW-11 and MW-12) and December 17 and 18, 1992 (MW-1 through MW-10).

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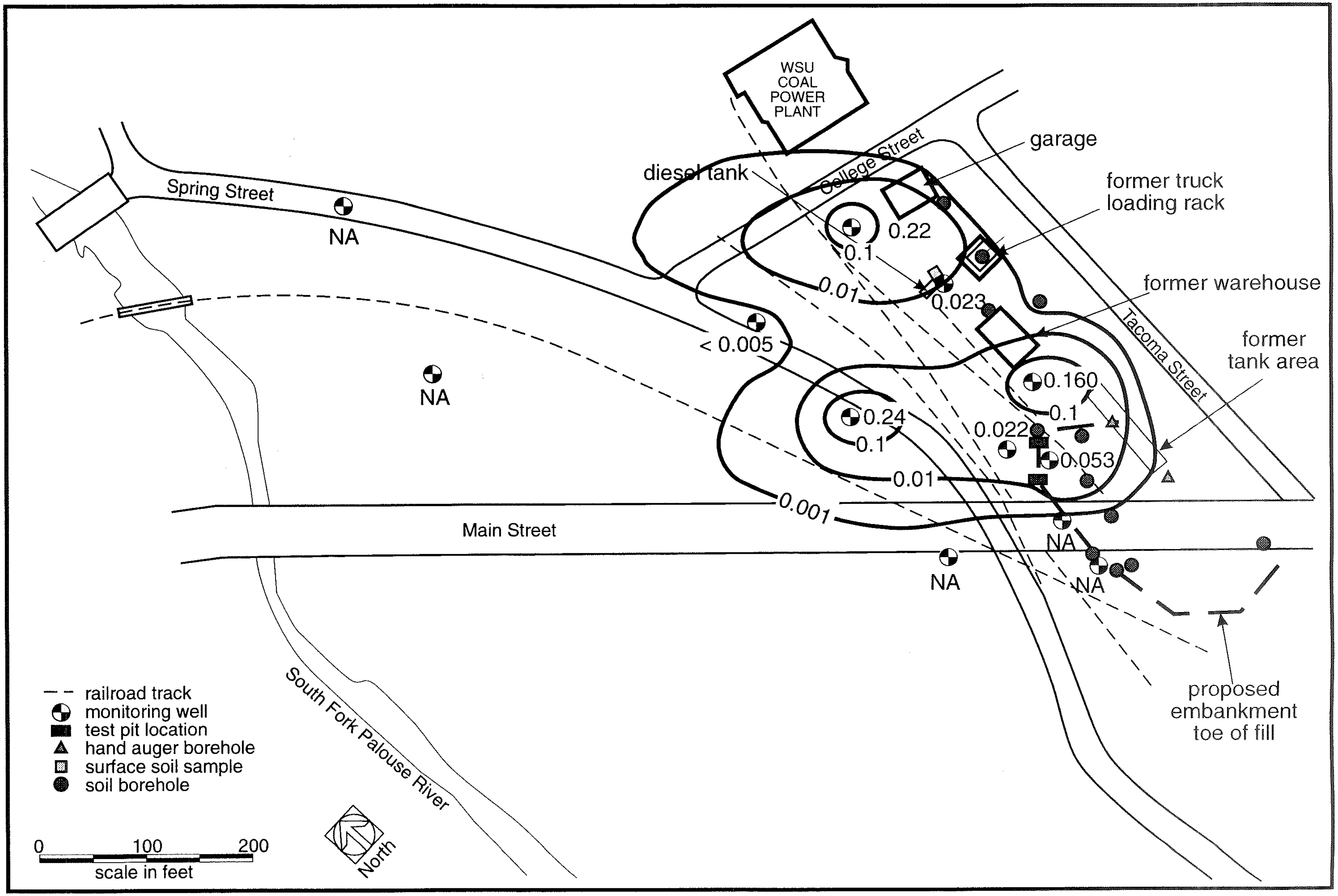

Figure A-8. Interpreted groundwater napthalene concentrations (mg/L) based on analytical results from February 23, 1993 (MW-11 and MW-12) and December 17 and 18, 1992 (MW-1 through MW-10).

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3. ESTIMATED RATE OF CHEMICAL MIGRATION

A conceptual model of solute transport at the site was developed from the observed distribution of total petroleum hydrocarbons (TPHs) and aromatic hydrocarbons in soil and groundwater and the observed lithology and hydraulic characteristics. The petroleum hydrocarbons observed in the shallow silts and clays are assumed to be acting as a source of aromatic hydrocarbons to the conductive gravel zone below. Because the hydraulic conductivity of the silt and clays was measured to be approximately 100,000 times less than that of the gravel below, horizontal solute migration in the silt and clay layer is considered to be insignificant (i.e., approximately 1/10,000th as much flow occurs in the silt and clay as in the gravel). Analysis of groundwater from wells screened only in the gravel and sand layer (e.g., MW-7, with 0.301 mg/L BTEX on 12/17/92, RZA-AGRA 1993b) demonstrates that aromatic hydrocarbons are present in the conductive gravel and sand layer.

The conceptual model assumes that BTEX and naphthalene move vertically from the silt and clay zone into the conductive gravel and sand at a relatively steady rate by a combination of dispersion, diffusion, and advective transport. Once in the conductive gravel and sand, solutes are assumed to migrate downgradient in accordance with conditions of constant advection, dispersion, and attenuation, as described previously. Chemical migration in the shallow aquifer is influenced by the groundwater velocity, the retardation of each solute by the aquifer matrix, and the attenuation of each solute by dispersive mixing and degradation.

The interstitial groundwater velocity, V_i, is calculated as:

$$V_i = \frac{K}{\theta_e}\left(\frac{dh}{dx}\right) \qquad (1)$$

where:

K = hydraulic conductivity of the aquifer (ft/min)
dh/dx = hydraulic gradient in the aquifer (unitless)
θ_e = effective porosity of the aquifer (unitless)

Based on February 23, 1993, water level measurements (Figure A-9), hydraulic gradients between the site and the offsite wells (MW-11 and MW-12) range from 0.007 to 0.01 (ft/ft). Because the gradient appears to be lower between the site and the river than onsite, a lower-end value of 0.008 (ft/ft) was selected for dh/dx as representative of the gradient from the source area to the river based on the gradient between wells MW-8 and MW-12. The direction of groundwater flow at the site appears to vary somewhat, as it was more westerly in December 1992 (RZA-AGRA 1993a) and more northwesterly during the recent water level measurements in March 1993 (RZA-AGRA 1993b). K was obtained from the aquifer tests, as described previously. A total porosity of 0.3 and an effective porosity of 0.25 were used, based on literature values for sand (Castany 1967, as cited by deMarsily 1986). Application of Equation 1 yields an interstitial groundwater flow velocity of 4.6 ft/day. At this rate, the time for groundwater to travel from the site to the south fork of the Palouse River is 163 days.

The rate at which a solute migrates in the aquifer will decrease due to adsorption to the aquifer solid matrix. This decrease in migration rate is described by the retardation coefficient, R, which is the rate that water moves relative to the rate of a particular solute. Thus, the plume of a solute with a retardation coefficient of 10 will move at 1/10th the velocity of the groundwater. The retardation coefficient (R) is calculated as:

$$R = 1 + \left(\frac{\rho_b}{\theta}\right) K_d \qquad (2)$$

where:

ρ_b = bulk density (g/cm^3)
K_d = soil/water distribution coefficient (L/Kg)
θ = total porosity of the aquifer (unitless)

The aquifer matrix is assumed to be primarily quartz and feldspar, which have a density of 2.65 g/cm^3. The bulk density is then the mineral density, minus the fraction of the soil occupied by pores (i.e., 2.65 g/cm^3 $\times$ $(1-0.3)$ = 1.85 g/cm^3).

K_d can be determined as:

$$K_d = K_{oc} F_{oc} \qquad (3)$$

where:

K_{oc} = organic carbon distribution coefficient (L/kg)
F_{oc} = fraction organic carbon in the soil (g/g, unitless)

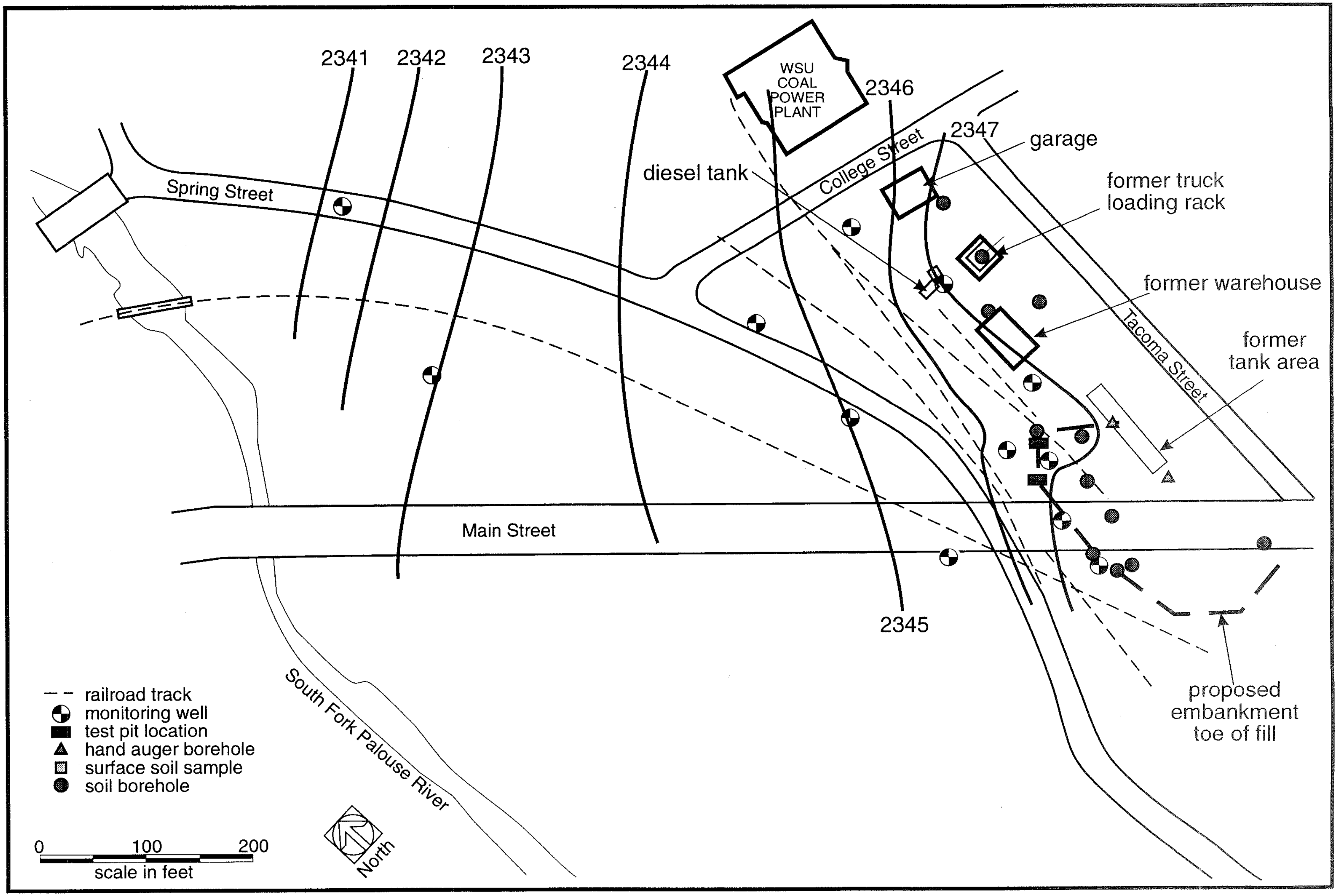

Figure A-9. Groundwater surface elevation contours (feet above sea level) on February 23, 1993 - former Chevron bulk storage facility, Pullman, WA.

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K_{oc} was estimated from the water solubility of each of the chemicals, based on a regression equation developed from 106 chemicals (including aromatic hydrocarbons) by Kenaga and Goring (1978):

$$\log K_{oc} = -0.55 \log S + 3.64 \tag{4}$$

The fraction organic carbon in the aquifer has been found to be the primary control on the retardation of soluble organic constituents (e.g., BTEX and naphthalene) (U.S. EPA 1985). Because no site-specific F_{oc} data were available, a value of 0.003 was selected based on a study by Woodward-Clyde Consultants (1988) of F_{oc} concentrations at hazardous waste sites within the United States that found this to be the average. The K_{oc} and R values used in the analysis for BTEX and naphthalene, are shown in Table A-1. The estimated retardation coefficients for the constituents of concern at the site range from 2.57 for benzene (the most mobile) to 15.5 for naphthalene.

The groundwater travel time from the source to the river is estimated to be approximately 0.5 years, which corresponds to solute travel times (i.e., that consider retardation, but exclude degradation) ranging from 1.1 years (benzene) to 6.9 years (naphthalene). Assuming that the source area has been in place at least since 1981, analysis of the rates of groundwater flow, contaminant transport, and biodegradation indicate that the groundwater plume is in steady state (i.e, the concentration at any point in the aquifer is relatively constant with time). The observed decreases in concentration downgradient may be accounted for by including biodegradation and dispersion. Under these conditions, the observed plume may expand or shrink seasonally due to variable groundwater flow rates, but the net effect will likely be a decrease in plume size as solutes are leached and degraded in the source area. With the plume dimensions at steady state, downgradient solute concentrations are not expected to increase significantly in the future.

TABLE A-1. PARAMETERS USED IN EVALUATION OF GROUNDWATER TRANSPORT

Chemical	Parameter Name	Units	Estimated Value	Comment	Reference
Benzene	Aqueous solubility	mg/L	1,791	Used to calculate K_{oc}	Howard (1990)
	Organic carbon partition coefficient	L/kg	79	Used to calculate R	Kenaga and Goring (1978)
	Retardation	--	2.57		From F_{oc} and K_{oc}
	Half life	days	20–60 days for 0.5 < DO < 2 mg/L 5–20 days for DO > 2 mg/L		Chiang et al. (1989)
Toluene	Aqueous Solubility	mg/L	535	Used to calculate K_{oc}	Howard (1990)
	Organic carbon partition coefficient	L/kg	138	Used to calculate R	Kenaga and Goring (1978)
	Retardation	--	4.1		Calculated from F_{oc} and K_{oc}
	Half life	days	20–60 days for 0.5 < DO < 2 mg/L 5–20 days for DO > 2 mg/L		Chiang et al. (1989)
Ethylbenzene	Aqueous solubility	mg/L	161	Used to calculate K_{oc}	Howard (1990)
	Organic carbon partition coefficient	L/kg	267	Used to calculate R	Kenaga and Goring (1978)
	Retardation	--	6.9		Calculated from F_{oc} and K_{oc}
	Half life	days	3–10 days aerobic water		Howard et al. (1991)
Xylenes	Aqueous solubility	mg/L	159 (avg.)	Used to calculate K_{oc}	Howard (1990)
	Organic carbon partition coefficient	L/kg	270 (avg.)	Used to calculate R	Kenaga and Goring (1978)

TABLE A-1. (cont.)

Chemical	Parameter Name	Units	Estimated Value	Comment	Reference
Xylenes (cont.)	Retardation	--	7.0 (avg.)		Calculated from f_{oc} and K_{oc}
	Half life	days	20–60 days for $0.5 < DO < 2$ mg/L 5–20 days for $DO > 2$ mg/L		Chiang et al. (1989)
Naphthalene	Aqueous solubility	mg/L	31.7	Used to calculate K_{oc}	Howard (1990)
	Organic carbon partition coefficient	L/kg	652	Used to calculate R	Kenaga and Goring (1978)
	Retardation	--	15.5		Calculated from F_{oc} and K_{oc}
	Half life	days	5–20 days in aerobic water		Howard et al. (1991)

Note: Retardation coefficient estimated using $F_{oc} = 0.003$, bulk density = 1.85 g/cm^3 and porosity = 0.25.

4. CONCLUSIONS

Based on the fate and transport analyses using chemical data and groundwater level measurements, the following conclusions have been reached about conditions at the site:

- Due to the lack of detectable levels of BTEX and naphthalene in downgradient wells MW-11 and MW-12, the concentrations of these constituents in groundwater discharging to the south fork of the Palouse River are expected to be significantly below risk-based levels.
- Assuming that any petrochemical releases at the site occurred prior to 1981, analysis of the rates of groundwater flow, contaminant transport, and biodegradation indicate that the BTEX and naphthalene plumes are in steady state. Thus, the groundwater concentrations of BTEX and naphthalene are not expected to increase in the future, and will in fact decrease as these constituents are biodegraded.
- Based on the observed distribution of BTEX and naphthalene in groundwater at the site, and the likelihood that the system is in steady state, chemical concentrations in onsite soils, including the area that will be under the proposed embankment and abutment for the replacement of the State Highway 270 bridge (see Figure A-1), will not result in exceedances of risk-based levels at the south fork of the Palouse River.

5. REFERENCES

Castany, G. 1967. Traité pratique des eaux souterraines. Second Edition. Dunod, Paris.

Chiang, C.Y., J.P. Salanitro, E.Y. Chai, J.D. Colthart, and C.L. Klein. 1989. Aerobic biodegradation of benzene, toluene, and xylene in a sandy aquifer—data analysis and computer modeling. Groundwater 27(6)823–834.

de Marsily, G. 1986. Quantitative hydrogeology: Groundwater hydrology for engineers. Academic Press, Inc., San Diego, CA. 440 pp.

Hadley, P.W., and R. Armstrong. 1991. "Where's the benzene?"—Examining California ground-water quality surveys. Groundwater 29(1)35–40.

Howard, P.H. 1990. Handbook of environmental fate and exposure data for organic chemicals: Volume 1—large production and priority pollutants. Lewis Publishers, Chelsea, MI. 574 pp.

Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M Michalenko. 1991. Handbook of environmental degradation rates. Lewis Publishers, Chelsea, MI. 725 pp.

Karison, U., and W.T. Frankenberger. 1989. Microbial degradation of benzene and toluene in groundwater. Bull. Environ. Contam. Toxicol. 43:505–510.

Kenaga, E.E. and C.A.I. Goring. 1978. Relationship between water solubility, soil-sorption, octanol-water partitioning, and bioconcentration of chemicals in biota. Prepublication copy of paper dated October 13, 1978, given at the American Society for Testing and Materials, Third Aquatic Toxicology Symposium, October 17–18, 1978, New Orleans, LA.

RZA-AGRA. 1992. Level II environmental site assessment—BNRR overcrossing Bridge 270/4 replacement, Pullman, Washington. Prepared for Washington State Department of Transportation. RZA-AGRA Engineering & Environmental Services, Spokane, WA.

RZA-AGRA. 1993a. Environmental site assessment, former bulk storage facility, Pullman, Washington. Prepared for Chevron Products, Inc. RZA-AGRA Engineering & Environmental Services, Spokane, WA.

RZA-AGRA. 1993b. Additional drilling and status report, former bulk storage facility E815 College Street, Pullman, Washington. Prepared for Chevron Products, Inc. RZA-AGRA Engineering & Environmental Services, Spokane, WA.

Smith, M.R. 1990. The biodegradation of aromatic hydrocarbons by bacteria. Biodegradation 1:191-206.

U.S. EPA. 1985. Water quality assessment: A screening procedure for toxic and conventional pollutants in surface and groundwater (Revised 1985). EPA 600/6-85/002a. U.S. Environmental Protection Agency, Athens, GA.

Woodward-Clyde Consultants. 1988. Background document for EPA's composite landfill model (EPACML). Prepared for U.S. Environmental Protection Agency, Office of Solid Waste, Washington, DC.

APPENDIX B

Basement Exposure Model

TABLE B-1. EXPOSURE PARAMETERS NECESSARY TO ESTIMATE EXPOSURES TO RESIDENTS VIA INHALATION OF BASEMENT VAPORS

Parameter	Assumption
Exposure frequency[a] (days/year)	350 days/year
Exposure frequency[b] (hours/day)	18 hours/day
Conversion factor (days/hour)	0.0417 days/hour
Exposure duration	30 years (adult)[a,b]
Inhalation absorption factor (all chemicals of concern)	1.00
Contact (daily inhalation) rate[b]	20 m^3/day
Body weight	70 kg (adult)[a]
Averaging time[c]	Carcinogenic effects: 75 years × 365 days/year Noncarcinogenic effects: exposure duration (ED) × 365 days/year

[a] U.S. EPA (1991).

[b] U.S. EPA (1990).

[c] U.S. EPA (1989a).

for residential scenarios and inhalation pathways were integrated in the calculations to reflect a reasonable maximum exposure case.

The groundwater concentrations of benzene that would result in these basement air concentrations are calculated as follows:

$$C_{gas} = C_{water} \times [\ H/RT]$$

where:

C_{gas} = concentration in gas (μg/L)
C_{water} = concentration in water (μg/L)
H = Henry's Law Constant (atm-m^3/mole) (values used in modeling shown in Table B-2)
R = Universal Gas Constant (8.204×10^{-5} atm-m^3/mole-°K)
T = temperature (276°K)

This calculation assumes that the benzene concentration in groundwater is in equilibrium with benzene concentrations in soil air directly in contact with the groundwater. Using a vapor diffusion model presented by Karimi et al. (1987), U.S. EPA (1988) and U.S. EPA (1989b), resulting maximum gas concentrations at the water surface are used to estimate chemical flux rates as:

$$D_v = D \times (P_a)^{4/3}$$

where:

D_v = effective vapor phase diffusion coefficient in soil (m^2/sec)
D = vapor phase diffusion coefficient in air (m^2/sec) (values used in modeling shown in Table B-2)
P_a = air-filled porosity, assumed to be 0.2

TABLE B-2. CHEMICAL PROPERTIES USED IN BASEMENT MODEL

Chemical	Henry's Law Constant (atm-m^3/mole)[a]	Vapor Phase Diffusion Coefficient in Air (m^2/sec)[b]
Benzene	5.5×10^{-3}	8.4×10^{-6}
Ethylbenzene	6.66×10^{-3}	6.9×10^{-6}
Toluene	7.9×10^{-3}	7.57×10^{-6}
Xylene	7.6×10^{-3}	6.9×10^{-6}

[a] Source: ATSDR (1989a,b, 1991, and 1992).

[b] Source: Lyman et al. (1982).

This diffusion occurs due to the concentration gradient in the soil column. Based on the soil vapor diffusion model, steady-state flux rates of volatile organic constituents can be represented by:

$$J = \left[-D_v \times (C_2 - C_{gas})\right] / L$$

where:

J = flux rate of vapors through the soil (mg/m^2-sec)
D_v = effective vapor phase diffusion coefficient (m^2/sec)
C_2 = vapor-phase concentration at the soil surface (mg/m^3)
C_{gas} = concentration of the chemical in the vapor phase (mg/m^3)
L = depth from the ground surface to the water table (m)

This equation is simplified by assuming that C_2 is approximately zero, an assumption that yields the maximum flux of chemicals through the soil.

Emission rates into the basement are calculated as follows:

$$E = J \times Area$$

where:

E = emission rate into basement (mg/sec)
J = flux rate of vapors through the soil (mg/m^2-sec)
Area = area over which exchange occurs (m^2)

In this model, it is assumed that vapors pass through a crack in the foundation without hindrance and that vapors mix uniformly and instantaneously throughout the basement. The crack is assumed to be 0.0032 m (0.125 m) in width and to extend around the entire basement perimeter.

The building is assumed to be square, 8.62 m on a side, for a total floor area of 74.3 m^2 (800 ft^2). Therefore, the total area of infiltration (total area of the crack) is given by:

$$\text{Area of infiltration } (m^2) = 4 \times (8.62 \text{ m} \times 0.0032 \text{ m})$$

$$\text{Area} = 0.11\text{m}^2$$

Once the emission rates are calculated, the associated indoor air concentration is estimated using a one-compartment, indoor air model (U.S. EPA 1989c). This model assumes that the infiltrating gas is uniformly and instantaneously mixed within the entire compartment. The indoor air concentration is given by:

$$\text{IAC} = \text{E/AER}$$

where:

IAC = indoor air concentration (mg/m^3)
E = chemical-specific emission rate (mg/sec)
AER = air exchange rate (m^3/sec)

The air exchange rate is estimated based on a conservative assumed residence time of 2 hours (Scheff and Wadden 1980). The residence timed represents the length of time one air volume would stay in the basement without being exchanged. Assuming a basement depth of 2.4 m, the air exchange rate is calculated to be 0.025 m^3/sec. The air exchange reflects the rate at which indoor air is replaced by outdoor air.

All of these equations may be combined to yield:

$$\text{Concentration}_{\text{air}} = \frac{C_{gw} \times H \times D \times P_a^{4/3} \times \text{Area}}{R \times T \times L \times \text{AER}}$$

where:

C_{gw} = Groundwater concentration corresponding to a specified risk level (mg/L)
H = 5.5×10^{-3} (atm-m^3/mole)
R = 8.204×10^{-5} (atm-m^3/mole°K)
T = 276 (°K)
D = 8.4×10^{-6} (m^2/sec)
P_a = 0.2 (dimensionless)
Area = 0.11 (m^2)
L = 2 (m)
AER = 0.025 (m^3/sec)

This equation is used to calculate groundwater concentrations corresponding to specified risk levels as described above. Using reasonable maximum exposure parameters, the risk-based concentration for benzene in groundwater based on inhalation of vapors migrating from groundwater into the basement is 800 mg/L. Detected site groundwater concentrations of benzene are 2 or 3 orders of magnitude less than this risk-based value. The risk-based concentrations for ethylbenzene, toluene, and xylenes are also well above any site groundwater concentrations. Thus, based on the results of the basement exposure model, exposure to any of the BTEX compounds at concentrations present at the site would not cause adverse health effects via inhalation of basement air.

REFERENCES

ATSDR. 1989a. Draft toxicological profile for ethylbenzene. Agency for Toxic Substances and Disease Registry, Atlanta, GA.

ATSDR. 1989b. Draft toxicological profile for xylene. Agency for Toxic Substances and Disease Registry, Atlanta, GA.

ATSDR. 1991. Draft toxicological profile for toluene. Agency for Toxic Substances and Disease Registry, Atlanta, GA.

ATSDR. 1992. Draft toxicological profile for benzene. Agency for Toxic Substances and Disease Registry, Atlanta, GA.

Karimi, A.A., W.J. Farmer, and M.M. Cliath. 1987. Vapor-phase diffusion of benzene in soil. J. Environ. Qual. 16:28–43.

Lyman, W.J., W.F. Reehl, and D.H. Rosenblatt. 1982. Handbook of chemical property estimation methods. McGraw-Hill, New York, NY.

Scheff, P.A., and R.A. Wadden. 1980. Indoor air pollution, characterization, prediction and control. John Wiley and Sons, New York, NY.

U.S. EPA. 1988. Superfund exposure assessment manual. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1989a. Exposure factors handbook. EPA 600/8-89-043. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA. 1989b. MMSOILS: A multimedia exposure assessment model for soils at hazardous waste sites. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Exposure Assessment Group, Washington, DC.

U.S. EPA. 1989c. RCRA facility investigation (RFI) guidance, Volume II of IV: Soil, groundwater and subsurface gas releases. EPA 530/SW-89-031. U.S. Environmental Protection Agency, Waste Management Division Office of Solid Waste, Washington, DC.

U.S. EPA. 1990. Memorandum from L. Woodruff to Region 10, regarding risk assessment guidance for Superfund reports, dated January 31, 1990. U.S. Environmental Protection Agency Region 10, Seattle, WA.

U.S. EPA. 1991. Risk assessment guidance for Superfund: Vol. I. Human health evaluation manual. Supplemental guidance. OSWER Directive 9285.6-03. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

RZA - AGRA
(Rittenhouse-Zeman & Associates, Inc.)
Engineering & Environmental Services

Georgetown Office Building
539 W Sharp, Suite D
Spokane, WA 99201
(509) 325-0104
FAX (509) 325-0212

31 March 1993

RECEIVED
APR 14 1993
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

Chevron Products Company
Marketing Operations Northwest Region
P.O. Box 5004
San Ramon, California 98111

Attention: Mr. Clint Rogers
Subject: Additional Drilling and Status Report
Former Bulk Storage Facility
East 815 College Street
Pullman, Washington

Mr. Rogers:

RZA AGRA, Inc. is pleased to present this letter summarizing the results of our recent field work accomplished at the above referenced site. The approximate location of the site is presented on Figure 1, Site Vicinity Map. This phase of the project consisted of drilling four borings and installing 2-inch I.D. monitoring wells in two of the borings located down gradient of the subject site. Representative soil samples collected from the borings and groundwater collected from the new monitoring wells were submitted for analytical testing of petroleum constituents. This work was based on our proposal and scope of work dated 8 February 1993. Authorization to conduct work was given by Mr. Clint Rogers of Chevron U.S.A. in Release No. 8910990 dated 17 February 1993.

SUBSURFACE CONDITIONS

Two borings (CB-5 and CB-6) were completed immediately southwest of the subject site along the proposed toe of embankment fill. Two monitoring wells (MW-11 and MW-12) were installed off-site approximately 500 feet hydraulically down gradient of the site. Approximate exploration locations are shown on Figure 2, Site and Exploration Plan. Boring logs and monitoring well as-built diagrams are attached to this letter.

GROUNDWATER CONDITIONS

At the time of drilling, groundwater was generally encountered at a depth ranging from 4 to 9 feet below the existing ground surface. Installation of off-site monitoring wells MW-11 and MW-12 allowed measurement of the static groundwater level in the wells after completion of drilling operations. Groundwater levels were also collected on 23 February 1993 from monitoring wells MW-1 through MW-5 and MW-8 through MW-10 installed during previous investigations. Groundwater elevations in monitoring wells MW-6 and MW-7 could not be measured at this time due to deep snow and parked cars over well location. On 9 March 1993, a representative from RZA AGRA revisited the site to collect measurements from all site monitoring wells. Table 1 presents a summary of well construction, measuring point and groundwater elevations for all site and surrounding wells. Vertical well elevations for the wells completed for this phase of the study were measured by RZA AGRA personnel. Figure 3 presents an estimation of the groundwater surface contour and flow direction based on the geometry of the static water level elevation data collected on 9 March 1993. Based on this interpretation of measurements, the shallow groundwater beneath the subject site migrates to the west under a hydraulic gradient of approximately 0.018 ft/ft. The groundwater table beneath Spring Street, west of the subject site, flows towards the northwest at an approximate gradient of 0.005 ft/ft. In the vicinity of monitoring wells MW-11 and MW-12, the groundwater gradient changes again to approximately 0.021 ft/ft.

During our most recent site visit on 9 March 1993 measurable, liquid hydrocarbons had appeared in monitoring wells MW-8 and MW-10. Apparent LHC thicknesses at the time of our site visit were 0.27 feet wells and 0.21 feet for MW-8 and MW-10, respectively.

ANALYTICAL RESULTS

Representative soils were selected from each boring and submitted to Analytical Technologies, Inc. of Renton, Washington for analytical testing. Soil samples were analyzed for total petroleum hydrocarbons (TPH) by Washington Method WTPH-G and WTPH-D, total recoverable hydrocarbons (TRH) by Washington Method 418.1, selected volatile aromatic hydrocarbons common to fuel products (benzene, toluene, ethylbenzene, and xylenes or BTEX) by EPA Method 8020 and polynuclear aromatic hydrocarbons (PAH's) by EPA Method 8310. Laboratory Certificates are attached to this letter.

Groundwater samples were collected from the two new monitoring wells (MW-11 and MW-12). No detectable concentrations of total recoverable hydrocarbons, extractable hydrocarbons, purgeable hydrocarbons or the volatile aromatic hydrocarbons (BTEX) were exhibited by groundwater samples submitted for analytical testing. A summary of analytical testing of groundwater during this phase is presented in Table 2.

CONCLUSIONS

Based on the environmental assessment completed for this phase of the project, soils located approximately 500 feet down gradient of the former bulk storage facility and soils located south of the Main Street Bridge do not contain detectable levels of petroleum hydrocarbons. Soils located just outside the former bulk storage facility, north of the Main Street Bridge in the vicinity of the proposed embankment toe of fill, contain detectable concentrations of total recoverable hydrocarbons, extractable hydrocarbons, purgeable hydrocarbons and the volatile aromatic hydrocarbons BTEX. Groundwater samples collected from the two new monitoring wells located approximately 500 feet west northwest of the subject site, contain no detectable concentrations of petroleum hydrocarbons.

Groundwater at and around the subject site was determined to be migrating to the west and northwest at an approximate hydraulic gradients between 0.005 and 0.018 ft/ft as determined from groundwater measurements collected on 9 March 1993. During our latest site visit, approximately 0.27 and 0.21 feet of LHC was measured in monitoring wells MW-8 and MW-10, respectively.

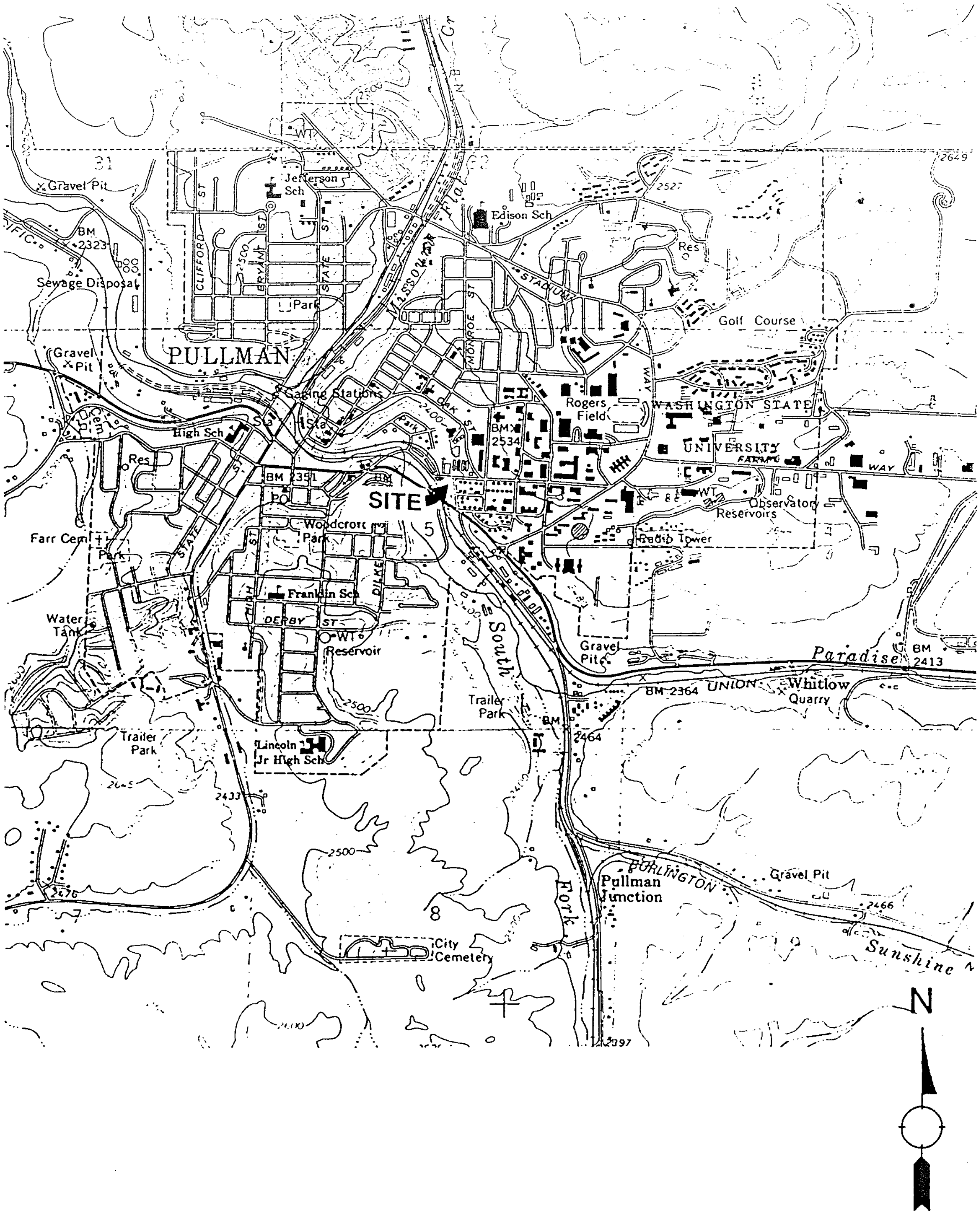
We appreciate the opportunity to be of continued service to Chevron Products Company. Should you have any questions regarding the contents of this letter or other aspects of this project, please call us at your earliest convience.

Respectfully submitted,
RZA AGRA, Inc.

Eugene N.J. St.Godard, P.G.
Senior Staff Geologist

Jon N. Sondergaard
Associate

Enclosures:	Figure 1:	Site Vicinity Map
	Figure 2:	Site and Exploration Plan
	Figure 3:	Groundwater Surface Elevation Map
	Table 1:	Summary of Analytical Testing
	Table 2:	Summary of Well and Groundwater Elevations in Feet
	Table 3:	Summary of Analytical Testing for all TPH Soils at the Study Area
	Table 4:	Polynuclear Hydrocarbon Analysis for Soils
	Table 5:	Summary of Analytical Testing for TPH for all Groundwater Sampling Events
	Table 6:	Polynuclear Hydrocarbon Analysis for Groundwater
		Boring Logs and Well As-Builts
		Analytical Laboratory Certificates



RZA AGRA, INC.
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Georgetown Office Building
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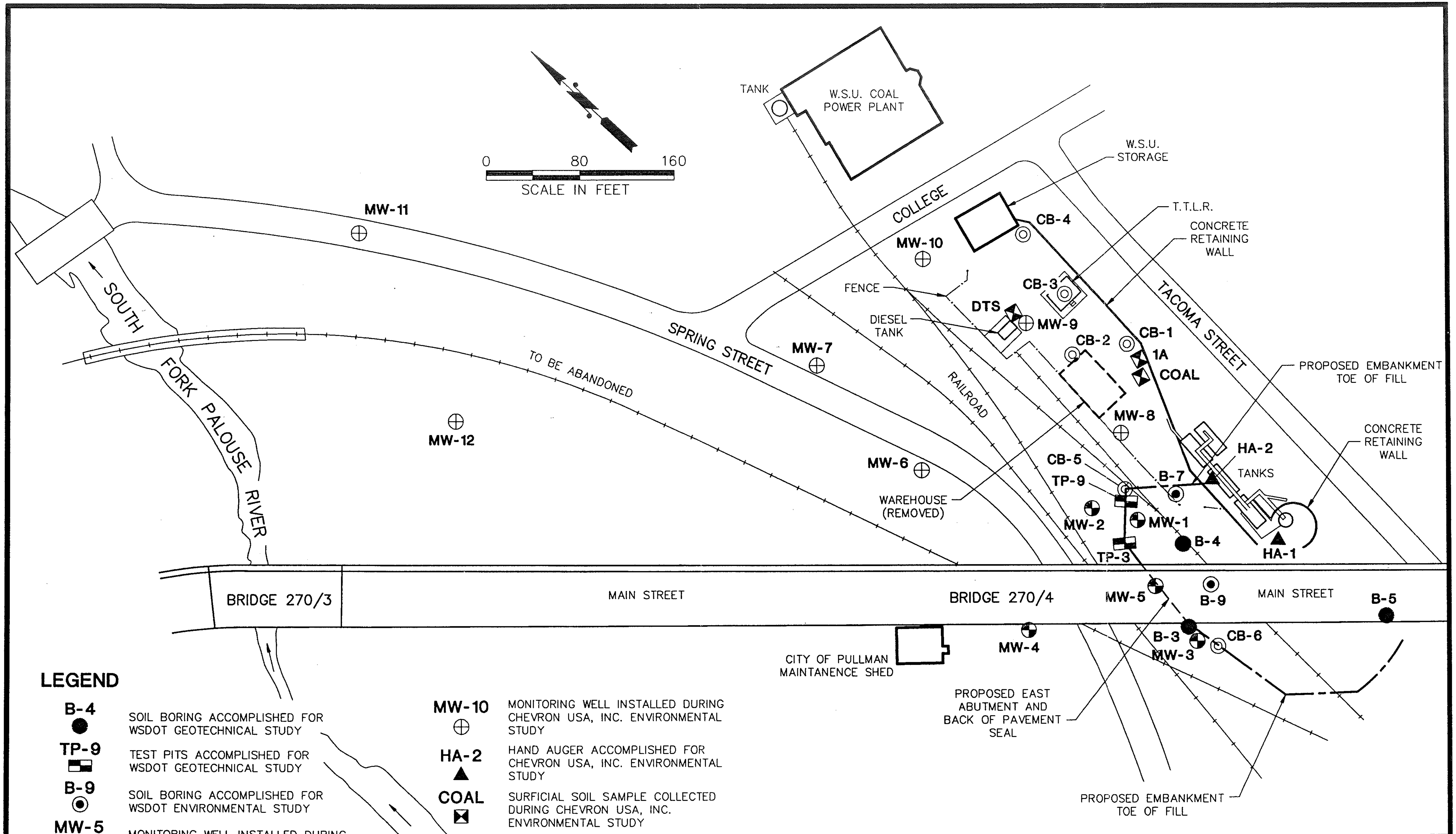
Suite D
Spokane, WA 99201

W.O. S-1070-1
DESIGN
DRAWN ENJS
DATE JAN 1993
SCALE N.T.S.

FIGURE 1

SITE VICINITY MAP

152284
GENDRON'S



LEGEND

B-4 ●	SOIL BORING ACCOMPLISHED FOR WSDOT GEOTECHNICAL STUDY
TP-9 ▨	TEST PITS ACCOMPLISHED FOR WSDOT GEOTECHNICAL STUDY
B-9 ◉	SOIL BORING ACCOMPLISHED FOR WSDOT ENVIRONMENTAL STUDY
MW-5 ◐	MONITORING WELL INSTALLED DURING WSDOT ENVIRONMENTAL STUDY
CB-4 ◎	SOIL BORING ACCOMPLISHED FOR CHEVRON USA, INC. ENVIRONMENTAL STUDY
MW-10 ⊕	MONITORING WELL INSTALLED DURING CHEVRON USA, INC. ENVIRONMENTAL STUDY
HA-2 ▲	HAND AUGER ACCOMPLISHED FOR CHEVRON USA, INC. ENVIRONMENTAL STUDY
COAL ⧓	SURFICIAL SOIL SAMPLE COLLECTED DURING CHEVRON USA, INC. ENVIRONMENTAL STUDY

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Engineering & Environmental Services

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Spokane, Washington 99201

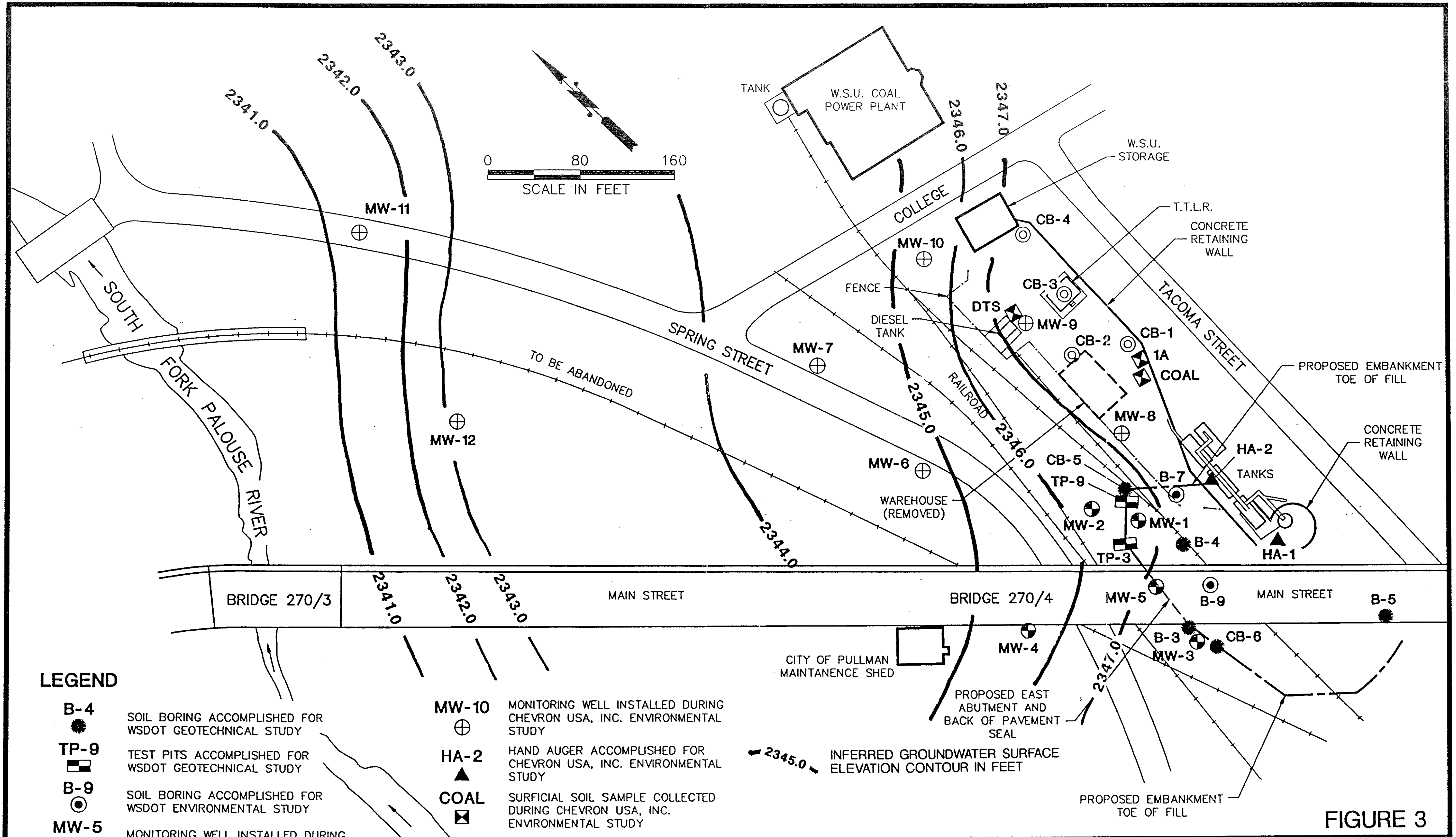
W.O.	S-1070-2
DESIGN	ENJS
DRAWN	MJF
DATE	MAR 1993
SCALE	1"=80'

FORMER CHEVRON BULK STORAGE FACILITY
EAST 815 COLLEGE STREET
PULLMAN, WASHINGTON

SITE AND EXPLORATION PLAN

FIGURE 2

DRAWING NO. \S\S-1070-2\SITE.DWG



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HA-2 ▲	HAND AUGER ACCOMPLISHED FOR CHEVRON USA, INC. ENVIRONMENTAL STUDY
COAL ☒	SURFICIAL SOIL SAMPLE COLLECTED DURING CHEVRON USA, INC. ENVIRONMENTAL STUDY
2345.0	INFERRED GROUNDWATER SURFACE ELEVATION CONTOUR IN FEET

FIGURE 3

RZA AGRA, INC.
Engineering & Environmental Services

539 West Sharp
Suite D
Spokane, Washington 99201

W.O.	S-1070-1
DESIGN	GS
DRAWN	MJF
DATE	MAR 1993
SCALE	1"=80'

FORMER CHEVRON BULK STORAGE FACILITY
EAST 815 COLLEGE STREET
PULLMAN, WASHINGTON

GROUNDWATER SURFACE ELEVATION MAP
MARCH 1993

DRAWING NO. \S\S-1070-1\SITE2.DWG

TABLE 1: SUMMARY OF ANALYTICAL TESTING
S-1070-2
FORMER CHEVRON BULK STORAGE FACILITY
PULLMAN, WASHINGTON

						SOIL (MG/L OR PPM)					
BORING/WELL NO.	SAMPLE NO.	DEPTH (FT)	DATE SAMPLED	CERTIFICATE NO.	WTPH 418.1	WTPH-D	WTPH-G	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES
MW-11	S-1	3.0 - 4.5	2/22/93	9302-204-1	ND	ND	ND	ND	ND	ND	ND
MW-12	S-2	7.5 - 9.0	2/22/93	9302-204-2	ND	ND	ND	ND	ND	ND	ND
CB-5	S-2	7.5 - 9.0	2/23/93	9302-204-3	870.0	480.0	2400.0	5.5	2.9	9.0	17.0
CB-6	S-2	8.0 - 9.5	2/23/93	9302-204-4	ND	ND	ND	ND	ND	ND	ND
DETECTION LIMIT					27.0	14.0	55.0	0.033	0.033	0.033	0.033
						GROUNDWATER (MG\L OR PPM)					
MW-11			2/23/93	9302-204-5	ND	ND	ND	ND	ND	ND	ND
MW-12			2/23/93	9302-204-6	ND	ND	ND	ND	ND	ND	ND
DETECTION LIMIT					1.0	0.3	100	0.5	0.5	0.5	0.5

ND = BELOW METHOD DETECTIO LIMITS
NA = NOT ANALYZED

POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) (Mg/Kg or ppm)			
SAMPLE NO.	CB-5	CB-6	DETECTION LIMIT
MATRIX	S-2	S-2	
	SOIL	SOIL	
SAMPLE DATE	2/23/93	2/23/93	
ACENAPHTHENE	0.35	ND	0.14
ACENAPHTHYLENE	ND	ND	0.23
ANTHRACENE	0.031	ND	0.014
BENZO (A)ANTHRACENE	0.014	ND	0.014
BENZE (A)PYRENE	ND	ND	0.014
BENZO (B)FLUORANTHENE	ND	ND	0.014
BENZO (GHI)PERYLENE	ND	ND	0.014
BENZO (K)FLUORANTHENE	ND	ND	0.014
CHRYSENE	0.052	ND	0.014
DIBENZO (A,H)ANTHRACEN	ND	ND	0.014
FLUORANTHENE	2.3	ND	0.027
FLUORENE	0.6	ND	0.027
IDENO (1,2,3-CD)PYRENE	ND	ND	0.014
NAPHTHALENE	7.3	ND	0.14
PENANTHRENE	1.1	ND	0.014
PYRENE	0.12	ND	0.014

Ta Sur / of \ nd G lwat vatic Feet
Pullman Chevron
Pullman, Washington
S-1070

WELL NO.	DATE MEASURED	TOP OF PVC WELL CASING	TOP OF WELL SCREEN	BOTTOM OF WELL SCREEN	APPARENT LHC THICKNESS	GROUNDWATER ELEVATION
MW-1	4/23/92	2,354.24	2,349.99	2,339.99	0.0	2,346.50
MW-1	12/17/92	2,354.24	2,349.99	2,339.99	0.0	2,346.22
MW-1	2/23/93	2,354.24	2,349.99	2,339.99	0.0	2,346.78
MW-1	3/09/93	2,354.24	2,349.99	2,339.99	0.0	2,346.97
MW-2	4/23/92	2,354.29	2,349.61	2,339.61	0.0	2,345.91
MW-2	12/17/92	2,354.29	2,349.61	2,339.61	0.0	2,345.57
MW-2	2/23/93	2,354.29	2,349.61	2,339.61	0.0	2,346.13
MW-2	3/09/93	2,254.29	2,349.61	2,339.61	0.0	2,346.58
MW-3	4/23/92	2,354.43	2,348.30	2,338.30	0.0	2,347.23
MW-3	12/17/92	2,354.43	2,348.30	2,338.30	0.0	2,346.69
MW-3	2/23/93	2,354.43	2,348.30	2,338.30	0.0	2,347.45
MW-3	3/09/93	2,354.43	2,348.30	2,338.30	0.0	2,347.71
MW-4	4/23/92	2,352.35	2,343.87	2,338.87	0.0	2,345.43
MW-4	12/17/92	2,352.35	2,343.87	2,338.87	0.0	2,344.60
MW-4	2/23/93	2,352.35	2,343.87	2,338.87	0.0	2,345.53
MW-4	3/09/93	2,352.35	2,343.87	2,338.87	0.0	2,345.63
MW-5	4/23/92	2,353.38	2,346.79	2,341.79	0.0	2,347.08
MW-5	12/17/92	2,353.38	2,346.79	2,341.79	0.0	2,246.52
MW-5	2/23/93	2,353.38	2,346.79	2,341.79	0.0	2,347.26
MW-5	3/09/93	2,353.38	2,346.79	2,341.79	0.0	2,347.39
MW-6	12/17/92	2,348.38	2,343.98	2,338.98	0.0	2,342.99
MW-6	2/23/93	2,348.38	2,343.98	2,338.98	0.0	NM
MW-6	3/09/93	2,348.38	2,343.98	2,338.98	0.0	2,344.45
MW-7	12/17/92	2,347.72	2,341.42	2,336.42	0.0	2,343.51
MW-7	2/23/93	2,347.72	2,341.42	2,336.42	0.0	NM
MW-7	3/09/93	2,347.72	2,341.42	2,336.42	0.0	2,344.29
MW-8	12/17/92	2,355.45	2,348.80	2,338.80	0.0	2,346.79
MW-8	2/23/93	2,355.45	2,348.80	2,338.80	0.0	2,347.13
MW-8	3/09/93	2,355.45	2,348.80	2,338.80	0.27	*2,347.75
MW-9	12/17/92	2,353.61	2,338.61	2,338.61	0.0	2,347.15
MW-9	2/23/93	2,353.61	2,338.61	2,338.61	0.0	2,347.73
MW-9	3/09/93	2,353.61	2,338.61	2,338.61	0.0	2,347.84
MW-10	12/17/92	2,354.35	2,337.15	2,337.15	0.0	2,345.23
MW-10	2/23/93	2,354.35	2,337.15	2,337.15	0.0	2,345.53
MW-10	3/09/93	2,354.35	2,337.15	2,337.15	0.21	*2,345.93
MW-11	2/23/93	2,345.24	2,344.99	2,337.49	0.0	2,341.18
MW-11	3/09/93	2,345.24	2,344.99	2,337.49	0.0	2,341.26
MW-12	2/23/93	2,351.43	2,344.23	2,336.73	0.0	2,342.97
MW-12	3/09/93	2,351.43	2,344.23	2,366.73	0.0	2,343.13

* VALUE CORRECTED BY A FACTOR OF 0.80 TO COMPENSATE FOR WATER/PRODUCT DENSITY DIFFERENCES
ALL MEASUREMENTS ARE IN FEET

Table 3: Summary of Analytical Testing for all TPH Soils at Study Area
Pullman Chevron
Pullman, Washington
S-1070-2

BORING/WELL NO.	DEPTH FEET	DATE MEASURED	HCID	WTPH-418.1	WTPH-D (PPM)	WTPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TOTAL LEAD (PPM)
MW-1, S-2	5.0 - 6.5	03/26/91	D	NA	1889.00	NA	1.45	ND	0.925	0.559	20.70
MW-1,S-4	10.0 - 11.5	03/26/91	ND	NA	ND	NA	ND	0.041	0.005	0.017	19.20
MW-2,S-3	7.5 - 9.0	03/26/91	ND	NA	ND	NA	0.006	ND	0.054	0.079	17.90
MW-2,S-5	12.5 - 13.4	03/26/91	ND	NA	ND	NA	ND	ND	ND	ND	15.30
MW-3,S-2	2.5 - 4.0	03/26/91	ND	NA	ND	NA	ND	ND	ND	ND	23.30
MW-3,S-3	7.5 - 9.0	03/26/91	ND	NA	ND	NA	ND	ND	ND	ND	15.40
MW-4,S-1	6.0 - 7.5	03/27/92	ND	NA	ND	NA	ND	ND	ND	ND	52.70
MW-4,S-2	5.0 - 6.5	03/27/92	ND	NA	ND	NA	ND	ND	ND	ND	23.50
MW-5,S-1	7.5 - 9.0	03/27/92	ND	NA	ND	NA	ND	ND	ND	ND	44.80
B-7, S-2	5.0 - 6.5	03/27/92	ND	NA	ND	NA	0.106	ND	0.536	0.216	32.60
B-7,S-3	7.5 - 7.0	03/27/92	D	NA	700.00	NA	--	--	--	--	--
B-7,S-5	12.5 - 14.0	03/27/92	ND	NA	ND	NA	ND	ND	0.538	0.218	21.70
B-8,S-2	7.0 - 8.5	03/27/92	ND	NA	ND	NA	ND	ND	ND	ND	28.10
B-8,S-3	12.0 - 13.2	03/27/92	ND	NA	ND	NA	ND	ND	ND	ND	20.00
B-9,S-2	7.5 - 9.0	03/26/91	D	NA	428.00	NA	0.038	ND	ND	ND	19.20
B-9,S-3	12.5 - 14.0	03/26/91	ND	NA	ND	NA	ND	ND	ND	ND	19.10
TP-9,S-1	5.0 - 5.5	03/15/91	G	NA	NA	533.00	5.35	2.3	2.17	21.1	--
TP-9,S-2	6.0 - 7.0	03/15/91	G	NA	NA	1129.00	0.065	2.77	1.33	5.0	--
MW-7,S-2	7.5 - 9.0	12/16/92	NA	11.00	ND	ND	ND	ND	ND	ND	ND
MW-8,S-1	2.5 - 4.0	12/15/92	NA	NT	2500.00	5.60	1.20	0.88	33.0	100.0	NT
MW-8,S-2	7.5 - 9.0	12/15/92	NA	520.00	440.00	2000.00	0.29	0.19	1.7	6.0	ND
MW-9,S-2	7.5 - 9.0	12/15/92	NA	560.00	320.00	23.00	2.10	27.0	33	120.0	ND
MW-10,S-2	7.5 - 9.0	12/16/92	NA	1500.00	480.00	1700.00	25.00	17.0	360	1100.0	30.00
CB-1,S-2	8.0 - 9.5	12/14/92	NA	980.00	3200.00	15000.00	ND	ND	ND	14.0	35.00
CB-1,S-3	7.5 - 9.0	12/14/92	NA	NT	18.00	4000.00	ND	ND	ND	0.26	NT
CB-2,S-2	8.0 - 9.5	12/14/92	NA	840.00	220.00	200.00	ND	ND	ND	1.0	ND
CB-3,S-1	2.5 - 4.0	12/15/92	NA	400.00	490.00	750.00	0.12	0.63	0.10	0.11	20.00
CB-4,S-2	7.5 - .90	12/15/92	NA	20.00	630.00	41.00	ND	0.012	ND	ND	24.00
DTS	0.0 - 0.5	12/14/92	NA	NT	ND	3.40	NT	NT	NT	NT	NT
COAL 829	SURFACE	12/14/92	NA	330.00	250.00	NT	0.047	0.11	0.029	0.14	NT
COAL 986	SURFACE	12/14/92	NA	260.00	200.00	4.30	0.10	0.38	0.067	0.45	NT
HA-1,S-1	1.5 - 2.0	12/14/92	NA	ND	140.00	14.00	ND	0.0099	ND	ND	170.00
HA-2,S-1	1.5 - 2.0	12/16/92	NA	ND	19.00	ND	ND	ND	ND	ND	ND
MW-11,S-1	3.0 - 4.5	02/22/93	NA	ND	ND	ND	ND	ND	ND	ND	NA
MW-12,S-2	7.5 - 9.0	02/22/93	NA	ND	ND	ND	ND	ND	ND	ND	NA
CB-5,S-2	7.5 - 9.0	02/23/93	NA	870.00	480.00	2400.00	5.50	2.9	9.0	17	NA
CB6,S-2	8.0 - 9.5	02/23/93	NA	ND	ND	ND	ND	ND	ND	ND	NA
DETECTION LIMITS			200.0	27.0	14.0	1.0	0.005	0.005	0.005	0.01	15.0

* ALL RESULTS IN MG/L (PPM)
ND = BELOW METHOD DETECTION LIMIT
NA = SAMPLE NOT ANALYZED FOR THIS SAMPLE DATE

S-1070-2

Table 4: Summary of All Polynuclear Hydrocarbon Analysis for Soils at Subject Site

Results in Mg/Kg (ppm)

SAMPLE NO.	MW-7	MW-8	MW-9	CB-1	CB-2	CB-3	CB-4	DTS	COAL	COAL	HA-1	HA-2	CB-5	CB-6	DETECTION LIMIT
MATRIX	S-2	S-2	S-2	S-2	S-2	S-1	S-2		829	986			S-2	S-2	
ANALYTE	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
SAMPLE DATE	12/16/92	12/15/92	12/15/92	12/14/92	12/14/92	12/15/92	12/15/92	12/14/92	12/14/92	12/14/92	12/14/92	12/16/92	02/23/93	02/23/92	
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.35	ND	0.14
ACENAPHTHYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.23
ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.031	ND	0.014
BENZO (A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014	ND	0.014
BENZE (A)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014
BENZO (B)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014
BENZO (GHI)PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014
BENZO (K)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.052	ND	0.014
DIBENZO (A,H)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014
FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.3	ND	0.027
FLUORENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6	ND	0.027
IDENO (1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014
NAPHTHALENE	ND	ND	1.9	ND	1.6	ND	0.79	ND	ND	ND	ND	ND	7.3	ND	0.14
PENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	0.014
PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12	ND	0.014

NOTE: Results in Mg/L or ppm

Table 5: Summary of Analytical Testing for TPH for all Groundwater Sampling Events at Subject Site
Pullman Chevron
Pullman, Washington
S-1070-2

WELL NO.	DATE MEASURED	HCID	WTPH-418.1	WTPH-D (PPM)	WTPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TOTAL LEAD (PPM)
MW-1	3/28/92	ND	NA	49.8	NA	0.169	0.027	0.462	0.048	0.323
MW-1	12/18/92	NA	19.0	15.0	3.9	0.2	0.015	0.26	0.032	0.022
MW-2	3/29/92	ND	NA	ND	NA	0.95	0.024	0.025	0.005	0.12
MW-2	12/18/92	NA	4.3	2.4	4.3	1.3	0.053	0.31	0.16	0.029
MW-3	3/29/92	ND	NA	ND	NA	ND	ND	ND	ND	0.196
MW-3	12/18/92	NA	ND	ND	ND	ND	ND	ND	ND	0.045
MW-4	3/29/92	ND	NA	ND	NA	ND	ND	ND	ND	0.142
MW-4	12/17/92	NA	1.2	ND	ND	ND	ND	ND	ND	0.048
MW-5	3/29/92	ND	NA	ND	NA	ND	ND	ND	ND	0.139
MW-5	12/17/92	NA	ND	ND	ND	ND	ND	ND	ND	0.081
MW-6	12/17/92	NA	4.6	0.78	2.2	0.95	0.034	0.36	ND	0.46
MW-7	12/17/92	NA	ND	1.6	0.58	0.2	0.0081	0.07	0.023	2.5
MW-8	12/16/92	NA	270.0	8.7	29.0	1.2	0.62	1.6	3.2	0.47
MW-8	12/17/92	NA	79.0	200.0	16.0	1.6	0.32	2.1	3.4	0.19
MW-9	12/18/92	NA	15.0	2.0	15.0	7.2	1.5	1.2	2.5	0.14
MW-10	12/17/92	NA	94.0	23.0	66.0	1.3	0.22	5.4	16	1.3
MW-11	2/23/93	NA	ND	ND	ND	ND	ND	ND	ND	NA
MW-12	2/23/93	NA	ND	ND	ND	ND	ND	ND	ND	NA

* ALL RESULTS IN MG/L (PPM)
ND = BELOW METHOD DETECTION LIMIT
NA = SAMPLE NOT ANALYZED FOR THIS SAMPLE DATE

S-1070-2

Table 6: Summary of All Polynuclear Hydrocarbon Analysis for Groundwater at Subject Site

Results in Mg/Kg (ppm)

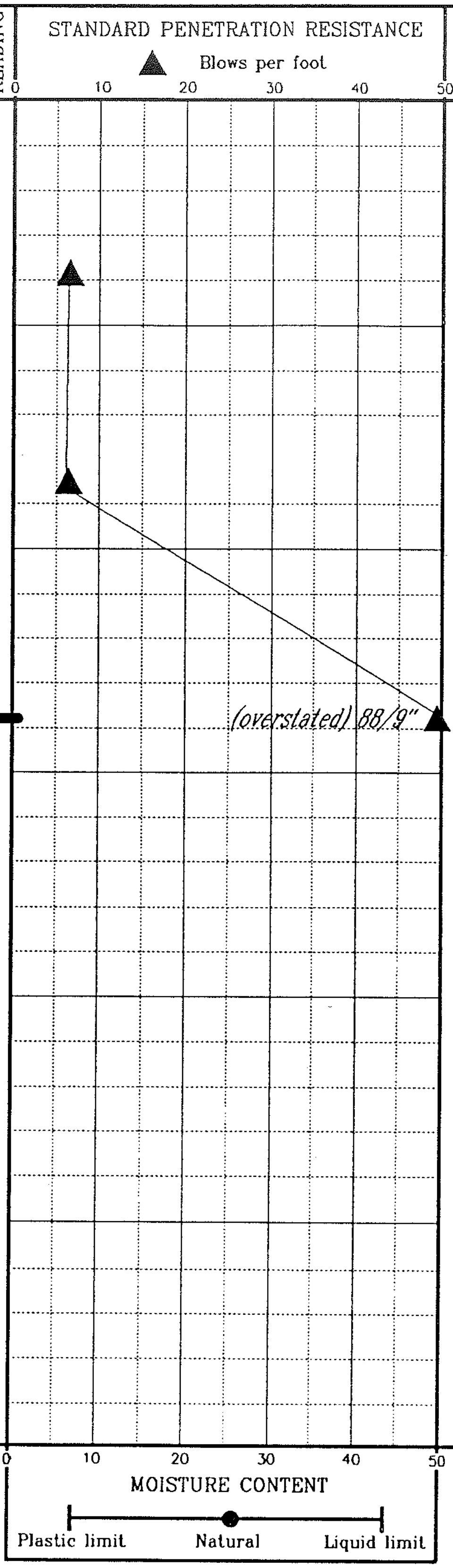
SAMPLE NO.	MW-1	MW-2	MW-6	MW-7	MW-8	MW-8	MW-9	MW-10	DETECTION LIMIT
MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	
ANALYTE									
SAMPLE DATE	12/18/92	12/18/92	12/17/92	12/17/92	12/16/92	12/18/92	12/18/92	12/17/92	
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	0.005
ACENAPHTHYLENE	ND	ND	ND	ND	ND	ND	ND	ND	0.005
ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	0.005
BENZO (A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	0.0001
BENZE (A)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
BENZO (B)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
BENZO (GHI)PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	0.0001
BENZO (K)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND	2E-05
DIBENZO (A,H)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	IE-05
FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	0.0001
FLUORENE	ND	ND	ND	ND	ND	ND	ND	ND	0.005
IDENO (1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	4E-05
NAPHTHALENE	0.053	0.022	0.24	ND	0.16	0.067	0.023	0.22	0.005
PENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	0.005
PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	0.0005

NOTE: Results in Mg/L or ppm

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070-2* BORING NO. *CB-5*

Approximate ground surface elevation: *2352.36*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	OVM READING	TESTING
0					
	Loose, wet, dark brown, very silty fine SAND with some gravel. Strong hydrocarbon-like odor	I	*S-1*		
5					
	-groundwater encountered at approximately 8 feet				
		I	*S-2*		BTEX TPH-G TPH-D 418.1 LEAD 8310
10	*Soft, saturated, greenish-black, fine sandy SILT with hydrocarbon-like odor and sheen*				
	Dense, saturated, green , coarse SAND with gravel and hydrocarbon-like odor				
		I	*S-3*		
	Basalt Bedrock *Boring terminated at approximately 13.8 feet*				
15					
20					
25					
30					



LEGEND

I 2-inch OD split spoon sampler

BTEX TPH	Soil Analysis (method shown)

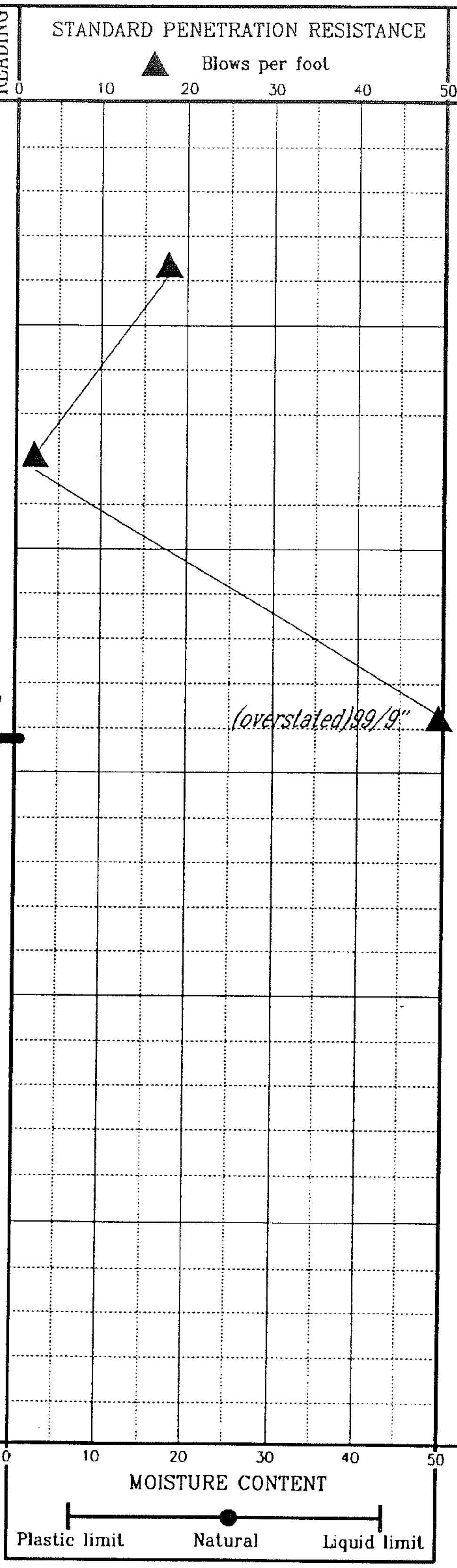
RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

Drilling started: *22 February 1993* Drilling completed: *22 February 1993* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070-2* BORING NO. *CB-6*

Approximate ground surface elevation: *2352.94*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	OVM READING	TESTING
0					
5	*Medium-dense, wet, dark brown, very silty fine SAND with gravelly sand interbeds*	I	*S-1*	*0.0*	
	-groundwater encountered at approximately 9 feet				
10	*Soft, wet to saturated, dark brown, sandy SILT with clay and scattered gravels*	I	*S-2*	*0.0*	BTEX TPH-G TPH-D 418.1 LEAD 8310
	Dense to very dense, saturated, yellowish-green gravelly SAND with some silt	I	*S-3*	*0.0*	
15	*Basalt Bedrock* *Boring terminated at approximately 14.2 feet*				
20					
25					
30					



LEGEND

I 2-inch OD split spoon sampler

BTEX TPH	Soil Analysis (method shown)

RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

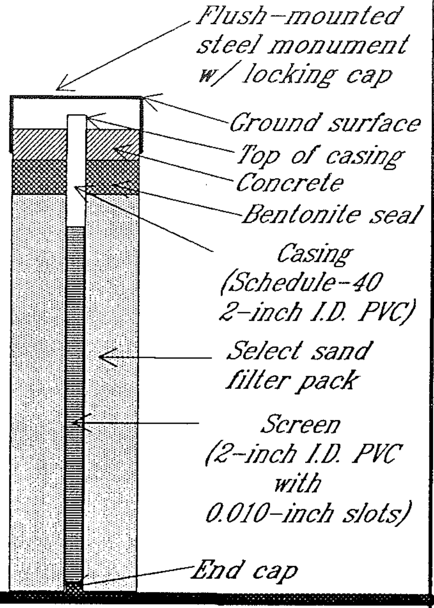
Drilling started: *22 February 1993* Drilling completed: *22 February 1993* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070-2* WELL NO. *MW-11*

Elevation reference:
Ground surface elevation: *2,354.63* Casing elevation: *2,354.24*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER
0	*0-3" Asphalt*					
	Very soft, moist, dark brown, SILT with some clay	I	*S-1*	*4*	*0.0*	▼ 2/23/93
5	*Loose, wet, brown, silty SAND*					
	Very dense, saturated, brown to yellowish brown gravelly coarse SAND with some silt	I	*S-2*	*81/10"*	*0.0*	
10	*BASALT Bedrock* *Boring terminated at approximately 10.3 feet*					
15						
20						
25						
30						

AS-BUILT DESIGN



TESTING

BTEX
TPH-G
TPH-D
418.1

LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ 8020 Soil Analysis (EPA method shown)

RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

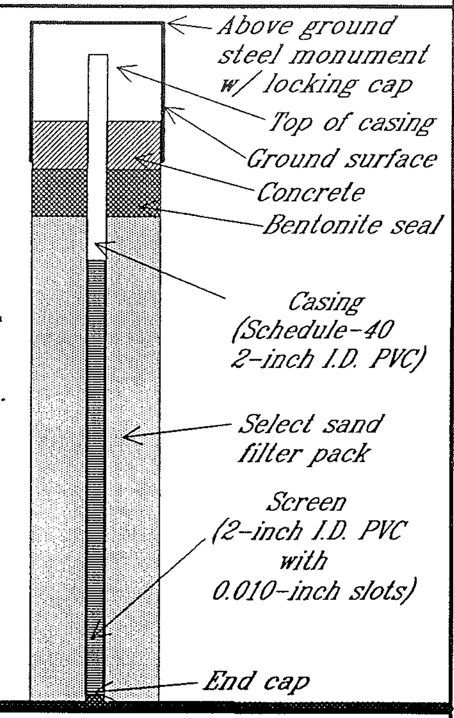
Drilling started: *22 February 1993* Drilling completed: *22 February 1993* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070-2* WELL NO. *MW-12*

Elevation reference:
Ground surface elevation: *2349.14* Casing elevation: *2351.43*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Silty SAND with abundant organics (TOPSOIL)*						
	Medium dense, damp, dark brown to brown gravelly SAND	I	*S-1*	*17*	*0.0*		
5						▼ 2/23/93	BTEX TPH-G TPH-D 418.1
	Medium dense, moist, dark brown, very silty fine SAND with some coarse SAND	I	*S-2*	*11*	*0.0*		
10	*Dense to very dense, saturated, brown to dark gray, gravelly SAND*	I	*S-3*	*60/9"*	*0.0*		
	BASALT Bedrock *Boring terminated at approximately 12.7 feet*						
15							
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ 8020 Soil Analysis (EPA method shown)

RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *22 February 1993* Drilling completed: *22 February 1993* Logged by: *ENJS*

AnalyticalTechnologies,Inc.
560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
John H. Taylor, Jr., Laboratory Manager
Frederick W. Grothkopp, Technical Director

ATI I.D. # 9302-204

March 9, 1993

RZA-AGRA
539 West Sharp Avenue
Suite D
Spokane WA 99201

Attention : Gene St. Godard

Project Number : S1070-2

Project Name : Chevron - Pullman

Dear Mr. St. Godard:

On February 25, 1993, Analytical Technologies, Inc. (ATI), received seven samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Donna M. McKinney

Donna M. McKinney
Senior Project Manager

DMM/hal/dmc

Enclosure

ATI I.D. # 9302-204

SAMPLE CROSS REFERENCE SHEET

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9302-204-1	MW-11 S-1	02/22/93	SOIL
9302-204-2	MW-12 S-2	02/22/93	SOIL
9302-204-3	CB-5 S-2	02/23/93	SOIL
9302-204-4	CB-6 S-2	02/23/93	SOIL
9302-204-5	MW-11	02/23/93	WATER
9302-204-6	MW-12	02/23/93	WATER
9302-204-7	TRIP BLANK	N/A	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	3
SOIL	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9302-204

ANALYTICAL SCHEDULE

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

ANALYSIS	TECHNIQUE	REFERENCE	LAB
POLYNUCLEAR AROMATIC HYDROCARBONS	HPLC/UV/FLUOR	EPA 8310	R
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-D	R
PETROLEUM HYDROCARBONS	IR	WA DOE WTPH-418.1 MODIFIED	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9302-204

QUALITY CONTROL INFORMATION

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

POLYNUCLEAR AROMATICS

CONTROL LIMITS

BLANK SPIKE	WATER	RPD	SOIL	RPD
Acenaphthylene	35-104	32	28-111	20
Phenanthrene	47-147	30	40-130	35
Pyrene	31-155	30	43-143	34
Bebzo(k)fluoranthene	39-145	29	43-138	34
Dibenzo(a,h)anthracene	34-135	26	37-125	33

MATRIX SPIKE	WATER	RPD	SOIL	RPD
Acenaphthylene	31-127	32	33-116	20
Phenanthrene	31-143	30	20-154	35
Pyrene	37-140	30	20-147	34
Bebzo(k)fluoranthene	39-131	29	25-144	34
Dibenzo(a,h)anthracene	31-142	26	20-128	33

SURROGATE RECOVERIES

	WATER	SOIL
2-Chloroanthracene	33-123	25-134

CONTINUED ON NEXT PAGE

ATI I.D. # 9302-204

QUALITY CONTROL
INFORMATION
CONTINUED

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

BETX

DETECTION LIMITS

	WATER	SOIL
Benzene	0.0005 mg/L	0.025 mg/Kg
Toluene	0.0005 mg/L	0.025 mg/Kg
Ethyl Benzene	0.0005 mg/L	0.025 mg/Kg
Xylenes	0.0005 mg/L	0.025 mg/Kg

CONTROL LIMITS

BLANK SPIKE	WATER	RPD	SOIL	RPD
Benzene	80-111	20	63-115	20
Toluene	78-111	20	75-110	20
Xylenes	80-114	20	79-109	20

MATRIX SPIKE	WATER	RPD	SOIL	RPD
Benzene	77-112	20	35-113	20
Toluene	72-113	20	43-107	20
Xylenes	80-110	20	46-114	20

SURROGATE RECOVERY

	WATER	SOIL
Bromofluorobenzene	76-120	52-116

WA DOE WTPH-G

DETECTION LIMITS

	WATER	SOIL
Gasoline	0.1 mg/L	5 mg/Kg

CONTROL LIMITS

BLANK SPIKE	WATER	RPD	SOIL	RPD
Gasoline	75-120	20	80-119	20

MATRIX SPIKE	WATER	RPD	SOIL	RPD
Gasoline	58-127	20	50-112	20

SURROGATE RECOVERY

	WATER	SOIL
Trifluorotoluene	50-150	50-150

CONTINUED ON NEXT PAGE

ATI I.D. # 9302-204

QUALITY CONTROL
INFORMATION
CONTINUED

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

WA DOE WTPH-D

DETECTION LIMITS

	WATER	SOIL
Diesel	0.5 mg/L	25 mg/Kg

CONTROL LIMITS

	WATER	RPD	SOIL	RPD
BLANK SPIKE				
Diesel	70-115	20	69-122	20
MATRIX SPIKE	WATER	RPD	SOIL	RPD
Diesel	*	20	63-131	20

SURROGATE RECOVERY

	WATER	SOIL
O-Terphenyl	50-150	50-150

* Control limits not yet established.

WTPH 418.1 Modified

DETECTION LIMITS

COMPOUND	WATER	SOIL
Petroleum Hydrocarbons	1 mg/L	20 mg/Kg

CONTROL LIMITS

	WATER	RPD	SOIL	RPD
BLANK SPIKE				
Petroleum Hydrocarbons	51-104	20	96-144	20
MATRIX DUPLICATE				
Petroleum Hydrocarbons	-	35	-	35
MATRIX SPIKE	WATER	RPD	SOIL	RPD
Petroleum Hydrocarbons	40-121	35	45-187	35

AnalyticalTechnologies,Inc.

ATI I.D. # 9302-204

CASE NARRATIVE

CLIENT : RZA-AGRA
PROJECT # : S1070-2
ROJECT NAME : CHEVRON - PULLMAN

ASE NARRATIVE: POLYNUCLEAR AROMATICS ANALYSIS

Thirty (30) grams of sample were extracted with methylene chloride by onication. The sample extracts were solvent exchanged to acetonitrile and brought to a relative final volume of 1.0 mL.

he extracts were analyzed by HPLC with 220/254 UV and fluorescence detectors n series. A gradient mobile phase of water and acetonitrile was utilized for the analysis.

six point calibration curve was generated and utilized for the analysis. Due to the high sensitivity of the detectors, a minimum five point curve was available for all analyses.

The percent recoveries for phenanthrene in the matrix spike/matrix spike duplicate (MS/MSD) were outside ATI limits due to high amounts of the target nalyte already present in the sample. The relative percent difference (RPD) or phenanthrene was consequently outside ATI limits. The appropriate data were flagged with a "G"; out of limits due to high levels of target analytes in sample.

All other quality control parameters were within acceptable ATI limits.

ATI I.D. # 9302-204

POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : METHOD BLANK
SAMPLE MATRIX : SOIL
EPA METHOD : 8310
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : 02/25/93
DATE ANALYZED : 02/26/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT
NAPHTHALENE	0.10	ND
ACENAPHTHYLENE	0.17	ND
ACENAPHTHENE	0.10	ND
FLUORENE	0.020	ND
PHENANTHRENE	0.010	ND
ANTHRACENE	0.010	ND
FLUORANTHENE	0.020	ND
PYRENE	0.010	ND
BENZO(A)ANTHRACENE	0.010	ND
CHRYSENE	0.010	ND
BENZO(B)FLUORANTHENE	0.010	ND
BENZO(K)FLUORANTHENE	0.010	ND
BENZO(A)PYRENE	0.010	ND
DIBENZO(A,H)ANTHRACENE	0.010	ND
BENZO(G,H,I)PERYLENE	0.010	ND
INDENO(1,2,3-CD)PYRENE	0.010	ND

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	86

ATI I.D. # 9302-204-3

POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : CB-5 S-2
SAMPLE MATRIX : SOIL
EPA METHOD : 8310
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 02/25/93
DATE ANALYZED : 02/26/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT	
NAPHTHALENE	0.14	7.3	
ACENAPHTHYLENE	0.23	ND	
ACENAPHTHENE	0.14	0.35	
FLUORENE	0.027	0.60	
PHENANTHRENE	0.014	1.1	D4
ANTHRACENE	0.014	0.031	
FLUORANTHENE	0.027	2.3	D4
PYRENE	0.014	0.12	
BENZO(A)ANTHRACENE	0.014	0.014	
CHRYSENE	0.014	0.052	
BENZO(B)FLUORANTHENE	0.014	ND	
BENZO(K)FLUORANTHENE	0.014	ND	
BENZO(A)PYRENE	0.014	ND	
DIBENZO(A,H)ANTHRACENE	0.014	ND	
BENZO(G,H,I)PERYLENE	0.014	ND	
INDENO(1,2,3-CD)PYRENE	0.014	ND	

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	132

D4 = Value from a ten fold diluted analysis.

ATI I.D. # 9302-204-4

POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : RZA-AGRA
ROJECT # : S1070-2
ROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : CB-6 S-2
AMPLE MATRIX : SOIL
PA METHOD : 8310
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 02/25/93
DATE ANALYZED : 02/27/93
UNITS : mg/Kg
DILUTION FACTOR : 1

OMPOUNDS	MDL	RESULT
APHTHALENE	0.14	ND
CENAPHTHYLENE	0.23	ND
ACENAPHTHENE	0.14	ND
LUORENE	0.027	ND
HENANTHRENE	0.014	ND
ANTHRACENE	0.014	ND
LUORANTHENE	0.027	ND
YRENE	0.014	ND
ENZO(A)ANTHRACENE	0.014	ND
CHRYSENE	0.014	ND
ENZO(B)FLUORANTHENE	0.014	ND
ENZO(K)FLUORANTHENE	0.014	ND
BENZO(A)PYRENE	0.014	ND
IBENZO(A,H)ANTHRACENE	0.014	ND
ENZO(G,H,I)PERYLENE	0.014	ND
INDENO(1,2,3-CD)PYRENE	0.014	ND

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	68

ATI I.D. # 9302-204

POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : SOIL
EPA METHOD : 8310

SAMPLE I.D. # : 9302-204-3
DATE EXTRACTED : 02/25/93
DATE ANALYZED : 02/26/93
UNITS : mg/Kg

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
ACENAPHTHYLENE	ND	1.66	1.526	92	1.647	99	8
PHENANTHRENE	0.829	0.166	0.342	G	0.848	11G	85G
PYRENE	0.091	0.166	0.184	56	0.237	88	25
BENZO(K)FLUORANTHENE	ND	0.166	0.152	92	0.159	96	5
DIBENZO(A,H)ANTHRACENE	ND	0.166	0.153	92	0.159	96	4

G = Out of limits due to high levels of target analytes in sample.

$$\text{\% Recovery} = \frac{\text{(Spiked Result - Sample Result)}}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{\left|\text{(Spike Result - Dup. Spike Result)}\right|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : SOIL
EPA METHOD : 8310

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 02/25/93
DATE ANALYZED : 02/26/93
UNITS : mg/Kg

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
ACENAPHTHYLENE	ND	1.66	1.30	78	N/A	N/A	N/A
PHENANTHRENE	ND	0.166	0.127	77	N/A	N/A	N/A
PYRENE	ND	0.166	0.137	83	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	ND	0.166	0.160	96	N/A	N/A	N/A
DIBENZO(A,H)ANTHRACENE	ND	0.166	0.154	93	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: N/A
ROJECT #	: S1070-2	DATE RECEIVED	: N/A
ROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 02/27/93
AMPLE MATRIX	: WATER	UNITS	: ug/L
ETHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

OMPOUNDS	MDL	RESULT
ENZENE	0.5	ND
THYLBENZENE	0.5	ND
TOLUENE	0.5	ND
OTAL XYLENES	0.5	ND
FUEL HYDROCARBONS	100	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
YDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	99
RIFLUOROTOLUENE	98

ATI I.D. # 9302-204

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : METHOD BLANK
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020 (BETX)

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 02/28/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT
BENZENE	0.5	ND
ETHYLBENZENE	0.5	ND
TOLUENE	0.5	ND
TOTAL XYLENES	0.5	ND
FUEL HYDROCARBONS	100	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	92
TRIFLUOROTOLUENE	103

ATI I.D. # 9302-204-5

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : MW-11
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020 (BETX)

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : N/A
DATE ANALYZED : 02/28/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT
BENZENE	0.5	ND
ETHYLBENZENE	0.5	ND
TOLUENE	0.5	ND
TOTAL XYLENES	0.5	ND
FUEL HYDROCARBONS	100	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	94
TRIFLUOROTOLUENE	102

ATI I.D. # 9302-204-6

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : MW-12
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020 (BETX)

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : N/A
DATE ANALYZED : 02/28/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT
BENZENE	0.5	ND
ETHYLBENZENE	0.5	ND
TOLUENE	0.5	ND
TOTAL XYLENES	0.5	ND
FUEL HYDROCARBONS	100	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	94
TRIFLUOROTOLUENE	102

ATI I.D. # 9302-204-7

BETX - GASOLINE
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: N/A
PROJECT #	: S1070-2	DATE RECEIVED	: 02/25/93
ROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: N/A
CLIENT I.D.	: TRIP BLANK	DATE ANALYZED	: 02/28/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
ETHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	MDL	RESULT
BENZENE	0.5	ND
THYLBENZENE	0.5	ND
TOLUENE	0.5	0.8
TOTAL XYLENES	0.5	ND
UEL HYDROCARBONS	100	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	99
TRIFLUOROTOLUENE	97

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020 (BETX)

SAMPLE I.D. # : 9302-202-1
DATE EXTRACTED : N/A
DATE ANALYZED : 02/27/93
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	ND	N/A	N/A	20.0	20.9	105	20.5	102	2
TOLUENE	ND	N/A	N/A	20.0	21.2	106	20.9	105	1
TOTAL XYLENES	ND	N/A	N/A	40.0	41.9	105	42.4	106	1
GASOLINE	ND	ND	NC	1,000	985	99	963	96	2

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020 (BETX)

SAMPLE I.D. # : 9302-230-1
DATE EXTRACTED : N/A
DATE ANALYZED : 02/28/93
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	ND	N/A	N/A	20.0	21.7	109	22.1	111	2
TOLUENE	ND	N/A	N/A	20.0	23.2	116H	23.5	118H	1
TOTAL XYLENES	ND	N/A	N/A	40.0	47.5	119H	48.2	121H	1
GASOLINE	ND	ND	NC	1,000	1,060	106	1,050	105	1

NC = Not Calculable.
H = Out of limits.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA		SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: S1070-2		DATE EXTRACTED	: N/A
PROJECT NAME	: CHEVRON - PULLMAN		DATE ANALYZED	: 02/27/93
SAMPLE MATRIX	: WATER		UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020 (BETX)			

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	ND	20.0	20.3	102	N/A	N/A	N/A
TOLUENE	ND	20.0	19.8	99	N/A	N/A	N/A
TOTAL XYLENES	ND	40.0	38.2	96	N/A	N/A	N/A
GASOLINE	ND	1,000	940	94	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020 (BETX)

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 02/28/93
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	ND	20.0	21.3	107	N/A	N/A	N/A
TOLUENE	ND	20.0	22.1	111	N/A	N/A	N/A
TOTAL XYLENES	ND	40.0	43.5	109	N/A	N/A	N/A
GASOLINE	ND	1,000	1,030	103	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : METHOD BLANK
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020 (BETX)

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : 03/01/93
DATE ANALYZED : 03/01/93
UNITS : mg/Kg
DILUTION FACTOR : 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	MDL	RESULT
BENZENE	0.025	ND
ETHYLBENZENE	0.025	ND
TOLUENE	0.025	ND
TOTAL XYLENES	0.025	ND
FUEL HYDROCARBONS	5	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	93
TRIFLUOROTOLUENE	97

ATI I.D. # 9302-204-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: 02/22/93
PROJECT #	: S1070-2	DATE RECEIVED	: 02/25/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 03/01/93
CLIENT I.D.	: MW-11 S-1	DATE ANALYZED	: 03/02/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	MDL	RESULT
BENZENE	0.033	ND
ETHYLBENZENE	0.033	ND
TOLUENE	0.033	ND
TOTAL XYLENES	0.033	ND
FUEL HYDROCARBONS	7	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	78
TRIFLUOROTOLUENE	76

ATI I.D. # 9302-204-2

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : MW-12 S-2
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 02/22/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 03/01/93
DATE ANALYZED : 03/02/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT
BENZENE	0.033	ND
ETHYLBENZENE	0.033	ND
TOLUENE	0.033	ND
TOTAL XYLENES	0.033	ND
FUEL HYDROCARBONS	7	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	81
TRIFLUOROTOLUENE	85

ATI I.D. # 9302-204-3

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : CB-5 S-2
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 03/01/93
DATE ANALYZED : 03/02/93
UNITS : mg/Kg
DILUTION FACTOR : 20

COMPOUNDS	MDL	RESULT
BENZENE	0.68	5.2
ETHYLBENZENE	0.68	9.0
TOLUENE	0.68	2.9
TOTAL XYLENES	0.68	17
FUEL HYDROCARBONS	140	2,400
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	F
TRIFLUOROTOLUENE	179 F

F = Out of limits due to matrix interference.

ATI I.D. # 9302-204-4

BETX - GASOLINE
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : CB-6 S-2
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 03/01/93
DATE ANALYZED : 03/02/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	MDL	RESULT
BENZENE	0.034	ND
ETHYLBENZENE	0.034	ND
TOLUENE	0.034	ND
TOTAL XYLENES	0.034	ND
FUEL HYDROCARBONS	7	ND
HYDROCARBON RANGE		TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING		GASOLINE

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	76
TRIFLUOROTOLUENE	77

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA		SAMPLE I.D. #	: 9302-194-1
PROJECT #	: S1070-2		DATE EXTRACTED	: 03/01/93
PROJECT NAME	: CHEVRON - PULLMAN		DATE ANALYZED	: 03/01/93
SAMPLE MATRIX	: SOIL		UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020 (BETX)			

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
GASOLINE	ND	ND	NC	N/A	N/A	N/A	N/A	N/A	N/A

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020 (BETX)

SAMPLE I.D. # : 9302-194-12
DATE EXTRACTED : 03/01/93
DATE ANALYZED : 03/02/93
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	ND	N/A	N/A	1.00	0.782	78	0.809	81	3
TOLUENE	ND	N/A	N/A	1.00	0.812	81	0.839	84	3
TOTAL XYLENES	ND	N/A	N/A	2.00	1.64	82	1.69	85	3
GASOLINE	ND	ND	NC	50.0	40.4	81	41.9	84	4

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020 (BETX)

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 03/01/93
DATE ANALYZED : 03/01/93
UNITS : mg/Kg

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	ND	1.00	0.791	79	N/A	N/A	N/A
TOLUENE	ND	1.00	0.874	87	N/A	N/A	N/A
TOTAL XYLENES	ND	2.00	1.81	91	N/A	N/A	N/A
GASOLINE	ND	50.0	48.7	97	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: N/A
PROJECT #	: S1070-2	DATE RECEIVED	: N/A
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 02/26/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 02/26/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	0.3	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY

O-TERPHENYL	88

ATI I.D. # 9302-204-5

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : MW-11
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-D

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 02/26/93
DATE ANALYZED : 02/27/93
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	0.3	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY

O-TERPHENYL	91

ATI I.D. # 9302-204-6

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: 02/23/93
PROJECT #	: S1070-2	DATE RECEIVED	: 02/25/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 02/26/93
CLIENT I.D.	: MW-12	DATE ANALYZED	: 02/27/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	0.3	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY

O-TERPHENYL	87

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
METHOD : WA DOE WTPH-D
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9302-202-9
DATE EXTRACTED : 02/26/93
DATE ANALYZED : 02/26/93
UNITS : mg/L

COMPOUND	SAMPLE RESULT	DUP. SAMPLE RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (DIESEL)	1.1	0.9	20	N/A	N/A	N/A	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	:	RZA-AGRA	SAMPLE I.D. #	:	9302-206-4
PROJECT #	:	S1070-2	DATE EXTRACTED	:	02/26/93
PROJECT NAME	:	CHEVRON - PULLMAN	DATE ANALYZED	:	02/26/93
METHOD	:	WA DOE WTPH-D	UNITS	:	mg/L
SAMPLE MATRIX	:	WATER			

COMPOUND	SAMPLE RESULT	DUP. SAMPLE RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (DIESEL)	1.3	1.1	17	N/A	N/A	N/A	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA	SAMPLE I.D. #	: 9302-202-3
PROJECT #	: S1070-2	DATE EXTRACTED	: 02/26/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE ANALYZED	: 02/26/93
METHOD	: WA DOE WTPH-D	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (DIESEL)	ND	2.50	2.32	93	2.31	92	0

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
METHOD : WA DOE WTPH-D
SAMPLE MATRIX : WATER

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 02/26/93
DATE ANALYZED : 02/26/93
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (DIESEL)	ND	2.50	2.13	85	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: N/A
PROJECT #	: S1070-2	DATE RECEIVED	: N/A
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 02/27/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 02/28/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	10	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY	
O-TERPHENYL	64

ATI I.D. # 9302-204-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: 02/22/93
PROJECT #	: S1070-2	DATE RECEIVED	: 02/25/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 02/27/93
CLIENT I.D.	: MW-11 S-1	DATE ANALYZED	: 03/01/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	13	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY	
O-TERPHENYL	77

ATI I.D. # 9302-204-2

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: 02/22/93
PROJECT #	: S1070-2	DATE RECEIVED	: 02/25/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 02/27/93
CLIENT I.D.	: MW-12 S-2	DATE ANALYZED	: 03/01/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	13	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY

O-TERPHENYL	76

ATI I.D. # 9302-204-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE SAMPLED	: 02/23/93
PROJECT #	: S1070-2	DATE RECEIVED	: 02/25/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE EXTRACTED	: 02/27/93
CLIENT I.D.	: CB-5 S-2	DATE ANALYZED	: 03/01/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	14	480
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY	
O-TERPHENYL	80

ATI I.D. # 9302-204-4

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
CLIENT I.D. : CB-6 S-2
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-D
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 02/23/93
DATE RECEIVED : 02/25/93
DATE EXTRACTED : 02/27/93
DATE ANALYZED : 03/01/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	MDL	RESULT
FUEL HYDROCARBONS	14	ND
HYDROCARBON RANGE		C12 - C24
HYDROCARBON QUANTITATION USING		DIESEL

SURROGATE PERCENT RECOVERY	
O-TERPHENYL	72

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA	SAMPLE I.D. #	: 9302-198-7
PROJECT #	: S1070-2	DATE EXTRACTED	: 02/27/93
PROJECT NAME	: CHEVRON - PULLMAN	DATE ANALYZED	: 02/28/93
METHOD	: WA DOE WTPH-D	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
DIESEL	ND	ND	NC	200	160	80	155	78	3

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
METHOD : WA DOE WTPH-D
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 02/27/93
DATE ANALYZED : 02/28/93
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
DIESEL	ND	200	164	82	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: RZA-AGRA	DATE EXTRACTED	: 02/26/93
PROJECT #	: S1070-2	DATE ANALYZED	: 03/01/93
PROJECT NAME	: CHEVRON - PULLMAN	UNITS	: mg/L
METHOD	: WA DOE WTPH-418.1 MODIFIED	SAMPLE MATRIX	: WATER

ATI I.D. #	CLIENT I.D.	TOTAL PETROLEUM HYDROCARBONS MDL	RESULT	RESULT*
9302-204-5	MW-11	1	1.2	ND
9302-204-6	MW-12	1	ND	-
METHOD BLANK	-	1	ND	ND

* Reanalyzed after second aliquot of silica gel added.

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA		SAMPLE I.D. #	: 9302-211-1
PROJECT #	: S1070-2		DATE EXTRACTED	: 02/26/93
PROJECT NAME	: CHEVRON - PULLMAN		DATE ANALYZED	: 03/01/93
METHOD	: WA DOE WTPH-418.1 MODIFIED		UNITS	: mg/L
SAMPLE MATRIX	: WATER			

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (MOTOR OIL)	ND	ND	NC	N/A	N/A	N/A	N/A	N/A	N/A

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA		SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: S1070-2		DATE EXTRACTED	: 02/26/93
PROJECT NAME	: CHEVRON - PULLMAN		DATE ANALYZED	: 03/01/93
METHOD	: WA DOE WTPH-418.1 MODIFIED		UNITS	: mg/L
SAMPLE MATRIX	: WATER			

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (MOTOR OIL)	ND	N/A	N/A	10	8.56	86	8.47	85	1

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
METHOD : WA DOE WTPH-418.1 MODIFIED
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE EXTRACTED : 02/27/93
DATE ANALYZED : 03/01/93
UNITS : mg/Kg
SAMPLE MATRIX : SOIL

		TOTAL PETROLEUM HYDROCARBONS		
ATI I.D. #	CLIENT I.D.	MDL	RESULT	RESULT*
9302-204-1	MW-11 S-1	27	ND	-
9302-204-2	MW-12 S-2	26	ND	-
9302-204-3	CB-5 S-2	27	870	880
9302-204-4	CB-6 S-2	27	ND	-
BLANK SPIKE	-	20	ND	ND

* Reanalyzed after second aliquot of silica gel added.

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
METHOD : WA DOE WTPH-418.1 MODIFIED
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : 9302-194-11
DATE EXTRACTED : 02/27/93
DATE ANALYZED : 03/01/93
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (MOTOR OIL)	ND	ND	NC	N/A	N/A	N/A	N/A	N/A	N/A

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: RZA-AGRA		SAMPLE I.D. #	: 9302-194-3
PROJECT #	: S1070-2		DATE EXTRACTED	: 02/27/93
PROJECT NAME	: CHEVRON - PULLMAN		DATE ANALYZED	: 03/01/93
METHOD	: WA DOE WTPH-418.1 MODIFIED		UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL			

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (MOTOR OIL)	545	607	11	400	1,110	141	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN
METHOD : WA DOE WTPH-418.1 MODIFIED
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 02/27/93
DATE ANALYZED : 03/01/93
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (MOTOR OIL)	ND	N/A	N/A	400	517	129	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9302-204

GENERAL CHEMISTRY ANALYSIS

CLIENT	: RZA-AGRA	MATRIX : SOIL	
PROJECT #	: S1070-2		
PROJECT NAME	: CHEVRON - PULLMAN		

PARAMETER	DATE ANALYZED
MOISTURE	02/25/93

ATI I.D. # 9302-204

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9302-204-1	MW-11 S-1	25
9302-204-2	MW-12 S-2	24
9302-204-3	CB-5 S-2	27
9302-204-4	CB-6 S-2	27

ATI I.D. # 9302-204

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : RZA-AGRA
PROJECT # : S1070-2
PROJECT NAME : CHEVRON - PULLMAN

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9302-204-4	27	27	0	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

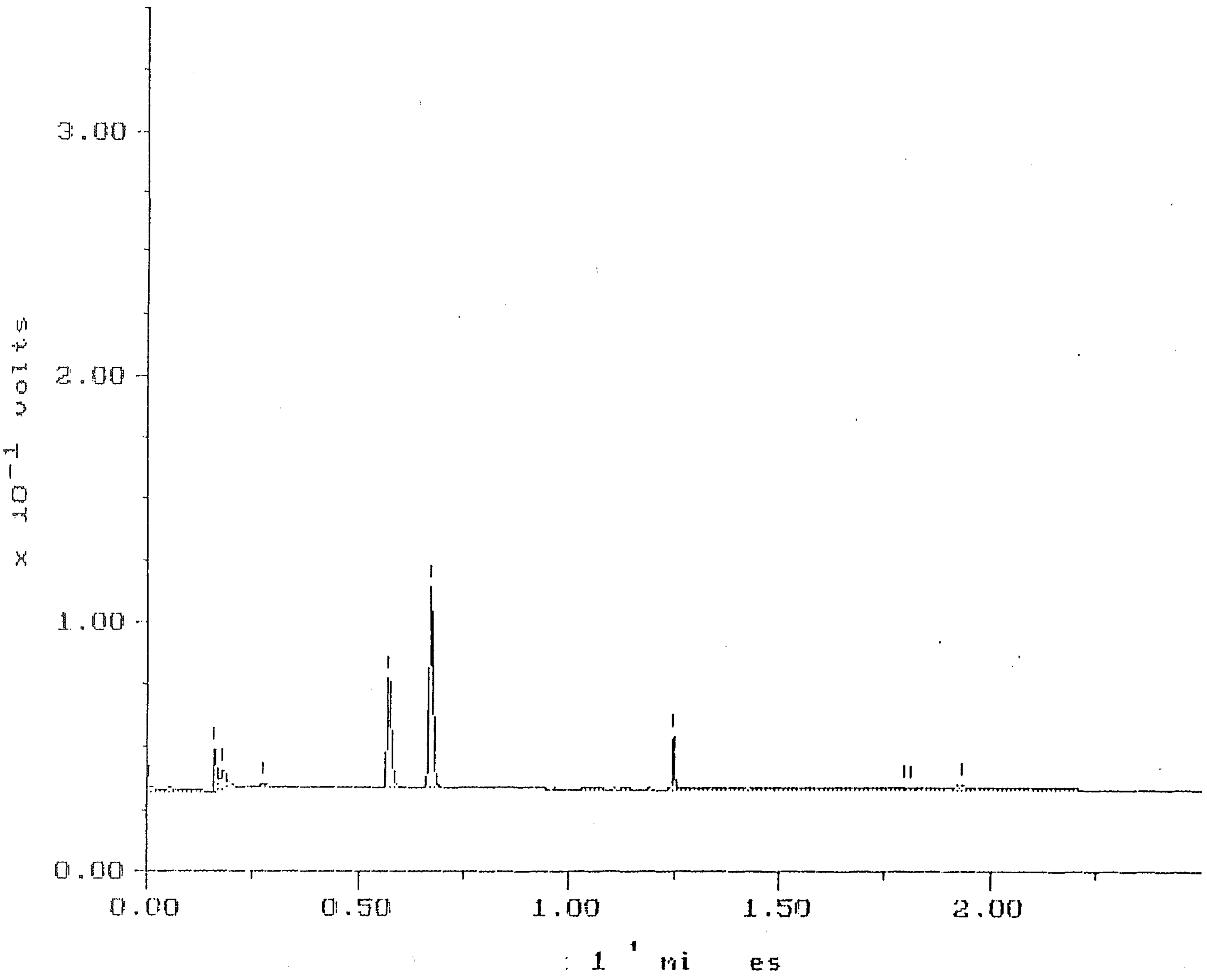
WA DOE WTPH-G

Blank

Sample: WRB
Acquired: 27-FEB-93 12:59

Channel: JEROME-FID
Method: F:\BRU2\MAXDATA\JEROME\02279JR

Filename: K2279J03
Operator:



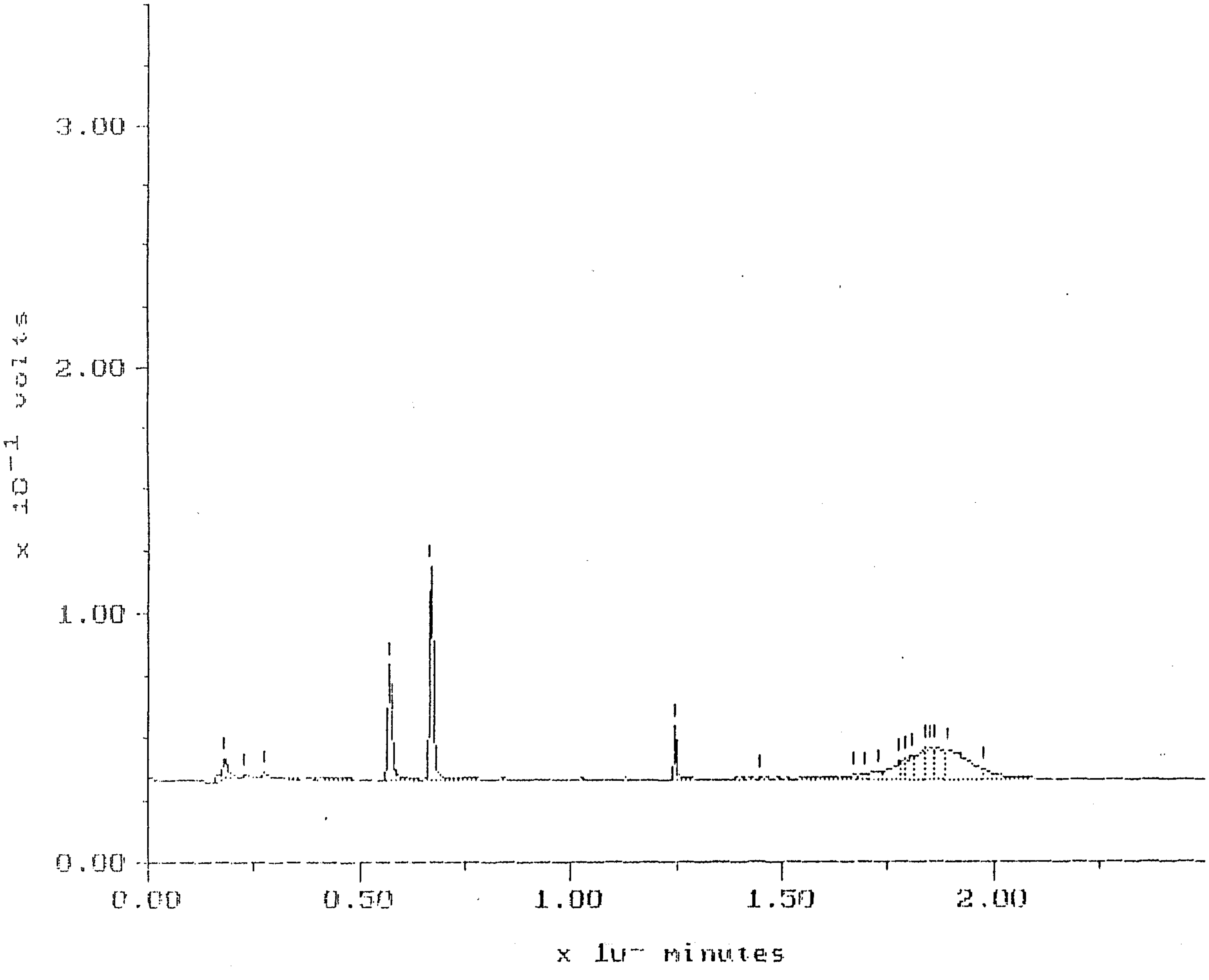
WA DOE WTPH-G

Blank

Sample: WRB 2-28
Acquired: 28-FEB-93 11:31

Channel: JEROME-FID
Method: F:\BRUE\MAXDATA\JEROME\0228J3JR

Filename: K2283J33
Operator:



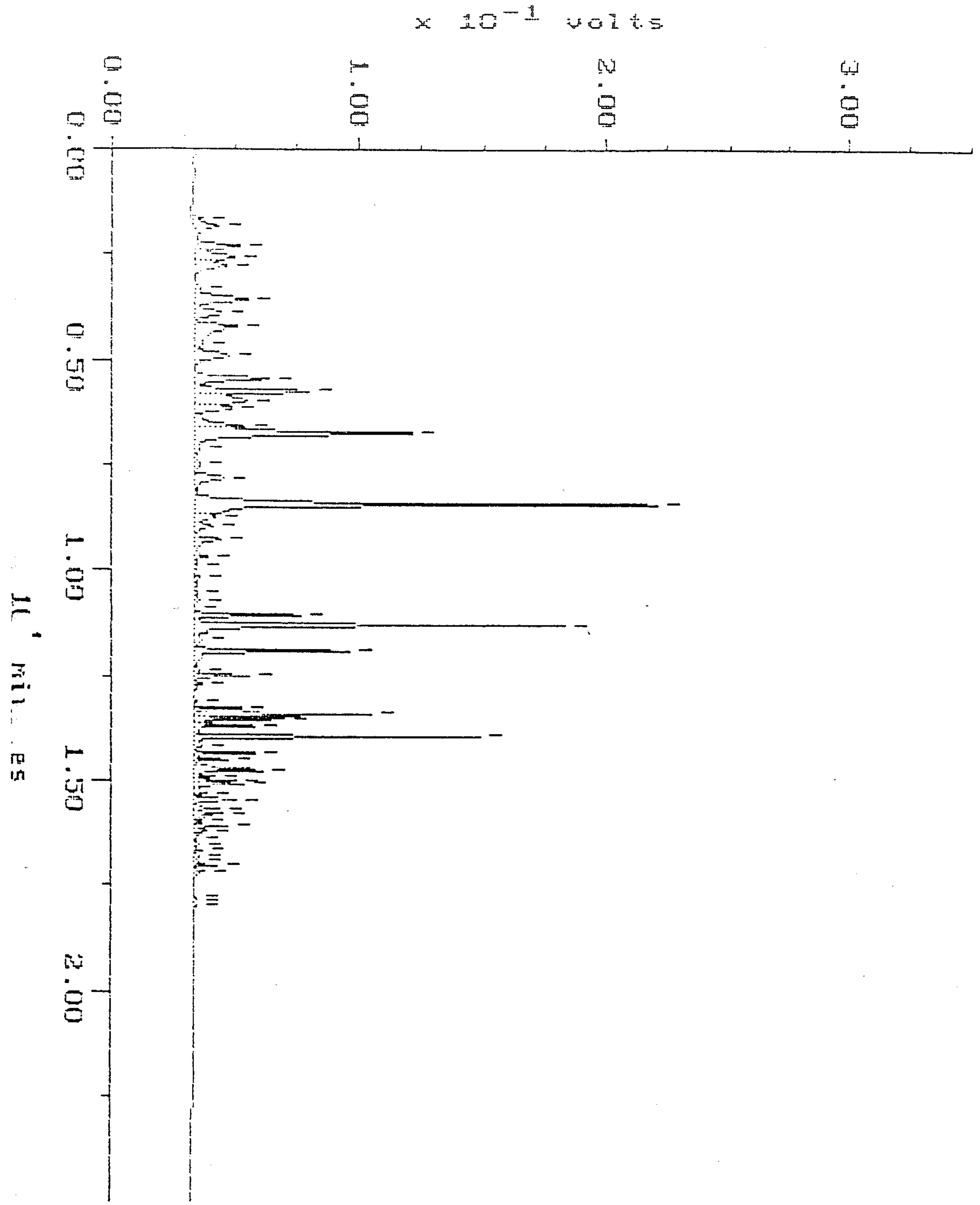
WA DOE WTPH-G

Continuing Calibration

Sample: STD-C
Acquired: 27-FEB-93 12:29

Channel: JEROME-FID
Method: F:\BRU2\MAXDATA\JEROME\022793JR

Filename: R2279J02
Operator:



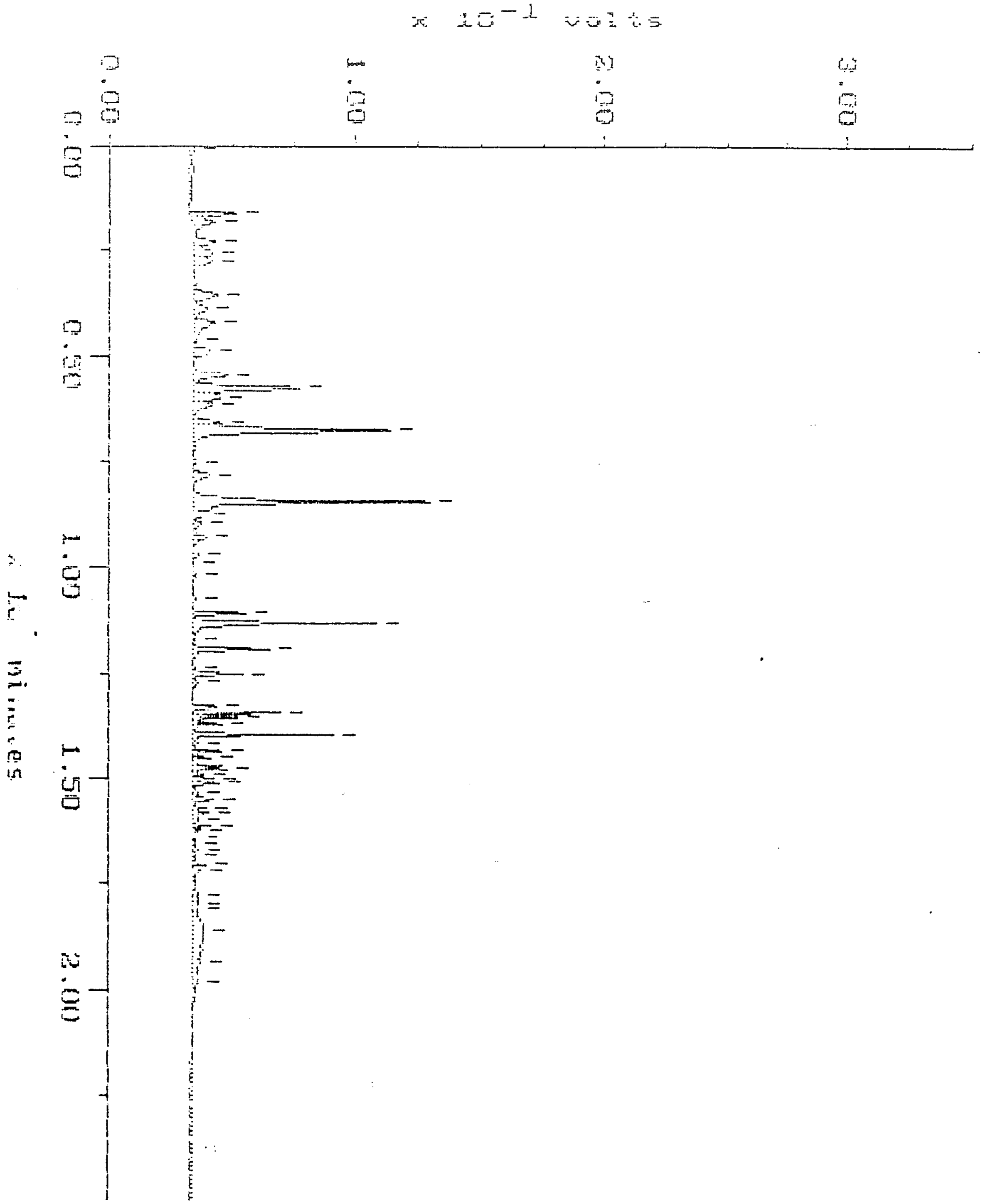
WA DOE WTPH-G

Continuing Calibration

Sample: STD-C G
Acquired: 28-FEB-93 10:31

Channel: JEROME-FID
Method: F:\BRU2\MAXDATA\JEROME\022893JR

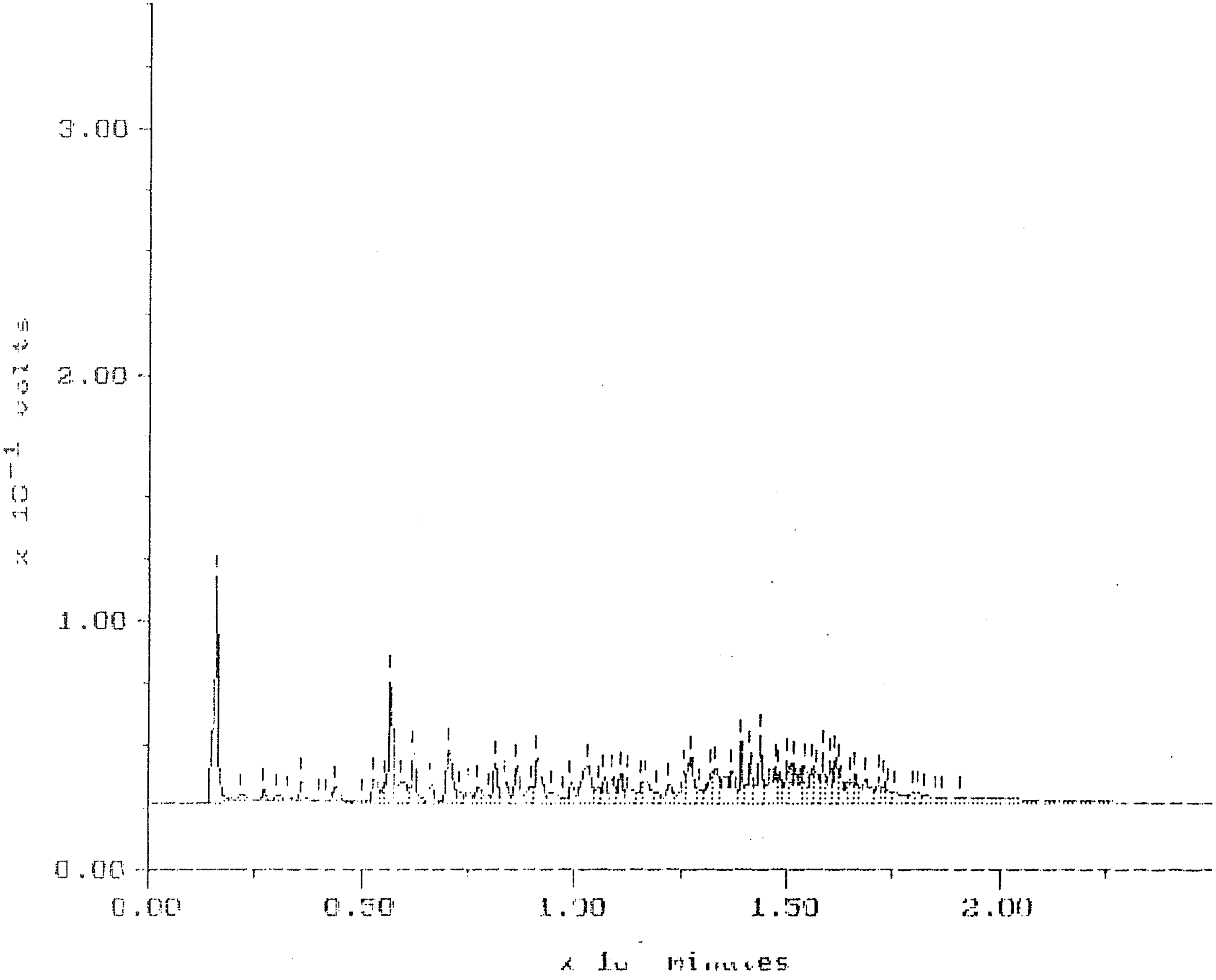
Filename: K2289J01
Operator:



Sample: 9302-204-3 OIL
Acquired: 02-MAR-93 16:39
Dilution: 1 : 20.000
Comments: ATI : A COMMITMENT TO QUALITY

Channel: FID
Method: F:\AAO2\MAXDATA\GLAD\A2029365

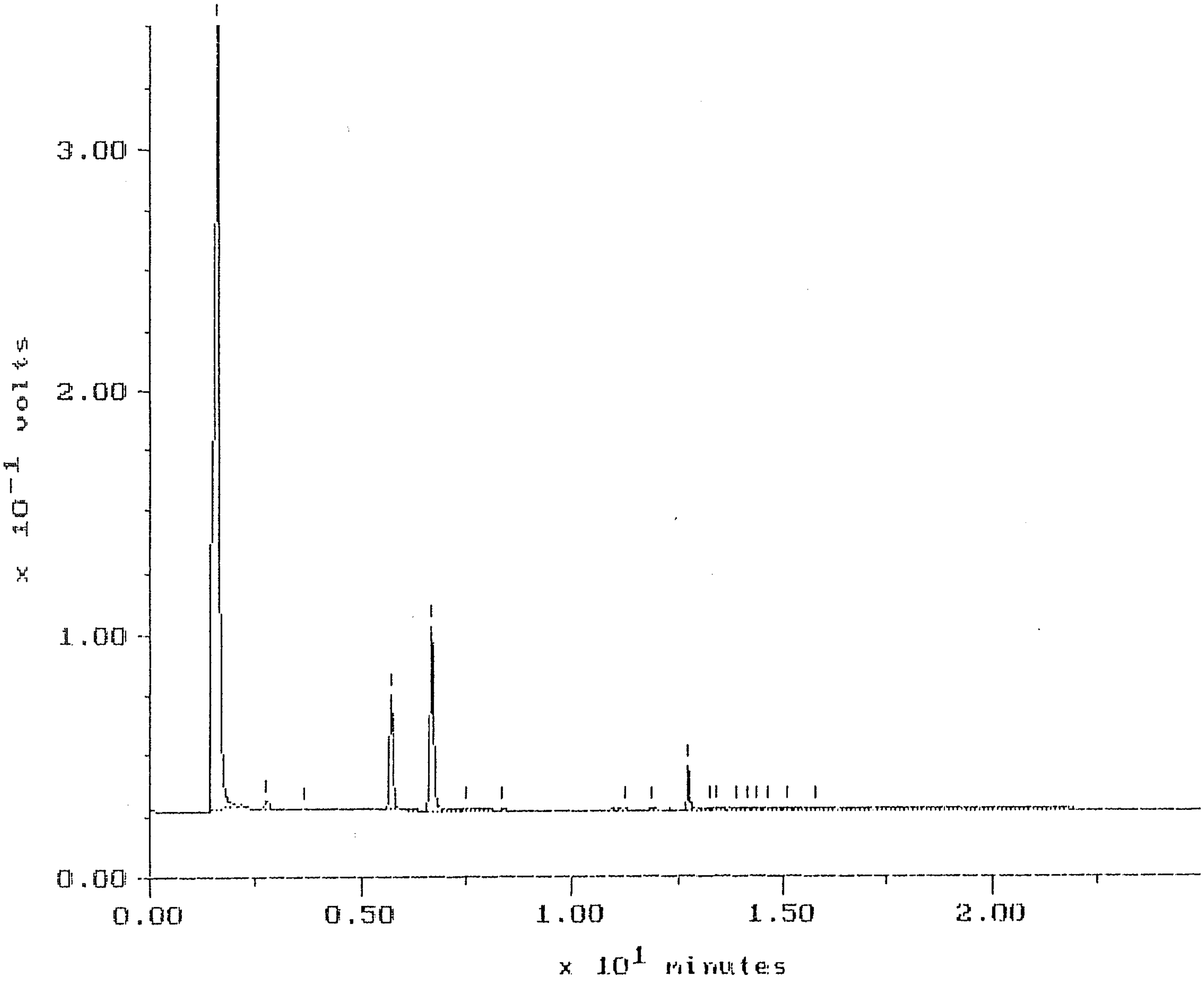
Filename: R3029413
Operator: ATI



WA DOE WTPH-G

Blank

Sample: SKB-A 3/1 Channel: FID Filename: R3019G19
Acquired: 01-MAR-93 18:09 Method: F:\BRU2\MAXDATA\GLAD\03019365 Operator: Afl
Comments: Afl : A COMMITMENT TO QUALITY

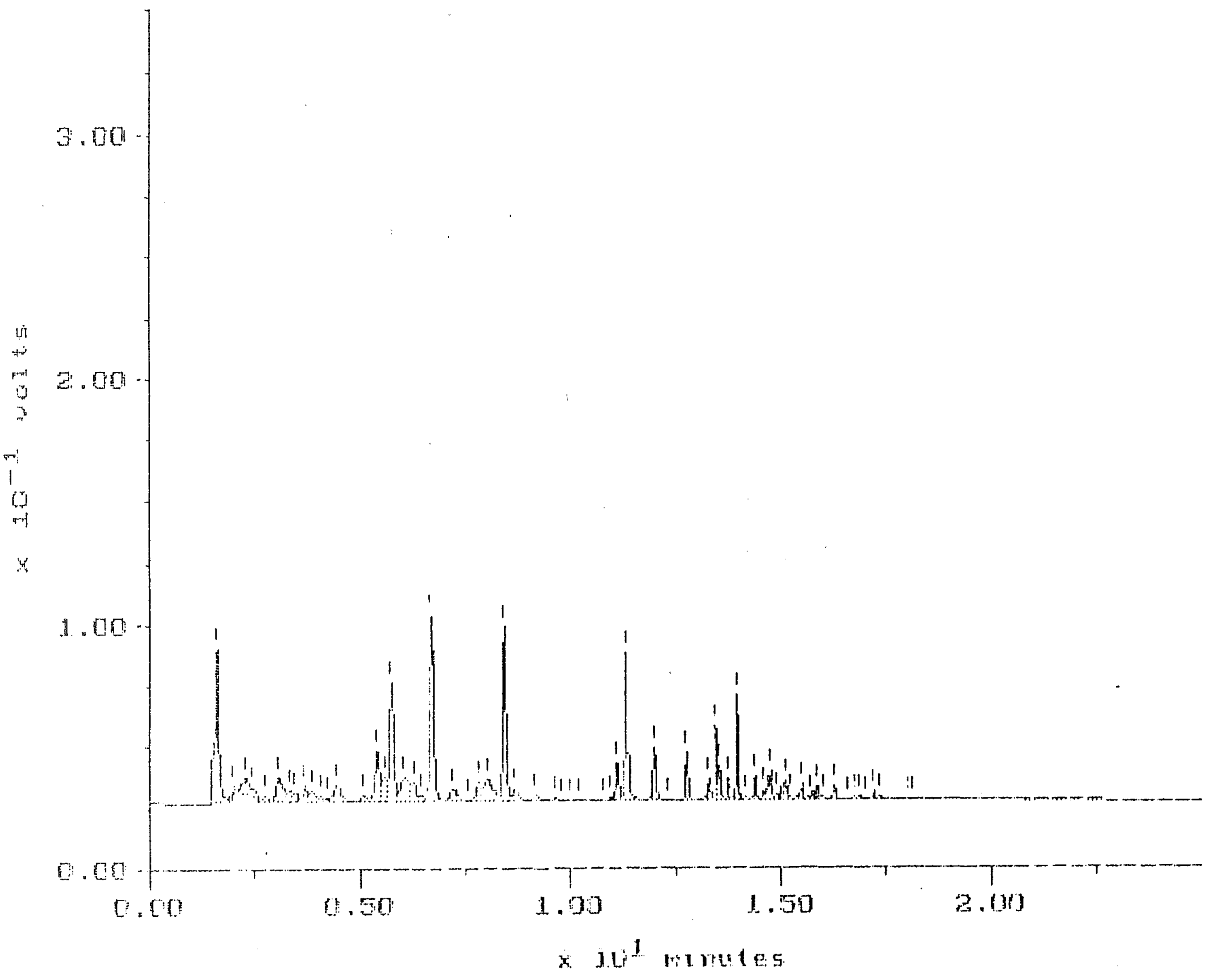


Continuing Calibration

Sample: STD-C G
Acquired: 31-MAR-93 7:11
Comments: ATI : A COMMITMENT TO QUALITY

Channel: FID
Method: F:\WRU2\MAXDATA\GLAD\W3019G5

Filename: K3019G02
Operator: ATI

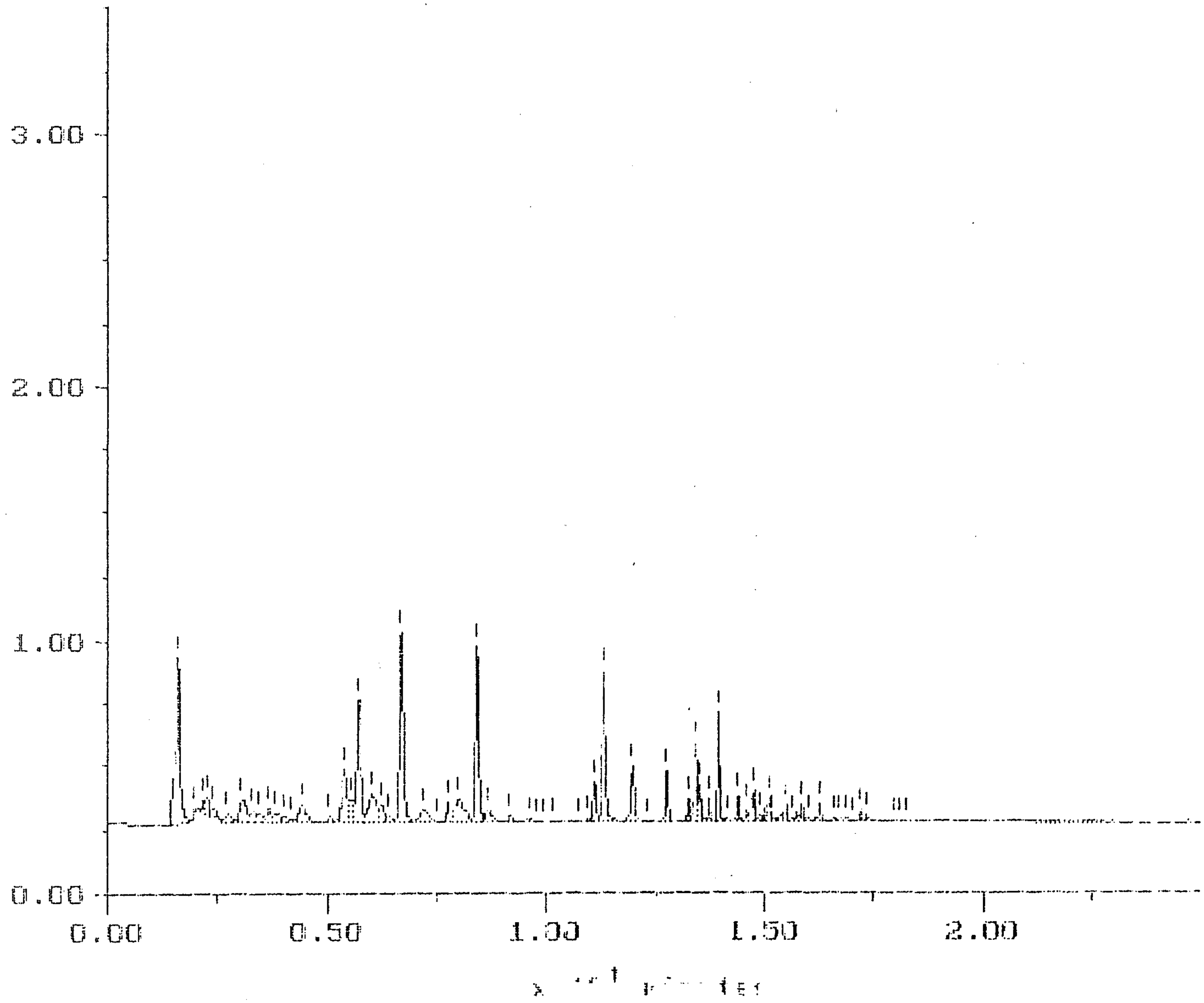


Continuing Calibration

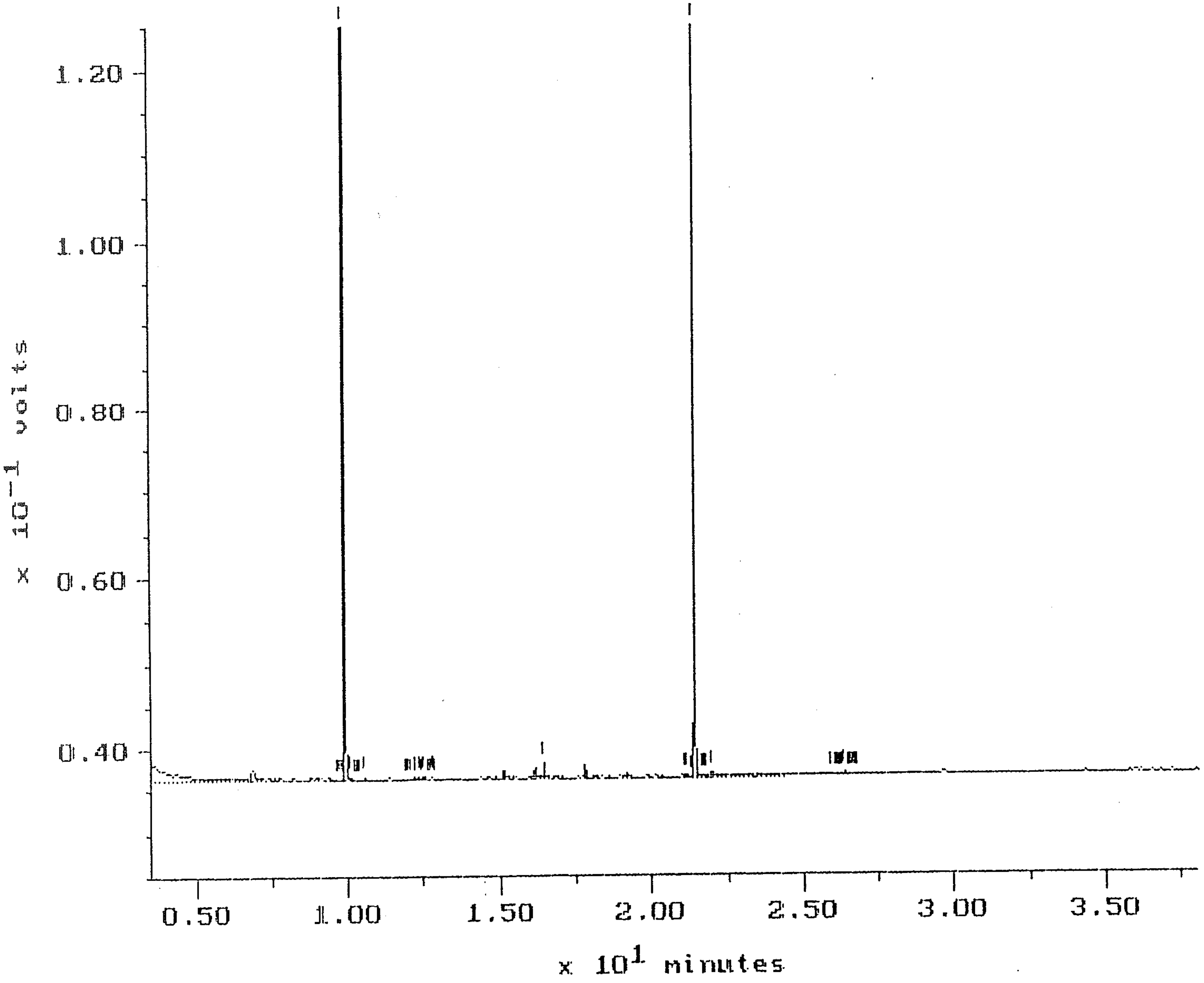
Sample: STD-C 6
Acquired: 02-MAR-93 9:55
Comments: ATI : A COMMITMENT TO QUALITY

Channel: FID
Method: F:\ARU2\MAXDATA\GLAD\G3029365

Filename: R3029601
Operator: ATI



Sample: WRB 2-26 Channel: CLARENCE Filename: R226BC02
Acquired: 26-FEB-93 19:00 Method: F:\BRB2\MAXDATA\SERGE-C\FUEL0226 Operator: ATI
Comments: ATI RUSH FUELS: DEDICATED TO QUALITY CLIENT SERVICE



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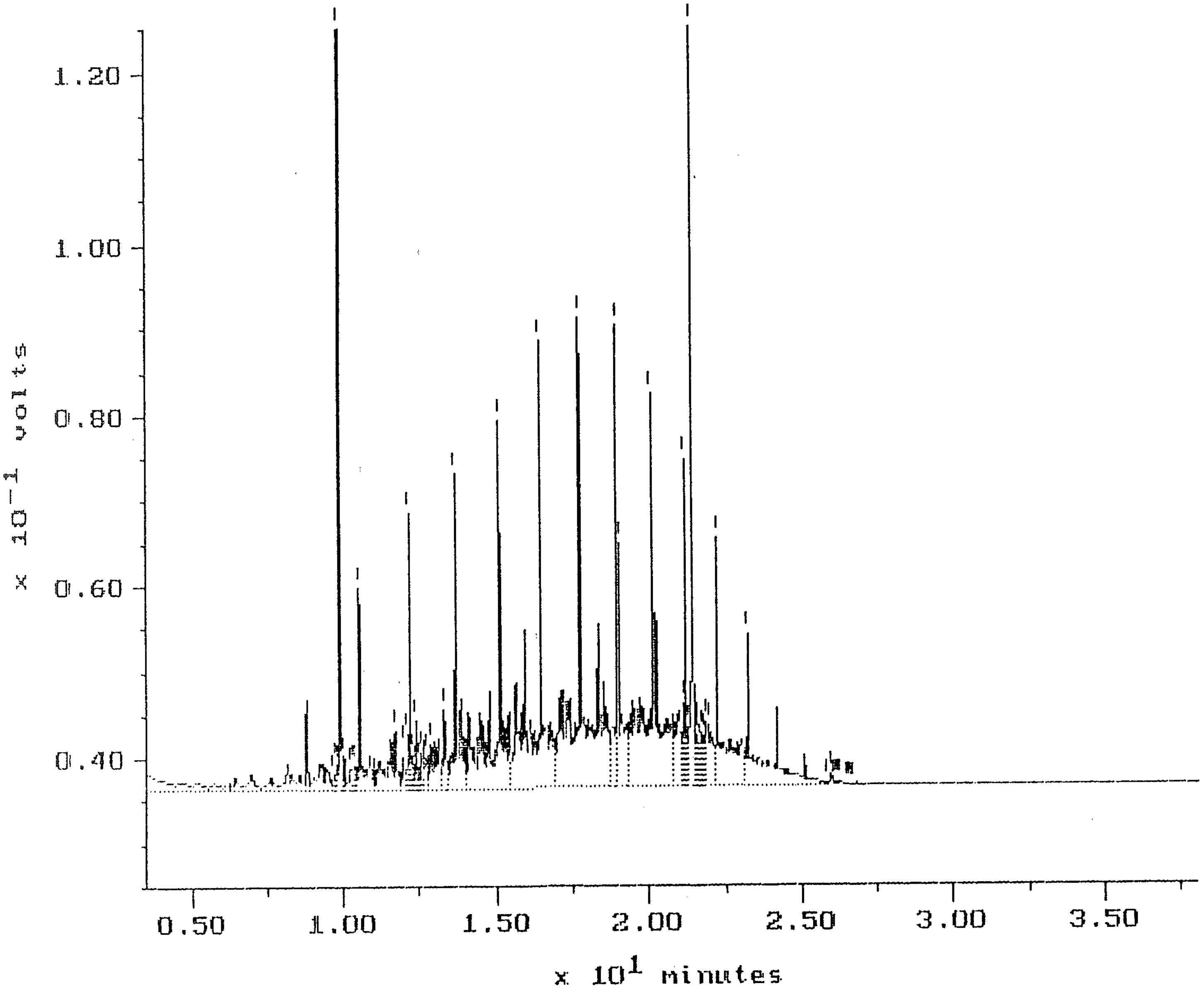
Acquired: 26-FEB-93 14:20
Comments: ATI RUSH FUELS: DEDICATED TO QUALITY CLIENT SERVICE

Channel: CLARENCE
Method: F:\BRO2\MAXDATA\SERGE-C\FUEL0226

Filename: R2368C01
Operator: ATI



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Acquired: 27-FEB-93 7:17
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Channel: CLARENCE
Method: F:\BRO2\MAXDATA\SERGE-C\FUEL0226

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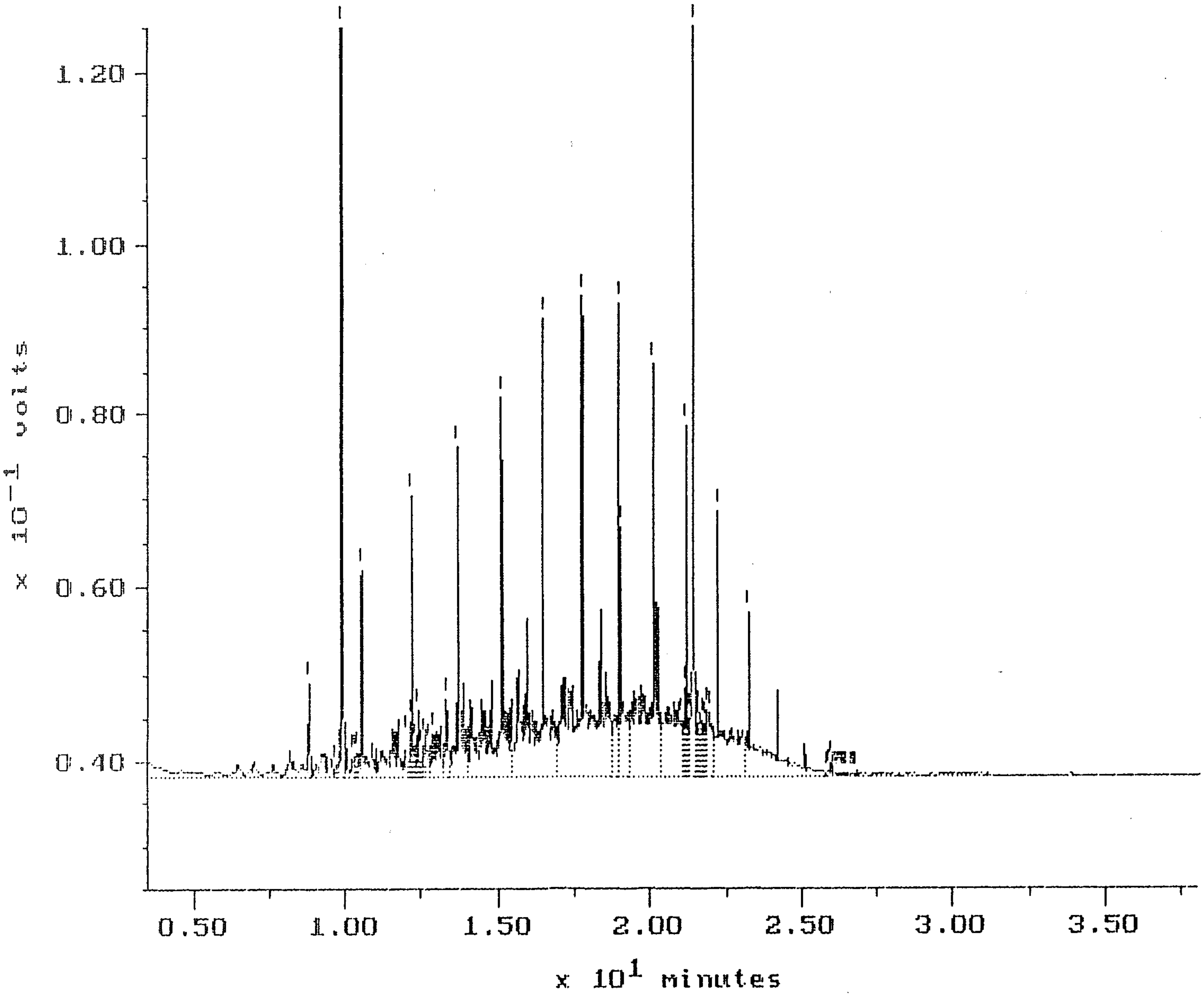
Operator: ATI



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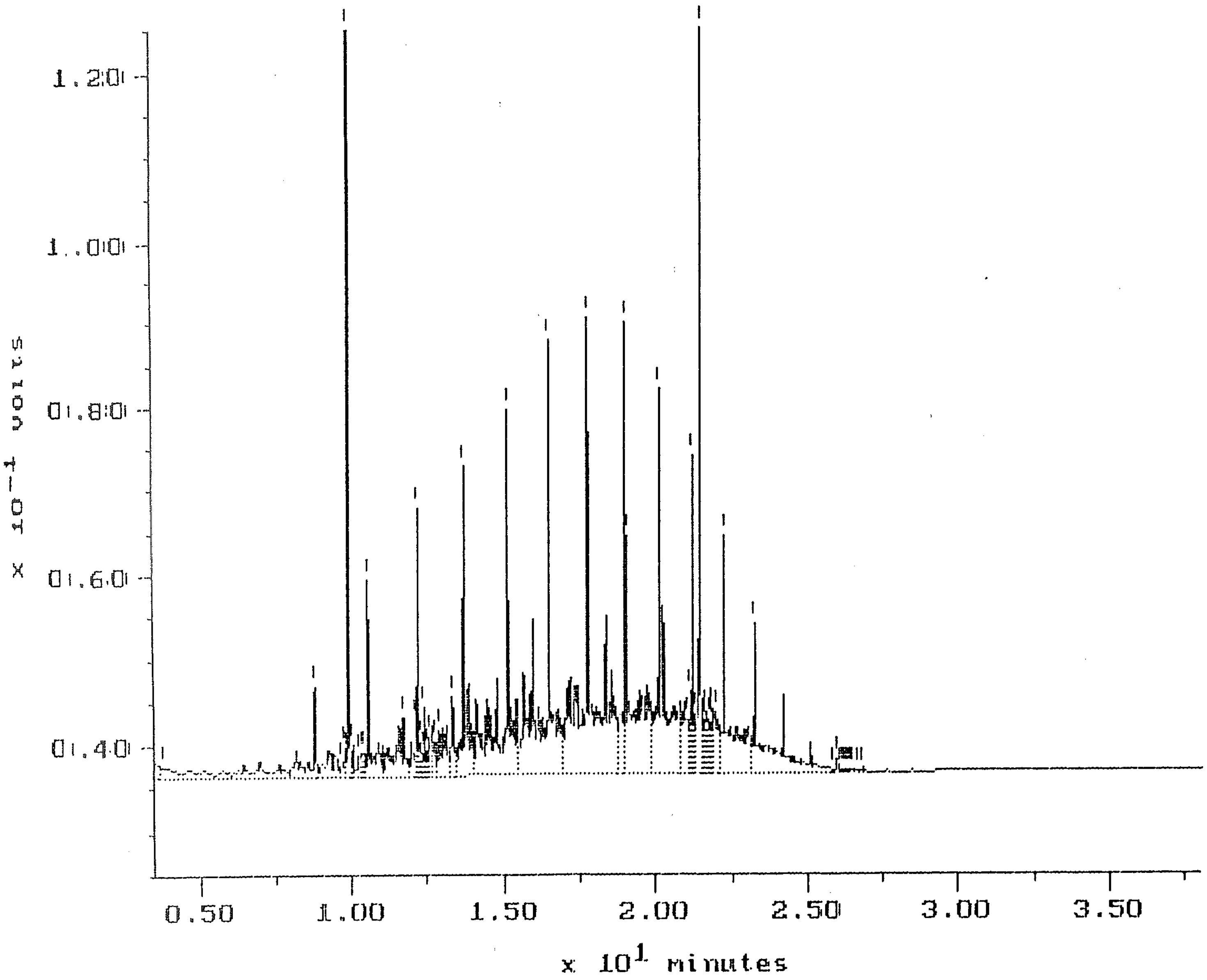
Comments: ATI RUSH FUELS: DEDICATED TO QUALITY CLIENT SERVICE



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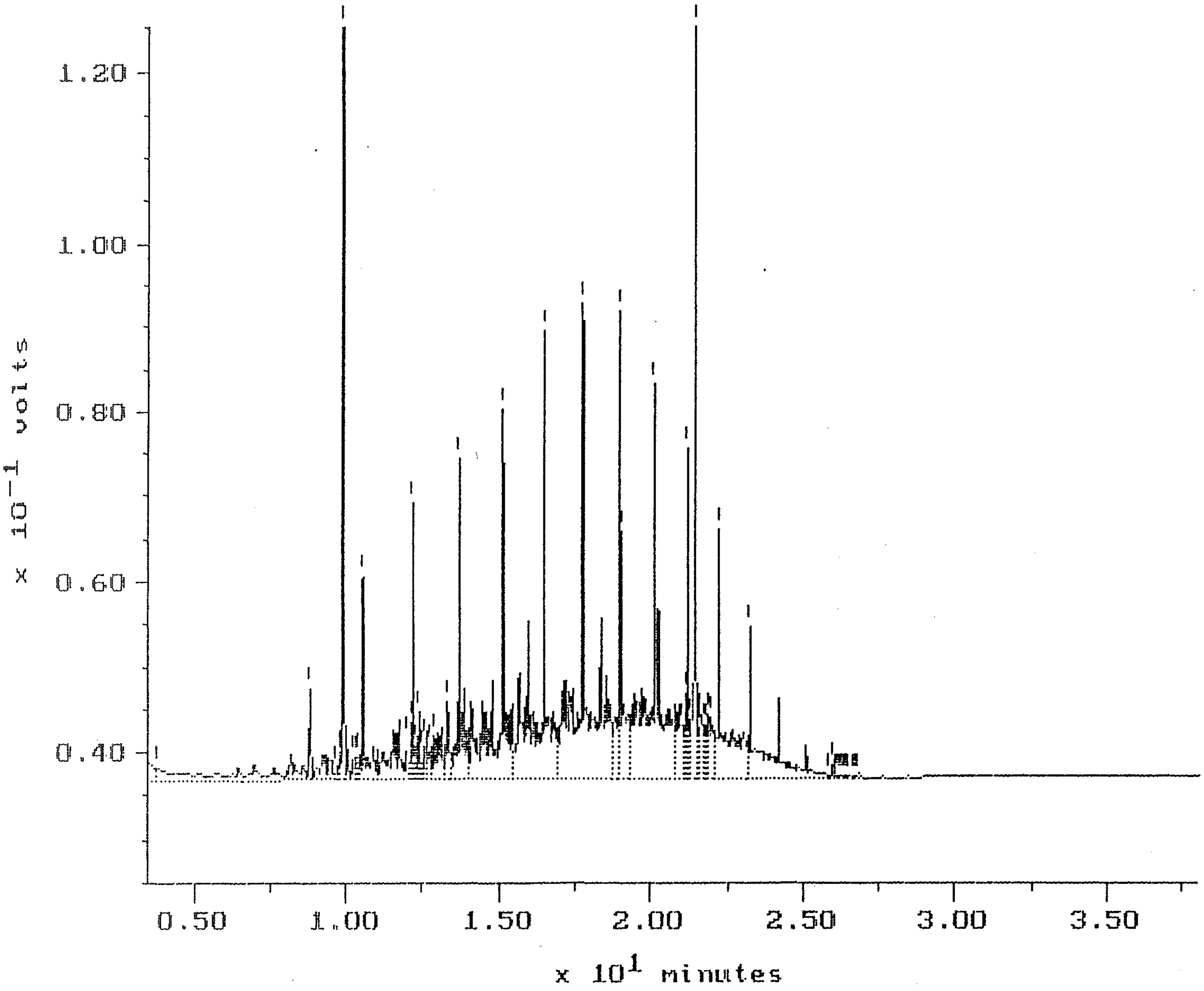
Comments: ATI RUSH FUELS: DEDICATED TO QUALITY CLIENT SERVICE

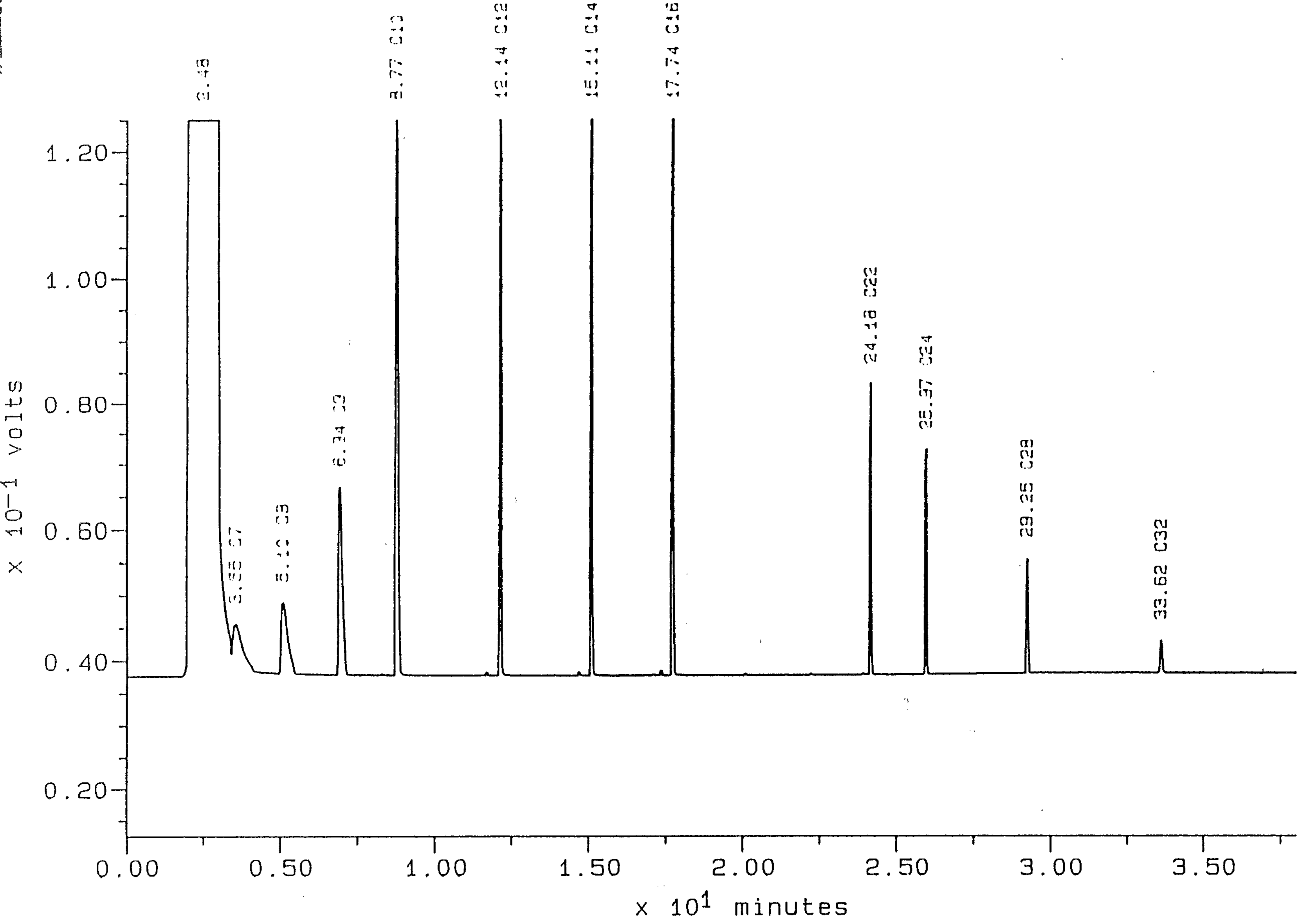


Sample: ALKANE
Acquired: 29-JAN-93 13:44
Inj Vol: 1.00

Channel: CLARENCE
Method: H:\ERG2\MAXDATA\SERGE-C\FUEL0129

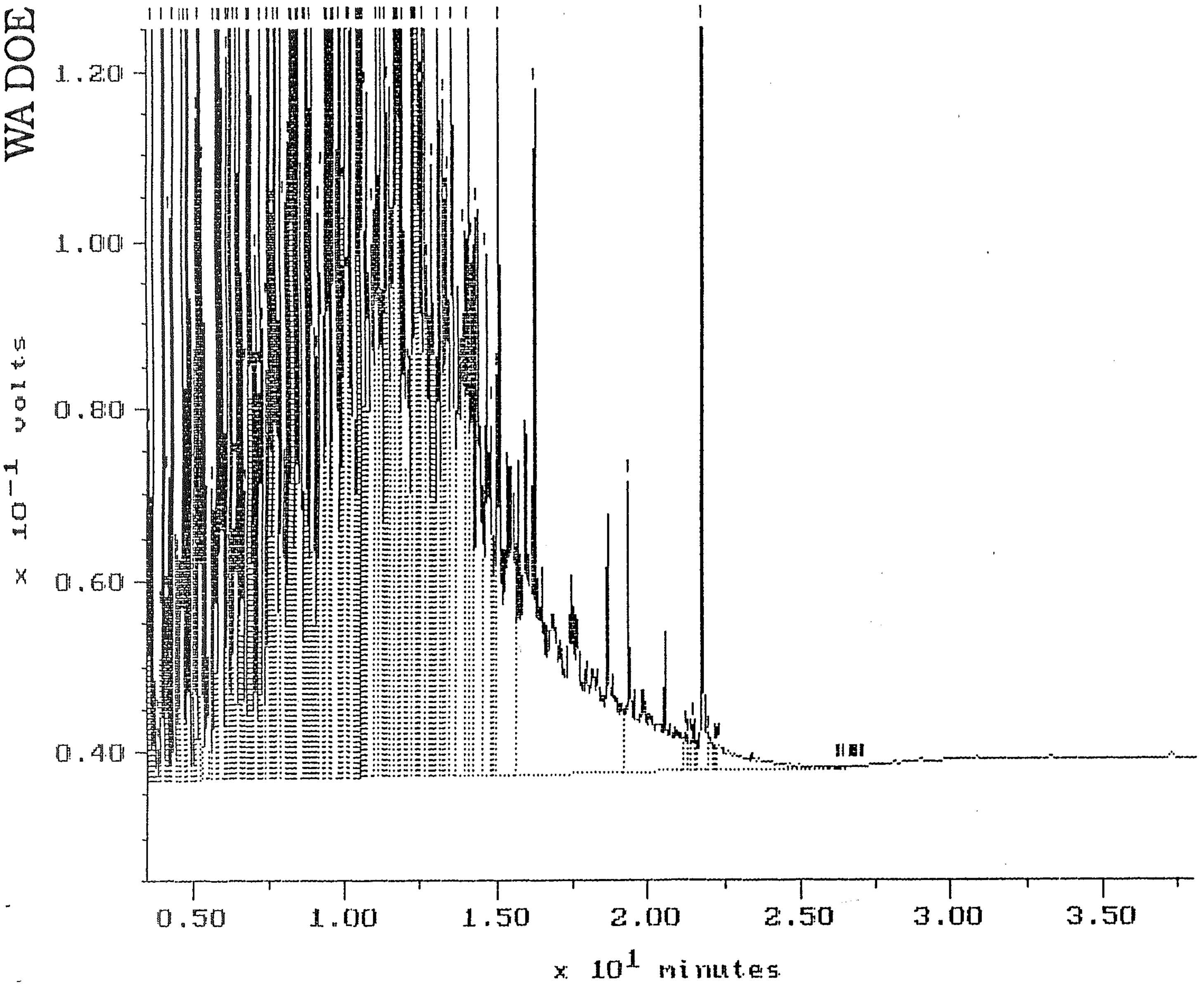
Filename: R129C02
Operator: ATI

Alkane



Acquired: 01-MAR-93 6:50 Method: F:\BR02\MAXDATA\SERGE-D\FUEL0228 Operator: ATT

WA DOE WTPH-D



Sample: SRB 2-27
Acquired: 28-FEB-93 11:41
Channel: DEMITRI
Method: F:\BRO2\MAXDATA\SERGE-D\FUEL0228
Filename: B228D03
Operator: ATI

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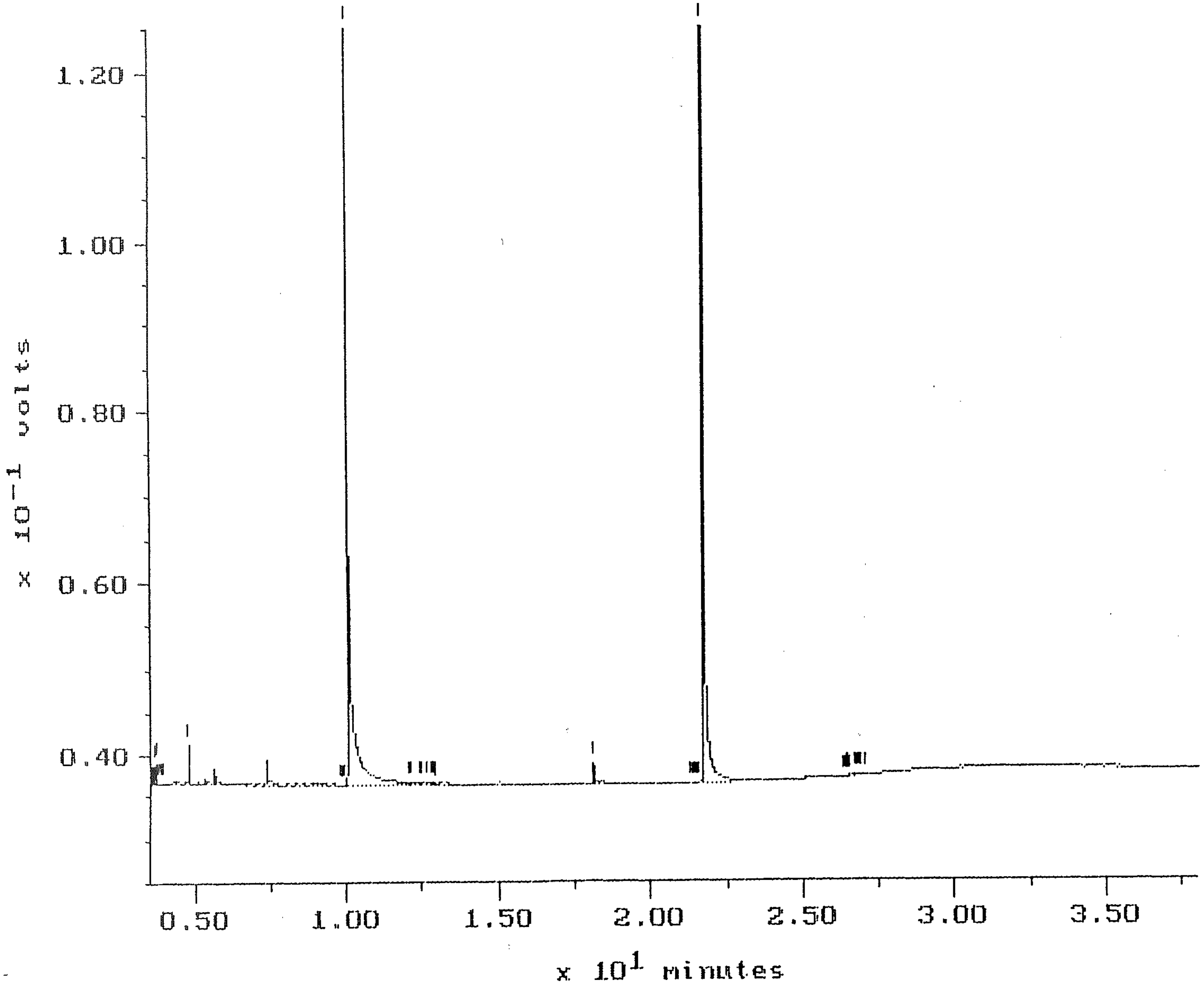
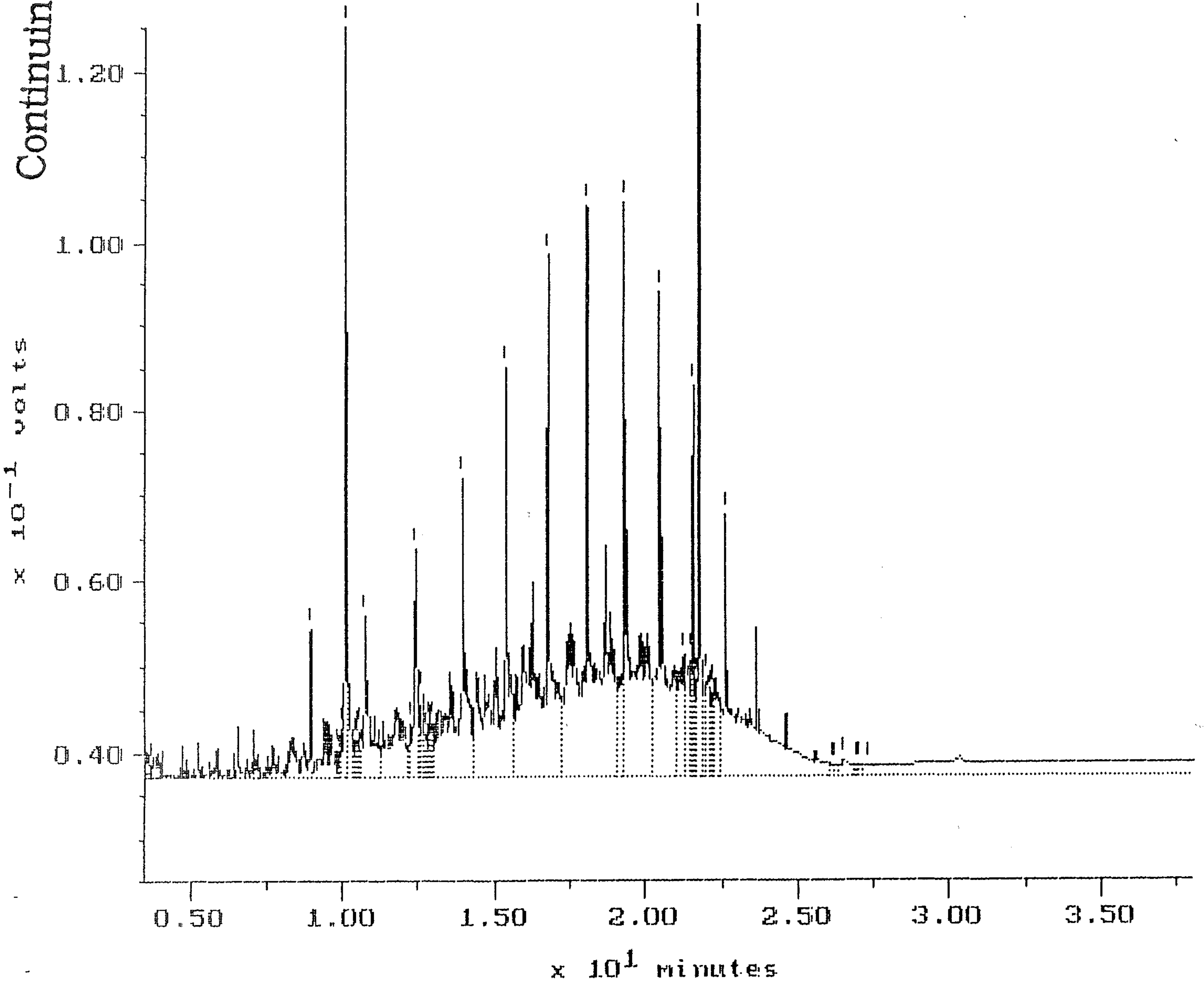


Continuing Calibration

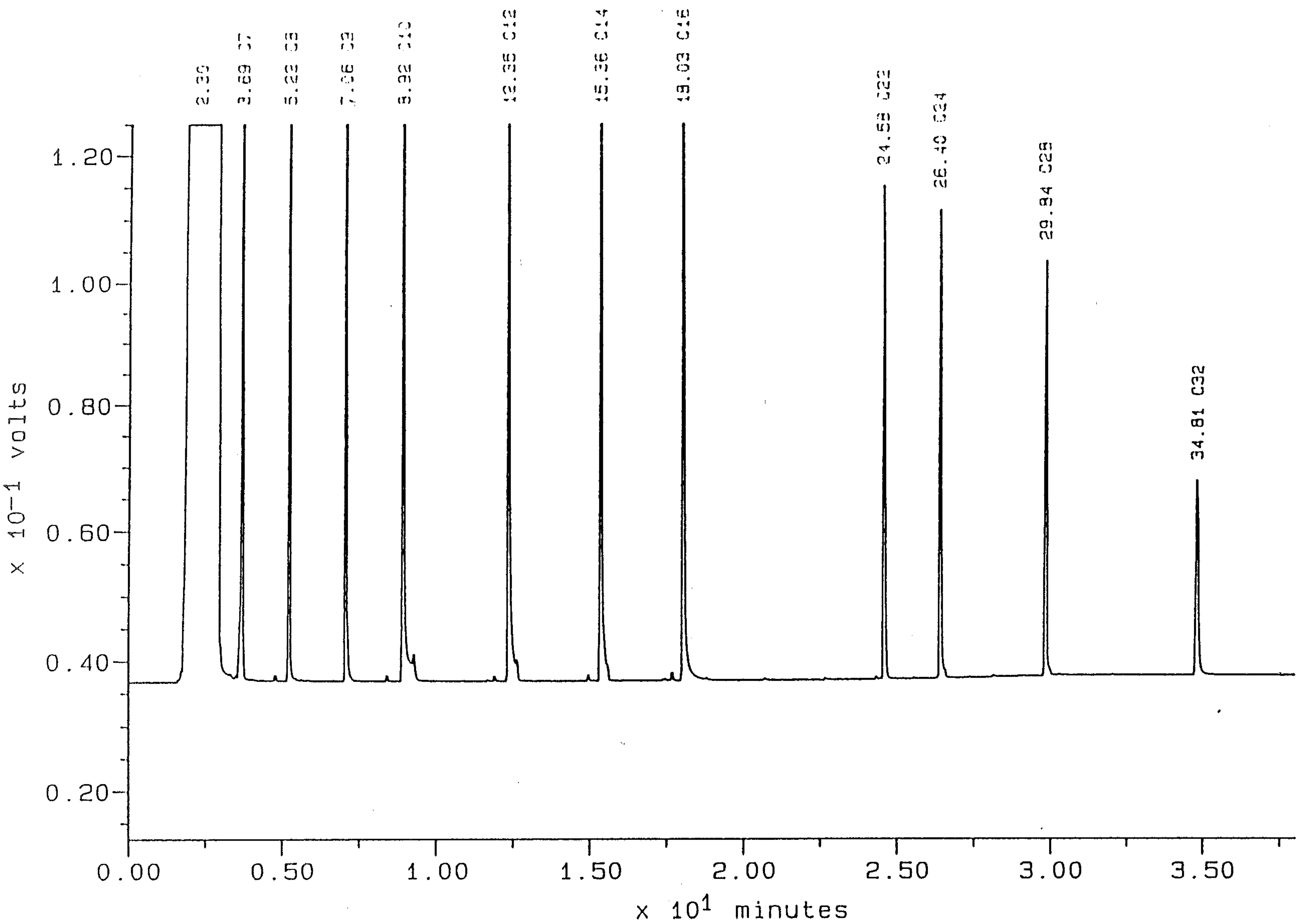


Sample: ALKANE
Acquired: 29-JAN-93 13:44
Inj Vol: 1.00

Channel: CEMETRI
Method: H:\ERO2\MAXDATA\SERGE-D\FUEL0129

Filename: R129BC02
Operator: ATI

Alkane



RZA AGRA, Inc.
Engineering & Environmental Services
539 W. Sharp, Suite D
Spokane, WA 99201
(509) 325-0104 FAX: (509) 325-0212

№ 00018

Chain of Custody Record / Analysis Request

Project Name: Pullman Chevron
Job No.: S-1070-2
Project Manager: Gene St. Godard
Phone #: 509 325-0104
Sampler:

	RZA-AGRA Sample ID	Lab Samp ID	Date Collected	Time Collected	Matrix (S=soil, W=water A=air)	# Containers/Preservation							Analysis Requested: (write preferred method in box)																		
						40 ml VOA /	1 L Glass /	8 oz Glass /				CHILL	WTPH-G	WTPH-D	BTEX 8020/602	TPH-418.1	PAH 8310LL 2/25/93													Hold for Further Analysis	RUSH (see below)
-1	mw-11 S-1	1	2/22		S								X	X	X	X	⊗														
-2	mw-12 S-2	2	2/22		S								X	X	X	X	⊗														
-3	CB-5 S-2	3	2/23		S								X	X	X	X	X														
-4	CB-6 S-2	4	2/23		S								X	X	X	X	X														
-5	mw-11	5	2/23	12:15	W								X	X	X	X	⊗														
-6	mw-12	6	2/23	11:45	W								X	X	X	X	⊗														
-7	TRIP BLANK	7	2/23		W								X		X																

-1,2,5,6
Do not run 8310LL unless 418.1, D, G are detected.

RELINQUISHED BY SAMPLER:	RELINQUISHED BY:	RELINQUISHED BY:
Signature: Gene M St Godard	Signature:	Signature:
Printed Name: E. St Godard	Printed Name: Fed EX	Printed Name:
Firm: RZA	Firm:	Firm:
Date/Time: 2/24/93 15:55	Date/Time:	Date/Time:
RECEIVED BY:	**RECEIVED BY:**	**RECEIVED BY:**
Signature: Michael S Kuth	Signature:	Signature:
Printed Name: Michael S Kuth	Printed Name: STINA KENSLER	Printed Name:
Firm: Fed EX	Firm: ATI-WA	Firm:
Date/Time: 2-24 1553	Date/Time: 2/25/93 930	Date/Time:

LABORATORY: 9302-204
Total # Containers:
Condition of Containers?
Condition of Seals?

Special Handling

Turnaround:
☐ 8 hours
☐ 24 hours
~~☐ 5 business days~~ mw-11 S-1 + mw-12 S-2 mw-11 + mw-12
~~☒ 10 business days~~
☒ other 3 (#)business days CB-5 S-2 + CB-6 S-2

PURPOSE OF SAMPLING / COMMENTS:
Need ultralow detection limits on PAH's 0.01 ppm soil
0.01 ppb water
Bill according to Chevron contract
Release # 8626800
NTA
NOTE: ⊗

Form 100B

DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator; GOLDENROD - to lab in advance

PAGE 1 OF 1

allowing disposal to the sewer and analyzed for BTEX using EPA Method 602 and total oil and grease by EPA Method 413.1 to insure proper treatment as required under the minor discharge authorization. A sample of the pump test effluent would also be analyzed for total dissolved solids to evaluate the quality of the groundwater. The effluent analyses for BTEX and total oil and grease would be performed by a local laboratory able to provide a 24 hour turn-around.

8.0 HEALTH AND SAFETY PLAN

Prior to the beginning of site characterization work, a site specific Health and Safety Plan would be prepared. The Health and Safety Plan would identify project safety officers, emergency contact numbers, threshold conditions for the use of personal protective equipment and detail health effects of compounds specifically identified at the site. The site Health and Safety Plan would have to be read and signed by all persons entering or working on the site during the characterization activities.

9.0 SITE CHARACTERIZATION REPORT

Upon completion of the field and laboratory studies, which involve soil and groundwater sampling and analysis, groundwater measurements and performance of a limited aquifer pump test, a summary report will be prepared. The report will include a site plan showing the approximate exploration and well locations, construction details of the monitoring wells including well head elevations, analytical test results on soil and groundwater, a groundwater elevation map and an interpretive subsurface profile of the site. Based on the information collected during the site characterization efforts, the report will present our conclusions regarding the subsurface geology and hydrogeology, the vertical and lateral extent of petroleum hydrocarbons in soil and groundwater and the migration direction and gradient of shallow groundwater beneath the site.

ENVIRONMENTAL SITE ASSESSMENT

FORMER BULK STORAGE FACILITY

Pullman, Washington

Prepared for

CHEVRON PRODUCTS CO., INC.

January 1993

S-1070-1

RZA AGRA, Inc.
Engineering & Environmental Services

AGRA
Earth & Environmental Group

Chevron

Chevron U.S.A. Products Company
2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

RECEIVED
FEB - 8 1993
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

February 3, 1993

Mr. Dave George
WA Department of Ecology, Eastern Region
North 4601 Monroe, Suite 100
Spokane, WA 99205-1295

Re: Former Chevron bulk storage facility (Washington State University property)
815 East College Street, Pullman, Washington
Enclosed report of environmental site assessment (RZA, 1/29/93)

Dear Dave:

I have enclosed a report dated January 29, 1993, which was prepared by Chevron's consultant, RZA-AGRA of Spokane (RZA), to describe the results of an environmental assessment conducted in December 1992 at the subject site. The assessment consisted of drilling and sampling numerous soil borings and groundwater monitoring wells both on and off of the site property, collecting surficial soil and coal samples, monitoring preexisting groundwater wells, and conducting a groundwater yield test. Soil and water samples were analyzed for a variety of petroleum related compounds. RZA's report describes the field activities and results in detail, and it describes the current and future uses of the property, including the proposed bridge expansion project by the Washington Department of Transportation.

To summarize, petroleum related compounds were detected in soil and groundwater samples from shallow depths in the majority of the locations tested. The impacted soil and groundwater are generally found within the low permeability silt layer where the top of the saturated water zone occurs. The groundwater yield test concluded that the affected shallow water bearing zone, which is perched upon basalt bedrock, cannot sustain a flow of 0.5 gallons per minute. This finding is relevant within the context of groundwater cleanup standards under the Model Toxics Control Act (MTCA, section WAC 173-340-720.1.ii.A). The groundwater yield test data will be further utilized to model the groundwater and dissolved hydrocarbon fate and transport in the subsurface.

Chevron and RZA are pursuing additional offsite assessment actions to provide a more clear picture of the impact to offsite soil and groundwater. The proposed scope includes soil sampling in the area of the planned bridge's eastern retaining wall which will be founded on the native basalt bedrock. The scope will also include additional groundwater monitoring wells to be located in the hydraulically downgradient direction from the site beyond the current offsite wells MW-6 and MW-7. Chevron and RZA will work to complete the additional assessment as quickly as possible in consideration of the proposed future uses of the property. A copy of RZA's findings will be forwarded to you when finalized.

Chevron's consultant, PTI Environmental Services of Bellevue (PTI), is using the site specific characteristics, the results of site assessments, and the provisions within MTCA to determine clean-up criteria and points of compliance for the media affected at this site. Chevron's plans will include special consideration of the proposed future uses of the property, most notably the planned bridge expansion project by the Department of Transportation.

If you have any questions or comments, I can be reached at (510) 842-8658.

Sincerely,

Clint B. Rogers

Clint B. Rogers
Environmental Engineer

Enclosure

cc: Jim Owens, WSU, French Admin. Bldg., Room 432, Pullman, WA 99164-1045
Joe Chatterton, WA Dept. of Transportation, N. 2714 Mayfair, Spokane, WA 99207-2090
Jim Hudak, City of Pullman, P.O. Box 249, Pullman, WA 99163-0249
Celia Evans, PTI, Bellevue, WA
Jon Sondergaard, RZA-AGRA, Spokane, WA (w/o enclosure)

RZA - AGRA
(Rittenhouse-Zeman & Associates, Inc.)
Engineering & Environmental Services

Georgetown Office Building
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FEB - 8 1993
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

29 January 1993

FEB 02 '93 PWM

Site Assessment and Remediation Group
Chevron U.S.A. Products Company
P.O. Box 5004
San Ramon, California 94583-0804

Attention: Mr. Clint Rogers

Subject: Environmental Site Assessment Report
Former petroleum Bulk Storage Facility
East 815 College Street
Pullman, Washington

Mr. Rogers:

RZA AGRA, Inc. is pleased to present the results of our site assessment at the above referenced site. Authorization to proceed with this work was provided by Mr. Clint Rogers of Chevron U.S.A. under Release No. 8288120. This work was performed in accordance with generally accepted environmental assessment practices for the exclusive use of Chevron U.S.A., Inc. and their agents for specific application to the subject site.

We appreciate the opportunity to be of continuing service to Chevron U.S.A. Products Company. Should you have any questions regarding this report or other aspects of the project, please call us at your earliest convenience.

Respectfully submitted,
RZA AGRA, Inc.

Jon N. Sondergaard, P.G., R.E.A.
Associate

AGRA
Earth & Environmental Group

Environmental Site Assessment Report of Former Bulk Storage Facility

CHEVRON PRODUCTS CO., INC.
E. 815 College Street
Pullman, Washington

Prepared for

Chevron Products Co., Inc.
P.O. Box 5004
San Ramon, CA 94583-0804

RZA AGRA, Inc.
W. 539 Sharp Avenue, Suite D
Spokane, Washington 99201

29 January 1993
S-1070-1

AGRA
Earth & Environmental Group

TABLE OF CONTENTS

S-1070-1

SITE ASSESSMENT
FORMER CHEVRON BULK STORAGE FACILITY
PULLMAN, WASHINGTON

S-1070-1

1.0 INTRODUCTION

RZA AGRA, Inc. performed a Site Assessment for Chevron U.S.A. Products Co., Inc. on the subject property located at East 815 College Street in Pullman, Washington. Our work consisted of a subsurface exploration program, installation of groundwater monitoring wells, analytical testing of soil and groundwater samples, and an evaluation of field and laboratory data. The purpose of this assessment is to present a subsurface petroleum hydrocarbon characterization of the subject property. The following summary presents significant findings of this assessment. Additional background information and analyses are described subsequently in the text of this report.

- The subsurface exploration program consisted of advancing 9 soil borings; installing groundwater monitoring wells in 5 of these borings and advancing 2 hand auger borings at specific locations across the site. In addition to the subsurface explorations, 3 surface samples were collected for analysis;

- The subsurface exploration program encountered sandy, gravelly, FILL with coal fragments over soft to stiff, SILT over dense silty SAND over basalt bedrock;

- Groundwater was encountered at a depth of 6 1/2 to 11 feet below the existing ground surface at the time of drilling and measured at an approximate depth of 5 to 9 feet in installed monitoring wells. No groundwater was encountered in boring CB-4. The shallow groundwater is inferred to migrate to the west under a hydraulic gradient of approximately 0.0278 ft/ft;

- The alluvial SILT soils encountered in the vicinity of explorations CB-1, CB-2, MW-8, MW-9 and MW-10 contain TPH and scattered BTEX concentrations in excess of MTCA Method A Compliance Clean-up Levels (CCL's). Samples collected from CB-1 and MW-9 exhibited detectable concentrations of the polynuclear aromatic hydrocarbon (PAH) naphthalene;

- Analytical laboratory test results of groundwater samples collected from site and surrounding wells contained purgeable hydrocarbons (WTPH-G), BTEX and extractable hydrocarbons (WTPH-D and 418.1) in wells MW-1, MW-2, MW-6, MW-7, MW-8, MW-9 and MW-10 above the cleanup levels set forth in Method A of MTCA. Well MW-4 exhibited concentrations of TPH above the MTCA Method A Criteria as determined by EPA Method 418.1;

- An aquifer yield test performed on the shallow aquifer using monitoring well MW-8 indicated the aquifer could not sustain a constant pumping rate of 0.5 gallons per minute when pumped for a period exceeding 10 hours.

- Data acquired during the assessment is evaluated in conjunction with information collected during a previous site assessment accomplished for the Washington State Department of Transportation to present a detailed evaluation of subsurface conditions beneath the subject property and surrounding areas.

This summary is presented for introductory purposes and should only be used in conjunction with the full text of this report. Our observations of subsurface conditions, installation of groundwater monitoring wells, and laboratory analyses are included in the text of this report. The exploration procedures and boring logs are presented in Appendix A, discharge permits in Appendix B, pump test data in Appendix C, and analytical test procedures and certificates in Appendix D.

The scope of work for this assessment consisted of the following:

- Drill and soil sampling a total of 11 borings on and around the property. The subsurface explorations consisted of completing 4 machine augered soil borings, 5 machine augered borings finished as groundwater monitoring wells, and 2 hand augered soil borings;

- Collecting three surficial soil samples, one to characterize for possible recent releases of diesel fuel by the above ground diesel tank, one to characterize the incinerated coal ash stockpiled on the site, and one to characterize the abundant coal dust spread across the site;

- Performing a limited aquifer yield test on the new groundwater monitoring well (MW-8) installed on-site;
- Measuring the vertical location of the new groundwater monitoring wells and fluid levels in all monitoring wells located on and around the property;
- Submitting selected representative soil samples collected from the subsurface explorations to an analytical laboratory for quantification of total petroleum hydrocarbons (gasoline and diesel), volatile aromatic hydrocarbons specific to petroleum fuels (BTEX), total recoverable hydrocarbons (WTPH-418.1), polynuclear aromatic hydrocarbons and total lead;
- Submitting groundwater samples collected from the new and existing monitoring wells and submitting the water samples to an analytical laboratory for quantification of total petroleum hydrocarbons (gasoline and diesel), volatile aromatic hydrocarbons specific to petroleum fuels (BTEX), total recoverable hydrocarbons (WTPH-418.1), polynuclear aromatic hydrocarbons, total lead and total dissolved lead. In addition, a water sample collected during the limited pump test was analyzed for BTEX, total oil and grease, total dissolved solids and flashpoint;
- Evaluate all the collected data and prepare a summary report.

2.0 BACKGROUND

2.1 Facility Description and History

The project site occupies approximately 0.67 acres and is located in the southwest 1/4 of the northwest 1/4 of Section 5, Township 14 North, Range 45 East in Pullman, Washington. The approximate location of the site is presented on Figure 1, Site Vicinity Map. The Subject property is bordered on the north by College Street, on the west by Riverview Street (Spring Street), on the south by railroad property and student parking areas, and on the east by Tacoma Street. A structure is present in the northern section of the property and is used by Washington State University (WSU) power plant personnel to store equipment. A small 500 gallon above ground diesel storage tank is located in the western area of the property near the former warehouse. The property is fenced and is currently being used by WSU to stockpile coal and incinerated coal ash.

The former bulk storage facility was previously owned by Chevron U.S.A. Products Company and existed on the site from at least 1920 to its dismantling in about 1981. In 1981, Chevron donated the property to Washington State University who currently uses the site to store excess coal used at the nearby coal power plant. The local area within the drainage valley is used primarily for parking by WSU students and is occupied by a city park with playing fields. The WSU coal power plant and scattered retail stores are also present throughout the valley. Washington State University and housing is located east of the subject site. To the south and west of the site, on the plateau above the drainage, are located residential housing and retail centers.

2.2 Local and Regional Geology and Hydrogeology

The geology of the site is characterized by a thin deposit (10 to 15 feet) of fluvial sediments and overbank flood deposits (consisting of fine-grained sediments) deposited by the South Fork of the Palouse River which occupies the western portion of the valley west of the subject site. Directly above the fluvial flood deposits in the western side of the valley, is located fill material which thickens towards the west where a dump was once located. The fluvial flood deposits overlie a thin (1 to 4 foot thick) regolith gravel/sand interval which lies directly on basalt bedrock. These gravel deposits were deposited directly over the Miocene basalts of the Columbia River Group.

Approximately 13 to 16 million years ago basalt lava erupted from a center in southeastern Washington or nearby Oregon and flooded most of central and eastern Washington. There were many lava flows, erupting approximately every few thousand years and flooding the area around Pullman. Each lava flow would thinly spread over hundreds of square miles and then cool to form the black, fine-grained basalt bedrock which is present throughout southeastern Washington.

A relatively well defined shallow groundwater table was observed in the vicinity of the site at a depth of 5 to 9 feet below the ground surface within the regolith gravel/sand and overlying silts as determined from monitoring wells installed on and surrounding the subject site. Static water level measurements collected from the monitoring wells may result from partial confining of the coarser aquifer materials located above bedrock. The shallow groundwater beneath the site is inferred to flow to the west at an approximate hydraulic gradient of 0.0278 ft/ft.

The basaltic rocks that host the regional aquifer system underlying the Columbia Plateau are located in central and eastern Washington, northern Oregon, and a small portion of north-western Idaho. The basalt under the Columbia Plateau comprise a multilayered aquifer system. Many basalt flows are connected hydraulically either directly or through sedimentary interbeds. These interbeds typically are comprised of regolith soils derived from weathering of the top of the basalt flow or from interbed fluvial gravel/sands which were buried by later flows. These major aquifers within the basalt interflows form the regional groundwater flow system that provides water for most municipal, industrial, domestic and for agricultural purposes. Regional hydrology Water supply wells in the area are deep and draw water from the permeable basalt interbeds. In our opinion, the shallow groundwater encountered beneath the site represents an aquifer perched above basalt bedrock and is not a part of the deeper, regional aquifer system.

2.3 Previous Environmental Investigations

During geotechnical assessment for replacement of the existing State Highway 270 bridge in Pullman, Washington in August 1991, the Washington State Department of Transportation (WSDOT) encountered indications of petroleum hydrocarbon containing soils and groundwater within the project right of way. Subsequent investigations, including a Level I Environmental Site Assessment reviewing historic use of the site and a Level II Environmental Site Assessment to evaluate the presence and extent of hydrocarbon impacted soils and groundwater, were conducted by RZA AGRA under contract to WSDOT. The results of these investigations were presented to WSDOT in two reports entitled, "Level I Environmental Site Assessment" (S-1023) dated 26 June 1992 and "Level II Environmental Site Assessment" (S-1023) dated 26 June 1992. Data collected during these investigations have been incorporated into this report.

3.0 METHODS

3.1 Subsurface Characterization

The exploration program designed to characterize the subsurface conditions at the site involved the completion of 9 machine augered soil borings completed with a Mobile B-61 drill rig and two hand auger borings completed with a 4-inch stainless steel hand auger. All subsurface exploration for this assessment were completed from 14 to 16 December 1992. Five of the soil borings were completed as groundwater monitoring wells (MW-6 through MW-10) while the remaining 4 borings (CB-1 through CB-4) were backfilled according to Washington State Department of Ecology (Ecology) guidelines. The two hand auger borings (HA-1 and HA-2) were backfilled with soil cuttings from each boring. In addition to these borings, subsurface information from explorations previously completed for the WSDOT bridge 270/4 geotechnical design study (B-1 through B-6 and TP-1 through TP-9) and Level II Environmental Site Assessment (MW-1 through MW-5 and B-7 through B-9) were utilized in this report. The approximate locations of all subsurface explorations completed for this assessment and those relevant explorations from previous studies are presented on the Site and Exploration Plan, Figures 2 and 2A. Discussion of the drilling procedures and logs of the soil borings and monitoring well as-built diagrams are presented in Appendix A.

Soil samples were generally collected at 5 feet depth intervals using the standard penetration test (SPT) methods and a 2-inch O.D. split spoon sampler. Collection procedures were conducted to minimize the risk of cross-contamination between sampling and exploration locations. Sampling procedures and collection methods are described in Appendix A.

3.2 Monitor Well Installation and Development

Five borings were completed for the purpose of installing site monitoring wells. The auger was advanced into the substrate until the desired depth (refusal at the top of bedrock), approximately 10 to 17 feet below the ground surface. Ten feet of 2-inch inside diameter (I.D.) Schedule 40 PVC well screen (with 0.010 -inch sized slots) attached to blank Schedule 40 PVC riser pipe was installed in MW-8, MW-9 and MW-10 and five feet of 2-inch I.D. well screen attached to Schedule 40 PVC blank riser pipe in MW-6 and MW-7. The constructed well was placed inside the auger casing and the casing was then filled continuously with a select sand filter pack and slowly withdrawn to allow the sand to surround the well screen and fill the annulus of the boring to approximately two feet above the top of the well screen. A seal consisting of bentonite was then placed in the hole to a depth of 2 feet above the sand filter pack. Concrete was then placed above the bentonite seal and each well was completed by installing a locking cap in the top of the PVC casing and cementing in a flush-mounted or above ground steel well monument. The monitoring wells were installed in accordance with Ecology's Minimum Standards for the Construction and Maintenance of Wells (WAC 173-160).

After installation of the monitoring wells, groundwater was allowed to achieve static water level overnight. Fluid level measurements were then obtained from each well. Monitoring wells were developed by surging the well utilizing a 2-inch O.D. stainless steel bailer and removing approximately 10 gallons of groundwater. This enabled the removal of sand and silt which collected in the well during drilling and installation. The bailer was decontaminated between use in each well with Liquinox and water. After purging three well volumes, samples were then collected using a new disposable polyethylene bailer which was discarded after use in each well. Dedicated bailer cord was used at each sampling location. Installation procedures and sampling protocols are described in detail in Appendix A.

4.0 RESULTS OF THE ASSESSMENT

4.1 Subsurface Characterization

The approximate locations of all subsurface explorations completed for this study and explorations completed during the previous environmental assessment are presented on Figures 2 and 2A, Site and Exploration Plan. Discussion of the drilling procedures and logs of the soil borings and monitoring well as-builts are presented in Appendix A.

Subsurface soils beneath the site typically consist of the following: 0 to 2.5 feet of silty gravel FILL with coal cinders over; 6 to 11 1/2 feet of very soft to medium stiff, damp to wet, greenish gray to black clayey SILT and SILT with some sand and scattered gravels over; 2 to 6 feet of loose to dense, saturated, gray to black, silty SAND with gravel; over basalt bedrock. Explorations MW-6 and MW-7 encountered 1 foot of gravel FILL over; 4 to 6 1/2 feet of loose to dense, damp, reddish brown SAND and GRAVEL with debris (FILL) over; 4 feet of soft, wet, dark brown, sandy SILT (only in MW-6) over; 1 1/2 to 5 feet of loose to dense, saturated, dark gray, gravelly SAND; over basalt bedrock. Typically, basalt bedrock was encountered in borings on the site at a depth ranging from 9 to 18 1/2 feet below the existing ground surface and from 10 to 11 1/2 feet below grade in borings completed on the City of Pullman property (MW-6 and MW-7) along Riverview Street. Interpretive geologic cross-sections of the subsurface stratigraphy are presented in Figure 3.

4.2 Groundwater Conditions

At the time of drilling, groundwater was generally encountered at a depth ranging between 9 and 11 feet below the existing ground surface for borings completed on-site and 4 to 5 feet below grade for those borings completed off-site. Installation of on-site monitoring wells MW-6 through MW-10 allowed measurement of the static groundwater level in the wells after completion of drilling operations. Groundwater levels were also collected from monitoring wells MW-1 through MW-5 installed during the WSDOT investigation of the adjacent property. Table 1 presents a summary of well construction, measuring point and groundwater elevations for all site and surrounding monitoring wells. Vertical well elevations for the wells completed for this study were measured by RZA AGRA personnel. After drilling and well installation activities, the static water levels measured in the monitoring wells ranged from approximately 4.21 to 9.12 feet below the top of the PVC well casings. Figure 4 presents an estimation of the groundwater surface contour and flow direction based on the geometry of the static water level elevation data collected on 17 December 1992. Based on this interpretation, the shallow groundwater beneath the site migrates to the west under a hydraulic gradient of 0.0278 ft/ft.

4.3 Shallow Aquifer Yield Test

A limited aquifer yield test was performed at the site on 16 December 1992. The pump test procedure consisted of extracting groundwater from monitoring well MW-8 using a Grundfos Redi-Flo2 submersible pump with a rated flow of between 100 milliliters per minute and 9 gallons per minute. Groundwater was pumped from the well at a constant rate of 0.5 gallons per minute (gpm) and was monitored by a Signet Accum-U-Flo meter with gpm and total flow LED readouts. As groundwater was withdrawn from MW-8, the magnitude of groundwater drawdown in the pumping well and surrounding monitoring wells was recorded. Groundwater removed from the pumping well was pumped through 2 Water Scrub Unit-55 Charcoal Tubs treatment systems which removed petroleum hydrocarbons from the influent.

Prior to starting the pump test, RZA AGRA received a permit from the City of Pullman to allow discharge of treated groundwater effluent from the test to the city sanitary sewer system. A copy of this permit is presented in Appendix B, along with analytical test results for the effluent discharge. Over the duration of the pump test, approximately 307 gallons of effluent were treated through the charcoal system. A preliminary pump test was conducted on 15 December 1992 for 1 1/2 hours in order to generate enough groundwater to run through the charcoal filters for sampling purposes. The city of Pullman waste water department required analyses of treated effluent prior to discharging groundwater to the city sewer system. Groundwater derived from subsequent development and purging of the groundwater monitoring wells was also treated through the charcoal system. A total of approximately 492 gallons of treated water was discharged to the City of Pullman sanitary sewer system.

The constant pumping rate of 0.5 gpm was sustained for 10 hours and 5 minutes (605 minutes) before water within the well fell below the pump intake which was located about 0.8 feet above the bottom of the well. Groundwater elevations during the duration of the test are presented graphically in Figure 5, MW-8 Aquifer Yield Test. Surrounding site monitoring wells were also monitored during the pump test. Influence was recorded in MW-9, MW-1 and MW-2. A radius of influence between 70 and 125 feet was achieved with the test setup and aquifer conditions present at the time this test was performed. Measurements obtained throughout the duration of the pump test and during recharge are presented in Appendix C.

The pumping well was monitored for 1004 minutes during recharge after pumping ceased. Analysis of the recharge data is presented in Figure 6. It should be noted that groundwater elevations in surrounding observation wells continued to fall after pumping ceased in the pumping well and throughout the time recharge was monitored.

Based on the subsurface stratigraphy, the shallow aquifer beneath the site appears to be semi-confined. The sand and gravel bed lying directly above bedrock is relatively permeable compared to the underlying basalt and the overlying native silt, yet first groundwater levels encountered during drilling appeared in the overlying silt. Also evaluation of the recharge data as a slug test resulted in a much better curve matching when analyzed as an unconfined aquifer verses a confined aquifer. Based on this conclusion, the pump test data was analyzed using Bouwer and Rice slug test method for unconfined systems (Figure 6). The recharge data indicate a rapid recharge within the 4 feet thick sand which lies directly above bedrock followed by an extended recharge period for groundwater originating in the overlying clayey SILT. For this reason the recharge analysis results in determination of a hydraulic conductivity for the clayey SILT, not the underlying silty SAND. Based on the pump test data analysis, the hydraulic conductivity of the clayey SILT is calculated at 7.4×10^{-7} ft/min.

4.4 Analytical Results

4.4.1 Subsurface Soil

The presence of petroleum hydrocarbons in the subsurface soils was evaluated by: 1) observing collected soil samples and drill cuttings for discoloration, sheen or petroleum hydrocarbon-like odor; 2) performing field headspace measurements using a portable photoionization detector on sample jars containing collected soil samples and; 3) submitting selected soil samples to the laboratory for quantification of total petroleum hydrocarbons (TPH), total recoverable hydrocarbons (TRH), selected volatile aromatic hydrocarbons common to fuel products (benzene, toluene, ethylbenzene, and xylenes or BTEX), polynuclear aromatic hydrocarbons (PAH's) and total lead. Laboratory test certificates are attached in Appendix D.

Table 2 presents a summary of head space measurements for volatile organic vapors collected from soil samples retrieved from the subsurface explorations for this study. Table 3 presents a summary of head space measurements collected from soil samples retrieved from previous studies in the vicinity of the subject site. The field headspace measurement procedure is described in Appendix A. The portable photoionization detector used for the head space measurements can detect a wide range of organic compounds, including many associated with petroleum hydrocarbon fuel products, but cannot speciate between different organic compounds. The headspace measurement method is used as a screening technique to determine qualitatively if volatile organics are present within a soil sample and as one criteria for identifying which samples should be sent to the laboratory for further analysis. It should be noted that during this investigation, ambient temperatures were below freezing and may have effected the headspace readings.

Based on the results of visual and olfactory sensing, organic vapor headspace measurements and position with respect to the groundwater table, selected representative soil samples were submitted to North Creek Analytical in Bothell, Washington for further testing. Table 4 presents a summary of the analytical test results of soils tested for this study and descriptions of the analytical testing procedures and laboratory certificates are presented in Appendix A. Table 5 is summary of analytical test results of soils analyzed during the WSDOT studies.

The native silt soil, which underlies the subject site, contains detectable petroleum hydrocarbons throughout its thickness. The highest concentrations are likely located within the zone above the groundwater interface directly below the subject site and within the zone of seasonal groundwater fluctuations downgradient of the former bulk storage facility. Evidence for the presence of petroleum hydrocarbons in the native silts occurs as noticeable dark gray to black staining and discoloration of the soil, obvious petroleum hydrocarbon-like sheen and odor, the organic vapor headspace measurements and analytical test results. Analytical test results for TPH and total BTEX are presented on Figure 3 for those borings utilized for this interpretation.

Field observations, from previous WSDOT studies, of the native silt soil down gradient and cross gradient of the former bulk storage facility contained indications of petroleum hydrocarbons in the area around explorations MW-1, B-4, B-7, TP-3 and TP-9.

TPH detections were typically identified as diesel or the heavier end gasoline (G-2). All borings on the subject site completed for this study contained soil samples which exhibited TPH concentrations as determined by WTPH 418.1, WTPH-D and WTPH-G. Borings completed off-site (MW-7) contained soil samples which exhibited TPH and BTEX concentrations below MTCA Method A CCL or below method detection limits. No soil samples were retrieved from off-site boring MW-6 because the subsurface fill at this location consisted of oversized material and debris which could not enter the 2-inch O.D. sample.

The more granular sandy interval which underlies the silt and directly overlies bedrock typically did not exhibit obvious staining or discoloration. However, hydrocarbon-like odors were detectable in these soils. Quantitative analytical testing of three soil samples collected during the WSDOT environmental study from this horizon (MW-2 S-5, B-8 S-3 and B-9 S-3) exhibited no detectable concentrations of TPH or BTEX.

Soil samples were analyzed for total lead, which sometimes is released to the subsurface from spills of leaded gasoline. Total lead concentrations varied between nondetectable and 35 ppm for samples analyzed for this study and between 19 and 53 ppm for the previous WSDOT studies. These concentrations are below the MTCA Method A CCL for lead in soil of 250 ppm.

Selected soil samples were also analyzed for polynuclear aromatic hydrocarbons (PAH's) by EPA Method 8310. Soil samples exhibiting concentrations of naphthalene (the only PAH detected) were MW-9 S-2, CB-1 S-2, CB-2 S-2 and CB-3 S-1. Only soil samples MW-9 S-2 and CB-1 S-2 exceeded the MTCA Method A CCL for PAH in soil of 1.0 ppm. All other samples collected from the borings exhibited concentrations below method detection limits. A summary of PAH analyses for this project is presented on Table 6.

4.4.2 Hand Auger Borings

Due to difficulty accessing the elevated area behind the retaining wall where the above ground tanks were formerly located, two hand auger borings (HA-1 and HA-2) were completed to depths of approximately 2 1/2 feet in this area (Figure 2). At this depth, refusal occurred most likely due to the old gravel base which was present below the tank field. In general the borings encountered a 4-inch topsoil layer over a dark brown clayey silt with scattered sand grading down into a brown sandy silt through the full depth explored. Samples were collected at a depth of 1 1/2 to 2 feet from each hand boring.

Samples collected from the hand borings exhibited detectable concentrations of WTPH-D which did not exceed the MTCA Method A CCL of 200 ppm. Sample HA-1 S-1, collected near the large circular retaining wall, also exhibited a low concentration of toluene and a total lead concentration of 170 ppm. No PAH's were detected in the hand auger samples. Analytical test results for these samples are summarized in Table 4.

4.4.3 Surficial Soil Samples

Three surficial soil samples were collected at the approximate locations shown on Figure 2. These samples were collected to evaluate the condition of: coal dust which covers most of the site; incinerated ash temporarily stored on site and; soils located beneath the existing above ground diesel fuel storage tank used by WSU power plant. Samples were collected from the upper 6 inches of soil.

A sample was collected from the soil located beneath the diesel fuel tank (DTS) and analyzed for WTPH-D. Analyses revealed that soil at the sample location contained diesel concentrations below method detection limits. A sample of the coal scattered across the site was also collected. Analyses show TPH concentrations of 260 to 330 ppm by WTPH 418.1, 200 to 250 ppm by WTPH-D and 4.3 to 14.0 ppm WTPH-G. Varying amounts of BTEX were detected in the coal samples, however, no concentrations exceeded the MTCA Method A CCL. The coal sample was also analyzed for priority metals, a summary of which is presented in Table 7. The incinerated ash sample (IA) was analyzed for priority metals and TCLP metals and is summarized in Table 7. The samples exhibited detectable concentrations of certain priority metals (Cr, Cu, Ni, Zn, and Be) which were below regulatory action limits. No concentrations of leachable metals were detected in the incinerated ash sample (IA).

4.4.4 Groundwater

Groundwater samples were collected from monitoring wells MW-1 through MW-10 on 17 and 18 December 1992. The water samples were submitted to North Creek Analytical in Bothell, Washington for quantification of petroleum hydrocarbons and lead. The water samples were analyzed for total petroleum hydrocarbons using the WTPH-D and WTPH-G methods, total recoverable hydrocarbons by WTPH-418.1, volatile aromatics BTEX by EPA Method 602, polynuclear aromatic hydrocarbons by EPA Method 8310, and total lead and total dissolved lead using the EPA 7000 series. Two groundwater samples were collected from MW-8, one collected before the aquifer yield test (MW-8A) and one after the aquifer test when groundwater recharge had occurred into the well (MW-8B). A summary of analytical test results on groundwater is presented in Table 4 and laboratory test certificates are presented in Appendix D.

Groundwater samples collected from all wells except MW-3, MW-4 and MW-5 exhibited varying amounts of TPH and BTEX above MTCA Method A CCL. Monitoring well MW-4 also exhibited a TRH concentration of 1.2 ppm by WTPH-418.1. All water samples except MW-7 exhibited the PAH naphthalene in concentrations above MTCA Method A CCL. Monitoring Wells MW-3, MW-4 and MW-5 were not analyzed for PAH. A summary of PAH concentrations for groundwater is presented in Table 6.

Groundwater samples collected from all monitoring wells were analyzed for total lead. Total lead concentrations in the groundwater samples ranged from 0.022 to 2.50 ppm. Total dissolved lead concentrations exceeding the MTCA Method A CCL of 0.005 ppm was detected in samples collected from MW-8B and MW-10. All other samples exhibited dissolved lead concentrations below MTCA Method A CCL's or below method detection limits. There appears to be no correlation between the petroleum hydrocarbon soil contamination and the total lead concentrations. Also no correlation is observed between the total and dissolved lead analyses with the sample having the largest total lead concentration containing a low dissolved lead concentration. In our opinion, the total lead concentrations exhibited in the groundwater samples are probably indicative of high sediment content in the samples obtained due to the fine-grained nature of the surrounding formation. Lead concentrations may represent natural background concentrations.

5.0 PROPOSED FUTURE LAND USE

The project site is located immediately north of state highway SR-270, where WSDOT is proposing a bridge replacement project. The existing bridge spans the valley approximately 456 feet with the footings supporting the piers founded on native bedrock. The new bridge will span approximately 104 feet between the proposed pavement seats. Shortening the length of the bridge will be accomplished by extending the approach embankment fills approximately 170 to 180 feet at each end of the proposed bridge. The embankment fill will be contained by retaining walls near the permanent railroad tracks.

Figure 7 shows the area in which the embankment fill will be extended. This southeastern embankment fill will cover most of the southern section of the former bulk storage facility and areas beneath the existing bridge where this and previous site investigations have identified petroleum hydrocarbon containing soil and groundwater. The ground surface area covered by the embankment fill will be approximately 25,950 square feet (approximately 0.6 acres).

The embankment fill will be contained by retaining walls, which will also support the bridge deck, as shown in Figure 7. Retaining walls will be founded on native bedrock and require approximately 900 yd^3 of native soils to be removed. This estimation is based on vertical excavation walls. However, according to WSDOT during construction activities, excavation walls are to be are constructed at a 1 1/2 H: 1Y slope. Under these conditions, approximately an additional 650 yd^3 would be excavated to maintain stable slopes. We estimate a total of approximately 1,500 to 1,600 of native soil will be required to be removed for retaining wall construction.

6.0 CONCLUSIONS

Based on the environmental assessment completed for this project, soils underlying the former bulk storage facility contain petroleum hydrocarbons. Soils located outside the former bulk storage facility in the area of the planned bridge replacement also contain petroleum hydrocarbons. We estimate approximately 1,500 to 1,600 cubic yards of soil will require excavation for construction of the retaining wall which will support the east bridge abutment and retain the planned earth embankment. Groundwater encountered beneath and in the vicinity of the former bulk storage facility also contain petroleum hydrocarbons greater than MTCA Method A CCL's. Concentrations of total lead exhibited by groundwater may represent natural background levels. The polynuclear aromatic hydrocarbon Naphthalene, a non-carcinogen, was identified in several groundwater samples in excess of MTCA Method A CCL. Soil samples MW-9 S-2 and CB-1 S-2 were the only soils exhibiting Naphthalene in excess of the MTCA Methods A CCL of 1.0 for total PAH. All other PAH analytes were below method detection in both soils and groundwater.

A aquifer yield test was performed on monitoring well MW-8. A constant pump rate of 0.5 gpm was maintained for 605 minutes, at which time groundwater elevation fell below the screen intake of the pump located approximately 0.8 feet above bedrock. Based on the results of this test, in our opinion, the shallow aquifer located beneath the site is incapable of sustaining a yield of 0.5 gpm. Groundwater was determined to be migrating to the west at an approximate hydraulic gradient of 0.0278 ft/ft.

Information contained in this report is based upon site characterization, field observations, and the laboratory analyses accomplished for this study. Conclusions presented are professional opinions based upon our interpretation of the analytical laboratory test results, as well as our experience and observations during the project field characterizations. The number, locations, and depths of explorations and monitoring wells during the characterization program, including the analytical testing scope, were completed within the site and proposal constraints so as to yield the information utilized to formulate our conclusions.

We appreciate to be of service to Chevron U.S.A. Products Company. If you have any questions regarding information contained within this report or other aspects of the study, please call us at your earliest convenience.

Respectfully submitted,
RZA AGRA, Inc.

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Table 1: Summary of Well and Groundwater Elevations in Feet
Pullman Chevron
Pullman, Washington
S-1070

WELL NO.	DATE MEASURED	TOP OF PVC WELL CASING	TOP OF WELL SCREEN	BOTTOM OF WELL SCREEN	GROUNDWATER ELEVATION
MW-1	12/17/92	2,354.24	2,349.99	2,339.99	2,346.22
MW-2	12/17/92	2,354.29	2,349.61	2,339.61	2,345.57
MW-3	12/17/92	2,354.43	2,348.30	2,338.30	2,346.69
MW-4	12/17/92	2,352.35	2,343.87	2,338.87	2,344.60
MW-5	12/17/92	2,353.38	2,346.79	2,341.79	2,246.52
MW-6	12/17/92	2,348.38	2,343.98	2,338.98	2,342.99
MW-7	12/17/92	2,347.72	2,341.42	2,336.42	2,343.51
MW-8	12/17/92	2,355.45	2,348.80	2,338.80	2,346.79
MW-9	12/17/92	2,353.61	2,338.61	2,338.61	2,347.15
MW-10	12/17/92	2,354.35	2,337.15	2,337.15	2,345.23

Table 2: Summary of PID Headspace Measurements
Pullman Chevron
Pullman, Washington
S-1070

SAMPLE NO.	DATE MEASURED	DEPTH (FT)	HEADSPACE VAPOR MEASUREMENT (PPM)
CB-1, S-1	12/14/92	3.0 - 4.5	219.1
*CB-1, S-2	12/14/92	8.0 - 9.5	199.7
*CB-1, S-3	12/14/92	13.0 - 14.5	208.0
CB-1, S-4	12/14/92	18.0 - 18.9	196.0
CB-2, S-1	12/14/92	3.0 - 4.5	24.4
*CB-2, S-2	12/14/92	8.0 - 9.5	214.0
CB-2, S-3	12/14/92	13.0 - 14.5	171.0
*CB-3, S-1	12/15/92	2.5 - 4.0	169.0
CB-3, S-2	12/15/92	7.5 - 8.7	136.8
CB-4, S-1	12/15/92	2.5 - 4.0	2.4
*CB-4, S-2	12/15/92	7.5 - 8.7	4.0
MW-6, S-1	12/16/92	2.5 - 4.0	0.0
MW-6, S-2	12/16/92	7.5 - 9.0	4.0
MW-7, S-1	12/16/92	2.5 - 4.0	0.0
*MW-7, S-2	12/16/92	7.5 - 9.0	23.4
*MW-8, S-1	12/15/92	2.5 - 4.0	208.8
*MW-8, S-2	12/15/92	7.5 - 9.0	187.9
MW-8, S-3	12/15/92	12.5 - 14.0	68.8
MW-9, S-1	12/15/92	2.5 - 4.0	111.0
*MW-9, S-2	12/15/92	7.5 - 9.0	248.9
MW-9, S-3	12/15/92	12.5 - 14.0	219.0
MW-10, S-1	12/16/92	2.5 - 4.0	55.5
*MW-10, S-2	12/16/92	7.5 - 9.0	270.0
MW-10, S-3	12/16/92	12.5 - 14.0	233.3

* Sample submitted for Analytical Testing

S-1023

Table 3. Summary of PID Headspace Measurements
From WSDOT Environmental Study, March 1992

Sample No.	Depth (ft)	Headspace Vapor Measurement (ppm)
MW-1,S-1	2.5-4	198
MW-1,S-2	5-6.5	447
MW-1,S-3	7.5-9	407
MW-1,S-4	10-11.5	600
MW-1,S-5	12.5-13	557
MW-2,S-1	2.5-4	0
MW-2,S-2	5-6.5	35
MW-2,S-3	7.5-9	112
MW-2,S-4	10-11.5	68
MW-2,S-5	12.5-13.2	62
MW-3,S-1	2.5-4	0
MW-3,S-2	7.5-9	0
MW-3,S-3	12-13.4	0
MW-4,S-1	2.5-4	0
MW-4,S-2	7.5-9	0
MW-5,S-1	6-7.5	44
B-7,S-1	2.5-4	244
B-7,S-2	5-6.5	446
B-7,S-3	7.5-9	314
B-7,S-4	10-11.5	256
B-7,S-5	12.5-14	360
B-8,S-1	2.5-4	0
B-8,S-2	7.5-9	0
B-8,S-3	12.5-13.4	0
B-9,S-1	2.5-4	0
B-9,S-2	7.5-9	30
B-9,S-3	12.5-14	68
TP-3,S-1	5-7	345
TP-3,S-2	7-13	304
TP-9,S-1	5-5.5	989
TP-9,S-2	6-7	2,011
B-3,S-6	17.5-19	117
B-3,CS-7	19.5	12
B-4,CS-2	4.5-6	32
B-4,CS-4	10-10.5	284

*NOTE: PID measurements rounded to nearest ppm.

S-1070-01

Table 4. Summary of Analytical Test Results

SOIL (mg/kg)

Boring/ Well No.	Sample No.	Depth (ft)	Date Sampled	Certificate Number	WTPH- 418.1	WTPH-D	WTPH-G	Benzene	Toluene	Ethyl benzene	Total Xylenes	Total Lead	Total Diss. Lead	PAH (1)
MW-7	S-2	7.5-9	12/16/92	14,16,18,20,22,33	11.0	ND	5.6	ND	ND	ND	ND	ND		ND
MW-8	S-1	2.5-4	12/15/92	14,16,18	NT	2,500.0	2,000.0	1.2	0.88	33	100	NT		NT
MW-8	S-2	7.5-9	12/15/92	15,16,19,20,22,34	520.0	440.0	23.0	0.29	0.19	1.7	6	ND		ND
MW-9	S-2	7.5-9	12/15/92	15,16,19,20,22,36	560.0	320.0	1,700.0	2.1	27	33	120	ND		1.9n
MW-10	S-2	7.5-9	12/16/92	15,16,19,20,22,36	1,500.0	480.0	15,000	25	17	360	1100	30		ND
CB-1	S-2	8-9.5	12/14/92	14,16,18,20,22,29	980.0	3,200.0	4,000.0	ND	ND	ND	14	35		1.6n
CB-1	S-3	13-14.5	12/14/92	14,16,18	NT	18.0	200.0	ND	ND	ND	0.26	NT		NT
CB-2	S-2	8-9.5	12/14/92	14,16,18,20,22,30	840.0	220.0	750.0	ND	ND	ND	1	ND		ND
CB-3	S-1	2.5-4	12/15/92	14,16,18,20,22,31	400.0	490.0	41.0	0.12	0.63	0.1	0.11	20		0.79n
CB-4	S-2	7.5-9	12/15/92	14,16,18,20,22,32	20.0	630.0	3.4	ND	0.012	ND	ND	24		ND
DTS		0-0.5	12/14/92	14,16,18,28	NT	ND	NT	NT	NT	NT	NT	NT		ND
COAL 829		surface	12/14/92	14,16,18,20,24,27	330.0	250.0	4.3	0.047	0.11	0.029	0.14	NT		ND
COAL 986		surface	12/14/92	2,3,4,5,7	260.0	200.0	14.0	0.1	0.38	0.067	0.45	NT		ND
HA-1	S-1	1.5-2.0	12/14/92	14,16,18,20,22,26	ND	140.0	ND	ND	0.0099	ND	ND	170		ND
HA-2	S-1	1.5-2.0	12/16/92	95,96,97,98,99,100	ND	19.0	ND	ND	ND	ND	ND	ND		ND
DETECTION LIMIT					10	10	1	0.008	0.008	0.008	0.015	15		0.1n
							WATER (mg/L)							
MW-1			12/18/92	79,80,81,82,83,86	19	15	3.9	0.2	0.015	0.26	0.032	0.022	0.0042	0.053n
MW-2			12/18/92	79,80,81,82,83,85	4.3	2.4	4.3	1.3	0.053	0.31	0.16	0.029	ND	0.022n
MW-3			12/17/92	51,52,53,54,55	ND	ND	ND	ND	ND	ND	ND	0.045	0.0022	NT
MW-4			12/17/92	51,52,53,54,55	1.2	ND	ND	ND	ND	ND	ND	0.048	ND	NT
MW-5			12/17/92	51,52,53,54,55	ND	ND	ND	ND	ND	ND	ND	0.081	0.003	NT
MW-6			12/17/92	51,52,53,54,55,56	4.6	0.78	2.2	0.95	0.034	0.36	ND	0.46	ND	0.24n
MW-7			12/17/92	51,52,53,54,55,58	ND	1.6	0.58	0.2	0.0081	0.07	0.023	2.5	ND	ND
MW-8A	(before pump test)		12/16/92	67,68,69,70,71,72	270	8.7	29	1.2	0.62	1.6	3.2	0.47	0.0032	0.16n
MW-8B	(after pump test)		12/18/92	79,80,81,82,83,84	79	200	16	1.6	0.32	2.1	3.4	0.19	0.011	0.067n
MW-9			12/18/92	79,80,81,82,83,84	15	2	15	7.2	1.5	1.2	2.5	0.14	0.004	0.023n
MW-10			12/17/92	51,52,53,54,55,57	94	23	66	1.3	0.22	5.4	16	1.3	0.024	0.22n
DETECTION LIMIT					1	1	0.05	0.0005	0.0005	0.0005	0.001	0.002	0.002	0.005n

NOTE: 1) n = napthalene All other PAH below detection limit (see Table 2)
2) ND = Below method detection limit
3) NT = Sample not tested

S-1023

Table 5. Summary of Analytical Test Results
From WSDOT Environmental Study, March 1992

Soil

Sample No.	Depth (ft)	HCID	WTPH-D	Benzene	Toluene	Ethyl benzene	Xylenes	Lead
MW-1,S-2	5 - 6.5	D	1,889	1.45	ND	0.925	0.559	20.7
MW-1, S-4	10 - 11.5	ND	ND	ND	0.041	0.005	0.017	19.2
MW-2,S-3	7.5 - 9	ND	ND	0.006	ND	0.054	0.079	17.9
MW-2,S-5	12.5 - 13.2	ND	ND	ND	ND	ND	ND	15.3
MW-3,S-2	7.5 - 9	ND	ND	ND	ND	ND	ND	23.3
MW-3,S-3	12 - 13.4	ND	ND	ND	ND	ND	ND	15.4
MW-4,S-1	2.5 - 4	ND	ND	ND	ND	ND	ND	52.7
MW-4,S-2	7.5 - 9	ND	ND	ND	ND	ND	ND	23.5
MW-5,S-1	6 - 7.5	ND	ND	ND	ND	ND	ND	44.8
B-7,S-2	5 - 6.5	ND	ND	0.106	ND	0.536	0.216	32.6
B-7,S-3	7.5 - 9	D	700	---	---	---	---	---
B-7,S-5	12.5 - 14	ND	ND	ND	ND	0.538	0.218	21.7
B-8,S-2	7 - 8.5	ND	ND	ND	ND	ND	ND	28.1
B-8,S-3	12 - 13.2	ND	ND	ND	ND	ND	ND	20
B-9,S-2	7.5 - 9	D	428	0.038	ND	ND	ND	19.2
B-9,S-3	12.5 - 14	ND	ND	ND	ND	ND	ND	19.1
TP9,S-1	5 - 5.5	G	533.0	5.35	2.30	2.17	21.10	---
TP-9,S-2	6 - 7	G	1,129.0	0.065	2.77	1.33	5.00	---
				Water				
MW-1		ND	49.8	0.169	0.027	0.462	0.048	0.323
MW-2		ND	ND	0.95	0.024	0.025	0.005	0.12
MW-3		ND	ND	ND	ND	ND	ND	0.196
MW-4		ND	ND	ND	ND	ND	ND	0.142
MW-5		ND	ND	ND	ND	ND	ND	0.139

NOTE: All results in mg/kg (soil) and mg/l (water)
ND=Below method detection limit
D = Diesel

S-1070-1

Table 6. Polynuclear Aromatic Hydrocarbon Analyses
Results in mg/kg. Samples Collected in December 1992

Sample No.	MW-7 S-2	MW-8 S-2	MW-9 S-2	MW-10 S-2	CB-1 S-2	CB-2 S-2	CB-3 S-1	CB-4 S-2	DTS	COAL 829	COAL 986	HA-1	HA-2	Detection Limit
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Coal	Coal	Soil	Soil	
Analyte														
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
Benzo (a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Benzo (a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Benzo (b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Benzo (ghi)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Benzo (k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Dibenzo (a,h)anthracen	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
Ideno (1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05
Naphthalene	ND	ND	1.9	ND	1.6	ND	0.79	ND	ND	ND	ND	ND	ND	0.1
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05

Sample No.	MW-1	MW-2	MW-6	MW-7	MW-8A	MW-8B	MW-9	MW-10	Detection Limit
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	
Analyte									
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Benzo (a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	0.0001
Benzo (a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
Benzo (b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
Benzo (ghi)perylene	ND	ND	ND	ND	ND	ND	ND	ND	0.0001
Benzo (k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	2E-05
Dibenzo (a,h)anthracen	ND	ND	ND	ND	ND	ND	ND	ND	1E-05
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	0.0001
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Ideno (1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	4E-05
Naphthalene	0.053	0.022	0.24	ND	0.16	0.067	0.023	0.22	0.005
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	0.0005

Table 7. Metals Analyses for Soil Samples Collected in December 1992

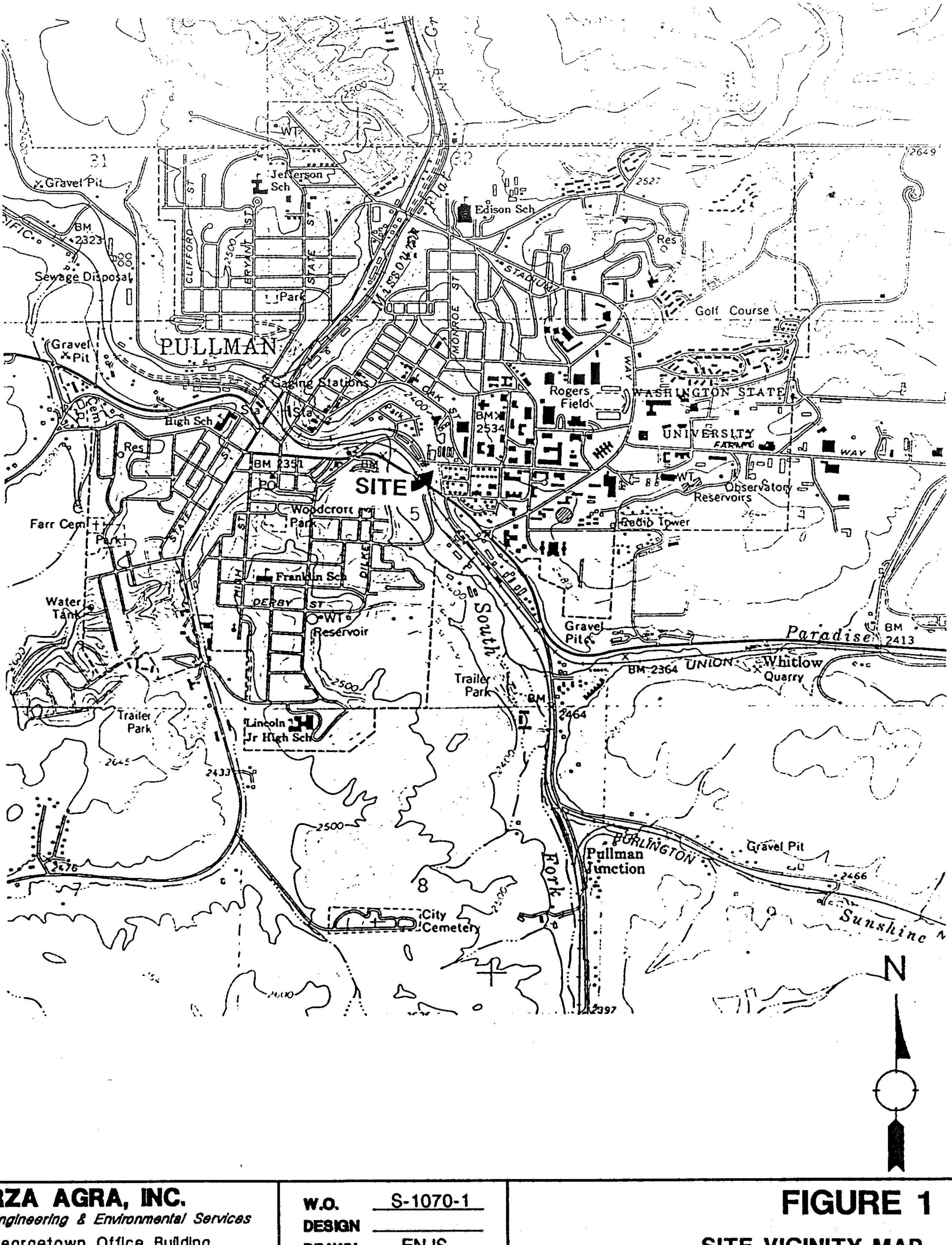
EPA Priority Pollutant Metals (mg/kg)

Analyte	Sample Number	IA	COAL 829	COAL 986	DETECTION LIMIT
Antimony		ND	ND	ND	5
Arsenic		ND	ND	ND	10
Beryllium		ND	3	ND	1
Cadmium		ND	ND	ND	0.5
Chromium		3.1	2.6	ND	2
Copper		8.1	3.8	3.2	0.5
Lead		ND	ND	ND	5
Mercury		ND	ND	ND	0.05
Nickel		3.7	ND	ND	2.5
Selenium		ND	ND	ND	5
Silver		ND	ND	ND	1
Thallium		ND	ND	ND	10
Zinc		12	3.5	4.8	2.5

TCLP Metals

Arsenic		ND			0.2
Barium		ND			1
Cadmium		ND			0.01
Chromium		ND			0.025
Lead		ND			0.1
Mercury		ND			0.001
Selenium		ND			0.1
Silver		ND			0.02

NOTE: Laboratory certificates for sample IA are presneted in Appendix D under numbers 14, 23 and 28.



RZA AGRA, INC.

Engineering & Environmental Services

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539 West Sharp
Suite D
Spokane, WA 99201

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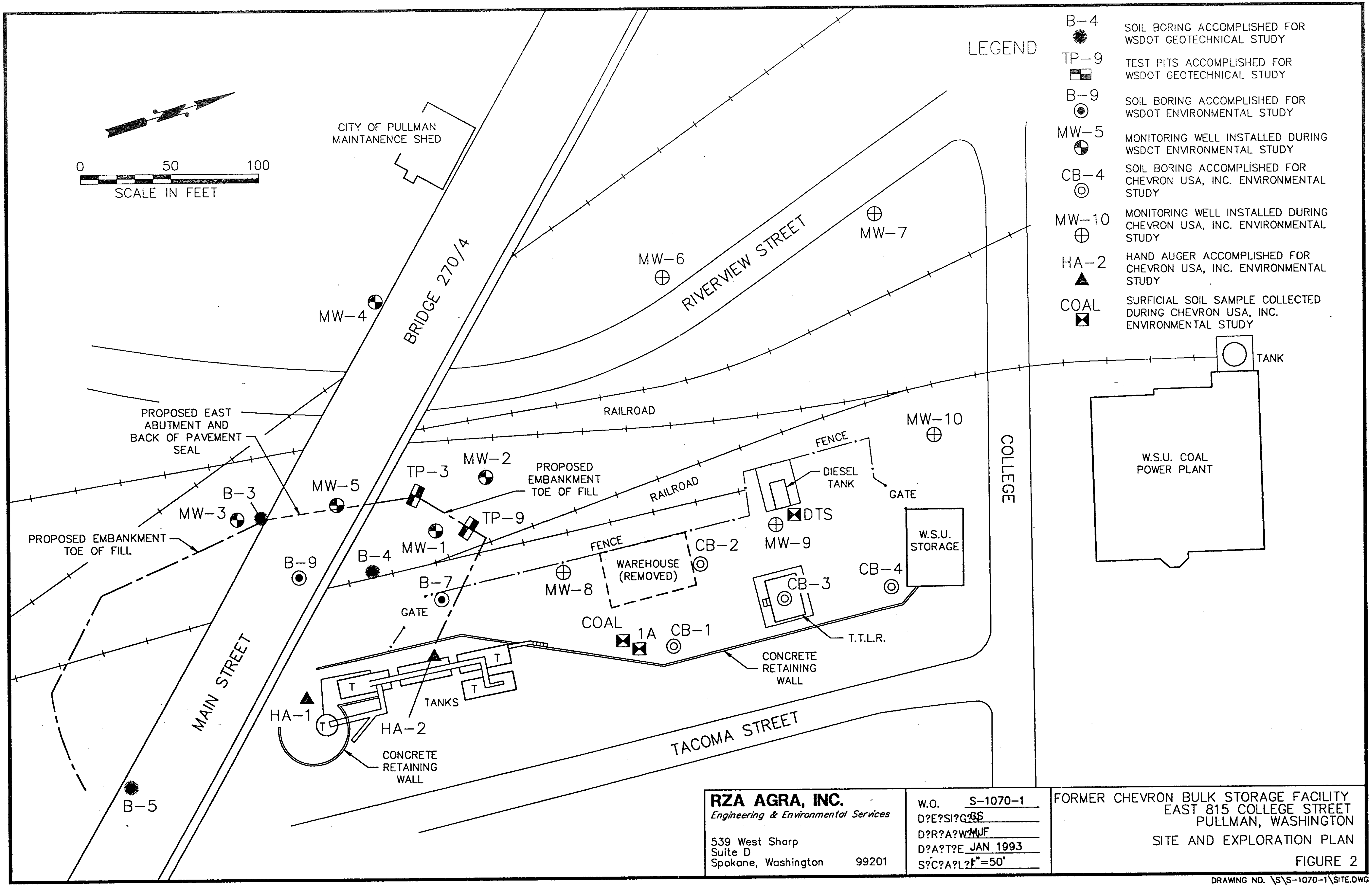
DRAWN	ENJS
DATE	JAN 1993
SCALE	N.T.S.

FIGURE 1

SITE VICINITY MAP

152284

GENDRON'S



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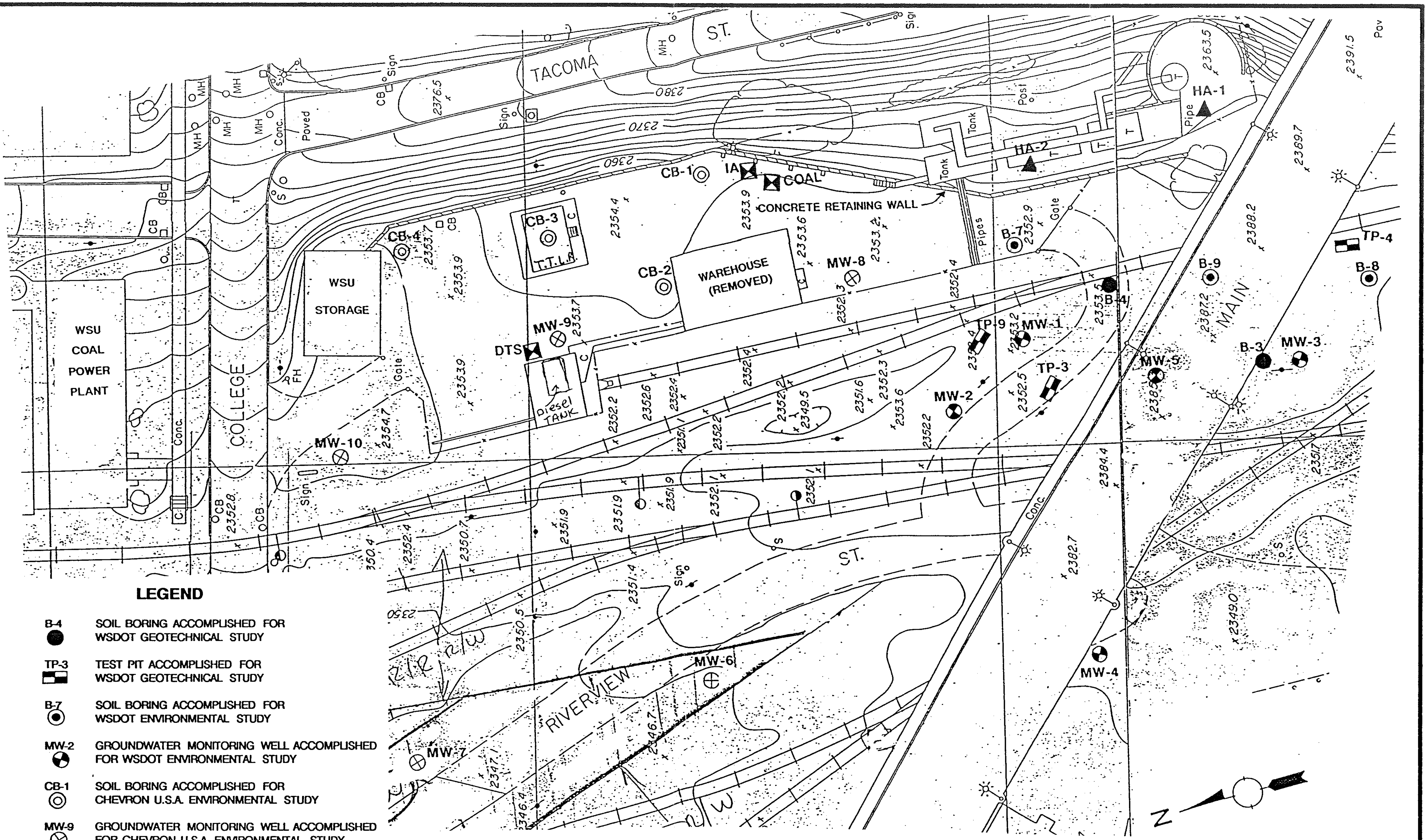
W.O. S-1070-1
D?E?SI?G?N GS
D?R?A?W?N MJF
D?A?T?E JAN 1993
S?C?A?L?E 1"=50'

FORMER CHEVRON BULK STORAGE FACILITY
EAST 815 COLLEGE STREET
PULLMAN, WASHINGTON

SITE AND EXPLORATION PLAN

FIGURE 2

DRAWING NO. \S\S-1070-1\SITE.DWG



LEGEND

B-4 ●	SOIL BORING ACCOMPLISHED FOR WSDOT GEOTECHNICAL STUDY
TP-3 ▨	TEST PIT ACCOMPLISHED FOR WSDOT GEOTECHNICAL STUDY
B-7 ◉	SOIL BORING ACCOMPLISHED FOR WSDOT ENVIRONMENTAL STUDY
MW-2 ◕	GROUNDWATER MONITORING WELL ACCOMPLISHED FOR WSDOT ENVIRONMENTAL STUDY
CB-1 ◎	SOIL BORING ACCOMPLISHED FOR CHEVRON U.S.A. ENVIRONMENTAL STUDY
MW-9 ⊗	GROUNDWATER MONITORING WELL ACCOMPLISHED FOR CHEVRON U.S.A. ENVIRONMENTAL STUDY
HA-1 ▲	HAND AUGER ACCOMPLISHED FOR CHEVRON U.S.A. ENVIRONMENTAL STUDY
IA ⧗	SURFACE SAMPLE COLLECTED FOR CHEVRON U.S.A. ENVIRONMENTAL STUDY

0 40 80
SCALE IN FEET

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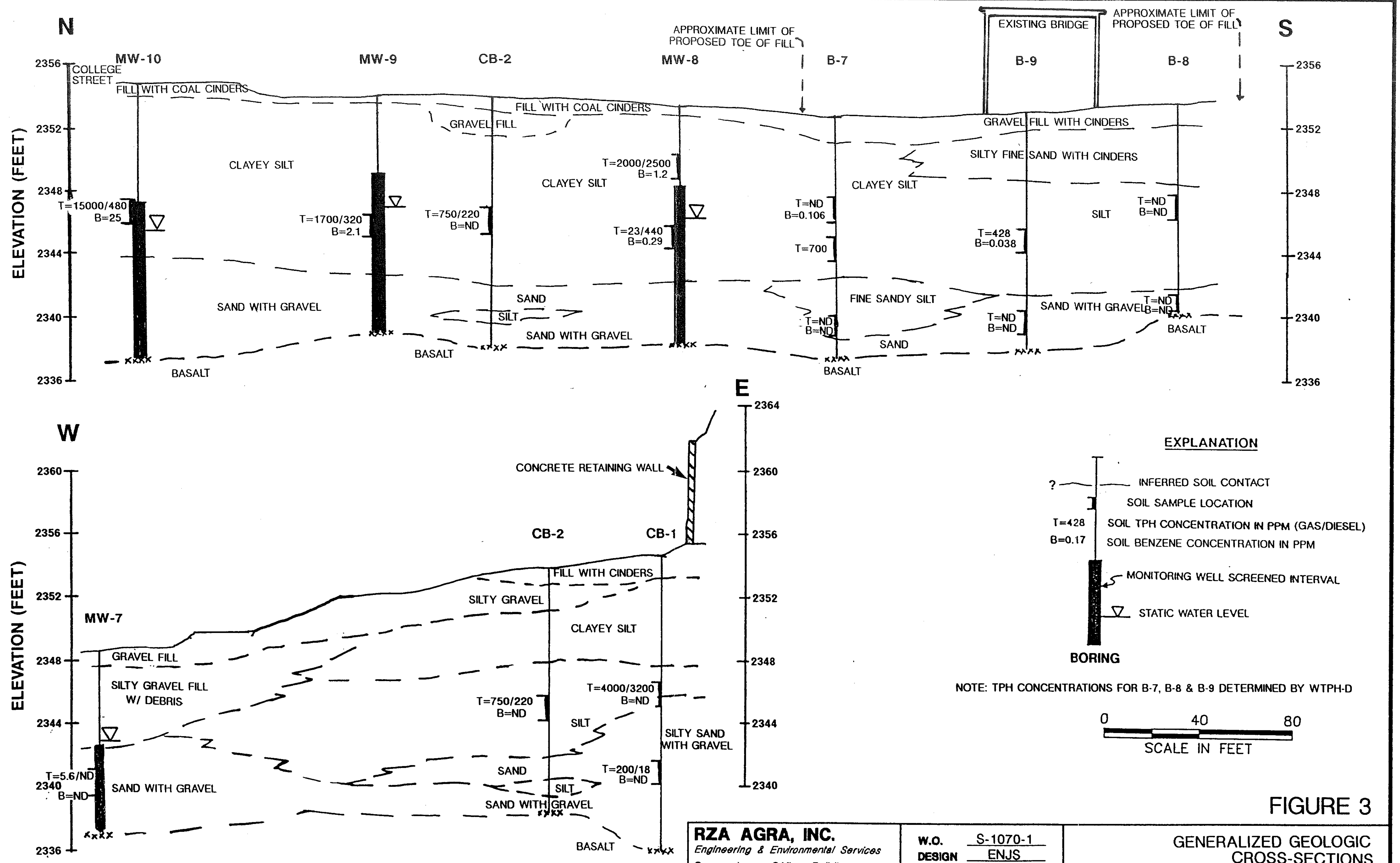
SCALE NOTED

FIGURE 2A

SITE AND EXPLORATION PLAN

152284
GENDRON'S



NOTE: TPH CONCENTRATIONS FOR B-7, B-8 & B-9 DETERMINED BY WTPH-D

FIGURE 3

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DRAWN ENJS
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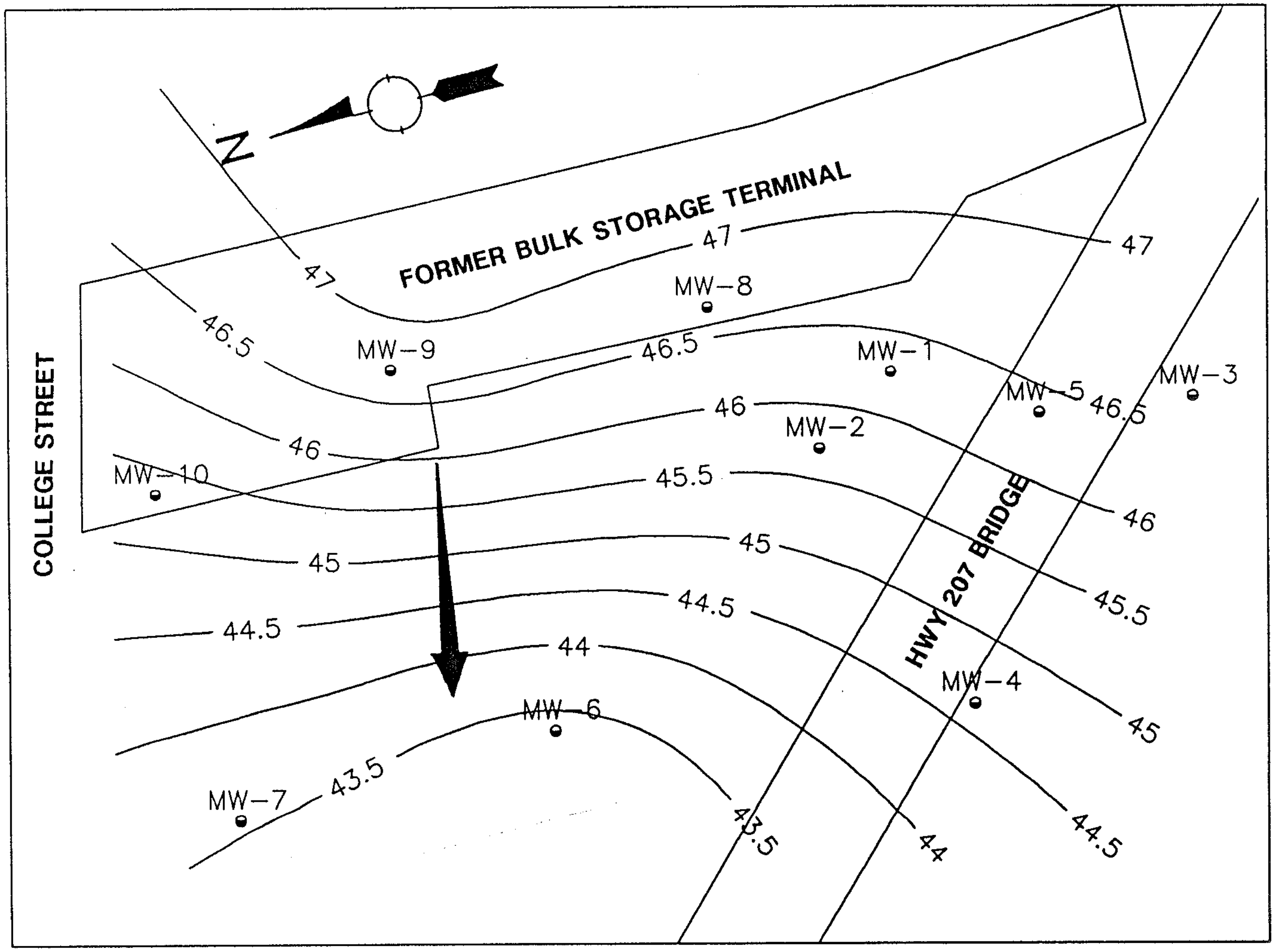
SCALE NOTED

GENERALIZED GEOLOGIC CROSS-SECTIONS

FORMER BULK STORAGE FACILTY
PULLMAN, WASHINGTON



← INFERRED GROUNDWATER MIGRATION DIRECTION

— 43.5 — GROUNDWATER ELEVATION CONTOUR

NOTE: 44 FEET ELEVATION ACTUALLY REPRESENTS ELEVATION OF 2,344 FEET

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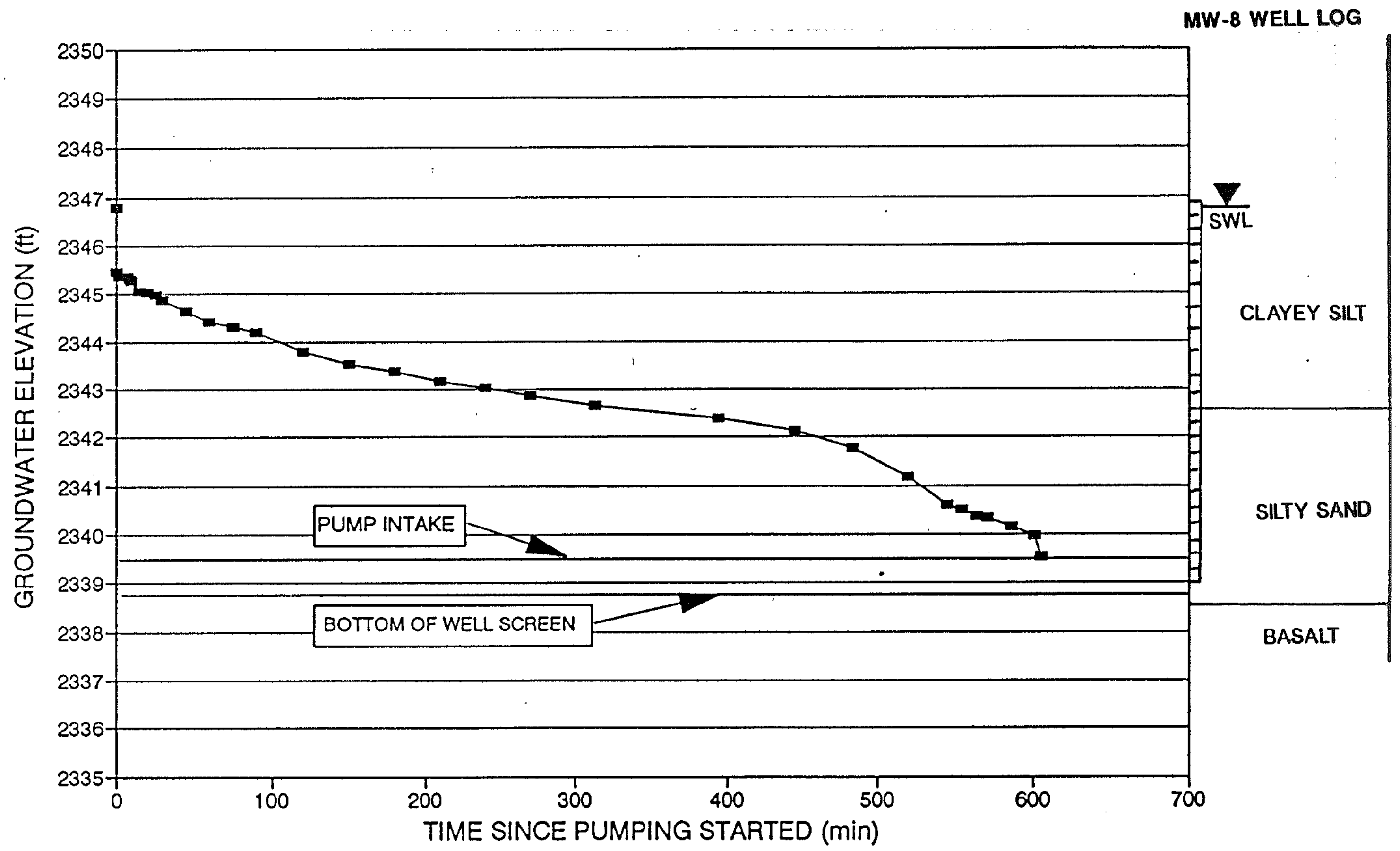
SCALE 1in=68.5ft

GROUNDWATER ELEVATION
17 DECEMBER 1992

FIGURE 4

152283

GENDRON'S



NOTE: WELL PUMPED AT A CONSTANT RATE OF 0.5 GPM.

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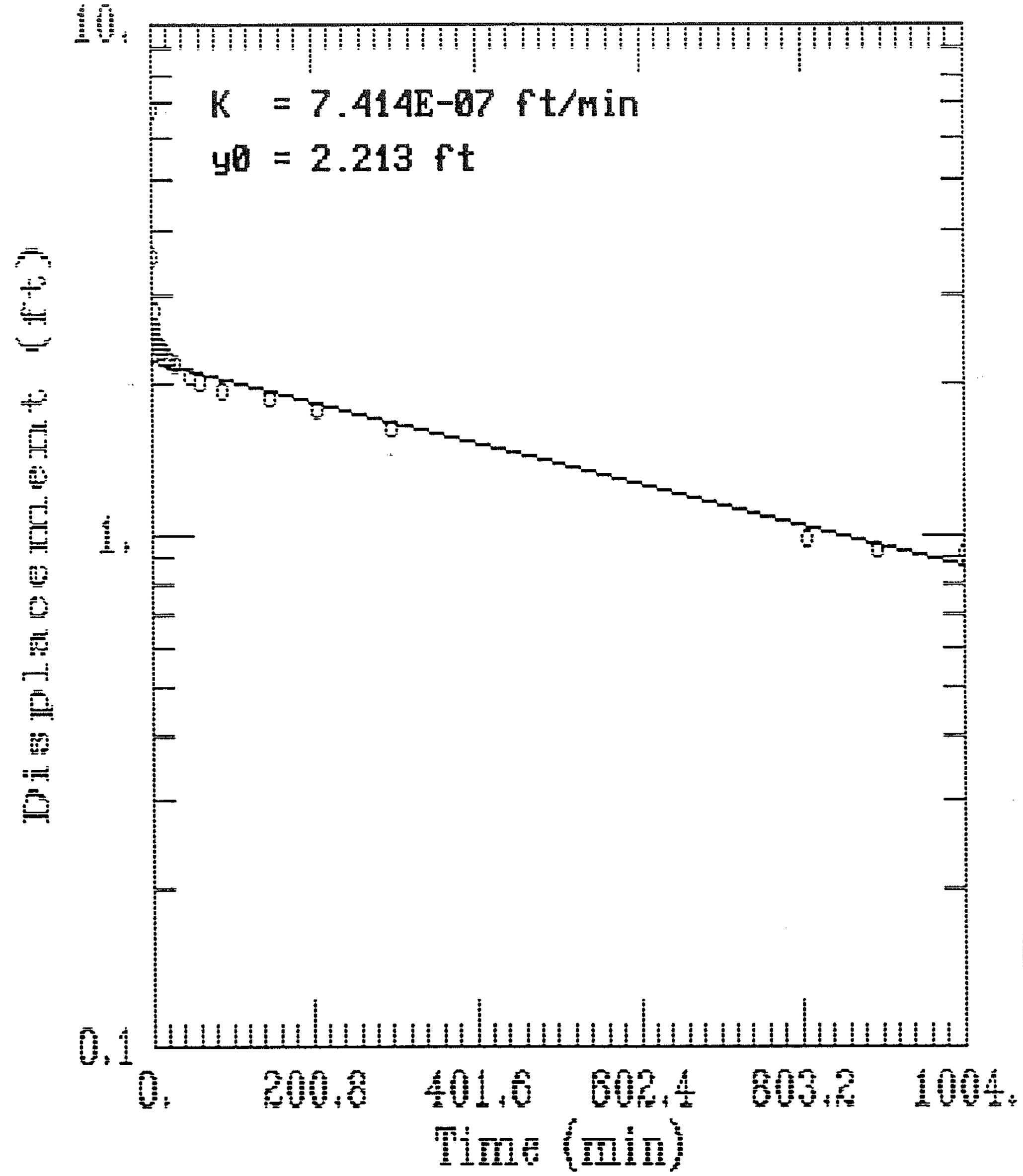
SCALE JAN 1993

MW-8 AQUIFER YIELD TEST
16 DECEMBER 1992

FIGURE 5

152283
GENDRON'S



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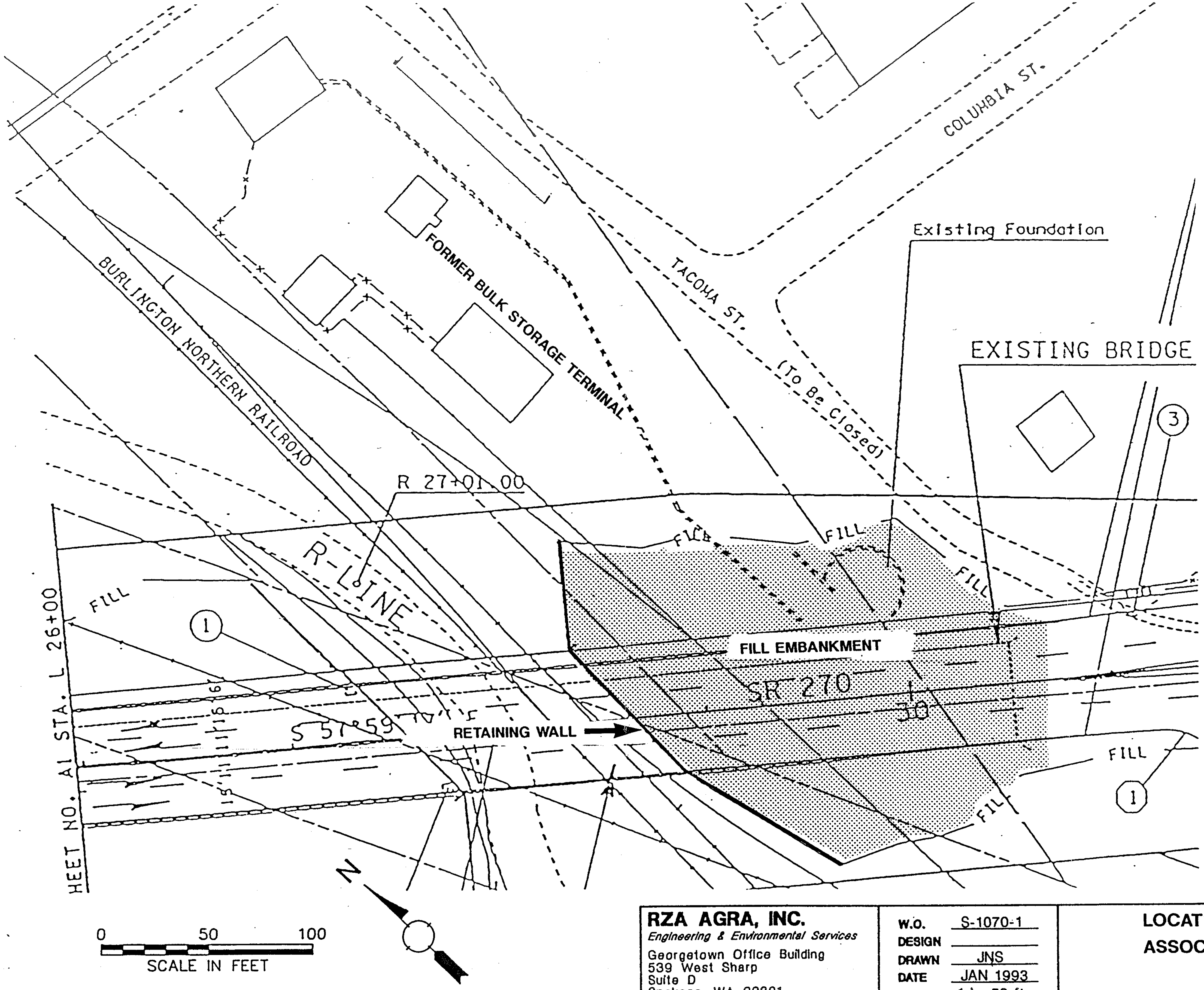
SCALE	

ANALYSIS OF WELL MW-8 RECHARGE AS SLUG TEST

FIGURE 6

152284
GENDRON'S



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DESIGN	
DRAWN	JNS
DATE	JAN 1993
SCALE	1 in=50 ft

LOCATION OF BRIDGE AND ASSOCIATED STRUCTURES

FIGURE 7

APPENDIX A
SUBSURFACE EXPLORATION PROCEDURES AND LOGS

APPENDIX A

Subsurface Exploration

The field exploration program conducted for this study consisted of advancing nine machine auger borings to depths of 9 to 18 1/2 feet below the existing site grade. Five borings were accomplished to install monitoring wells and three accomplished for exploratory purposes. The approximate locations of the explorations are illustrated on Figure 2. These locations were obtained in the field by taping and/or pacing from existing features. Elevations were surveyed by personnel from RZA AGRA, Inc.

The borings were drilled between 14 and 16 December 1992 by Ruen Drilling of Clark Fork, Idaho under subcontract to RZA AGRA, Inc. The nine borings were advanced utilizing a 4 1/4 inch inside diameter (8-inch O.D.) hollow stem auger with a truck mounted drill rig (B-61 model). During the drilling process, samples were generally obtained at 5 feet depth intervals. The borings were continuously observed and logged by an experienced geologist from our firm.

Characterization of Soils

Soil samples were obtained using the Standard Penetration Test Procedure as described in ASTM:D-1586. The testing and sampling consisted of driving a standard 2-inch outside diameter split barrel sampler a distance of 18 inches into the soil below the auger bit with a 140 pound hammer free falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded and the number of blows required to drive the sampler the final 12 inches is considered the Standard Penetration Resistance ("N") or the blow count which is represented on the boring logs in this appendix. If a total of 50 blows is recorded within a 6-inch interval, the blow count is recorded as 50 blows for the actual number of inches of penetration and is considered refusal. The blow count, or "N" value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils. The high gravel, cobble and boulder content of some fluvial and glacial soils often yields unrepresentatively high blow counts due to oversized material. The soil samples retrieved from the split-spoon sampler were classified in the field and a representative portion placed in laboratory prepared air tight glass containers.

Soil Sampling Procedures

The soil samples were recovered at each interval using procedures designed to minimize the risk of cross contamination. Prior to the drilling of the boring, the drilling equipment and sample tools were cleaned by a steam cleaner. Between each sampling attempt, the sampling tools were scrubbed with a stiff brush and a detergent solution consisting of Liquinox and warm water, and then rinsed with potable water and liberal quantities of distilled water. The samples were classified in the field and immediately transferred to laboratory treated glass jars, and tightly sealed with a teflon-lined threaded cap. Samples were screened in the field with a Model B organic vapor meter (OVM) and several samples were selected for laboratory analysis. Samples were stored and transported in a chilled ice chest throughout the field program. Selected soil samples were subsequently transferred to North Creek Analytical in Bothell, Washington in accordance with RZA AGRA, Inc. chain of custody procedures.

The boring logs presented in this appendix are based on the drilling action, visual inspection of the samples secured, laboratory results, and field logs. The various types of soils are indicated, as well as the depths where soils or characteristics of the soils changed. It should be noted that these changes may have been gradual, and if the changes occurred between sample intervals, the soil contacts are interpreted. Subsurface water conditions are evaluated by observing the moisture condition of the samples, the free water on the sample rods, and in well measurements. Groundwater was encountered at depths of 9 to 11 feet for on-site borings and 4 to 5 feet beneath the ground surface in off-site borings at time of drilling. Groundwater elevations in installed monitoring wells occurred at depths of 4.41 to 9.12 feet beneath the top of the PVC well casings..

Field Headspace Measurements

Each soil sample was screened for the presence of volatile organic compounds to facilitate selecting an appropriate soil sample to submit for chemical analysis. This involved placing approximately 6 ounces of sampled soil directly into an 8 ounce glass jar fitted with an aluminum foil cover secured by a teflon lid. The sample was then shaken vigorously for approximately 15 seconds and a head space reading was taken after plunging the probe of the OVM detector through the foil cover. Field head space analysis was performed on each sample utilizing a Model 580A OVM. The highest digital readout value displayed by the instrument was recorded for each sample. This value indicates the total vapor concentration of volatilized organic compounds. These compounds include numerous constituents of petroleum hydrocarbons. However, the OVM is not capable of determining the species of these compounds or their concentrations in the soil samples. Consequently, it should be considered merely a rough screening tool that aides in detecting the presence of volatile soil contaminants. Results of field headspace analysis are presented on the boring logs in this Appendix and in Table 2 for samples collected for this study and in Table 3 for previous WSDOT studies.

Groundwater Sampling

Groundwater samples were collected from site monitoring wells for analytical laboratory testing. Prior to collecting samples, fluid level measurements were obtained from each well. New site monitoring wells were developed by surging a 2-inch O.D. stainless steel bailer and removing approximately 10 gallons of groundwater. This enabled the removal of sand and silt which collected in the well during drilling and installation. The bailer was decontaminated between use in each well with Liquinox and water followed by consecutive rinses in clean potable and distilled water. After development the wells were purged prior to sampling by bailing approximately three well volumes of groundwater by means of a 2-inch disposable polyethylene bailer of approximately 1/4 gallon capacity. After purging, samples were collected using a new disposable polyethylene bailer. Dedicated bailer cord was used at each sampling location.

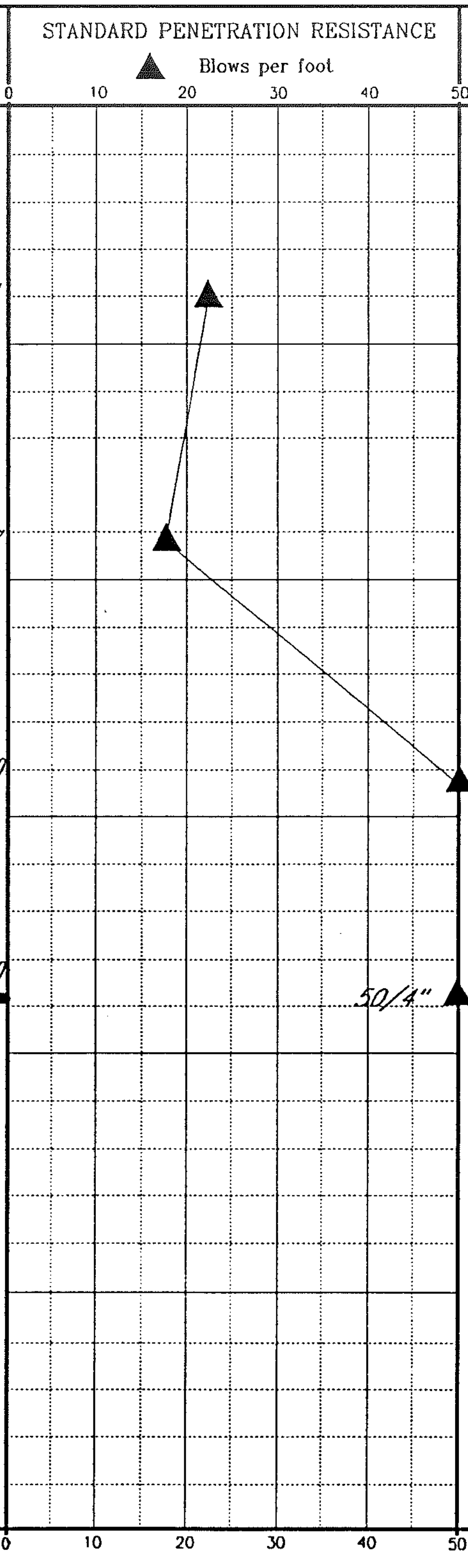
Monitoring Well Installation

Five borings were completed for the purpose of installing site monitoring wells. The 4 1/4-inch auger was advanced into the substrate until refusal occurred and the auger bit was resting on the bedrock. Ten feet (for wells MW-8, MW-9 and MW-10) and five feet (for wells MW-6 and MW-7) of 2-inch inside diameter Schedule 40 PVC 0.010-inch slotted well screen attached to blank Schedule 40 PVC pipe was installed inside the auger casing. The casing was then filled continuously with a select sand filter pack and slowly withdrawn to allow the sand to surround the well screen and fill the annulus of the boring to approximately two feet above the top of the well screen. A seal consisting of bentonite was then placed above the sand filter pack to a depth of approximately 1 1/2 feet. Each well was completed by installing a locking cap in the top of the blank PVC pipe and cementing in a steel well monument. A 2 foot circular concrete monument was then constructed at the ground surface and three H size steel rods were installed around the pad to protect the well.

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* BORING NO. *CB-1*

Approximate ground surface elevation: *2,354.69*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	TESTING
0	*Dense, wet, bluish green, gravelly SAND with silt and hydrocarbon-like odor*				
5	*Very stiff, damp, green to black, clayey SILT with hydrocarbon-like odor*	I	*S-1*	*219.1*	
	Very stiff, damp, mottled green and tan clayey SILT with angular basalt gravel	I	*S-2*	*199.7*	BTEX TPH-G TPH-D 418.1 LEAD 8310
10	*- groundwater at 9.6 feet*				
15	*Dense, damp, light brown to greenish brown silty SAND with gravel. Very silty in places, hydrocarbon-like odor*	I	*S-3*	*208.0*	BTEX TPH-G TPH-D
	Dense, saturated, brown to yellowish brown, gravelly SAND	I	*S-4*	*196.0*	
20	*BASALT BEDROCK* *Boring terminated at approximatelt 18.8 feet*				
25					
30					



MOISTURE CONTENT
Plastic limit — ● Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

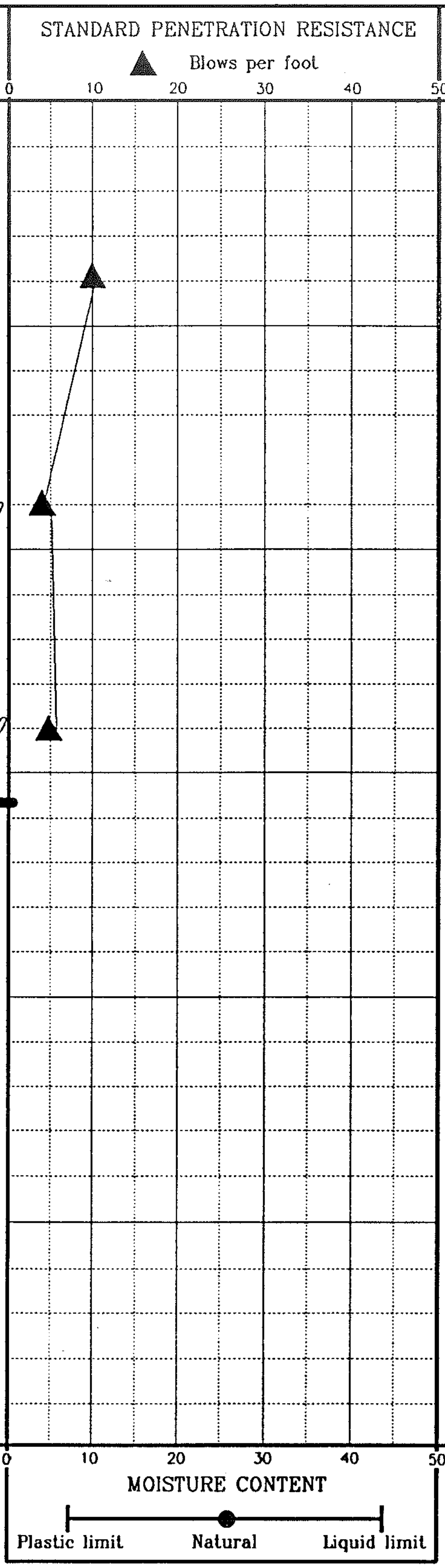
BTEX TPH Soil Analysis (method shown)

RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

Drilling started: *14 December 1992* Drilling completed: *14 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* BORING NO. *CB-2*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation: *2,354.69*	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	TESTING
0	*GRAVEL FILL with COAL CINDERS*				
	Silty GRAVEL				
	Stiff, damp, dark brown, clayey SILT with slight petroleum hydrocarbon-like odor	I	*S-1*	*24.4*	
5					
	Very soft, saturated, dark gray, silty CLAY to SILT with strong hydrocarbon-like odor	I	*S-2*	*214.0*	BTEX TPH-G TPH-D 418.1 LEAD 8310
10	*- groundwater at 10.14 feet*				
	Loose, saturated, greenish gray, SAND with gravel and strong hydrocarbon-like odor				
	Soft, saturated, dark gray, sandy SILT	I	*S-3*	*171.0*	
15	*Loose, saturated, greenish gray, SAND with some gravel and hydrocarbon-like odor*				
	BASALT BEDROCK *Boring terminated at approximatelt 15.7 feet*				
20					
25					
30					



LEGEND

I 2-inch OD split spoon sampler

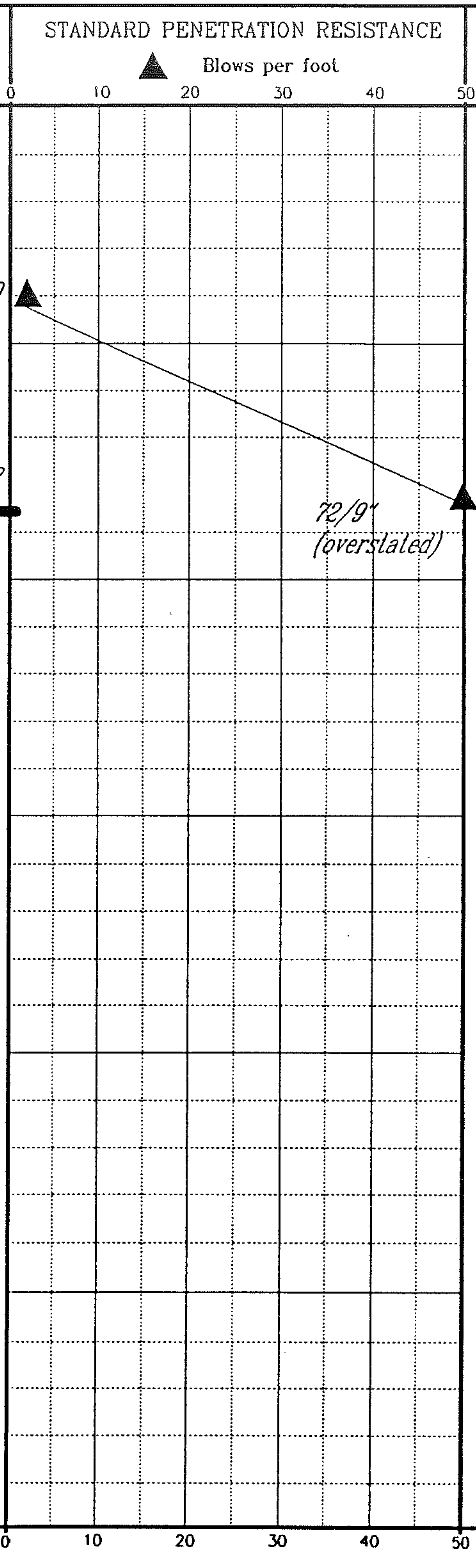
BTEX TPH	Soil Analysis (method shown)

RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

Drilling started: *14 December 1992* Drilling completed: *14 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* BORING NO. *CB-3*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation: *2,354.69*	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	TESTING
0	*GRAVEL FILL with COAL CINDERS*				
	Medium stiff, damp, greenish black, clayey SILT with hydrocarbon-like odor	I	*S-1*	*169.0*	BTEX TPH-G TPH-D 418.1 LEAD 8310
5					
	Dense, damp, brown black, gravell SAND	I	*S-2*	*136.8*	
10	*Boring terminated at approximately 8.8 feet*				
15	*BASALT BEDROCK* *Boring terminated at approximatelt 15.7 feet*				
20					
25					
30					



0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit Natural Liquid limit

LEGEND

I 2-inch OD split spoon sampler

BTEX TPH — Soil Analysis (method shown)

RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

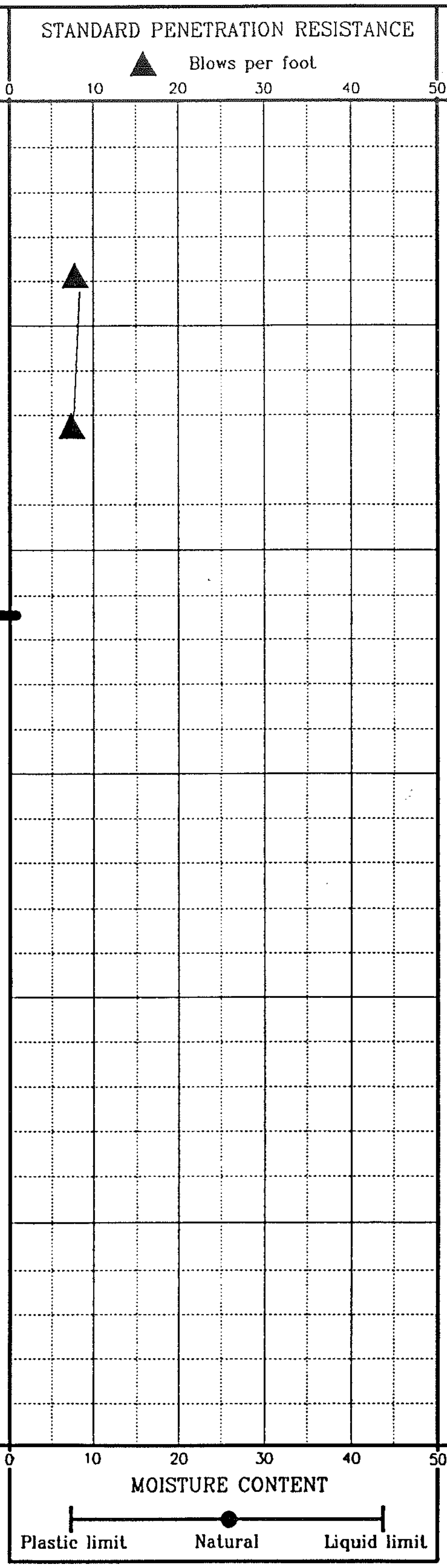
Drilling started: *15 December 1992* Drilling completed: *15 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* BORING NO. *CB-4*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation: *2,354.69*	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	TESTING
0	*GRAVEL FILL with COAL CINDERS*				
	Stiff, damp to moist, greenish to dark gray clayey SILT with slight hydrocarbon-like odor	I	*S-1*	*2.4*	BTEX TPH-G TPH-D 418.1 LEAD 8310
5					
	Medium stiff, moist, yellowish green to dark gray, SILT with some clay and sand and scattered basalt gravel	I	*S-2*	*4.0*	
10	*Dense, saturated, greenish yellow, gravelly SAND*				
	Basalt Bedrock *Boring terminated at approximately 11.5 feet*				
15	*BASALT BEDROCK* *Boring terminated at approximatelt 15.7 feet*				
20					
25					
30					

STANDARD PENETRATION RESISTANCE

▲ Blows per foot



LEGEND

I 2-inch OD split spoon sampler

BTEX TPH — Soil Analysis (method shown)

RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

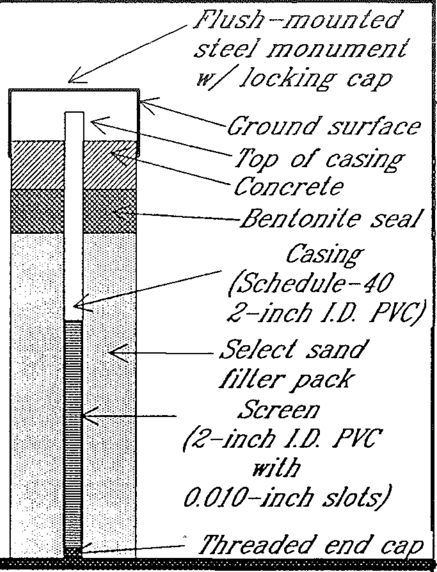
Drilling started: *15 December 1992* Drilling completed: *15 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* WELL NO. *MW-6*

Elevation reference:
Ground surface elevation: *2,348.88* Casing elevation: *2,348.38*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER
0	*GRAVEL FILL*					
	Loose, damp, reddish brown, SAND with debris (FILL)	I	*S-1*	*4*	*0.0*	
5	*Soft, wet, dark brown, sandy SILT*					▼ 12/17/92
		I	*S-2*	*5*	*4.0*	
	Loose, saturated, dark gray, silty SAND with gravel					
10	*BASALT Bedrock* *Boring terminated at approximately 9.8 feet*					
15						
20						
25						
30						

AS-BUILT DESIGN



TESTING

LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ 8020 Soil Analysis (EPA method shown)

RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

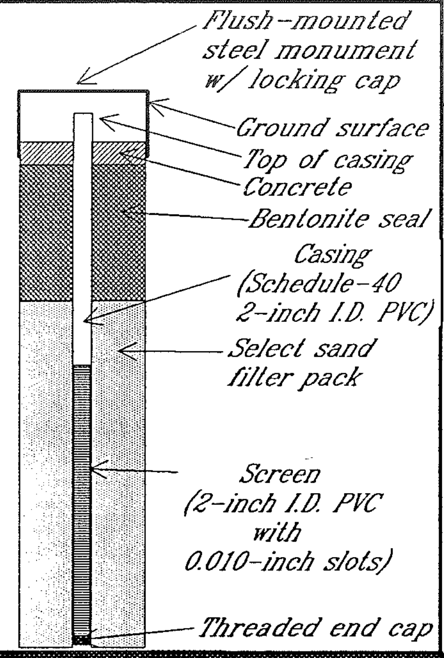
Drilling started: *16 December 1992* Drilling completed: *16 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* WELL NO. *MW-7*

Elevation reference:
Ground surface elevation: *2,348.25* Casing elevation: *2,347.72*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER
0	*GRAVEL FILL*					
	Dense, damp, dark brown to gray, silty gravel with debris (FILL)	I	*S-1*	*46*	*0.0*	
5						▼ 12/17/92
	Dense, saturated, gray to dark gray, gravelly SAND with some silt	I	*S-2*	*51*	*23.4*	
10						
	BASALT Bedrock *Boring terminated at approximately 11.7 feet*					
15						
20						
25						
30						

AS-BUILT DESIGN



TESTING

BTEX
TPH-G
TPH-D
418.1
LEAD
8310

LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ 8020 Soil Analysis (EPA method shown)

RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

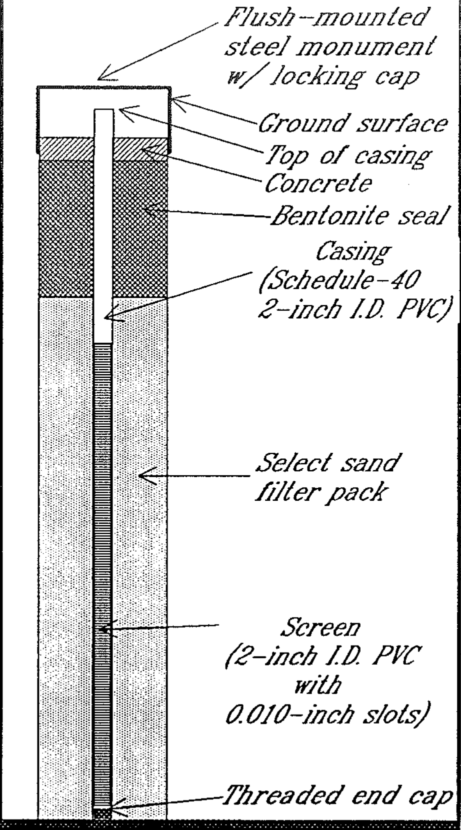
Drilling started: *16 December 1992* Drilling completed: *16 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* WELL NO. *MW-8*

Elevation reference:
Ground surface elevation: *2,353.59* Casing elevation: *2,355.45*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*0-4" Coal ash and cinders*						
		I	*S-1*	*8*	*208.8*		BTEX TPH-G TPH-D
5	*Medium stiff to very soft, wet, dark green to greenish gray, clayey SILT with strong hydrocarbon-like odor*					▼ 12/17/92	
		I	*S-2*	*1*	*187.9*		BTEX TPH-G TPH-D 418.1 LEAD 8310
10							
	Loose, saturated, greenish gray SAND with some silt	I	*S-3*	*3*	*68.8*		
15	*BASALT Bedrock* *Boring terminated at approximately 15.1 feet*						
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ 8020 Soil Analysis (EPA method shown)

RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

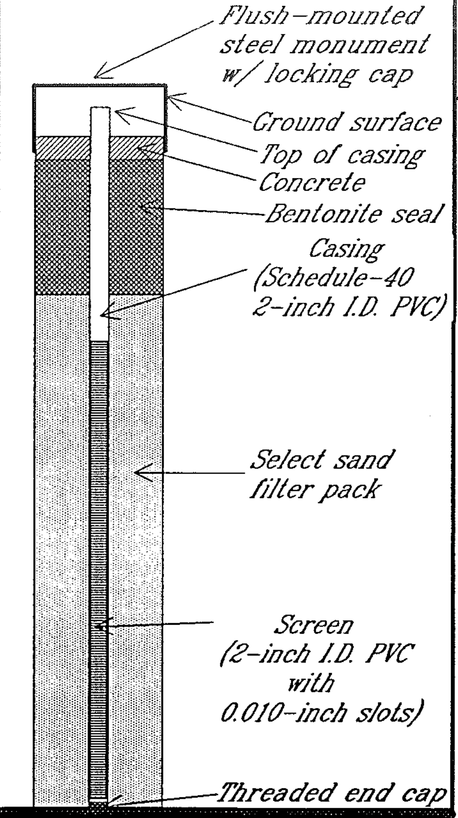
Drilling started: *15 December 1992* Drilling completed: *15 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* WELL NO. *MW-9*

Elevation reference:
Ground surface elevation: *2,353.59* Casing elevation: *2,355.45*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*0-3" Coal cinders*						
		I	*S-1*	*7*	*111.0*		
5	*Medium stiff damp grading to moist, dark gray to greenish gray, clayey SILT with hydrocarbon-like odor*					▼ 12/18/92	BTEX TPH-G TPH-D 418.1 LEAD 8310
		I	*S-2*	*5*	*248.9*		
10							
	Loose, saturated, greenish gray, gravelly SAND with some silt and hydrocarbon-like odor	I	*S-3*	*11*	*219.0*		
15	*BASALT Bedrock* *Boring terminated at approximately 15.0 feet*						
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ 8020 Soil Analysis (EPA method shown)

RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

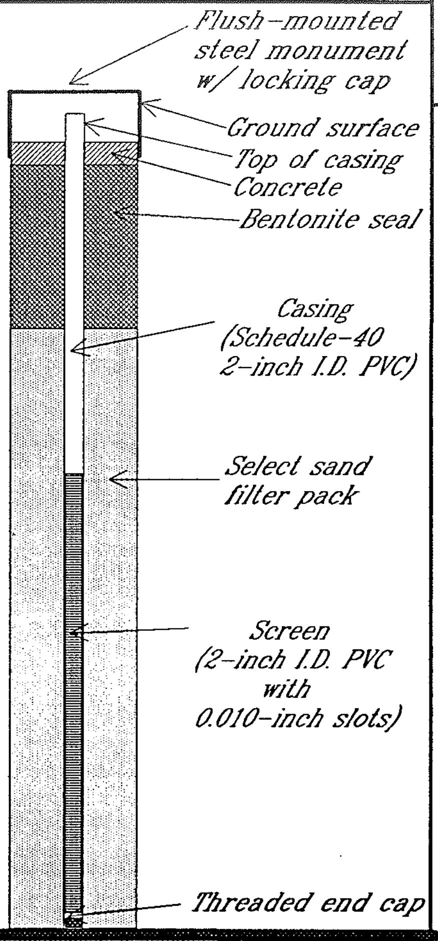
Drilling started: *15 December 1992* Drilling completed: *15 December 1992* Logged by: *ENJS*

PROJECT *Pullman Chevron Bulk Facility* W.O. *S-1070* WELL NO. *MW-10*

Elevation reference:
Ground surface elevation: *2,354.81* Casing elevation: *2,354.35*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*0-4" Coal cinders*						
		I	*S-1*	*8*	*55.5*		
5	*Medium stiff to soft, damp grading to wet, greenish gray to black, clayey SILT with some sand and scattered gravels and hydrocarbon-like odor*					▼ 12/18/92	BTEX TPH-G TPH-D 418.1 LEAD 8310
		I	*S-2*	*2*	*270.0*		
10							
	Loose, saturated, dark gray, silty SAND with gravel and hydrocarbon-like odor	I	*S-3*	*2*	*233.3*		
15							
	BASALT Bedrock *Boring terminated at approximately 17.5 feet*						
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

▨ Soil Analysis (EPA method shown) *8020*

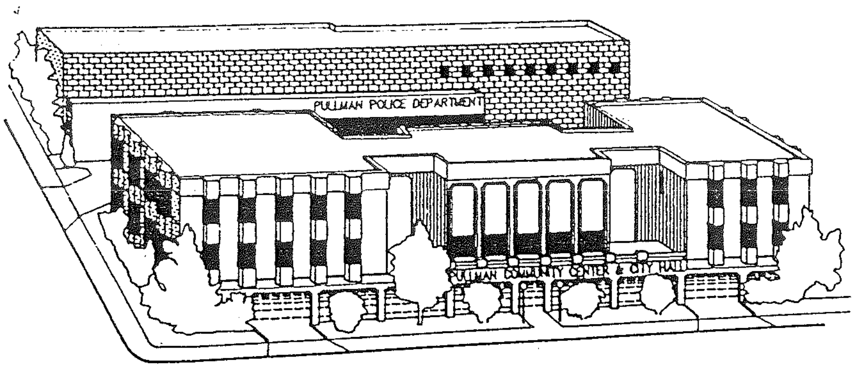
RZA AGRA, Inc.
Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *16 December 1992* Drilling completed: *16 December 1992* Logged by: *ENJS*

APPENDIX B

PUMP TEST DISCHARGE PERMITS



CITY
OF
PULLMAN
P.O. Box 249, Pullman, WA 99163-0249
(509) 334-4555 FAX (509) 334-2751

DEC 11 1992

December 10, 1992

RZA-AGRA
Georgetown Office Bldg.
539 W. Sharp, Suite D
Spokane, WA 99201

ATTN: Jon N. Sondergaard, PG

Mr. Sondergaard

The City of Pullman's, Public Works Department has received your request to discharge hydrocarbon impacted groundwater from beneath the East Main Street bridge or vicinity thereof and determined that the attached minor discharge authorization is the appropriate document for this discharge.

This authorization permits you to discharge limited amounts of hydrocarbon impacted groundwater into the citys sanitary sewer system in accordance with the effluent limitations and other requirements and conditions set forth in the document and the regulations outlined in our ordinance.

If you propose to substantially increase the volume of your discharge or change the type and quantities of substances discharged, you must submit a new waste discharge permit application to the City of Pullman.

In addition to the requirements set forth in the enclosed discharge authorization, you are also responsible for meeting the conditions of the City of Pullman before discharge under this authorization can begin. Your contact at the City of Pullman is Mr. Ron Cooper, 509/334-4555, Ext. 238 or home phone 509/332-3704. You may also contact Patrick Wiltzius, (work 334-4555, Ext. 233 or home 332-5932).

General

No permit to drill the test hole is necessary. If the test hole is drilled on City property, you must obtain approval from the City for the test hole location. If your operations imparts traffic, you must obtain approval for a traffic control plan from the City engineer.

At the request of the City of Pullman you must:

A. Discharge the hydrocarbon impacted ground water to a sanitary sewer manhole located beneath the Main Street bridge or next to College Street. The City of Pullman must approve the discharge location and temporary hook-up prior to discharge.

B. Discharge of hydrocarbon groundwater will not be discharged to the city sanitary sewer system until after the granular activated carbon (GAC) filtration process is in operation and analysis of the impacted groundwater is within the discharge limits found in the "Special Conditions" section of this document (this condition was satisfied with the initial testing on April 23, 1992).

C. Install a meter (that reads in cubic feet) on the discharge from the filtration process.

D. Submit copies of all test analysis required to the City of Pullman, Public Works Department (to the attention of Mr. Ron Cooper).

The City of Pullman wants to help you stay in compliance with our regulations. If at any time you have questions about this discharge authorization, or other question about your discharge, please do not hesitate to call me at (509) 334-4555.

Sincerely,

James J. Hudak

J.J. Hudak
Director of Public Works

INDUSTRIAL DISCHARGE PERMIT FOR SPECIAL/MINOR DISCHARGES

FOR

RZA-AGRA, INC.
GEORGETOWN OFFICE BLDG.
539 W SHARP, SUITE D
SPOKANE, WA 99201

CONTACT: GENE ST. GODARD

PHONE: (509) 325-0104

TYPE: HYDROCARBON IMPACTED GROUNDWATER

MAXIMUM VOLUME: 5,000 GPD

DOCUMENT EFFECTIVE DATE: 11/20/92

EXPIRATION DATE: 12/31/92

24 HOUR EMERGENCY NOTIFICATION

RON COOPER: 334-4555, Ext> 238 or home 332-3704

PATRICK WILTZIUS: 334-4555, Ext. 233 or home 332-5932

PULLMAN TREATMENT PLANT: 334-4555

PULLMAN POLICE DEPARTMENT: 332-2521

DEPARTMENT OF ECOLOGY: 456-6169

PULLMAN FIRE DEPARTMENT: 334-1515

SPECIAL CONDITIONS

Constituent	Maximum Concentration
BENZENE	0.13 ppm
TOLUENE	1.5 ppm
ETHYLBENZENE	1.4 ppm
NON-POLAR FATS, OIL & GREASE (NON-POLAR FOG)	100 ppm

Operating Procedures

Common Sense Criteria

A. There shall be no pronounced odor of solvent or gasoline

B. There shall be no pronounced oil sheen or unusual color

C. There shall be no pronounced hydrogen sulfide odor

D. There shall be no visibly pronounced turbidity, the discharge must remain translucent

The City of Pullman will expect operators on site to pay close attention to these common sense criteria whenever discharge to the sanitary sewer is occurring.

If any of the discharge limits or common sense criteria are exceeded, you must stop discharging and must notify the City of Pullman at 334-4555, Ext. 238 or Ext. 233 during working hours or Ron cooper at 332-3704 or Patrick Wiltzius at 332-5932 after working hours.

Monitoring Requirements

The following monitoring requirements shall be met for this discharge authorization:

Parameter	Frequency	Sample Type (method)
Flow	Gallon per day	Meter

Monitoring Requirements Continued

Parameter	Frequency	Sample Type (method)
Common Sense Criteria	Continuous	Observation
Explosiveness	One during the discharge	Meter
Hydrogen	Only if common sense criteria exceeded	Meter
Benzene, toluene ethylbenzene, xylene	Once during the discharge	Grab/EPA method 602
Non-polar Fog	Once during the discharge	Grab/Standard method 5520

A self monitoring report shall be filed with the City of Pullman by the 15th day of the month following sample collection. This report must include the total monthly volumn of water discharged to the sewer as well as the analytical results.

In the event of the industrial user is unable to comply with any of the conditions of this discharge authorization because of a breakdown of equipment, an accident caused by human error, negligence, or any other cause, such as a act of nature, the company shall:

A. Take immediate action to stop, contain and clean up the unauthorized discharges and correct the problem.

B. Immediately notify the city so steps can be taken to prevent damage to the sewerage system.

C. Submit a written report describing the breakdown, the actual quantity and quality of resulting waste discharge, corrective action taken, and the steps taken to prevent a recurrence.

Compliance with these requirements does not relieve the industrial user from responsibility to maintain continuous compliance with the conditions of the discharge authorization or the resulting liability for failure to comply.

The industrial user shall, at all reasonable times, allow authorized representatives of the City of Pullman to enter that portion of the premise where an effluent source or disposal system is located or in which any records are required to be kept under the terms and conditions of this discharge authorization.

Nothing in the discharge authorization shall be construed as excusing the industrial user from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

This discharge authorization does not constitute authority for discharge into waters of the state. Any such discharge is subject to regulation and enforcement action by the Department of Ecology.

All requirements and ordinances of the Environmental Protection Agency and Department of Ecology pertaining to hazardous and toxic wastes, disposal facilities, and discharge of wastes into the municipal sewer system, are hereby made a condition of this discharge authorization.

RZA - AGRA
(Rittenhouse-Zeman & Associates, Inc.)
Engineering & Environmental Services

Georgetown Office Building
539 W Sharp, Suite D
Spokane, WA 99201
(509) 325-0104
FAX (509) 325-0212

31 December, 1992

City of Pullman
P.O. Box 249
Pullman, Washington 99163-0249

Attention: Mr. Ron Cooper
Subject: Temporary Discharge of Hydrocarbon Impacted Groundwater
to City of Pullman's Sanitary Sewer System
From Former Chevron Bulk Storage Facility
East 815 College Ave.
Pullman, Washington

Mr. Cooper:

RZA AGRA, Inc. is reporting to you as requested in regards to the chemical analyses and amount of discharge of hydrocarbon impacted groundwater from our recent project at the above referenced site.

On 15 and 16 December 1992, RZA AGRA personnel conducted a pump test at the above referenced site. Water was pumped from the shallow aquifer beneath the site and filtered through two (2) Waterscrub WSU-55 charcoal filters before being discharged to the sanitary sewer system. The system was operated for 10 hours and 5 minutes at a pumping rate of 0.5 gallons per minute (gpm). A Signet Accum-U-Flo meter with LED readouts for gpm and total discharge was attached to the system. During the pump test approximately 307 gallons of water was discharged to the sewer system. RZA AGRA also ran all decontamination water (approximately 75 gallons), purge water from site monitoring wells (approximately 50 gallons) and water derived from the step drawdown pump test (approximately 60 gallons) through the charcoal filters before discharging to the sewer system. Therefore, a total of approximately 492 gallons of treated water was discharged to the City of Pullman sanitary sewer system.

As required by your office, RZA sampled the effluent from the system before it was discharged into the sewer system. One sample was collected of treated effluent. The sample was analyzed for the volatile aromatics benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 602, total oil and grease by EPA Method 413.1, total suspended solids by SW 846-160 and flashpoint. All analytical testing revealed the effluent to be discharged to the sewer system was within the requirements set forth in your letter dated 10 December 1992. Laboratory certificates for analyses on the sample from this site are attached to this letter.

We appreciate your cooperation and help during this project. Should you have any questions or require more information, please contact me at your earliest convenience.

Sincerely,

Eugene N. St Godard

Eugene N.J. St.Godard, P.G.
Senior Staff Geologist

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928

December 16, 1992

Rittenhouse-Zeman & Associates, Inc.
Earth & Environmental Consultants
539 W. Sharp, Suite D
Spokane, Washington 99201

Attn: Gene St. Goddard

Laboratory Reference	**Customer Reference**
Sample: 3029RZA1	Sample: Eff
Report number: RZA3029	
Date samples received: 12/15/92	

All analyses are performed by approved methodologies whenever applicable. Deviations, modifications and/or substitutions with more stringent EPA methodologies are sometimes necessary owing to the variety of matrices being analyzed.

A *Concentration Value* of U indicates a compound could not be detected in the sample above the lower quantitation limit printed in the *Detection Limit* column.

If you have any questions regarding the enclosed laboratory results, please include the above laboratory sample and report numbers in all correspondence.

Respectfully,

Michael McMillan

Michael McMillan, Ph.D.
Chemist

Chemist: Patel

Client Sample ID: Eff

Lab Sample Number: 3029RZA1

Date completed: 12/16/92

Sample type: Soil / [✓ Water] / Oil / Unknown

Method: EPA 413.1

Item Number	Compound	Detection Limit mg/L (ppm)	Concentration mg/L (ppm)
1	Oil and grease	1	8

Report Number: RZA3029 Pg 3 of 4 Total Suspended Solids

Chemist: Patel
Client Sample ID: Eff
Lab Sample Number: 3029RZA1

Date completed: 12/16/92
Sample type: Soil / [✓ Water] / Oil / Unknown
Method: SW 846-160

Item Number	Compound	Detection Limit mg/L (ppm)	Concentration mg/L (ppm)
1	Total suspended solids	2	5

Chemist: McMillan
Client Sample ID: Eff
Lab Sample Number: 3029RZA1

Date completed: 12/16/92
Sample type: Soil / [✓ Water] / Oil / Unknown
Method: EPA 8020

Item Number	Compound	Detection Limit μg/L (ppb)	Concentration μg/L (ppb)
1	Benzene	5	U
2	Toluene	5	10
3	Ethylbenzene	5	U
4	Xylene I	5	U
5	Xylene II	5	U

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928

December 16, 1992

Rittenhouse-Zeman & Associates, Inc.
Earth & Environmental Consultants
539 W. Sharp, Suite D
Spokane, Washington 99201

Attn: Gene St. Goddard

Laboratory Reference	**Customer Reference**
Sample: 3030RZA1	Sample: Eff
Report number: RZA3030	
Date sample received:12/16/92	

All analyses are performed by approved methodologies whenever applicable. Deviations, modifications and/or substitutions with more stringent EPA methodologies are sometimes necessary owing to the variety of matrices being analyzed.

A *Concentration Value* of U indicates a compound could not be detected in the sample above the lower quantitation limit printed in the *Detection Limit* column.

If you have any questions regarding the enclosed laboratory results, please include the above laboratory sample and report numbers in all correspondence.

Respectfully,

Michael Mc Millan

Michael McMillan, Ph.D.
Chemist

Report Number: RZA3029 Pg 2 of 2 **Flash Point**

Chemist: Patel
Client Sample ID: Eff
Lab Sample Number: 3030RZA1

Date completed: 12/16/92
Sample type: Soil / [✓ Water] / Oil / Unknown
Method: EPA 1010

Item Number	Analysis	Unit of Measurement	Result
1	Flash point	°F	>200

Comment: Boiling point is ~99° C.

APPENDIX C
LIMITED PUMP TEST DATA

Water Level Measurements

MW-8 DRAWDOWN

RZA-AGRA, Inc. Geotechnical & Hydrogeologic Consultants

Job No. S-1070-1

Measuring point elevation: 2355.45

TIME (Minutes)	WATER LEVEL (FT. BELOW CASING)
0.00	8.66
0.75	10.00
2.00	10.09
3.00	10.08
4.00	10.08
5.00	10.08
6.00	10.08
7.00	10.08
9.00	10.16
10.00	10.18
15.00	10.38
20.00	10.41
25.00	10.48
30.00	10.58
45.00	10.82
60.00	11.03
75.00	11.14
90.00	11.26
120.00	11.66
150.00	11.92
180.00	12.07
210.00	12.29
240.00	12.42
270.00	12.58
313.00	12.80
394.00	13.06
445.00	13.30
483.00	13.69
519.00	14.28
545.00	14.84
555.00	14.95
564.00	15.08
571.00	15.10
586.00	15.29
601.00	15.48
605.00	DRY

Water Level Measurements MW-8 RECHARGE

RZA-AGRA, Inc. Geotechnical & Hydrogeologic Consultants

Job No. S-1070-1

Measuring point elevation: 2355.45

TIME (Minutes)	WATER LEVEL (FT. BELOW CASING)
0.00	15.60
0.50	12.18
3.50	11.44
4.00	11.26
4.50	11.20
5.00	11.16
6.00	11.12
7.00	11.09
8.00	11.07
9.00	11.05
10.00	11.03
11.00	11.02
12.00	11.01
13.00	11.00
14.00	10.98
15.00	10.97
20.00	10.92
25.00	10.88
30.00	10.83
48.00	10.72
60.00	10.67
90.00	10.60
150.00	10.52
210.00	10.44
300.00	10.28
810.00	9.64
900.00	9.60
1004.00	9.58

APPENDIX D

LABORATORY METHODS AND TEST CERTIFICATES

APPENDIX D

Laboratory Testing Procedures

Soil samples were selected from each boring and groundwater from each monitoring well for analytical testing for a variety of analytes commonly associated with petroleum hydrocarbon fuels and oils. All analyses were performed by North Creek Analytical of Bothell, Washington, under contract from our firm. A brief description of each laboratory tests conducted is given below.

GASOLINE-RANGE ORGANIC COMPOUNDS (BTEX)
by WTPH-G/BTEX

The WTPH-G adapts EPA SW 846 Methods 5030 and 8020 to perform the analysis for gasoline in soils. The method involves extracting the soil samples with methanol, combining a portion of the extract with reagent water and analysis utilizing a purge/trap concentrator equipped gas chromatograph with FID detection. The reporting limit for gasoline is 1.0 parts per million. This method along with the prescribed detector will allow simultaneous determination of total gasoline with the listed target analytes (benzene, toluene, ethylbenzene and xylenes).

DIESEL RANGE ORGANIC COMPOUNDS
by WTPH-D

The WTPH-D method covers the analysis for diesel in soils (analogous to EPA Method 8015 Modified). The method involves extracting the soil samples with methylene chloride, filtering the extract through sodium sulfate and injection of a portion into a gas chromatograph equipped with a flame ionization detector (FID). The lower reporting limit is 1.0 ppm.

TOTAL PETROLEUM HYDROCARBONS
by EPA Method 418.1

Analytes are extracted from the sample by mixing the sample with a freon solution. The sample and extracting solution are thoroughly mixed utilizing a mechanical shaker or sonicator. The extract is then separated from the sample and analyzed by infrared spectrophotometry (IR). The freon extracting solution is used for both soil and water analyses. Method 418.1 allows detection of a wide variety of petroleum hydrocarbons. However, Method 418.1 is susceptible to interferences by non-petroleum hydrocarbons and cannot distinguish between fuel types.

BTEX

by EPA SW-846 Method 8020/602

Analytes are extracted from soil samples by mixing the sample in a solution of methanol. The sample and extracting solution are thoroughly mixed utilizing a mechanical shaker or sonicator. The extract is separated from the sample by filtration and analyzed utilizing a gas chromatograph coupled with a photoionization detector (PID). The PID is very specific for analysis of aromatic hydrocarbons.

Analytes are extracted from water samples using a purge-and-trap technique. The sample is held in a hollow "sparge" tube. A purified, inert gas (helium) is bubbled through the sample which efficiently extracts the purgeable organic analytes from the aqueous phase to the vapor. The gaseous mixture is then passed through a sorbent trap where the analytes are collected. After the extraction is complete, the trap is backflushed and heated which effectively desorbs the purgeable analytes from the trap and onto the gas chromatograph column.

TOTAL AND DISSOLVED METALS

by EPA Method 7000 and 200 Series

Metals in solution may be readily determined by atomic absorption spectroscopy. Preliminary treatment of waste water, groundwater, EP extracts, and industrial waste is always necessary because of the complexity and variability of sample matrix. Solids, slurries, and suspended material must be subjects to soluble process before analysis. In direct-aspiration atomic absorption spectroscopy, a sample is aspired and atomized in a flame. A light beam from a hollow cathode lamp or electrodeless discharge lamp is directed through the flame into a monochromator, an onto a detector that measures the amount of absorbed light. When using the furnace technique in conjunction with atomic absorption spectrophotometer, a representative aliquot of a sample is placed in the graphite tube in the furnace, evaporated to dryness, charred, and atomized.

POLYNUCLEAR AROMATIC HYDROCARBONS (PAH)

Method 8310 is used to determine the concentration of the polynuclear aromatics in groundwater and wastes. The reporting limits vary according to the PAH analyte and are subject to the type of matrix analyzed. This method utilizes High Performance Liquid Chromatography (HPLC) technology with both fluorescence and ultra-violet detectors to determine the levels of the constituents in the sample in question. If interferences prevent proper detection of the analytes of interest method 3630, silica gel cleanup should be used in addition to the extraction method employed (3510 for water samples, 3540 or 3550 for soil samples). Possible Interferences are other PAH compounds, matrix artifacts, solvents, reagents, glassware, and other processing hardware i.e. weighing spatula. Most interferences can be recognized through the use of matrix blanks.

EXTRACTABLE METALS (TCLP)

This method analyzes for leachable concentrations of metals in the sample. The sample is leached with slightly acidic water (to simulate rain water), and then the sample is tumbled in a container for eighteen (18) hours. After the sample has been mixed by the previously described process, a zero headspace extraction and bottle extraction method are performed. The extraction is then analyzed for the defined analytes. Typically, the metals Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Selenium (SE) and Silver (Ag) are analyzed in this method.

PRIORITY POLLUTANT METALS

Method 6010 is used to determine the concentration of the majority of Priority Pollutant Metals, but the 7000 series may also be used for a few of the constituents in groundwater and wastes The reporting limits are subject to the type of matrix analyzed. Method 6010 utilizes Inductively Coupled Plasma (ICP) Atomic Emission Spectroscopy technology while Mercury and Silver are analyzed using EPA SW-846 7000 series Flame Atomic Absorption (FAA). Spectroscopy to determine the levels of the aforementioned constituents in the sample in question.

Method extraction type as is:

3005-Water and surface water for total and dissolved metals via ICP and FAA
3010-Water and surface water for total metals via ICP and FAA
3050-Waste samples for total metals via ICP and FAA

Possible interferences while utilizing 6010 are overlap of spectral interferences, physical interferences, and Chemical Interferences. Mercury uses the cold vapor technique and Sulfide can interfere, but Potassium Permanganate is added to reduce this affect. Seawaters and Brines are also possible interferences. Most interferences can be recognized through the use of matrix blanks.

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HYDROCARBON ANALYSES FOOTNOTES

(8/92)

Code	Description
	VOLATILE HYDROCARBONS - Gasoline Range Organics
G 1	This sample appears to contain extractable diesel range organics.
G 2	The chromatogram for this sample is not a typical gasoline fingerprint.
G 3	The total hydrocarbon result in this sample is primarily due to a peak(s) eluting in the volatile hydrocarbon range. Identification and quantitation by EPA 8010, 8021 or 8240 is recommended.
	EXTRACTABLE HYDROCARBONS - Diesel Range Organics
D 1	This sample appears to contain volatile gasoline range organics.
D 2	The hydrocarbons present in this sample are primarily due to very heavy, non-resolvable oil range organics. Quantitation by EPA 418.1 is recommended.
D 3	The hydrocarbons present in this sample are a complex mixture of extractable diesel range and non-resolvable motor oil or other heavy oil range organics.
D 4	The hydrocarbon result shown is an estimated (greater than) value due to high concentration. Reanalysis is being performed to yield a quantitative result.

Oils & Lubricants
[---]
T.R.P.H. (418.1)

Diesel & Fuel Oils
[---]
Extractables (3550/8015)

Gasoline
[--------------------------------]
Volatiles (5030/8015)

HYDROCARBON BOILING POINT RANGE

LOW   LOW TO MEDIUM   MEDIUM   MEDIUM TO HIGH   VERY HIGH

CARBON RANGE:
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 +

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
W. 539 Sharp, Suite D	Matrix Descript:	Soil	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis Method:	WTPH-G, EPA 5030/8020	Analyzed:	Dec 28, 1992
Attention: Gene St. Godard	First Sample #:	212-0986	Reported:	Jan 6, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Surrogate Recovery %
212-0986	COAL	14	0.10	0.38	0.067	0.45	127
BLK122892	Method Blank	N.D.	N.D.	N.D.	N.D.	N.D.	99
Reporting Limits:		**1.0**	**0.0080**	**0.0080**	**0.0080**	**0.015**	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (nC7 - nC12). Surrogate recovery reported is for Bromofluorobenzene.
Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
Matrix Descript:	Soil	Received:	Dec 21, 1992
Analysis Method:	WTPH-D	Extracted:	Dec 29, 1992
First Sample #:	212-0986	Analyzed:	Jan 2, 1993
		Reported:	Jan 6, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/kg (ppm)	Surrogate Recovery %
212-0986	Coal	200 D-2	104
BLK122992	Method Blank	N.D.	87

Reporting Limits:	10

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Matrix Descript: Soil
Analysis Method: EPA 418.1 Modified (I.R. w/clean-up)
First Sample #: 212-0986

Sampled: Dec 14, 1992
Received: Dec 21, 1992
Extracted: Dec 29, 1992
Analyzed: Dec 29, 1992
Reported: Jan 6, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
212-0986	COAL	260
BLK122992	Method Blank	N.D.

Reporting Limits: 10

Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
W. 539 Sharp, Suite D	Sample Descript:	COAL	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis Method:	EPA 6010/7000	Digested:	Dec 30, 1992
Attention: Gene St. Godard	Sample Number:	212-0986	Analyzed:	Dec 31, 1992
	Matrix:	Soil	Reported:	Jan 6, 1993

E.P.A. PRIORITY METALS

Analyte	Reporting Limit mg/kg (ppm)	Sample Results mg/kg (ppm)
Antimony	5.0	N.D.
Arsenic	10	N.D.
Beryllium	1.0	N.D.
Cadmium	0.50	N.D.
Chromium	2.0	N.D.
Copper	0.50	3.2
Lead	5.0	N.D.
Mercury	0.025	N.D.
Nickel	2.5	N.D.
Selenium	5.0	N.D.
Silver	0.50	N.D.
Thallium	10	N.D.
Zinc	2.5	4.8

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Method Blank
Analysis Method: EPA 6010/7000
Sample Number: BLK123092
Matrix: Soil

Digested: Dec 30, 1992
Analyzed: Dec 31, 1992
Reported: Jan 6, 1993

E.P.A. PRIORITY METALS

Analyte	**Reporting Limit mg/kg (ppm)**	**Sample Results mg/kg (ppm)**
Antimony	5.0	N.D.
Arsenic	10	N.D.
Beryllium	1.0	N.D.
Cadmium	0.50	N.D.
Chromium	2.0	N.D.
Copper	0.50	N.D.
Lead	2.5	N.D.
Mercury	0.025	N.D.
Nickel	2.5	N.D.
Selenium	5.0	N.D.
Silver	0.50	N.D.
Thallium	10	N.D.
Zinc	2.5	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Soil, Coal
Analysis Method: EPA 8310
Sample Number: 212-0986

Sampled: Dec 14, 1992
Received: Dec 21, 1992
Extracted: Dec 29, 1992
Analyzed: Jan 8, 1993
Reported: Jan 8, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit μg/kg (ppb)	Sample Results μg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 68
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, #S-1070		
W. 539 Sharp, Suite D	Sample Descript: Method Blank		
Spokane, WA 99201	Analysis Method: EPA 8310	Extracted:	Dec 29, 1992
Attention: Gene St. Godard	Sample Number: BLK122992	Analyzed:	Jan 5, 1993
		Reported:	Jan 8, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit μg/kg (ppb)	Sample Results μg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 54
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 8310
Sample Matrix : Soil
Units: µg/kg (ppb)
QC Sample #: 212-0834

Analyst: S. Kouri
Extracted: Dec 29, 1992
Analyzed: Jan 5, 1993
Reported: Jan 6, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Fluorene	Indeno(1,2,3-cd) pyrene
Sample Result:	N.D.	N.D.
Spike Conc. Added:	67	33
Spike Result:	46	20
Spike % Recovery:	69%	61%
Spike Dup. Result:	44	22
Spike Duplicate % Recovery:	66%	67%
Upper Control Limit %:	125	125
Lower Control Limit %:	44	46
Relative % Difference:	4%	10%
Maximum RPD:	46	42

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% Recovery: $\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}} \times 100$

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RZA/AGRA, Spokane
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Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 5030/8020
Sample Matrix: Soil
Units: mg/kg (ppm)
QC Sample #: 212-0827

Analyst: R. Lister
K. Wilke

Analyzed: Dec 28, 1992
Reported: Jan 6, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.50	0.50	0.50	1.5
Spike Result:	0.45	0.44	0.50	1.5
Spike % Recovery:	90%	88%	100%	100%
Spike Dup. Result:	0.47	0.44	0.50	1.5
Spike Duplicate % Recovery:	94%	88%	100%	100%
Upper Control Limit %:	98	96	107	108
Lower Control Limit %:	76	75	83	84
Relative % Difference:	4.4%	0%	0%	0%
Maximum RPD:	7.1	9.5	7.4	9.8

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% Recovery: $$\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference: $$\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}} \times 100$$

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Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-G
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: R. Lister
K. Wilke

Analyzed: Dec 28, 1992
Reported: Jan 6, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Gasoline
Spike Conc. Added:	5.0
Spike Result:	5.0
% Recovery:	100
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Volatile Hydrocarbons
Sample Number:	212-1232
Original Result:	4.0
Duplicate Result:	4.0
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	50

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% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-418.1
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: S. Mitchell

Extracted: Dec 29, 1992
Analyzed: Dec 29, 1992
Reported: Jan 6, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Petroleum Oil
Spike Conc. Added:	170
Spike Result:	170
% Recovery:	100
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Petroleum Oil
Sample Number:	212-0835
Original Result:	15
Duplicate Result:	21
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	50

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% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-D
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: L. Dutton
Extracted: Dec 29, 1992
Analyzed: Dec 30, 1992
Reported: Jan 6, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

Diesel

Spike Conc. Added: 68

Spike Result: 62

% Recovery: 91

Upper Control Limit %: 120

Lower Control Limit %: 80

PRECISION ASSESSMENT
Sample Duplicate

Extractable Hydrocarbons

Sample Number: 212-0834

Original Result: 400

Duplicate Result: 390

Relative % Difference 2.5

Maximum RPD: 50

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% Recovery: $\dfrac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\dfrac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) \ / \ 2} \times 100$

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	
W. 539 Sharp, Suite D	Matrix:	Soil	
Spokane, WA 99201	Analysis for:	Moisture Content	Received: Dec 18, 1992
Attention: Gene St. Godard	First Sample #:	212-0827	Reported: Jan 5, 1993

LABORATORY ANALYSIS FOR: Moisture Content

Sample Number	Sample Description	Total Solids %	Moisture Content %
212-0827	HA-1 S-1	83	17
212-0828	IA	78	22
212-0829	COAL	93	7.0
212-0830	DTS	84	16
212-0831	CB-1 S-2	68	32
212-0832	CB-1 S-3	73	27
212-0833	CB-2 S-2	67	33
212-0834	CB-3 S-1	81	19
212-0835	CB-4 S-2	76	24
212-0836	MW-7 S-2	90	10
212-0837	MW-8 S-1	76	24

The enclosed analytical results for soils, sediments and sludges have been converted to a DRY WEIGHT reporting basis.
To attain the wet weight "as received" equivalent, multiply the dry weight result by the decimal fraction of percent Total Solids.
The results in this report apply only to the samples analyzed, as indicated on the custody document.
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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070		
W. 539 Sharp, Suite D	Matrix:	Soil		
Spokane, WA 99201	Analysis for:	Moisture Content	Received:	Dec 18, 1992
Attention: Gene St. Godard	First Sample #:	212-0838	Reported:	Jan 5, 1993

LABORATORY ANALYSIS FOR: Moisture Content

Sample Number	Sample Description	Total Solids %	Moisture Content %
212-0838	MW-8 S-2	75	25
212-0839	MW-9 S-2	75	25
212-0840	MW-10 S-2	71	29

The enclosed analytical results for soils, sediments and sludges have been converted to a DRY WEIGHT reporting basis.
To attain the wet weight "as received" equivalent, multiply the dry weight result by the decimal fraction of percent Total Solids.
The results in this report apply only to the samples analyzed, as indicated on the custody document.
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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, #S-1070	Sampled:	Dec 14-16,1992
W. 539 Sharp, Suite D	Matrix Descript: Soil	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method: WTPH-G, EPA 5030/8020	Analyzed:	Dec 28-29,1992
Attention: Gene St. Godard	First Sample #: 212-0827	Reported:	Jan 5, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Surrogate Recovery %
212-0827	HA-1 S-1	N.D.	N.D.	0.0099	N.D.	N.D.	101
212-0829	COAL	4.3 G2	0.047	0.11	0.029	0.14	108
212-0831	CB-1 S-2	4,000 G2	N.D.	N.D.	N.D.	14	135
212-0832	CB-1 S-3	200 G2	N.D.	N.D.	N.D.	0.26	122
212-0833	CB-2 S-2	750 G2	N.D.	N.D.	N.D.	1.0	121
212-0834	CB-3 S-1	41 G2	0.12	0.63	0.10	0.11	111
212-0835	CB-4 S-2	3.4 G2	N.D.	0.012	N.D.	N.D.	102
212-0836	MW-7 S-2	5.6 G2	N.D.	N.D.	N.D.	N.D.	105
212-0837	MW-8 S-1	2,000 G2	1.2	0.88	33	100	132
212-0838	MW-8 S-2	23	0.29	0.19	1.7	6.0	116
Reporting Limits:		**1.0**	**0.0080**	**0.0080**	**0.0080**	**0.015**	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (nC7 - nC12). Surrogate recovery reported is for Bromofluorobenzene.
Analytes reported as N.D. were not present above the stated limit of reporting.

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Please Note:
The detection limit for Benzene, Toluene and Ethyl Benzene in # 212-0831 = 1.0 mg/kg.
The detection limit for Benzene, Toluene and Ethyl Benzene in # 212-0832 = 0.08 mg/kg.
The detection limit for Benzene, Toluene and Ethyl Benzene in # 212-0833 = 0.4 mg/kg.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070		Sampled:	Dec 14-16,1992
W. 539 Sharp, Suite D	Matrix Descript:	Soil		Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	WTPH-G, EPA 5030/8020		Analyzed:	Dec 28, 1992
Attention: Gene St. Godard	First Sample #:	212-0839		Reported:	Jan 4, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Surrogate Recovery %
212-0839	MW-9 S-2	1,700	2.1	27	33	120	128
212-0840	MW-10 S-2	15,000	25	17	360	1,100	126
BLK122892	Method Blank	N.D.	N.D.	N.D.	N.D.	N.D.	100
Reporting Limits:		**1.0**	**0.0080**	**0.0080**	**0.0080**	**0.015**	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (nC7 - nC12). Surrogate recovery reported is for Bromofluorobenzene.
Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Matrix Descript: Soil
Analysis Method: WTPH-D
First Sample #: 212-0827

Sampled: Dec 14-16,1992
Received: Dec 18, 1992
Extracted: Dec 28-29,1992
Analyzed: Dec 31, 1992
Reported: Jan 5, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/kg (ppm)	Surrogate Recovery %
212-0827	HA-1 S-1	140 D2	96
212-0829	COAL	250 D2	101
212-0830	DTS	N.D.	91
212-0831	CB-1 S-2	3200 D1	107
212-0832	CB-1 S-3	18	90
212-0833	CB-2 S-2	220 D1	107
212-0834	CB-3 S-1	490	98
212-0835	SB-4 S-2	630 D2	87
212-0836	MW-7 S-2	N.D.	92
212-0837	MW-8 S-1	2500 D1	97

Reporting Limits:	10

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

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Phone (206) 481-9200 · FAX (206) 485-2992

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Matrix Descript: Soil
Analysis Method: WTPH-D
First Sample #: 212-0838

Sampled: Dec 14-16,1992
Received: Dec 18, 1992
Extracted: Dec 28-29,1992
Analyzed: Dec 31, 1992
Reported: Jan 5, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/kg (ppm)	Surrogate Recovery %
212-0838	MW-8 S-2	440 D2	76
212-0839	MW-9 S-2	320 D1	89
212-0840	MW-10 S-2	480 D1	104
BLK122892	Method Blank	N.D.	87

Reporting Limits: 10

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14-16,1992
W. 539 Sharp, Suite D	Matrix Descript:	Soil	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 418.1 Modified (I.R. w/clean-up)	Extracted:	Dec 28-29,1992
Attention: Gene St. Godard	First Sample #:	212-0827	Analyzed:	Dec 28-29,1992
			Reported:	Jan 5, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
212-0827	HA-1 S-1	N.D.
212-0829	COAL	330
212-0831	CB-1 S-2	980
212-0833	CB-2 S-2	840
212-0834	CB-3 S-1	400
212-0835	CB-4 S-2	20
212-0836	MW-7 S-2	11
212-0838	MW-8 S-2	520
212-0839	MW-9 S-2	560
212-0840	MW-10 S-2	1500
Reporting Limits:		10

Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14-16,1992
W. 539 Sharp, Suite D	Matrix Descript:	Soil	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 418.1 Modified (I.R. w/clean-up)	Extracted:	Dec 28-29,1992
Attention: Gene St. Godard	First Sample #:	BLK122892	Analyzed:	Dec 28-29,1992
			Reported:	Jan 5, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
BLK122892	Method Blank	N.D.
BLK122992	Method Blank	N.D.

Reporting Limits:	10

Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Analysis Method: EPA 7420
Analysis for: Lead
First Sample #: 212-0827
Matrix: Soil

Sampled: Dec 14-16,1992
Received: Dec 18, 1992
Digested: Dec 30, 1992
Analyzed: Dec 31, 1992
Reported: Jan 5, 1993

METALS ANALYSIS FOR: Lead

Sample Number	Sample Description	Reporting Limit mg/kg (ppm)	Sample Result mg/kg (ppm)
212-0827	HA-1 S-1	15	170
212-0831	CB-1 S-2	15	35
212-0833	CB-2 S-2	15	N.D.
212-0834	CB-3 S-1	15	20
212-0835	CB-4 S-2	15	24
212-0836	MW-7 S-2	15	N.D.
212-0838	MW-8 S-2	15	N.D.
212-0839	MW-9 S-2	15	N.D.
212-0840	MW-10 S-2	15	30
BLK123092	Method Blank	15	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
Sample Descript:	IA	Received:	Dec 18, 1992
Analysis Method:	EPA 6010/7000	Digested:	Dec 30, 1992
Sample Number:	212-0828	Analyzed:	Dec 31, 1992
Matrix:	Soil	Reported:	Jan 5, 1993

E.P.A. PRIORITY METALS

Analyte	Reporting Limit mg/kg (ppm)	Sample Results mg/kg (ppm)
Antimony	5.0	N.D.
Arsenic	10	N.D.
Beryllium	1.0	N.D.
Cadmium	0.50	N.D.
Chromium	2.0	3.1
Copper	0.50	8.1
Lead	5.0	N.D.
Mercury	0.050	N.D.
Nickel	2.5	3.7
Selenium	5.0	N.D.
Silver	1.0	N.D.
Thallium	10	N.D.
Zinc	2.5	12

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
W. 539 Sharp, Suite D	Sample Descript:	COAL	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 6010/7000	Digested:	Dec 30, 1992
Attention: Gene St. Godard	Sample Number:	212-0829	Analyzed:	Dec 31, 1992
	Matrix:	Soil	Reported:	Jan 5, 1993

E.P.A. PRIORITY METALS

Analyte	Reporting Limit mg/kg (ppm)	Sample Results mg/kg (ppm)
Antimony	5.0	N.D.
Arsenic	10	N.D.
Beryllium	1.0	3.0
Cadmium	0.50	N.D.
Chromium	2.0	2.6
Copper	0.50	3.8
Lead	5.0	N.D.
Mercury	0.050	N.D.
Nickel	2.5	N.D.
Selenium	5.0	N.D.
Silver	1.0	N.D.
Thallium	10	N.D.
Zinc	2.5	3.5

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070			
W. 539 Sharp, Suite D	Sample Descript:	Method Blank			
Spokane, WA 99201	Analysis Method:	EPA 6010/7000		Digested:	Dec 30, 1992
Attention: Gene St. Godard	Sample Number:	BLK123092		Analyzed:	Dec 31, 1992
	Matrix:	Soil		Reported:	Jan 5, 1993

E.P.A. PRIORITY METALS

Analyte	Reporting Limit mg/kg (ppm)	Sample Results mg/kg (ppm)
Antimony	5.0	N.D.
Arsenic	10	N.D.
Beryllium	1.0	N.D.
Cadmium	0.50	N.D.
Chromium	2.0	N.D.
Copper	0.50	N.D.
Lead	5.0	N.D.
Mercury	0.050	N.D.
Nickel	2.5	N.D.
Selenium	5.0	N.D.
Silver	1.0	N.D.
Thallium	10	N.D.
Zinc	2.5	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Soil, HA-1 S-1
Analysis Method: EPA 8310
Sample Number: 212-0827

Sampled: Dec 14, 1992
Received: Dec 18, 1992
Extracted: Dec 28, 1992
Analyzed: Jan 4-8,1992
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 66
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
W. 539 Sharp, Suite D	Sample Descript:	Soil, COAL	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 28, 1992
Attention: Gene St. Godard	Sample Number:	212-0829	Analyzed:	Jan 4, 1993
			Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 29
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Soil, DTS
Analysis Method: EPA 8310
Sample Number: 212-0830

Sampled: Dec 14, 1992
Received: Dec 18, 1992
Extracted: Dec 28, 1992
Analyzed: Jan 4, 1993
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 69
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
W. 539 Sharp, Suite D	Sample Descript: Soil, CB-1 S-2	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method: EPA 8310	Extracted:	Dec 28, 1992
Attention: Gene St. Godard	Sample Number: 212-0831	Analyzed:	Jan 4, 1993
		Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	1,600
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 41
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 14, 1992
W. 539 Sharp, Suite D	Sample Descript:	Soil, CB-2 S-2	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 28, 1992
Attention: Gene St. Godard	Sample Number:	212-0833	Analyzed:	Jan 4, 1993
			Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 79

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Please Note:
This report was amended on 1/28/93.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Soil, CB-3 S-1
Analysis Method: EPA 8310
Sample Number: 212-0834

Sampled: Dec 15, 1992
Received: Dec 18, 1992
Extracted: Dec 29, 1992
Analyzed: Jan 4, 1993
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	790
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 89
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Soil, CB-4 S-2
Analysis Method: EPA 8310
Sample Number: 212-0835

Sampled: Dec 15, 1992
Received: Dec 18, 1992
Extracted: Dec 29, 1992
Analyzed: Jan 4, 1993
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 60
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 16, 1992
W. 539 Sharp, Suite D	Sample Descript:	Soil, MW-7 S-2	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 29, 1992
Attention: Gene St. Godard	Sample Number:	212-0836	Analyzed:	Jan 4, 1993
			Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 62
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Soil, MW-8 S-2
Analysis Method: EPA 8310
Sample Number: 212-0838

Sampled: Dec 15, 1992
Received: Dec 18, 1992
Extracted: Dec 29, 1992
Analyzed: Jan 4, 1993
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit μg/kg (ppb)	Sample Results μg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 66
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 15, 1992
Sample Descript:	Soil, MW-9 S-2	Received:	Dec 18, 1992
Analysis Method:	EPA 8310	Extracted:	Dec 29, 1992
Sample Number:	212-0839	Analyzed:	Jan 4, 1993
		Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	1,900
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 66
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070		Sampled:	Dec 16, 1992
W. 539 Sharp, Suite D	Sample Descript:	Soil, MW-10 S-2		Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310		Extracted:	Dec 29, 1992
Attention: Gene St. Godard	Sample Number:	212-0840		Analyzed:	Jan 5, 1993
				Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 92

Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc

Steven G. Mayer
Project Manager

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Method Blank
Analysis Method: EPA 8310
Sample Number: BLK122992

Extracted: Dec 29, 1992
Analyzed: Jan 5, 1993
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 54
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Steven G. Mayer
Project Manager

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: IA
Analysis Method: EPA 1311/6010/7000
Sample Number: 212-0828

Sampled: Dec 14, 1992
Received: Dec 18, 1992
TCLP Ext: Dec 22, 1992
Analyzed: Dec 22, 1992
Reported: Jan 5, 1993

TCLP Extraction Metals

Analyte	Regulatory Level mg/L (ppm)	Reporting Limit mg/L (ppm)	Sample Results mg/L (ppm)
Arsenic	5.0	0.20	N.D.
Barium	100	1.0	N.D.
Cadmium	1.0	0.010	N.D.
Chromium	5.0	0.025	N.D.
Lead	5.0	0.10	N.D.
Mercury	0.20	0.0010	N.D.
Selenium	1.0	0.10	N.D.
Silver	5.0	0.020	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Steven G. Mayer
Project Manager

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, #S-1070		
Sample Descript:	Method Blank		
Analysis Method:	EPA 1311/6010/7000	TCLP Ext:	Dec 22, 1992
Sample Number:	BLK122292	Analyzed:	Dec 22, 1992
		Reported:	Jan 5, 1993

TCLP Extraction Metals

Analyte	Regulatory Level mg/L (ppm)	Reporting Limit mg/L (ppm)	Sample Results mg/L (ppm)
Arsenic	5.0	0.20	N.D.
Barium	100	1.0	N.D.
Cadmium	1.0	0.010	N.D.
Chromium	5.0	0.025	N.D.
Lead	5.0	0.10	N.D.
Mercury	0.20	0.0010	N.D.
Selenium	1.0	0.10	N.D.
Silver	5.0	0.020	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Steven G. Mayer
Project Manager

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 5030/8020
Sample Matrix: Soil
Units: mg/kg (ppm)
QC Sample #: 212-0827

Analyst: R. Lister
Analyzed: Dec 28-29,1992
Reported: Jan 5, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.50	0.50	0.50	1.50
Spike Result:	0.45	0.44	0.50	1.48
Spike % Recovery:	90%	88%	100%	99%
Spike Dup. Result:	0.47	0.44	0.50	1.48
Spike Duplicate % Recovery:	94%	88%	100%	99%
Upper Control Limit %:	98	96	107	108
Lower Control Limit %:	76	75	83	84
Relative % Difference:	4%	0%	0%	0%
Maximum RPD:	7.1	9.5	7.4	9.8

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Steven G. Mayer
Project Manager

% Recovery: $\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}}$ x 100

Relative % Difference: $\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}}$ x 100

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-G
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: R. Lister

Analyzed: Dec 28-29,1992
Reported:

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Gasoline
Spike Conc. Added:	5.0
Spike Result:	5.0
% Recovery:	100
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Volatile Hydrocarbons	
Sample Number:	212-1232	212-0827
Original Result:	N.D.	N.D.
Duplicate Result:	N.D.	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentrations levels less than 10 times the Detection Limit.	
Maximum RPD:	50	50

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 8310
Sample Matrix : Soil
Units: µg/kg (ppb)
QC Sample #: 212-0834

Analyst: S. Kouri
Extracted: Dec 29, 1992
Analyzed: Jan 5, 1993
Reported: Jan 11, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Fluorene	Indeno(1,2,3-cd) pyrene
Sample Result:	N.D.	N.D.
Spike Conc. Added:	67	33
Spike Result:	46	20
Spike % Recovery:	69%	61%
Spike Dup. Result:	44	22
Spike Duplicate % Recovery:	66%	67%
Upper Control Limit %:	125	125
Lower Control Limit %:	44	46
Relative % Difference:	4%	10%
Maximum RPD:	46	42

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% Recovery:
$$\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference:
$$\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}} \times 100$$

Steven G. Mayer
Project Manager

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-D
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: L. Dutton
Extracted: Dec 29, 1992
Analyzed: Dec 30, 1992
Reported: Jan 5, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Diesel
Spike Conc. Added:	68
Spike Result:	62
% Recovery:	91
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Extractable Hydrocarbons
Sample Number:	212-0834
Original Result:	400
Duplicate Result:	390
Relative % Difference	2.5
Maximum RPD:	50

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Steven G. Mayer
Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-418.1
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: S. Mitchell
Extracted: Dec 29, 1992
Analyzed: Dec 29, 1992
Reported: Jan 5, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Petroleum Oil
Spike Conc. Added:	174
Spike Result:	167
% Recovery:	96
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Petroleum Oil
Sample Number:	212-0835
Original Result:	15
Duplicate Result:	21
Relative % Difference	Relative Percent Difference values are not reported at sample concentrations levels less than 10 times the Detection Limit.
Maximum RPD:	50

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Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Soil
Units: mg/kg

Analyst: T. Fitzgibbon

Digested: Dec 30, 1992
Reported: Jan 5, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Lead
EPA Method:	7420
Date Analyzed:	1/4/92
ACCURACY ASSESSMENT	
LCS Spike Conc. Added:	50
LCS Spike Result:	51
LCS Spike % Recovery:	102
Upper Control Limit:	124
Lower Control Limit:	87
Matrix Spike Sample #:	212-0827
Matrix Spike % Recovery:	120
PRECISION ASSESSMENT	
Sample #:	212-0827
Original:	140
Duplicate:	170
Relative % Difference:	19

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Lab Control Sample % Recovery: $\frac{\text{Conc. of L.C.S.}}{\text{L.C.S. Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Soil
Units: mg/L

Analyst: B. Oaks

Digested: Dec 28, 1992
Reported: Jan 5, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium
EPA Method:	1311/6010	1311/6010	1311/6010	1311/6010	1311/6010	1311/6010
Date Analyzed:	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92
ACCURACY ASSESSMENT						
LCS Spike Conc. Added:	1.0	5.0	1.0	1.0	1.0	1.0
LCS Spike Result:	0.98	4.8	0.90	0.84	0.87	0.86
LCS Spike % Recovery:	98	96	90	84	87	86
Upper Control Limit:	108	104	102	99	97	107
Lower Control Limit:	74	84	79	80	73	79
Matrix Spike Sample #:	212-0820	212-0820	212-0820	212-0820	212-0820	212-0820
Matrix Spike % Recovery:	84	76	85	80	73	88
PRECISION ASSESSMENT						
Sample #:	212-0820	212-0820	212-0820	212-0820	212-0820	212-0820
Original:	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Duplicate:	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Relative % Difference:	(*)	(*)	(*)	(*)	(*)	(*)

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Steven G. Mayer
Project Manager

Please Note:
(*) = Relative Percent Difference Values are not reported at sample concentrations of less than ten times the detection limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Soil
Units: mg/L

Analyst: T. Fitzgibbon

Digested: Dec 28, 1992
Reported: Jan 5, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Silver	Mercury
EPA Method:	1311/7760	1311/7470
Date Analyzed:	12/28/92	12/28/92
ACCURACY ASSESSMENT		
LCS Spike Conc. Added:	1.0	0.010
LCS Spike Result:	1.0	0.0096
LCS Spike % Recovery:	100	96
Upper Control Limit:	116	121
Lower Control Limit:	82	81
Matrix Spike Sample #:	212-0820	212-0820
Matrix Spike % Recovery:	100	92
PRECISION ASSESSMENT		
Sample #:	212-0820	212-0820
Original:	N.D.	N.D.
Duplicate:	N.D.	N.D.
Relative % Difference:	(*)	(*)

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Please Note:
(*) = Relative Percent Difference Values are not reported at sample concentrations of less than ten times the detection limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Soil
Units: mg/kg

Analyst: B. Oaks

Digested: Dec 30, 1992
Reported: Jan 5, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead
EPA Method:	6010	6010	6010	6010	6010	6010	6010
Date Analyzed:	12/30/92	12/30/92	12/30/92	12/30/92	12/30/92	12/30/92	12/30/92
ACCURACY ASSESSMENT							
LCS Spike Conc. Added:	50	50	50	50	50	50	50
LCS Spike Result:	45	43	46	43	44	45	43
LCS Spike % Recovery:	90	86	92	86	88	90	86
Upper Control Limit:	104	97	117	104	120	112	100
Lower Control Limit:	82	69	77	69	65	74	66
Matrix Spike Sample #:	212-0951	212-0951	212-0951	212-0951	212-0951	212-0951	212-0951
Matrix Spike % Recovery:	80	76	80	78	82	84	74
PRECISION ASSESSMENT							
Sample #:	212-0951	212-0951	212-0951	212-0951	212-0951	212-0951	212-0951
Original:	N.D.	N.D.	N.D.	N.D.	17	15	N.D.
Duplicate:	N.D.	N.D.	N.D.	N.D.	15	10	N.D.
Relative % Difference:	(*)	(*)	(*)	(*)	(*)	40	(*)

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Steven G. Mayer
Project Manager

Please Note:
(*) = Relative Percent Difference Values are not reported at sample concentrations of less than ten times the detection limit.
The Relative Percent Difference Value for Copper in this sample is outside of North Creek Analytical's established control limits.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Soil
Units: mg/kg

Analyst: B. Oaks
T. Fitzgibbon

Digested: Dec 30, 1992
Reported: Jan 5, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Nickel	Selenium	Thallium	Zinc	Silver	Mercury
EPA Method:	6010	6010	6010	6010	7760	7470
Date Analyzed:	12/30/92	12/30/92	12/30/92	12/30/92	1/4/93	1/4/93
ACCURACY ASSESSMENT						
LCS Spike Conc. Added:	50	50	50	50	50	0.50
LCS Spike Result:	45	43	45	42	49	0.47
LCS Spike % Recovery:	90	86	90	84	98	94
Upper Control Limit:	130	104	112	119	117	123
Lower Control Limit:	57	65	54	71	87	82
Matrix Spike Sample #:	212-0951	212-0951	212-0951	212-0951	212-0827	212-0543
Matrix Spike % Recovery:	78	94	74	80	94	89
PRECISION ASSESSMENT						
Sample #:	212-0951	212-0951	212-0951	212-0951	212-0827	212-0543
Original:	14	N.D.	N.D.	15	N.D.	0.053
Duplicate:	11	N.D.	N.D.	9.4	N.D.	0.058
Relative % Difference:	(*)	(*)	(*)	(*)	(*)	(*)

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

Please Note:
(*) = Relative Percent Difference Values are not reported at sample concentrations of less than ten times the detection limit.

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HYDROCARBON ANALYSES FOOTNOTES

(8/92)

Code	Description
VOLATILE HYDROCARBONS - Gasoline Range Organics	
G 1	This sample appears to contain extractable diesel range organics.
G 2	The chromatogram for this sample is not a typical gasoline fingerprint.
G 3	The total hydrocarbon result in this sample is primarily due to a peak(s) eluting in the volatile hydrocarbon range. Identification and quantitation by EPA 8010, 8021 or 8240 is recommended.
EXTRACTABLE HYDROCARBONS - Diesel Range Organics	
D 1	This sample appears to contain volatile gasoline range organics.
D 2	The hydrocarbons present in this sample are primarily due to very heavy, non-resolvable oil range organics. Quantitation by EPA 418.1 is recommended.
D 3	The hydrocarbons present in this sample are a complex mixture of extractable diesel range and non-resolvable motor oil or other heavy oil range organics.
D 4	The hydrocarbon result shown is an estimated (greater than) value due to high concentration. Reanalysis is being performed to yield a quantitative result.

Oils & Lubricants
[--]
T.R.P.H. (418.1)

Diesel & Fuel Oils
[--]
Extractables (3550/8015)

Gasoline
[--------------------------------]
Volatiles (5030/8015)

HYDROCARBON BOILING POINT RANGE

LOW LOW TO MEDIUM MEDIUM MEDIUM TO HIGH VERY HIGH

CARBON RANGE:
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 +

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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
W. 539 Sharp, Suite D	Matrix Descript: Water	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis Method: WTPH-G, EPA 5030/8020	Analyzed:	Dec 29, 1992
Attention: Gene St. Godard	First Sample #: 212-0979	Reported:	Jan 6, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/L (ppm)	Benzene mg/L (ppm)	Toluene mg/L (ppm)	Ethyl Benzene mg/L (ppm)	Xylenes mg/L (ppm)	Surrogate Recovery %
212-0979	MW-4	N.D.	N.D.	N.D.	N.D.	N.D.	94
212-0980	MW-3	N.D.	N.D.	N.D.	N.D.	N.D.	91
212-0981	MW-5	N.D.	N.D.	N.D.	N.D.	N.D.	96
212-0982	MW-6	2.2	0.95	0.034	0.36	N.D.	100
212-0983	MW-10	66	1.3	0.22	5.4	16	100
212-0984	MW-7	0.58	0.20	0.0081	0.070	0.023	110
212-0985	TRIP BLANK	N.D.	N.D.	N.D.	N.D.	N.D.	92
BLK122992	Method Blank	N.D.	N.D.	N.D.	N.D.	N.D.	86
Reporting Limits:		**0.050**	**0.00050**	**0.00050**	**0.00050**	**0.0010**	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (nC7 - nC12). Surrogate recovery reported is for Bromofluorobenzene.
Analytes reported as N.D. were not present above the stated limit of reporting.

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

Please Note:
The detection limit for Xylenes in #212-0982 = 0.0080 mg/L.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
W. 539 Sharp, Suite D	Matrix Descript:	Water	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis Method:	WTPH-D	Extracted:	Dec 23, 1992
Attention: Gene St. Godard	First Sample #:	212-0979	Analyzed:	Dec 29-31, 1992
			Reported:	Jan 6, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/L (ppm)	Surrogate Recovery %
212-0979	MW-4	N.D. D-2	Matrix Interference
212-0980	MW-3	N.D. D-2	Matrix Interference
212-0981	MW-5	N.D. D-2	Matrix Interference
212-0982	MW-6	0.78 D-1, D-2	61
212-0983	MW-10	23 D-1	75
212-0984	MW-7	1.6 D-2	Matrix Interference
BLK122392	Method Blank	N.D.	79

Reporting Limits:	0.25

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Matrix Descript: Water
Analysis Method: EPA 418.1 (I.R. with clean-up)
First Sample #: 212-0979

Sampled: Dec 17, 1992
Received: Dec 21, 1992
Extracted: Dec 28, 1992
Analyzed: Dec 29, 1992
Reported: Jan 6, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/L (ppm)
212-0979	MW-4	1.2
212-0980	MW-3	N.D.
212-0981	MW-5	N.D.
212-0982	MW-6	4.6
212-0983	MW-10	94
212-0984	MW-7	N.D.
BLK122892	Method Blank	N.D.

Reporting Limits:	1.0

Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
W. 539 Sharp, Suite D	Analysis Method:	EPA 7420/7421	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis for:	Total Lead	Digested:	Dec 29, 1992
Attention: Gene St. Godard	First Sample #:	212-0979	Analyzed:	Jan 4, 1993
	Matrix:	Water	Reported:	Jan 6, 1993

METALS ANALYSIS FOR: Total Lead

Sample Number	Sample Description	Reporting Limit µg/L (ppb)	Sample Result µg/L (ppb)
212-0979	MW-4	2.0	48
212-0980	MW-3	2.0	45
212-0981	MW-5	2.0	81
BLK122992	Method Blank	2.0	N.D.
212-0982	MW-6	300	460
212-0983	MW-10	300	1,300
212-0984	MW-7	300	2,500
BLK010593	Method Blank	300	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
W. 539 Sharp, Suite D	Analysis Method:	EPA 7421	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis for:	Dissolved Lead	Digested:	Dec 29, 1992
Attention: Gene St. Godard	First Sample #:	212-0979	Analyzed:	Jan 5, 1993
	Matrix:	Water	Reported:	Jan 6, 1993

METALS ANALYSIS FOR: Dissolved Lead

Sample Number	Sample Description	Reporting Limit µg/L (ppb)	Sample Result µg/L (ppb)
212-0979	MW-4	2.0	N.D.
212-0980	MW-3	2.0	2.2
212-0981	MW-5	2.0	3.0
212-0982	MW-6	2.0	N.D.
212-0983	MW-10	2.0	24
212-0984	MW-7	2.0	N.D.
BLK122992	Method Blank	2.0	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
Sample Descript:	Water, MW-6	Received:	Dec 21, 1992
Analysis Method:	EPA 8310	Extracted:	Dec 22, 1992
Sample Number:	212-0982	Analyzed:	Jan 3-6,1992
		Reported:	Jan 8, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.20	N.D.
Benzo (b) fluoranthene	0.20	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.20	N.D.
Chrysene	4.0	N.D.
Dibenzo (a,h) anthracene	0.20	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.04	N.D.
Naphthalene	5.0	240
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 55
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
W. 539 Sharp, Suite D	Sample Descript:	Water, MW-10	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 22, 1992
Attention: Gene St. Godard	Sample Number:	212-0983	Analyzed:	Jan 4, 1993
			Reported:	Jan 8, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.01	N.D.
Benzo (b) fluoranthene	0.01	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.01	N.D.
Chrysene	0.02	N.D.
Dibenzo (a,h) anthracene	0.01	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.04	N.D.
Naphthalene	5.0	220
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 58
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 17, 1992
W. 539 Sharp, Suite D	Sample Descript:	Water, MW-7	Received:	Dec 21, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 22, 1992
Attention: Gene St. Godard	Sample Number:	212-0984	Analyzed:	Jan 4, 1993
			Reported:	Jan 8, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.01	N.D.
Benzo (b) fluoranthene	0.01	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.01	N.D.
Chrysene	0.02	N.D.
Dibenzo (a,h) anthracene	0.01	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.04	N.D.
Naphthalene	5.0	N.D.
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 51
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Method Blank
Analysis Method: EPA 8310
Sample Number: BLK122292

Extracted: Dec 22, 1992
Analyzed: Jan 1, 1993
Reported: Jan 8, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.10	N.D.
Benzo (b) fluoranthene	0.10	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.10	N.D.
Chrysene	0.10	N.D.
Dibenzo (a,h) anthracene	0.10	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.10	N.D.
Naphthalene	5.0	N.D.
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 94
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 8310
Sample Matrix : Water
Units: µg/L (ppb)
QC Sample #: BLK122292

Analyst: S. Kouri

Extracted: Dec 22, 1992
Analyzed: Jan 7, 1993
Reported: Jan 8, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Fluorene	Indeno(1,2,3-cd) pyrene	Chrysene
Sample Result:	N.D.	N.D.	N.D.
Spike Conc. Added:	2.0	1.0	2.0
Spike Result:	1.8	0.82	1.0
Spike % Recovery:	90%	82%	50%
Spike Dup. Result:	2.2	1.0	1.2
Spike Duplicate % Recovery:	110%	100%	60%
Upper Control Limit %:	126	156	134
Lower Control Limit %:	38	28	36
Relative % Difference:	20%	22%	17%
Maximum RPD:	42	26	28

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% Recovery: $\dfrac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\dfrac{\text{Spike Result - Spike Dup. Result}}{(\text{Spike Result + Spike Dup. Result}) / 2} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 5030/8020
Sample Matrix: Water
Units: μg/L (ppb)
QC Sample #: 212-0985

Analyst: R. Lister
K. Wilke
Analyzed: Dec 29, 1992
Reported: Jan 6, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	5.0	5.0	5.0	15
Spike Result:	4.9	5.1	5.3	14
Spike % Recovery:	98%	102%	106%	93%
Spike Dup. Result:	4.7	5.2	5.2	13
Spike Duplicate % Recovery:	94%	104%	104%	87%
Upper Control Limit %:	126	124	134	118
Lower Control Limit %:	66	85	77	88
Relative % Difference:	4.2%	1.9%	1.9%	7.4%
Maximum RPD:	8.0	13	12	11

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Please Note:
The Spike Duplicate Percent Recovery for Xylenes is outside of the NCA established control limits.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-G
Sample Matrix: Water
Units: mg/L (ppm)

Analyst: R. Lister
K. Wilke

Analyzed: Dec 29, 1992
Reported: Jan 6, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT Laboratory Control Sample		PRECISION ASSESSMENT Sample Duplicate	
Gasoline		Volatile Hydrocarbons	
Spike Conc. Added:	100	**Sample Number:**	212-0939
Spike Result:	94	**Original Result:**	3,900
% Recovery:	94	**Duplicate Result:**	3,400
Upper Control Limit %:	120	**Relative % Difference**	14
Lower Control Limit %:	80	**Maximum RPD:**	20

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% Recovery: $\dfrac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\dfrac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) \;/\; 2} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-418.1
Sample Matrix: Water
Units: mg/L (ppm)

Analyst: S. Mitchell
Extracted: Dec 28, 1992
Analyzed: Dec 29, 1992
Reported: Jan 6, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Petroleum Oil
Spike Conc. Added:	5.2
Spike Result:	5.3
% Recovery:	102
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Petroleum Oil
Sample Number:	212-1202
Original Result:	N.D.
Duplicate Result:	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than ten times the Detection Limit.
Maximum RPD:	20

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% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane W. 539 Sharp, Suite D Spokane, WA 99201 Attention: Gene St. Godard	Client Project ID: Pullman Chevron, #S-1070 EPA Method: WTPH-D Sample Matrix: Water Units: mg/L (ppm)	Analyst: Extracted: Analyzed: Reported:	L. Dutton Dec 23, 1992 Dec 28, 1992 Jan 6, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT

Laboratory Control Sample

	Diesel
Spike Conc. Added:	2.0
Spike Result:	2.6
% Recovery:	130
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT

Sample Duplicate

	Extractable Hydrocarbons
Sample Number:	212-0982
Original Result:	0.78
Duplicate Result:	0.75
Relative % Difference	Relative Percent Difference values are not reported at sample concentrations levels less than 10 times the Detection Limit.
Maximum RPD:	20

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% Recovery: $\dfrac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\dfrac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Water
Units: μg/L (ppb)

Analyst: T. Fitzgibbon

Digested: Jan 5, 1993
Reported: Jan 6, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Lead
EPA Method:	7420
Date Analyzed:	Jan 5, 1993
ACCURACY ASSESSMENT	
LCS Spike Conc. Added:	500
LCS Spike Result:	530
LCS Spike % Recovery:	106
Upper Control Limit:	124
Lower Control Limit:	87
Matrix Spike Sample #:	212-1416
Matrix Spike % Recovery:	108
PRECISION ASSESSMENT	
Sample #:	212-1416
Original:	N.D.
Duplicate:	N.D.
Relative % Difference:	RPD values are not reported at sample concentration levels <10 times the Detection Limit.

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Lab Control Sample % Recovery: $\frac{\text{Conc. of L.C.S.}}{\text{L.C.S. Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Water
Units: μg/L (ppb)

Analyst: K. Ackerlund

Digested: Dec 29, 1992
Reported: Jan 6, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Lead
EPA Method:	7421
Date Analyzed:	Jan 4, 1993
ACCURACY ASSESSMENT	
LCS Spike Conc. Added:	30
LCS Spike Result:	29
LCS Spike % Recovery:	97
Upper Control Limit:	119
Lower Control Limit:	73
Matrix Spike Sample #:	212-1055
Matrix Spike % Recovery:	98
PRECISION ASSESSMENT	
Sample #:	212-1055
Original:	4.6
Duplicate:	N.D.
Relative % Difference:	RPD values are not reported at sample concentration levels < 10 times the Detection Limit.

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Lab Control Sample % Recovery: $\frac{\text{Conc. of L.C.S.}}{\text{L.C.S. Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Matrix Descript: Water
Analysis Method: WTPH-G, EPA 5030/8020
First Sample #: 212-0826

Sampled: Dec 16, 1992
Received: Dec 18, 1992
Analyzed: Dec 24, 1992
Reported: Jan 5, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/L (ppm)	Benzene mg/L (ppm)	Toluene mg/L (ppm)	Ethyl Benzene mg/L (ppm)	Xylenes mg/L (ppm)	Surrogate Recovery %
212-0826	MW-8A	29	1.2	0.62	1.6	3.2	114
BLK122492	Method Blank	N.D.	N.D.	N.D.	N.D.	N.D.	101
Reporting Limits:		**0.050**	**0.00050**	**0.00050**	**0.00050**	**0.0010**	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (nC7 - nC12). Surrogate recovery reported is for Bromofluorobenzene.
Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Matrix Descript: Water
Analysis Method: WTPH-D
First Sample #: 212-0826

Sampled: Dec 16, 1992
Received: Dec 18, 1992
Extracted: Dec 23, 1992
Analyzed: Dec 29, 1992
Reported: Jan 5, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/L (ppm)	Surrogate Recovery %
212-0826	MW-8A	8.7 D2	Matrix Interference
BLK122392	Method Blank	N.D.	79

Reporting Limits: 1.0

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 16, 1992
W. 539 Sharp, Suite D	Matrix Descript:	Water	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis Method:	EPA 418.1 (I.R. with clean-up)	Extracted:	Dec 28, 1992
Attention: Gene St. Godard	First Sample #:	212-0826	Analyzed:	Dec 29, 1992
			Reported:	Jan 5, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/L (ppm)
212-0826	MW-8A	270
BLK122892	Method Blank	N.D.

Reporting Limits:	1.0

Analytes reported as N.D. were not present above the stated limit of reporting.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-D
Sample Matrix: Water
Units: mg/L (ppm)

Analyst: L. Dutton

Extracted: Dec 23, 1992
Analyzed: Dec 28, 1992
Reported: Jan 5, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT

Laboratory Control Sample

	Diesel
Spike Conc. Added:	2.0
Spike Result:	2.6
% Recovery:	130
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT

Sample Duplicate

	Extractable Hydrocarbons
Sample Number:	212-0982
Original Result:	0.84
Duplicate Result:	1.0
Relative % Difference	Relative Percent Difference values are not reported at sample concentrations levels less than 10 times the Detection Limit.
Maximum RPD:	20

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Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: WTPH-418.1
Sample Matrix: Water
Units: mg/L (ppm)

Analyst: S. Mitchell

Extracted: Dec 28, 1992
Analyzed: Dec 29, 1992
Reported: Jan 5, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Petroleum Oil
Spike Conc. Added:	5.2
Spike Result:	5.3
% Recovery:	102
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Petroleum Oil
Sample Number:	212-1149
Original Result:	N.D.
Duplicate Result:	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than ten times the Detection Limit.
Maximum RPD:	20

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Project Manager

% Recovery: $$\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$$

Relative % Difference: $$\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$$

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HYDROCARBON ANALYSES FOOTNOTES

(8/92)

Code	Description
	VOLATILE HYDROCARBONS - Gasoline Range Organics
G 1	This sample appears to contain extractable diesel range organics.
G 2	The chromatogram for this sample is not a typical gasoline fingerprint.
G 3	The total hydrocarbon result in this sample is primarily due to a peak(s) eluting in the volatile hydrocarbon range. Identification and quantitation by EPA 8010, 8021 or 8240 is recommended.
	EXTRACTABLE HYDROCARBONS - Diesel Range Organics
D 1	This sample appears to contain volatile gasoline range organics.
D 2	The hydrocarbons present in this sample are primarily due to very heavy, non-resolvable oil range organics. Quantitation by EPA 418.1 is recommended.
D 3	The hydrocarbons present in this sample are a complex mixture of extractable diesel range and non-resolvable motor oil or other heavy oil range organics.
D 4	The hydrocarbon result shown is an estimated (greater than) value due to high concentration. Reanalysis is being performed to yield a quantitative result.

Oils & Lubricants
[--]
T.R.P.H. (418.1)

Diesel & Fuel Oils
[--]
Extractables (3550/8015)

Gasoline
[--------------------------------]
Volatiles (5030/8015)

HYDROCARBON BOILING POINT RANGE

LOW **LOW TO MEDIUM** **MEDIUM** **MEDIUM TO HIGH** **VERY HIGH**

CARBON RANGE:
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 +

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
W. 539 Sharp, Suite D	Matrix Descript:	Water	Received:	Dec 22, 1992
Spokane, WA 99201	Analysis Method:	WTPH-G,EPA 5030/8020	Analyzed:	Dec 30, 1992
Attention: Gene St. Godard	First Sample #:	212-1097	Reported:	Jan 7, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/L (ppm)	Benzene mg/L (ppm)	Toluene mg/L (ppm)	Ethyl Benzene mg/L (ppm)	Xylenes mg/L (ppm)	Surrogate Recovery %
212-1097	MW-9	15	7.2	1.5	1.2	2.5	96
212-1098	MW-2	4.3	1.3	0.053	0.31	0.16	98
212-1099	MW-1	3.9	0.20	0.015	0.26	0.032	106
212-1100	MW-8B	16	1.6	0.32	2.1	3.4	102
212-1102	TRIP BLANK	N.D.	N.D.	N.D.	N.D.	N.D.	92
BLK123092	Method Blank	N.D.	N.D.	N.D.	N.D.	N.D.	91
Reporting Limits:		0.050	0.00050	0.00050	0.00050	0.0010	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane). Surrogate recovery reported is for Bromofluorobenzene. Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Matrix Descript: Water
Analysis Method: WTPH-D
First Sample #: 212-1097

Sampled: Dec 18, 1992
Received: Dec 22, 1992
Extracted: Dec 28, 1992
Analyzed: Jan 1, 1993
Reported: Jan 7, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/L (ppm)	Surrogate Recovery %
212-1097	MW-9	2.0 D-1	109
212-1098	MW-2	2.4 D-1	120
212-1099	MW-1	15 D-1	94
212-1100	MW-8B	200 D-1	Matrix Interference
BLK122892	Method Blank	N.D.	104

Reporting Limits:	1.0

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
Matrix Descript:	Water	Received:	Dec 22, 1992
Analysis Method:	WTPH-418.1	Extracted:	Dec 28, 1992
First Sample #:	212-1097	Analyzed:	Dec 29, 1992
		Reported:	Jan 7, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/L (ppm)
212-1097	MW-9	15
212-1098	MW-2	4.3
212-1099	MW-1	19
212-1100	MW-8B	79
BLK122892	Method Blank	N.D.

Reporting Limits:	1.0

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
W. 539 Sharp, Suite D	Analysis Method:	EPA 7421	Received:	Dec 22, 1992
Spokane, WA 99201	Analysis for:	Total Lead	Digested:	Jan 4, 1993
Attention: Gene St. Godard	First Sample #:	212-1097	Analyzed:	Jan 5-6, 1993
	Matrix:	Water	Reported:	Jan 7, 1993

METALS ANALYSIS FOR: Total Lead

Sample Number	Sample Description	Reporting Limit mg/L (ppm)	Sample Result mg/L (ppm)
212-1097	MW-9	0.0020	0.14
212-1098	MW-2	0.0020	0.029
212-1099	MW-1	0.0020	0.022
212-1100	MW-8B	0.0020	0.19
BLK010493	Method Blank	0.0020	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
Analysis Method:	EPA 7421	Received:	Dec 22, 1992
Analysis for:	Dissolved Lead	Digested:	Jan 4, 1993
First Sample #:	212-1097	Analyzed:	Jan 5-6, 1993
Matrix:	Water	Reported:	Jan 7, 1993

METALS ANALYSIS FOR: Dissolved Lead

Sample Number	Sample Description	Reporting Limit mg/L (ppm)	Sample Result mg/L (ppm)
212-1097	MW-9	0.0020	0.0040
212-1098	MW-2	0.0020	N.D.
212-1099	MW-1	0.0020	0.0042
212-1100	MW-8B	0.0020	0.011
BLK010493	Method Blank	0.0020	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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D-70

RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070	Sampled:	Dec 16, 1992
W. 539 Sharp, Suite D	Analysis Method:	EPA 7421	Received:	Dec 18, 1992
Spokane, WA 99201	Analysis for:	Total Lead	Digested:	Dec 28, 1992
Attention: Gene St. Godard	First Sample #:	212-0826	Analyzed:	Dec 28, 1992
	Matrix:	Water	Reported:	Jan 8, 1993

METALS ANALYSIS FOR: Total Lead

Sample Number	Sample Description	Reporting Limit µg/L (ppb)	Sample Result µg/L (ppb)
212-0826	MW-8A	2.0	470
BLK122892	Method Blank	2.0	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Analysis Method: EPA 7421
Analysis for: Dissolved Lead
First Sample #: 212-0826
Matrix: Water

Sampled: Dec 16, 1992
Received: Dec 18, 1992
Digested: Jan 4, 1993
Analyzed: Jan 7, 1993
Reported: Jan 8, 1993

METALS ANALYSIS FOR: Dissolved Lead

Sample Number	Sample Description	Reporting Limit µg/L (ppb)	Sample Result µg/L (ppb)
212-0826	MW-8A	2.0	3.2
BLK010492	Method Blank	2.0	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Descript: Water, MW-8A
Analysis Method: EPA 8310
Sample Number: 212-0826

Sampled: Dec 16, 1992
Received: Dec 18, 1992
Extracted: Dec 22, 1992
Analyzed: Jan 4-8,1993
Reported: Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.02	N.D.
Benzo (b) fluoranthene	0.02	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.02	N.D.
Chrysene	0.04	N.D.
Dibenzo (a,h) anthracene	0.02	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.08	N.D.
Naphthalene	5.0	160
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 103
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, #S-1070		
W. 539 Sharp, Suite D	Sample Descript:	Method Blank		
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 22, 1992
Attention: Gene St. Godard	Sample Number:	BLK122292	Analyzed:	Jan 1, 1993
			Reported:	Jan 11, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.01	N.D.
Benzo (b) fluoranthene	0.01	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.01	N.D.
Chrysene	0.02	N.D.
Dibenzo (a,h) anthracene	0.01	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.04	N.D.
Naphthalene	5.0	N.D.
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 94
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
EPA Method: 5030/8020
Sample Matrix: Water
Units: μg/L (ppb)
QC Sample #: 212-0739

Analyst: R. Lister

Analyzed: Dec 24, 1992
Reported: Jan 5, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	5.0	5.0	5.0	15.0
Spike Result:	5.2	4.8	5.4	16.2
Spike % Recovery:	104%	96%	108%	108%
Spike Dup. Result:	5.2	4.8	5.4	15.8
Spike Duplicate % Recovery:	104%	96%	108%	105%
Upper Control Limit %:	116	113	120	120
Lower Control Limit %:	94	84	88	85
Relative % Difference:	0%	0%	0%	2%
Maximum RPD:	5.6	9.0	7.1	6.9

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% Recovery: $\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}} \times 100$

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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, #S-1070	Analyst:	R. Lister
W. 539 Sharp, Suite D	EPA Method: WTPH-G		
Spokane, WA 99201	Sample Matrix: Water		
Attention: Gene St. Godard	Units: μg/L (ppb)	Analyzed:	Dec 24, 1992
		Reported:	Jan 5, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Gasoline
Spike Conc. Added:	100
Spike Result:	98
% Recovery:	98
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Volatile Hydrocarbons
Sample Number:	212-0746
Original Result:	N.D.
Duplicate Result:	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentrations levels less than 10 times the Detection Limit.
Maximum RPD:	20

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$$\text{\% Recovery: } \frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$$

$$\text{Relative \% Difference: } \frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, #S-1070
Sample Matrix : Water
Units: µg/L

Analyst: K. Ackerlund
Digested: Dec 28, 1992
Digested: Jan 4, 1993
Reported: Jan 8, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Lead	Dissolved Lead
EPA Method:	7421	7421
Date Analyzed:	12/29/92	1/7/92
ACCURACY ASSESSMENT		
LCS Spike Conc. Added:	20	30
LCS Spike Result:	29	30
LCS Spike % Recovery:	97	100
Upper Control Limit:	119	119
Lower Control Limit:	73	73
Matrix Spike Sample #:	212-1144	212-1420
Matrix Spike % Recovery:	93	81
PRECISION ASSESSMENT		
Sample #:	212-1144	212-1420
Original:	N.D.	7.6
Duplicate:	N.D.	7.6
Relative % Difference:	Q4	Q4

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Please Note:
Q4 = Relative Percent Difference Values are not reported at sample concentrations of less than ten times the detection limit.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
W. 539 Sharp, Suite D	Sample Descript:	Water, MW-9	Received:	Dec 22, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310	Extracted:	Dec 28, 1992
Attention: Gene St. Godard	Sample Number:	212-1097	Analyzed:	Jan 3, 1993
			Reported:	Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.010	N.D.
Benzo (b) fluoranthene	0.010	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.010	N.D.
Chrysene	0.020	N.D.
Dibenzo (a,h) anthracene	0.010	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.040	N.D.
Naphthalene	5.0	23
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 69
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
W. 539 Sharp, Suite D	Sample Descript: Water, MW-2	Received:	Dec 22, 1992
Spokane, WA 99201	Analysis Method: EPA 8310	Extracted:	Dec 28, 1992
Attention: Gene St. Godard	Sample Number: 212-1098	Analyzed:	Jan 3, 1993
		Reported:	Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.010	N.D.
Benzo (b) fluoranthene	0.010	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.010	N.D.
Chrysene	0.020	N.D.
Dibenzo (a,h) anthracene	0.010	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.040	N.D.
Naphthalene	5.0	22
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 67
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Sample Descript: Water, MW-1
Analysis Method: EPA 8310
Sample Number: 212-1099

Sampled: Dec 18, 1992
Received: Dec 22, 1992
Extracted: Dec 28, 1992
Analyzed: Jan 3, 1993
Reported: Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.010	N.D.
Benzo (b) fluoranthene	0.010	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.010	N.D.
Chrysene	0.020	N.D.
Dibenzo (a,h) anthracene	0.010	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.040	N.D.
Naphthalene	5.0	53
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 43
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Sample Descript: Water, MW-8B
Analysis Method: EPA 8310
Sample Number: 212-1100

Sampled: Dec 18, 1992
Received: Dec 22, 1992
Extracted: Dec 28, 1992
Analyzed: Jan 3, 1993
Reported: Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.040	N.D.
Benzo (b) fluoranthene	0.040	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.040	N.D.
Chrysene	0.080	N.D.
Dibenzo (a,h) anthracene	0.040	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.16	N.D.
Naphthalene	5.0	67
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 32
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Steven G. Mayer
Project Manager

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Sample Descript: Method Blank
Analysis Method: EPA 8310
Sample Number: BLK122892

Extracted: Dec 28, 1992
Analyzed: Jan 3, 1993
Reported: Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/L (ppb)	Sample Results µg/L (ppb)
Acenaphthene	5.0	N.D.
Acenaphthylene	5.0	N.D.
Anthracene	5.0	N.D.
Benzo (a) anthracene	0.10	N.D.
Benzo (a) pyrene	0.010	N.D.
Benzo (b) fluoranthene	0.010	N.D.
Benzo (ghi) perylene	0.10	N.D.
Benzo (k) fluoranthene	0.010	N.D.
Chrysene	0.020	N.D.
Dibenzo (a,h) anthracene	0.010	N.D.
Fluoranthene	0.10	N.D.
Fluorene	5.0	N.D.
Indeno (1,2,3-cd) pyrene	0.040	N.D.
Naphthalene	5.0	N.D.
Phenanthrene	5.0	N.D.
Pyrene	0.50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 69
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Project Manager

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: 8310
Sample Matrix : Water
Units: μg/L (ppb)
QC Sample #: BLK122892

Analyst: S. Kouri

Extracted: Dec 28, 1992
Analyzed: Jan 4, 1993
Reported: Jan 7, 1993

BLANK SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Fluorene	Indeno(1,2,3-cd) pyrene	Chrysene
Sample Result:	N.D.	N.D.	N.D.
Spike Conc. Added:	2.0	1.0	1.0
Spike Result:	1.8	0.99	1.1
Spike % Recovery:	90%	99%	110%
Spike Dup. Result:	0.96	0.41	0.37
Spike Duplicate % Recovery:	48%	41%	37%
Upper Control Limit %:	126	134	156
Lower Control Limit %:	38	35	28
Relative % Difference:	61%	83%	99%
Maximum RPD:	42	28	26

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% Recovery: $\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}}$ x 100

Relative % Difference: $\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}}$ x 100

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D-90

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Sample Matrix : Water
Units: mg/L (ppm)

Analyst: K. Ackerlund

Digested: Jan 4, 1993
Reported: Jan 7, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Lead	Lead
EPA Method:	7421	7421
Date Analyzed:	Jan 5, 1993	Jan 6, 1993
ACCURACY ASSESSMENT		
LCS Spike Conc. Added:	0.030	0.030
LCS Spike Result:	0.026	0.030
LCS Spike % Recovery:	87	100
Upper Control Limit:	119	119
Lower Control Limit:	73	73
Matrix Spike Sample #:	212-1099	212-1099
Matrix Spike % Recovery:	79	81
PRECISION ASSESSMENT		
Sample #:	212-1099	212-1099
Original:	0.0042	0.0047
Duplicate:	0.0027	0.0033

Relative % Difference: RPD values are not reported at sample concentration levels < 10 times the Detection Limit.

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Lab Control Sample % Recovery: $\frac{\text{Conc. of L.C.S.}}{\text{L.C.S. Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

en N.E., Suite 101 · Bothell, WA 98011-2569
Phone (206) 481-9200 · FAX (206) 485-2992

-1C) Analyst: S. Mitchell

Extracted: Dec 28, 1992
Analyzed: Dec 29, 1992
Reported: Jan 7, 1993

OL DATA REPORT

PRECISION ASSESSMENT

Sample Duplicate

Petroleum Oil

le
er 212-1149

al
lt: N.D.

ate
lt: N.D.

ive Relative Percent Difference values are not
nc reported at sample concentration levels
less than ten times the Detection Limit.

un
: 20

x 100
Added

Du cate Result x 100
Dup..cate Result) / 2

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D-92

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: WTPH-D
Sample Matrix: Water
Units: mg/L (ppm)

Analyst: L. Dutton
Extracted: Dec 28, 1992
Analyzed: Jan 1, 1993
Reported: Jan 7, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Diesel
Spike Conc. Added:	2.0
Spike Result:	1.3
% Recovery:	65
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Extractable Hydrocarbons
Sample Number:	212-1055
Original Result:	N.D.
Duplicate Result:	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	20

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% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: WTPH-G
Sample Matrix: Water
Units: mg/L (ppm)

Analyst: R. Lister
K. Wilke

Analyzed: Dec 30, 1992
Reported: Jan 7, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT

Laboratory Control Sample

	Gasoline
Spike Conc. Added:	0.10
Spike Result:	0.097
% Recovery:	97
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT

Sample Duplicate

	Volatile Hydrocarbons
Sample Number:	212-1202
Original Result:	N.D.
Duplicate Result:	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	20

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% Recovery: $\dfrac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\dfrac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: 5030/8020
Sample Matrix: Water
Units: mg/L (ppm)
QC Sample #: 212-1102

Analyst: R. Lister
K. Wilke

Analyzed: Dec 30, 1992
Reported: Jan 7, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.0050	0.0050	0.0050	0.015
Spike Result:	0.0047	0.0052	0.0053	0.013
Spike % Recovery:	94%	104%	106%	87%
Spike Dup. Result:	0.0046	0.0050	0.0050	0.011
Spike Duplicate % Recovery:	92%	100%	100%	73%
Upper Control Limit %:	126	124	134	118
Lower Control Limit %:	66	85	77	88
Relative % Difference:	2.2%	3.9%	5.8%	17%
Maximum RPD:	8.0	13	12	11

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Please Note:
The Relative Percent Difference value for Xylenes is outside of the NCA established control limits.

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RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, S-1070			
W. 539 Sharp, Suite D	Matrix:	Soil			
Spokane, WA 99201	Analysis for:	Moisture Content		Received:	Dec 22, 1992
Attention: Gene St. Godard	First Sample #:	212-1101		Reported:	Jan 7, 1993

LABORATORY ANALYSIS FOR: Moisture Content

Sample Number	Sample Description	Total Solids %	Moisture Content %
212-1101	HA2 S-1	63	37

The enclosed analytical results for soils, sediments and sludges have been converted to a DRY WEIGHT reporting basis.
To attain the wet weight "as received" equivalent, multiply the dry weight result by the decimal fraction of percent Total Solids.
The results in this report apply only to the samples analyzed, as indicated on the custody document.
This analytical report is to be reproduced only in its entirety.

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D-96

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Matrix Descript: Soil
Analysis Method: WTPH-G, EPA 5030/8020
First Sample #: 212-1101

Sampled: Dec 18, 1992
Received: Dec 22, 1992
Analyzed: Dec 30, 1992
Reported: Jan 7, 1993

TOTAL PETROLEUM HYDROCARBONS with BTEX DISTINCTION (WTPH-G/BTEX)

Sample Number	Sample Description	Volatile Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Surrogate Recovery %
212-1101	HA-2, S-1	N.D.	N.D.	N.D.	N.D.	N.D.	108
BLK123092	Method Blank	N.D.	N.D.	N.D.	N.D.	N.D.	105
Reporting Limits:		1.0	0.0080	0.0080	0.0080	0.015	

Volatile Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane). Surrogate recovery reported is for Bromofluorobenzene.
Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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D-97

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
Matrix Descript:	Soil	Received:	Dec 22, 1992
Analysis Method:	WTPH-D	Extracted:	Dec 28, 1992
First Sample #:	212-1101	Analyzed:	Jan 1, 1993
		Reported:	Jan 7, 1993

TOTAL PETROLEUM HYDROCARBONS (WTPH-D)

Sample Number	Sample Description	Extractable Hydrocarbons mg/kg (ppm)	Surrogate Recovery %
212-1101	HA-2, S-1	19	95
BLK122892	Method Blank	N.D.	105

Reporting Limits:	10

Extractable Hydrocarbons are quantitated as Diesel Range Organics (nC12 - nC24). Surrogate recovery reported is for 2-Fluorobiphenyl.
Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID:	Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
Matrix Descript:	Soil	Received:	Dec 22, 1992
Analysis Method:	WTPH-418.1 Modified	Extracted:	Dec 29, 1992
First Sample #:	212-1101	Analyzed:	Dec 29, 1992
		Reported:	Jan 7, 1993

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (WTPH-418.1)

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
212-1101	HA-2, S-1	N.D.
BLK122992	Method Blank	N.D.

Reporting Limits: 10

Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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RZA/AGRA, Spokane	Client Project ID: Pullman Chevron, S-1070	Sampled:	Dec 18, 1992
W. 539 Sharp, Suite D	Analysis Method: EPA 7420	Received:	Dec 22, 1992
Spokane, WA 99201	Analysis for: Total Lead	Digested:	Dec 31, 1992
Attention: Gene St. Godard	First Sample #: 212-1101	Analyzed:	Jan 4, 1993
	Matrix: Soil	Reported:	Jan 7, 1993

METALS ANALYSIS FOR: Total Lead

Sample Number	Sample Description	Reporting Limit mg/kg (ppm)	Sample Result mg/kg (ppm)
212-1101	HA-2, S-1	15	N.D.
BLK123192	Method Blank	15	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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D-100

RZA/AGRA, Spokane	Client Project ID:	Pullman Chevron, S-1070		Sampled:	Dec 18, 1992
W. 539 Sharp, Suite D	Sample Descript:	Soil, HA-2, S-1		Received:	Dec 22, 1992
Spokane, WA 99201	Analysis Method:	EPA 8310		Extracted:	Dec 28, 1992
Attention: Gene St. Godard	Sample Number:	212-1101		Analyzed:	Jan 3, 1993
				Reported:	Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit μg/kg (ppb)	Sample Results μg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 65
Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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D-101

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Sample Descript: Method Blank
Analysis Method: EPA 8310
Sample Number: BLK122892

Extracted: Dec 28, 1992
Analyzed: Jan 3, 1993
Reported: Jan 7, 1993

POLYNUCLEAR AROMATIC HYDROCARBONS (EPA 8310)

Analyte	Reporting Limit µg/kg (ppb)	Sample Results µg/kg (ppb)
Acenaphthene	100	N.D.
Acenaphthylene	100	N.D.
Anthracene	100	N.D.
Benzo (a) anthracene	25	N.D.
Benzo (a) pyrene	25	N.D.
Benzo (b) fluoranthene	25	N.D.
Benzo (ghi) perylene	25	N.D.
Benzo (k) fluoranthene	25	N.D.
Chrysene	25	N.D.
Dibenzo (a,h) anthracene	25	N.D.
Fluoranthene	25	N.D.
Fluorene	100	N.D.
Indeno (1,2,3-cd) pyrene	50	N.D.
Naphthalene	100	N.D.
Phenanthrene	100	N.D.
Pyrene	50	N.D.

2-Fluorobiphenyl Surrogate Recovery, %: 62
Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: 8310
Sample Matrix : Soil
Units: µg/kg (ppb)
QC Sample #: 212-0827

Analyst: S. Kouri

Extracted: Dec 28, 1992
Analyzed: Jan 3, 1993
Reported: Jan 7, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Fluorene	Indeno(1,2,3-cd) pyrene	Chrysene
Sample Result:	N.D.	N.D.	N.D.
Spike Conc. Added:	67	33	67
Spike Result:	54	29	59
Spike % Recovery:	81%	88%	88%
Spike Dup. Result:	46	36	53
Spike Duplicate % Recovery:	69%	109%	79%
Upper Control Limit %:	125	125	125
Lower Control Limit %:	44	46	51
Relative % Difference:	16%	22%	11%
Maximum RPD:	46	42	63

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Project Manager

% Recovery: $\dfrac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}}$ x 100

Relative % Difference: $\dfrac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}}$ x 100

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D-103

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
Sample Matrix : Soil
Units: mg/kg (ppm)

Analyst: T. Fitzgibbon

Digested: Dec 31, 1992
Reported: Jan 7, 1993

METALS QUALITY CONTROL DATA REPORT

ANALYTE	Lead
EPA Method:	7420
Date Analyzed:	Jan 4, 1993
ACCURACY ASSESSMENT	
LCS Spike Conc. Added:	50
LCS Spike Result:	57
LCS Spike % Recovery:	114
Upper Control Limit:	124
Lower Control Limit:	87
Matrix Spike Sample #:	212-1082
Matrix Spike % Recovery:	120
PRECISION ASSESSMENT	
Sample #:	212-1082
Original:	N.D.
Duplicate:	N.D.
Relative % Difference:	RPD values are not reported at sample concentration levels < 10 times the Detection Limit.

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Lab Control Sample % Recovery: $\frac{\text{Conc. of L.C.S.}}{\text{L.C.S. Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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D-104

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: WTPH-418.1
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: S. Mitchell
Extracted: Dec 29, 1992
Analyzed: Dec 29, 1992
Reported: Jan 7, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Petroleum Oil
Spike Conc. Added:	174
Spike Result:	167
% Recovery:	96
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Petroleum Oil
Sample Number:	212-0835
Original Result:	15
Duplicate Result:	21
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	50

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% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$

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D-105

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: WTPH-D
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: L. Dutton
Extracted: Dec 28, 1992
Analyzed: Dec 30, 1992
Reported: Jan 7, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Diesel
Spike Conc. Added:	68
Spike Result:	72
% Recovery:	106
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT
Sample Duplicate

	Extractable Hydrocarbons
Sample Number:	212-0791
Original Result:	17,000
Duplicate Result:	15,000
Relative % Difference	6.3
Maximum RPD:	50

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% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) \ / \ 2} \times 100$

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D-106

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: WTPH-G
Sample Matrix: Soil
Units: mg/kg (ppm)

Analyst: R. Lister
K. Wilke

Analyzed: Dec 30, 1992
Reported: Jan 7, 1993

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT

Laboratory Control Sample

	Gasoline
Spike Conc. Added:	5.0
Spike Result:	4.5
% Recovery:	90
Upper Control Limit %:	120
Lower Control Limit %:	80

PRECISION ASSESSMENT

Sample Duplicate

	Volatile Hydrocarbons
Sample Number:	212-0909
Original Result:	3.2
Duplicate Result:	1.6
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	50

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

% Recovery: $$\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$$

Relative % Difference: $$\frac{\text{Original Result - Duplicate Result}}{\text{(Original Result + Duplicate Result) / 2}} \times 100$$

NORTH CREEK ANALYTICAL

18939 120th Avenue N.E., Suite 101• Bothell, WA 98011-2569
Phone (206) 481-9200 • FAX (206) 485-2992

D-107

RZA/AGRA, Spokane
W. 539 Sharp, Suite D
Spokane, WA 99201
Attention: Gene St. Godard

Client Project ID: Pullman Chevron, S-1070
EPA Method: 5030/8020
Sample Matrix: Soil
Units: mg/kg (ppm)
QC Sample #: 212-0912

Analyst: R. Lister
K. Wilke

Analyzed: Dec 30, 1992
Reported: Jan 7, 1993

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.50	0.50	0.50	1.5
Spike Result:	0.48	0.48	0.51	1.5
Spike % Recovery:	96%	96%	102%	100%
Spike Dup. Result:	0.48	0.48	0.50	1.5
Spike Duplicate % Recovery:	96%	96%	100%	100%
Upper Control Limit %:	92	94	103	95
Lower Control Limit %:	70	76	84	74
Relative % Difference:	0%	0%	2.0%	0%
Maximum RPD:	13	11	11	7.2

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

Please Note:
The Spike Percent and Spike Duplicate Percent Recoveries for Benzene, Toluene and Xylenes are outside of the NCA established control limits.

SITE CHARACTERIZATION AND WORK PLAN

FORMER DIESEL FUEL BULK FACILITY

Pullman, Washington

Prepared for

CHEVRON U.S.A., INC.

December 1992

S-1070

RZA-AGRA
Engineering & Environmental Services

AGRA
Earth & Environmental Group

Chevron

Chevron U.S.A. Products Company
2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

RECEIV
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DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

December 8, 1992

SEND VIA OVERNIGHT MAIL

Mr. Dave George
WA Department of Ecology, Eastern Region
North 4601 Monroe, Suite 100
Spokane, WA 99205-1295

Re: <u>Chevron/Washington State University site in Pullman, Washington</u>
Enclosed work plan for site investigation (RZA, 12/4/92)

Dear Dave:

I have enclosed a work plan dated December 4, 1992, which was prepared by Chevron's consultant, RZA-AGRA of Spokane (RZA), to describe the planned field activities to be performed at the subject site. RZA's proposal includes numerous soil borings, groundwater monitoring wells, and surface samples to assess the extent of hydrocarbon impacted soil and groundwater at the site. RZA will also conduct a pump test to determine whether the shallow perched water bearing zone is capable of sustaining the flow necessary for consideration of potential beneficial water usage.

Due to the time requirements of the proposed Department of Transportation bridge project, I have asked RZA to schedule the field work as soon as possible. I understand that work will begin on December 14, 1992. RZA will submit a report of the findings to Chevron, and I will forward it to the involved parties.

If you have any questions or comments, I can be reached at (510) 842-8658.

Sincerely,

Clint B. Rogers

Clint B. Rogers
Environmental Engineer

Enclosure

cc: Jim Owens, WSU, French Admin. Bldg., Room 432, Pullman, WA 99164-1045
Joe Chatterton, WA Dept. of Transportation, N. 2714 Mayfair, Spokane, WA 99207-2090
Jim Hudak, City of Pullman, P.O. Box 249, Pullman, WA 99163-0249
Celia Evans, PTI, Bellevue, WA
Jon Sondergaard, RZA-AGRA, Spokane, WA (w/o enclosure)
Dana Thurman, Chevron USA Products Company, San Ramon, CA (w/o enclosure)

RZA - AGRA
(Rittenhouse-Zeman & Associates, Inc.)
Engineering & Environmental Services

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EASTERN REGIONAL OFFICE

Georgetown Office Building
539 W Sharp, Suite D
Spokane, WA 99201
(509) 325-0104
FAX (509) 325-0212

S-1070

4 December 1992

Chevron U.S.A. Products Company
Site Assessment and Remediation Group
P.O. Box 5004
San Ramon, California 94583-0804

Attention: Mr. Clint Rogers

Subject: Site Characterization and Work Plan
Former Petroleum Bulk Storage Facility
Pullman, Washington

Mr. Rogers:

As requested, RZA AGRA, Inc. is pleased to present our proposed work plan to complete a subsurface petroleum hydrocarbon characterization at the former petroleum hydrocarbon bulk storage facility located in Pullman, Washington. This proposed work plan is based on our meeting at the site on 28 October 1992, our previous work in the area for the Washington State Department of Transportation, our telephone conversation with you and your letter dated 4 November 1992. The estimated cost to perform this work is presented under separate cover.

We appreciate the opportunity to be of continuing service to Chevron. Should you have any questions regarding this work plan, please call us at your earliest convenience.

Respectfully submitted,
RZA AGRA, Inc.

Jon N. Sondergaard, P.G.. R.E.A.
Associate

AGRA
Earth & Environmental Group

Site Characterization and Work Plan

CHEVRON PRODUCTS CO., INC.
Former Petroleum Bulk Storage Facility
Pullman, Washington

Prepared for

Chevron Products Co., Inc.
P.O. Box 5004
San Ramon, CA 94583-0804

RZA AGRA, Inc.
W. 539 Sharp Avenue, Suite D
Spokane, Washington 99201

4 Decmeber 1992

S-1070

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TABLE OF CONTENTS
S-1070

SITE CHARACTERIZATION WORK PLAN S-1070
FORMER PETROLEUM HYDROCARBON BULK STORAGE FACILITY
PULLMAN, WASHINGTON

1.0 INTRODUCTION

During geotechnical assessment for replacement of the existing State Highway 270 bridge in Pullman, Washington in August 1991, the Washington State Department of Transportation (WSDOT) encountered indications of petroleum hydrocarbon containing soils and groundwater within the project right-of-way. Subsequent investigations into the historic use of the site identified the location of a former petroleum hydrocarbon bulk storage facility on and bordering the northeast portion of the highway right-of-way. Soil and groundwater sampling and analysis confirmed the existence of petroleum hydrocarbons in the soil and groundwater in one boring (B-7) located on the bulk storage facility and several other explorations or wells (TP-9, B-9, MW-1 and MW-2) located on adjacent railroad property.

The former bulk storage facility was previously owned by Chevron U.S.A. Products Company and existed on the property from at least 1920 to its dismantling in about 1981. In 1981, Chevron donated the property to Washington State University (WSU) who currently uses the site to store excess coal used at the nearby power plant. Records also indicate the site contained an underground storage tank, used to store petroleum hydrocarbons, which was located along the west central border of the property and was recently removed. Current site operations over the former UST location also include storage of diesel fuel in an above ground tank.

The purpose of this work plan is to present a method and scheme for providing further subsurface characterization of the former petroleum hydrocarbon bulk storage facility. The work plan presents proposed methods for soil sampling, groundwater monitoring well installation, soil and groundwater analysis and developing health and safety procedures.

2.0 PROPOSED SCOPE OF WORK

The proposed scope of work for completing a subsurface petroleum hydrocarbon characterization of the subject property consists of the following:

1) Drilling and soil sampling a total of 11 borings on and around the property. The subsurface explorations would consist of 6 machine augered soil borings, 3 machine augered borings finished as groundwater monitoring wells, and 2 hand augered soil borings;

2) Collecting two surficial soil samples, one to characterize for possible recent releases of diesel fuel and one to characterize the abundant coal dust spread across the site;

3) Performing a limited aquifer pump test on the new groundwater monitoring well installed on the site;

4) Measuring the vertical location of the new groundwater monitoring wells and fluid levels in all monitoring wells located on and around the property;

5) Submitting selected representative soil samples collected from the subsurface explorations to an analytical laboratory for quantification of total petroleum hydrocarbons (gasoline and diesel), volatile aromatic hydrocarbons specific to petroleum fuels (BTEX), total recoverable hydrocarbons, polynuclear aromatic hydrocarbons and total lead;

6) Submitting groundwater samples collected from the new and existing monitoring wells and submitting the water samples to an analytical laboratory for quantification of total petroleum hydrocarbons (gasoline and diesel), volatile aromatic hydrocarbons specific to petroleum fuels (BTEX), total recoverable hydrocarbons, polynuclear aromatic hydrocarbons and total dissolved lead. In addition, a water sample collected during the limited pump test would be analyzed for BTEX, total oil and grease and total dissolved solids;

7) Preparing a summary report of the site characterization including: a site plan showing approximate well, boring and sampling locations; soil logs of all subsurface explorations; as-built diagrams of groundwater monitoring wells; analytical test results; results of the limited pump test; a plan showing inferred groundwater elevation contours; and conclusions.

3.0 SUBSURFACE EXPLORATION METHODS

3.1 Machine Auger Drilling

Nine of the 11 total proposed subsurface explorations will be completed using a truck-mounted drill rig at the approximate soil boring and monitoring well locations shown on Figure 1. As shown on Figure 1, the exploration locations would be placed spatially to obtain subsurface information on soils over a wide area of the property and also target specific locations of interest, ie; the truck trailer loading rack (TTLR), underground fuel oil storage tank and pipeline valve station . Three of the soil borings would be completed as groundwater monitoring wells with one well located near the former pipeline valve station and two wells located hydrologically downgradient and offsite to the west of the former bulk storage facility (Figure 1). The soil borings would be generally drilled to the top of the underlying basalt bedrock which typically occurs at a depth of about 15 feet below the existing ground surface in the area of the site.

The drill rig will advance a nominal 6-inch inside diameter hollow stem auger into the subsurface for the purpose of collecting representative soil samples and installing groundwater monitoring wells at selected locations. Soil samples will be collected at a depth interval of about every 2 1/2 to 5 feet using the Standard Penetration Test procedure which uses a 2-inch diameter steel split barrel to collect soil samples. The 18-inch long split barrel sampler is driven into undisturbed soil below the auger bit with a 140 pound hammer dropped a distance of approximately 36 inches. Blow counts are recorded for every 6-inch depth interval and refusal to sampling is reached if the blow count for any 6 inch interval exceeds 50 blows. Soil samples retrieved from the sampler will be logged in the field by a geologist from RZA AGRA, placed in laboratory prepared glass jars fitted with teflon lid liners and an aluminum foil covers and measured in the field for organic vapors in the headspace of the jar. The field headspace measurement will consist of vigorously shaking the sample for approximately 15 seconds, plunging the probe of a portable 10.2 EV organic vapor meter (OVM) through the foil liner and recording the highest measurement registered by the OVM. Upon completion of the field headspace measurements, the jars will be placed in a chilled cooler for transportation to the laboratory under standard RZA AGRA chain-of-custody procedures (see Figure 2).

Soil debris removed from the boreholes will be segregated by boring and collected in secured and labeled steel drums. The results of the analytical testing on the soil samples collected from each boring will be used to characterize soil cuttings for disposal. Soil debris from borings exhibiting analyte concentrations below MTCA Method A Numeric Clean-up criteria will be disposed of by spreading on-site in an area away from traffic. Soil debris from borings which exhibit analyte concentrations above MTCA Method A Numeric clean-up criteria will be stored on-site until a suitable method of disposal is chosen.

3.2 Monitoring Well Construction

Groundwater monitoring wells installed in three of the soil borings would be constructed in accordance with the Minimum Standards for the Construction and Maintenance of Wells (WAC 173-160 Part III). A typical monitoring well construction configuration is shown on Figure 3. We anticipate the wells would be completed to depths of about 15 feet below the existing ground surface and constructed of 2-inch diameter, Schedule 40 PVC plastic pipe. The screened section would consist of 10 feet of machine slotted PVC well screen with a 0.010 inch slot size fitted with a 6-inch, threaded bottom plug. The riser would consist of approximately 7 feet of solid, threaded PVC pipe allowing for about two feet of riser stick-up above the existing ground surface. A sand pack consisting of 10-20 silica sand would be placed in the annulus of the well as the auger is withdrawn to a depth of about 2 feet above the top of the PVC screen. The remainder of the annulus would be filled with cement/bentonite surface seal to the ground surface. The wellhead would be protected by an 8-inch diameter locking steel casing and three vertically installed concrete-filled steel pipes surrounded by a 2 feet square concrete pad. Well identification would be recorded on the inside of the PVC slip cap and on the outside of the protective steel casing.

3.3 Hand Auger Borings

Due to difficulty accessing the elevated area behind the retaining wall where the above ground tanks were formerly located, two of the proposed borings will be accomplished using hand methods. The hand auger borings would be advanced at the approximate locations shown on Figure 1 using an approximately 3-inch diameter stainless steel hand auger. Soil samples would be collected from the auger bucket at a depth interval of about every 3 feet. Soil samples collected from the hand auger borings would be handled as described in Section 2.1 above. Upon completion, the hand borings would be backfilled with auger cuttings derived from the boring. Should subsurface conditions prevent the advancement of hand auger borings, Chevron would be notified as soon as possible and soil samples from this area will be recovered by other hand methods, which could include shovel excavation. Hand shovel excavation may limit sampling to the upper 2 feet of soil.

3.4 Surficial Soil Samples

Three surficial soil samples will be collected at the approximate locations shown on Figure 1 to evaluate the condition of: coal dust which covers much of the site; incinerated coal ash occasionally temporarily stored on-site and; soils located beneath the existing above ground diesel fuel storage tank. The samples will be collected from the upper 6 to 12 inches of soil and coal dust/ash using stainless steel hand tools. Upon collection, the samples will be handled as described in Section 3.1 above.

4.0 GROUNDWATER MEASURING AND SAMPLING

Fluid level measurements and groundwater samples will be collected from each of the 3 new monitoring wells and the five (MW-1 though MW-5) previously installed monitoring wells located within the Washington State Department of Transportation's (WSDOT) right-of-way for the bridge 270 replacement project.

The vertical elevation for the top-of-casing for the new monitoring wells will be measured using optical differential levelling techniques to an accuracy of 0.01 feet using existing well MW-1 as a datum. The vertical and horizontal location of well MW-1 was previously surveyed by WSDOT personnel. Fluid level measurements for each well will be collected using aMMC Model D-2401 Interface Probe accurate to 0.01 feet.

Groundwater samples will be collected following standard Chevron protocol which includes: 1) purging a minimum of three casing volumes from the well using a clean disposable bailer and; 2) collecting a water sample from the well using a clean disposable bailer after the water level has recovered to within 60 percent of static.

5.0 DECONTAMINATION PROCEDURES

In order to minimize the risk of cross contamination between boreholes and sample intervals, the following decontamination procedures would be implemented: 1) all samples would be collected and stored in laboratory prepared glass containers; 2) the drill rig and sampling equipment would be decontaminated by steam cleaning prior to arriving at the site, between each boring location and prior to leaving the site; 3) soil sampling tubes would be steam cleaned between each boring location and decontaminated by rinsing with potable water, washing with Liquinox detergent and rinsing with deionized water between each sample interval; 4) all hand tools would be rinsed in potable water, washed in Liquinox detergent and rinsed in deionized water between each sampling location; 5) all steam cleaning effluent and rinse water would be trapped following decontamination procedures, pumped to 55 gallon steel drums and treated thru granular activated carbon (GAC) prior to disposal to the city sewer system.

6.0 ANALYTICAL TESTING

Selected representative soil samples collected from the borings and groundwater samples collected from the monitoring wells will be submitted to a Chevron approved laboratory for analysis. The soil samples selected for analysis will be chosen based on the field headspace measurements, location with respect to the groundwater table, and obvious indications of petroleum hydrocarbons such as odor, sheen or discoloration. One soil sample from each drilling and sampling location and one groundwater sample from each of the new and existing monitoring wells will be submitted for analysis. A schedule of laboratory analyses is attached as Table 1.

Soil and water samples submitted to the laboratory will be analyzed for the following: total petroleum hydrocarbons gasoline and diesel using the Washington WTPH-G and WTPH-D methods; total recoverable hydrocarbons (TRH) using the WTPH-418.1 method; benzene, toluene, ethyl benzene and xylenes (BTEX) using EPA Method 8020 and 602; polynuclear aromatic hydrocarbons (PAH) using EPA Method 8310 and 610 and; dissolved lead in groundwater using EPA Method 7421/3010.

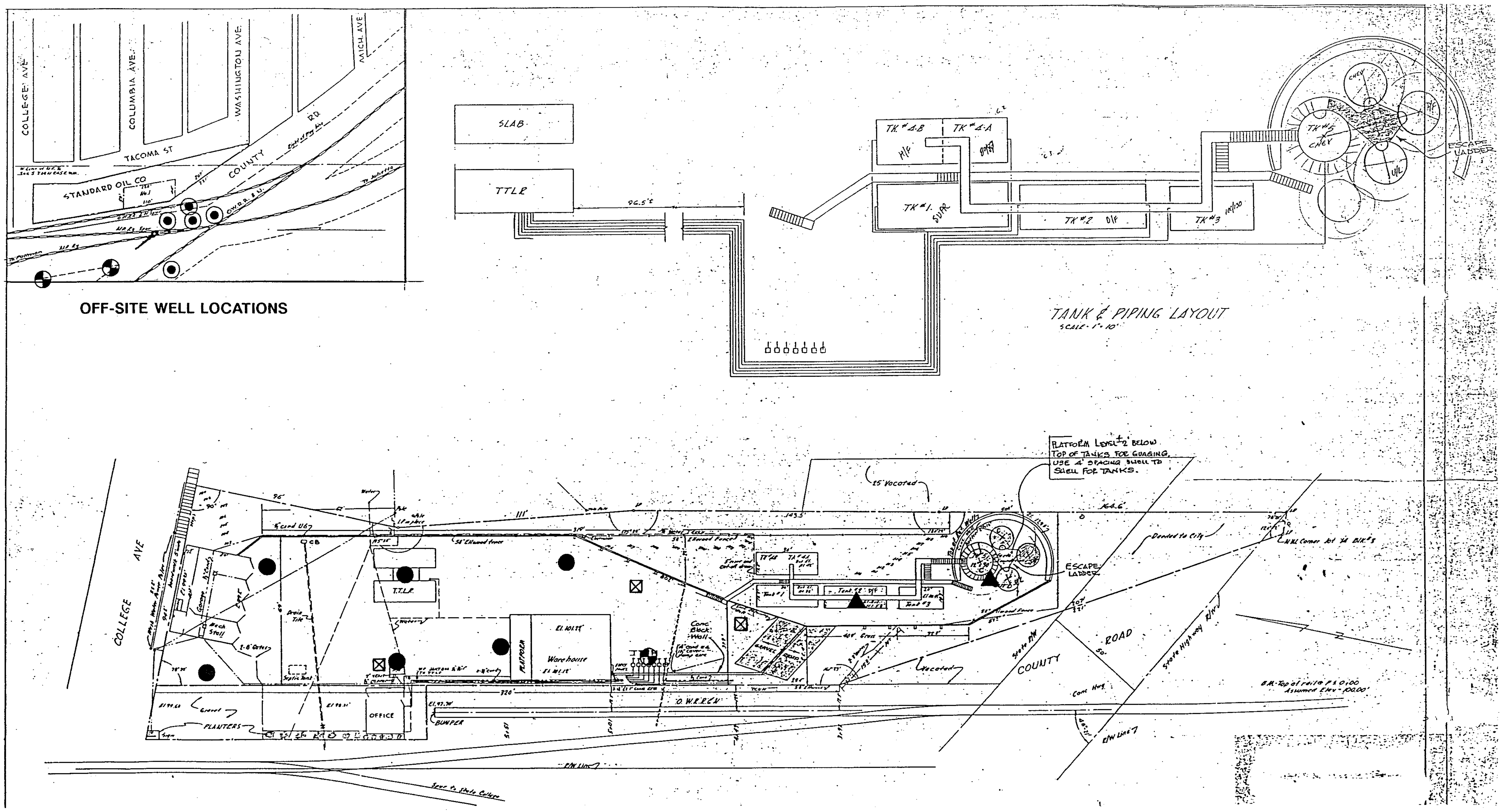
The surficial sample of coal dust will be analyzed for TRH using the Washington WTPH-418.1 Method, diesel hydrocarbons using Washignton WTPH-D method and gasoline hydrocarbons ((including; BTEX) using Washington WTPH-G method. The surficial sample collected near the above ground storage tank will be analyzed for diesel hydrocarbons using the WTPH-D method. The surficial sample of incinerated coal ash will be analyzed for priority pollutant metals (total concentrations of Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Ti and Zn) using EPA Method 6010 and leachable concentrations of the metals As, Ba, Cd, Pb, Hg, Se, and Ag using the EPA Toxicity Characteristic Leading Potential (TCLP) method 6010/7470.

All samples submitted to the laboratory will be accompanied by a chain of custody form (Figure 2) and preserved by storage and transport in a chilled cooler. In addition to the standard laboratory quality control analyses, one trip blank per sample set will accompany the laboratory prepared sample containers.

7.0 LIMITED PUMP TEST

Upon completion and development of the on-site groundwater monitoring well, a limited pump test would be performed on this well to quantify the yield of the shallow aquifer. The testing procedure would involve pumping the well at a constant rate of approximately 0.5 gallons per minute (gpm) while recording drawdown in the pump well and nearby, existing groundwater monitoring wells. The pump test would be conducted at the constant rate of withdrawal until the well could no longer sustain the 0.5 gpm pumping rate or until such time as the aquifer drawdown stabilizes and the sustained yield is judged to be sufficient for domestic water supply use.

The pump test procedure would involve using a Grundfos Rediflo 2 stainless steel pump to remove groundwater from the well. A Hermit Model SE100B data logger would be utilized to collect continous water level information from the well. Discharge from the well would be would be pumped through two granulated activated carbon (GAC) filtration units connected in series to remove dissolved petroleum hydrocarbons prior to disposal into the city sewer system under a minor discharge authorization from the City of Pullman. A sample of effluent from the limited pump test would be collected from the GAC canister discharge prior to



EXPLANATION

- ● PROPOSED SOIL BORING LOCATION
- ⊕ PROPOSED MONITORING WELL LOCATION
- ◉ APPROXIMATE LOCATION OF EXISTING MONITORING WELL
- ▲ PROPOSED HAND AUGER LOCATION
- ☒ PROPOSED SURFICIAL SAMPLE LOCATION

* BASED ON CHEVRON U.S.A. GROUND PLAN DATED 11/27/20 AND REVISED 11/75

RZA AGRA, INC.
Engineering & Environmental Services
Georgetown Office Building
539 West Sharp
Suite D
Spokane, WA 99201

W.O. S-1070
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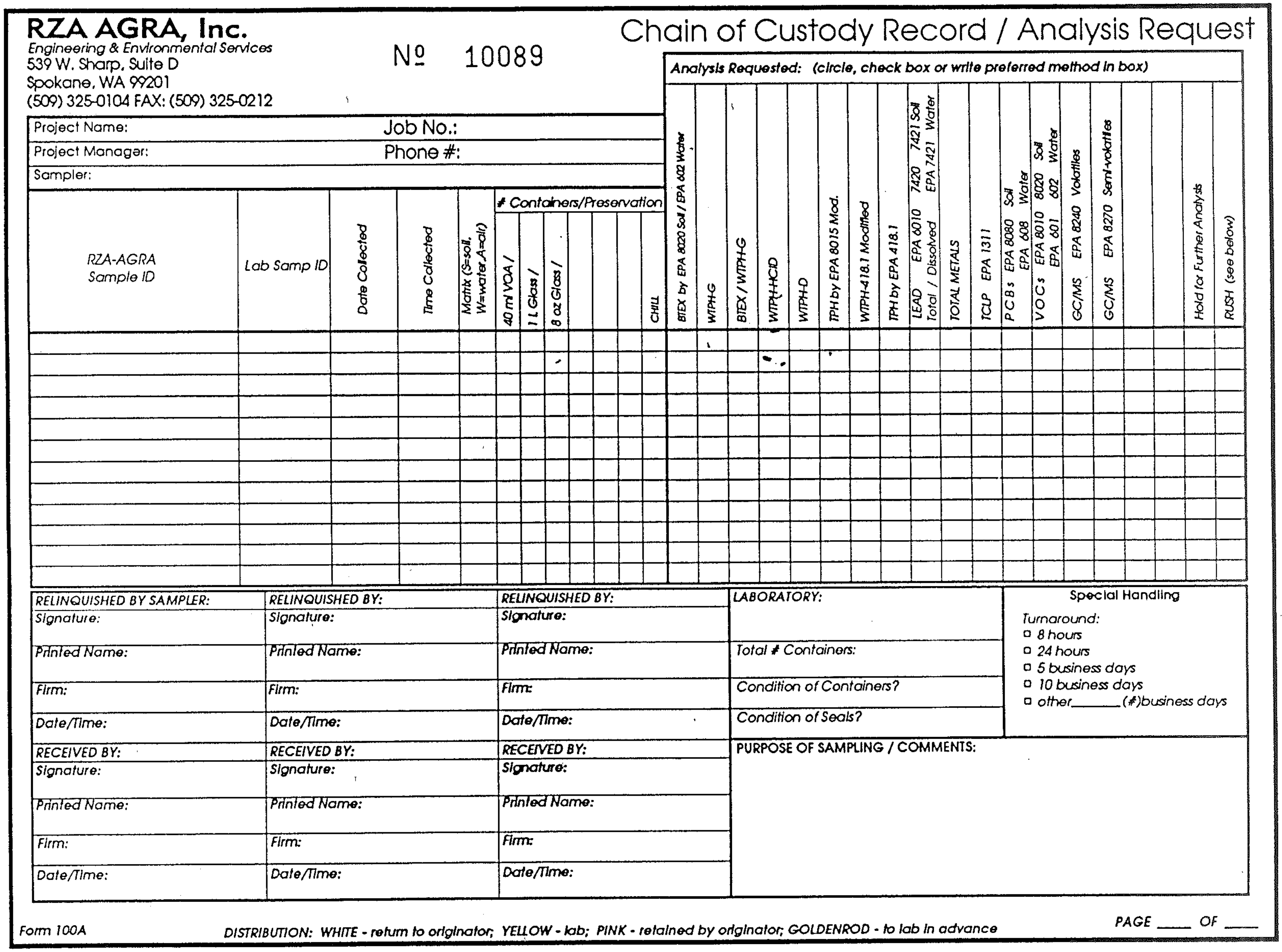
DATE NOV 1992
SCALE APPROX. 1"=50'

PROPOSED EXPLORATION LOCATIONS

FIGURE 1

152284

GENDRON'S



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Engineering & Environmental Services
539 W. Sharp, Suite D
Spokane, WA 99201
(509) 325-0104 FAX: (509) 325-0212

№ 10089

Chain of Custody Record / Analysis Request

Project Name: Job No.:
Project Manager: Phone #:
Sampler:

Analysis Requested: (circle, check box or write preferred method in box)

RZA-AGRA Sample ID	Lab Samp ID	Date Collected	Time Collected	Matrix (S=soil, W=water A=air)	# Containers/Preservation 40 ml VOA /	1 L Glass /	8 oz Glass /				CHILL	BTEX by EPA 8020 Soil / EPA 602 Water	WTPH-G	BTEX / WTPH-G	WTPH-HCID	WTPH-D	TPH by EPA 8015 Mod.	WTPH-418.1 Modified	TPH by EPA 418.1	LEAD EPA 6010 7420 7421 Soil Total / Dissolved EPA 7421 Water	TOTAL METALS	TCLP EPA 1311	PCBs EPA 8080 Soil EPA 608 Water	VOCs EPA 8010 8020 Soil EPA 601 602 Water	GC/MS EPA 8240 Volatiles	GC/MS EPA 8270 Semi-volatiles			Hold for Further Analysis	RUSH (see below)

RELINQUISHED BY SAMPLER:	*RELINQUISHED BY:*	*RELINQUISHED BY:*	*LABORATORY:*
Signature:	*Signature:*	*Signature:*	
Printed Name:	*Printed Name:*	*Printed Name:*	*Total # Containers:*
Firm:	*Firm:*	*Firm:*	*Condition of Containers?*
Date/Time:	*Date/Time:*	*Date/Time:*	*Condition of Seals?*
RECEIVED BY:	*RECEIVED BY:*	*RECEIVED BY:*	**PURPOSE OF SAMPLING / COMMENTS:**
Signature:	*Signature:*	*Signature:*	
Printed Name:	*Printed Name:*	*Printed Name:*	
Firm:	*Firm:*	*Firm:*	
Date/Time:	*Date/Time:*	*Date/Time:*	

Special Handling

Turnaround:
- ☐ *8 hours*
- ☐ *24 hours*
- ☐ *5 business days*
- ☐ *10 business days*
- ☐ *other______(#)business days*

Form 100A *DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator; GOLDENROD - to lab in advance* PAGE ____ OF ____

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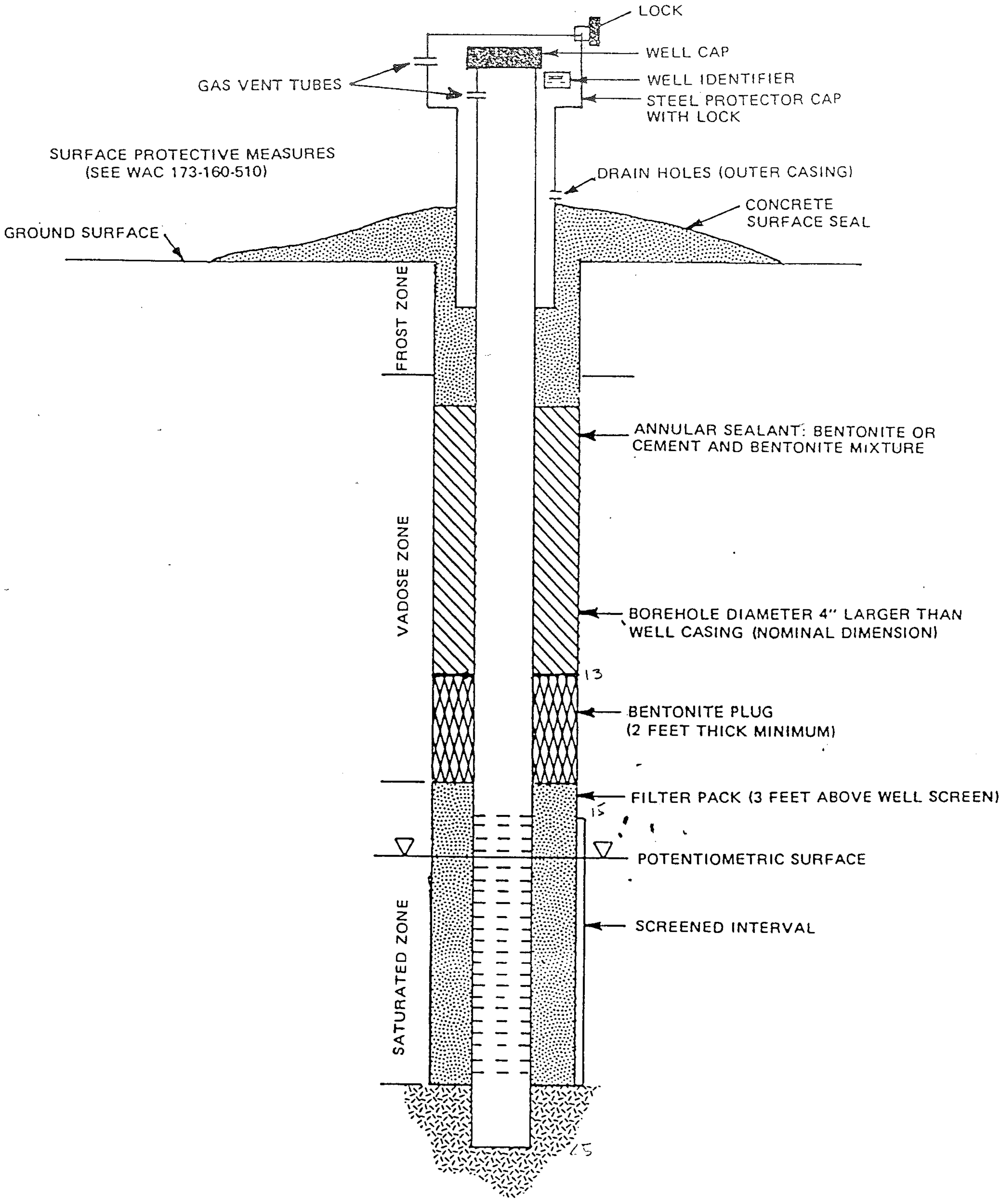
DATE NOV 1992
SCALE

CHAIN OF CUSTODY FORM

FIGURE 2

152283
GENDRON'S



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SCALE	NTS

TYPICAL MONITORING WELL CONSTRUCTION

FIGURE 3

S-1070

TABLE 1. SCHEDULE OF LABORATORY ANALYSES

Exploration	Quantity	Analyses
Soil Borings (Machine)	9	WTPH-G and EPA-8020
	9	WTPH-D
	9	WTPH-418.1
	9	EPA 8310 (PAH)
	9	EPA 7421 (Total Lead)
Soil Borings (Hand)	2	WTPH-G and EPA 8020
	2	WTPH-D
	2	WTPH-418.1
	2	EPA 8310 (PAH)
	2	EPA 7421 (Total Lead)
	1	WTPH-G
Surface Samples	1	WTPH-418.1
	2	WTPH-D
	1	EPA 6010 (Total Lead)
	1	TCLP Metals
Groundwater	8	WTPH-G and EPA 8020
	8	WTPH-D
	8	WTPH-418.1
	3	EPA 8310 (PAH)
	8	EPA 7421 (Dissolved Lead)
Pump Test Effluent	1	EPA 8020 (24 hr)
	1	EPA 413.1 (24 hr)
	1	SW 846-160 (Total
Suspended Solids)		

LEVEL II ENVIRONMENTAL SITE ASSESSMENT

BNRR OVERCROSSING BIDGE 270/4 REPLACEMENT

Pullman, Washington

Prepared for

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

June 1992

S-1023

RZA-AGRA
Engineering & Environmental Services

AGRA
Earth & Environmental Group

RZA - AGRA

Engineering & Environmental Services

26 June 1992

S-1023

Washington State Department of Transportation
P.O. Box 167
Olympia, Washington

Attention: Mr. Todd Harrison, P.E.

Subject: Level II Environmental Site Assessment
BNRR Overcrossing
Bridge No. 270/4 Replacement
Pullman, Washington

Mr. Harrison;

RZA AGRA, Inc. is pleased to present the results of our Level II Environmental Site and Hazardous Waste Assessment for the above referenced site. This work has been performed and was approved under Consultant Agreement Y-4771, Task Assignment 8 dated November 20 1991.

We appreciate the opportunity to be of continuing service to the Washington State Department of Transportation. Should you have any questions regarding this report or other aspects of the project, please call us at your earliest convenience.

Respectfully submitted,
RZA AGRA, Inc.

Jon N. Sondergaard, P.G., R.E.A.
Associate

LEVEL II ENVIRONMENTAL SITE ASSESSMENT

BNRR Overcrossing Bridge 270/4 Replacement
Pullman, Washington

Prepared for

Washington State Department of Transportation
P.O. Box 167
Olympia, Washington 98504

RZA - AGRA
W. 539 Sharp Avenue, Suite D
Spokane, Washington 99201

26 June 1992

S-1023

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TABLE OF CONTENTS

S-1023

CONTINUED, TABLE OF CONTENTS

S-1023

1.0 SUMMARY LEVEL II SITE ASSESSMENT

RZA AGRA, Inc. performed a Level II Environmental Site Assessment for the Washington State Department of Transportation (WSDOT) on the subject property located beneath Bridge 270/4 in Pullman, Washington which overcrosses the Burlington Northern Railroad (BNRR). The purpose of the assessment was to: 1) characterize the subsurface at the site for the presence of fugitive petroleum hydrocarbons associated with a former bulk storage facility which existed on the site; 2) perform various field test procedures which provide information concerning several soil and groundwater remediation alternatives and 3) evaluate the various possible remediation alternatives with respect to feasibility, performance and cost. The following summary presents the key findings of this assessment. Additional background information and analyses are described subsequently in the text of this report.

- The soils at the site consist of sandy, gravelly, FILL with coal fragments over soft to stiff, SILT over loose to dense sandy angular GRAVEL over basalt bedrock;

- Groundwater was encountered at a depth of between approximately 6 to 8 feet below the existing ground surface. The shallow groundwater migrates to the west-northwest under a gradient of about 0.013 ft/ft;

- The alluvial SILT soils encountered in the vicinity of explorations B-7, MW-1, MW-2, B-4, TP-3, TP-9, MW-5 and B-9 contain TPH and scattered BTEX concentrations in excess of MTCA Method A Compliance Clean-up Levels (CCL's). Estimates of total volume of impacted soil range from 5,000 to 6,500 cubic yards within the highway right-of-way;

- Groundwater samples collected from monitoring wells MW-1 and MW-2 exhibited BTEX concentrations in excess of MTCA Method A CCL's. Water from well MW-1 also exhibited an elevated TPH concentration;

- o An evaluation of possible remedial alternatives suggest that excavation with off-site disposal or incineration or on-site treatment is the most feasible and cost effective treatment option for soils. An evaluation of groundwater treatment alternatives indicates a pump and treat system using air stripping, air sparging or GAC filtration would be the most effective groundwater treatment option. Due to site hydrogeology, groundwater treatment is expected to require a time frame of years to complete.

This summary is presented for introductory purposes and should only be used in conjunction with the full text of this report. The project description, site conditions, analytical test results, interpretations and evaluations are presented below. The exploration procedures and borings logs are presented in Appendix A, analytical test procedures and certificates in Appendix B, discharge permits in Appendix C and pump test data in Appendix C.

2.0 INTRODUCTION

The project site is located in the southwest 1/4 of the northwest 1/4 of Section 5, Township 14 North, Range 45 East in Pullman, Washington. The approximate location of the site is presented in Figure 1, the Site Vicinity Map. The subject property is bordered on the north by College Street, on the west by Spring Street, on the south by open land used for campus parking and on the east by the Tacoma Street embankment and east abutment for the Highway 270 bridge.

During the course of performing a Subsurface Exploration and Geotechnical Engineering study for replacement of the existing bridge (RZA AGRA, Inc. report to WSDOT entitled "Subsurface Exploration and Geotechnical Engineering Report", S-1008 dated September 1991), field explorations observed and logged by RZA AGRA personnel encountered soils exhibiting indications of petroleum hydrocarbon contamination. Field indications of the contamination were sheens observed on the surface of the soil samples, odors emanating from the soils and elevated organic vapor measurements. Subsequent quantitative analysis of soil samples collected from the test pit (TP-9) which exhibited obvious indications of fugitive petroleum hydrocarbons confirmed the presence petroleum hydrocarbons. These analysis exhibited total petroleum hydrocarbon (TPH) concentrations of 533 parts per million (ppm) and 1,129 ppm and a benzene concentration of 5.35 ppm, which are above the state Model Toxics Control Act (MTCA) Method A Compliance Cleanup Levels (CCL) for hydrocarbons in soil.

Based on the results of the preliminary field and laboratory testing accomplished during the geotechncial design study, WSDOT contracted with RZA AGRA, Inc. to perform a Level I Environmental Site Assessment of the subject site. The results of the Level I assessment are presented to WSDOT in our report entitled "Level I Environmental Site Assessment" (S-1023) dated 26 June 1992. The Level I assessment identified the subject property as formerly being the site of a petroleum hydrocarbon bulk storage facility between the years 1913 to 1980. In conjunction with the Level I assessment, RZA AGRA commenced a Level II Environmental Site Assessment since soil contamination was previously confirmed during the geotechnical design study. The area of study for the Level II Environmental Site Assessment was limited to property occurring within the right-of-way of State Highway 270 and the new bridge replacement.

3.0 RESULTS OF THE ASSESSMENT

3.1 Subsurface Characterization

The exploration program designed to characterize the subsurface conditions at the site with respect to potential contamination involved the completion of eight soil borings on 26 and 27 March 1992. Five of the soil borings were completed as groundwater monitoring wells (MW-1 through MW-5) while the remaining three borings (B-7, B-8 and B-9) were backfilled according to Washington State Department of Ecology (Ecology) guidelines. In addition to these borings, subsurface information for geologic characterization was available from the explorations previously completed for the geotechnical design study (B-1 through B-6 and TP-1 through TP-9). The approximate locations of all subsurface explorations completed on the site are presented on the Site and Exploration Plan, Figure 2. Discussion of the drilling procedures and logs of the soil borings and monitoring well as-built diagrams for the explorations completed as part of the Level II assessment are presented in Appendix A.

Subsurface soils beneath the site typically consist of the following: 1 to 7 feet of soil, debris and coal FILL over; 2 to 11 feet of soft to stiff, moist to saturated, brown to black, clayey SILT over; 1 to 3 feet of loose to dense, saturated, gray to brown, sandy, angular basalt GRAVEL over; basalt BEDROCK. Typically, basalt bedrock was encountered at a depth ranging from 12 to 15 feet below the existing ground surface. An interpretive geologic profile of the subsurface stratigraphy is presented in Figure 3.

At the time of drilling, groundwater was generally encountered at a depth ranging between 2 and 8 feet below the existing ground surface. Installation of monitoring wells MW-1 through MW-5 allowed measurement of the static groundwater level in the wells after completion of drilling operations. Table 1 presents a summary of well construction, measuring point and groundwater elevations for the installed monitoring wells. Horizontal and vertical survey of the well locations was performed by personnel from the Washington State Department of Transportation. Approximately four weeks after drilling and well installation activities, the static water levels measured in the monitoring wells ranged from approximately 6.1 to 8.4 feet below the top of the PVC well casings. Figure 4 presents an estimation of the groundwater surface contour and flow direction based on the geometry of the static water level elevation data. Based on this interpretation, the shallow groundwater beneath the site migrates to the west/northwest under a gradient of 0.0126 ft/ft.

3.2 Petroleum Hydrocarbon Occurrence

3.2.1 Soils

The presence of petroleum hydrocarbons in the subsurface soils was evaluated by: 1) observing collected soil samples and drill cuttings for discoloration, sheen or petroleum hydrocarbon odor; 2) performing headspace measurements using a portable photoionization detector on sample jars containing collected soil samples and; 3) submitting selected soil samples to the laboratory for quanitification of total petroleum hydrocarbons (TPH), selected volatile aromatic hydrocarbons common to fuel products (benzene, toluene, ethyl benzene and xylenes or BTEX) and total lead.

Table 2 presents a summary of head space measurements for volatile organic vapors collected from soil samples retrieved from the subsurface explorations. The field headspace measurement procedure is described in Appendix A. The portable photoionization detector used for the head space measurements can detect a wide range of organic compounds, including many associated with petroleum hydrocarbon fuel products, but cannot speciate between different organic compounds. The headspace measurement method is used as a screening technique to determine qualitatively if volatile organics are present with a soil sample and as one criteria for identifying which samples should be sent to the laboratory for further analysis. For the samples collected during the environmental assessment phase of the project, soils retrieved from borings MW-3, MW-4 AND B-8 exhibited no detectable organic vapors using the headspace method. In the other environmental borings, detectable headspace measurements on soil samples ranged from 30 ppm to 600 ppm. The highest and most continuous headspace detections were exhibited by soil samples collected from borings MW-1 and B-7, which exhibited measurements ranging from 198 ppm to 600 ppm. Soil samples collected from boring MW-2 exhibited headspace measurements ranging form 35 ppm to 112 ppm. In addition to the environmental borings, soil samples collected from geotechnical explorations TP-3, TP-9, B-3 and B-4 exhibited detectable organic vapor headspace measurements.

Based on the results of visual and olfactory sensing, organic vapor headspace measurements and position with respect to the groundwater table, selected representative soil samples were submitted to Precision Analytics, Inc. of Pullman, Washington for further testing. Submitted soil samples were analyzed for TPH using the Washington State Hydrocarbon Identification (HCID) screening test and the WTPH-D analysis for diesel fuel, BTEX using EPA Method 8020 and total lead using EPA Method 7420. Table 3 presents a summary of the analytical test results on soil and descriptions of the analytical procedures and laboratory test certificates are presented in Appendix A.

Figure 3 presents an estimate of the subsurface limits of petroleum hydrocarbons in soil based on the results of field observations and measurements and laboratory testing. The fill soils which overlie the native silts, may or may not contain petroleum hydrocarbons depending upon whether these soils have been placed or disturbed since the fuel handling facility was decommissioned. Field headspace measurements appear to indicate that petroleum hydrocarbons are present in the fill soils located in the vicinity of explorations MW-1, B-3 and B-7.

The native silt soil which underlies the fill contains detectable petroleum hydrocarbons throughout its thickness, in the area around explorations MW-1, B-4, B-7, TP-3 and TP-9. The highest concentrations are likely located within the zone of seasonal groundwater fluctuations. Evidence for the presence of petroleum hydrocarbons in the native silts occurs as noticeable dark gray to black staining and discoloration of the soil, obvious petroleum hydrocarbon sheen and odor, the organic vapor headspace measurements and analytical test results.

The more granular sandy, angular basalt gravel which underlies the silt and directly overlies bedrock typically did not exhibit obvious staining, discoloration or odors, except at the location of boring MW-1. Quantitative analytical testing of three soil samples collected from this horizon (MW-2,S-5, B-8,S-3 and B-9,S-3) exhibited no detectable concentrations of TPH or BTEX.

Soil samples were also analyzed for total lead, which is sometimes released to the subsurface from spills of leaded gasoline. Total lead concentrations varied between approximately 19 and 53 ppm. These concentrations are well below the MTCA Method A CCL for lead in soil of 250 ppm.

Based on the field observations and measurements and laboratory analyses, in our opinion, the fill and native silt soils in the vicinity of the former bulk storage facility are the soils most likely to contain petroleum hydrocarbons at concentrations requiring remediation or special handling. Figure 5 presents the estimated limits of petroleum hydrocarbons in soil. As evident from Figure 5, the most likely locations to encounter petroleum hydrocarbon contaminated soil would be in excavations accomplished near or beneath the north half of the east abutment for the new bridge. Although no subsurface explorations were accomplished east of B-7 and B-4, this area is included within the estimated limits of contamination because fuel storage tanks and handling operations formerly occurred on that portion of the property. Based on the estimated limits shown on Figure 5 and an estimated average impacted soil thickness of 10 feet, we approximate the total volume of petroleum hydrocarbon contaminated soil within the highway right-of-way to be about 5,000 to 6,500 cubic yards (8,100 to 10,500 tons). We assume to the highway right-of-way corresponds to the proposed toe of fill line depicted on site drawings.

3.2.2 Groundwater

Groundwater samples were collected from monitoring wells MW-1 through MW-5 on 28 March 1992. The water samples were submitted to Precision Analytics, Inc. of Pullman, Washington for quantification of petroleum hydrocarbons and total lead. The water samples were analyzed for total petroleum hydrocarbons using the Washington State HCID method, total recoverable hydrocarbons using EPA Method 418.1, BTEX using EPA Method 8020 and total lead using EPA Method 7421. A summary of analytical test results on groundwater is presented in Table 3, sampling procedures are described in Appendix A and laboratory test certificates are presented in Appendix B.

Groundwater samples collected from wells MW-3, MW-4 and MW-5 exhibited no detectable concentrations of BTEX nor TPH by either the HCID or EPA 418.1 test methods. Petroleum hydrocarbon concentrations above method detection limits were exhibited by groundwater samples collected from wells MW-1 and MW-2. Groundwater collected from well MW-1 exhibited detectable concentrations of TPH-D (49.8 ppm), benzene (0.169 ppm), toluene (0.027 ppm), ethyl benzene (0.462 ppm) and xylenes (0.048 ppm). All analyte concentrations in the sample collected from well MW-1 except that for toluene are above MTCA CCLs for these compounds in groundwater. Groundwater collected from well MW-2 exhibited detectable concentrations of benzene (0.95 ppm), toluene (0.024 ppm), ethyl benzene (0.025 ppm) and xylenes (0.005 ppm). Only the benzene concentration in the sample collected from well MW-2 exceeds the MTCA CCL for groundwater. Figure 6 presents the distribution of benzene concentrations detected in groundwater samples collected from the site monitoring wells.

Groundwater samples collected from the site monitoring wells were also analyzed for total lead. Total lead concentrations in the groundwater samples ranged from 0.12 to 0.323 ppm which is above the MTCA Method A CCL of 0.005 ppm. However, all groundwater samples collected exhibited total lead concentrations above the MTCA CCL and there appears to be no correlation between the petroleum hydrocarbon soil contamination and the total lead concentrations in water. In our opinion, the total lead concentrations exhibited by the groundwater samples are probably indicative of high sediment content in the water samples due to the fine grained nature of the formation soils and may represent natural background concentrations of lead.

Based on the previously determined groundwater flow direction, well MW-2 is located directly down gradient from well MW-1, which contains the highest detected petroleum hydrocarbon concentrations. The other monitoring wells are located cross gradient from the source area and from well MW-1. Benzene is the most soluble and mobile of the four volatile aromatic hydrocarbon analytes and apparently has migrated farthest from the source area. It is possible that detectable petroleum hydrocarbons exist in shallow groundwater farther to the west/northwest of well MW-2. However, the rapid decrease in BTEX concentrations away from the source area suggests that, with the possible exception of benzene, dissolved aromatic hydrocarbon concentrations in groundwater farther downgradient are likely below MTCA CCLs. The preliminary conclusions presented above are based on one sampling event and should be confirmed with future additional groundwater monitoring to confirm seasonal water table fluctuations, groundwater migration direction and contaminant concentrations in groundwater.

4.0 FIELD REMEDIAL INVESTIGATIONS

To evaluate the site for possible in-situ remediation alternatives, a field testing program was performed to collect data on the in-place physical characteristics of the subsurface soils and groundwater. The field testing program consisted of performing a subsurface vapor extraction test and a groundwater pump test.

4.1 Vapor Extraction Test

A subsurface vapor extraction test was performed at the site on 3 April 1992. The purpose of this test was to evaluate the feasibility of using in-situ vapor extraction as a treatment method for the removal of petroleum hydrocarbons from soil. The vapor extraction test used the existing monitoring wells as extraction points and vacuum measurement wells. The test procedure involved connecting the extraction well to a Rotron DR 404 blower rated at 100 cubic feet per minute (cfm) and measuring the vacuum induced with time in the subsurface at the surrounding monitoring well locations. Exposed screen sections within unsaturated soils varied from 0.73 feet (MW-5) to 4.4 feet (MW-2), with the exception of well MW-4 whose well screen was totally submerged. The vacuum exerted in the subsurface at each of the surrounding well locations was measured with a Magnahelic gauge set with a sensitivity range of between 0.01 and 100 inched of water.

The test utilized well MW-1 as a vapor extraction point. At the time the test was performed, the well had approximately 4 feet of screen available within the unsaturated zone above the static water level from which to extract soil gas. A vacuum of 59 inches of water was applied to the well for a period of approximately 3 hours. During that time, no induced subsurface vacuum was measured in any of the surrounding monitoring wells. As measured with a portable photoionization detector (PID), concentrations of volatile petroleum hydrocarbons in the off-gas from the blower attached to well MW-1 ranged from about 87 ppm to 134 ppm.

Based on the results of the test, in-situ vapor extraction for the removal of hydrocarbons from the subsurface of the site would require a closely space network of extraction points. Due to their low permeability to air flow, the native silt soils which comprise most of the soil contamination result in a small radius of vacuum influence (less than 46 feet). Though volatile hydrocarbons were removed from the subsurface during the test, as evidenced by the elevated PID off-gas measurements, in our opinion the subsurface soils at the site are not sufficiently permeable to air flow to allow efficient and cost effective in-situ vapor extraction procedures.

4.2 Groundwater Pump Test

A groundwater pump test was performed at the site on 23 April 1992. The pump test procedure consisted of extracting groundwater from monitoring well MW-1 using a Grundfos Redi-Flo2 submersible pump with a rated flow of between 100 milliliters per minute and 9 gallons per minute. As groundwater was withdrawn from well MW-1, the magnitude of groundwater drawdown in the surrounding monitoring wells was measured over a 24 hour pumping period. Groundwater removed from the pumping well was transferred to RZA AGRA's mobile, portable groundwater treatment system which removed petroleum hydrocarbons from the influent via gravity separation and air stripping.

Prior to starting the pump test, RZA AGRA received a permit from the City of Pullman to allow discharge of groundwater effluent from the test to the city sanitary sewer system. A copy of this permit is presented in Appendix C, along with analytical test results for the effluent discharge. Over the duration of the pump test, approximately 910 gallons of water was discharged into the sewer system.

Pumping was initiated at a flow rate of 0.85 gallons per minute (gpm). This pumping rate was sustained for a period of 30 minutes before the rate started to decline due to fouling of the pump with fine sediment. Over the length of the pump test, the pumping rate was adjusted several times as drawdown increased in the pump well to near maximum allowable depths and as the pump became fouled. The average pumping rate over the length of the test period was about 0.61 gpm. Maximum drawdown obtained in the pumping well ranged between 3.98 and 4.28 feet below static water level. Drawdown and recharge data recorded during performance of the pump test is presented in Appendix C.

Figure 7 presents the maximum drawdown achieved for the wells at the end of the 24 hour pumping period and presents an idealized radius of pumping influence achieved during the test. A radius of influence between 140 and 150 feet was achieved with the test setup and aquifer conditions present at the time this test was performed.

Based on the subsurface stratigraphy and response of the groundwater during drilling, the shallow aquifer beneath the site appears to be semi-confined. The granular, angular gravel regolith lying just above bedrock is relatively permeable compared to the underlying basalt and the overlying native silt, yet first groundwater levels encountered during drilling appeared within the overlying silt. Based on this conclusion, the pump test data was analyzed using the Hantush method for unsteady flow to a semi-confined aquifer. Figure 8, Figure 9, and Figure 10 present the graphical analysis of the pump test data from monitoring wells MW-2, MW-3 and MW-5, respectively. Based on the pump test data analysis, the hydraulic conductivity of the shallow aquifer ranges from 3.6 to 6.9 x 10^2 centimeters per second (cm/sec). This is a relatively high hydraulic conductivity and reflects the relatively high permeability of the granular regolith soils lying directly above bedrock. However, due to the thinness of the aquifer and low transmissivity, yields from wells founded in the aquifer will be low (200 to 1,200 gallons per day).

Based on the pump test performance, a pump and treat groundwater remediation system would be feasible at the site. However, due to the low transmissivity of the aquifer, the treatment time to remediate large volumes of contaminated water could be extreme. Installation of a larger diameter pump well or more than on pump well may be necessary to totally capture the dissolved hydrocarbon plume and reduce treatment time to a reasonable length.

5.0 EVALUATION OF REMEDIAL ALTERNATIVES

The remedial options for soil evaluated for this project include: 1) excavated and remove off-site for disposal or treatment; 2) excavate and treat on-site; 3) in-situ vapor extraction and; 4) in-site bioremediation. Groundwater remedial alternatives considered include: 1) pump and treat; 2) in-situ air sparging; and 3) in-situ bioremediation. In general, several factors are involved when evaluating remedial alternatives and for this project we have considered the following: feasibility, cost, completion time and liability. Table 4 summarizes the evaluation of soil and groundwater remedial alternatives for this site.

5.1 Feasibility

Feasibility refers to the suitability of a particular technology to a site depending upon geology, hydrogeology, type and distribution of contaminant, and space available. For this particular site, the fine grained nature and relatively low permeability of the soils greatly reduces the feasibility of in-situ treatment options. For this reason, the feasibility of using in-situ bioremediation and in-situ vapor extraction are considered to be very low at this site. Vapor extraction could possible be used, however it is likely that the extraction well spacing would be very close and further field testing would be required to determine a proper design. In our opinion, the most feasible remedial alternatives would involve excavating the contaminated soil and either removing the soil off-site for treatment and disposal or treating the soil on-site and using the treated soil as backfill for the project.

Two possible methods of off-site disposal are transporting the soil to a landfill which is permitted to accept petroleum contaminated soil (PCS) or transporting the soil to Spokane for incineration at Remtac's facility. Landfills available to accept PCS include the Whitman County Landfill located near Pullman, Washington and the Roosevelt Regional Landfill located in Klickitat County, Washington. Between the two, the Whitman County Landfill is closer but has higher disposal costs. The Roosevelt Regional Landfill can be serviced by train and has a service agreement with Burlington Northern Railroad to provide transportation service to the landfill. Transportation of soil to Remtec's facility in Spokane is closer than the Roosevelt Regional Landfill but would require the use of trucks instead of rail cars. Based on the estimated volume of PCS, hauling by truck would require between 250 to 350 loads and a large fleet of vehicles to be completed in a reasonable time period.

For groundwater treatment, the in-situ methods are considered very low feasibility because of the fine grained soils and their relatively low permeability. The most feasible remedial option for groundwater treatment is to pump the water to the surface for removal of volatile aromatic hydrocarbons via air stripping, air sparging, or filtration through granular activated carbon (GAC). Due to the low transmisivity of the aquifer, effluent volumes are likely to be relatively small and treated water could probably be disposed of within the City of Pullman's sanitary sewer system

5.2 Completion Time

For the soil remediation, particularly with the fine grained site soils, the in-situ options generally require a period of years to complete remediation. Contaminants remain more tightly bound to clay soils and are more difficult to expose to treatment techniques, requiring longer in-situ treatment times than more granular soils.

The excavation of soils requires a time frame scheduled in days or weeks with off-site disposal occurring as the material is being excavated. On-site, above ground treatment methods involving vapor extraction and bioremediation afterthe soil has been excavated can be accomplished more quickly than the in-situ methods because the soil and required additives can be manipulated at the surface to achieve the most desirable treatment conditions and the process can be more easily controlled. In general, on-site soil treatment can be completed within months, provided the total volume of soil can be treated simultaneously.

For groundwater treatment, most remedial technologies require a number of years to complete remediation depending upon the size of the contaminant plume, level of contamination and contamination source. At this site, the downgradient and northern extent of the plume has not been completely identified. It is unlikely that groundwater located within the highway right-of-way can be treated separately from that located outside of the right-of-way. In our opinion, once remediation is started treatment would be continued until the groundwater has been remediated to regulatory levels or asymptotic concentrations are reached.

5.3 Potential Liability

Soils or groundwater in which the contaminant is not completely destroyed remain a potential liability to the owner or generator of waste. Of the alternatives evaluated for this project, the treatment technologies with the lowest potential for future liability are those that keep the waste material on-site and remove or destroy the contaminant. Those alternatives with low potential for future liability include bioremediation (in-situ and ex-situ) where the contaminants are destroyed by microorganisms, and vapor extraction (in-situ and ex-situ), where the contaminants can be destroyed by thermal incineration or oxidation. Mass transfer technologies such as vapor extraction, air sparging and air stripping will provide higher potentials for future liability if the contaminants are simply released to the atmosphere instead of being destroyed by an additional treatment step.

The alternative with the highest potential for future liability is the landfill disposal option because, in most cases, the soils are not treated, or treated simply by landfarming, and become an intimate part of the landfill operation. Future actions against the disposal landfill could include all parties who have contributed waste to the facility. Potential future liability associated with the incineration operation is probably somewhat less than that for landfilling because the contamination is destroyed. However, there is usually a period of time when the waste is stored prior to treatment and if problems arise due to the handling and storage of the material, potential future liabilities could exist.

For groundwater treatment, potential liability could exist if the granular activated carbon (GAC) option is used. Spent carbon from the site would be recycled by the manufacturer. Potential future liability could be imposed on the generator of the spent carbon if the manufacturers processing facility requires clean up under RCRA or CERCLA actions.

5.4 Cost

Estimated costs for design and installation or implementation of soil and groundwater treatment were only evaluated for those alternatives considered feasible at the site. The costs presented in Table 4 are estimates based on approximate soil volumes calculated from the site assessment work, costs for similar projects RZA AGRA has involved within the past and do not include costs for periodic monitoring (including maintenance and chemical analyses) throughout the life of the project. Monitoring, maintenance and operation costs can run up to $40,000 per year, depending upon the type of remedial technology used and treatment system installed. Also, remediation cost would be increased if Best Available Control Technology

(BACT) is required to treat air emissions generated by the remediation process. The estimated cost to remediate the impacted soil, if all the soil within the right-of-way was treated, ranges between $372,000 to $958,000 dollars, not including monitoring, or annual operaation costs, depending upon the remedial alternative implemented.

For the feasible soil remediation alternatives, the Roosevelt Regional Landfill, Remtec Spokane and on-site treatment options all have estimated costs in the $300,000 to $500,000 range. The estimated cost per ton for the Roosevelt Regional Landfill ($40/T) and Remtec Spokane ($50/T) include transport costs. The estimated per ton cost for Whitman County Landfill ($80/T) does not include transport and the on-site treatment option ($46/T) does not require off-site transport. Estimated transport costs from the site to the Whitman County Landfill is approximately $8 per cubic yard or $5 per ton. None of the estimated per ton soil remediation costs presented above include the cost to excavate the soil. Excavation costs are estimated at about $10 per cubic yard or approximately $6 per ton. The lowest cost alternatives for soil remediation appear to be disposal at the Roosevelt Regional Landfill or on-site treatment. It is possible the cost for incineration at Remtec Spokane could be lower if the cost estimate is solicited in a competitive bid situation.

In our opinion, the only feasible groundwater treatment option is a pump and treat system. Several different treatment methods were evaluated including air stripping, air sparging and granular activated carbon (GAC) filtration. In general, the design and installation costs for each of these systems are approximately equal, being in the range of $100,000 to $120,000, not including periodic monitoring, maintenance or operating costs. The estimated design and installation costs assume the equipment is purchased and not rented. Typically, the cost of purchasing remediation equipment is equal to about one year of rental costs. Considering that groundwater remediation is likely to last for longer than one year, the long term costs of equipment purchase would be less than equipment rental. The operating costs for the three methods are also similar. While air stripping and air sparging treatments possibly require off-gas treatment not involved in GAC filtration, these additional costs are offset somewhat by the cost required to recycle GAC after saturation has occurred. Preliminary calculations indicate one ton of GAC would require recycling about every 250 days. Disposal costs for treated groundwater would be the same for all three methods, anticipating that a disposal fee would be paid to the City of Pullman for effluent discharge to their sewer system.

6.0 MTCA REPORTING REQUIREMENTS

The following section presents probable reporting requirements for the site based on our review and interpretation of the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 WAC. The information presented in this section are not legal opinions and WSDOT should solicit interpretations from bonified legal counsel prior to taking action at the site.

Under the MTCA regulations, a discovery of a release from a source other than an underground storage tank is required to be reported to Ecology within 90 days of discovery (WAC 173-340-300). Since the site was formerly used for petroleum product storage in above ground storage tanks and has been abandoned for a number of years, in our opinion, this site requires notification under the 90 day schedule and not the more stringent 24 hour notification for underground storage tanks. Under this schedule, and based on the date of receipt of laboratory certificates, Ecology should be notified of the confirmed release at the site prior to 18 July 1992.

In our opinion, this Level II report satisfies the requirements for a Remedial Investigation/Feasibility Study (RI/FS) as required under 173-340-350: remedial alternatives have been evaluated and feasible options recommended. The next step would be to prepare a Draft Cleanup Action Plan (DCAP) which provides the details of site remediation and the specific remedial action chosen for the site and presents a public participation plan, since this was not included in the Level II assessment. The DCAP should also contain a preliminary design for the groundwater treatment system and binding bids to accomplish the planned work should be obtained from subcontractors at this time. This will allow determination of the actual cost of the project. Following a public comment period, the DCAP could be finalized and remedial actions begun.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the Level II Environmental Site Assessment completed for this project, we estimate there are between 5,000 and 6,500 cubic yards of petroleum hydrocarbon impacted soil, which may require treatment, located within the right-of-way for the bridge upgrade and expansion. Groundwater encountered in the vicinity of the former bulk storage facility also contains petroleum hydrocarbons at concentrations greater than MTCA Method A Compliance Cleanup Levels. Concentrations of total lead in excess of the MTCA Method A CCLs exhibited by groundwater may represent natural background levels and we recommend resampling the wells and testing the groundwater for total dissolved lead.

Of the remedial alternatives for soil evaluated for this project, we recommend either excavating the soil for removal and disposal at the Roosevelt Regional Landfill or excavation of the soil for on-site treatment via vapor extraction and bioremediation. The landfill option appears to be the lowest cost alternative, but also presents the greatest potential for future liability. The on-site treatment option is somewhat more costly than landfilling and could be impacted by site space constraints but offers less potential future liability because the contamination will be removed from the ground and destroyed. Upon completion of treatment, soils could be incorporated as backfill in the bridge project. The incineration of soils at Remtec Spokane may become a feasible option if a competitive bid lowers the estimated cost and soil transport issues can be addressed.

Based on our evaluation, a pump and treat system for remediating groundwater appears to be the most feasible and cost effective alternative. Due to the low transmissivity of the shallow groundwater aquifer it is likely that remediation of the groundwater would take a few years to complete.

S-1023

Table 1. Summary of Well and Groundwater Elevations in Feet

Well No.	Top of PVC Well Casin	Top of Well Screen	Bottom of Well Screen	Groundwater Elevation 4/23/92
MW-1	2,354.24	2,349.99	2,339.99	2,346.50
MW-2	2,354.29	2,349.61	2,339.61	2,345.91
MW-3	2,354.43	2,348.30	2,338.30	2,347.23
MW-4	2,352.35	2,343.87	2,338.87	2,345.43
MW-5	2,353.19	2,346.59	2,341.59	2,347.08

S-1023

Table 2. Summary of PID Headspace Measurements

Sample No	Depth (ft)	Headspace Vapor Measurement (ppm)
MW-1,S-1	2.5-4	198
MW-1,S-2	5-6.5	447
MW-1,S-3	7.5-9	407
MW-1,S-4	10-11.5	600
MW-1,S-5	12.5-13	557
MW-2,S-1	2.5-4	0
MW-2,S-2	5-6.5	35
MW-2,S-3	7.5-9	112
MW-2,S-4	10-11.5	68
MW-2,S-5	12.5-13.2	62
MW-3,S-1	2.5-4	0
MW-3,S-2	7.5-9	0
MW-3,S-3	12-13.4	0
MW-4,S-1	2.5-4	0
MW-4,S-2	7.5-9	0
MW-5,S-1	6-7.5	44
B-7,S-1	2.5-4	244
B-7,S-2	5-6.5	446
B-7,S-3	7.5-9	314
B-7,S-4	10-11.5	256
B-7,S-5	12.5-14	360
B-8,S-1	2.5-4	0
B-8,S-2	7.5-9	0
B-8,S-3	12.5-13.4	0
B-9,S-1	2.5-4	0
B-9,S-2	7.5-9	30
B-9,S-3	12.5-14	68
TP-3,S-1	5-7	345
TP-3,S-2	7-13	304
TP-9,S-1	5-5.5	989
TP-9,S-2	6-7	2,011
B-3,S-6	17.5-19	117
B-3,CS-7	19.5	12
B-4,CS-2	4.5-6	32
B-4,CS-4	10-10.5	284

*NOTE: PID measurements rounded to nearest ppm.

S-1023

Table 3. Summary of Analytical Test Results

				Soil				
Sample No.	Depth (ft)	HCID	WTPH-D	Benzene	Toluene	Ethyl benzene	Xylenes	Lead
MW-1,S-2	5 - 6.5	D	1,889	1.45	ND	0.925	0.559	20.7
MW-1, S-4	10 - 11.5	ND	ND	ND	0.041	0.005	0.017	19.2
MW-2,S-3	7.5 - 9	ND	ND	0.006	ND	0.054	0.079	17.9
MW-2,S-5	12.5 - 13.2	ND	ND	ND	ND	ND	ND	15.3
MW-3,S-2	7.5 - 9	ND	ND	ND	ND	ND	ND	23.3
MW-3,S-3	12 - 13.4	ND	ND	ND	ND	ND	ND	15.4
MW-4,S-1	2.5 - 4	ND	ND	ND	ND	ND	ND	52.7
MW-4,S-2	7.5 - 9	ND	ND	ND	ND	ND	ND	23.5
MW-5,S-1	6 - 7.5	ND	ND	ND	ND	ND	ND	44.8
B-7,S-2	5 - 6.5	ND	ND	0.106	ND	0.536	0.216	32.6
B-7,S-3	7.5 - 9	D	700	---	---	---	---	---
B-7,S-5	12.5 - 14	ND	ND	ND	ND	0.538	0.218	21.7
B-8,S-2	7 - 8.5	ND	ND	ND	ND	ND	ND	28.1
B-8,S-3	12 - 13.2	ND	ND	ND	ND	ND	ND	20
B-9,S-2	7.5 - 9	D	428	0.038	ND	ND	ND	19.2
B-9,S-3	12.5 - 14	ND	ND	ND	ND	ND	ND	19.1
TP9,S-1	5 - 5.5	G	533.0	5.35	2.30	2.17	21.10	---
TP-9,S-2	6 - 7	G	1,129.0	0.065	2.77	1.33	5.00	---
MTCA METHOD A CCL			200	0.5	40	20	20	250
				Water				
MW-1		ND	49.8	0.169	0.027	0.462	0.048	0.323
MW-2		ND	ND	0.95	0.024	0.025	0.005	0.12
MW-3		ND	ND	ND	ND	ND	ND	0.196
MW-4		ND	ND	ND	ND	ND	ND	0.142
MW-5		ND	ND	ND	ND	ND	ND	0.139
MTCA METHOD A CCL			1.0	0.005	0.04	0.03	0.02	0.005

NOTE: All results in mg/kg (soil) and mg/l (water)

ND=Below method detection limit

D = Diesel

Shaded area denotes concentrations above MTCA Method A CCL.

S-1023

Table 4. Evaluation of Remedial Alternatives

	Method	Feasability	Completion Time	Liability	Cost (in thousands)*
SOIL	Excavate w/ off-site disposal	High	Rapid (days)		
	Whitman Co. Landfill			High	$737. - 958.
	Roosevelt Landfill			High	$372. - 485.
	Remtec, Spokane burner			Moderate	$453. - 589.
	Excavate w/ on-site treatment VES + Bioremediation	High	Moderate (months)	Moderate (short term)	$372. - 485.
	In-situ VES	Low	Long term (years)	Low	Not Evaluated
	In-situ Bioremediation	Very Low	Long term (years)	Low	Not Evaluated
WATER	Pump and Treat				
	Air stripping	Moderate	Long term (years)	Moderate	$100. - 120.
	GAC Filtration	Moderate		Moderate	
	Air sparging	Moderate		Moderate	
	In-situ air sparging	Very Low	Long term (years)	Low	Not Evaluated
	In-situ Bioremediation	Very Low	Long term (years)	Low	Not Evaluated

*NOTE: Cost Estimate Does Not Include Periodic Monitoring or Annual Operating Costs

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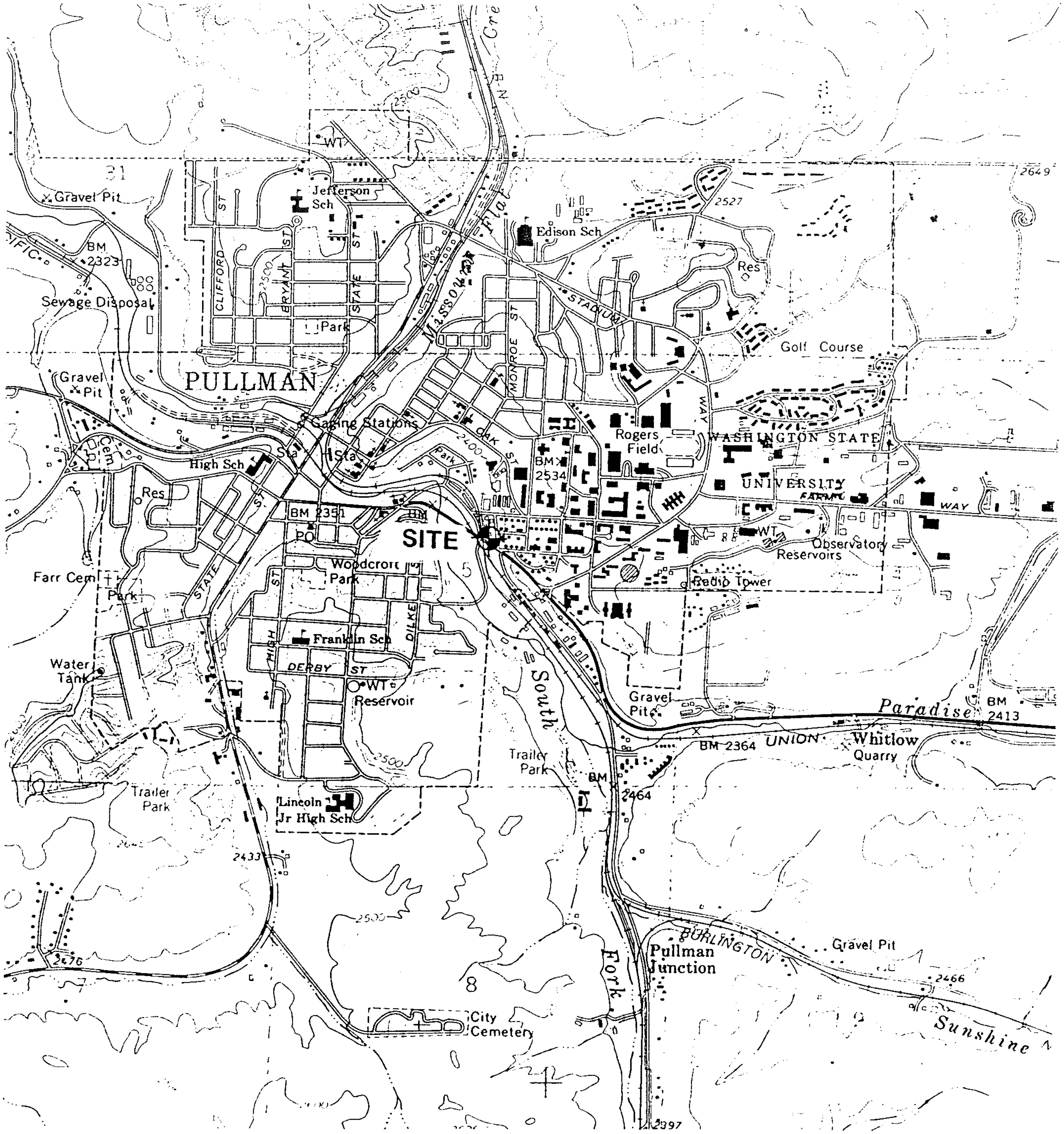
DATE
SCALE MAY 1992

TABLE 4

152284
GENDRON'S



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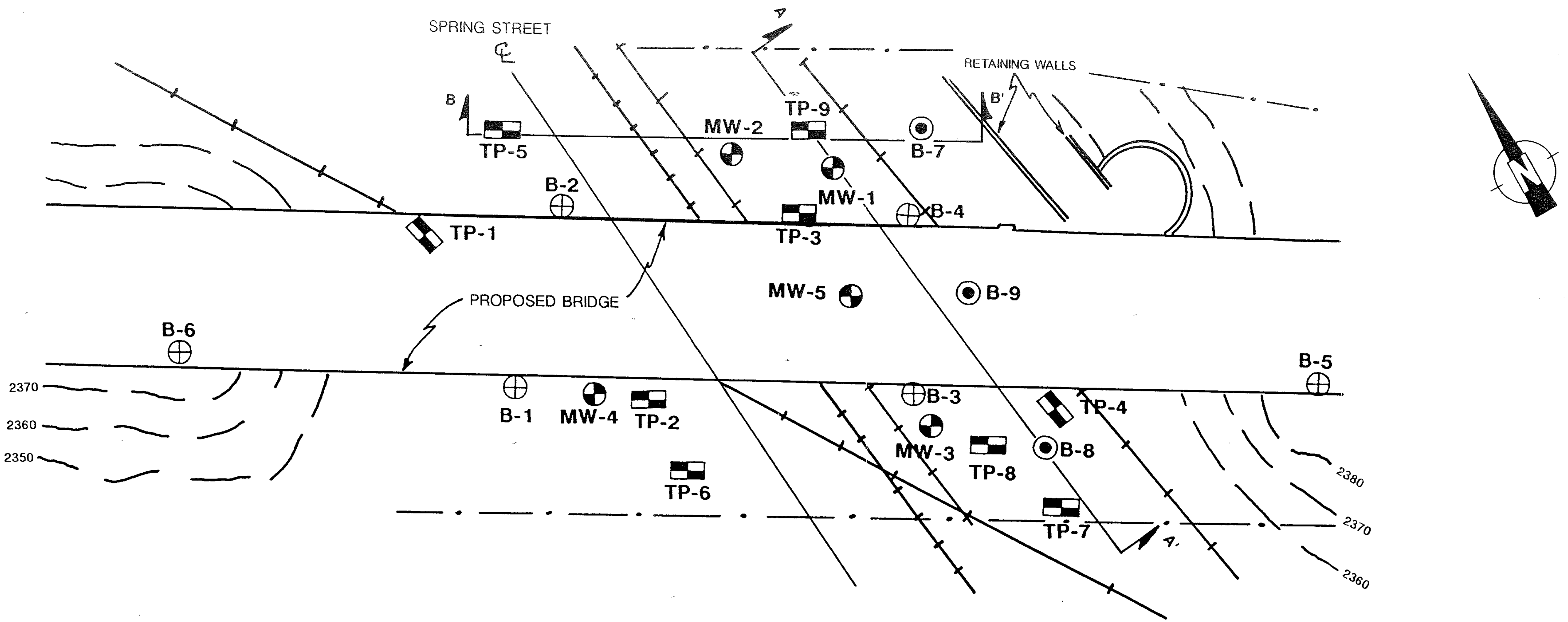
SCALE	1"=2,000'

VICINITY MAP

FIGURE 1

152284

GENDRON'S



EXPLANATION

B-1 ⊕ SOIL BORINGS ACCOMPLISHED FOR GEOTECHNICAL STUDY

TP-3 ▨ TEST PITS ACCOMPLISHED FOR GEOTECHNICAL STUDY

B-7 ⊙ SOIL BORINGS ACCOMPLISHED FOR ENVIRONMENTAL STUDY

MW-2 ◕ GROUNDWATER MONITORING WELLS

A A' LOCATION OF GEOLOGIC PROFILE

• — • — APPROXIMATE EDGE OF HIGHWAY RIGHT OF WAY

0 50 100 FEET

SCALE

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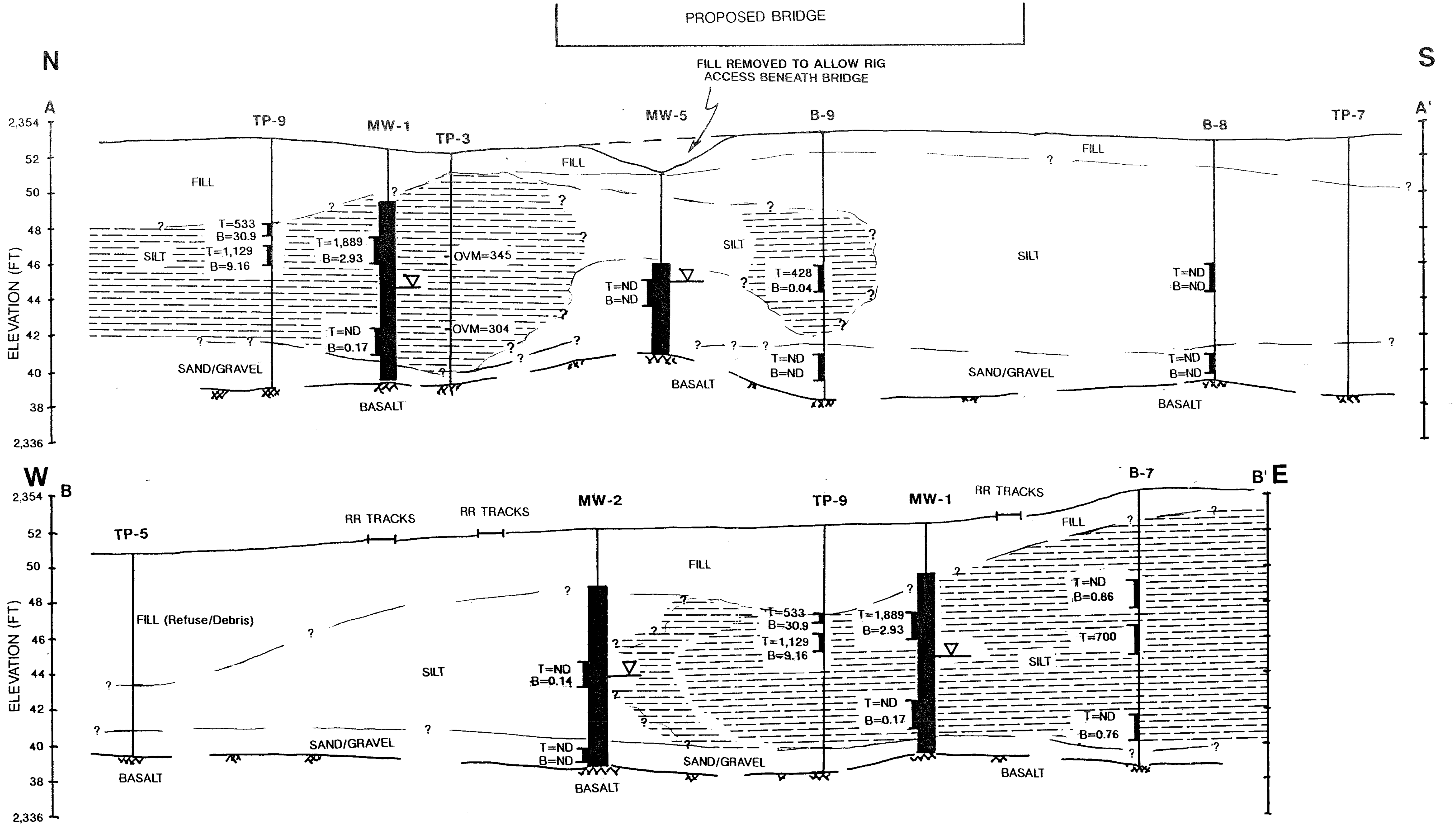
DATE	MAY 1992
SCALE	AS SHOWN

SITE AND EXPLORATION PLAN

FIGURE 2

152284

GENDRON'S



EXPLANATION

? —— INFERRED SOIL CONTACT

SOIL SAMPLE LOCATION

T=428 SOIL TPH CONCENTRATION IN PPM

B=0.17 SOIL TOTAL BTEX CONCENTRATION IN PPM

MONITORING WELL SCREENED INTERVAL

▽ STATIC WATER LEVEL

TEST PIT OR BORING

▤ SUBSURFACE SOILS LIKELY TO CONTAIN PETROLEUM HYDROCARBONS

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ENGINEERING & ENVIRONMENTAL SERVICES

11335 N.E. 122nd Way
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Kirkland, Washington
98034-6918

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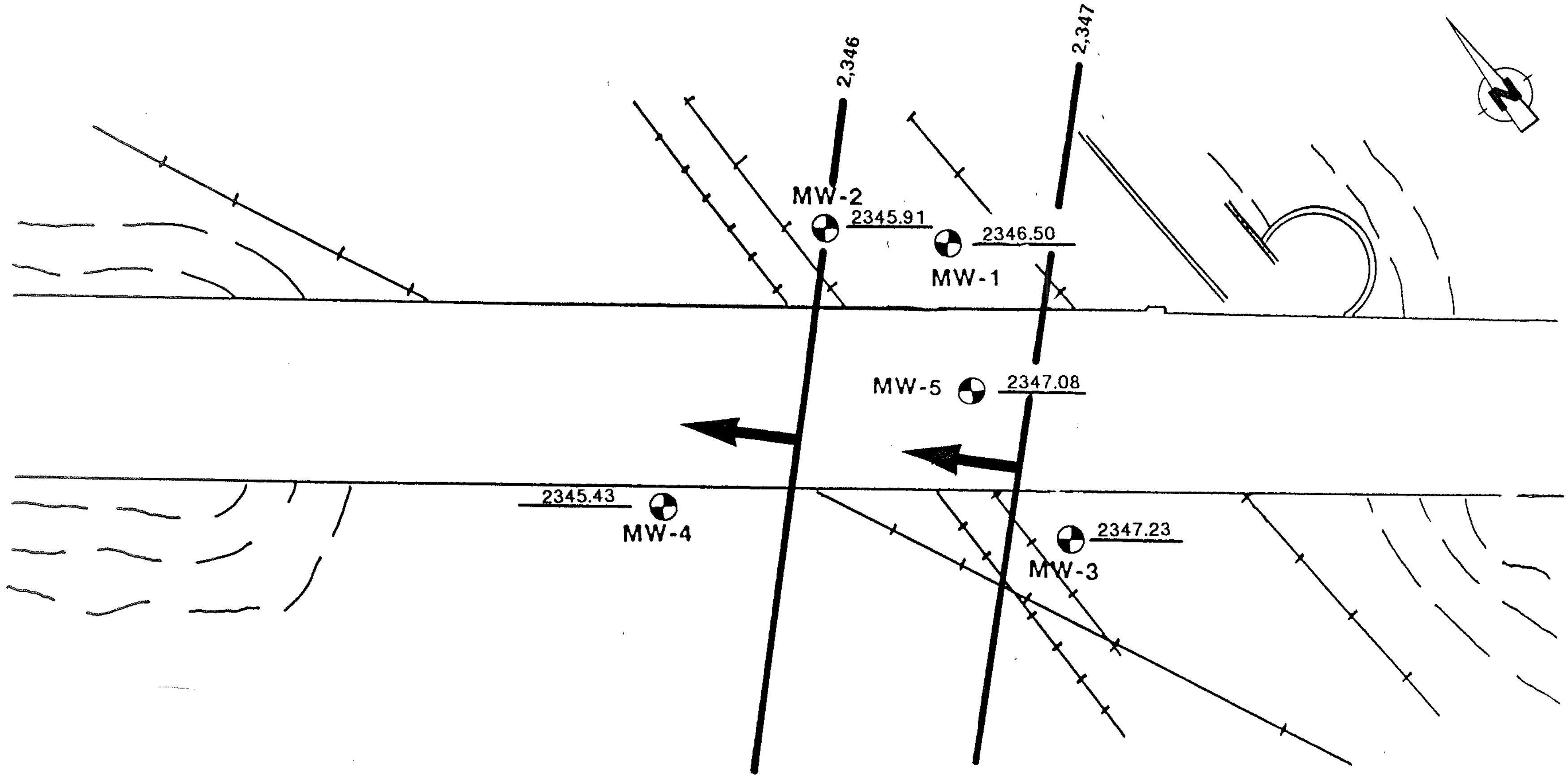
DATE MAY 1992
SCALE H:1"=20'

INTERPRETIVE GEOLOGIC PROFILE

FIGURE 3



← INFERRED GROUNDWATER FLOW DIRECTION

— GROUNDWATER ELEVATION CONTOUR

2345.43 GROUNDWATER ELEVATION AT WELL

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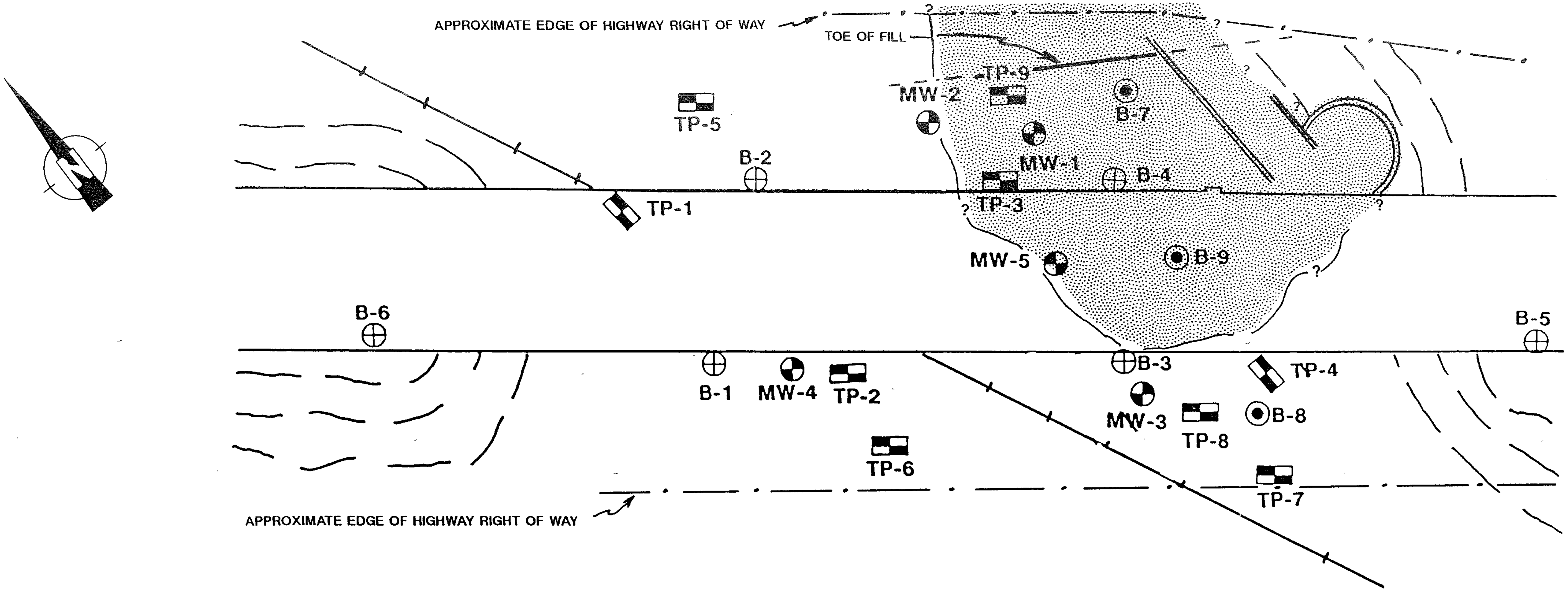
SCALE 1"=60'

GROUNDWATER SURFACE CONTOUR

FIGURE 4

152283
GENDRON'S



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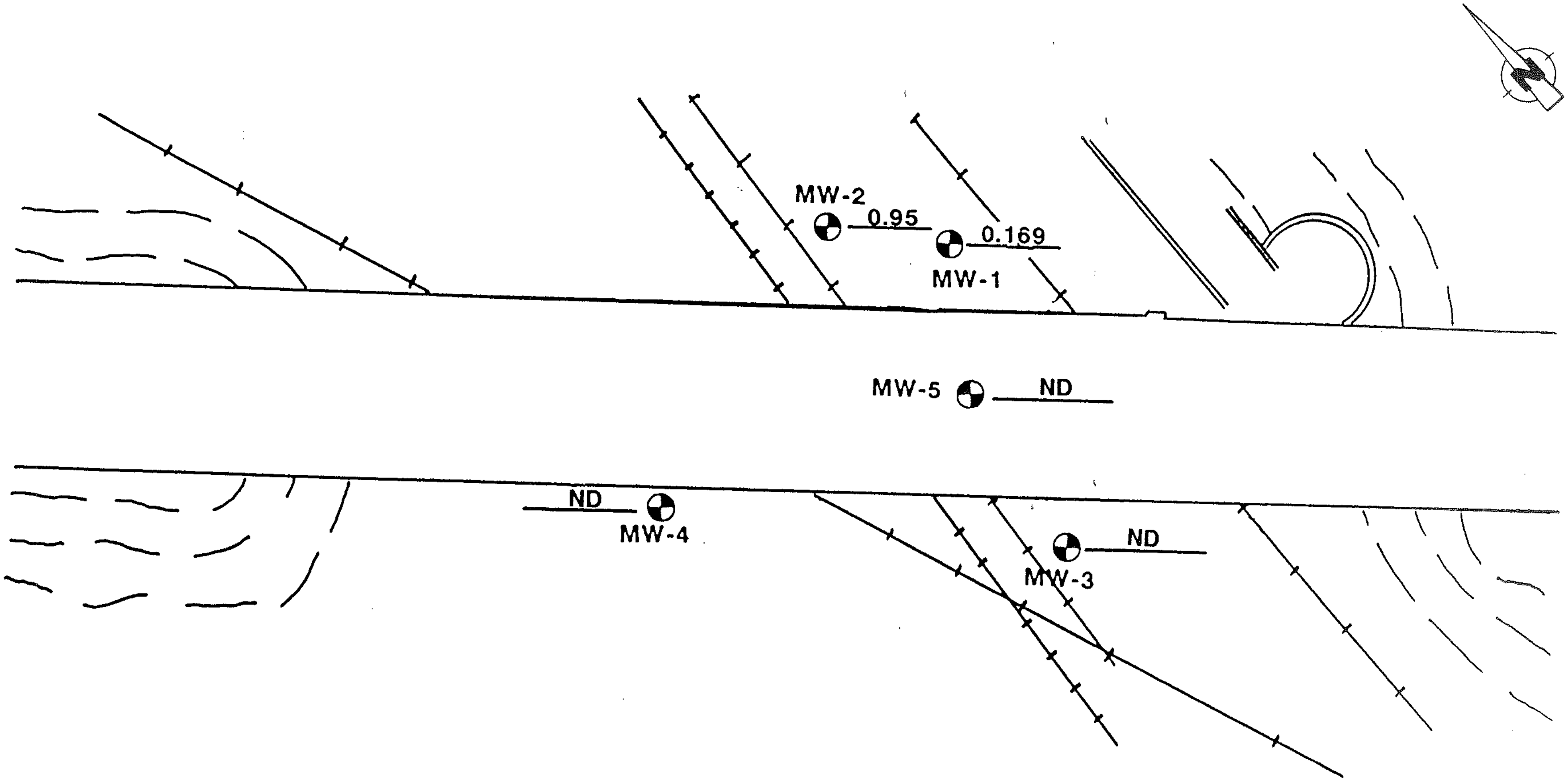
SCALE	1"=50'

ESTIMATED LIMITS OF PETROLEUM HYDROCARBONS IN SOIL

FIGURE 5

152284
GENDRON'S



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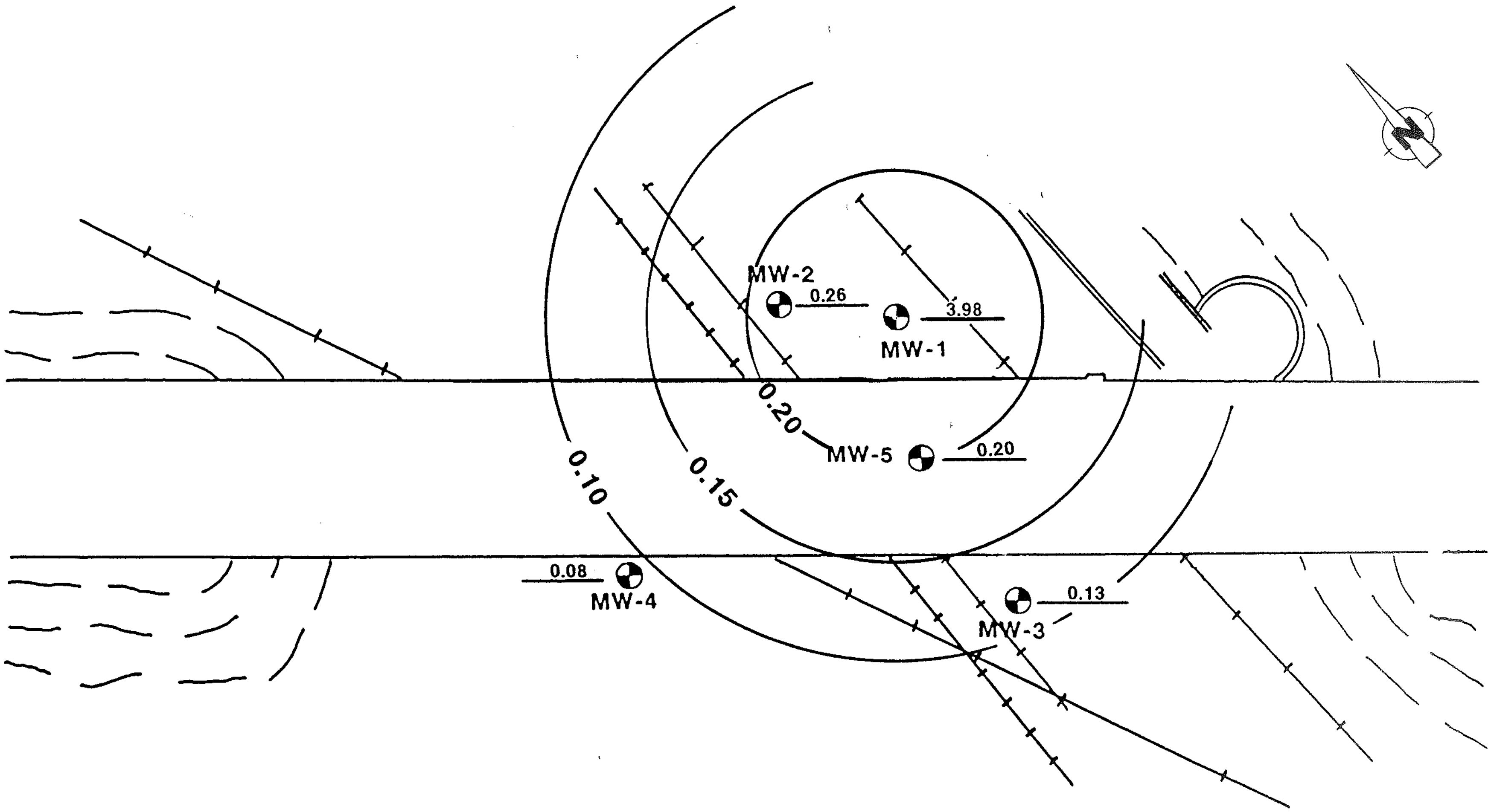
DRAWN	
DATE	MAY 1992
SCALE	1"=60'

BENZENE CONCENTRATIONS IN GROUNDWATER

FIGURE 6

152283
GENDRON'S



—0.10— AQUIFER DRAWDOWN IN FEET

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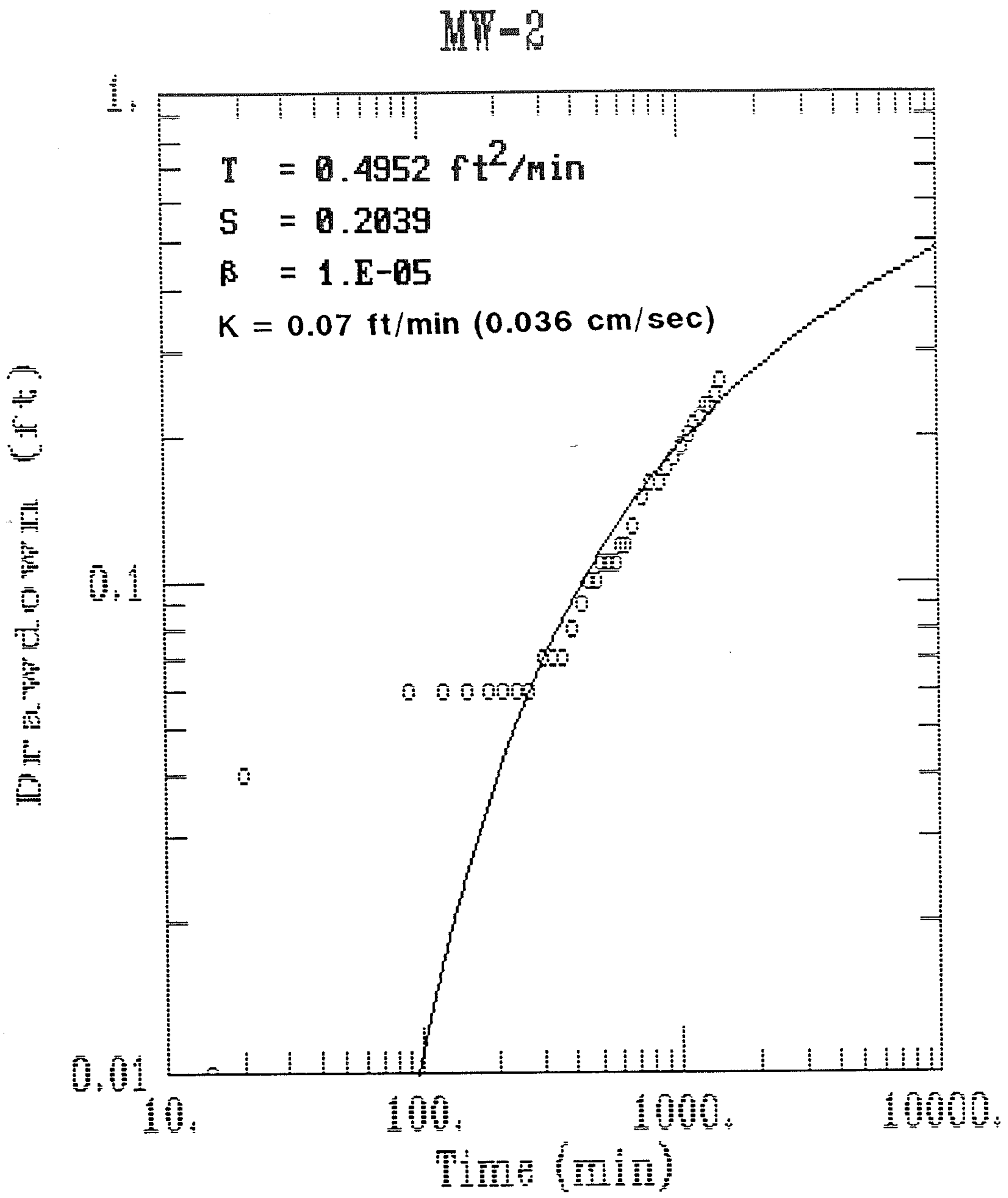
DATE	MAY 1992
SCALE	1"=60'

IDEALIZED RADIUS OF PUMPING INFLUENCE

FIGURE 7

152283

GENDRON'S



T = Transmissivity
S = Storage
ß = Leakage coefficient

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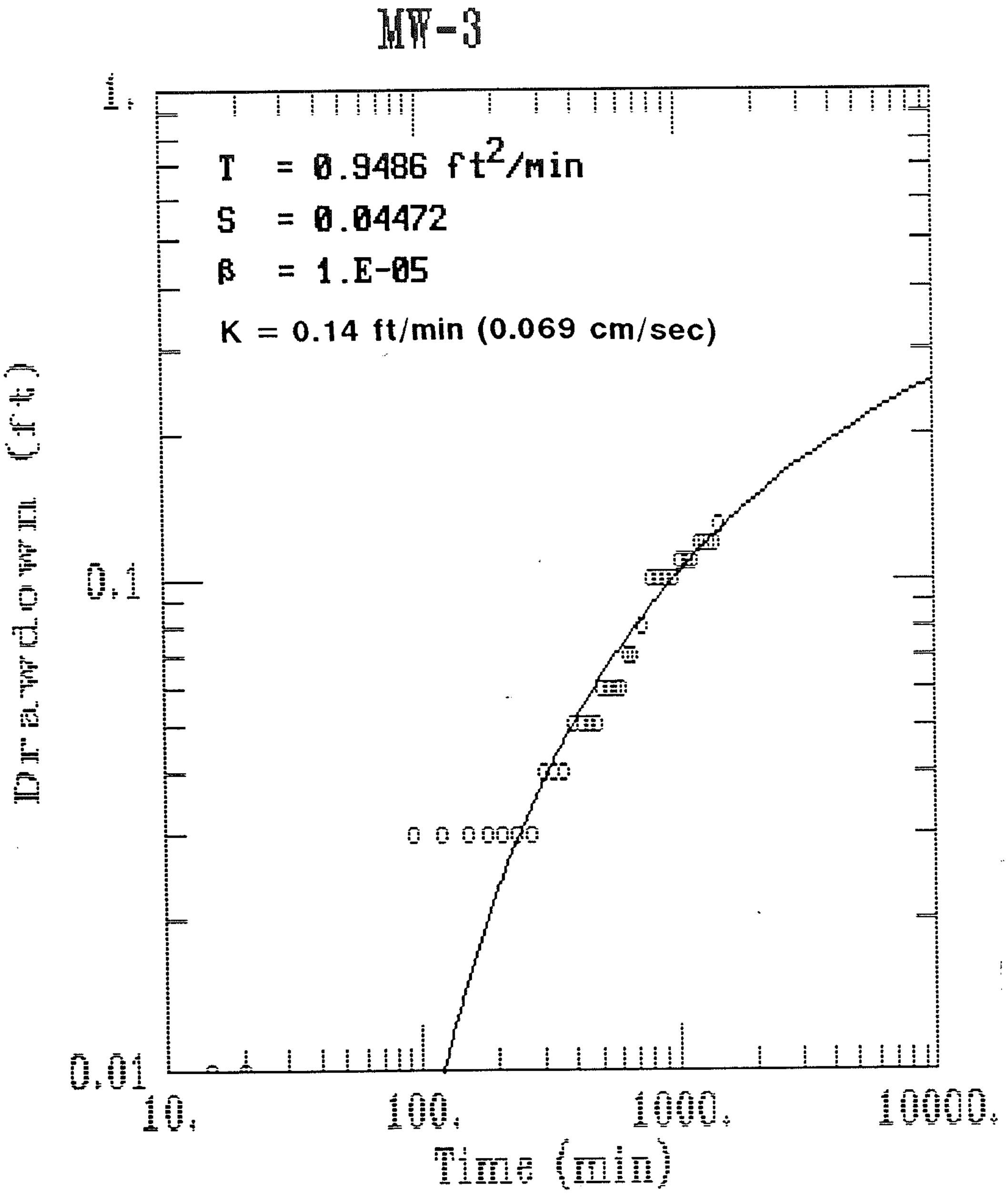
DATE	
SCALE	MAY 1992

ANALYSIS OF PUMP TEST DATA
FOR WELL MW-2

FIGURE 8

152284
GENDRON'S



T = Transmissivity
S = Storage
ß = Leakage coefficient

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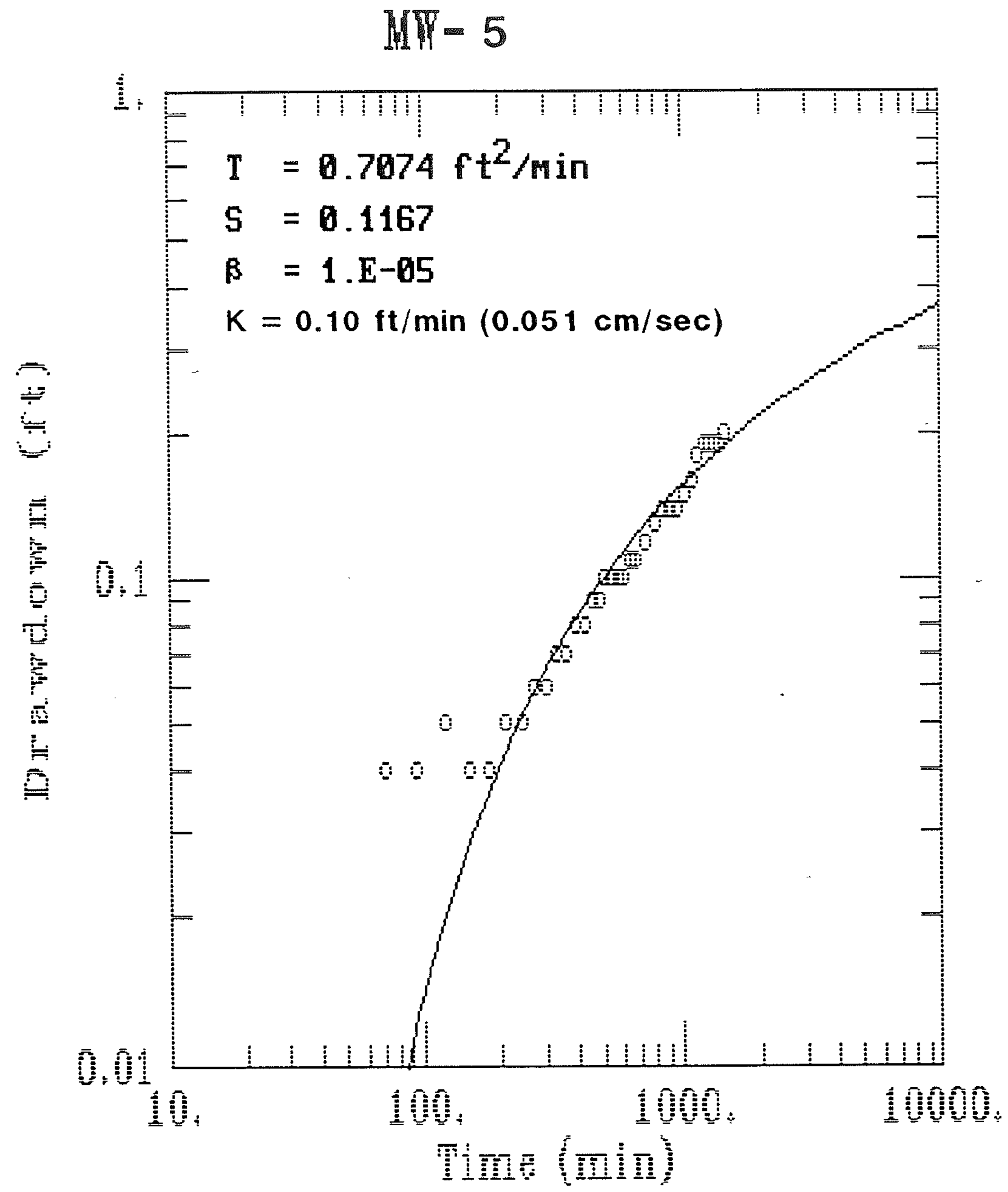
SCALE MAY 1992

ANALYSIS OF PUMP TEST DATA
FOR WELL MW-3

FIGURE 9



T = Transmissivity

S = Storage

ß = Leakage coefficient

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DRAWN	JNS
DATE	
SCALE	MAY 1992

ANALYSIS OF PUMP TEST DATA FOR WELL MW-5

FIGURE 10

APPENDIX A

SUBSURFACE EXPLORATION PROCEDURES AND LOGS

APPENDIX A

Subsurface Exploration

The field exploration program conducted for this study consisted of advancing eight auger borings to depths of 10 to 15 1/2 feet below the existing site grade. Five borings were accomplished to install monitoring wells and three to collect soil samples only. The approximate locations of the explorations are illustrated on Figure 2. These locations were obtained in the field by taping and/or pacing from existing features.

The borings were drilled from 26 March to 27 March 1992 by Ruen Drilling, Inc. of Clark Fork, Washington under subcontract to our firm. The eight borings were advanced utilizing a 4 1/4 inch inside diameter (8-inch O.D.) hollow stem auger with a truck mounted drilling (B-61 model). During the drilling process, samples were generally obtained at 5 feet depth intervals. The borings were continuously observed and logged by a geologist from our firm.

Characterization of Soils

Soil samples obtained using the Standard Penetration Test Procedure as described in ASTM:D-1586. The testing and sampling consisted of driving a standard 2-inch outside diameter split barrel sampler a distance of 18 inches into the soil below the auger bit with a 140 pound hammer free falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded and the number of blows required to drive the sampler the final 12 inches is considered the Standard Penetration Resistance ("N") or the blow count which is represented on the boring logs in this appendix. If a total of 50 blows is recorded within a 6-inch interval, the blow count is recorded as 50 blows for the actual number of inches of penetration and is considered refusal. The blow count, or "N" value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils. The soil samples retrieved from the split-spoon sampler were classified in the field and a representative portion placed in laboratory prepared air tight glass containers.

Soil Sampling Procedures

The soil samples were recovered at each interval using procedures designed to minimize the risk of cross contamination. Prior to the drilling of the boring, the drilling equipment and sample tools were cleaned by a steam cleaner. Between each sampling attempt, the sampling tools were scrubbed with a stiff brush and a detergent solution consisting of Liquinox and warm water, and then rinsed with potable water and liberal quantities of distilled water. The samples were classified in the field and immediately transferred to laboratory treated glass jars, and tightly sealed with a teflon-lined threaded cap. Samples were screened in the field with an organic vapor meter (OVM) and several samples were selected for laboratory analysis. Samples were stored and transported in a chilled ice chest throughout the field program. Selected soil samples were subsequently transferred to Precision Analytics, Inc. in Pullman, Washington in accordance with RZA AGRA, Inc. chain of custody procedures.

The boring logs presented in this appendix are based on the drilling action, visual inspection of the samples secured, laboratory results, and field logs. The various types of soils are indicated, as well as the depths where soils or characteristics of the soils changed. It should be noted that these changes may have been gradual, and if the changes occurred between sample intervals, the soil contacts are interpreted. Subsurface water conditions are evaluated by observing the moisture condition of the samples, the free water on the sample rods, and in well measurements. Groundwater was encountered at depths of about 6 to 8 feet beneath the ground surface at time of drilling.

Field Headspace Measurements

Each soil sample was screened for the presence of volatile organic compounds to facilitate selecting an appropriate soil sample to submit for chemical analysis. This involved placing approximately 6 ounces of sampled soil directly into an 8 ounce glass jar fitted with an aluminum foil cover secured by a teflon lid. The sample was then shaken vigorously for approximately 15 seconds and a head space reading was taken after plunging the probe of the OVM detector through the foil cover. Field head space analysis was performed on each sample utilizing a Model 580A OVM. The highest digital readout value displayed by the instrument was recorded for each sample. This value indicates the total vapor concentration of volatilized organic compounds. These compounds include numerous constituents of petroleum hydrocarbons. However, the OVM is not capable of determining the species of these compounds or their concentrations in the soil samples. Consequently, it should be considered merely a rough screening tool that aides in detecting the presence of volatile soil contaminants. Results of field analysis are presented on the boring logs in this Appendix and in Table 2.

Water Sampling Procedures

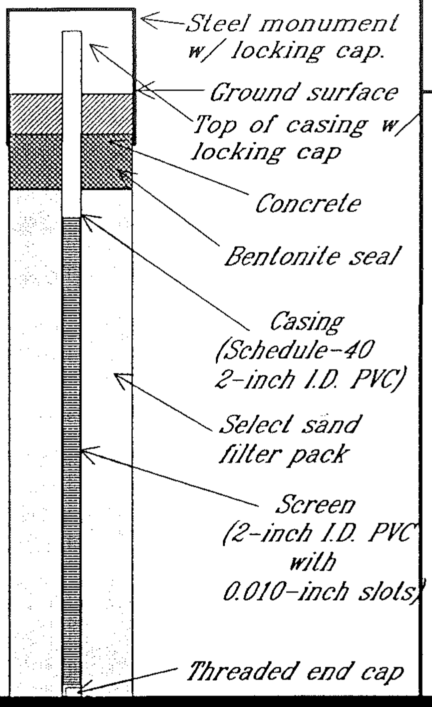
Groundwater samples were collected from the installed monitoring wells on 28 March 1992. Prior to sampling, fluid level measurements in the wells were recorded and 3 to 5 gallons of water was purged from each well. Purging was accomplished with a new disposable polyethylene bailer, which was discharged after use at each well. Following purging, groundwater samples were obtained from each well with an unused polyethylene disposable bailer and bailer cord dedicated to each well location.

PROJECT *Pullman Level II* W.O. *S-1023* WELL NO. *MW-1*

Elevation reference:
Ground surface elevation: Casing elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Broken Basalt gravel FILL.*						
		I	*S-1*	*4*	*198.1*		
5	*Soft to medium stiff, damp to saturated, dark gray to black SILT with trace of organics ans sand. Strong petroleum hydrocarbon odor and sheen in places.*	I	*S-2*	*5*	*447.0*	▼ ATD	*HCID BTEX LEAD*
		I	*S-3*	*4*	*407.0*		
10		I	*S-4*	*3'*	*600.0*		
	Very dense, saturated, dark gray, silty SAND with some gravels. Strong petroleum hydrocarbon-like odor.		*S-5*	*50/6"*	*557.0*		*HCID BTEX LEAD*
	Boring terminated at approximately 13.0 feet.						
15							
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

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Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

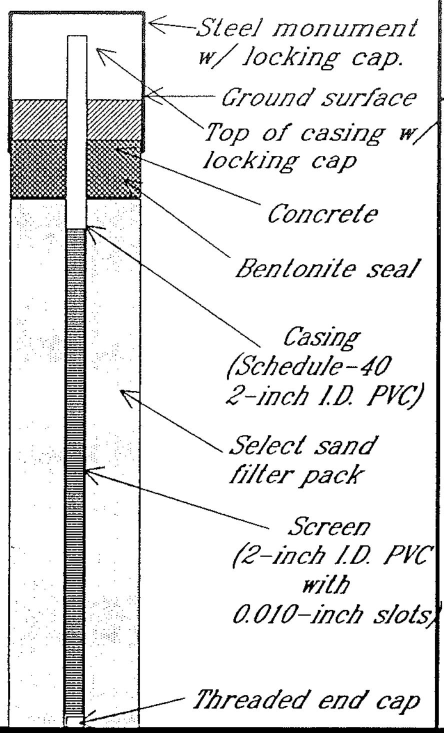
Drilling started: *26 March 1991* Drilling completed: *26 March 1991* Logged by: *ENJS*

ROJECT *Pullman Level II* W.O. *S-1023* WELL NO. *MW-2*

Elevation reference:
Ground surface elevation: Casing elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Sandy cobbles and GRAVEL for road fill.*						
		I	*S-1*	*3*	*0.0*		
5	*Soft to damp to wet, dark brown to mtottled green-brown/black SILT with trace fine sand and organics. Strong petroleum odor.*	I	*S-2*	*2*	*35.0*	▼ ATD	*HCID* *BTEX* *LEAD*
		I	*S-3*	*2*	*112.0*		
10		I	*S-4*	*3*	*600.0*		
	Very dense, saturated, dark green to yellow green, silty SAND with some gravel.						*HCID* *BTEX* *LEAD*
	Basalt bedrock		*S-5*	*50/3"*	*62.0*		
	Boring terminated at approximately 13.2 feet.						
15							
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

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Engineering & Environmental Services

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Spokane, WA 99201

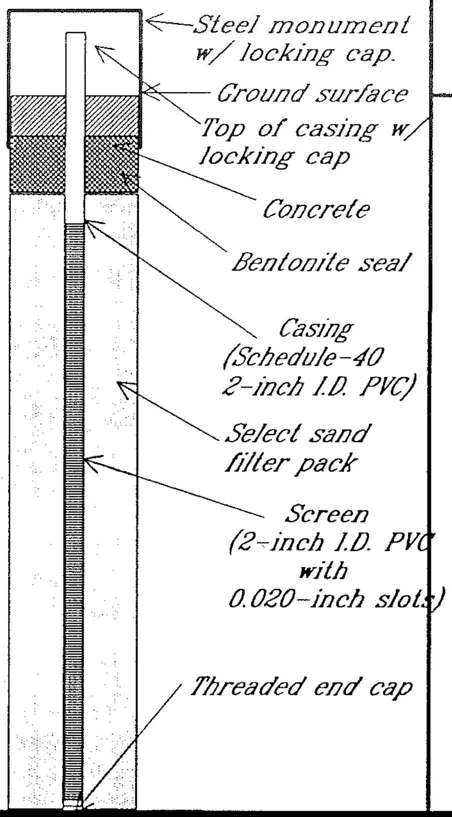
Drilling started: *26 March 1991* Drilling completed: *26 March 1991* Logged by: *ENJS*

PROJECT *Pullman Level II* W.O. *S-1023* WELL NO. *MW-3*

Elevation reference:
Ground surface elevation: Casing elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Broken basalt gravel fill.*						
		I	*S-1*	*3*	*0.0*		
5	*Soft damp to wet, dark brown to greenish brown fine sandy SILT with some organics.*					▼ ATD	*HCID* *BTEX* *LEAD*
		I	*S-2*	*3*	*0.0*		
10							
	Very dense, saturated, dark green to yelllow green, silty SAND with some gravel.	I	*S-3*	*84/10"*	*0.0*		*HCID* *BTEX* *LEAD*
15	*Basalt bedrock* *Boring terminated at approximately 15.0 feet.*						
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample
▼ ATD Observed groundwater level (ATD = at time of drilling)

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Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

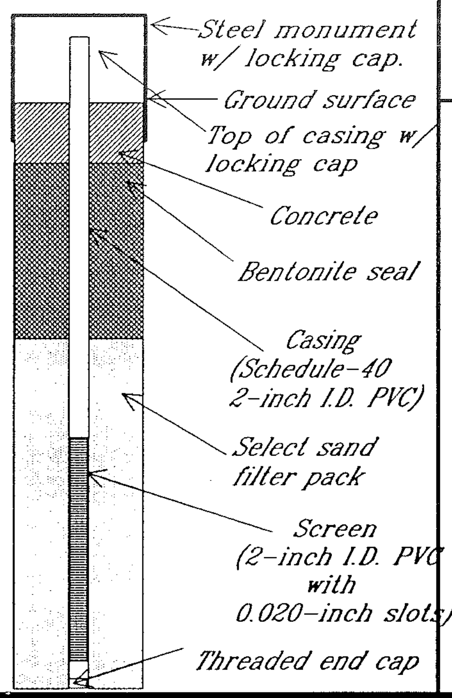
Drilling started: *26 March 1991* Drilling completed: *26 March 1991* Logged by: *ENJS*

PROJECT *Pullman Level II* W.O. *S-1023* WELL NO. *MW-4*

Elevation reference:
Ground surface elevation: Casing elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Gravel and cobble fill*						
	Medium stiff, damp brown to dark brown, fine, sandy SILT with organics and trace gravel	I	*S-1*	*6*	*0.0*		HCID BTEX LEAD
5							
				▼ ATD			
	Soft, wet, greenish brown, clayey SILT with thin interbeds of silty fine sand.	I	*S-2*		*0.0*		
10							HCID BTEX LEAD
	Basalt bedrock *Boring terminated at approximately 12.2 feet.*						
15							
20							
25							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

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Engineering & Environmental Services

539 West Sharp, Suite D
Spokane, WA 99201

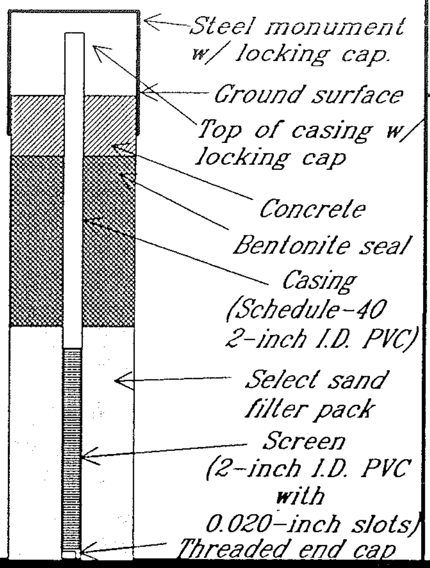
Drilling started: *27 March 1991* Drilling completed: *27 March 1991* Logged by: *ENJS*

ROJECT *Pullman Level II* W.O. *S-1023* WELL NO. *MW-5*

Elevation reference:
Ground surface elevation: Casing elevation:

EPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Silty gravel and cobble fill.*						
5	*Very stiff, saturated, green, fine sandy SILT with 1-2" silty, medium sand interbeds, slight petroleum hydrocarbon-like odor*	I	*S-1*	*16*	*43.6*	▼ ATD	*HCID* *BTEX* *LEAD*
10	*Basalt bedrock* *Boring terminated at approximately 10.0 feet.*						
15							
20							
5							
30							

AS-BUILT DESIGN



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level (ATD = at time of drilling)

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Engineering & Environmental Services

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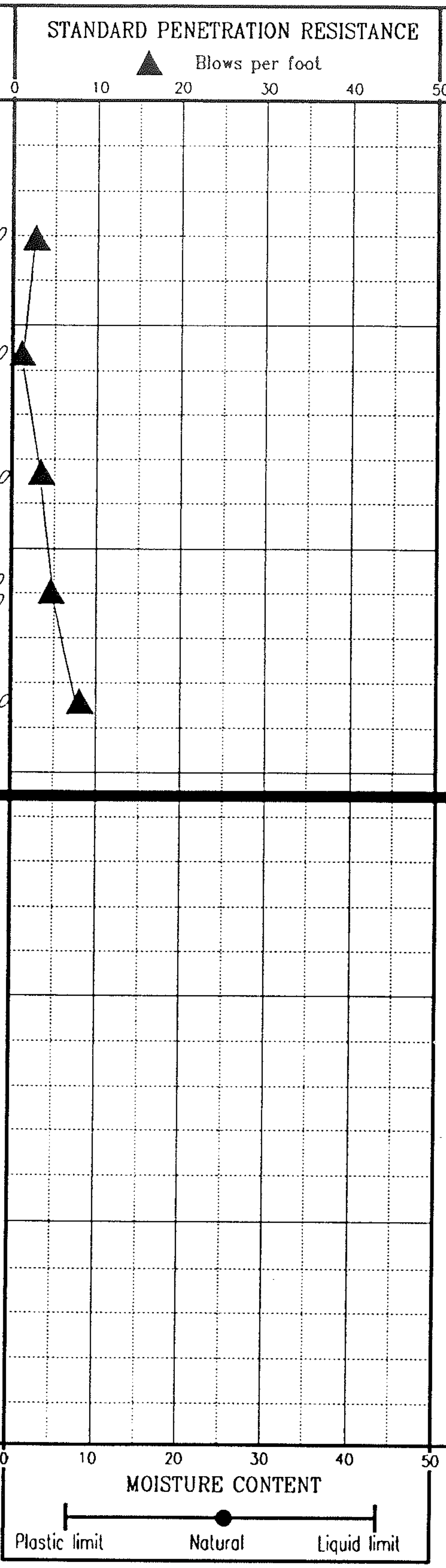
Drilling started: *27 March 1991* Drilling completed: *27 March 1991* Logged by: *ENJS*

PROJECT *Pullman Level II* W.O. *S-1023* BORING NO. *B-7*

Approximate ground surface elevation: *275 feet*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	TESTING
0	COAL CINDERS and GRAVEL FILL.				
	Soft, wet to saturated, green CLAY and SILT with sheen and strong petroleum hydrocarbon-like odor. Groundwater encountered at 2.6 feet at time of drilling.	I	S-1	244.0	
5		I	S-2	446.0	HCID BTEX LEAD
		I	S-3	314.0	
10	Soft, wet, dark brown, fine sandy SILT with some organics and petroleum hydrocarbon-like odor.	I	S-4	256.0 287.0	
	Soft to medium stiff, saturated, green and mottled green and yellowish brown, fine, sandy SILT with some gravels near bedrock contact. Strong petroleum hydrocarbon-like odor and sheen.	I	S-5	360.0	HCID BTEX LEAD
15	Basalt bedrock. Boring terminated at 15.5 feet.				
20					
25					
30					



LEGEND

I 3-inch OD split spoon sampler

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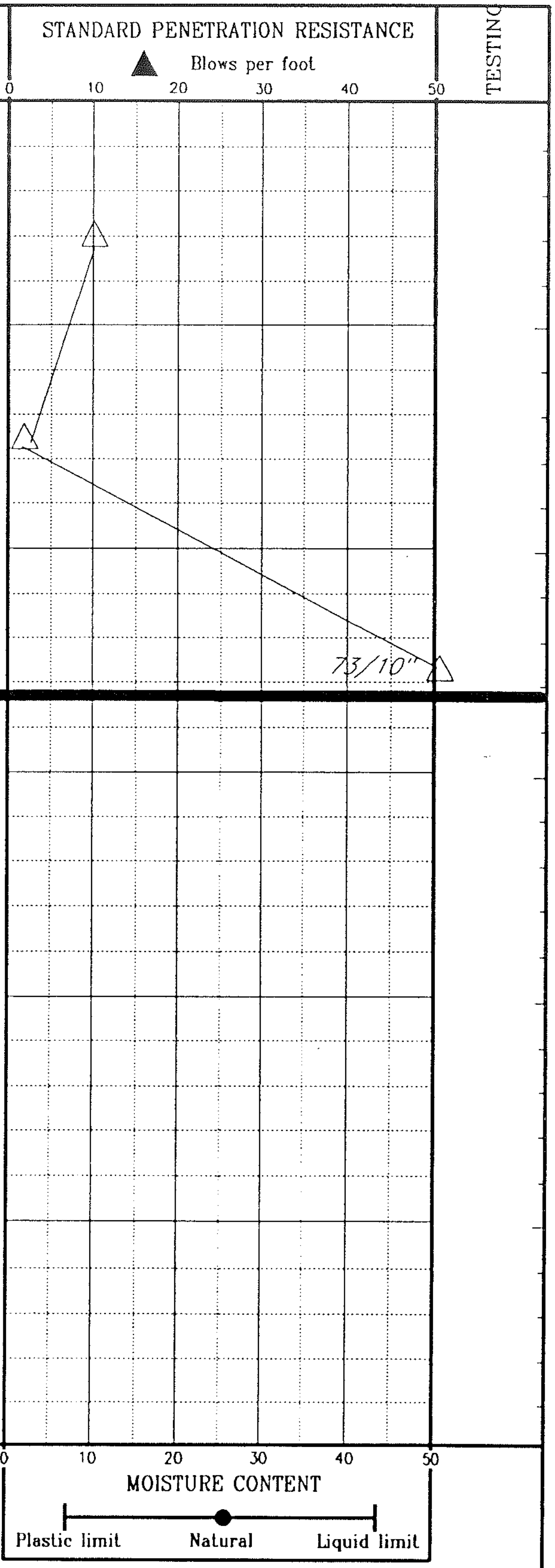
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

Drilling started: *27 March 1992* Drilling completed: *27 March 1992* Logged by: *ENJS*

PROJECT *Pullman Level II* W.O. *S-1023* BORING NO. *B-8*

Approximate ground surface elevation: *275 feet*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER
0				
	Loose, black to yellowish brown, silty fine SAND with some organics and trace gravel.	I	*S-1*	*0.0*
5	*Soft, wet, green to greenish brown, SILT with trace fine sand and thin fine sandy interbeds, Groundwater encountered at 7.8 feet at time of drilling.*	I	*S-2*	*0.0*
10				
	Very dense, saturated, green to yellow, gravelly SAND with some silt.	I	*S-3*	*0.0*
	Basalt bedrock. *Boring terminated at 13.3 feet.*			
15				
20				
25				
30				



LEGEND

I 3-inch OD split spoon sampler

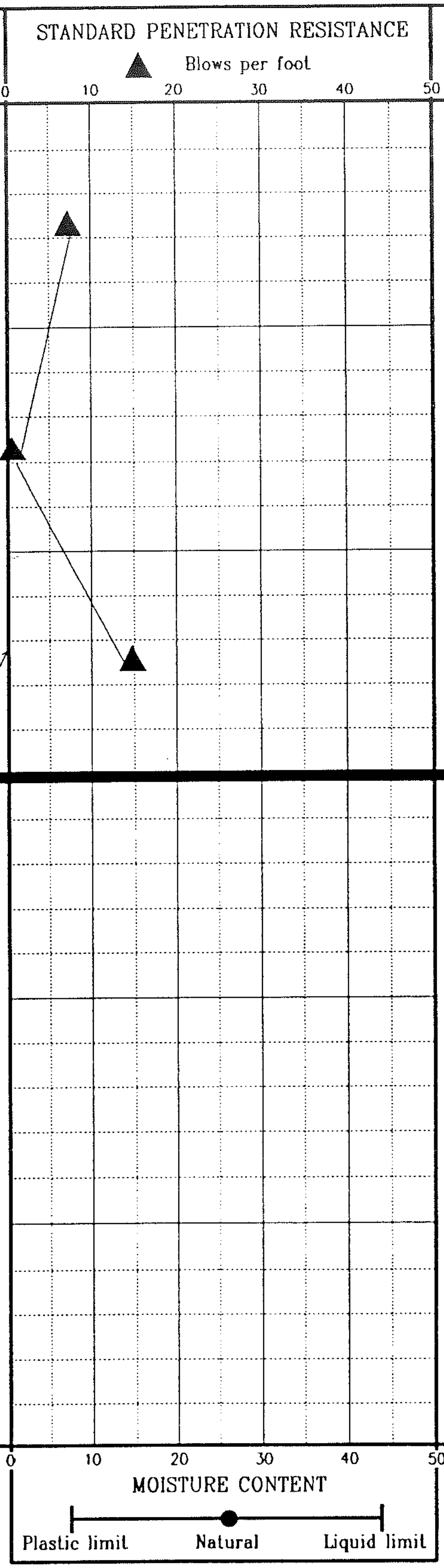
RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

Drilling started: *27 September 1990* Drilling completed: *27 September 1990* Logged by: *ENJS*

PROJECT *Pullman Level II* W.O. *S-1023* BORING NO. *B-9*

Approximate ground surface elevation: *275 feet*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	TESTING
0	*Angular basalt cobbles and gravel fill for road.*				
	Medium stiff, brown to dark brown, damp, fine sandy SILT with organics and trace coal cinders.	I	*S-1*	*0.0*	
5	*Soft, saturated, dark brown to black, mottled SILT organics and petroleum hydrocarbon-like odor. Groundwater encountered at 7.0 feet at time of drilling.*	I	*S-2*	*29.8*	HCID BTEX LEAD
10					
	Medium dense, saturated, dark gray to yellow, silty SAND with some fine angular gravels. Petroleum hydrocarbon-like odor.	I	*S-3*	*68.1*	HCID BTEX LEAD
15	*Basalt bedrock.* *Boring terminated at 15.0f feet.*				
20					
25					
30					



LEGEND

I 3-inch OD split spoon sampler

RZA AGRA, Inc.
Engineering & Environmental Services
539 West Sharp, Suite 100
Spokane, WA 99201

Drilling started: *26 September 1990* Drilling completed: *26 September 1990* Logged by: *ENJS*

200 wash

APPENDIX B

ANALYTICAL TEST RESULTS AND PROCEDURES

APPENDIX B

Laboratory Testing Procedures

Soil samples were selected from each boring for analytical testing for a variety of analytes commonly associated with petroleum hydrocarbon fuels and oils. All analyses were performed by Precision Analytics, Inc. of Pullman, Washington, under contract from our firm. A brief description of each laboratory tests conducted is given below.

TOTAL PETROLEUM HYDROCARBONS
by HCID Method

This method is a qualitative procedure which is used to identify petroleum products containing the components in the C_6 to C_{30} range by capillary gas chromatography with flame ionization detection. While this method is intended to be qualitative and will be required prior to quantification by WTPH-G and WTPH-D, it can be used to eliminate the need for further analysis for those samples which demonstrate TPH levels significantly below the regulatory limits. The detection limits for the HCID method is 20 ppm for gasoline, 50 ppm for diesel, and 100 ppm for heavy oils.

GASOLINE-RANGE ORGANIC COMPOUNDS (BTEX)
by WTPH-G/BTEX

The WTPH-G adapts EPA SW 846 Methods 5030 and 8020 to perform the analysis for gasoline in soils. The method involves extracting the soil samples with methanol, combining a portion of the extract with reagent water and analysis utilizing a purge/trap concentrator equipped gas chromatograph with FID detection. The reporting limit for gasoline is 1.0 parts per million. This method along with the prescribed detector will allow simultaneous determination of total gasoline with the listed target analytes (benzene, toluene, ethylbenzene and xylenes).

DIESEL RANGE ORGANIC COMPOUNDS
by WTPH-D

The WTPH-D method covers the analysis for diesel in soils (analogous to EPA Method 8015 Modified). The method involves extracting the soil samples with methylene chloride, filtering the extract through sodium sulfate and injection of a portion into a gas chromatograph equipped with a flame ionization detector (FID). The lower reporting limit is 1.0 ppm.

TOTAL PETROLEUM HYDROCARBONS
by EPA Method 418.1

Analytes are extracted from the sample by mixing the sample with a freon solution. The sample and extracting solution are thoroughly mixed utilizing a mechanical shaker or sonicator. The extract is then seperated from the sample and analyzed by infared spectrophotometry (IR). The freon extracting solution is used for both soil and water analyses. Method 418.1 allows detection of a wide variety of petroleum hydrocarbons. However, Method 418.1 is susceptible to interferences by non-petroleum hydrocarbons and cannot distinguish between fuel types.

TOTAL PETROLEUM HYDROCARBONS

by EPA 8015 Modified

The sample extraction procedure is similar to that used for EPA 418.1. Analysis of the extract is conducted utilizing a gas chromatograph coupled with a flame ionization detector (FID). Analysis is restricted to petroleum hydrocarbons which elude at or before diesel fuel hydrocarbons. Order of elution is primarily dependent upon volatility and/or molecular weight with light end analytes (i.e. low atomic and/or molecular weight) eluting prior to heavy end analytes.

BTEX

by EPA SW-846 Method 8020/602

Analytes are extracted from soil samples by mixing the sample in a solution of methanol. The sample and extracting solution are thoroughly mixed utilizing a mechanical shaker or sonicator. The extract is separated from the sample by filtration and analyzed utilizing a gas chromatograph coupled with a photoionization detector (PID). The PID is very specific for analysis of aromatic hydrocarbons.

Analytes are extracted from water samples using a purge-and-trap technique. The sample is held in a hollow "sparge" tube. A purified, inert gas (helium) is bubbled through the sample which efficiently extracts the purgeable organic analytes from the aqueous phase to the vapor. The gaseous mixture is then passed through a sorbent trap where the analytes are collected. After the extraction is complete, the trap is backflushed and heated which effectively desorbs the purgeable analytes from the trap and onto the gas chromatograph column.

TOTAL AND DISSOLVED METALS

by EPA Method 7000 and 200 Series

Metals in solution may be readily determined by atomic absorption spectroscopy. Preliminary treatment of waste water, groundwater, EP extracts, and industrial waste is always necessary because of the complexity and variability of sample matrix. Solids, slurries, and suspended material must be subjects to soluble process before analysis. In direct-aspiration atomic absorption spectroscopy, a sample is aspired and atomized in a flame. A light beam from a hollow cathode lamp or electrodeless discharge lamp is directed through the flame into a monochromator, an onto a detector that measures the amount of absorbed light. When using the furnace technique in conjunction with atomic absorption spectrophotometer, a representative aliquot of a sample is placed in the graphite tube in the furnace, evaporated to dryness, charred, and atomized.

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928
FAX (509) 332-0666

April 18, 1992

Rittenhouse-Zeman & Associates, Inc.
539 W. Aharp, Suite D
Spokane, WA 99201
Attn: Gene St.Godard

Items: Soil Sample for Petroleum Analysis
Date Received: 03/26/92
Project Name: Pullman Level 2
Log In #: 1827
Report #: RZA1827.001

Sample received in EPA approved containers

Analysis:
TPH-G & BTEX - EPA 8020 Modified
TPH-D - EPA 8015 Modified
Pb - EPA 7420

All results in mg/Kg (ppm)

ND = Not Detected
DL = Detection Limit

Sample	Analyte	Concentration	DL
MW1, S-2	Benzene	1.45	0.005
	Toluene	ND	0.005
	Ethylbenzene	0.925	0.005
	Xylene	0.559	0.005
	Gasoline	20.0	10.0
	Diesel	1889.0	25.0
	Pb	20.7	2.5
MW1, S-4	Benzene	ND	0.005
	Toluene	0.041	0.005
	Ethylbenzene	0.005	0.005
	Xylene	0.017	0.005
	Pb	19.2	2.5
MW2, S-3	Benzene	0.006	0.005
	Toluene	ND	0.005
	Ethylbenzene	0.054	0.005
	Xylene	0.079	0.005
	Pb	17.9	2.5
MW2, S-5	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	15.3	2.5

HCID - EPA 8015 Modified

Detection Limit for Diesel	50ppm
Detection Limit for Gasoline	25ppm

Sample	**Results**
MW1, S-2	Gasoline detected by TPH-HCID Diesel detected by TPH-HCID
MW1, S-4	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW2, S-3	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW2, S-5	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID

Respectfully,

J. Zhou

Jane Zhou
Analyst

Huang Honghan

Honghan Huang
Chemist

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928
FAX (509) 332-0666

April 18, 1992

Rittenhouse-Zeman & Associates, Inc.
539 W. Aharp, Suite D
Spokane, WA 99201
Attn: Gene St.Godard

Items: Soil Sample for Petroleum Analysis
Date Received: 03/27/92
Project Name: Pullman Level 2
Log In #: 1831
Report #: RZA1831.001

Sample received in EPA approved containers

Analysis:
TPH-G & BTEX - EPA 8020 Modified
TPH-D - EPA 8015 Modified
Pb - EPA 7420

All results in mg/Kg (ppm)

ND = Not Detected
DL = Detection Limit

Sample	**Analyte**	**Concentration**	**DL**
B-9S2	Benzene	0.038	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Diesel	428.0	25.0
	Pb	19.2	2.5
B-9S3	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	19.1	2.5
MW3S2	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	23.3	2.5
MW3S3	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	15.4	2.5

Sample	Analyte	Concentration	DL
MW4 S1	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	52.7	2.5
MW4 S2	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	23.5	2.5
B7 S2	Benzene	0.106	0.005
	Toluene	ND	0.005
	Ethylbenzene	0.536	0.005
	Xylene	0.216	0.005
	Pb	32.6	2.5
B7 S5	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	0.538	0.005
	Xylene	0.218	0.005
	Pb	21.7	2.5
MW5 S1	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	44.8	2.5
B8 S2	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	28.1	2.5
B8 S3	Benzene	ND	0.005
	Toluene	ND	0.005
	Ethylbenzene	ND	0.005
	Xylene	ND	0.005
	Pb	20.0	2.5

HCID - EPA 8015 Modified

Detection Limit for Diesel	50ppm
Detection Limit for Gasoline	25ppm

Sample	**Results**
B-9 S2	Gasoline not detected by TPH-HCID Diesel detected by TPH-HCID
B-9 S3	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW3 S2	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW3 S3	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW4 S1	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW4 S2	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
B7 S2	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
B7 S5	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW5 S1	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
B8 S2	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
B8 S3	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID

Respectfully,

Jane Zhou
Analyst

Huang Honghan
Honghan Huang
Chemist

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928
FAX (509) 332-0666

April 18, 1992

Rittenhouse-Zeman & Associates, Inc.
539 W. Aharp, Suite D
Spokane, WA 99201
Attn: Gene St.Godard

Items: Soil Sample for Petroleum Analysis
Date Received: 03/28/92
Project Name: Pullman Level 2
Log In #: 1832
Report #: RZA1832.001

Sample received in EPA approved containers

Analysis:
BTEX - EPA 602
TPH-D - EPA 8015 Modified
TPH - EPA 418.1
Pb - EPA 7421

All results in mg/L (ppm)

ND = Not Detected
DL = Detection Limit

Sample	Analyte	Concentration	DL
MW-4	Benzene	ND	0.001
	Toluene	ND	0.001
	Ethylbenzene	ND	0.001
	Xylene	ND	0.001
	TPH	ND	1.0
	Pb	0.142	0.05
MW-3	Benzene	ND	0.001
	Toluene	ND	0.001
	Ethylbenzene	ND	0.001
	Xylene	ND	0.001
	TPH	ND	1.0
	Pb	0.196	0.05
MW-5	Benzene	ND	0.001
	Toluene	ND	0.001
	Ethylbenzene	ND	0.001
	Xylene	ND	0.001
	TPH	ND	1.0
	Pb	0.139	0.05
MW-2	Benzene	0.950	0.001
	Toluene	0.024	0.001
	Ethylbenzene	0.025	0.001
	Xylene	0.005	0.001
	TPH	ND	1.0
	Pb	0.120	0.05

Sample	Analyte	Concentration	DL
MW-1	Benzene	0.169	0.001
	Toluene	0.027	0.001
	Ethylbenzene	0.462	0.001
	Xylene	0.048	0.001
	TPH	49.8	1.0
	Pb	0.323	0.05
MW-10	Benzene	0.167	0.001
	Toluene	0.026	0.001
	Ethylbenzene	0.215	0.001
	Xylene	0.051	0.001

HCID - EPA 8015 Modified

Detection Limit for Diesel	10ppm
Detection Limit for Gasoline	5ppm

Sample	**Results**
MW-4	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW-3	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW-5	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW-2	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID
MW-1	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID

Respectfully,

Jane Zhou
Analyst

Huang Honghan
Honghan Huang
Chemist

APPENDIX C
PUMP TEST DATA

Water Level Measurements MW-2

RZA-AGRA, Inc. Geotechnical & Hydrogeologic Consultants

Job No. S-1023

Measuring point elevation: 2354.29

TIME (min)	WATER LEVEL (FT BELOW CASING)
15	8.39
20	8.42
90	8.44
120	8.44
150	8.44
181	8.44
207	8.44
237	8.44
266	8.44
298	8.45
327	8.45
356	8.45
390	8.46
419	8.47
450	8.48
478	8.48
506	8.49
536	8.49
568	8.49
596	8.50
629	8.50
662	8.51
723	8.53
779	8.54
842	8.54
902	8.55
970	8.56
1030	8.57
1090	8.58
1150	8.59
1210	8.60
1270	8.61
1330	8.61
1392	8.62
1450	8.64

RZA-AGRA, Inc. Geotechnical & Hydrogeologic Consultants

Job No. S-1023

Measuring point elevation: 2354.43

TIME (min)	WATER LEVEL (FT. BELOW CASING)
15	7.21
20	7.21
95	7.23
123	7.23
154	7.23
184	7.23
212	7.23
242	7.23
269	7.23
302	7.24
331	7.24
359	7.24
393	7.25
424	7.25
453	7.25
481	7.25
508	7.26
539	7.26
572	7.26
599	7.26
632	7.27
665	7.27
729	7.28
785	7.30
854	7.30
902	7.30
970	7.30
1030	7.31
1090	7.31
1150	7.31
1210	7.32
1270	7.32
1330	7.32
1392	7.32
1450	7.33

Water Level Measurements MW-4

RZA-AGRA, Inc. Geotechnical & Hydrogeologic Consultants

Job No. S-1023

Measuring point elevation: 2352.35

TIME (min)	WATER LEVEL (FT. BELOW CASING)
15	6.92
20	6.95
95	6.95
123	6.95
154	6.94
184	6.94
212	6.94
242	6.94
269	6.94
302	6.94
331	6.94
359	6.95
393	6.95
424	6.95
453	6.96
481	6.96
508	6.96
539	6.96
572	6.96
599	6.96
632	6.96
665	6.96
729	6.96
785	6.96
854	6.965
902	6.96
970	6.97
1030	6.97
1090	6.97
1150	6.97
1210	6.98
1270	6.99
1330	6.99
1392	6.99
1450	7.00

Water Level Measurements MW-5

RZA-AGRA, Inc. Geotechnical & Hydrogeologic Consultants

Job No. S-1023

Measuring point elevation: 2353.19

TIME (min)	WATER LEVEL (FT. BELOW CASING)
15	6.11
20	6.16
93	6.15
121	6.16
151	6.15
180	6.15
208	6.16
239	6.16
268	6.17
299	6.17
328	6.18
357	6.18
391	6.19
422	6.19
451	6.20
479	6.20
507	6.21
537	6.21
569	6.21
597	6.21
631	6.22
663	6.22
725	6.23
783	6.24
844	6.25
902	6.25
970	6.25
1030	6.26
1090	6.27
1150	6.29
1210	6.30
1270	6.30
1330	6.30
1392	6.30
1450	6.31

CITY OF PULLMAN (509) 334-4555
P.O. BOX 249, PULLMAN, WA 99163-0249

April 10, 1992

RZA-AGRA
Georgetown Office Bldg.
539 W. Sharp, Suite D
Spokane, WA 99201

ATTN: Gene ST. Godard
SR Staff Geologist

Mr. Godard,

The City of Pullman's, Public Works Department has received your request to discharge hydrocarbon impacted groundwater from beneath the East Main Street bridge and determined that the attached minor discharge authorization is the appropriate document for this discharge.

This authorization permits you to discharge limited amounts of hydrocarbon impacted groundwater into the citys sanitary sewer system in accordance with the effluent limitations and other requirements and conditions set forth in the document and the regulations outlined in our ordinance.

If you propose to substantially increase the volume of your discharge or change the type and quantities of substances discharged, you must submit a new waste discharge permit application to the City of Pullman.

In addition to the requirements set forth in the enclosed discharge authorization, you are also responsible for meeting the conditions of the City of Pullman before discharge under this authorization can begin. Your contact at the City of Pullman is Mr. Ron Cooper, 509/334-4555, Ext. 238 or home phone 509/332-3704. You may also contact Patrick Wiltzius, (work 334-4555, Ext. 233 or home 332-5932).

At the request of the City of Pullman you must:

A. Discharge the hydrocarbon impacted ground water to a sanitary sewer manhole located beneath the Main Street bridge. The City of Pullman must approve the discharge location and temporary hook-up prior to discharge.

B. Discharge of hydrocarbon groundwater will not be discharged to the city sanitary sewer system until after the air stripper is in operation and analysis of the impacted groundwater is within the discharge limits found in the "Special Conditions" section of this document.

C. Install a meter (that reads in cubic feet) on the discharge from your air stripper.

D. Submit copies of all test analysis required to the City of Pullman, Public Works Department (to the attention of Mr. Ron Cooper).

The City of Pullman wants to help you stay in compliance with our regulations. If at any time you have questions about this discharge authorization, or other question about your discharge, please do not hesitate to call me at (509) 334-4555.

Sincerely,

James J. Hudak

J.J. Hudak
Director of Public Works

INDUSTRIAL DISCHARGE PERMIT FOR SPECIAL/MINOR DISCHARGES

FOR

RZA-AGRA, INC.
GEORGETOWN OFFICE BLDG.
539 W SHARP, SUITE D
SPOKANE, WA 99201

CONTACT: GENE ST. GODARD

PHONE: (509) 325-0104

TYPE: HYDROCARBON IMPACTED GROUNDWATER

MAXIMUM VOLUME: 14,400 GPD

DOCUMENT EFFECTIVE DATE: 4/15/92

EXPIRATION DATE: 4/30/92

24 HOUR EMERGENCY NOTIFICATION

RON COOPER: 334-4555, Ext> 238 or home 332-3704

PATRICK WILTZIUS: 334-4555, Ext. 233 or home 332-5932

PULLMAN TREATMENT PLANT: 334-4555

PULLMAN POLICE DEPARTMENT: 332-2521

DEPARTMENT OF ECOLOGY: 456-6169

PULLMAN FIRE DEPARTMENT: 334-1515

GENERAL DISCHARGE LIMITATIONS

* SEE "ATTACHMENT A"

SPECIAL CONDITIONS

Constituent	Maximum Concentration
BENZENE	0.13 ppm
TOLUENE	1.5 ppm
ETHYLBENZENE	1.4 ppm
NON-POLAR FATS, OIL & GREASE (NON-POLAR FOG)	100 ppm

Operating Procedures

Common Sense Criteria

A. There shall be no pronounced odor of solvent or gasoline

B. There shall be no pronounced oil sheen or unusual color

C. There shall be no pronounced hydrogen sulfide odor.

D. There shall be no visibly pronounced turbidity, the discharge must remain translucent.

The City of Pullman will expect operators on site to pay close attention to these common sense criteria whenever discharge to the sanitary sewer is occurring.

If any of the discharge limits or common sense criteria are exceeded, you must stop discharging and must notify the City of Pullman at 334-4555, Ext. 238 or Ext. 233 during working hours or Ron cooper at 332-3704 or Patrick Wiltzius at 332-5932 after working hours.

Monitoring Requirements

The following monitoring requirements shall be met for this discharge authorization:

Parameter	Frequency	Sample Type (method)
Flow	Gallon per day	Meter

Monitoring Requirements Continued

Parameter	Frequency	Sample Type (method)
Common Sense Criteria	Continuous	Observation
Explosiveness	Prior to initial discharge, once during the 24 hour discharge	Meter
Hydrogen	Only if common sense criteria exceeded	Grab/Imoff cone or turbidity meter is
Benzene, toluene ethylbenzene, xylene	Prior to initial discharge, once during the 24 hour discharge	Grab/EPA method 602
Non-polar Fog	Prior to initial discharge, once during the 24 discharge	Grab/Standard method 5520 F during the 24

A self monitoring report shall be filed with the City of Pullman by the 15th day of the month following sample collection. This report must include the total monthly volumn of water discharged to the sewer as well as the analytical results.

In the event of the industrial user is unable to comply with any of the conditions of this discharge authorization because of a breakdown of equipment, an accident caused by human error, negligence, or any other cause, such as a act of nature, the company shall:

A. Take immediate action to stop, contain and clean up the unauthorized discharges and correct the problem.

B. Immediately notify the city so steps can be taken to prevent damage to the sewerage system.

C. Submit a written report describing the breakdown, the actual quantity and quality of resulting waste discharge, corrective action taken, and the steps taken to prevent a recurrence.

Compliance with these requirements does not relieve the industrial user from responsibility to maintain continuous compliance with the conditions of the discharge authorization or the resulting liability for failure to comply.

The industrial user shall, at all reasonable times, allow authorized representatives of the City of Pullman to enter that portion of the premise where an effluent source or disposal system is located or in which any records are required to be kept under the terms and conditions of this discharge authorization.

Nothing in the discharge authorization shall be construed as excusing the industrial user from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

This discharge authorization does not constitute authority for discharge into waters of the state. Any such discharge is subject to regulation and enforcement action by the Department of Ecology.

All requirements and ordinances of the Environmental Protection Agency and Department of Ecology pertaining to hazardous and toxic wastes, disposal facilities, and discharge of wastes into the municipal sewer system, are hereby made a condition of this discharge authorization.

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928
FAX (509) 332-0666

April 23, 1992

Rittenhouse-Zeman & Associates, Inc.
539 W. Aharp, Suite D
Spokane, WA 99201
Attn: Gene St.Godard

Items: Water Sample for Petroleum Analysis
Date Received: 04/22/92
Project Name: Pullman Level 2
Log In #: 1881
Report #: RZA1881.001

Sample received in EPA approved containers

Analysis:
BTEX - EPA 602
HCID - EPA 8015 Modified
Oil & Grease

All results in mg/L (ppm)

ND = Not Detected
DL = Detection Limit

Sample	**Analyte**	**Concentration**	**DL**
EFF-1	Benzene	ND	0.001
	Toluene	ND	0.001
	Ethylbenzene	ND	0.001
	Xylene	ND	0.001
	Gasoline	ND	2.0
	Fuel oils	ND	5.0
	Heavy oils	ND	3.0

HCID - EPA 8015 Modified

Detection Limit for Diesel	5ppm
Detection Limit for Gasoline	2ppm

Sample	**Results**
EFF-1	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID

Respectfully,

Jane Zhou
Analyst

Todime Reddy
Todime Reddy
Chemist

PRECISION ANALYTICS, INC.

N.E. 2345 Hopkins Court • Pullman, WA 99163
TEL. (509) 332-0928
FAX (509) 332-0666

May 8, 1992

Rittenhouse-Zeman & Associates, Inc.
539 W. Aharp, Suite D
Spokane, WA 99201
Attn: Gene St.Godard

Items: Water Sample for Petroleum Analysis
Date Received: 04/24/92
Project Name: Pullman Level 2
Log In #: 1887
Report #: RZA1887.001

Sample received in EPA approved containers
Sample received under chain of custody

Analysis:
BTEX - EPA 602 Oil & Grease

All results in mg/L (ppm)

ND = Not Detected
DL = Detection Limit

Sample	**Analyte**	**Concentration**	**DL**
EFF-2	Benzene	ND	0.001
	Toluene	ND	0.001
	Ethylbenzene	ND	0.001
	Xylene	ND	0.001
	Gasoline	ND	2.0
	Fuel oils	ND	5.0
	Heavy oils	ND	3.0

HCID - EPA 8015 Modified

Detection Limit for Diesel	5ppm
Detection Limit for Gasoline	2ppm

Sample	**Results**
EFF-2	Gasoline not detected by TPH-HCID Diesel not detected by TPH-HCID

Flashpoint

Sample	**Results**
EFF-2	> 220 degree F

Respectfully,

Jane Zhou
Analyst

APPENDIX D
GLOSSARY OF ACRONYMS

GLOSSARY OF ACRONYMS

B	Leakage Coefficient
BACT	Best Available Control Technology
BNRR	Burlington Northern Rail Road
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CCL	Compliance Cleanup Level
CFM	Cubic Feet per Minute
CM/SEC	Centimeters per Second
DCAP	Draft Cleanup Action Plan
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
GAC	Granulated Activated Carbon
GPM	Gallons per Minute
HCID	Washington State Hydrocarbon Identification Analysis
K	Hydraulic Conductivity
MTCA	Model Toxics Control Act
PCS	Petroleum Contaminated Soils
PID	Photoionization Detector
PPM	Parts Per Million
PVC	Polyvinylchloride
RI/FS	Remedial Investigation/Feasibility Study
S	Storage Coefficient
T	Transmisivity
TPH	Total Petroleum Hydrocarbons
VES	Vapor Extraction System
WSDOT	Washington State Department of Transportation
WTPH-D	Washington State Total Petroleum Hydrocarbon Identification Analysis

LEVEL I ENVIRONMENTAL SITE ASSESSMENT

BNRR OVERCROSSING BRIDGE 270/4 REPLACEMENT

Pullman, Washington

Prepared for

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

June 1992

S-1023

RZA-AGRA
Engineering & Environmental Services

AGRA
Earth & Environmental Group

Dave George, DOE SPOKANE

Washington State
Department of Transportation

Memorandum

June 30, 1992

FROM: R. G. Finkle/T. L. Harrison
Headquarters Materials Laboratory, 7365
Phone: 586-7659 SCAN 321-7659

TO: J. Lenzi/Elmer Swanson
Dist. 6 Materials

RE: SR-270, C.S. 3831, XL-8578
Spring Street to Johnson Road
Bridge No. 270/4 Replacement
Environmental Site Assessment Final Report

Enclosed is the final report for the environmental assessment of the Bridge No. 270/4 replacement site prepared by RZA-AGRA. This work was done under our "on-call" agreement with RZA-AGRA.

We are distributing copies of the report to the offices in the District listed below, as well as to the Headquarters Environmental office and the Department of Ecology office in Spokane.

Please contact us if you need any further assistance.

RGF:tlh
TLH

Enclosures

cc: J. C. Lenzi, Dist. Administrator, D-6
S. L. Chatterton, Proj. Dev., D-6
Gion Gibson, Proj. Eng., D-6
Jay Yerxa, Dist. 6 Environ., D-6
B. Chaplin, HQ Eniron., 7329
Dave George, DOE Spokane

Chevron

Chevron U.S.A. Products Company
2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

RECEIVED
APR 14 1993
DEPT. OF ECOLOGY
EASTERN REGIONAL OFFICE

April 13, 1993

Mr. Dave George
WA Department of Ecology, Eastern Region
North 4601 Monroe, Suite 100
Spokane, WA 99205-1295

<u>Re:</u> <u>Former Chevron bulk storage facility (Washington State University property)</u>
<u>815 East College Street, Pullman, Washington</u>
<u>Enclosed report of environmental site assessment (RZA, 3/31/93)</u>

Dear Dave:

I have enclosed a report dated March 31, 1993, which was prepared by Chevron's consultant, RZA-AGRA of Spokane (RZA), to describe the results of an environmental assessment conducted in February and March 1993 at the subject site. The assessment consisted of drilling and collecting samples from two soil borings (CB-5 and CB-6) located on the southern end of the site and two groundwater monitoring wells (MW-11 and MW-12) located hydraulically downgradient from the site. Soil and water samples were analyzed for a variety of petroleum related compounds. In addition, RZA measured groundwater elevations in all twelve of the existing monitoring wells and constructed a potentiometric surface map depicting groundwater flow. RZA's report describes the field activities and results in detail.

To summarize, petroleum related compounds were detected in one of the four locations tested. The two soil borings, CB-5 and CB-6, were located in the area of the planned footing excavation for the proposed bridge project. Boring CB-5 was located in an area where previous testing had shown petroleum hydrocarbons to exist. The additional assessment of this area was conducted in order to collect data on polynuclear aromatic hydrocarbon concentrations in the soil there. Sampling at a location further south, boring CB-6, confirmed the lack of detectable petroleum hydrocarbons in that area. The locations of the two groundwater monitoring wells, MW-11 and MW-12, were selected to define the limit of the dissolved hydrocarbon plume in groundwater downgradient of the site and to confirm that petroleum hydrocarbons had not migrated to the South Fork of the Palouse River.

Chevron's consultant, PTI Environmental Services of Bellevue (PTI), is using the site specific characteristics, the results of site assessments, and the provisions within MTCA to determine clean-up criteria and points of compliance for the media affected at this site. Chevron's plans will include special consideration of the proposed future uses of the property, most notably the planned bridge expansion project by the Department of Transportation. PTI's findings will be transmitted under separate cover.

If you have any questions or comments, I can be reached at (510) 842-8658.

Sincerely,

Clint B. Rogers

Clint B. Rogers
Environmental Engineer

Enclosure

cc: Jim Owens, WSU, French Admin. Bldg., Room 432, Pullman, WA 99164-1045
Joe Chatterton, WA Dept. of Transportation, N. 2714 Mayfair, Spokane, WA 99207-2090
Jim Hudak, City of Pullman, P.O. Box 249, Pullman, WA 99163-0249
Celia Evans, PTI, Bellevue, WA
Jon Sondergaard, RZA-AGRA, Spokane, WA (w/o enclosure)

RZA-AGRA
Engineering & Environmental Services
(Rittenhouse-Zeman & Associates, Inc.)

Georgetown Office Building
529 W Sharp, Suite D
Spokane, WA 99201
[illegible]
FAX (509) 325-0212

26 June 1992

Washington State Department of Transportation
P.O. Box 167
Olympia, Washington 98504

Attention: Mr. Todd Harrison, P.E.
Subject: Level I Environmental Site Assessment
BNRR Overcrossing Bridge-270/4 Replacement
Pullman, Washington

Mr. Harrison:

RZA-AGRA, Inc. is pleased to present the results of our Level I Environmental Site Assessment for the above referenced site. This work was verbally authorized by Mr. Todd Harrison of Washington State Department of Transportation on 19 November 1991. Results of our Level II Environmental Site Assessment for the same project are presented under separate cover.

We appreciate the opportunity to be of service to the Washington State Department of Transportation on this project. Should you have any questions regarding this report, please call us at your earliest convenience.

Respectfully submitted,
RZA-AGRA

Jon Andey (for)

Eugene N.J. St.Godard
Senior Geologist

LEVEL I ENVIRONMENTAL SITE ASSESSMENT

BNRR Overcrossing Bridge 270/4 Replacement
Pullman, Washington

Prepared for

Washington State Department of Transportation
P.O. Box 167
Olympia, Washington 98504

RZA - AGRA
W. 539 Sharp Avenue, Suite D
Spokane, Washington 99201

26 June 1992

S-1023

AGRA
Earth & Environmental Group

TABLE OF CONTENTS

S-1023

LEVEL I ENVIRONMENTAL SITE ASSESSMENT
Washington Department of Transportation
Transportation Building KF-01
Olympia, Washington 99504

1.0 SUMMARY LEVEL I SITE ASSESSMENT

RZA AGRA, Inc. performed a Level I Environmental Site Assessment on the subject property located beneath Bridge 270/4 in Pullman, Washington which overcrossess the Burlington Northern Railroad (BNRR). The purpose of the assessment was to identify indications or reports of past or present activities or situations with potential to contaminate the environment on or in the vicinity of the subject property.

The following presents the key findings of the Level I investigation portion of this study. Additional background information is described subsequently in the text of this report.

- Based on the information available for this study, in our opinion, the subject property has a high potential for existing soil or groundwater contamination;
- The site is currently unoccupied but is owned and used as a coal stockpile area by Washington State University. The property was donated to the University by Chevron Corporation in 1981;
- The site was previously occupied by a petroleum bulk storage plant for at least 65 years;
- Obvious signs of petroleum stained soils are located along the railroad tracks and in the general vicinity of the site;
- Water supply wells for the City of Pullman and Washington State University are located within one half mile of the subject site. However, water is derived from deep aquifers within the basalt interflows which are not easily affected by near surface contamination;
- According to regulatory lists reviewed and agency personnel interviewed, no reported LUST's, or CERCLA sites are located within one mile of the subject property. RCRA sites are located within a 1/2 mile radius of the site.

This summary is presented for introductory purposes and should only be used in conjunction with the full text of this report. The project description, site conditions and results of our assessment are presented below.

2.0 INTRODUCTION

The purpose of this study was to evaluate the subject site for reports or indications of soil or groundwater contamination due to previous or ongoing site activities and to review the surrounding area for facilities which handle, produce or store substances which may have an adverse effect upon the soils or groundwater at this site if released to the environment. The scope of work for this project consisted predominantly of gathering existing available information.

The objective of the record search and the site visit was to identify obvious potentially contaminating activities that occurred at or near the site. Based on our findings, we present our opinion concerning the potential for contamination may be present at the site resulting from both on-site and off-site activities.

The data gathering portion of the study consisted of the following:

- Visiting the site and vicinity to make relevant observations;
- Reviewing local, State and Federal data bases to identify reported potentially environmentally hazardous activities located within a one mile radius of the property;
- Obtaining information from local city, county, state and university officials regarding the presence of underground storage tanks (UST) on the subject property and surrounding sites;
- Reviewing aerial and historic photographs of the site and vicinity to evaluate indications of past land use activities;

- Developing a qualitative statement or judgement, based on a visual property inspection and information provided by the various agencies or other sources, regarding the potential for the property to contain environmental contaminants in soil and groundwater at concentrations currently requiring remediation.

During our visit, we looked for obvious indications of underground and above ground storage tanks, storage drums, distressed vegetation, indications of groundwater and soil contamination, transformers that might contain polychlorinated biphenyls (PCB's) and other apparent hazardous or toxic substances, or waste materials.

A review of the surrounding area included attempting to locate nearby facilities such as service stations, automobile service centers, dry cleaning establishments, industrial facilities, and garden shop/nurseries which could potentially act as off-site sources of contaminants which could migrate to the subject site.

It should be understood that any parcel is vulnerable to environmental impairment from such activities as unreported or illicit dumping or spilling of deleterious materials that may not be readily apparent. The professional opinions and conclusions in this report are based on our review of available information, and our visual evaluation of current site conditions. The collection of quantitative information in the form of laboratory analyses of soil and water samples was beyond the scope of work for this portion of the study and will be discussed in the Level II report which will follow this report.

This report has been prepared in accordance with generally accepted environmental assessment practices, for the exclusive use of the Washington State Department of Transportation and their agents, for specific application to the subject site. No other warranty, express or implied, is made. In the event that there are any changes on the existing site or nearby properties, the conclusions and recommendations contained in this report should be reviewed by our office.

3.0 RESULTS OF THE ASSESSMENT

3.1 Site Description

The subject property is an irregularly shaped parcel located in the city of Pullman, Washington. The property is bordered by College Street to the north and Spring Street to the west. The subject property is located in the western part of Washington State University near the railroad right of way and beneath the

270/4 overpass. The subject property is located in Township 14 North, Range 45 East in the southwest 1/4 of the northwest 1/4 of Section 5 and occupies approximately 3/4 of an acre. The site is currently vacant with only one remaining structure located on College Street. The W.S.U. railroad spur line crosses the property in route to the W.S.U. powerplant. Figure 1, Vicinity Map, presents the location of the site within the City of Pullman.

3.2 Site Reconnaissance

A representative from our firm visited the site in February 1992 to perform a site reconnaissance. This site reconnaissance consisted of walking the site and record pertinent observations regarding the current condition of the property. The purpose of the site reconnaissance was to make observations regarding the obvious presence of stained surficial soils, distressed vegetation, underground storage tanks, current potentially contaminating site activities or other occurrences or activities which may indicate the environmental condition of the site.

Figure 2 presents the current site plan of the property. The subject site is currently unoccupied directly below the bridge and is crossed by railroad tracks. The eastern area of the property where the tanks from the former petroleum bulk plant were located, is now being used as a stockpile area for coal by Washington State University. A building is still located at the northern section of the property on College Street and is primarily used as a storage area for the Universities equipment.

The property is bordered to the north by College Street, to the east by Tacoma Street and to the west by Spring Street. The eastern portion of the property is fenced where the coal is stockpiled and is primarily unpaved. A concrete slab is located in the center of the property where a building once was located. The property parcel is relatively flat with an estimated elevation relief of approximately 3 feet. A steep slope with an estimated relief of thirty feet is located on the eastern border by Tacoma street.

A 500 gallon above ground storage tank is located near the center of the property (Figure 3-A). The tank is used by the university maintenance department and holds diesel fuel. Obvious signs of leakage or spillage is indicative of the petroleum stained soils located around the basal foundation constructed below the tank (Figure 3-B).

Other visible signs of stained soils are present along the railroad tracks which cross the property. Photographs presented in Figure 4 portray the stained soils and sheens present in puddles located across the property and the approximate location of stained surficial soils is indicated on Figure 2. Stained soils are more pervasive towards the east central portion of the property, near the W.S.U. Spur Line.

The eastern portion of the property is covered by stockpiled coal and the condition of the soils could not be assessed. This area is the general area where former petroleum storage tanks were once located. Concrete retaining walss located along the east side of the property, below Tacoma Street, are relicts of the former bulk storage facility.

Vegetation across the property consists primarily of weeds and various types of grasses along the slopes. The vegetation is sparse and thin in areas probably caused from vehicles driving through this area and the university dumping and moving soilswith their eqiupment. The dying of some of the grasses may be a result of minimal rainfall in the area.

3.3 Geology, Hydrogeology and Soils

The geology of the site is characterized by a thin deposit (10 to 15 feet) of fluvial sediments and overbank flood deposits (consisting of fine-grained sediments) deposited by the South Fork of the Palouse River occupying the western portion of the valley at the site location. Directly above the fluvial flood plain deposits is located some fill material which thickens towards the west where a dump area was once located. The fluvial flood deposits overlie a thin (1 to 2 foot thick) regolith gravel interval. These gravel deposits were deposited directly over the Miocene basalts of the Columbia Plateau. The basalt flows are the major geologic event that happened in this region. Approximately 13 to 16 million years ago basalt lava erupted from a center in southeastern Washington and nearby Oregon and flooded most of central and eastern Washington.

There were many lava flows, erupting approximately every few thousand years and flooding the area around Pullman. Each lava flow would thinly spread over hundreds of square miles. It would cool to form the black, fine-grained rock which is present throughout southeastern Washington.

A veneer of yellowish wind blown dust, called loess, covers large parts of eastern Washington. The loess is in old dunes, which create the rolling Palouse Hills of eastern Washington and western most Idaho. This loess produces the fertile lands located around Pullman. The wind blown loess of the Palouse Hills contains little evidence of its age except that it accumulated long after volcanic activity ceased in the Columbia Plateau, and sometime before the last ice age. Large clouds of dust blow off glacial outwash deposits during dry weather resulting in large loess deposits downwind from glaciated regions. The Palouse Hills lie immediately south of large glaciated regions, and immediately northeast of the extremely dry country in south central Washington and nearby Oregon.

The project site occupies the eastern floodplain of the south fork Palouse River, characterized by 10 to 15 feet of fluvial soils over bedrock. A relatively well defined groundwater level was observed at a depth of 8 to 11 feet below the existing ground surface (approximately 2 feet above bedrock) at the subject site within the gravels deposited above the basalt bedrock as determined from borings and test pits completed at the site location in the summer months. A groundwater elevation in the spring months was documented 5 to 6 feet below the ground surface. Monitoring wells installed at the site exhibit a static water level higher in the silt beds near the surface. These static level measurments in the observation wells may result from partial confininmg of the coarser aquifer materials above bedrock. The water probably flows to the west towards the south fork Palouse River as determined by the general valley gradient. It should be noted that groundwater levels will fluctuate seasonally with variations in rainfall, season, site utilization and other factors.

3.3.1 Drinking Water Supply

A representative from the City of Pullman Municipal Water Supply stated that no services are currently supplied to the subject site. Washington State University owns wells for their water supply. Four wells that supply water to the City of Pullman from the aquifers within the basalt interflows are located at 1) by Standard Lumber on the west side of town (well #3), 2) south of the city (well #5), 3) along the road to the town of Palouse (well #4) and 4) north of the city (well #6). None of these wells reportedly have exhibited water quality problems.

3.3.2 Nearby Water Supply Wells

A search of water well records by the Washington Department of Ecology (Ecology) has revealed 5 wells near the subject site, all of which are in a 1/2 mile radius of the property. The approximate locations of these wells with respect to the subject property are shown on Figure 5. Water supply wells are deep and draw water from the permeable basalt interbeds. Wells shown on Figure 5 retrieve water from confined aquifers that occur 100 to 1,824 feet beneath the ground surface. No water supply wells which utilize the unconfined flood plain water table are recorded in Ecology's records. Drillers logs for tthe identified water supply wells are attached in Appendix A. Identification numbers on logs in Appendix A correspond to those numbers presented on Figure 5

3.4 Site History/Past and Present Activities

The history of the site was reviewed utilizing historic aerial photographs, University archive photographs, the Polk's Directory compilation of addresses and various anecdotal information sources. Most of the people interviewed worked for various government agencies. We conducted our interviews with two objectives: 1) to identify past or present potentially contaminating activities or situations at or near the subject site and; 2) to screen or evaluate the quality of the information obtained by inquiring as to the person's knowledge of the subject site. Many of the people interviewed relied on their personal knowledge of their organization's and their colleagues activities, and did not search their organization's files for the information they reported.

Aerial Photographs and WSU archive photographs of the site at various scales were reviewed for the years 1928, 1930, 1934, 1936, 1937, 1939, 1969, 1981, 1983, and 1991. In the review of aerial photographs, our observations are interpretive and limited to the area within approximately 2,500 feet of the subject property.

3.4.1 Aerial Photographs

The aerial photographs indicate that the area surrounding the subject site was sporadically developed from the turn of the century. Immediately east and northeast of the subject site the area was developed by Washington State University. Immediately south and west of the property was undeveloped until the mid 1950's. Residential development on top of the western side of the valley began in the mid 1930's. Immediately north of the subject site, College Avenue was undeveloped until the University built the steam plant in 1934-1935. Construction of the bridge for route 270 began in the late 1930's.

Aerial photographs as far back as 1928 obtained from the Washington State University Archives show a petroleum bulk storage facility owned by Standard Oil to be located at the subject site. This facility existed at the site until 1981, when aerial photographs show the facility to be dismantled. The photograph presented in Figure 6 was obtained from WSU archives Hutchinson Photograph collection and shows the facility as it appeared in 1930. Between 1930 and 1936 the large petroleum tank located at the southern portion of the facility was dismantled and removed. The remaining six tanks were present until decommissioning in 1981. Photographs obtained during this project are on file at RZA AGRA Spokane, Washington office.

3.4.2 Historical Directories

The Polk's Address Directories for the City of Pullman dating back to 1915 were reviewed from this study. These directories were reviewed for the years 1912, 1915, 1917, 1921, 1950, 1980 and 1983. The area surrounding the site was primarily undeveloped except for Washington State University campus buildings located to the east of the study area. The directory also reveals that no occupant was on the property in 1912, however in 1915 Standard Oil Company operated a petroleum bulk storage facility at the subject site. This suggests the facility would have been built in 1913 or 1914. The directories show that Standard Oil or their independent jobbers occupied the site, (and later Chevron Oil) with many different operators and special agents. Tom Busch (Busch Distributors) was the last occupant listed at the subject site in 1980.

The directory also reveals that the new Washington State University steam plant was constructed in 1934-35. No occupant listing for the site is present after 1980. The area southwest of the subject property has been primarily a residential area since the mid 1930's.

3.4.3 Anecdotal Information

Personnel from the Washington State Department of Ecology, the City of Pullman Fire Marshall, the City of Pullman Municipal water supply, the City of Pullman Public Health Department, members of the Washington State University (WSU) staff and workers at the WSU steam power plant were interviewed by telephone and in person to gain their agency's knowledge of potentially environmentally contaminating activities, situations or other information of the subject site. We conducted our interviews with two objectives: 1) to identify past or present potentially contaminating activities or situations at or near the subject site and; 2) to screen or evaluate the quality of the information obtained by inquiring as the person's knowledge of the subject site.

Mr. Phil Leinart of the Washington State Department of Ecology was contacted regarding the location of reported leaking underground storage tanks (LUST) in the area. Mr. Leinart stated that he had no personal knowledge of any leaking underground storage tanks in the area, but a search of Ecology files indicate three leaking underground storage tanks have been reported in the vicinity of the subject site.

Jim Neble, director of Environmental Health for the City of Pullman, was also contacted. He informed our office that there have been no known negative impacts or threats to the public health at or near the subject site. He also informed us that there had been no documented occurrences of illegal dumping or reported releases or spills at the subject site. The fire Marshall for the city of Pullman, Captain McDonald also stated that he had no knowledge of any leaks, spills, code violations, fire hazards or any problems that may exist at the site.

The City of Pullman Municipal Water Supply office stated that there are no known impacts to the water supply in the area. The wells which supply water to the area are also analyzed for contaminants regularly.

Personnel at the University's Physical Plant informed us that the property donated to the university in 1981 by Chevron, U.S.A. and that they had no knowledge of any negative impacts to the subject site. Employee's of the power plant located across College Street from the subject site also stated that there were four above ground storage tanks at the site and that on occasion they would notice some spillage of petroleum product at the site. They also informed us that there used to be a 500 gallon underground storage on the site which was removed in November of 1991. The 500 gallon above ground storage tank presently located at the site was constructed after removal of that UST.

3.5 UST/RCRA/CERCLA Locations

Government literature and documents were reviewed to identify the locations of reported underground storage tanks (UST), leaking underground storage tanks (LUST), EPA Superfund Sites (CERCLA) and RCRA Sites. No reported CERCLA sites were identified in the vicinity of the subject site. The approximate locations of reported RCRA sites (UST's), leaking underground storage tanks (LUST) and other potential off-site sources of contamination are presented in Figure 7. These locations were compiled from a list of reported UST's (RCRA), from Ecology's LUST list and from visual identification during our site visit. No identified sites were reported to be hydrologically upgradient of the site. However, three sites were identified immediately north of the subject site, which is interpreted to be cross-gradient. These sites are the above ground storage tank used by W.S.U. maintenance department (#16 on Figure 7), the University power plant (#15 on Figure 7) and The Paint Shop (#17 on Figure 7) located on College Street.

The RCRA list reports all locations that generate, transport, or handle hazardous substances or waste. Eleven area properties are listed on Ecology's RCRA list. Seven of the sites are located 1/2 mile to 3/4 of a mile northwest of the subject site. One site is located approximately 1/2 mile southwest of the study area. The subject site is the remaining site reported on the RCRA list (#1 on Figure 7) and is listed as Chevron U.S.A., Inc.. This facility was dismantled in 1981 as discussed previously. Three area properties are listed on Ecology's LUST list. These are : 1) Pullman Glass (#12 on Figure 7), 2) Pullman Central Office (#13 on Figure 7), and 3) Chevron Service Station (#14 on Figure 7). None of these sites are hydrolligically upgradient of the subject site.

3.6 On-Site Conditions

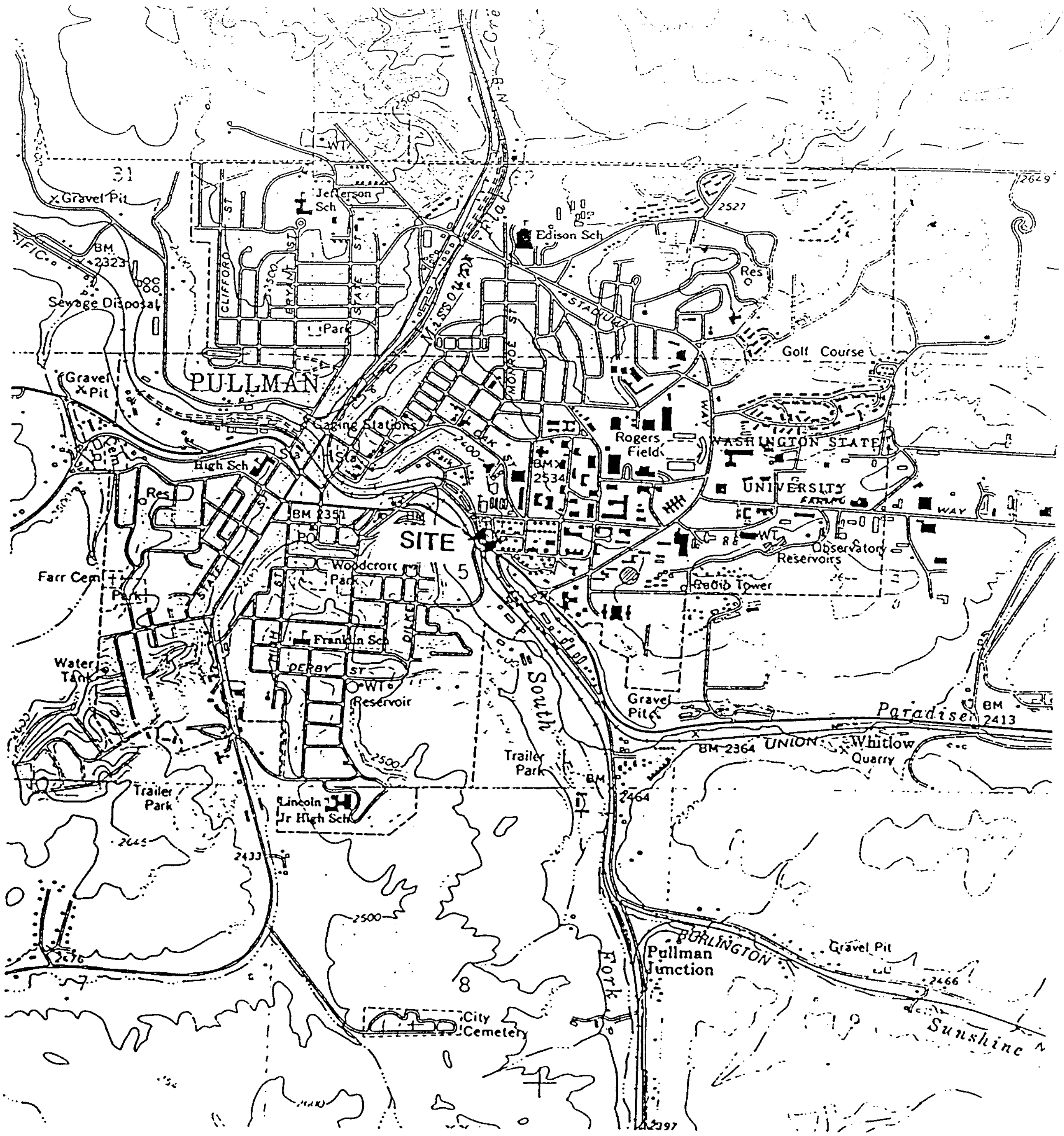
Based on the research performed for this study, in our opinion, the greatest potential for contamination from on-site sources were the large petroleum storage tanks and bulk handling operations which were present on the site for at least 65 years. Although these tanks have been removed, the potential for spillage or leakage during the operation of the facility is high. Also, the current above ground storage tank may be a source of release of petroleum products to the environment due to spillage, overfill or poor handling procedures.. Obvious signs of discolored and stained soils in the vicinity of this tank support this conclusion. Numerous signs of stained soils are present throughout the eastern area of the property where the bulk storage facility was located.

3.7 Off-Site Sources

The subject property is located hydrologically upgradient of most potential off-site sources of contamination. The power plant and paint shop located on College Street are hydrologically cross-gradient of the site but may be a potential source for contaminants to the ground water.

4.0 Conclusions

Based on the information gathered for this assessment and our review of available data, in our opinion, the subject property presents a high potential for environmental contamination. Due to the presence of a petroleum bulk storage facility on the property for more than 65 years, the potential for leakage or accidental spillage and the accumalation of released product over time which could negatively impact the subject site soils and groundwater is high. Based on the findings of this LEVEL I Environmental Site Assessment the additional site characterization undertaken to asses the extent of any contamination within the site soils and groundwater beneath the property is warranted.



RZA AGRA, INC.

Engineering & Environmental Services

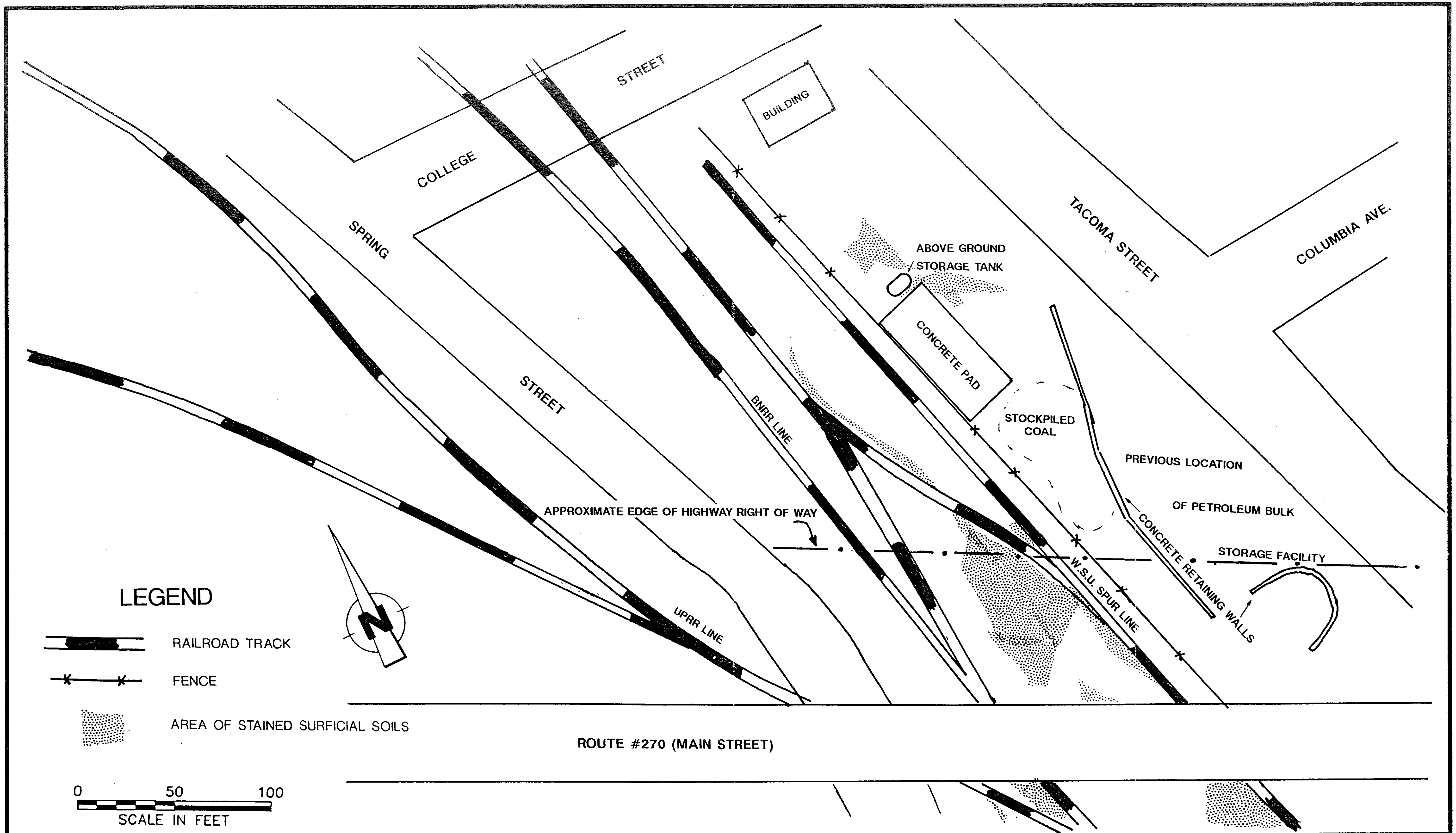
Georgetown Office Building
539 West Sharp
Suite D
Spokane, WA 99201

W.O. S-1023
DESIGN
DRAWN JNS
DATE MAY 1992
SCALE 1"=2,000'

VICINITY MAP

FIGURE 1

152284



RZA AGRA, INC.
Engineering & Environmental Services
Georgetown Office Building
539 West Sharp
Suite D
Spokane, WA 99201

W.O. S-1023
DESIGN
DRAWN ENJS
DATE MAY 1992
SCALE NOTED

SITE PLAN

FIGURE 2

152284
GENDRON'S

A

B

NOTE STAINED SOIL AT BASE OF TANK

RZA AGRA, INC.
Engineering & Environmental Services
Georgetown Office Building
539 West Sharp
Suite D
Spokane, WA 99201

W.O. S-1023
DESIGN
DRAWN ENJS
DATE MAY 1992
SCALE

ABOVE GROUND STORAGE TANK
LOCATED AT SUBJECT SITE

FIGURE 3

152284

GENDRON'S

A

B

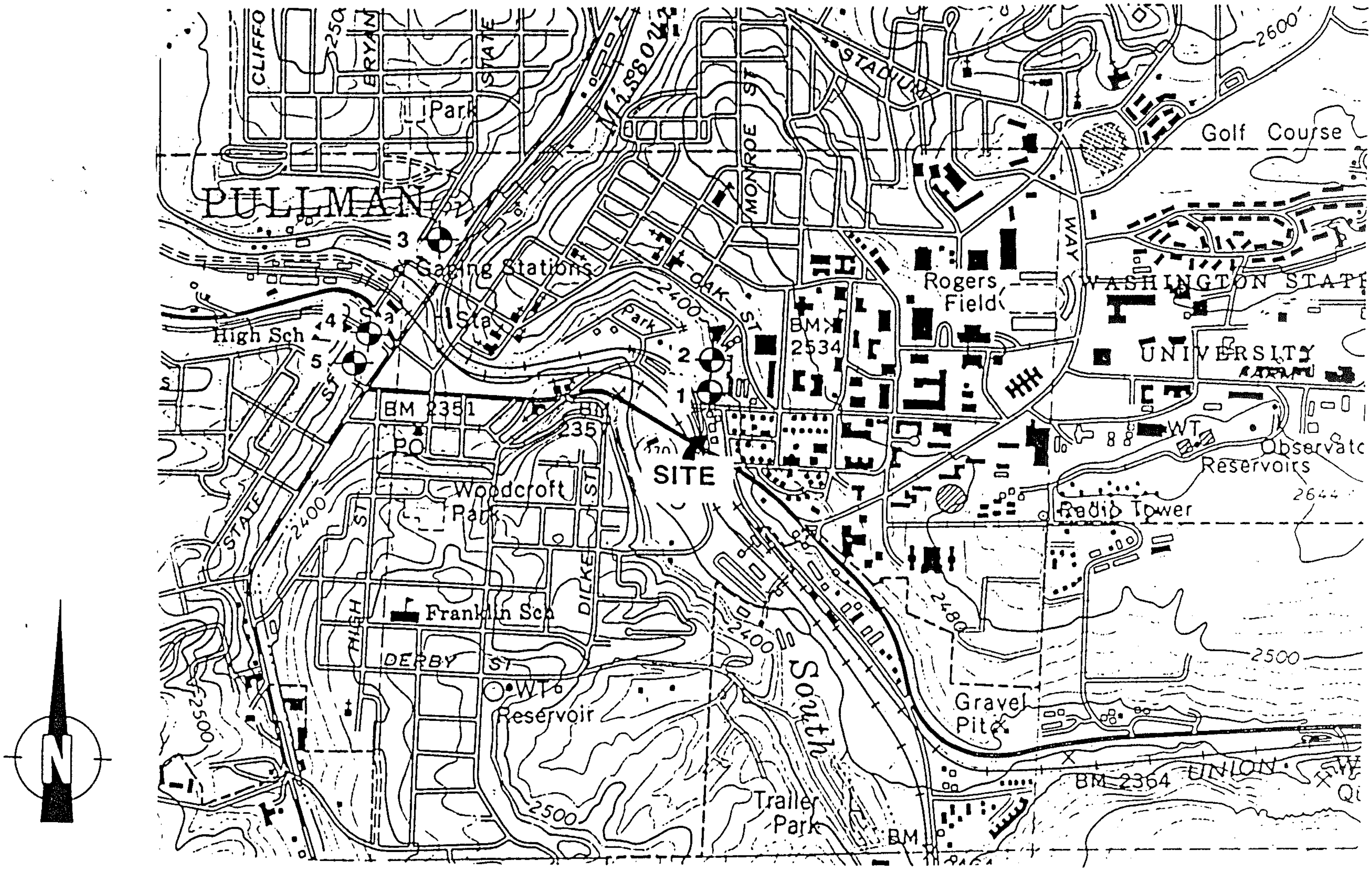
RZA-AGRA
ENGINEERING & ENVIRONMENTAL SERVICES

11335 N.E. 122nd Way
Suite 100
Kirkland, Washington
98034-6918

W.O. S-1023
DESIGN
DRAWN ENJS
DATE MAY 1992
SCALE

STAINED SOILS LOCATED IN EASTERN SECTION OF SUBJECT SITE

FIGURE 4



1/2 MILE

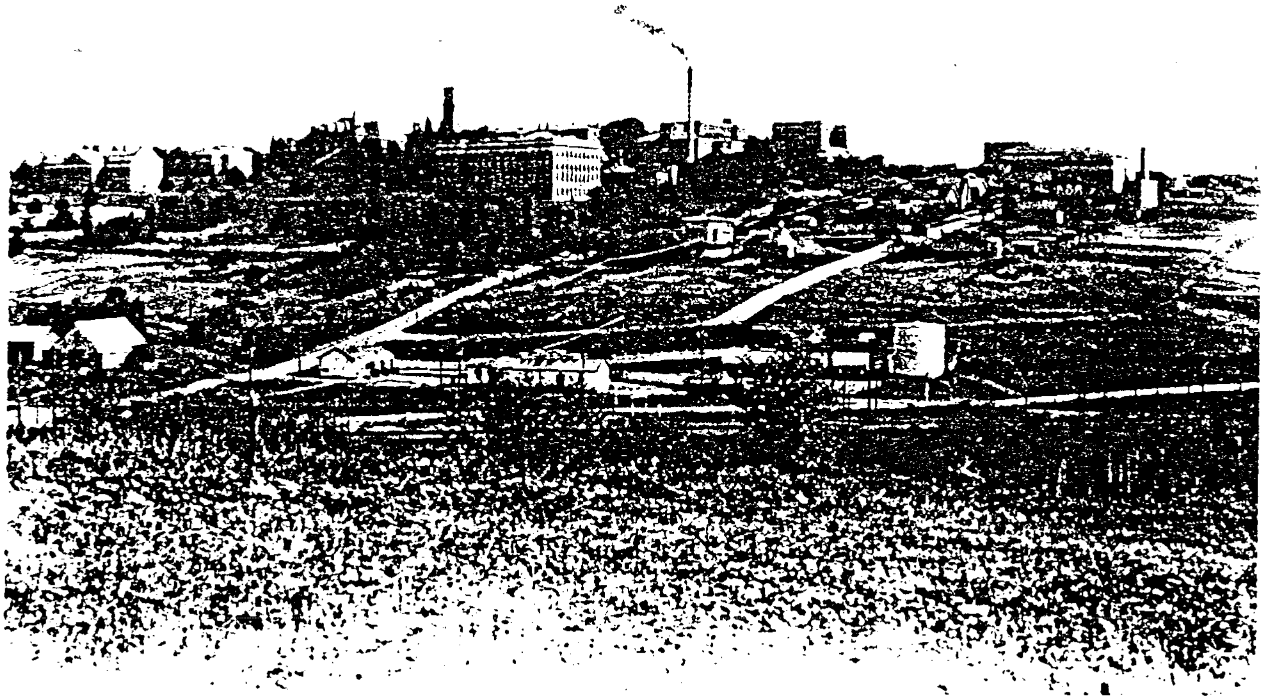
RZA-AGRA
ENGINEERING & ENVIRONMENTAL SERVICES

11335 N.E. 122nd Way
Suite 100
Kirkland, Washington
98034-6918

W.O.	S-1023
DESIGN	
DRAWN	ENJS
DATE	MAY 1992
SCALE	NOTED

WATER SUPPLY WELLS

FIGURE 5



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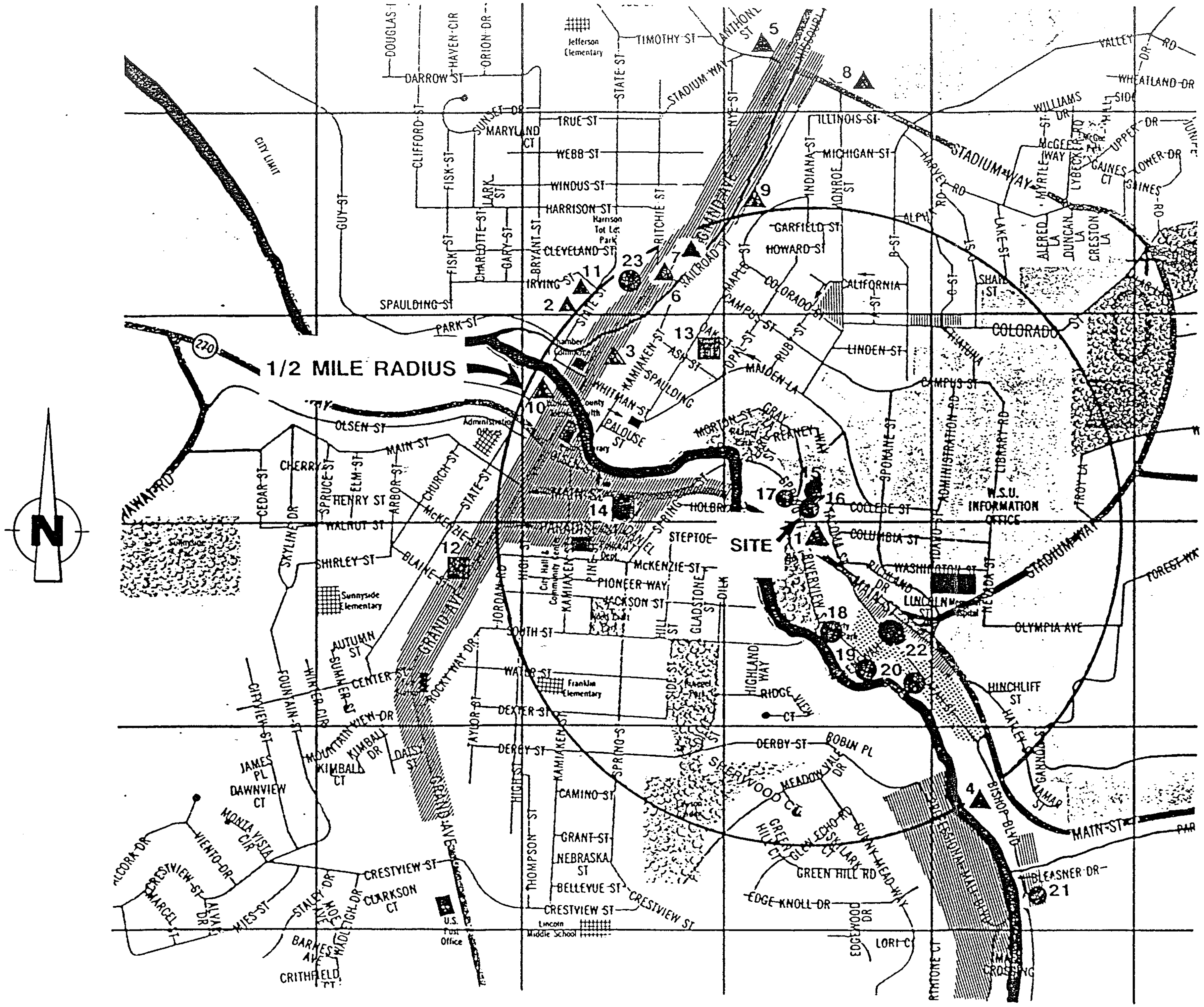
Georgetown Office Building
539 West Sharp
Suite D
Spokane, WA 99201

W.O.	S-1023
DESIGN	
DRAWN	ENJS
DATE	MAY 1992
SCALE	

1930 PHOTOGRAPH OF SUBJECT SITE
PHOTO IS TAKEN LOOKING
TO THE EAST

FIGURE 6

152284
GENDRON'S



RCRA ▲

1. E. 815 College Street	Chevron U.S.A., Inc.
2. 325 State Street	Wilbur-Ellis Cenex Bulk Storage Facility
3. S. 160 Grand	Jerry's Radiator Service
4. S.E. 250 Bishop Blvd.	Chipman Brown Chevrolet Olsmobile
5. Stadium Way & Grand	Mary Carter Cleaners
6. N. 740 Grand	Greens Cleaners
7. N. 770 Grand	Conoco Service Station
8. 400 Stadium Way	Chevron Service Station
9. N. 950 Grand	DUMAS Corporation
10. N.W. 115 State	Pullman School District No. 267
11. N.W. 355 State	Grange Supply Company

LUST ▨

12. S. 370 Grand	Pullman Glass
13. Oak Street	Pullman Central Office
14. E. 485 Main	Chevron Service Station

OTHER ●

15. College Street	W.S.U. Coal Power Plant
16. E. 815 College Street	W.S.U. Maintenance AGST
17. E. 780 College Street	The Paint Shop
18. Riverview Street	DEDA Import Auto Repair/Advance Muffler
19. S.E. 630 Benewah	Al's Auto Body Shop
20. 1122 Datah	Sun Rental Center
21. S.E. 1165 Johnson Ave.	Busch Import Car Service
22. E. 975 Main St.	University Car Wash
23. Grand Ave.	UPS Center

RZA AGRA, INC.
Engineering & Environmental Services
Georgetown Office Building
539 West Sharp
Suite D
Spokane, WA 99201

W.O. S-1023
DESIGN
DRAWN ENJS
DATE MAY 1992
SCALE 1" = 2,000'

POTENTIAL OFF-SITE SOURCES
FOR CONTAMINATION

FIGURE 7

APPENDIX A

ile Original and First Copy with
epartment of Ecology
econd Copy — Owner's Copy
hird Copy — Driller's Copy

WELL #1

WATER WELL REPORT

STATE OF WASHINGTON

Application No. G3-28278
Permit No. G3-28278P

(1) OWNER: Name WASHINGTON STATE UNIVERSITY Address PULLMAN WA

) LOCATION OF WELL: County WHITMAN — SW ¼ NE ¼ Sec 5 T 14 N., R 45E W.M.

Bear g and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) #7
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 16"X12"X10" inches.
Drilled 2224 ft. Depth of completed well 1814 ft.

(6) CONSTRUCTION DETAILS:

Casing installed:	~~16~~ 20" Diam.	from +2 +1'	ft. to 365 ft. 170'
Threaded ☐	12" Diam.	from 366	ft. to 543 ft.
Welded ☒	12" Diam.	from 583	ft. to 673 ft.
	~~12~~	~~713~~	~~725~~
	12	775	908
	12	948	1006

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name JOHNSON
Type STEEL HI-CAP Model No. PIPE SIZE

Diam. 12	Slot size 80	from 543 ft.	to 580 ft.
Diam. 12	Slot size 80	from 573 ft.	to 713 ft.
~~12~~	~~80~~	~~725~~	~~775~~
12	80	908	948

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 170 ft.
Material used in seal NEAT CEMENT
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7 PUMP: Manufacturer's Name
Type: H.P.

(8 WATER LEVELS: Land-surface elevation above mean sea level 2415.6 ft.
St c level 154 ft. below top of well Date 9-20-89
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9 WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? CONTRACTOR

Yi d: 1700 gal./min. with	4.9 ft. drawdown after	3.5 hrs.
3000 "	11.6 "	5.5 "
2400 "	9.0 "	7.0 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

me	Water Level	Time	Water Level	me	Water Level
0	163				
17 HR	154				

ECEIVE
MAR 21 1989
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Date of test 10-7-87
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
T perature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
TOP SOIL + CLAY	0	5
GRAY BASALT HARD	5	125
CLAY YELLOW	125	140
★ BASALT GRAY MED	140	360
★ BASALT GRAY-BRN MED	360	480
BASALT GRAY HARD	480	550
★ BASALT GRAY MED	550	670
★ BASALT GRAY SOFT	670	800
BASALT GRAY MED	800	920
★ BASALT GRAY MED	920	980
SAND STONE SALT + PEPPER	980	1004
BASALT BLACK MED	1004	1070
SAND STONE GRAY	1070	1115
★ BASALT BLK SOFT	1115	1430
BASALT GRAY MED	1430	1575
★ SAND GRAY SOFT	1575	1595
★ BASALT GRAY MED	1595	1740
★ ~~SAND~~ BASALT BLK SOFT	1740	1840
★ SAND GRAY SOFT	1840	1882
BASALT BLK + GRAY CLAY	1882	1930
★ BASALT GRAY HARD-MED	1930	1980
BASALT GRAY HARD	1980	2210
CLAY BRN + GRAY	2210	2224

★ INDICATES WATER BEARING ZONE
HOLE BACKFILLED WITH DRILL CUTTINGS TO 1824FT

NEAT CEMENT PLUG PLACED FROM 1824 TO 1814FT

16" CASING CEMENTED AT 365FT WITH 60 SKS OF CEMENT, USING a INJECTION LINE + CEMENT FLOAT SHOE

Work started July 20 1987 Completed SEPT 24 1987

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME HOLMAN DRILLING CORP (Person, firm, or corporation) (Type or print)

Address E3410 9th AVE SPOKANE WA 99202

[Signed] Arnold E Holman (Well Driller)

License No. 0189 Date OCT 20, 1987

(USE ADDITIONAL SHEETS IF NECESSARY)

WELL #2 Appl.# 6405

STATE OF WASHINGTO

DEPARTMENT OF CONSERVATION
AND DEVELOPMENT Applic #6064

Well #4

WELL LOG No. /

Date April 9, 19 63

Record by Driller

Source Driller's Record

Location: State of WASHINGTON

County Whitman

Area

Map

¼ ¼ sec. 5 T. 14 N., R. 45 E.

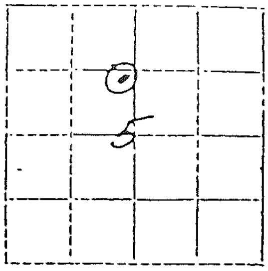


Diagram of Section

Drilling Co. Holman Drilling Corporation

Address 3410 E. 9th, Spokane 31, Washington

Method of Drilling Date Nov. 29, 19 62

Owner Washington State University

Address Pullman, Washington

Land surface, datum ft. above below

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Top soil	15	15
	Brown clay	8	23
	Basalt, hard	45	68
	Brown sandy clay	17	85
	Green & blue, conglomerate	13	98
	Basalt, soft water bearing	10	108
	Basalt, medium hard	28	136
	Basalt, hard	63	199
	Basalt, soft	11	210
	Basalt, soft & fractured water bearing	10	220
	Basalt, medium hard fractured	15	235
	Basalt, hard very broken, water bearing	28	263
	Basalt, crevice, hard water bearing	7	270

Turn up Sheet of sheets

WELL #3

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. Decla. #667
Cert. #588-D

Date 1930, 19

Record by J. T. Moore

Source G. W. Decla. Claim

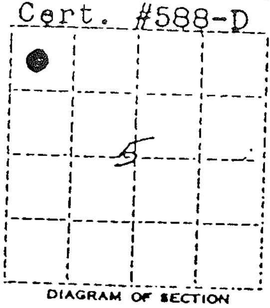


DIAGRAM OF SECTION

Location: State of WASHINGTON

County Whitman

Area

Map

NW ¼ NW ¼ sec. 5 T. 14 N., R. 45 ~~E~~ W.

Drilling Co.

Address

Method of Drilling drilled Date Apr. 23 1940

Owner Northern Pacific Railway Co.

Address Seattle, Wash.

Land surface, datum ft. above / below

Correlation	Material	Thickness (feet)	Depth (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Basalt	10	10
	Black basalt	28	38
	Hard gray rock	23	61
	Soft rock	29	90
	Honey comb rock, water	10	100
	Hard black rock	64	164
Pump	Test:		
	Dim: 164' x 6" & 4½"		
	SWL: 6'		
	Dd: 13.5'		
	Yield: 55 g.p.m.		
	Casing: 5 5/8" dia. S.S. well casin		
	from 8.8' to 19.5'; top 10' is		
	concrete sump		
	Pump: Turbine, 73, g.p.m., 130' TDH		
	Motor: 5 hp, vertical		

Turn up

Sheet ______ of ______ sheets

WELL #4

STATE OF WASHINGTO.
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG Well #3 No. A.6118

Date 8-2, 1962

Record by well driller

Source driller's record

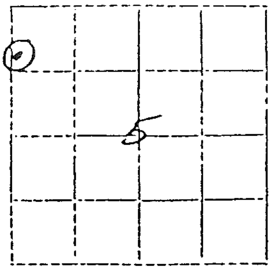


Diagram of Section

Location: State of WASHINGTON

County Whitman

Area

Map

¼ ¼ sec. 5 T. 14 N., R. 45 E. ~~W.~~

Drilling Co. Dickerson Machinery Co.

Address Spokane, Wash.

Method of Drilling Date June 5, 1962

Owner City of Pullman, Wash.

Address

Land surface, datum ft. above/below

Correlation	Material	Thickness (feet)	Depth (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Fill	7	7
	Gray silt	9	16
	Yellow decomposed rock	6	22
	Hard gray rock	2	24
	Yellow rock not very hard	25	49
	" " harder	14	63
	Grey rock not very hard	16	79
	" " but harder	13	92
	" " not so hard	6	98
	Soft green rock	8	106
	Fairly hard black rock	6	112
	Hard grey rock	10	122
	Soft black rock	29	151
	Soft red rock	8	159
	Gray rock crevices, water	3	162
	Soft red rock	5	167
	(over)		

Turn up Sheet of sheets

WELL #5

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. Decla. #595

Date 1913, 19

Cert. #693-D

Record by M. R. Ebner

Source G. W. Decla. Claim

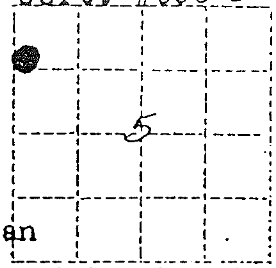


DIAGRAM OF SECTION

Location: State of WASHINGTON

County Whitman

~~xxx~~ Lot 4, Block 49, of

~~xxx~~ original town of Pullman

¼ ¼ sec. 5 T. 14 N., R. 45 E.

Drilling Co. Originally drilled

Address 1913

Method of Drilling drilled Date 1945 19

Owner City of Pullman

Address Pullman, Wash.

Land surface, datum ft. above below

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	no log		
Pump	Test:		
	Dim: 150' x 10"		
	SWL: 0		
	Dd: 6'		
	Yield: 1200 g.p.m.		
	Casing: 10" dia. from	0' to	32'
	Pump: Bingham, 500 g.p. m.; Bryon-Jackson, 250 g.p.m.; Fairbanks-Morse, 550 g.p.m.; Worthington, 350 g.p.m.		
	Motor: (1) 75 hp G.E., (2) 30 hp, (3) 40 hp, G.E., (4) 40 hp, G.E.		
	well reconditioned 4-12-70		
	Casing: 16"D +3'-62'	+3'	62'

Turn up

(over)

Sheet of sheets

WELL LOG.—Continued

No. Dec 595

CORRE-LATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	———	
	Casing +3'	+3'	155'
	Perforations : Torch		
	1/4" x 18" 64 perf.	135'	155'
	Surface Seal:	0	62'
	16" casing - cement		
	SWL 42' (4-12-72)		

WELL LOG.—Continued

No. A 6118

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	—	
	PUMP TEST:		
	Dim. 16"x167'		
	SWL: 26.5 ft. (6-5-62) Also see C.611-A		
	DD: 106 ft.		
	Yield: 1350 g.p.m.		
	Water Temp. 58°		
	2 minute recovery		
	Type & size of Pump: 1400 g.p.m. Peerless turbine		
	Type & size of motor or engine: 150 h.p. VHS G.E.		
	CASING:		
	16" diam. steel casing from ground to 140 ft.		
	PERFORATIONS:		
	10" Galvanized cone		
	Pumped 1976 212	716	000