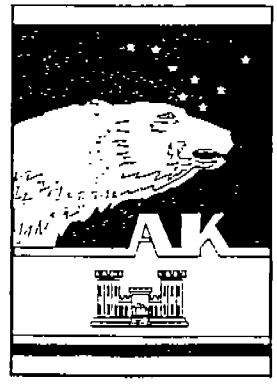
Chemical Data Report

Groundwater Study

Fall 1994 and Spring 1995
Fort Richardson, Alaska



Alaska District
U.S. Army Corps of Engineers
Geotechnical Branch
Materials and Instrumentation Section

November 1995

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Executive Summary

Twenty-six wells were sampled in Fall 1994, and fifty-eight wells were sampled in Spring 1995, as part of a continuing biannual post-wide groundwater study on Fort Richardson Alaska. Significant fuel and volatile organic compound (VOC) contamination was detected in the groundwater at wells AP-3233 and AP-2982; the contamination in AP-2982 appears to have increased substantially over the several sampling events. Low levels of PCBs were also detected in AP-2982. Fuel and/or VOC contamination was also detected in the newly-installed wells AP-3455, AP-3458, AP-3476, AP-3532, and AP-3533 (see Figure 1 or Table 2-1 for well locations). Low levels of chlorinated VOCs were detected in a number of wells.

Chemical Data Report

1. Introduction

This chemical data report has been prepared by the Materials and Instrumentation Section of the U.S. Army Corps of Engineers, Alaska District (CENPA-EN-G-MI), to present the results of an investigation of groundwater quality at Fort Richardson, Alaska. The investigation was performed at the request of the Alaska District Environmental Engineering Branch, Active Installations Section (CENPA-EN-EE-AI), and the Fort Richardson Department of Public Works (DPW), United States Army, Alaska (USARAK).

At the request of DPW, this report presents the chemical data from two distinct sampling events, Fall 1994 and Spring 1995. The Fall 1994 sampling event included the sampling of 26 wells during September through December 1994; the Spring 1995 sampling event included the sampling of 58 wells (the 26 wells sampled in Fall 1994 plus 32 newly installed monitoring wells) during April to July 1995.

2. Background Information

2.1 Sampling Objectives: The purpose of the two sampling events was to continue a postwide study of groundwater quality on Fort Richardson, by collecting samples of groundwater for chemical analysis from widely distributed locations on Fort Richardson, and gathering data on groundwater depth and physical parameters.

2.1.1 Scope of Sampling - Number and Location of Wells: This latest continuous postwide groundwater study at Fort Richardson began in Spring 1994, with the sampling of 26 supply and monitoring wells (the first 26 wells listed in Table 2-1) selected by CENPA and DPW (ref. 7f). These 26 wells were chosen primarily because of their inclusion in previous groundwater studies (i.e., a body of chemical data existed from previous years), to fulfill regulatory obligations (e.g., the landfill wells), or to monitor areas of known groundwater contamination (the Building 987, Building 35-752, and powerplant wells). These 26 wells were sampled for the Spring 1994 sampling event, and again for

TABLE 2-1
Well Sampling and Location Information
Fort Richardson Groundwater Study
Fall 1994/Spring 1995
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Well ID	Dates Sampled	Sample Numbers	Well Location; Figure 1 Grid Square in Brackets {}
Active Supply Wells			
ADFG C	20 Sep 94	109WA	{J7} Sampled in ADFG well manifold building
	14 Apr 95	16WA	
ADFG E	20 Sep 94	110WA	{J7} Sampled in ADFG well manifold building
	14 Apr 95	14WA	
ADFG K	20 Sep 94	111WA	{J7} Sampled in ADFG well manifold building
	14 Apr 95	15WA	
ADFG 9	20 Sep 94	112WA	{J7} Sampled in access vault at ADFG hatchery
	13 Apr 95	17WA	
Well 1	14 Nov 94	125WA	{J6} Post supply well, Bldg 35610
	6 Apr 95	08WA	
Well 3	14 Nov 94	125WA	{K5} Post supply well, Bldg 35630
	6 Apr 95	07WA	
Otter Lake	9 Nov 94	122WA	{B4} Supply well for Otter Lake Lodge
	28 Apr 95	20WA	
Former Supply Wells and Piezometers			
TW-1	8 Nov 94	121WA	{L4} Corner of Oil Well Rd and Hospital entrance
	7 Jul 95	78WA	
A-1	11 Nov 94	123WA	{K5} In woodline 150 ft west of well access rd
	15 Jun 95	47WA	
A-6	11 Nov 94	124WA	{K6} 100 ft west of Well 2
	15 Jun 95	48WA	
AK-2127	1 Dec 94	128WA	{M10} Training area south of Glenn Highway
	6 Jul 95	76WA	
Well B	18 Nov 94	127WA	{B9} 1000 ft NW of Roosevelt Transmitter Site
	5 May 95	25WA	

TABLE 2-1
Well Sampling and Location Information
Fort Richardson Groundwater Study
Fall 1994/Spring 1995

Well ID	Dates Sampled	Sample Numbers	Well Location; Figure 1 Grid Square in Brackets {}
Monitoring Wells, Previously Sampled			
AP-3233	21 Sep 94	106WA, 163WA[QC], 162WA[QA]	{F7} 100 ft NW of Bldg 987
	23 Jun 95	59WA, 60WA[QC], 61WA[QA]	
AP-3235	2 Dec 94	129WA	{F7} 50 ft SE of Bldg 987
	25 Apr 95	19WA	
AP-2982	13 Sep 94	101WA, 161WA[QC], 160WA[QA]	{I6} SW corner of Bldg 35752
	11 Apr 95	09WA, 10WA[QC], 11WA[QA]	
AP-2985	13 Sep 94	102WA	{I6} 75 ft S of Bldg 35752
	11 Apr 95	12WA	
AP-3231	13 Sep 94	103WA	{I6} NE corner of Bldg 35752
	11 Apr 95	13 WA	
AP-2974	19 Sep 94	104WA	{I7} 25 ft S of Power Plant
	14 Apr 94	18WA	
Landfill Monitoring Wells			
AP-3010	17 Nov 94	117WA	{D9} N of Landfill, on moraine
	4 Apr 95	01WA	
AP-3013	29 Nov 94	118WA, 165WA[c], 164WA[a]	{E7} W of Landfill
	3 May 95	21WA	
AP-3014	15 Nov 94	115WA	{D6} W of Landfill
	10 Apr 95	04WA	
AP-3015	20 Dec 94	119WA	{D6} W of Landfill
	5 Apr 95	03WA	
AP-3221	17 Nov 94	116WA	{E9} SE of Landfill
	4 Apr 95	02WA	
FR-1	26 Nov 94	120WA	{E7} W of Landfill
	19 Jun 95	49WA, 50WA[c], 51WA[a]	
FR-2	22 Sep 94	107WA	{D7} NW of Landfill
	20 Jun 95	53WA	

TABLE 2-1
Well Sampling and Location Information
Fort Richardson Groundwater Study
Fall 1994/Spring 1995

Well ID	Dates Sampled	Sample Numbers	Well Location; Figure 1 Grid Square in Brackets {}
Landfill Monitoring Wells (cont.)			
FR-3	25 Sep 94	108WA	{D10} E of Landfill
	20 Jun 95	52WA	
		54WA[S], 55WA[S,QC], 56WA[S,QA]	
New Monitoring Wells, Installed Aug 1994 - May 1995			
AP-3447	28 Jun 95	71WA	{I4} South Ammo Area
AP-3448	23 Jun 95	63WA	{J5} Antenna Loop Rd
AP-3449	8 May 95	26WA, 27WA[QC], 28WA[QA]	{K4} N of old Hospital
AP-3450	15 Jun 95	44WA	{L5} On well access rd
AP-3451	8 May 95	29WA	{K7} On well access rd
AP-3452	29 Jun 95	75WA	{K6} Woodline S of well rd
AP-3453	10 May 95	34WA	{J8} Along Arc. Valley Rd
AP-3454	29 Jun 95	74WA	{K8} ASD prop. S of Ship Crk
AP-3455	6 Jul 95	77WA, 79WA[T,QC]	{H6} Davis Hwy & Antenna Rd
AP-3457	13 Jun 95	41WA	{I6} Antenna Loop Road
AP-3458	13 Jun 95	42WA	{I6} Antenna Loop Road
AP-3459	13 Jun 95	43WA	{J6} Antenna Loop Road
AP-3470	4 May 95	23WA	{G12} S end of runway
AP-3471	26 Jun 95	68WA	{C5} Ammo Area A
AP-3472	26 Jun 95	67WA	{D5} Ammo Area A
AP-3473	4 May 95	24WA	{D12} NE of Cemetary
AP-3474	12 May 95	36WA, 37WA[QC], 38WA[QA]	{F6} E of railyard
AP-3475	10 May 95	33WA	{F10} 6th & Davis
AP-3476	26 Jun 95	64WA, 65WA[QC], 66WA[QA]	{F11} N of airfield
AP-3477	10 May 95	30WA	{E13} N end of runway
AP-3478	4 May 95	22WA	{G12} S end of runway
AP-3479	14 Jun 95	45WA	{I10} 6th & Dyea
AP-3480	12 May 95	39WA	{G5} SE of railyard
AP-3481	22 Jun 95	58WA	{H5} treeline N of Davis Hwy

TABLE 2-1
Well Sampling and Location Information
Fort Richardson Groundwater Study
Fall 1994/Spring 1995

Well ID	Dates Sampled	Sample Numbers	Well Location; Figure 1 Grid Square in Brackets {}
Monitoring Wells, Installed 1994-1995 (cont.)			
AP-3482	23 Jun 95	62WA	{J5} Antenna Loop Road
AP-3483	14 Jun 95	46WA	{H6} Old Davis Highway
AP-3484	10 May 95	35WA	{H8} 2nd & Davis
AP-3485	22 Jun 95	57WA	{I6} Antenna Loop Road
AP-3530	27 Jun 95	69WA	{E6} Bldg 55955, N side
AP-3531	27 Jun 95	70WA	{E6} Bldg 55955, SE side
AP-3532	28 Jun 95	72WA	{G7} Bldg 740
AP-3533	28 Jun 95	73WA	{F9} Bldg 796

Key -
QC : Quality Control Duplicate
QA : Quality Assurance Duplicate
T : Method 180.1 Turbidity only
S : Method 8270 SVOC only

Sample Numbers from Fall 1994 have sample prefix "94FRGW-"
Sample Numbers from Spring 1995 have sample prefix "95FRGW-"

the Fall 1994 sampling event. The chemical data from the Spring 1994 sampling event were reported in a CENPA-EN-G-MI Chemical Data Report (ref. 7t. Jul 94).

Because of a lack of information on groundwater gradients at Fort Richardson, a system of 34 new monitoring wells was installed across the post between August 1994 and May 1995. The locations of most of these new wells were chosen by CENPA-EN-G-SG primarily to close gaps in the groundwater geotechnical data. This well installation effort was originally scoped to involve 28 new wells (hence the project name "28 Monitoring Wells" that appears on the soil boring logs and other project documents). CENPA-EN-G-SG installed an additional two wells to investigate encounters of groundwater at unexpected depths. At the request of DPW, another four additional wells were installed to investigate groundwater quality at Buildings 55955, 796, and 740.

These new wells were sampled for chemical analysis for the first time as part of the Spring 1995 sampling event, in addition to the twenty-six wells sampled in 1994. Only thirty-two of the 34 new wells were sampled; AP-3456 and AP-3486 were not sampled due to their close proximity to other wells of similar depth.

2.1.2 Scope of Sampling - Analytical Methods: The methods of chemical analysis used for this groundwater study were selected by DPW and CENPA (ref. 7f) to provide a broad baseline of chemical data. These analytical methods are summarized in Table 2-2, and include, for all wells, methods for volatile organic compounds (VOCs), gasoline range organics (GRO), diesel range organics (DRO), and total and dissolved metals. The analyses did not originally include testing for semivolatile organic compounds. Method 8270 Semivolatile Organic Compounds (SVOCs) was added to the list of analyses for the Fall 1994 sampling, in response to review comments from the U.S. EPA (ref. 7e). It became apparent from the data generated during Fall 1995 that sufficiently low detection limits could not be achieved with Method 8270, and no useful data was being obtained with this method. CENPA-EN-G-MI made the decision to replace Method 8270 with Method 8310 Polyaromatic Hydrocarbons (PAHs) for the Spring 1995 sampling, narrowing the range of target compounds in exchange for lower detection limits.

The wells around Building 35752 were sampled for polychlorinated biphenyls (PCBs) because of a history of PCB contamination of soils in the area. Method 608 was

TABLE 2-2
Analytical Methods
Fort Richardson Groundwater Study
Fall 1994/Spring 1995

Method	Fall 1994	Spring 1995
Method 8260, Volatile Organic Compounds (VOC)	All wells	All wells
Method 8015, modified, Gasoline Range Organics (GRO), ADEC version	All wells	All wells
Method 8100, modified, Diesel Range Organics (DRO), ADEC version	All wells	All wells
Method 8270, Semivolatile Organic Compounds (SVOC)	All wells	FR-3 only
Method 8310, Polyaromatic Hydrocarbons (PAH)	None	All wells
23 TAL Metals, total	All wells	All except AP-3532, AP-3533
23 TAL Metals, dissolved	All wells	All except AP-3532, AP-3533
Method 8080, PCBs only	Bldg 35-752 wells only	Bldg 35-752 wells only
Method 8080, PCBs and Pesticides	Landfill wells	Landfill wells
Method 418.1, Total Recoverable Petroleum Hydrocarbons	Landfill wells	Landfill wells
Method 415.1, Total Organic Carbon	Landfill wells	Landfill wells
Method 410.1, Chemical Oxygen Demand	Landfill wells	Landfill wells
Method 405.1, Biological Oxygen Demand	Landfill wells	Landfill wells
Method 365.1, Total Phosphate	Landfill wells	Landfill wells
Method 350.3, Ammonia Nitrogen	Landfill wells	Landfill wells
Method 353.3, Nitrate & Nitrite Nitrogen	Landfill wells	Landfill wells
Method 375.4, Sulfate	Landfill wells	Landfill wells
Method 325.1, Chloride	Landfill wells	Landfill wells
Method 310.1, Alkalinity	Landfill wells	Landfill wells
Method 130.1, Hardness	Landfill wells	Landfill wells
Method 180.1, Turbidity	Landfill wells	Landfill wells

ADEC: Alaska Department of Environmental Conservation
-Different but equivalent methods may have been performed by different laboratories especially for 300-400 series methods. See Summary of Extraction and Analysis tables at beginning of Appedices B & C for exact extraction and analysis methods.

originally requested (Spring and Fall 1994) because it was thought that lower detection limits could be achieved than with Method 8080. The primary laboratory actually analyzed the sample by Method 8080, and achieved better detection limits (0.1 ppb) than the QA laboratory (0.5 ppb) who performed the requested Method 608. Method 8080 for PCBs was requested during later sampling, for the sake of consistency with the Method 8080 analyses requested for samples from the landfill wells. For both analytical methods, a double sample volume (2 liters) has always been submitted for analysis from each of the three Building 35752 wells.

The landfill wells have been sampled according to analyses specified for landfill monitoring wells in the State of Alaska Solid Waste Management (18 AAC 60) 1993 proposed regulations (ref. 71). It has since been learned that the earlier 1987 regulations, with a somewhat different analysis list, are still in effect. For the Fall 1995 sampling, the analyses performed for the landfill wells has reverted to the 1987 18 AAC 60 analysis list, in conjunction with a landfill closure study. The analyses performed for the landfill wells in Fall 1994 and Spring 1995 are inclusive of the 1987 18 AAC 60 analysis list, with the exception of Methylene Blue Active Substances and Total Kjeldahl Nitrogen.

DPW had requested that wells AP-3532 and AP-3533 be sampled only for volatile organic compounds, gasoline and diesel range organics, and total recoverable petroleum hydrocarbons (TRPH). Due to a chain-of-custody error, samples from these wells were analyzed for polyaromatic hydrocarbons (Method 8310) instead of TRPH (Method 418.1).

2.2 General Geology: Fort Richardson is located primarily within an area locally referred to as the Anchorage Bowl. The Anchorage Bowl is located within the Cook Inlet-Susitna Lowland Section of the Coastal Trough Physiographic Province of Alaska, and generally is bordered by the Chugach Mountains on the east, Turnagain Arm on the south, Knik Arm on the west and the Elmendorf Moraine on the north. The Cook Inlet-Susitna Lowlands are characterized by glacial features including ground moraines, drumlins, eskers and outwash plains. Five major glacial advances of the Quaternary Period (Pleistocene and Holocene or Recent) can be recognized in the Cook Inlet-Susitna Lowlands section. These glacial advances are discussed further in the following paragraph. Most of Fort Richardson

lies less than 300 feet above sea level (refs. 7r, 7s).

The Anchorage Bowl is near the east border of a deep structural trough filled with moderately consolidated Tertiary rocks that underlie Cook Inlet and extend northeastward toward Mount McKinley. These Tertiary rocks are overlain by Pleistocene deposits as a result of repeated glacial advances during that epoch. These deposits accumulated to a thickness of 600 feet and more and appear to thicken westward from the mountain front toward Cook Inlet. They consist chiefly of three categories of material: (1) glaciofluvial consisting primarily of outwash sands and gravels, (2) proglacial silty clays of estuarine-marine or lacustrine-estuarine origin (including Bootlegger Cove Clay), and (3) glacial till deposited as ground moraine. Most of the Anchorage Bowl is overlain by relatively clean coarse-grain soils derived from outwash and glacial debris deposited in front of the youngest Pleistocene glacier (Naptowne-Wisconsin) that migrated into the area. This glacier produced a large east-west end moraine (Elmendorf moraine) across Fort Richardson. Outwash from this glacier spread southward across the Anchorage Bowl and buried ground moraine and the proglacial silty clays. The thickness of the outwash is thought to be about 60 feet under most of Fort Richardson, but is not everywhere constant. The outwash thins toward the west and south away from its source and tends to become coarser toward the mountains, grading laterally into cobble and boulder sizes. The silty clays below the outwash are interbedded with silt and fine sand. The clay deposit extends to depths on the order of 200 to 250 feet within the Anchorage Bowl and "pinches-out" on the east near the Chugach Mountains and on the north near a line connecting Dishno Pond and Six-Mile Lake. Glacial till, consisting of boulders, cobbles, gravels, sand, and fine-grain soils, underlies the silty clays (where encountered) and extends to the Tertiary rock. Ground moraine of the Naptowne glaciation overlies the advance outwash of that glaciation and glacial till of the earlier Knik glaciation to the north of the Elmendorf moraine (refs. 7r, 7s).

2.3 Groundwater: Groundwater at Fort Richardson exists as a deep confined aquifer, a shallow unconfined aquifer, and discontinuous zones of perched groundwater. The Bootlegger Cove formation described above constitutes much of the confining layer

that separates the confined and unconfined aquifers. Depth to groundwater ranges from near the surface along Ship Creek (see Figure 1) to greater than 250 feet below ground surface among the thicker glacial deposits found in the northern section of Fort Richardson. Lenses of silt found 20 to 40 feet below ground surface often underlie perched groundwater. Wells installed in these zones of perched groundwater often become unproductive or poorly productive after development. Water is known to recharge the groundwater system of Fort Richardson in several ways. Groundwater seeps from bedrock fractures into the sediments along the Chugach Mountains to the east. Snowmelt and rainfall infiltrate to the groundwater. Streams feed groundwater in areas where the elevation of the stream is above the watertable. Discharge of the aquifers is either by groundwater flow into Knik Arm to the west, or into streams (e.g., Ship Creek, Eagle River) that ultimately discharge into Knik Arm (refs. 7r, 7s).

Groundwater flow is thought to parallel Ship Creek's westward flow in the southern portion of Fort Richardson, but groundwater may flow towards the northwest or west towards the low-lying wetlands bordering upper Knik Arm (e.g., Eagle River Flats). In the past, construction of a comprehensive groundwater contour map of Fort Richardson had not been possible due to the limited number of wells. From August 1994 to May 1994, 28 new monitoring wells (ultimately increased to 32 wells) were installed by CENPA-EN-G on Fort Richardson with the specific intent of generating sufficient data on groundwater depths to create groundwater contour maps. This new groundwater information was not available at the writing of this Chemical Data Report; CENPA-EN-G-SG is expected to complete a Geotechnical Report including this information by the end of 1995.

2.4 Well Histories: Wells sampled as part of these sampling events include active supply wells, former supply wells, test wells and piezometers, and monitoring wells. Table 2-3 lists the wells sampled and summarizes information concerning these wells that is pertinent to the groundwater chemical data, such as casing depths and screened intervals. Some information on the older supply wells has not been available. Boring logs and well construction diagrams have not been provided with this report, in the interest of reducing the size of this report. Well logs and diagrams are available at CENPA-EN-G-SG.

Table 2-3
Well Physical Dimensions
Fort Richardson Groundwater Study
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Well ID	Date Installation Completed	Bottom of Casing (ft bgs)	Top of Screen (ft bgs)	Casing Stickup (ft ags)	Depth to GW (ft bgs) Fall 94[1]/Spring 95[1]
Active Supply Wells					
ADFG C	29 Apr 85	unknown	48 i	na	nm / nm
ADFG E	3 May 85	unknown	29 i	na	nm / nm
ADFG K	unknown	unknown	34 i	na	nm / nm
ADFG 9	unknown	120	unknown	na	nm / nm
Well 1	9 Sep 56	162	132 i	na	nm / nm
Well 3	27 Sep 56	138	117 i	na	nm / nm
OtterLake	unknown	unknown	unknown	unknown	nm / nm
Former Supply Wells and Piezometers					
TW-1	Mar 56	250	unknown p	2.4	24.96 / 23.45
A-1	2 Aug 82	78	72 p	2.0	33.51 / 33.41
A-6	25 Jan 83	60	unknown p	2.3	5.4 / 3.39
AK-2127	17 Apr 73	190	unknown p	2.8	76.35 / 71.67
Well B	unknown	155	unknown p	2.0	96.25 / 96.54
Monitoring Wells, Previously Sampled					
AP-3233	29 Sep 93	124.8	104.8	-0.25 f	115.63 / 116.72
AP-3235	6 Oct 93	128.3	108.6	-0.38 f	116.83 / 119.68
AP-2982	21 Aug 90	24.6	14.3	2.8	15.00 / 9.63
AP-2985	23 Aug 90	14.3	4.0	2.3	11.15 / 5.26
AP-3231	26 Aug 93	21.0	10.7	2.8	17.25 / 13.00
AP-2974	2 Aug 90	18.6	8.3	1.9	17.00 / 16.40

Table 2-3
Well Physical Dimensions
Fort Richardson Groundwater Study
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Well ID	Date Installation Completed	Bottom of Casing (ft bgs)	Top of Screen (ft bgs)	Casing Stickup (ft ags)	Depth to GW (ft bgs) Fall 94[1]/Spring 95[1]
Landfill Wells					
AP-3010	18 Dec 90	233.5	218.5	3.8	225.08 / 225.64
AP-3013	7 Dec 90	149.5	134.5	3.4	132.26 / 134.20
AP-3014	21 Dec 90	29.5	14.4	4.6	14.72 / 17.55
AP-3015	16 Jan 91	126.5	116.5	4.0	115.85 / 117.42
AP-3221	2 Nov 92	178.4	158.4	2.2	152.34 / 154.00
FR-1	15 Jan 85	146	136	2.8	131.61 / 130.17
FR-2	27 Jun 85	162	152	2.6	145.08 / 146.55
FR-3	9 Jul 85	160	150	1.7	145.95/ 147.3
New Monitoring Wells, Installed August 1994 - May 1995					
AP-3447	31 Aug 94	64.9	54.6	1.5	nm/ 56.58
AP-3448	26 Aug 94	32.0	22.0	2.0	nm/ 27.25
AP-3449	12 Aug 94	30.0	19.7	2.0	nm/ 24.38
AP-3450	10 Aug 94	27.7	17.3	2.0	nm/ 22.18
AP-3451	11 Aug 94	18.0	7.7	2.1	nm/ 11.76
AP-3452	27 Aug 94	37.0	26.6	2.9	nm/ 29.67
AP-3453	29 Aug 94	34.1	23.7	1.9	nm/ 26.38
AP-3454	30 Aug 94	24.4	14.4	2.0	nm/ 16.45
AP-3455	16 Aug 94	82.4	72.1	2.2	nm/ 75.30
AP-3457	24 Aug 94	49.5	40.0	2.0	nm/ 36.47
AP-3458	25 Aug 94	34.7	25.0	2.0	nm/ 23.62

Table 2-3
Well Physical Dimensions
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Well ID	Date Installation Completed	Bottom of Casing (ft bgs)	Top of Screen (ft bgs)	Casing Stickup (ft ags)	Depth to GW (ft bgs) Fall 94[1]/Spring 95[1]
Monitoring Wells Installed August 1994 - May 1995 (cont.)					
AP-3459	25 Aug 94	15.0	5.0	2.0	nm/ 8.75
AP-3470	10 Jan 95	45.1	25.5	2.6	nm/ 35.02
AP-3471	26 Apr 95	105.6	75.6	2.8	nm/ 88.74
AP-3472	20 Apr 95	140.7	110.7	2.4	nm / 125.45
AP-3473	16 Feb 95	192.0	162.7	2.5	nm/ 175.08
AP-3474	25 Jan 95	129.7	100.1	1.9	nm/ 114.27
AP-3475	9 Feb 95	170.6	140.9	2.2	nm/ 155.38
AP-3476	3 Apr 95	150.0	120.3	2.5	nm/ 134.64
AP-3477	21 Feb 95	169.0	139.0	3.7	nm/ 151.76
AP-3478	4 Mar 95	106.8	96.6	2.4	nm/ 45.57
AP-3479	3 Feb 95	77.4	67.3	2.6	nm/ 12.80
AP-3480	31 Jan 95	115.1	85.0	1.9	nm/ 102.10
AP-3481	28 Jan 95	94.5	64.3	1.4	nm/ 79.71
AP-3482	9 Mar 95	104.1	94.0	1.5	nm/ **38.28**
AP-3483	10 Jan 95	114.6	104.7	2.4	nm/ 92.46
AP-3484	13 Apr 95	98.6	68.7	2.6	nm/ 85.94
AP-3485	13 Mar 95	106.2	96.5	2.3	nm/ **54.23**
AP-3530	28 Apr 95	129.6	99.7	-0.25 f	nm/ 112.34
AP-3531	1 May 95	131.0	101.1	2.6	nm/ 114.01
AP-3532	7 May 95	133.7	113.5	2.8	nm/ **108.27**
AP-3533	10 May 95	131.4	111.3	2.5	nm/ 101.40

Table 2-3
Well Physical Dimensions
Fort Richardson Groundwater Study
Fall 1994/Spring 1995

Key:
bgs: below ground surface
ags: above ground surface
[1]: Depths to groundwater measured on dates well was sampled (see Table 3-1).
p: According to records, well constructed of perforated pipe rather than well screen.
i: Depth indicated is depth of water intake pipe.
f: Well installed with a flush mount wellhead.
na: Not applicable at this well.
nm: Not measured.
Boldface indicates that the measured groundwater level is above the top of the screened interval.

Locations of the wells are shown on Figure 1; an alphanumeric grid has been superimposed on Figure 1, and the grid locations of each well are shown in the last column of Table 3-1. The sampling histories of previously-sampled wells are shown in the chemical data summary tables of Section 4.

3. Field Activities and Sampling Procedures

3.1 Summary of Field Activities: For the Fall 1994 sampling event, groundwater samples were collected from 26 wells, starting 13 Sep 94 and ending on 20 Dec 94 (see Table 2-1 for summary of wells and dates sampled, and Figure 1 for well locations). The wells were sampled by chemists Chris Floyd, Richard Ragle, Serena Wolery, and Bret Walters of CENPA-EN-G-MI. For the Spring 1995 sampling event, 58 wells were sampled, from 4 Apr 95 to 7 Jul 95 (see Table 2-1 for summary of wells and dates sampled, and Figure 1 for well locations). The Spring 1995 sampling was performed by chemists Chris Floyd, Bret Walters, and Richard Ragle, with the assistance of college intern Jyl Venner.

3.2 Sampling Equipment and Procedures: The groundwater sampling was performed in a manner consistent to the greatest extent possible with the Sampling and Analysis Plans (refs. 7c, 7d) and relevant technical guidance (refs. 7g, 7h, 7i, 7j, 7k). Deviations from procedures specified in the Sampling and Analysis Plans or recommended in the technical guidance are explained in Section 3.4 below.

3.2.1 Sampling Equipment: The groundwater monitoring project on Fort Richardson encompasses a number of different types of wells, and thus requires several different types of sample collection equipment. The type of equipment used at each well is specified in the Sample Summary Forms located in Appendix A.

The project has included seven active supply wells. The four Alaska Department of Fish and Game (ADFG) hatchery wells and the two post supply wells (see Table 2-1) contain large high-volume pumps and large diameter risers that make sampling directly

from the well casing impractical. Water samples are collected directly from spigots mounted in steel water mains leading from the well, upflow from any chlorination equipment. ADFG-E, -F, and -K are sampled within a manifold building across Ship Creek from the hatchery, where groundwater from a number of wells is combined from individual well feeder pipes into a single water main; ADFG-9 is sampled within a concrete vault at the hatchery complex. The supply well at the Otter Lake Lodge is sampled from a spigot in a small-diameter water line in the lodge basement, believed to be upflow of the chlorination equipment. No spigot used for sampling includes an aerator.

Five of the wells sampled are former supply wells, test wells, or piezometers (see Table 3-1). Each of these has a 6-inch diameter steel casing, and contains a dedicated 4-inch single-speed submersible pump on PVC risers. A reusable custom-made Teflon and stainless-steel hose is used to direct water flow from the bronze spigot at the wellhead and collect the samples. The pumps are powered with a portable generator.

The remainder of the wells are all monitoring wells with 2- or 4-inch diameter PVC casings. Most contain dedicated 2-inch-diameter stainless-steel submersible variable-speed pumps (Grundfos RediFlo II). These pumps are mounted on rigid PVC riser or flexible polyvinyl tubing. A reusable stainless-steel and Teflon sampling tube is used to direct the water flow from the wellhead, and a portable generator is used to power the pumps.

A few wells have been sampled using a bailer during the Fall 1994 and/or Spring 1995 sampling events. Table 3-1 below summarizes the wells that have been sampled by bailer. Wells AP-2982, -2985, -3231, and -2974 are shallow, silty wells with slow recharge rates, and are considered poor candidates for pump installation. A dedicated pump was installed in AP-3455 upon development of the well, but was removed during the first attempt to sample the well when it was discovered that the well's recharge rate was too slow for pump operation. Pumps were installed in FR-1, FR-2, FR-3, and AP-3233 during the Spring 1995 sampling event. Equipment used at TW-1 in Spring 1995 was a special case discussed in the 'Problems Encountered' section below. Where feasible, disposable single-use Teflon bailers are used. At wells deeper than 50 feet, such as AP-3233, FR-1, FR-2, FR-3, and AP-3455, heavy-duty reusable Teflon bailers have been preferred.

Table 3-1 Wells That Have Been Sampled by Bailer		
Well ID	Sampling Equipment, Fall 1994	Sampling Equipment, Spring 1995
AP-3233	Bailer	Pump
AP-2982	Bailer	Bailer
AP-2985	Bailer	Bailer
AP-3231	Bailer	Bailer
AP-2974	Bailer	Bailer
FR-1	Bailer	Pump
FR-2	Bailer	Pump
FR-3	Bailer	Pump
AP-3455	(not sampled)	Bailer
TW-1	Pump	Pump/Bailer

3.2.2 Well Purging: Immediately prior to sampling, the wells were purged of standing, stagnant water by removing a certain quantity of water and allowing the well to recharge. For wells at which the purge water was withdrawn directly from the well casing (monitoring wells and former supply wells), a volume equivalent to three to five standing water-column volumes (as measured immediately prior to purging) was purged from the well. The standing water-column volume was calculated as follows:

$$V = (D-d)\ \pi\ r^2\ \ [7.48 \text{ gallons} / 1\ ft^3]$$

where V = standing water-column volume (in gallons),

D = distance from well casing top to well bottom (in feet),

d = distance from well casing top to watertable (in feet),

r = internal radius of the well casing (in feet).

At wells with pumps, the purging was accomplished by pumping water from the wells at a moderate rate, generally 0.5 to 3.0 liters/minute. At many of the wells with new 2-inch-diameter submersible pumps, it was discovered that purging at rates of less than approximately 1 liter/minute caused the temperature of the discharged water to rise

markedly; when the purge rate was increased, the water temperature decreased. At the 6-inch-diameter former supply wells, the fact that the purge volumes were extremely large (up to 1,000 gallons), and that the pumps were not variable-speed, necessitated the use of purge rates of approximately 3 to 6 gallons/minute. It has been shown that these large wells can be purged at relatively high rates without causing an increase in turbidity.

At wells that were purged by bailing, the bailer was lowered into the well as gently as possible, and was not lowered all the way to the bottom of the casing; these precautions were observed to minimize the disturbance of sediment in the well casing.

If the well had a very low rate of recovery and could be bailed or pumped dry, then the well was considered to be purged when it had been bailed or pumped to dryness twice. This has been an issue only at wells AP-2974, AP-3455, and FR-3 (Spring 95 only). Attempts were made to reduce the rate of purge to match the rate of well screen inflow, but this has been found to be almost impossible to put into practice in the field, especially with bailed wells.

Measurements of temperature, pH, conductivity, and oxidation-reduction potential and/or dissolved oxygen were recorded periodically in the field log while the well was purged, to indicate when the physical characteristics of the well had stabilized. These measurements were considered to be stable when two consecutive measurements of each physical characteristics agree within 10 percent. Sampling proceeded only after the physical characteristics had stabilized. The final physical characteristic measurements for each well, along with purge rates and volumes, are shown on the Sample Summary Forms in Appendix A.

At the active supply wells which were in operation at the time of sampling (ADFG wells, Well 1), purging was limited to allowing water to run through the sampling spigot for several seconds before sampling. Well 3 is a standby supply well; it was allowed to purge itself of approximately three casing volumes (based upon well dimensions and flowrates provided by DPW) after activation by DPW personnel. At the Otter Lake Lodge, the well and plumbing system of the facility was purged by running water from restroom faucets for 15 minutes before sampling from a pre-chlorination system spigot in the basement .

3.2.3 Well Sampling: At wells that were sampled with a bailer, the bailer was lowered into the casing as gently as possible to avoid aeration of the water and suspension of sediment. At wells sampled by submersible pump, the flow rate was reduced to the lowest that would still provide a sustainable continuous stream of water; gaping and bubbles in the water stream, and the increased temperatures associated with very slow flowrates, were considered to be more deleterious to sample quality than the effects of sampling at flowrates higher than the EPA-recommended 100 mL/minute. The sampling flowrate was in all cases equal to or less than the purge rate for that well, and was generally within a range of 100 to 300 mL/minute for volatiles analyses (including gasoline range organics), and 300 to 800 mL/minute for the other analyses. The sampling rate for each well is provided in the Sample Summary Forms in Appendix A.

Samples were collected in the following order: volatile organic compounds and gasoline range hydrocarbons; diesel range organics; semivolatile organic compounds and other organic analyses; metals and other inorganic analyses. Samples for volatiles analyses were collected as soon after purging as possible. If well recovery was very slow, samples for volatiles analyses were collected as soon as sufficient volume was present to collect those samples. The well was then allowed to recharge as often as necessary to collect samples for the non-volatile analyses.

Samples collected for dissolved metals analysis were filtered as soon as was practical, and prior to the addition of nitric acid preservative. Filtration was accomplished by drawing the sample through a single-use 0.45 micron filter by means of a vacuum pump. The filtered water sample was dispensed into a new sample container, then preserved with acid.

3.2.4 Equipment Decontamination: Teflon sampling tubes and reusable bailers were decontaminated by rinsing sequentially with potable water, reagent-grade methanol, reagent-grade hexane, again with reagent-grade methanol, then finally with distilled water. The decontaminated equipment was sealed in plastic bags until use.

The water-level indicator was decontaminated after use at each well by wiping the tape and probe with paper towels dampened with methanol and deionized water as the tape was reeled in, and then rinsing the head of the probe with methanol and deionized water.

3.2.5 Trip Blanks: Trip blanks to be analyzed for volatile organic compounds and gasoline range organics were prepared by the primary laboratory. Trip blanks were carried to the field with the sample containers, and submitted to the laboratory as blind samples. One set of trip blanks accompanied to the laboratory each cooler containing samples for volatile organics or gasoline range organics analysis. The results of the analyses of trip blanks are discussed in Section 4.8.

3.2.6 Rinsates: Equipment rinsates were prepared to demonstrate that the sampling equipment was properly decontaminated. Deionized water obtained from the primary laboratory was allowed to flow over and through a decontaminated item of sampling equipment, and the water collected in appropriate sample containers. At least one rinsate blank and duplicate was prepared for each type of sampling equipment that was used (namely, the Teflon sampling tubes and reusable bailers), and for each analytical method (see Table 2-2), with the exception of dissolved metals, biological oxygen demand, and turbidity. The rinsates were submitted as blind samples. The results of the analyses of rinsates are discussed in Section 4.9.

3.2.7 Investigation-Derived Waste: Purge water from most wells was containerized in steel drums or sealable plastic buckets and turned in to the DPW Hazardous Materials Storage Facility at Building 45-125, Fort Richardson. When the results of chemical analysis of the water samples were available, the levels of contamination in the containerized water were compared to discharge limits allowed by Fort Richardson's wastewater discharge permit with the Municipality of Anchorage. A memorandum to DPW was prepared recommending methods of disposal of the containerized water. Purge water from the large former supply wells was discharged onto the ground in the vicinity of the well, with the agreement of the project engineering manager.

3.3 Summary of Observations: Observations pertinent to the sampling of each well (appearance, odor, purging and sampling flowrates, measurements of temperature, pH, conductivity, oxidation-reduction potential, and dissolved oxygen) are recorded on Sample Summary Forms in Appendix A.

3.4 Problems Encountered: Problems encountered during the two sampling events that may have a bearing on sample quality or interpretation are discussed below.

3.4.1 Cooler Temperatures: Some difficulty in maintaining temperatures of sample coolers within the EPA-mandated range of 2 to 6 °C was encountered. Since the potential adverse affects of elevated temperatures on samples for volatiles analyses are obvious. it had been the practice of the CENPA project chemist to submit samples at temperatures on the cold end of the required range, with the result that some coolers reached the laboratory at temperatures slightly below 2°C. Such below-range cooler temperatures had not been considered to be discrepancies in the past by CENPD; the QAR for the Fall 1994 sampling event does not remark upon samples submitted at temperatures below 2 °C. The QAR for the Spring 1995 sampling event, however, reflects a more strict interpretation of the mandated temperature range, and states that samples submitted at temperature below that range "may have been compromised prior to analysis". It is the position of CENPA-EN-G that samples from this project submitted at temperatures below 2 °C *were not* compromised. unless evidence exists that ice crystals formed within the sample. The sole rational that has been offered for regarding samples submitted at below 2 °C as compromised has been the possibility that samples received at the laboratory below that temperature may have frozen and then thawed prior to being examined at the laboratory. The great majority of samples from the Fall 1994 and Spring 1995 sampling events were stored overnight at 2 to 4 °C in a CENPA-EN-G-MI refrigerator, then packed in coolers with ice the next morning for the fifteen-minute drive to the Columbia Analytical Services, Inc. (CAS), laboratory in Anchorage. The likelihood that the samples could have frozen and then thawed unnoticed during that brief time is extremely small.

A large number of samples were subjected to *elevated* temperatures when they were transferred from CAS-Anchorage to the CAS laboratory in Kelso, Washington. This issue is discussed in detail in Section 5.

3.4.2 Pump Flow Rates and Temperatures: The major field problem encountered in Spring 1995 involved the 32 newly installed monitoring wells. All these wells had 2-inch diameter PVC casings and were fitted with 2-inch submersible stainless-

steel pumps (Grundfos "RediFlo II"). It was discovered that when these pumps were operated at speeds sufficiently low to generate an EPA-recommended purge flow rate of 0.2 to 0.3 liters/minute, the temperature of the discharged water would rise by approximately 2 °C or more over the course of purging. The submersible pumps are cooled and lubricated by the flow of water generated by the pump's action, so it is logical . . . he pumps would heat up somewhat at low operating speeds, especially within deep wells. Such a large increase in temperature, however, was unexpected. Technical service representatives of the pump's manufacturer were consulted, but could shed no insight on the problem. It was discovered by trial-and-error that operating the pumps at 1 to 3 liters/minute generally moderated or reversed the temperature increases. For sampling, the flow rate was often ramped up to a higher flow in order to reduce the discharge temperature to the originally noted temperature (or as low as possible), then dropped quickly to the slowest sustainable flow. The samples for VOCs and GRO were then collected as quickly as possible before the temperature began to increase again. This temperature increase issue was not seen in Fall 1994 among the handful of wells sampled by pump during that sampling event; most of those wells have 4-inch or larger diameter casings and a different model of pump.

A similar issue affecting pumped wells in both sampling events concerns the minimum flow rate that can be achieved at a given well. It was found that the EPA-recommended flow rate of 0.1 liters/minute cannot be obtained by many of the pumps. The degree of control over the pump speed and the corresponding flow rate is not infinite, and at many pumps the lowest rate of continuous flow was well above 0.1 liters/minute. This lowest continuous flow was generally used for the collection of the VOC and GRO samples, as the "gapping" of the waterstream at lower flowrates was thought to potentially have a great negative impact on the VOC and GRO sample quality.

3.4.3 Slow-Recharge Wells: Poor well recharge rates were encountered in a handful of wells. AP-3455 was found to have a recharge rate too slow for its submersible pump to operate effectively; the pump was eventually removed, and the well was purged and sampled with a bailer. Slow recharge rates were also encountered at FR-3, AP-3452, and AP-3458, but the wells were successfully sampled by pump.

3.4.4 Damaged Wells: AP-2974 has a damaged housing that cannot be locked. AP-3221 was discovered to have had its entire housing pulled from the ground and stolen in Fall 1994. The well casing and pump have not been damaged, and the well can still be sampled, although it cannot be secured. The pump at TW-1 is thought to have worked itself off the bottom of its riser during the first attempt to sample that well in Spring 1995. Because of the great weight of the 4-inch pump and its 1-inch diameter riser pipe, the disabled pump was left in place through the Spring 1995 sampling event. TW-1 was eventually sampled by purging the well with a portable submersible pump, and sampling with a disposable bailer. The disabled pump and riser was removed in October 1995.

4. Results of Chemical Analysis

The complete tabulated chemical data are presented in Appendices B (Fall 1994) and C (Spring 1995). The data are summarized in Table 4-2, and are discussed in the sections below. The discussions are organized by well type (as shown in Table 2-1), and include comparisons of Fall 1994, Spring 1995, and earlier data.

4.1 Threshold Levels and other Data Criteria: Table 4-1 outlines Risk-Based Concentrations (RBCs). Maximum Contaminant Levels (MCLs), and Secondary Maximum Contaminant Levels (SMCLs) established for selected contaminants in *drinking water*. Since only Well 1, Well 3, and the Otter Lake well produce water for consumption, these levels are not entirely applicable to the data from most of the wells. These levels are, however, useful as points of comparison, and are used as "threshold levels" in the discussions of the data.

Maximum Contaminant Levels (MCLs) are regulatory limits established for drinking water by the U.S. Environmental Protection Agency (ref. 7n) for chemicals known or suspected to be harmful to human health. Secondary Maximum Contaminant Levels (SMCLs) are regulatory limits for chemicals that affect the aesthetic qualities of drinking water (e.g., taste, odor, color, etc.), but pose negligible or indeterminant risk to human

TABLE 4-1
RBC and MCL Threshold Levels
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Compound/Analyte	RBC, µg/L	MCL, µg/L	SMCL, µg/L
Volatile Compounds			
Acetone	3,700[N]	–	–
Benzene	0.36[C] x	5	--
2-Butanone	1,900[N]	--	–
n-Butylbenzene	61[N]	–	–
t-Butylbenzene	61[N]	--	--
Carbon Disulfide	21[N]	--	–
Carbon Tetrachloride	0.16[C] x	5	–
Chlorobenzene	39[N]	100	--
Chloroform	0.15[C] x	100	–
Chloromethane	1.4[C]	--	--
1,2-Dibromoethane	0.00075[C] x	--	--
Dibromomethane	--	100	--
1,2-Dichlorobenzene	270[N]	600	10
1,3-Dichlorobenzene	540[N]	–	--
1,4-Dichlorobenzene	0.44[C] x	75	--
1,1-Dichloroethane	810[N]	--	--
1,2-Dichloroethane	0.12[C] x	5	–
cis-1,2-Dichloroethene	61[N]	70	--
Dichlorofluoromethane	390[N]	–	–
1,3-Dichloropropane	0.16[c] x	–	–
Ethylbenzene	1,300[N]	700	–
Hexachlorobutadiene	0.14[C] x	--	–
Isopropylbenzene	--	--	--
p-Isopropyltoluene	–	–	--
Methylene Chloride	4.1[C]	5	–

TABLE 4-1
RBC and MCL Threshold Levels
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Compound/Analyte	RBC, µg/L	MCL, µg/L	SMCL, µg/L
Volatile Compounds (cont)			
Naphthalene	1,500[N]	–	–
n-Propylbenzene	–	–	–
1,1,2,2-Tetrachloroethane	0.052[C] x	–	–
Tetrachloroethene (PCE)	1.1[C]	5	–
Toluene	750[N]	1,000	–
1,2,4-Trichlorobenzene	190[N]	70	–
1,1,1-Trichloroethane	1,300[N]	200	–
1,1,2-Trichloroethane	0.19[C] x	5	–
Trichloroethene (TCE)	1.6[C] x	5	–
1,2,4-Trimethylbenzene	3[N]	–	–
1,3,5-Trimethylbenzene	2.4[N]	–	–
Xylenes (mixed)	12,000	10,000	–
Semivolatile Compounds			
Benzoic Acid	150,000[N]		
bis(2-Ethylhexyl)phalate	4.8[C] x	6	–
PAHs			
Acenaphthene	2,200[N]	–	–
Anthracene	11,000[N]	–	–
Benz(a)anthracene	0.092[C] x	0.1[P]	–
Benzo(b)fluoranthene	0.092[C] x	0.2[P]	–
Benzo(k)fluoranthene	0.92[C]	0.2[P]	–
Benzo(a)pyrene	0.0092[C] x	0.2	–
Chrysene	9.2[C]	0.2[P]	–
Dibenz(a,h)anthracene	0.0092[C] x	0.3[P]	–
Fluoranthene	1,500[N]	–	–

TABLE 4-1
RBC and MCL Threshold Levels
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Compound/Analyte	RBC, µg/L	MCL, µg/L	SMCL, µg/L
PAHs (cont)			
Fluorene	1,500[N]	--	--
Indeno(1,2,3-cd)pyrene	0.092[C] x	0.4[P]	--
Naphthalene	1,500[N]	--	--
Phenanthrene	--	--	--
Pyrene	1,100[N]	--	--
Polychlorinated Biphenyls (PCBs)			
Total PCBs	0.0087[C] x	0.5	--
Aroclor 1016	2.6[N]	--	--
Aroclor 1254	0.73[N]	--	--
Pesticides			
alpha-BHC (HCH)	0.011[C] x	--	--
BHC, mixed (technical)	0.037[C] x	--	--
Metals			
Aluminum	37,000[N]	--	200
Antimony	15[N]	6	--
Arsenic	11[N]/0.038[C] x	50	--
Barium	2,600[N]	2,000	--
Beryllium	0.016[C] x	4	--
Cadmium	18[N]	5	--
Calcium	--	--	--
Chromium (III)	37,000[N]	100	--
Cobalt	2,200[N]	--	--
Copper	1,400[N]	--	1,000
Iron	--	--	300
Lead	--	15[A]	--
Magnesium	--	--	--
Manganese	180[N]	--	50

TABLE 4-1
RBC and MCL Threshold Levels
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Compound/Analyte	RBC, µg/L	MCL, µg/L	SMCL, µg/L
Metals (cont)			
Mercury	11[N]	2	--
Nickel	730[N]	100	--
Potassium	--	--	--
Selenium	180[N]	50	
Silver	180[N]	--	100
Sodium	--	--	250,000
Thallium	2.9[N]	2	--
Vanadium	260[N]	--	--
Zinc	11,000[N]	--	5,000
Other Inorganics			
Chloride	--	--	250,000
Nitrate + Nitrite	58,000	10,000	--
Sulfate	--	--	250,000

Key:
RBC: Risk-Based Concentration, for long-term ingestion of drinking water, EPA Region III, 7 Mar 95.
MCL: Maximum Contaminant Level (drinking water)
SMCL: Secondary Maximum Contaminant Level (drinking water)
C: Carcinogen (value is for risk = 10^{-6})
N: Noncarcinogen (value is for hazard quotient (HQ) of 1.0)
A: Value is not a MCL, but an EPA "action level"
P: Value is the *Proposed* MCL (PMCL)
x: Method Reporting Limit (MRL) typical for this compound/analyte may be higher than RBC/MCL threshold limit.

health at the SMCL concentration.

An RBC is a concentration of a chemical that is thought to correspond a certain defined level of risk to human health. In this report, the RBCs cited are for a lifetime cancer risk of 10^{-6} for carcinogenic chemicals, or for a hazard quotient of 1.0 for noncarcinogenic chemicals, developed to model long-term consumption of contaminated drinking water. RBCs developed by one U.S. EPA region may differ from those developed by another region; most RBCs presented in this report are from tables developed by U.S. EPA Region III (ref. 7o). Region III tables were chosen for their completeness and regular updates.

The RBC or MCL for a particular compound or analyte, whichever is lowest, is used as a very conservative "threshold value" for inclusion of a detected quantity of that chemical in Table 4-2 (analytes for which only an SMCL exists are not included in Table 4-2). Therefore, Table 4-2, in the interest of brevity, may exclude some compounds or analytes that may be of interest, but are not considered a potential health risk at the concentrations detected (e.g., polyaromatic hydrocarbons). Such chemicals will be addressed in the text below. Aluminum concentrations above the threshold value of 37,000 ppb are also not included in Table 4-2, as it is believed that all high aluminum values are due to large amounts of silt in the samples; no dissolved aluminum values approaching the threshold value have been detected in these wells. A number of samples contain low levels of acetone, methylene chloride, and carbon disulfide. These are common laboratory contaminants, and are flagged "B" in the Chemical Data Tables if the compound was also detected in the laboratory method blank. "B"-flagged detections of these compounds are not included in Table 4-2. Low-level detections of these compounds that cannot be dismissed as laboratory contamination (i.e., are not "B"-flagged) should still be viewed with skepticism, and are not discussed below unless the concentration approaches the threshold value.

Some RBCs used as threshold levels are well below the practical detection limits for those compounds or analytes (e.g., 1,2-dibromoethane, beryllium). Conceivably, concentrations of these chemicals could exist in the groundwater above the threshold levels, but below the reporting limit of that chemical. These RBCs are flagged "x" in Table 4-2.

TABLE 4-2
Chemical Detections above Threshold Levels
Fall 1 Spring 1995

Well ID	VOCs, µg/L		GRO, µg/L		DRO, mg/L		Metals (total/diss.), µg/L	
	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95
ADFG C	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
ADFG E	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
ADFG K	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
ADFG 9	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
Well 1	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
Well 3	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
Otter Lake	ND	ND	137	ND(50)	ND	ND	*NDAT*	*NDAT*
TW-1	ND	*NDAT*	ND	ND	ND(0.1)	0.3J	*NDAT*	*NDAT*
A-1	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
A-6	ND	ND	ND	ND	0.1 A	ND(0.1)	*NDAT*	*NDAT*
AK-2127	ND	*NDAT*	ND	ND	ND	ND	Cd: 11/ND(10)	Cd: ND(5)/ND(5)
Well B	1,2-DCA: 0.9	1,2-DCA: ND(0.5)	ND	ND	ND	ND	*NDAT*	*NDAT*

TABLE 4-2
Chemical Detections above Threshold Levels
Fall 1994/Spring 1995

Well ID	VOCs, µg/L		GRO, µg/L		DRO, mg/L		Metals (total/diss.), µg/L	
	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95
AP-3233	Benzene: 50-55J 1,2-DCA: ND(1)-5J 1,2,4-Trimethylbenzene: 116-130J 1,3,5-Trimethylbenzene: 64-82J	Benzene: 20-22J 1,2-DCA: ND(0.92)-2.3J 1,2,4-Trimethylbenzene: 120-130J 1,3,5-Trimethylbenzene: 56-70J	1720-3000	1830-1900	6.0-9.2	1.4-2.0	Mn: 1490-1600/ 1400-1590	Mn: 1480-1600/ 1460-1700
AP-3235	Benzene: ND(2)	Benzene: 0.7J	350	455	0.4	0.7	Mn: 426/419	Mn: 387/377
AP-2982 PCBs* Pesticides*	Benzene: 86-120 1,2,4-Trimethylbenzene: 35-40 1,3,5-Trimethylbenzene: 10-31 1,2-DCA: ND(2) *sec*-Butylbenzene: ND(2) TCE: ND(2)-1.3	Benzene: 230-335J 1,2,4-Trimethylbenzene: 170-275J 1,3,5-Trimethylbenzene: 46-54J 1,2-DCA: ND(0.5)-6.94J *sec*-Butylbenzene: ND(1)-175J TCE: 3.3-4.21J	1000-1160	7100-8400	0.4-0.6	4.2-4.6 A	Pb: 12-20/ ND(5)-2 Mn: 1900-2360/ 1150-1280 Ni: 70-120/ ND(30)	Pb: 1.4/ND(1) Mn: 3940-4500/ 4060-4900 Ni: 22/ND(20) PCBs*

TABLE 4-2
Chemical Detections above Threshold Levels
Fall 1994/Spring 1995

Well ID	VOCs, µg/L		GRO, µg/L		DRO, mg/L		Metals (total/diss.), µg/L	
	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95
AP-2985	ND	ND	ND	ND	ND(0.1)	0.5	As: 26/ND(5) Cr: 122/ND(10) Pb: 28/ND(5) Mn: 2940/ND(5) Ni: 164/ND(30)	As: ND(5)/ ND(5) Cr: 20/ND(10) Pb: 14/ND(2) Mn: 440/144 Ni: ND(30) /ND(30)
AP-3231	TCE: ND(2)	TCE: 11	ND	ND	ND(0.2)	0.5	As: 22/ND(5) Cr: 158/ND(10) Pb: 27/ND(5) Mn: 4580/ND(5) Ni: 261/ND(30)	As: 8/ND(5) Cr: 20/ND(5) Pb: 8/ND(2) Mn: 635/ND(5) Ni: ND(30) /ND(30)
AP-2974	ND	ND	ND	ND	ND	0.4	Mn: 2190/ND(5)	Mn: 440/6

TABLE 4-2
Chemical Detections above Threshold Levels
Fall 1994/Spring 1995

Well ID	VOCs, µg/L		GRO, µg/L		DRO, mg/L		Metals (total/diss.), µg/L	
	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95	Fall 94	Spring 95
AP-3010	ND	ND	ND	ND	ND	ND	Mn: 87/69	Be: 7/ND(5) Mn: 154/34
AP-3013	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
AP-3014	ND	ND	ND	ND	ND	ND	Mn: 170/85	Mn: 78/30
AP-3015	ND	ND	ND	ND	ND	ND	*NDAT*	*NDAT*
AP-3221	*NDAT*	*NDAT*	ND	ND	ND	ND	Cr: 115/ND(10) Mn: 390/6	Cr: 410/ND(10) Mn: 560/23 Ni: 290/ND(30)
FR-1	1,1,2,2-Tetrachloroethane: ND(2) 1,2-Dibromoethane: ND(2) Chloroform: ND(2)	1,1,2,2-Tetrachloroethane: 0.15J-ND(0.5) 1,2-Dibromoethane: 0.1J-ND(2) Chloroform: 0.29J-ND(0.81)	ND	ND	4.2	ND	*NDAT*	*NDAT*
FR-2	Chloroform: ND(2)	Chloroform: 0.27J	ND	ND	2.6	ND	*NDAT*	*NDAT*
FR-3	Chloroform: ND(2)	Chloroform: 0.11J	ND	ND	4.8	ND	Mn: 228/ND(5)	Mn: 73/ND(5)

TABLE 4-2
Chemical Detections above Threshold Levels
Spring 1995

Well ID	Volatile Organic Compounds, µg/L	DRO, mg/L	Metals (total/diss.), µg/L
AP-3448	1,1,2,2-Tetrachloroethane: **0.26J** 1,3-Dichloropropane: **0.22J**	ND(1.0)	*NDAT*
AP-3452	ND	ND(0.1)	Cd: **6**/ND(5)
AP-3453	1,2-Dibromoethane: **0.11J** Hexachlorobutadiene: **0.39J**	ND(1.0)	Mn: **360**/ND(5)
AP-3455	Chloroform: **0.16J**	**7.9**	Mn: **2080/75** Ni: **130**/ND(30)
AP-3457	*NDAT*	ND(0.1)	Mn: **267/56**
AP-3458	*NDAT*	**1.2** A	Mn: **2700/2530**
AP-3472	1,1,2,2-Tetrachloroethane: **0.47J**	ND(0.1)	*NDAT*
AP-3474	Chloroform: **0.49J**	ND(0.1)	*NDAT*
AP-3475	*NDAT*	**0.2**	*NDAT*
AP-3476	1,1,2,2-Tetrachloroethane: **0.21J** 1,2-Dibromoethane: **0.16J**	**0.3-0.4**	*NDAT*
AP-3477	*NDAT*	**0.2** A	*NDAT*
AP-3479	ND	ND(0.1)	*NDAT*
AP-3480	Carbon Tetrachloride: **0.33J** Chloroform: **0.4J**	ND(0.1)	*NDAT*

TABLE 4-2
Chemical Detections above Threshold Levels
Spring 1995

Well ID	Volatile Organic Compounds, µg/L	DRO, mg/L	Metals (total/diss.), µg/L
AP-3483	ND	ND(0.1)	*NDAT*
AP-3484	*NDAT*	**0.3**	*NDAT*
AP-3485	Carbon Tetrachloride: **0.29J**	ND(0.1)	*NDAT*
AP-3530	Chloroform: **0.11J**	ND(0.1)	*NDAT*
AP-3532	Carbon Tetrachloride: **1.5** Chloroform: **0.2J**	ND(0.1)	*NDAT*
AP-3533	1,1,2,2-Tetrachloroethane: **0.2J** 1,2-Dibromoethane: **0.13J** Carbon Tetrachloride: **1.4** Chloroform: **1.6**	ND(0.1)	*NDAT*

Key:
Table displays reports of concentrations above RBC or MCL, whichever is lower.
Absence of well or parameter in table indicates ND or NDAT.
Hyphenated ranges of values indicate triplicate samples
ND: Not Detected (value in parentheses is the Method Reporting Limit).

NDAT: No target analytes detected above threshold level.
J: Estimated value.
A: Chromatogram does not match typical fuel fingerprint.
GRO: Gasoline Range Organics
DRO: Diesel Range Organics
DCA: Dichloroethane
TCE: Trichloroethene

Be: Beryllium
Cd: Cadmium
Cr: Chromium
Pb: Lead
Mn: Manganese
Ni: Nickel
PCBs*: ND(0.48)-0.8J PCBs detected at AP-2982 (Spring 95 only).
Pesticides*: BHCs detected in QA duplicate at AP-2982 (Spring 95 only).

Compound- and analyte-specific method reporting limits (MRLs) may vary depending on the well and the sampling event, and are shown in the Chemical Data Tables in Appendices B and C.

It should also be noted that the threshold levels pertain to drinking water (which presumably would be rather low in sediment) and are perhaps best compared to the data for *dissolved metals* rather than total metals. Analyses for metals of unfiltered (total) water samples quantitate both dissolved metals and metals that are suspended in the water as sediment. Calcium, magnesium, potassium, and sodium are very common constituents of the earth's crust and of groundwater, and their presence in the water samples is almost certainly due to natural sources. The high aluminum concentrations reported in many unfiltered samples are likewise due to the abundant aluminosilicate minerals that no doubt comprise much of the sediment in the sample. In the discussions below, concentrations of total aluminum will not be remarked upon; similarly, ubiquitous dissolved metals (e.g., calcium, magnesium, potassium,) are generally not discussed below.

No federal or state drinking water standards exist for diesel-range organics (DRO) or gasoline-range organics (GRO). Water quality standards established by the State of Alaska in 18 AAC 70, December 1989, describe a number of different allowable limits for "petroleum hydrocarbons, oils, and greases", depending upon the use of the water supply. *All detections of DRO and GRO are shown in Table 4-2*, and are discussed below. Some samples contained organic constituents that were quantitated and reported as "DRO", but may not in fact be diesel fuel. These instances are flagged in the data tables and described below.

Recent amendments to 18 AAC 70 (ref. 7p) have established criteria for maximum allowable concentrations of total aromatic hydrocarbons (TAH) and polyaromatic hydrocarbons (termed TAqH, or "total aqueous hydrocarbons"). The applicability of these criteria to unexploited groundwater is unclear, but the chemical data will be addressed in terms of these criteria in Section 4.7.

4.2 Active Supply Wells: The ADFG wells, Wells 1 and 3, and the Otter Lake Lodge well contained no detectable quantities of volatiles, semivolatiles, DRO, or PAHs

in Fall 1994 or Spring 1995. 137 ppb GRO was reported at Otter Lake in Fall 1994, but was not detected in Spring 1995; no volatile or semivolatile fuel constituents were reported in the Otter Lake sample from either sampling event. Low levels of total lead (less than 5 ppb) were detected at ADFG C, Well 1, and Otter Lake, in Spring 1995 but not Fall 1994 (laboratory method reporting limits (MRLs) of 5 ppb were reported for some wells in Fall 1994; all MRLs were 2 ppb in Spring 1995).

The low levels of 1,2-dichloroethane (less than 2 ppb) reported in Spring 1994 at ADFG C, ADFG E, ADFG K, Well 1, and Well 3 were not repeated in Fall 1994 or Spring 1995 (ref. 7t). Well 1, ADFG E, and ADFG 9 have historically shown relatively high levels of total and dissolved lead (up to 18 ppb total lead in Well 1 in May 1990, and 52 ppb total lead in ADFG E in November 1991), but these levels appear to have declined to below 10 ppb since 1993 (ref. 7d).

4.3 Former Supply Wells and Piezometers: In Fall 1994, no GRO or semivolatile compounds were detected at TW-1, A-1, AK-2127, or Well B. 1,2-Dichloroethane was reported in Well B at 0.9 ppb; no other VOCs were reported in any of these wells. The semivolatile compound benzoic acid was reported in A-6 at a concentration well below the threshold value. DRO was reported at the MRL of 0.1 ppm at A-6. This sample result was flagged as having been quantitated as diesel range organics, but having a chromatogram that did not resemble that of a fuel product, and may be a false positive caused by the benzoic acid mentioned above. No volatile or semivolatile fuel constituents were detected in that sample. Total cadmium was reported at 11 ppb (dissolved, less than 10 ppb) in AK-2127; no other metals were reported above threshold levels at these wells.

In Spring 1995, no GRO or PAHs were detected, and no metals were reported above threshold levels in any well. No VOCs were reported above threshold levels; a very low concentration of toluene (0.11, estimated) was reported at TW-1. 0.3 ppm DRO were also reported in TW-1, but not in any other well. No cadmium was reported above an MRL of 5 ppb in AK-2127.

1,2-Dichloroethane (0.5 ppb) had been reported in AK-2127 in Spring 1994, but not

in Well B. This compound has not been reported before 1994 in any of these wells. TW-1 has a sporadic history of low-level DRO detections, and reports of very low concentrations (3 ppb or less) of fuel-associated volatile compounds such as benzene and toluene (ref. 7d, 7t). Cadmium has been detected in AK-2127 in Spring 1994 and Fall 1994 (at 7 ppb and 11 ppb total concentrations, respectively), but was not detected in Spring 1995 at this well above an MRL of 5 ppb.

4.4 Monitoring Wells, Previously Sampled

4.4.1 Building 987 Monitoring Wells: AP-3233 and AP-3235 are monitoring wells installed in late 1993 near the site of a leaking underground fuel-line overflow tank. Table 4.3 below summarizes the concentrations of selected contaminants

Table 4-3 AP-3233 Contamination History

Compound/Analyte	Oct 1993 (bailed)	Spring 1994 (bailed)	Fall 1994 (bailed)	Spring 1995 (pumped)
DRO, ppm	2.0-4.2	13.6	6.0-9.2	1.4-2.0
GRO, ppm	1.6-1.8	2.28	1.7-3.0	1.8-1.9
Benzene, ppb	83-120	22	50-55J	20-22J
1,2,4-Trimethylbenzene, ppb	NT	84	116-130J	120-130J
1,2-Dichloroethane, ppb	NT	3.8	ND(1)-5J	ND(1)-2.3J
Manganese (tot/dis), ppb	NT	2030/1620	1490-1600/ 1400-1590	1480-1600/ 1460-1700
Lead (tot/dis), ppb	NT	17/ND(5)	ND(2)-3/ ND(2)	ND(2)/ND(2)

Oct 1993 sampling was not part of a post-wide groundwater study.
ND: Not detected (value in parentheses is the Method Reporting Limit).
NT: Parameter not tested for during this sampling event
J: Estimated value.

that have been reported in samples from the downgradient well, AP-3233. The contaminants in this well have also included the assortment of volatile aromatic compounds associated with fuel contamination (toluene, xylenes, napthalene), although at concentrations

below drinking water threshold levels. In Spring 1995, the polyaromatic compounds anthracene, fluorene, and phenanthrene were also detected at very low concentrations in at least one of the triplicate samples from AP-3233 (see Appendix B, Table 4).

The upgradient well, AP-3235, has typically shown lower levels of contamination than AP-3233 since 1993. The concentrations of DRO, GRO, and benzene at AP-3233 and

Table 4-4 AP-3235 Contamination History

Compound/Analyte	Oct 1993 (bailed)	Spring 1994 (bailed)	Fall 1994 (pumped)	Spring 1995 (pumped)
DRO, ppm	4.2	4.25-8.39	0.4	0.7
GRO, ppm	1.2	0.5-0.64	0.35	0.45
Benzene, ppb	97	4.0-5.4	ND(2)	0.7J
1,2,4-Trimethylbenzene, ppb	NT	0.5J-ND(2)	ND(2)	ND(1)J
1,2-Dichloroethane, ppb	NT	ND(0.9)-2.4	ND(2)	ND(0.5)J
Manganese (tot/dis), ppb	NT	2200-2450/ 880-889	426/419	387/377
Lead (tot/dis), ppb	NT	28-32/ ND(2)-6	ND(2)/ND(2)	ND(2)/ND(2)

Oct 1993 sampling was not part of a post-wide groundwater study.
ND Not detected (value in parentheses is the Method Reporting Limit).
NT Parameter not tested for during this sampling event
J: Estimated value.

AP-3235 were comparable when the wells were initially sampled soon after installation, but contaminant levels in AP-3235 have decreased far more over time than those in AP-3233 (see Table 4-4).

The relatively high concentrations of dissolved manganese in both wells are notable. It is thought that this may be related to the presence of petroleum hydrocarbons in the groundwater and associated microbiological processes; speculation on this possibility lies outside the scope of this report.

4.4.2 Building 35-752 Monitoring Wells: AP-2982, AP-2985, and AP-3231 are monitoring wells installed in 1990 and in 1993 around Building 35-752, as part

of an investigation of petroleum- and PCB-contaminated soils at the site of a former waste-oil underground storage tank. Of these three wells, AP-2982 has the most notable history of chemical contamination; see Table 4-5 below.

Table 4-5 AP-2982 Contamination History

Compound/Analyte	Sep 1993	Spring 1994	Fall 1994	Spring 1995
DRO, ppm	NT	0.508	0.4-0.6	4.2-4.6
GRO, ppm	NT	ND(0.05)	1.0-1.16	7.1-8.4
Benzene, ppb	25	4.5	86-120	230-335J
1,2,4-Trimethylbenzene, ppb	11	ND(2)	35-40	170-275J
1,2-Dichloroethane, ppb	ND(?)	1.2	ND(2)	ND(0.5)-6.9J
Trichloroethene, ppb	ND(?)	0.6	ND(2)-1.3	3.3-4.21J
PCBs, ppb	ND(0.5)	ND(0.1)	ND(0.1)	ND(0.5)-0.8
Manganese (tot/dis), ppb	NT	814/815	1900-2360/ 1150-1280	3940-4500/ 4060-4900
Lead (tot/dis), ppb	ND(2)/NT	2/ND(2)	12-20/ ND(5)-2	1.4/ND(1)
Nickel (tot/dis), ppb	NT	ND(20)/ ND(20)	70-120/ ND(30)	22/ND(20)

Sep 1993 sampling was not part of a post-wide groundwater study.
ND: Not detected (value in parentheses is the Method Reporting Limit).
NT: Parameter not tested for during this sampling event
J: Estimated value.

Since Spring 1994, the concentrations of DRO, GRO, and benzene at this well have increased dramatically, suggesting that the well is still being affected by contamination from some unknown source. Trichloroethene was detected in all three samples of the triplicate from this well in Spring 1995; 1,2-dichloroethane was reported only in the quality assurance duplicate in Spring 1995. PCBs were detected in two of three triplicate samples in Spring 1995 (0.794 and 0.804 ppb of Aroclor 1260), the first time PCBs have been detected in samples from this well. The pesticides alpha-BHC and delta-BHC were reported in the quality assurance duplicate from Spring 1995 at concentrations of 0.06 and 0.1 ppb, respectively. These levels are above the RBC of 0.037 ppb for technical grade

BHC. The dissolved manganese concentrations can again be seen to increase in parallel with the DRO and GRO concentrations. The variations in the concentrations of total lead and nickel probably are due to variations in the quantities of silt in the samples from this shallow, bailed well.

AP-2985 and AP-3231 have had much lower levels of DRO, GRO, and VOC contamination than AP-2982 (see Table 4-2). Both AP-2985 and AP-3231 were reported to contain 0.5 ppm DRO in Spring 1995, less than 0.2 ppm in Fall 1994, and 0.067 and 0.085 ppm, respectively, in Spring 1994. No GRO or PCBs have been reported in these wells. No volatile compounds have been detected in AP-2985. AP-3231 has a history of detections of chlorinated hydrocarbons. Trichloroethene (1.4 ppb) and dichloroethane (2.5 ppb) were reported in Spring 1994; trichloroethene (11 ppb) appears again in Spring 1995. No polyaromatic hydrocarbons were detected in either well in Spring 1995. Both wells have a history of total arsenic, chromium, lead, nickel, and manganese concentrations above threshold levels, but the dissolved concentrations of these metals are always below reporting limits (with the exception of manganese in the Spring 1995 AP-2985 sample). The high total concentrations of these metals are probably due to the large quantities of silt in the samples from these shallow, hand-bailed wells.

4.4.3 Powerplant Well: AP-2974 was installed in 1990 as part of an underground storage tank investigation at the post powerplant. DRO was reported in the Spring 1995 sample from this well at a concentration of 0.5 ppm (see Table 2). This well has a history of DRO levels of 1 ppb or less, but few other contaminants have been reported. The low levels of carbon tetrachloride, trichloroethene, and 1,2-dichloroethane (less than 1 ppb each) detected in Spring 1994 were not detected again in Fall 1994 or Spring 1995.

4.5 Landfill Wells: Eight monitoring wells surrounding the Fort Richardson landfill area have been included in the post-wide groundwater study (see Table 4-2, page 4 of 6). The three oldest wells, FR-1, FR-2, and FR-3 (all installed in 1985) have a history of detections of DRO, which has not been detected in any other landfill well. Table 4-6 shows DRO concentrations at these three wells over the last six sampling events, including

preliminary results from Fall 1995. The chromatograms of the DRO analyses from these three wells have been very similar, and suggestive of a petroleum product heavier than diesel fuel. No volatile or semivolatile fuel constituents that would be expected to accompany these levels of diesel *fuel* contamination have ever been detected. Table 4-6 shows that DRO has not been detected in samples from these wells for the last two sampling events. The data suggest that the change in sample collection method may be related to the change in reported DRO levels, but it is unclear why this should be so.

Table 4-6 DRO Concentrations (ppm) at Landfill Wells

Well ID	Oct 92 (?)	Oct 93 (?)	Spring 94 (bailed)	Fall 94 (bailed)	Spring 95 (pumped)	Fall 95* (pumped)
FR-1	NS	NS	8.06	4.2	ND(0.1)	ND(0.1)*
FR-2	1.0 x	0.30	3.14	2.6	ND(0.1)	ND(0.1)*
FR-3	ND(0.5)	NS	4.02	4.8	ND(0.1)	ND(0.1)*

* : Preliminary, unvalidated data
x : Lab reported that the sample contained a phthalate-type contaminant that may have resulted in a false positive

GRO (0.53 ppm) was reported in FR-2 in Spring 1994, but has not been reported since in any other well.

The 1,2-dichloroethane reported in the samples from AP-3013, AP-3014, and AP-3015 in Spring 1994 were not detected again in Fall 1994 or Spring 1995. In the Spring 1995 samples, low levels of chloroform were detected in FR-1 and FR-2, and chloroform, 1,2-dibromoethane, and 1,1,2,2-tetrachloroethane were detected in the sample from FR-3 (see Table 4-2, page 4 of 6); these compounds had not been previously reported in these wells. Hexachlorobutatiene was reported in one of three triplicate samples from FR-1 in Spring 1995, at a concentration just below the threshold level. Dichlorofluoromethane was reported in AP-3221 in Fall 1994 and Spring 1995, and in FR-3 in Spring 1995, at concentrations well below the threshold level.

No PCBs or pesticides have been detected in the landfill wells. Due to a miscommunication with the laboratory, the sample from FR-2 was analyzed for PCBs only. No polyaromatic hydrocarbons have been detected in the landfill wells. The semivolatile

compound bis(2-ethylhexyl)phthalate was reported in FR-3 in Fall 1994 at 20 ppb, prompting the testing of FR-3 by Method 8270 again in Spring 1995. No bis(2-ethylhexyl)phalate or any other target compound of Method 8270 was reported above MRLs in the Spring 1995 sample from FR-3.

Most metals have been reported at concentrations below threshold levels in the landfill wells. Exceptions are total chromium, nickel, and manganese in AP-3221 in both Fall 1994 and Spring 1995; dissolved concentrations of these metals have been well below threshold levels (see Table 4-2, page 4 of 6). Total manganese above threshold levels was also reported in AP-3010, AP-3014, AP-3221, and FR-3 in Fall 1994, but concentrations were below threshold levels in Spring 1995. AP-3010 was reported to contain 7 ppb total beryllium in Spring 1995; no dissolved beryllium was detected above the MRL of 5 ppb. Beryllium has not been detected in AP-3010 before; preliminary data from the Fall 1995 sampling event show no detection of beryllium above 5 ppb. Beryllium is a toxic but rather exotic metal not known to be a groundwater contaminant of concern anywhere on Fort Richardson. The RBC for beryllium is 0.016 ppb, far below detection limits achievable by conventional analytical methods. The MCL for beryllium is 5 ppb (see Table 4-1).

The groundwater samples from the eight landfill wells were also analyzed by a group of miscellaneous methods required by State of Alaska solid waste management (18 AAC 60) regulations (see Section 2.1). These analyses include inorganic parameters such as nitrates, chloride, sulfate, alkalinity, and total dissolved solids, as well as total organic carbon, total recoverable petroleum hydrocarbons (TRPH), and biological oxygen demand (BOD). The results of these analyses are shown in Table 8 of Appendix B (Fall 1994) and Table 9 of Appendix C (Spring 1995). The TRPH data essentially parallel the DRO data for the same wells, and the turbidity levels reflect the values for total metals (for Spring 1995, turbidity data are provided with the total metals data in Table 5 of Appendix C). The remainder of the results are not remarkable from an environmental standpoint. Dissolved oxygen, conductivity, oxidation-reduction potential, temperature, and pH (as required by 18 AAC 60) were measured in the field, and presented for each well in Appendix A.

4.6 New Monitoring Wells: Wells AP-3447 through AP-3533 were sampled for the first time in Spring 1995. Compounds or analytes were reported above threshold levels in samples from nineteen of the thirty-two monitoring wells installed between August 1994 and May 1995 for the groundwater study (see Table 4-2, pages 5 and 6). Most of the detections are of low levels of chlorinated hydrocarbons, such as 1,1,2,2-tetrachloroethane (detected in four of the wells), chloroform (detected in six wells), and carbon tetrachloride (detected in four wells). The compound 1,2-dibromoethane (a gasoline additive also known as ethylene dibromide) was reported in two of the wells. Chlorinated benzenes were also reported in the sample from AP-3453.

The 7.9 ppm DRO reported in the sample from AP-3455 has a chromatogram that is suggestive of a petroleum product heavier than diesel fuel. The volatile constituents that would be expected from that level of diesel *fuel* contamination are noticeably absent from the AP-3455 volatiles analyses. Low levels of DRO were also reported in four other wells; the chromatograms of none of these samples closely resemble that of the DRO standard. The chromatogram from AP-3458 shows a small diesel fuel-range peak, and a cluster of small peaks at the low end of the DRO integration range. The chromatograms from AP-3458 bear some resemblance to those from the nearby contaminated AP-2982. The chromatograms of the samples from AP-3475, AP-3477, and AP-3484 each show a single, similar, well-defined peak at the extreme low end of the DRO integration range, as if from a single compound, that likely accounts for the reported DRO value. No target compounds or tentatively-identified compounds from the Method 8260 analyses were reported that could help explain this peak; the peak does not appear in the laboratory method blank.

No GRO was reported in any of the new monitoring wells. Polyaromatic hydrocarbons (Appendix C, Table 4) were reported in the samples from AP-3455, AP-3457, AP-3458, AP-3479, and AP-3483. Only the benzo(k)fluoranthene (estimated at 0.04 ppb) and the indeno(1,2,3-cd)pyrene (estimated at 0.01 ppb) reported in AP-3455 approach threshold levels for individual PAHs.

Metals detected in the new monitoring wells above threshold levels were limited to total manganese in AP-3453, AP-3457, and AP-3458, dissolved manganese in AP-3458, total nickel in AP-3455, and cadmium in AP-3452. Except for the dissolved manganese

in AP-3458, no samples contained any dissolved metals above threshold levels. The 6 ppb total cadmium in AP-3452 is above the MCL of 5 ppb, but below the RBC of 18 ppb. Preliminary data from the Fall 1995 sampling event show no cadmium detected in AP-3452 above an MRL of 5 ppb.

4.6.1 Site-Specific New Monitoring Wells: Unlike most of the new project monitoring wells installed between August 1994 and May 1995, AP-3530, AP-3531, AP-3532, and AP-3533 were placed near specific buildings on Fort Richardson at the request of DPW, in order to assess potential groundwater contamination in those areas. AP-3530 and AP-3531 were placed immediately north and southeast, respectively, of Building 55955, a munitions incinerator. A low-level detection of chloroform (estimated at 0.11 ppb) was reported in the sample from AP-3530, similar to low-level chloroform detections seen elsewhere on the post. No evidence of metals, DRO, GRO, or PAH contamination was noted in either AP-3530 or AP-3531. AP-3532 is located approximately 120 feet north of Building 740 (a facility maintenance shop), and AP-3533 is located approximately 100 feet northeast of Building 795 (an ordnance maintenance shop). Chlorinated compounds such as chloroform and carbon tetrachloride were reported in both of these wells (see Table 4-2, page 6 of 6). No DRO, GRO, or PAHs were detected in either well. Per DPW's request, these two wells were not sampled for metals.

4.7 Water Quality Standards: The new State of Alaska 18 AAC 70 TAH criterion (total aromatic hydrocarbons) establishes a limit of 10 ppb for the sum of the concentrations of benzene, toluene, ethylbenzene, and xylenes. The standards also require a method reporting limit of 0.2 ppb, which was not achieved for Method 8260 in either sampling event. The TAqH criterion establishes a limit of 15 ppb for the sum of the concentrations of a substantial list of polyaromatic hydrocarbons. This list of required compounds was not met entirely by the Method 8270 semivolatile compound analysis performed in Fall 1995, nor by the Method 8310 PAH analysis performed in Spring 1995. The TAqH standards also require a MRL of 0.1 ppb for each compound, which was generally achieved by the Method 8310 analyses but not by the Method 8270 analyses.

Volatile compound and PAH data from the Spring 1995 sampling were reviewed,

and the relevant compounds were summed. Setting aside the fact that the MRLs and analyte lists from the Spring 1995 data would be inadequate under the TAH and TAqH criteria, it would appear that only the water from wells AP-3233 and AP-2982 would likely be in violation of these criteria.

4.8 Tentatively-Identified Compounds: The volatile and semivolatile organic compound mass spectrometry analyses (Methods 8260 and 8270, respectively) include the reporting of tentatively-identified compounds (TICs), compounds that are not target compounds of the analytical method, but whose presence may be inferred with varying degrees of confidence from mass fragmentation patterns.

In the Fall 1994 data, all Method 8260 TICs were reported for samples from wells known to be petroleum-contaminated, such as AP-3233 and AP-2982. These TICs include methyl-substituted benzenes and other hydrocarbons that are expected constituents of the known petroleum contamination. "Aromatic methylated alcohols" (i.e., substituted cresols) were also identified in the sample from AP-3233, at concentrations not thought to be of concern.

TICs reported from the Fall 1994 Method 8270 data include much of the same petroleum-associated compounds. Numerous TICs were also reported for the samples from the landfill wells FR-1, FR-2, and FR-3. Most of these were also petroleum-associated compounds, but a compound described as "butylidene dis(dimethylethyl)methylphenol" was also reported in all three wells, at estimated concentrations of 20 to 30 ppb. No specific information could be found concerning this compound; it is structurally similar to a compound with the proprietary name 'Bisphenol A', which is used in the manufacture of phenolic resins and has a drinking water RBC of 1,800 ppb (ref. 7o). This TIC did not reappear in the FR-3 samples for Spring 1995.

In the Spring 1995 data, all Method 8260 TICs were reported for samples from wells known to be petroleum-contaminated, such as AP-3233 and AP-2982. These TICs include an assortment of substituted benzenes, cycloalkanes, and other hydrocarbons that are expected constituents of the known petroleum contamination. A TIC described as an "unknown dimethyldihydro-1H-indene" was reported in the sample from AP-3458. This

compound may be loosely classified as a naphthalene-like PAH; no toxicological data could be found for this compound, and it is considered to be an element of the petroleum contamination known to be present at AP-3458. Groundwater from only one well, FR-3, was analyzed by Method 8270 in Spring 1995. Only one TIC, described as "unknown", was reported for the samples from this well.

4.9 Trip Blanks: Trip blanks were prepared as described in Section 3.2.5 above. The purpose of the trip blanks are to detect possible contamination of the field samples from external sources of volatile chemicals during collection and transport of the samples. The results of the analyses of the trip blanks are summarized in Table I of the QARs for each sampling event (see Appendix D).

The Fall 1994 trip blanks were found to contain no GRO. Low levels of methylene chloride were detected in several trip blanks, but was the only volatile compound detected. Detections of methylene chloride that cannot be attributed to laboratory contamination of the trip blank are though to be most likely due to methylene chloride-contamination of the water used to prepare the trip blanks.

The Spring 1995 trip blanks were also found to contain no GRO. Most of the trip blanks for volatiles analysis were found to contain common laboratory contaminants such as acetone, methylene chloride, and carbon disulfide. Detections of these compounds that cannot be attributed to laboratory contamination of the trip blank are thought to be due to contamination of the water used to prepare the trip blanks. The trip blank numbered 95FRGW91WA was found to contain a large number of compounds, including chlorinated hydrocarbons such as 1,1,2-trichloroethane and 1,1,2,2-tetrachloroethane (see Table I-b of the Spring 1995 QAR, Appendix D). This trip blank accompanied volatiles samples collected from FR-1, FR-2, and FR-3. Hexachlorobutadiene and 1,1,2,2-tetrachloroethane were the only two compounds detected in common between this trip blank and a sample from these three wells, and then only in the quality control duplicate from FR-1. The samples from FR-2 and FR-3 had only acetone, methylene chloride, and carbon disulfide (all attributed to laboratory contamination) in common with the compounds detected in this trip blank. The trip blank accompanying the quality assurance duplicate from FR-1 (-

95WA), prepared from the same water as -91WA, also contained only acetone, methylene chloride, and carbon disulfide. The source of the contamination in -91WA is unknown; the inadvertent use of a piece of contaminated glassware at the analytical laboratory could be one possible explanation.

4.10 Rinsates: Rinsate blanks were prepared as described in Section 3.2.6 above. The results of the analyses of the rinsates are summarized in Table II of the QARs for each sampling event (see Appendix D).

The rinsates collected from bailers and sampling tubes during Fall 1994 were generally free of compounds or analytes. Methylene chloride was detected in most of the rinsates, but its presence is attributed to laboratory contamination or the use of contaminated water for the rinsate (especially as the levels of methylene chloride in the rinsate are generally higher than that detected in the associated field samples, a fact the QAR does not take into account). Aluminum and iron were detected in one rinsate blank (94FRGW130WA) but not in the duplicate rinsate (-131WA). Other metals typically detected at large concentrations in the field samples were not detected either rinsate, so it is not thought that the detections are the result of poor decontamination of the sampling equipment. The QAR suggests that laboratory contamination may be the cause.

One pair of rinsates prepared from a bailer during the Spring 1995 sampling event (sample numbers 95FRGW100WA and -101WA) was found to contain significant detections of a variety of analytes and compounds (see Table II-c of the Spring 1995 QAR). The QAR attributes this to poor decontamination of field equipment; however, a careful examination of the data shows that this is not a satisfactory explanation. The rinsates were prepared from a bailer after the sampling of a single well, AP-3455. The rinsates were reported to contain 110 to 129 ppb GRO, but no GRO was detected in the groundwater sample from AP-3455. The rinsates also contained 240 to 250 ppb of copper, while the groundwater sample from AP-3455 contained 170 ppb of copper. Clearly, these chemicals detected in the rinsates were not the result of groundwater contaminants being carried over into the rinsates. More likely, water was used for the rinsate preparation that was thought to be fresh deionized water, but was instead ordinary tap water.

Similarly, a pair of rinsates (95FRGW05WA and -06WA; see Table II-a of the Spring 1995 QAR) were prepared from a Teflon sampling tube after the sampling of a single well. AP-3014. The QAR attributes the 1,1,1-trichloroethane and methylene chloride detected in the rinsates to improper equipment decontamination, although those compounds were not detected in the groundwater sample. Total organic carbon levels of 4.7 to 5.6 ppm were detected in the rinsates, while 1.0 ppm was detected in the groundwater sample. Again, the simplest explanation is that poor quality deionized water was used for rinsate preparation. It is apparent that a better quality source of deionized water must be obtained for future projects, but no clear evidence exists that poor equipment decontamination procedures were a problem during the Fall 1994 and Spring 1995 sampling events.

4.11 Turbidity and Flow Rates: As was mentioned previously, a conflict was found to exist between the desire to observe EPA-recommended purging and sampling flow rates (0.2-0.3 liters/minute and 0.1 liters/minute, respectively; ref. 7k) and the need to avoid the outflow temperature increases and discontinuous sampling streams seen to occur at very low pump speeds. It was decided that the deleterious effects of increased temperature and discontinuous flow on volatile organics were of more concern than increased turbidity of the sample due to higher-than-recommended pump speeds. During the Spring 1995 sampling event, extra samples for turbidity analysis were collected from more-or-less randomly chosen wells, in order to monitor the effects of increased flow rates on sample turbidity. Table 4-3 ranks the wells by turbidity, and shows the corresponding purge and sampling rates for each well. The table shows that, for this population of wells, there is no discernable correlation between the purging and sampling rates used, and the resulting sample turbidity.

5. Data Quality Review

The complete chemical data packages, including the laboratories' internal quality control reports, are on file at CENPA-EN-G-MI. The data and associated materials were reviewed by chemists at the Corps of Engineers North Pacific Division Laboratory

TABLE 4-3
Turbidity and Flow Rate
Spring 1995

Well ID	Turbidity, NTU	Highest Purge Rate, Liters/minute	Sampling Rate, Liters/minute
FR-3	300	1.0	1.0
AP-3010	112	1.9	0.6
AP-3235	105	1.6	0.5
AP-3453	100	1.0	0.5
AP-3452	46	1.0	1.0
AP-3221	30	1.9	0.2-0.5
AP-3015	23	2.0	1.0
AP-3450	16	1.9	0.7
A-6	7	27.3	2.0
AP-3454	5	1.0	0.6
AP-3013	4	2	0.2-0.6
AP-3447	4	1.0	0.5
AP-3477	4	1.0	0.5
AP-3531	4	1.2	0.6
AP-3476	3	2.7	0.5
AP-3014	2	1.9	1.0
AP-3530	2	0.9	0.7
A-1	1	17.4	1.9
AP-3470	ND(1)	1.1	0.15-0.5
AP-3471	ND(1)	1.5	0.5
AP-3472	ND(1)	2.2	0.3-0.8
AP-3478	ND(1)	1.7	0.5-0.8
AP-3479	ND(1)	3.8	0.6
AK-2127	ND(1)	12.3	0.5
FR-1	ND(1)	3.8	1.0
FR-2	ND(1)	2.0	0.5

NTU: Nephelometric Turbidity Units
ND : Not Detected (or below Method Reporting Limit (MRL); MRL shown in parentheses).

(CENPD-ET-EN-L), who presented their findings in Quality Assurance Reports; QARs for both the Fall 1994 and the Spring 1995 data are provided in full in Appendix D). Data quality issues that may affect the interpretation of the data are summarized in Sections 5.2 and 5.3 below, and have led to the "flagging" of the affected data in the Chemical Data Tables (Appendices B and C).

5.1 Quality Review Overview: CENPD-ET-EN-L chemists performed an extensive set of procedures to assess the quality of the data. The initial review of the data screened for errors and inconsistencies. The CENPD chemist checked the instrument and analysis identification, sample description and identification, time and date of analysis, weight or volume of sample, units employed, dilutions, sample clean-up, and detection limits. The chemist then verified that the data were checked by the laboratory manager or quality assurance officer. Sample holding times, preservation, and storage were checked and noted.

The second step of the data verification process was an assessment of the laboratory's instrumentation procedures. The precise process varied depending on the method of analysis, but may have included inspection of instrument tuning, initial and continuing calibration procedures, example calculations, standard solution preparation methods, and identification criteria including quantification and confirmation of ions. Surrogate recoveries were scrutinized to ensure they fell within an acceptable range. Adequate surrogate recoveries indicate that sample extraction procedures were effective, and that overall instrument procedures were acceptable.

The next phase of data quality assessment was an examination of the actual data. By examining data from laboratory duplicates, blind duplicates, trip blanks, laboratory blanks, matrix spike samples, matrix spike duplicate samples, and field samples, the chemist can determine whether the data are of high quality.

The precision of the data was quantified by the relative percent difference (RPD) between two results obtained for the same sample. Laboratory duplicates and matrix spike duplicates were assessed by their RPD values. High RPD values indicate a lack of reproducibility, and such data are rejected. Any such results were reported in the

assessment of data quality.

Data from blank samples were examined to determine if sample contamination occurred after the sample was collected in the field. Method blanks are blank samples prepared in the laboratory and analyzed along with project samples. If analytes are detected in a method blank, it is a strong indication of laboratory contamination. This would raise the possibility that project samples were contaminated in the laboratory as well. Trip blanks are samples of pure water that accompanied the project samples from the field to the laboratory. Trip blanks accompany each shipment of water samples to be analyzed for volatile organic compounds. Analysis of the trip blanks indicated whether sample contamination occurred during shipment or storage.

The accuracy of the data was monitored by analysis of matrix spike and matrix spike duplicate sample analyses. A matrix spike sample is prepared by adding a known quantity of a certain analyte to an actual sample. The matrix spike duplicate is prepared in an identical manner. Matrix spike and matrix spike duplicates must be run at least once per every twenty samples. Recovery of the matrix spike indicates the level of accuracy of the data. Comparison of the matrix spike and matrix spike duplicate results provides another indication of data precision. Chemists at NPD examined all matrix spike and matrix spike duplicate data. Low or high spike recoveries or a high RPD for duplicates are evidence of poor accuracy or low precision; all such results are reported in the quality assurance assessment.

Laboratory data quality is summarized in the quality assurance report (QAR; attached as Appendix C). In general, the project and quality assurance data were in agreement and are acceptable. Exceptions are noted in the discussion of specific test results.

A blind duplicate quality control (QC) sample was submitted to the project laboratory, which analyzed the majority of the samples. Analysis of the QC duplicate sample provides a measure of intra-laboratory variations. An additional replicate sample was provided to an independent quality assurance (QA) laboratory, to provide a test of inter-laboratory accuracy. QC and QA samples for analyses other than volatile organic compounds were collected by dispensing aliquots into each sample container from each

bailer collected. For each method, two of the four samples were QA or QC replicates that effectively provide triplicate analysis on 50% of the samples. QC and QA duplicates are so noted in the data tables.

Data from all replicate samples were analyzed by CENPD-ET-EN-L as part of development of the QAR. The three results for each set were carefully compared and tabulated. Any discrepancies were noted in the QAR. If results for a given analyte did not agree within a factor of three between the replicate samples, the data were annotated. If two of three data sets agreed, each laboratory's internal QA/QC data were reassessed to determine which set of data is the most accurate. Data from related analyses may have been inspected to determine which set of data was more accurate.

5.2 Fall 1994 Data Quality Issues: The VOC data from Columbia Analytical Systems, Inc., (CAS) report A940533 (wells AP-3233 and FR-2) should be regarded as estimates due to matrix spike recovery failures. The VOC and GRO data from the quality assurance duplicate of the AP-3233 sample should be considered high estimates due to out-of-limit surrogate recoveries.

The "nondetects" of dissolved iron, magnesium, and manganese data from AP-3233 sample 94FRGW106WA are questionable in light of that sample's quality control and quality assurance duplicate (-163WA and -162WA) data, and should be disregarded in favor of the duplicates data.

Low levels of acidic semivolatile compounds in the samples from FR-1, FR-2, FR-3, and AP-3221 may not have been detected due to out-of-limit surrogate recoveries.

The primary laboratory VOC samples from AP-2982 were reanalyzed up to six days past holding time limits; the data was not thought to be adversely affected.

The GRO sample from AP-2985 was reanalyzed up to nine days past holding time limits; low levels of GRO may have been lost during storage.

The VOC and GRO samples from AP-2974 and all four ADFG wells may have been compromised due to elevated temperatures (up to 11 degrees C) of shipping coolers, as measured at the receiving laboratory.

All methylene chloride detections in field samples should be viewed with caution due to the compound's presence in trip blanks, rinsates, and laboratory blanks.

5.3 Spring 1995 Data Quality Issues: The major data quality issue affecting the Spring 1995 data is the elevated temperatures of coolers transhipped from the CAS Anchorage laboratory to the CAS laboratory in Kelso, WA. CAS transferred most project samples for VOC analyses to its Kelso laboratory, and a large number of the coolers in those shipments arrived at Kelso with temperatures above 6 degrees C. Two coolers delivered from the field to CAS Anchorage were also received at the laboratory with reported temperatures above 6 degrees C, in which case the GRO samples (which remained in Anchorage for analysis) would have been affected as well. All quality assurance duplicates arrived at CENPD and at the quality assurance laboratory at temperatures below 6 degrees C. Table 5-1 summarizes the affected samples and the maximum temperatures to which the samples are thought to have been subjected. Only VOC and GRO data are

Table 5-1 Spring 1995 VOC and GRO Samples Potentially Affected by Elevated Cooler Temperatures

CAS Kelso Report Number	Max. Cooler Temp, (°C)	Wells Affected
K9502322	8.3	*VOC & GRO:* ADFG-C, ADFG-E, ADFG-K, ADFG-9, AP-2974
K9502688	7.8	*VOC only:* Otter Lake, AP-3235
K9502890	9.0	*VOC only:* Well B, AP-3449^{Q}, AP-3451
K9503019	10.9	*VOC only:* AP-3453, AP-3474^{Q}, AP-3475, AP-3477, AP- 3480, AP-3484
K9502890	13.6	*VOC only:* AP-3233^{Q}, AP-3448, AP-3481, AP-3482, AP-3485
K9503872	7.1	*VOC & GRO:* FR-1^{Q}, FR-2, FR-3

Q: An uncompromised Quality Assurance Duplicate from this well exists.

being considered to have been affected by elevated temperatures. Samples received at temperatures *below* the required range of 2 to 6 degrees C are not considered to have been

negatively affected, barring evidence that the sample had frozen (this matter is discussed in Section 3.4). Where both a cooler ambient temperature and a temperature-blank water bottle temperature are available, the water bottle temperature is regarded as more accurate. the triplicate sample collected from AP-3233 is examined, the concentrations of some compounds (but not all) reported by CAS-Kelso appear to be lower than the concentrations reported by the quality assurance laboratory. However, similar variation can be observed between the data of the triplicate sample collected at AP-2982, which was not subjected to elevated temperatures. Considering that the VOC samples from AP-3233 were subjected to the highest recorded temperature (13.6 °C) and show an interlaboratory variation similar to that of samples not subjected to elevated temperatures, the reported VOC data from samples subjected to elevated temperatures should be regarded as estimates, but do not deserve to be thrown out as irretrievably compromised.

The due to surrogate recovery failure, low levels of DRO may not have been detected in AK-2127. .

The PCB data from AP-2982 are considered estimates due to matrix interferences.

The MRLs for silver reported for samples from Otter Lake, AK-2127, and AP-3455, should be considered estimates due to out-of-limit matrix spike recoveries.

The vanadium reported in samples from AP-2982, AP-2985, and AP-3231 is considered to be due to laboratory contamination, as this analyte was also reported in the associated method blank.

The DRO concentration reported for the quality assurance duplicate from AP-2982 should be considered an estimate. Due to low surrogate recoveries, low concentrations of PAHs may not have been detected in the quality assurance duplicate from AP-3476, and the MRLs are considered to be estimates.

The VOC data of the quality assurance duplicate from AP-2982, rinsates 95FRGW06WA and -100WA, and trip blanks -82WA and -97WA are considered to be estimated due to incomplete quality control information and reanalyses past holding times.

The concentrations reported for total and dissolved barium in the quality assurance duplicates from AP-3449 and AP-3474, and the concentrations reported for total magnesium in the quality assurance duplicate from AP-3449, are considered to be due at

least in part to laboratory contamination.

6. Summary and Conclusions

1. Significant groundwater contamination has been identified at the following wells.

a. **AP-2982:** DRO, GRO, and VOC contamination has *increased* substantially at this well since Spring 1994, suggesting that another source of contamination may be present other than the known UST-contaminated soils, or that a plume from the contaminated soils may be moving into the vicinity of the well. Low levels of PCBs were reported in AP-2982 in the Spring 1995 primary laboratory data: the pesticides alpha-BHC and delta-BHC were detected by the quality assurance laboratory, but were not tested for by the primary laboratory (Method 8080 "PCBs Only" had been requested).

Two other nearby wells, AP-2985 and AP-3231 (see Figure 3), have not shown an increase in contamination. 11 ppb trichloroethene was detected in AP-3231 in Spring 1995. Total arsenic, chromium, lead, and nickel concentrations above threshold limits were detected in AP-3231, AP-2985, AP-2982 in Fall 1994 but not in Spring 1995. Elevated manganese concentrations were detected in all three wells in both sampling events.

b. **AP-3233:** DRO, GRO, and VOC levels are still significant, but appear to be declining. Much lower levels are still reported at the nearby AP-3235 (see Figure 2). Dissolved manganese above threshold levels is present at both wells.

c. **AP-3455:** The 7.9 ppm DRO detected in this well appears to be lube oil or some other petroleum product heavier than diesel. A number of PAHs were also detected in this well.

d. **AP-3458:** The 0.2 ppm DRO detected in this well is not a remarkably high concentration; however, the DRO chromatogram from this well displays some unusual low-end peaks that are similar to some seen on the DRO chromatogram from AP-2982, a heavily contaminated well approximately 100 feet to the southeast. This suggests that the two wells may have a common source of contamination. The high levels of dissolved

manganese reported in AP-3458 are also similar to those detected in AP-2982 and other petroleum-contaminated wells.

e. **AP-3476:** Up to 0.4 ppm DRO was reported in this well, just north of Bryant Army Airfield. Contaminated soil was encountered during the drilling of this well.

f. Substantial (greater than 1.0 ppb) concentrations of chlorinated VOCs such as carbon tetrachloride and chloroform were detected at **AP-3532** and **AP-3533**.

2. Low levels of DRO (less than 1.0 ppm) were also reported at TW-1 and AP-2974 in the Spring 1995 data, but not the Fall 1994 data. Similar levels of DRO were reported at A-6, FR-1, FR-2, and FR-3 in the Fall 1994 data, but not the Spring 1995 data. The DRO levels reported in the samples from A-6, AP-3475, AP-3477, and AP-3484 are thought to be due to discrete semivolatile compounds in the sample. rather than fuel product (see Section 4.6).

3. With the exception of manganese at certain wells, only unfiltered groundwater samples have been found to contain metals concentrations above threshold levels; no dissolved, and therefore highly mobile, arsenic, lead, chromium, cadmium, beryllium, or nickel was reported in any well above method reporting limits. While it is acknowledged that filtration is an imperfect means of distinguishing between mobile and immobile metals in groundwater, it is nonetheless thought that, in the absence of evidence of specific sources of metal contamination, virtually all the reported metals in the unfiltered samples ("total metals") are due to minerals in the silt contained in the sample. The correlation between the turbidity of the samples and the numbers and concentrations of metals detected in the unfiltered sample is very high. The beryllium detected in the unfiltered sample from AP-3010 and the cadmium detected in AP-3452 in Spring 1995 are not repeated in the preliminary data from Fall 1995, and are regarded as probable laboratory artifacts.

At many wells with measurable fuel contamination, the dissolved manganese concentration is strikingly high, and is nearly equal to the reported total manganese concentration (i.e., nearly all the manganese present is in the dissolved form). There is some evidence cited in environmental literature (ref. 7u) that would support speculation that

the high levels of dissolved manganese are generated by geochemical and/or microbiological chemical processes associated with the presence of the fuel.

4. Very low concentrations (below 1.0 ppb) of halogenated volatile compounds were reported in samples from number of wells, especially in Spring 1995 (see Table 4-2). These compounds include 1,1,2,2-tetrachloroethane, 1,2-dibromoethane, and chloroform. The presence of these compounds deserves to be viewed with some skepticism. Most of these compounds are reported at estimated concentrations below the actual method reporting limit. Within a triplicate sample, the compounds are often reported for only one or two samples of the triplicate. This project has a history of transient detections of halogenated compounds: 1,2-dichloroethane was detected in many samples from the Spring 1994 sampling event, but was detected only in samples from three wells (Well B, AP-3233, and AP-3235) in Fall 1994, and two wells (AP-3233 and AP-3235) in Spring 1995. A number of halogenated VOCs was detected in samples from FR-1, FR-2, FR-3 in Spring 1995 than were not reported in Fall 1994; in this instance, this could be explained by the lower detection limits achieved in Spring 1995. A review of available preliminary data from the Fall *1995* sampling event show that the halogenated VOCs above threshold levels reported in the Spring 1995 data from AP-3448, AP-3455, AP-3476, and AP-3485 are not repeated. The carbon tetrachloride and chloroform reported in AP-3480 and AP-3485 in the Spring 1995, are, on the other hand, seen again in Fall 1995.

It is possible that the some of the halogenated compounds reported may be due to contamination of the sample after collection. After the Spring 1994 sampling event, all field materials and equipment were reviewed in an effort to account for the detections of 1,2-dichloroethane in so many samples, but no likely source of contamination was identified. Similarly, no likely source of contamination has been identified that can account for the 1,1,2,2-tetrachloroethane, chloroform, and 1,2-dibromoethane. The 1,2-dibromoethane is particularly troublesome because of its high toxicity. This compound is used as a fumigant, and as an additive in leaded gasolines. Exposure of the samples to gasoline is not a satisfactory explanation for its presence, as detectable levels of benzene or other aromatic volatile compounds would also be expected.

5. Many VOC samples from the Spring 1995 sampling event were subjected to elevated temperatures during interlaboratory shipments. Comparisons of data from a triplicate sample of contaminated groundwater subjected to one of the warmest cooler temperatures (13.6 °C) with data from a triplicate sample of contaminated groundwater not subjected to out-of-range temperatures. show no clear evidence of a loss of volatile constituents from the warm samples (see Section 5.3). The data subjected to warm temperatures, flagged "J" in the Chemical Data Tables, should be viewed with some caution, but should not be rejected as unusable.

The following recommendations for future post-wide groundwater sampling at Fort Richardson are offered:

1. Scaling back the number of wells sampled should be considered for future sampling efforts. With the addition of new monitoring wells to the area along Ship Creek, sampling of the former supply wells A-1, A-6, and TW-1 should probably be discontinued. These wells are constructed of old perforated iron pipe, and were never intended to serve as proper monitoring wells. No significant evidence of contamination has been detected within these wells, and it is unclear from records at what geologic interval these wells are "screened". Similar reservations exist concerning AK-2127 and Well B, but these wells are located at unique positions, and no monitoring wells now exist to replace them. Well 1, Well 3, and the ADFG wells also contribute little additional information to the environmental study, although continued sampling at these wells may be desired for other reasons. Many of the newly installed monitoring wells were placed in areas where no groundwater contamination was expected or is likely; after the Fall 1995 data is reviewed, some of these wells may be found to be good candidates for elimination from future sampling efforts.

2. Given the variety of organic compounds that have been detected, the number and types of analyses performed on samples from each well should remain approximately the same. The number of metal analytes requested could be reduced sharply, to eliminate elements like calcium and cobalt that appear to have no environmental or human-health

significance.

3. The situation at AP-2982 should be closely watched, perhaps as part of a separate program. The pesticides reported in the Spring 1995 quality assurance sample from AP-2982 may have been method interferences, but future sampling from this well should include analyses for chlorinated pesticides to confirm the presence of pesticides.

4. If the presence of 1,2-dichloroethane is confirmed by the Fall 1995 data, future sampling efforts should include an analytical method with a reporting limit for that compound much closer to its RBC than that which can be achieved by Method 8260.

7. References

a. Memorandum CENPD-EN-L dated 20 Sep 95, subject: W.O. 95-0177, Results of Chemical Analysis, Ft. Richardson G.W. Study (Spring 95).

b. Memorandum CENPD-ET-P-L dated 27 Feb 95, subject: W.O. 95-508, Results of Chemical Analysis, Ft. Richardson Groundwater Study - Fall 1994.

c. Memorandum CENPA-EN-G-MI dated 24 Mar 95, subject: Sampling and Analysis Plan, Groundwater Monitoring (Spring 1995), Fort Richardson, Alaska.

d. Memorandum CENPA-EN-G-MI dated 8 Apr 94, subject: Sampling and Analysis Plan, Groundwater Monitoring, Fort Richardson, Alaska.

e. Memorandum Department of Public Works, Fort Richardson, Alaska, dated 15 Sep 94, subject: EPA, ADEC, and DPW review comments on Sampling and Analysis Plan and Chemical Data Report, Groundwater Monitoring, Fort Richardson, Spring 1994.

f. Memorandum CENPA-EN-G-MI dated 11 Feb 94, subject: Proposed Scope of Sampling, Groundwater Monitoring, Fort Richardson, Alaska.

g. U.S. Army Corps of Engineers, Sample Handling Protocol for Low, Medium, and High Concentration Samples of Hazardous Waste, October 1986.

h. U.S. Army Corps of Engineers, ER-1110-1-263, Chemical Data Quality Management for Hazardous Waste Remedial Activities, 1 October 1990.

i. U.S. Army Corps of Engineers. EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans, 1 September 1994.

j. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Test Methods for Evaluating Solid Wastes, SW-846, Third Edition, November 1986.

k. U.S. Environmental Protection Agency, Office of Solid Waste, Draft Technical Guidance: RCRA Groundwater Monitoring, November 1992.

l. Alaska Department of Environmental Conservation, Solid Waste Management 18 AAC 60, Proposed Regulations, 7 September 1993.

m. Alaska Department of Environmental Conservation, Solid Waste Management Regulations 18 AAC 60, October 1987.

n. United States Code of Federal Regulations, Title 40, Part 141, Sections 11 and 12 (40 CFR 141.11 and 40 CFR 141.12).

o. U.S Environmental Protection Agency, Region III, Risk-Based Concentration Table, January - June 1995, 7 March 1995.

p. Alaska Department of Environmental Conservation, Water Quality Standards 18 AAC 70, (as amended through 4 January 1995).

q. ENSR Consulting and Engineering, Sampling Report for Groundwater Monitoring Network at Fort Richardson, Alaska (Document No. 6583-061-600), January 1994.

r. U.S. Army Corps of Engineers, Alaska District, Geotechnical Branch, Geotechnical Report for Groundwater Monitoring Network, Fort Richardson, Alaska, August 1992.

s. U.S. Army Corps of Engineers, Alaska District, Geotechnical Branch, Geotechnical Report for Groundwater Monitoring Network, Fort Richardson, Alaska, 1991.

t. Memorandum CENPA-EN-G-MI dated 17 July 1994, subject: Chemical Data Report, Groundwater Study (Spring 1994), Fort Richardson, Alaska.

u. Schwartzenbach, R.P., Environmental Organic Chemistry, 1993.

OPERABLE UNITS

REV.	DATE	C.O.	ACTION	DESCRIPTION	BY	APP'D.

CONTRACT NO. _____

CONTRACTOR _____

CITY _____ STATE _____

ALASKA DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

DESIGNED:
DRAWN: DDB
TRACED:
CHECKED:
SUBMITTED:
CHIEF ENVR. DESIGN SECTION

FORT RICHARDSON GROUNDWATER STUDY

LOCATION AND VICINITY MAP

RECOMMENDED: _____ CHIEF MILITARY TECHNICAL ENG. BRANCH

APPROVED: _____ CHIEF ENGINEERING DIVISION

DATE:

SCALE:

SPEC. NO.

DRAWING NUMBER

SHEET

FIG. 1

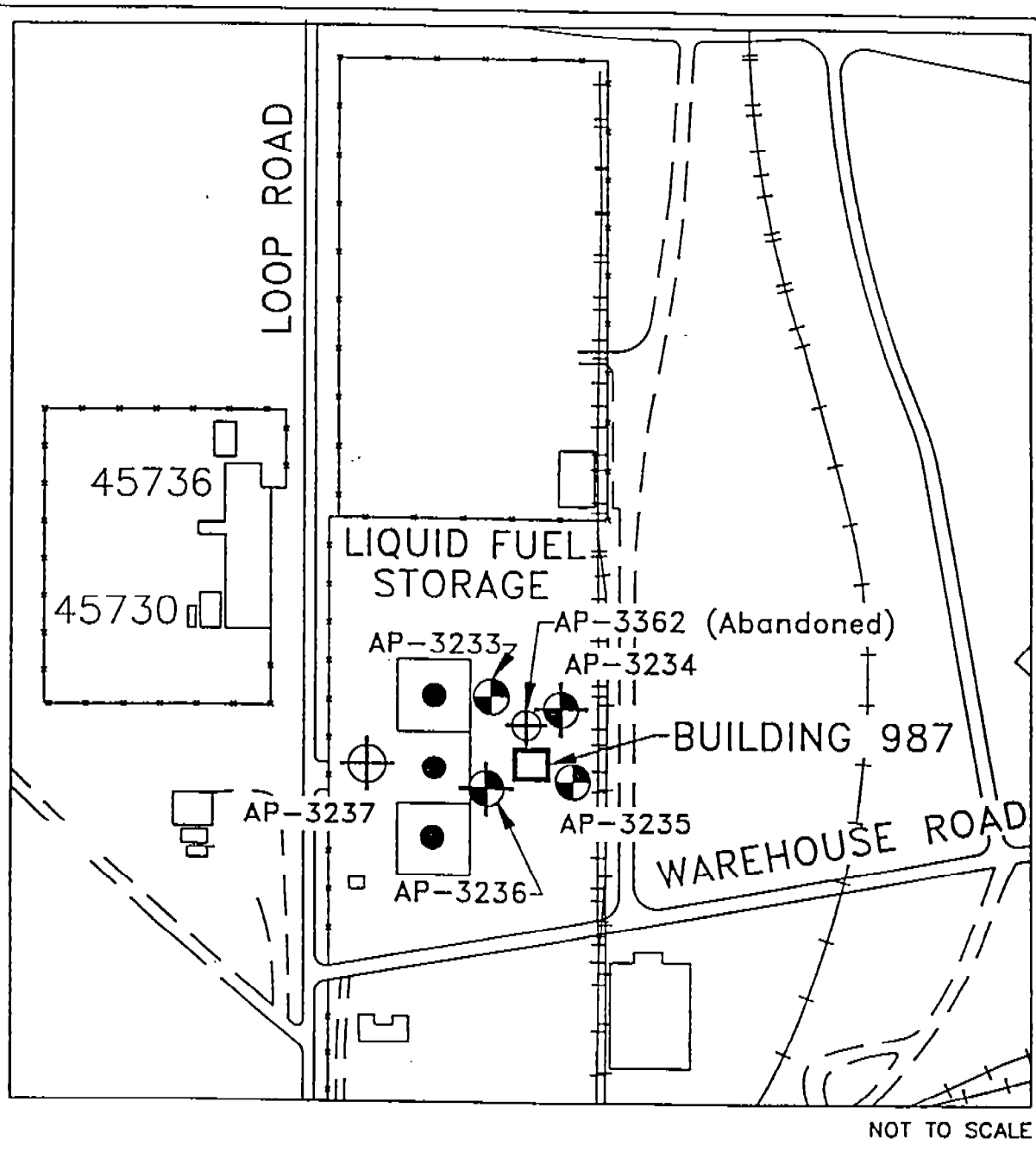

FIGURE 2

Building 987 Well Locations

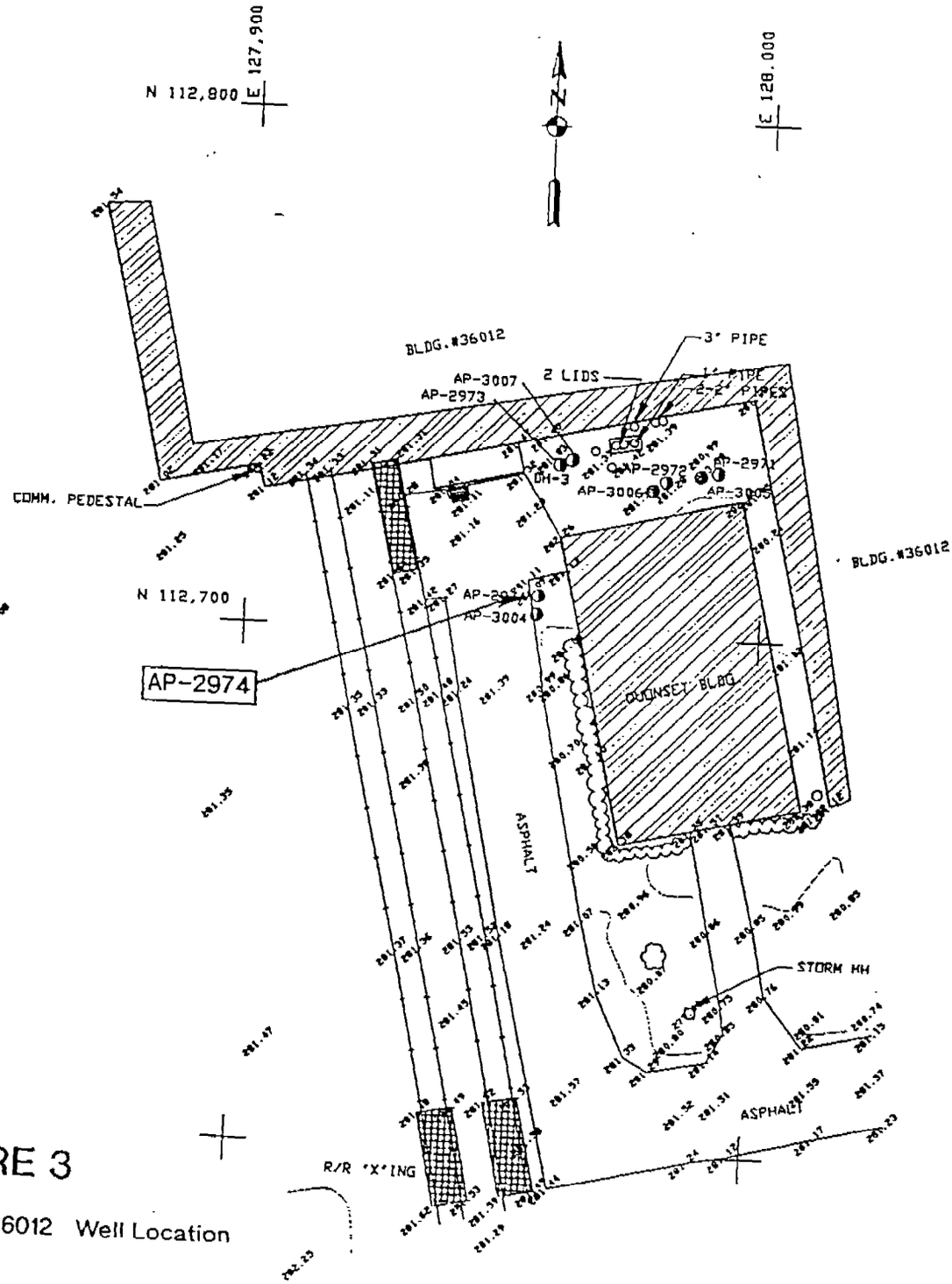

FIGURE 3

Building 36012 Well Location

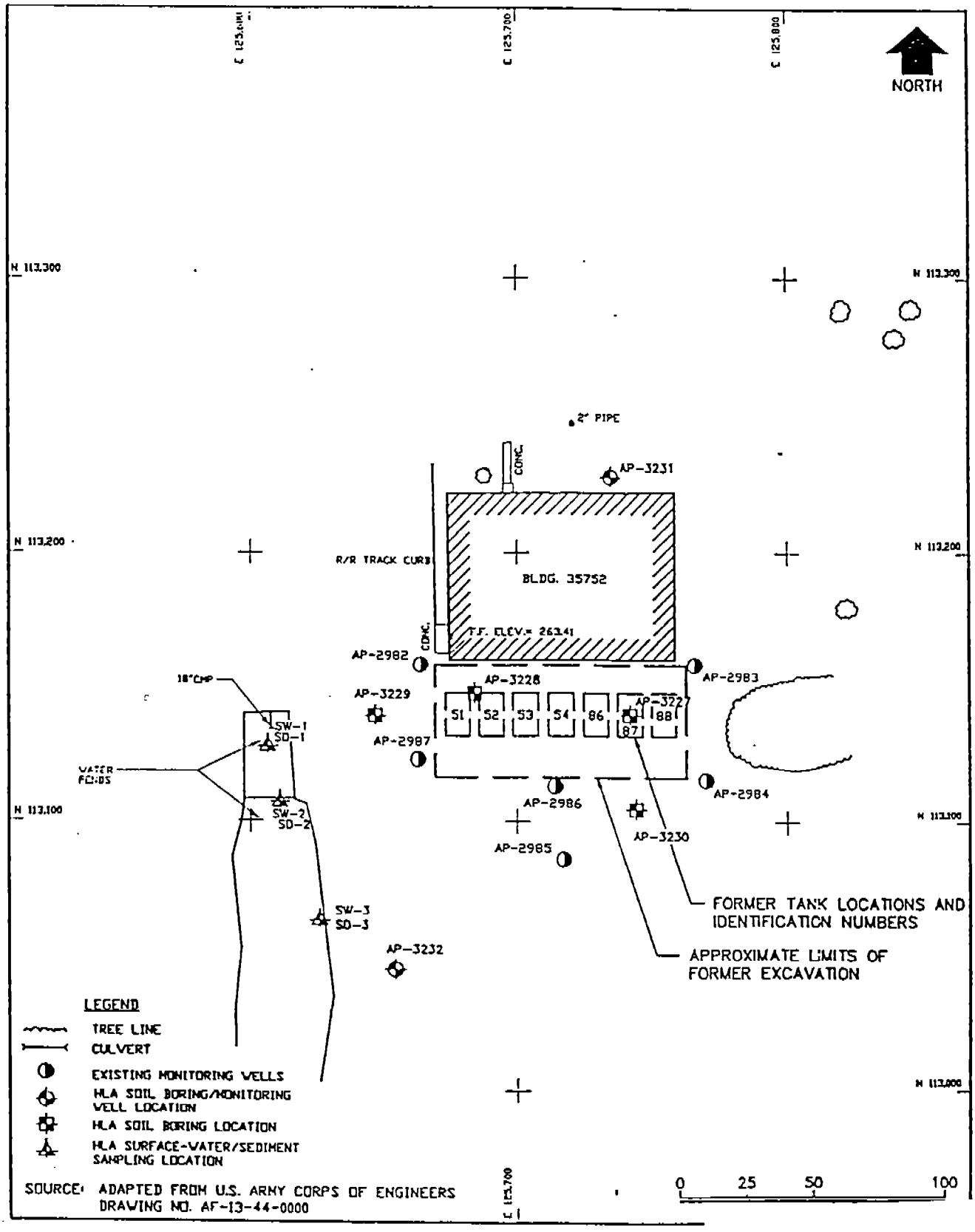

FIGURE 4

Building 35752
Well Locations

Appendix A

Sampling Summary Forms

Sampling Summary Forms

Fall 1994

Well 1
Fort Richardson Supply Well
14 Nov 94

Sampling Point/Equipment: Sample collected from in-line spigot just downline of the pump/wellhead; sampling upline of pump not possible.

Well boring depth 162 ft bgs; screened interval unknown.

Purge Volume: Minimal quantity to purge spigot.

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.3 deg. C
pH:	6.97
Conductivity:	0.239 millimhos/cm
Redox Potential:	194 millivolts
Odor:	None detectable
Appearance:	Clear, colorless

Sample Number: 94FRGW125WA

Time of Sampling: 1345-1355 14 Nov 94

Analyses Requested: 8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Minimal quantity to purge spigot collected in bucket, discarded into drain of pump building.

Note: No chlorinator system at Well 1.

Well 3
Fort Richardson Supply Well
14 Nov 94

Sampling Point/Equipment: Sample collected from i line spigot just downline of the pump/wellhead; sampli uplin of pump not possible.

Well boring depth 145 ft bgs; screened interval known

Purge Volume: Minimal quantity to purge spigot

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.7 deg. C
pH:	7.60
Conductivity:	0.239 millimhos/cm
Redox Potential:	170 millivolts
Odor:	None detectable
Appearance:	Clear, colorless

Sample Number: 94FRGW126WA

Time of Sampling: 1420-1430 14 Nov 94

Analyses Requested: 8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Minimal quantity to purge spigot collected in bucket, discarded into drain in floor of well building.

Note: There is a chlorinator system at Well 3, but it is downline of the sampling point.

Otter Lake Lodge
Supply Well
9 Nov 94

Sampling Point/Equipment: In "basement" of Otter Lake Upper Lodge, at spigot that appears to be upline of the chlorination apparatus. It is possible that the water sample taken from this location may contain some chlorination compound.

Purge Volume: Sink faucet in kitchen allowed to run for 15 minutes before sampling to draw water through system; spigot at sampling point flushed for 1 minute to clear lines.

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.8 deg. C
pH:	6.90
Conductivity:	0.364 millimhos/cm
Redox Potential:	623 millivolts
Odor:	None detectable
Appearance:	Clear and colorless

Sample Number: 94FRGW122WA

Time of Sampling: 1405-1415 9 Nov 94

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Approx. 10 gallons purged from spigot discarded in toilet.

ADFG C
Fishery Supply Well
20 Sep 94

Sampling Point/Equipment: Sample collected from spigot installed in 10-inch steel supply line, inside ADFG Well Manifold Building.
Pump Intake Depth: 48 ft bgs.

Purge Volume: Minimal quantity to clear spigot.

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.2 deg. C
pH:	6.65
Conductivity:	0.286 millimhos/cm
Redox Potential:	251 millivolts
Odor:	None detectable
Appearance:	Clear, colorless

Sample Number: 94FRGW109WA

Time of Sampling: 0920-0930 20 Sep 94

Rate of Sampling: Volatiles and GRO collected at approx. 80 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Minimal quantity; discharged to floor drain per ADFG permission.

ADFG E
Fishery Supply Well
20 Sep 94

Sampling Point/Equipment: Sample collected from spigot installed in 10-inch steel supply line, inside ADFG Well Manifold Building.
Pump Intake Depth: 29 ft bgs.

Purge Volume: Minimal quantity to clear spigot.

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.8 deg. C
pH:	6.95
Conductivity:	0.175 millimhos/cm
Redox Potential:	196 millivolts
Odor:	None detectable
Appearance:	Clear, colorless

Sample Number: 94FRGW110WA

Time of Sampling: 0945-0955 20 Sep 94

Rate of Sampling: Volatiles and GRO collected at approx. 80 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Minimal quantity; discharged to floor drain per ADFG permission.

ADFG K
Fishery Supply Well
20 Sep 94

Sampling Point/Equipment: Sample collected from spigot installed in 10-inch steel supply line, inside ADFG Well Manifold Building.
Pump Intake Depth: 34 ft bgs.

Purge Volume: Minimal quantity to purge spigot

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.2 deg. C
pH:	6.67
Conductivity:	0.152 millimhos/cm
Redox Potential:	194 millivolts
Odor:	None detectable
Appearance:	Rusty at first, contains minimal orange sediment at time of sampling

Sample Number: 94FRGW111WA

Time of Sampling: 1010 to 1025

Rate of Sampling: Volatiles and GRO collected at approx. 80 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Minimal quantity; discharged to floor drain per ADFG permission.

NOTE: ADFG employee Paul Smith, who provided access to the manifold building, remarked that the pressure in the Well K feeder pipe was low, and that the water collected may be a mixture of water from Well K and the other wells feeding into the water main at that time.

ADFG 9
Fishery Supply Well
20 Sep 94

Sampling Point/Equipment: Sample collected from spigot installed in 12-inch steel supply line, inside a concrete vault southeast of Building 37531.

Well Intake Depth: approx. 120 ft bgs?

Purge Volume: Minimal quantity to purge spigot.

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.0 deg. C
pH:	6.52
Conductivity:	0.379 millimhos/cm
Redox Potential:	227 millivolts
Odor:	None detectable
Appearance:	Clear, colorless

Sample Number: 94FRGW112WA

Time of Sampling: 1045-1100 20 Sep 94

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Minimal quantity to purge spigot collected in bucket, discarded on ground outside of vault.

Test Well 1 (TW-1)
8 Nov 94

Sampling Point/Equipment: 6" diameter metal casing, conve ted to monitoring well. Well contains 4" diameter single-spee submersible pump. Teflon and stainless steel hose used t direct water flow. Homelight 4400 watt, 240 volt, 8 hp generator used, with adaptor cord needed.

Casing top/water: 108.45 ft
Casing top/bottom: 252.4 ft (from records)
Purge Volume: 630 gallons total
Purge Rate: 5 gal/min for 124 min, then 0.2 gal/min for 60 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.3 deg. C
pH:	7.97
Conductivity:	0.285 millimhos/cm
Redox Potential:	60 millivolts
Odor:	None detectable
Appearance:	Clear with dark brown tint at first, becomes colorless after a few minutes; clear and colorless at time of sampling.

Sample Number: 94FRGW121WA

Time of Sampling: 1620-1645

Rate of Sampling: Volatiles and GRO collected at approx. 100 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Discharged to ground in vicinity of well.

Well A-1
11 Nov 94

Sampling Point/Equipment: 6" diameter converted to monitoring well. Well contains 4" diameter submersible pump; 24-inch length of 1-inch Tygon tubing used to direct water flow. Homelight 4400 watt, 240 volt, 8 hp generator used, with adaptor cord needed.

Casing top/water: 33.69 ft
Casing top/bottom: 80.0 ft (from records)
Purge Volume: 202.8 gallons
Purge Rate: 5 gal/min for 38 min, then 0.2 gal/min for 65 min.

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.8 deg. C
pH:	7.82
Conductivity:	0.225 millimhos/cm
Redox Potential:	136 millivolts
Odor:	None detectable
Appearance:	Dark brown at first; clear and colorless at time of sampling

Sample Number: 94FRGW123WA

Time of Sampling: 1305-1330 11 Nov 94

Rate of Sampling: Volatiles and GRO collected at approx. 100 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Discharged to ground in vicinity of well.

Well A-6
11 Nov 94

Sampling Point/Equipment: 6" diameter metal casing converted to monitoring well. Well contains 4" diameter single-speed submersible pump; Teflon and stainless steel hose used to direct water flow. Homelight 4400 watt, 240 volt, 8 hp generator used, with adaptor cord needed.

Casing top/water: 7.94 ft
Casing top/bottom: 62.3 ft (from records)

Purge Volume: 239 gallons
Purge Rate: 5 gal/min for 45 min, then 0.2 gal/min for 70 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.3 deg. C
pH:	5.06 (possible malfunction)
Conductivity:	0.159 millimhos/cm
Redox Potential:	77 millivolts
Odor:	slight sewage/sulfide odor
Appearance:	Very dark-colored and turbid at first, but cleared up in a few minutes; clear and colorless at time of sampling.

Sample Number: 94FRGW124WA

Time of Sampling: 1605-1630 11 Nov 94

Rate of Sampling: Volatiles and GRO collected at approx. 100 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Discharged onto ground in vicinity of well.

Well B
18 Nov 94

Sampling Point/Equipment: 6" diameter metal casing converted to monitoring well. Well contains 4" diameter single-speed submersible pump; Teflon and stainless steel used to direct water flow. Homelight 4400 watt, 240 volt, 8 hp generator used, with adaptor cord needed. Well is located within an open concrete shed.

Casing top/water: 98.34 ft
Casing top/bottom: 140 ft (from records)
Purge Volume: 186 gallons
Purge Rate: 4 gal/min for 42 min, then 1 gal/min for 18 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	2.8 deg. C
pH:	7.75
Conductivity:	0.340 millimhos/cm
Redox Potential:	185 millivolts
Odor:	None detectable
Appearance:	Blackish-brown tint at first; clear and colorless after 5 minutes, and at time of sampling.

Sample Number: 94FRGW127WA

Time of Sampling: 1320-1330 18 Nov 94

Rate of Sampling: Volatiles and GRO collected at approx. 100 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Discharged to ground in vicinity of well; water tended to drain away through hole in floor of concrete shed.

AK-2127
1 Dec 94

Sampling Point/Equipment: 6" diameter metal casing (former piezometer) converted to monitoring well. Well contains 4" diameter single-speed submersible pump; Teflon and stainless steel used to direct water flow. Homelight 4400 watt, 2[illegible] volt, 8 hp generator used, with adaptor cord needed.

Casing top/water: 79.82 ft
Casing top/bottom: 191 ft (from records)
Purge Volume: 480 gallons
Purge Rate: 3 gal/min for 150 min, then 1 gal/min for 30 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	0.9 deg. C
pH:	7.61
Conductivity:	0.277 millimhos/cm
Redox Potential:	163 millivolts
Odor:	None detectable
Appearance:	Rust-colored at first; clear and colorless after 10 minutes purging, and at time of sampling

Sample Number: 94FRGW128WA

Time of Sampling: 1445-1500 1 Dec 94

Rate of Sampling: Volatiles and GRO collected at approx. 100 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Discharged to ground in vicinity of well.

AP-3233
Building 987
21 Sep 94

Sampling Point: 2" diameter flush-mount monitoring well (requires a 1/2-inch socket wrench to open)
Equipment: Reuseable Teflon bailer

Casing top/water: 114.33 ft
Casing top/bottom: 125 ft (from records)
Purge Volume: 5 gallons
Purge Rate: 0.1 gal/min

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.3 deg. C
pH:	6.19
Conductivity:	0.32 millimhos/cm
Redox Potential:	69 millivolts
Odor:	Faint petroleum odor
Appearance:	Slightly turbid at sampling; slight sheen on water collected.

Sample Number: 94FRGW106WA
-163 (Quality Control Duplicate)
-162 (Quality Assurance Duplicate)

Time of Sampling: 1055-1135 21 Sep 94

Rate of Sampling: Volatiles and GRO sampled at slowest possible rate; remainder sampled at approx. 0.5 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Stored in sealed 5-gallon polyethylene containers, with 35-gallon steel drum as overpack, in CENPA-EN-G IDW holding facility pending determination of proper disposal.

AP-3235
Building 987
2 Dec 94

Sampling Point: 4" diameter flush-mount monitoring well (1/2-inch socket wrench required to open).

Equipment: Stainless steel variable-speed submersible pump, with Teflon sampling tube. Pump installed 19 Nov 94, with pump intake 120 ft below casing top.

Casing top/water: 117.14 ft
Casing top/bottom: 128.0 ft (from records)
Purge Volume: 24 gallons
Purge Rate: approx. 0.5 gal/min

Physical Parameters and Observations at time of Sample Collection

Temperature:	0.9 deg. C
pH:	7.10
Conductivity:	0.616 millimhos/cm
Redox Potential:	16 millivolts
Odor:	Slight petroleum odor
Appearance:	Turbid for first minute, then becomes clear and colorless. Slight sheen on collected water.

Sample Number: 94FRGW129WA

Time of Sampling: 1050-1110 2 Dec 94

Rate of Sampling: Volatiles and GRO collected at approx. 150 mL/min; remainder collected at approx. 0.8 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Stored in sealed 5-gallon polyethylene containers, with 35-gallon steel drum as overpack; will be turned in to DPW at Bldg 45-125 for disposal.

AP-2982
Building 35-752
13 Sep 94

Sampling Point: 2" diameter monitoring well
Sampling Equipment: Disposable Teflon bailer

Casing top/water: 16.90 ft
Casing top/bottom: 25.42 ft
Purge Volume: 4 gallons
Purge Rate: approx. 6 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature: 7.3 deg. C
pH: 5.93
Conductivity: 0.137 millimhos/cm
Redox Potential: -150 millivolts
Odor: slight sewer-like odor
Appearance: Slightly turbid with first bailer, then very turbid, then clears up considerably but still turbid upon sampling.

Sample Number: 94FRGW101WA
-161WA (Quality Control Duplicate)
-160WA (Quality Assurance Duplicate)

Time of Sampling: 1025-1100 13 Sep 94 (except 8270)

Rate of Sampling: Volatiles and GRO sampled at slowest possible rate; remainder sampled at approx. 0.5 L/min

Analyses Requested: 8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
608 PCBs
8270 Semivolatile Organic Compounds (8270 collected 19 Sep 94)

Disposition of Purge Water: Stored in sealed 5-gallon polyethylene containers, with 35-gallon steel drum as overpack; will be disposed of in oil/water separator.

AP-2985
Building 35-752
13 Sep 94

Sampling Point: 2" diameter monitoring well
Equipment: Disposable Teflon bailer

Casing top/water: 12.47 ft
Casing top/bottom: 16.35 ft
Purge Volume: 4 gallons
Purge Rate: approx. 4.5 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.7 deg. C
pH:	6.12
Conductivity:	1.07 millimhos/cm
Redox Potential:	37 millivolts
Odor:	None detectable
Appearance:	Extremely silty, then becoming much less turbid; still slightly turbid at time of sampling

Sample Number: 94FRGW102WA

Time of Sampling: 1100-1120 13 Sep 94 (except 8270)

Rate of Sampling: Volatiles and GRO sampled at slowest possible rate; remainder sampled at approx. 0.5 L/min

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs
- 8270 Semivolatile Organic Compounds (collected 19 Sep 94)

Disposition of Purge Water: Stored in sealed 5-gallon polyethylene containers, with 35-gallon steel drum as overpack;
will be disposed of in an oil/water separator.

AP-3231
Building 35-752
13 Sep 94

Sampling Point/Equipment: 2" diameter monitoring well
Equipment: Disposable Teflon bailer.

Casing top/water: 18.77 ft
Casing top/bottom: 23.79 ft
Purge Volume: 4 gallons
Purge Rate: approx. 5 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.7 deg. C
pH:	6.22
Conductivity:	0.101 millimhos/cm (malfunction)
Redox Potential:	93 millivolts
Odor:	None detectable
Appearance:	Extremely turbid with silt and sand, still very turbid upon sampling.

Sample Number: 94FRGW103WA

Time of Sampling: 1230-1250 13 Sep 94 (except 8270)

Rate of Sampling: Volatiles and GRO sampled at slowest possible rate; remainder sampled at approx. 0.5 L/min

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs
- 8270 Semivolatile Organic Compounds (collected 19 Sep 94)

Disposition of Purge Water: Stored in sealed 5-gallon polyethylene containers, with 35-gallon steel drum as overpack, in CENPA-EN-G IDW holding facility pending determination of proper disposal.

AP-2974
Fort Richardson Power Plant
19 Sep 94

Sampling Point: 2" diameter monitoring well
Equipment: Disposable Teflon bailer

Casing top/water: 18.61 ft
Casing top/bottom: 20.17 ft
Purge Volume: 2.5 gallons
Purge Rate: approx. 6 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature: 5.6 deg. C
pH: 6.70
Conductivity: 0.292 millimhos/cm
Redox Potential: 11 millivolts
Odor: None detectable
Appearance: Much reddish silt and dark sand at first, still quite turbid when sampled.

Sample Number: 94FRGW104WA

Time of Sampling: 1240-1300 19 Sep 94

Rate of Sampling: Volatiles and GRO sampled at slowest possible rate; remainder sampled at approx. 0.5 L/min

Analyses Requested: 8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Stored in sealed 5-gallon polyethylene container, with 35-gallon steel drum as overpack; will be disposed of in oil/water separator.

AP-3010
Landfill Well
17 Nov 94

Sampling Point/Equipment: 4" diameter monitoring well; well contains a 2" diameter stainless steel variable-speed submersible pump. Homelight 4400 watt, 240 volt, 8 hp generator used, with Grundfos voltage control box.

Casing top/water: 228.74 ft
Casing top/bottom: 237.8 ft (from records)
Purge Volume: 20 gallons
Purge Rate: 2 gal/min for 5 min, then 0.5 gal/min for 2.5 min, then 0.24 gal/min for 30 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	45.2 deg. C
pH:	7.28 (measured off-site due to frozen probe)
Conductivity:	0.549 millimhos/cm
Redox Potential:	18 millivolts
Diss. Oxygen:	4.8 ppm
Odor:	None detectable
Appearance:	Turbid at first, then clear and colorless

Sample Number: 94FRGW117WA

Time of Sampling: 1615-1630 17 Nov 94

Rate of Sampling: Volatiles and GRO collected at approx. 120 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs and Pesticides
- 418.1 Total Petroleum Hydrocarbons
- 415.1 Total Organic Carbon
- 410.4 Chemical Oxygen Demand
- 405.1 Biological Oxygen Demand
- 130.1 Hardness
- 365.2 Phosphate, total
- 350.3 Ammonium Nitrogen
- 353.3 Nitrate/Nitrite
- 310.1 Alkalinity
- 160.1 Total Dissolved Solids
- 325.1 Chloride
- 375.4 Sulfate
- 180.1 Turbidity
- 8270 Semivolatile Organic Compounds

AP-3010
Landfill Well
17 Nov 94
(cont.)

Disposition of Purge Water: Containerized in a 35-gallon steel drum with a 55-gallon steel drum as overpack; turned in to DPW at Bldg. 45-125.

AP-3013
Landfill Well
29 Nov 94

Sampling Point/Equipment: 4" diameter monitoring well; well contains a 2" diameter stainless steel variable-speed submersible pump. Homelight 4400 watt, 240 volt, 8 hp generator used, with Grundfos voltage control box.

Casing top/water: 135.36 ft
Casing top/bottom: 153.4 ft (from records)
Purge Volume: 35 gallons
Purge Rate: 0.6 gal/min for 50 min, then 0.13 gal/min for 40 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	0.3 deg. C
pH:	7.81
Conductivity:	0.411 millimhos/cm
Redox Potential:	150 millivolts
Diss. Oxygen:	4.2 ppm
Odor:	None detectable
Appearance:	Dark silt at first, clears up within minutes

Sample Number: 94FRGW118WA
-165WA (quality control duplicate)
-164WA (quality assurance duplicate)

Time of Sampling: 1425-1500 29 Nov 94

Rate of Sampling: Volatiles and GRO collected at approx. 120 mL/min; remainder collected at approx. 0.5 L/min.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
608 PCBs and Pesticides
418.1 Total Petroleum Hydrocarbons
415.1 Total Organic Carbon
410.4 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
365.2 Phosphate, total
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
310.1 Alkalinity
160.1 Total Dissolved Solids
325.1 Chloride

AP-3013
Landfill Well
29 Nov 94
(cont.)

Disposition of Purge Water: Containerized in a 35-gallon steel drum with a 55-gallon steel drum as overpack; turned in to DPW at Bldg 45-125.

AP-3014
Landfill Well
15 Nov 94

Sampling Point/Equipment: 4" diameter monitoring well; well contains a 2" diameter stainless steel variable-speed submersible pump. Homelight 4400 watt, 240 volt, 8 hp generator used, with Grundfos voltage control box.

Casing top/water: 20.27 ft
Casing top/bottom: 34.6 ft (from records)
Purge Volume: 27 gallons
Purge Rate: 5 gal/min for 4 min, then 0.2 gal/min for 35 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.9 deg. C
pH:	7.08
Conductivity:	0.190 millimhos/cm
Redox Potential:	165 millivolts
Diss. Oxygen:	4.2 ppm
Odor:	None detectable
Appearance:	Clear, colorless

Sample Number: 94FRGW115WA

Time of Sampling: 1255-1320 15 Nov 94

Rate of Sampling: Volatiles and GRO collected at approx. 100 mL/min; remainder collected at approx. 0.6 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs and Pesticides
- 418.1 Total Petroleum Hydrocarbons
- 415.1 Total Organic Carbon
- 410.4 Chemical Oxygen Demand
- 405.1 Biological Oxygen Demand
- 130.1 Hardness
- 365.2 Phosphate, total
- 350.3 Ammonium Nitrogen
- 353.3 Nitrate/Nitrite
- 310.1 Alkalinity
- 160.1 Total Dissolved Solids
- 325.1 Chloride
- 375.4 Sulfate
- 180.1 Turbidity
- 8270 Semivolatile Organic Compounds

AP-3014
Landfill Well
15 Nov 94
(cont.)

Disposition of Purge Water: Containerized in a 35 gallon steel drum with a 55-gallon steel drum as overpack. turned in to DPW at Bldg. 45-125.

AP-3015
Landfill Well
20 Dec 94

Sampling Point/Equipment: 4" diameter monitoring well; well contains a 2" diameter stainless steel variable-speed submersible pump (new pump installed 15 Dec 94). Homelight 4400 watt, 240 volt, 8 hp generator used, with Grundfos voltage control box.

Casing top/water: 120.06 ft
Casing top/bottom: 130.0 (from records)
Purge Volume: 25 gallons
Purge Rate: approx. 0.5 gal/min (pump failed and was restarted several times during pumping)

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.5 deg. C
pH:	7.31
Conductivity:	0.395 millimhos/cm
Redox Potential:	109 millivolts
Diss. Oxygen:	4.1 ppm
Odor:	None detectable
Appearance:	Slightly turbid

Sample Number: 94FRGW119WA

Time of Sampling: 1245-1320 20 Dec 94

Rate of Sampling: Volatiles and GRO collected at approx. 200 mL/min (slowest obtainable flow); remainder collected at approx. 0.8 L/min.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
608 PCBs and Pesticides
418.1 Total Petroleum Hydrocarbons
415.1 Total Organic Carbon
410.4 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
365.2 Phosphate, total
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
310.1 Alkalinity
160.1 Total Dissolved Solids
325.1 Chloride
375.4 Sulfate

AP-3015
Landfill Well
20 Dec 94
(cont.)

180.1 Turbidity
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Containerized in a 35-gallon steel drum; turned in to DPW at Bldg 45-125.

AP-3221
Landfill Well
17 Nov 94

Sampling Point/Equipment: 4" diameter monitoring well; well contains a 2" diameter stainless steel variable speed submersible pump. Homelight 4400 watt, 240 volt, 8 hp generator used, with Grundfos voltage control box. Electric connection at well head has a square-shaped connector, and requires a special adaptor cord.

Casing top/water: 153.90 ft
Casing top/bottom: 180 ft (from records)
Purge Volume: 50 gallons
Purge Rate: 2 gal/min for 23 min, then 0.2 gal/min for 20 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.5 deg. C
pH:	7.01
Conductivity:	0.741 millimhos/cm
Redox Potential:	101 millivolts
Diss. Oxygen:	3.7 ppm
Odor:	None detectable
Appearance:	Somewhat turbid at sampling

Sample Number: 94FRGW116WA

Time of Sampling: 1200-1230 17 Nov 94

Rate of Sampling: Volatiles and GRO collected at < 100 mL/min; remainder collected at approx. 0.3 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs and Pesticides
- 418.1 Total Petroleum Hydrocarbons
- 415.1 Total Organic Carbon
- 410.4 Chemical Oxygen Demand
- 405.1 Biological Oxygen Demand
- 130.1 Hardness
- 365.2 Phosphate, total
- 350.3 Ammonium Nitrogen
- 353.3 Nitrate/Nitrite
- 310.1 Alkalinity
- 160.1 Total Dissolved Solids
- 325.1 Chloride
- 375.4 Sulfate

AP-3221
Landfill Well
17 Nov 94

180.1 Turbidity
8270 Semivolatile Organic Compounds

(cont.)

AP-3221
Landfill Well
17 Nov 94
(cont.)

Disposition of Purge Water: Containerized in a 35-gallon steel drum; turned in to DPW at Bldg 45-125.

FR-1
Landfill Well
26 Nov 94

Sampling Point: 2" diameter monitoring well
Equipment: Reusable Teflon bailer.

Casing top/water: 130.72 ft
Casing top/bottom: 149.8 ft (from records)
Purge Volume: 10 gallons
Purge Rate: Approx. 6 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.8 deg. C
pH:	7.05
Conductivity:	0.228 millimhos/cm
Redox Potential:	204 millivolts
Diss. Oxygen:	4.9 ppm
Odor:	None detectable
Appearance:	Very clear at sampling

Sample Number: 94FRGW120WA

Time of Sampling: 1530-1615

Rate of Sampling: Volatiles and GRO collected at slowest possible rate; remainder collected at approx. 0.8 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs and Pesticides
- 418.1 Total Petroleum Hydrocarbons
- 415.1 Total Organic Carbon
- 410.4 Chemical Oxygen Demand
- 405.1 Biological Oxygen Demand
- 130.1 Hardness
- 365.2 Phosphate, total
- 350.3 Ammonium Nitrogen
- 353.3 Nitrate/Nitrite
- 310.1 Alkalinity
- 160.1 Total Dissolved Solids
- 325.1 Chloride
- 375.4 Sulfate
- 180.1 Turbidity
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Containerized in a 35-gallon steel drum; turned in to DPW at Bldg 45-125 for disposal.

FR-2
Landfill Well
22 Sep 94

Sampling Point: 2" diameter monitoring well
Equipment: Reusable Teflon bailer.

Casing top/water: 147.14 ft
Casing top/bottom: 167.6 ft (from records)
Purge Volume: 9.5 gallons
Purge Rate: Approx. 4 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.7 deg. C
pH:	7.07
Conductivity:	0.365 millimhos/cm
Redox Potential:	[malfunction]
Diss. Oxygen:	13.4 ppm [probable malfunction]
Odor:	None detectable
Appearance:	Very clear at sampling

Sample Number: 94FRGW107WA

Time of Sampling: 1415-1500 22 Sep 94

Rate of Sampling: Volatiles and GRO collected at slowest possible rate; remainder collected at approx. 0.8 L/min.

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 608 PCBs and Pesticides
- 418.1 Total Petroleum Hydrocarbons
- 415.1 Total Organic Carbon
- 410.4 Chemical Oxygen Demand
- 405.1 Biological Oxygen Demand
- 130.1 Hardness
- 365.2 Phosphate, total
- 350.3 Ammonium Nitrogen
- 353.3 Nitrate/Nitrite
- 310.1 Alkalinity
- 160.1 Total Dissolved Solids
- 325.1 Chloride
- 375.4 Sulfate
- 180.1 Turbidity
- 8270 Semivolatile Organic Compounds

Disposition of Purge Water: Containerized in a 35-gallon steel drum; turned in to DPW at Bldg 45-125 for disposal.

FR-3
Landfill Well
25 Sep 94

Sampling Point: 2" diameter monitoring well
Equipment: Reusable Teflon bailer.

Casing top/water: 147.65 ft
Casing top/bottom: 171.7 ft (from records)
Purge Volume: 12 gallons
Purge Rate: Approx. 6 gal/hr

Physical Parameters and Observations at time of Sample Collection

Temperature:	3.5 deg. C
pH:	7.32
Conductivity:	0.207 millimhos/cm
Redox Potential:	144 millivolts
Diss. Oxygen:	4.0 ppm
Odor:	None detectable
Appearance:	Still somewhat turbid at sampling

Sample Number: 94FRGW108WA

Time of Sampling: 1325-1440

Rate of Sampling: Volatiles and GRO collected at slowest possible rate; remainder collected at approx. 0.8 L/min.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
608 PCBs and Pesticides
418.1 Total Petroleum Hydrocarbons
415.1 Total Organic Carbon
410.4 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
365.2 Phosphate, total
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
310.1 Alkalinity
160.1 Total Dissolved Solids
325.1 Chloride
375.4 Sulfate
180.1 Turbidity
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Containerized in a 35-gallon steel drum; turned in to DPW at Bldg 45-125 for disposal.

Sampling Summary Forms

Spring 1995

ADFG-C
Fishery Supply Well
14 Apr 95

Sampling Point: Spigot in 10-inch water supply pipe in ADFG well manifold building; water flowing through pipe prior to sampling.
Equipment: Samples collected directly from spigot

Casing top/water: Not applicable
Casing top/bottom: Not applicable
Purge Volume: Minimal quantity to clear spigot
Purge Rate: Not applicable
Sampled by: R. Ragle

Physical Parameters and Observations at time of Sample Collection

Temperature:	0.2 deg. C
pH:	7.26
Conductivity:	0.092 millimhos/cm
Redox Potential:	144 millivolts
Odor:	None reported
Appearance:	Clear

Sample Number: 95FRGW16WA

Time of Sampling: 1039-1049 14 Apr 95

Rate of Sampling: Slowest possible for VOA, GRO

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Discharged to floor drain in manifold building

ADFG-E
Fishery Supply Well
14 Apr 95

Sampling Point: Spigot in 10-inch water supply pipe in ADFG well manifold building; water flowing through pipe prior to sampling.
Equipment: Samples collected directly from spigot

Casing top/water: Not applicable
Casing top/bottom: Not applicable
Purge Volume: Minimal quantity to purge spigot
Purge Rate: Not applicable
Sampled by: R. Ragle

Physical Parameters and Observations at time of Sample Collection

Temperature:	1.4 deg. C
pH:	6.63
Conductivity:	0.088 millimhos/cm
Redox Potential:	187 millivolts
Odor:	None reported
Appearance:	Very clear

Sample Number: 95FRGW14WA

Time of Sampling: 1015-1025 14 Apr 95

Rate of Sampling: Slowest possible for VOA, GRO; approx. 0.4 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Discharged to floor drain in manifold building

ADFG-K
Fishery Supply Well
14 Apr 95

Sampling Point: Spigot in 10-inch water supply pipe in ADFG well manifold building; water flowing through pipe prior to sampling.
Equipment: Samples collected directly from spigot

Casing top/water: Not applicable
Casing top/bottom: Not applicable
Purge Volume: Minimal quantity to clear spigot
Purge Rate: Not applicable
Sampled by: R. Ragle

Physical Parameters and Observations at time of Sample Collection

Temperature:	2.3 deg. C
pH:	6.80
Conductivity:	.085 millimhos/cm
Redox Potential:	157 millivolts
Odor:	None reported
Appearance:	Rusty at first, then clear

Sample Number: 95FRGW15WA

Time of Sampling: 1030-1040 14 Apr 95

Rate of Sampling: Slowest possible for VOA, GRO

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Discharged to floor drain in manifold building

ADFG-9
Fishery Supply Well
13 Apr 95

Sampling Point: Spigot in water supply pipe in access utilidor; water running in pipe during and prior to sample collection.
Equipment: Samples collected directly from spigot

Casing top/water: not applicable
Casing top/bottom: not applicable
Purge Volume: Minimal quantity to purge spigot
Purge Rate: not applicable
Sampled by: R. Ragle

Physical Parameters and Observations at time of Sample Collection

Temperature:	Not reported
pH:	Not reported
Conductivity:	Not reported
Redox Potential:	Not reported
Odor:	Not reported
Appearance:	Not reported

Sample Number: 95FRGW17WA

Time of Sampling: 1500-1515 13 Apr 95

Rate of Sampling: Slowest possible for VOA,GRO

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Discharged onto bottom of pipe utilidor.

Well 1
Post Supply Well - Bldg 35-610
6 Apr 95

Sampling Point: Spigot in water main just downline of wellhead; well in operation prior to and during visit, flowrate 600 gal/min.

Equipment: Samples collected directly from spigot; no chlorination equipment at this well.

Casing top/water: approx. 37 ft (from DPW records)
Casing top/bottom: approx 162 ft (from DPW records)
Purge Volume: Minimal amount (2 gal) to clear spigot.
Purge Rate: Not applicable.
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	1.6 deg. C
pH:	7.58
Conductivity:	0.161 millimhos/cm
Redox Potential:	110 millivolts
Odor:	None detectable
Appearance:	Clear and colorless

Sample Number: 95FRGW08WA

Time of Sampling: 1106-1115 6 Apr 95

Rate of Sampling: approx. 0.1 L/min for VOA/GRO; 0.5 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Disposed of down floor drain with permission of maintenance personnel.

Well 3
Post Supply Well - Bldg 35-630
6 Apr 95

Sampling Point: Spigot in water main just downline from wellhead. Well not in operation prior to visit; pump started at 1034, allowed to run at 1,200 gal/min (normal operating rate) for 10+ min.

Equipment: Samples collected directly from spigot; chlorination equipment present, but not in service and downline of spigot.

Casing top/water: approx. 20 ft (from DPW records)
Casing top/bottom: approx. 138 ft (from DPW records)
Purge Volume: 12,000 gal to purge casing; minimal amount to clear spigot
Purge Rate: 1,200 gal/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	2.3 deg. C
pH:	7.99
Conductivity:	0.154 millimhos/cm
Redox Potential:	146 millivolts
Odor:	None detectable
Appearance:	Clear and colorless

Sample Number: 95FRGW07WA

Time of Sampling: 1047-1055 6 Apr 95

Rate of Sampling: approx. 0.1 L/min for VOA/GRO; 0.5 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Water to clear spigot disposed of down floor drain with permission of maintenance personnel.

Otter Lake
Otter Lake Lodge Supply Well
28 Apr 95

Sampling Point: Spigot that appears to be upline of the chlorination appartus, in basement of Otter Lake Lodge. It is possible that the sample taken from this location may contain chlorination compound.
Equipment: Samples collected directly from spigot.

Purge Volume: Sink faucet in restroom allowed to run for 15 min prior to sampling to draw water through system; spigot at sampling point flushed for 1 min to clear lines.

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.2 deg. C
pH:	7.20
Conductivity:	0.367 millimhos/cm
Redox Potential:	202 millivolts
Odor:	None noticeable
Appearance:	Very clear

Sample Number: 95FRGW20WA

Time of Sampling: 1440-1450 28 April 95

Rate of Sampling: Flow approx. 0.5 L/min from spigot

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Purge water from spigot discharged to sink drain.

TW-1
7 Jul 95

Sampling Point: 6-inch diameter former test well
Equipment: Well purged with portable submersible stainless steel pump (Grundfos Reel-Eze rig) with Homelight 4400-watt 240-volt 8hp generator; well sampled with disposable Teflon bailer.
Note: Pump installed in well was discovered to be non-functional during an earlier sampling attempt on 26 Apr 95; pump and risors have not been removed.

Casing top/water: 25.85 ft
Casing top/bottom: 252.4 ft (from records)
Purge Volume: 1,020 gal
Purge Rate: 4.86 gal/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.0 deg. C
pH:	7.68
Conductivity:	0.228 millimhos/cm
Redox Potential:	66 millivolts
Odor:	None noticeable
Appearance:	Very clear

Sample Number: 95FRGW78WA

Time of Sampling: 1435-1450 7 Jul 95

Rate of Sampling: avg. 0.3 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Water discharged onto ground.

Well A-1
15 Jun 95

Sampling Point: 6-inch diameter former supply well converted to monitoring well.
Equipment: Well contains a 4-inch diameter single-speed submersible pump; Homelight 4400-watt 240-volt 8-hp gener or; Teflon and stainless steel hose used

Casing top/water: 35.41 ft
Casing top/bottom: 80.0 ft (from records)
Purge Volume: 196 gal
Purge Rate: 4.6 gal/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.0 deg. C
pH:	6.86
Conductivity:	0.219 millimhos/cm
Redox Potential:	118 millivolts
Odor:	None noticeable
Appearance:	Very clear from start of purging

Sample Number: 95FRGW47WA

Time of Sampling: 1135-1145 15 Jun 95

Rate of Sampling: approx. 1.9 L/min for all analyses (slowest sustainable undisturbed flow)

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons
- 180.1 Turbidity

Disposition of Purge Water: Discharged onto ground.

Well A-6
15 Jun 95

Sampling Point: 6-inch diameter former supply well converted to monitoring well.
Equipment: Well contains a 4-inch single-speed diameter submersible pump; Homelight 4400-watt 240-volt 8-hp generator; Teflon and stainless steel hose used

Casing top/water: 5.69 ft
Casing top/bottom: 62.3 ft (from records)
Purge Volume: 250 gallons
Purge Rate: 7.2 gal/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.9 deg. C
pH:	6.37
Conductivity:	0.149 millimhos/cm
Redox Potential:	115 millivolts
Odor:	None noticeable
Appearance:	Water dark-colored and rusty at first, becomes very clear within 10 min. Rust-colored sediment noticed on membrane after sample filtration

Sample Number: 95FRGW48WA

Time of Sampling: 1251-1300 15 Jun 95

Rate of Sampling: approx. 2 L/min for all analyses (slowest sustainable continuous flow)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Discharged onto ground.

AK-2127
6 Jul 95

Sampling Point: 6-inch diameter former piezometer
Equipment: Dedicated 4-inch single-speed submersible pump; Homelight 4400-watt 240-volt 8hp generator; Teflon/stainless steel hose

Casing top/water: 74.47 ft
Casing top/bottom: 191 ft (from records)
Purge Volume: 500 gal
Purge Rate: 3.25 gal/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.8 deg. C
pH:	7.23
Conductivity:	0.234 millimhos/cm
Redox Potential:	72 millivolts
Odor:	None noticeable
Appearance:	Rusty at first, clears within 20 min

Sample Number: 95FRGW76WA

Time of Sampling: 1237-1255

Rate of Sampling: approx. 0.5 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Water discharged onto ground.

Well B
5 May 95

Sampling Point: 6-inch diameter former supply well converted to monitoring well; well is located in an open concrete shed.
Equipment: Well contains a 4-inch diameter single speed submersible pump; Homelight 4400-watt 240-volt 8-hp generator; Teflon and stainless steel hose used

Casing top/water: 98.54 ft
Casing top/bottom: 140 ft (from records)
Purge Volume: 186 gals
Purge Rate: 3 gal/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.2 deg. C
pH:	7.55
Conductivity:	0.358 millimhos/cm
Redox Potential:	110 millivolts
Odor:	None noticeable
Appearance:	Water mostly clear but dark-colored at first; becomes clear and mostly colorless by sampling time

Sample Number: 95FRGW25WA

Time of Sampling: 1500-1510 5 May 95

Rate of Sampling: Approx. 0.25 L/min for VOA, GRO; approx. 0.8 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Discharged to ground; most escapes through drainhole in floor of shed.

AP-3233
23 Jun 95

Sampling Point: 2-inch diameter flush-mount monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 116.47 ft
Casing top/bottom: 125.0 ft (from records)
Purge Volume: 6.5 gal
Purge Rate: 1 L/min
Sampled by: C. Floyd/J. Venner

Physical Parameters and Observations at time of Sample Collection

Temperature:	8.6deg. C
pH:	5.94
Conductivity:	0.581 millimhos/cm
Redox Potential:	69 millivolts
Odor:	None noticeable
Appearance:	Very clear at time of sampling

Sample Number: 95FRGW59WA
-60WA (Quality Control Duplicate)
-61WA (Quality Assurance Duplicate)

Time of Sampling: 1215-1235 23 Jun 95

Rate of Sampling: 0.8 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3235
Bldg 987
25 Apr 95

Sampling Point: 4-inch diameter flush-mount monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 119.30 ft
Casing top/bottom: 128.00 ft (from records)
Purge Volume: 19 gal
Purge Rate: 0.8 L/min for 20 min, then 1.6 L/min for 47 min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.2 deg. C
pH:	6.68
Conductivity:	0.378 millimhos/cm
Redox Potential:	-22 millivolts
Odor:	Distinct fuel odor
Appearance:	Very clear and colorless throughout purging and sampling

Sample Number: 95FRGW19WA

Time of Sampling: 1245-1300 25 Apr 95

Rate of Sampling: approx. 0.5 L/min (slowest unbroken flow)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-2982
Bldg 35-752
11 Apr 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Disposable Teflon bailer

Casing top/water: 12.43 ft
Casing top/bottom: 25.24 ft
Purge Volume: 7.5 gal
Purge Rate: avg. 0.3 gal/min
Sampled by: R. Ragle/B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	1.4 deg. C
pH:	7.56
Conductivity:	0.479 millimhos/cm
Redox Potential:	192 millivolts
Odor:	None reported
Appearance:	Very clear at sampling

Sample Number: 95FRGW09WA
-10WA (Quality Control Duplicate)
-11WA (Quality Assurance Duplicate)

Time of Sampling: 1215-1315 11 Apr 95

Rate of Sampling: Slowest possible for VOA,GRO; avg. 0.6 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs only

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-2985
Bldg 35-752
11 Apr 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Disposable Teflon bailer

Casing top/water: 7.56 ft
Casing top/bottom: 16.30 ft
Purge Volume: 5 gal
Purge Rate: avg. 0.08 gal/min
Sampled by: R. Ragle/B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	2.8 deg. C
pH:	6.11
Conductivity:	0.202 millimhos/cm
Redox Potential:	83 millivolts
Odor:	None recorded
Appearance:	Slightly turbid at time of sampling

Sample Number: 95FRGW12WA

Time of Sampling: 1100-1120 11 Apr 95

Rate of Sampling: Slowest possible for VOA,GRO; avg. approx. 0.2 L/min for remainder

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3231
Bldg 35-752
11 Apr 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Disposable Teflon bailer

Casing top/water: 15.81 ft
Casing top/bottom: 23.75 ft
Purge Volume: 4.5 gal
Purge Rate: avg. 0.13 gal/min
Sampled by: R. Ragle/B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	0.8 deg. C
pH:	7.32
Conductivity:	0.268 millimhos/cm
Redox Potential:	210 millivolts
Odor:	None reported
Appearance:	Not recorded

Sample Number: 95FRGW13WA

Time of Sampling: 1100-1130 11 Apr 95

Rate of Sampling: Slowest possible for VOA, GRO; avg. approx 0.14 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-2974
Power Plant Well
14 Apr 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Disposable Teflon bailer

Casing top/water: 18.30 ft
Casing top/bottom: 21.80 ft
Purge Volume: 1.3 gal
Purge Rate: avg. 0.065 gal/min
Sampled by: R. Ragle

Physical Parameters and Observations at time of Sample Collection

Temperature:	0.6 deg. C
pH:	6.98
Conductivity:	0.380 millimhos/cm
Redox Potential:	94 millivolts
Odor:	None reported
Appearance:	Fairly turbid at time of sampling

Sample Number: 95FRGW18WA

Time of Sampling: 1155-1220 14 Apr 95

Rate of Sampling: Slowest possible for VOA, GRO; avg. 0.17 L/min for remainder

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3010
Landfill Well
4 Apr 95

Sampling Point: 4-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 229.44 ft
Casing top/bottom: 237.8 (from records)
Purge Volume: 17 gal
Purge Rate: 1.9 L/min
Sampled by: C. Floyd/ B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	3.5 deg. C
pH:	7.84
Conductivity:	0.564 millimhos/cm
Redox Potential:	41 millivolts
Diss. Oxygen:	4.0 ppm
Odor:	None noticeable
Appearance:	Mostly clear at sampling

Sample Number: 95FRGW01WA

Time of Sampling: 1045-1122 4 Apr 95

Rate of Sampling: 0.6 L/min for all analyses (slowest unbroken flow)

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity

AP-3010 (cont.)
Landfill Well
4 Apr 95

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3013
Landfill Well
3 May 95

Sampling Point: 4-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon/stainless steel hose

Casing top/water: 137.60 ft
Casing top/bottom: 153.4 ft (from records)
Purge Volume: 25 gal
Purge Rate: 2 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.5 deg. C
pH:	6.89
Conductivity:	0.292 millimhos/cm
Redox Potential:	97 millivolts
Diss. Oxygen:	Not recorded
Odor:	None noticeable
Appearance:	Very clear

Sample Number: 95FRGW21WA

Time of Sampling: 1035-1105 3 May 95

Rate of Sampling: approx. 0.2 L/min for VOA, GRO; 0.6 L/min for remainder

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity

AP-3013 (cont.)
Landfill Well
3 May 95

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3014
Landfill Well
10 Apr 95

Sampling Point: 4-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 22.18 ft
Casing top/bottom: 31.19 ft
Purge Volume: 18 gal
Purge Rate: 1.9 L/min
Sampled by: B. Walters/ R. Ragle

Physical Parameters and Observations at time of Sample Collection

Temperature:	2.9 deg. C
pH:	6.62
Conductivity:	0.115 millimhos/cm
Redox Potential:	152 millivolts
Diss. Oxygen:	5.2 ppm
Odor:	None reported
Appearance:	Very clear

Sample Number: 95FRGW04WA

Time of Sampling: 1410-1437 10 Apr 95

Rate of Sampling: approx. 1 L/min for all analyses

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity

AP-3014 (cont.)
Landfill Well
10 Apr 95

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3015
Landfill Well
5 Apr 95

Sampling Point: 4-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 121.42 ft
Casing top/bottom: 130 ft (from records)
Purge Volume: 22 gal
Purge Rate: 2 L/min
Sampled by: C. Floyd/ B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	2.1 deg. C
pH:	7.52
Conductivity:	0.425 millimhos/cm
Redox Potential:	125 millivolts
Diss. Oxygen:	5.2 ppm
Odor:	None noticeable
Appearance:	Somewhat turbid

Sample Number: 95FRGW03WA

Time of Sampling: 1212-1230 5 Apr 95

Rate of Sampling: approx. 1 L/min for all analyses

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity

AP-3015 (cont.)
Landfill Well
5 Apr 95

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3221
Landfill Well
4 Apr 95

Sampling Point: 4-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 156.20 ft
Casing top/bottom: 180 ft (from records)
Purge Volume: 48 gal
Purge Rate: 1.9 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.4 deg. C
pH:	7.96
Conductivity:	0.748 millimhos/cm
Redox Potential:	48 millivolts
Diss. Oxygen:	3.2 ppm
Odor:	None noticeable
Appearance:	Slightly turbid at sampling

Sample Number: 95FRGW02WA

Time of Sampling: 1440-1500

Rate of Sampling: 0.2 L/min for VOA, GRO; 0.5 L/min for remainder

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity

AP-3221 (cont.)
Landfill Well
4 Apr 95

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

FR-1
Landfill Well
19 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor (pump and risor installed 16 Jun 95 with pump set on 140 ft of risor); Homelight 4400-watt 240-volt 8hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 132.97 ft
Casing top/bottom: 149 ft (from records)
Purge Volume: 12 gal
Purge Rate: 3.8 L/min for 3 min, then 1.9 L/min for 10 min, then 3.8 L/min for 9 min (flow increased to limit rising temperature)
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.7 deg. C
pH:	7.20
Conductivity:	0.352 millimhos/cm
Redox Potential:	132 millivolts
Diss. Oxygen:	6.0 ppm
Odor:	None noticeable
Appearance:	Very clear

Sample Number: 95FRGW49WA
-50WA (Quality Control Duplicate)
-51WA (Quality Assurance Duplicate; none for Turbidity or BOD)

Time of Sampling: 1155-1240 19 Jun 95

Rate of Sampling: approx. 1 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon

FR-1 (cont.)
Landfill Well
19 Jun 95

410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

FR-2
Landfill Well
20 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor (pump and risor installed 16 Jun 95 with pump on 150 ft of risor); Homelight 4400-watt 240-volt 8hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 149.15 ft
Casing top/bottom: 167 ft (from records)
Purge Volume: 8.5 gal
Purge Rate: 0.5 L/min for 28 min, then 2 L/min for 8 min (flow increased to limit rise in temperature)
Sampled by: C. Floyd/ B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	8.2 deg. C
pH:	6.86
Conductivity:	0.394 millimhos/cm
Redox Potential:	143 millivolts
Diss. Oxygen:	4.8 ppm
Odor:	None noticeable
Appearance:	Very clear

Sample Number: 95FRGW53WA

Time of Sampling: 1235-1252 20 Jul 95

Rate of Sampling: 0.5 L/min for all analyses

Analyses Requested:

8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness

FR-2 (cont.)
Landfill Well
20 Jun 95

180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

FR-3
Landfill Well
20 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor (pump and risor installed 16 Jun 95 with pump set on 155 ft of risor. Pump sits on bottom of casing; Homelight 4400-watt 240-volt 8hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 149.00 ft
Casing top/bottom: 171.7 ft (from records)
Purge Volume: 11 gal
Purge Rate: approx. 1 L/min; well recharges very slowly, and can be purged dry easily; an equilibrium purge rate is very difficult to establish.
Sampled by: C. Floyd/ B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	12.6 deg. C
pH:	7.40
Conductivity:	0.333 millimhos/cm
Redox Potential:	117 millivolts
Diss. Oxygen:	5.8 ppm
Odor:	None noticeable
Appearance:	Still turbid at time of sampling

Sample Number: 95FRGW52WA (all analyses except 8270)
8270 Only: 95FRGW54WA
-55WA (Quality Control Dup.)
-56WA (Quality Assurance Dup.)

Time of Sampling: 107-1045 20 Jun 95

Rate of Sampling: approx. 1 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity

FR-3 (cont.)
Landfill Well
20 Jun 95

160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand
405.1 Biological Oxygen Demand
130.1 Hardness
180.1 Turbidity
8270 Semivolatile Organic Compounds

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3447
28 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 58.08 ft
Casing top/bottom: 64.5 ft (from records)
Purge Volume: 3.5 gal
Purge Rate: 1 L/min
Sampled by: B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	12.8 deg. C
pH:	7.06
Conductivity:	0.124 millimhos/cm
Redox Potential:	128 millivolts
Odor:	None noticeable
Appearance:	Still slightly turbid at time of sampling

Sample Number: 95FRGW71WA

Time of Sampling: 1440-1510 28 Jun 95

Rate of Sampling: 0.5 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3448
23 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 29.25 ft
Casing top/bottom: 36.0 ft (from records)
Purge Volume: 3 gal
Purge Rate: 1.3 L/min
Sampled by: C. Floyd/J. Venner

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.6 deg. C
pH:	6.59
Conductivity:	0.136 millimhos/cm
Redox Potential:	84 millivolts
Odor:	None noticeable
Appearance:	Very clear at sampling

Sample Number: 95FRGW63WA

Time of Sampling: 1450-1500 23 Jun 95

Rate of Sampling: 0.5 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3449
8 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersibl pum (Grundfos RediFlow II); PVC risor; Homelight 4400-watt ±0-· .t 8 hp generator; Grundfos BMI/MP1 voltage control box; Te .on sampling tube

Casing top/water: 26.38 ft
Casing top/bottom: 32.2 ft (from records)
Purge Volume: 5 gal
Purge Rate: approx. 1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.9 deg. C
pH:	7.15
Conductivity:	0.123 millimhos/cm
Redox Potential:	161 millivolts
Odor:	None noticeable
Appearance:	Water fairly murky at first; mostly clear by time of sampling

Sample Number: 95FRGW26WA
-27WA (Quality Control Duplicate)
-28WA (Quality Assurance Duplicate)

Time of Sampling: 1010-1035 8 May 95

Rate of Sampling: Approx. 0.15 L/min for VOA, GRO; approx. 0.6 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3450
15 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 24.18 ft
Casing top/bottom: 29.8 ft (from records)
Purge Volume: 4 gal
Purge Rate: 1.9 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.0 deg. C
pH:	6.39
Conductivity:	0.150 millimhos/cm
Redox Potential:	174 millivolts
Odor:	None noticeable
Appearance:	Slightly turbid at time of sample collection

Sample Number: 95FRGW44WA

Time of Sampling: 0953-1011 15 Jun 95

Rate of Sampling: 0.7 L/min for all analyses (slowest unbroken flow)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3451
8 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 13.86 ft
Casing top/bottom: 19.8 ft (from records)
Purge Volume: 5 gal
Purge Rate: 0.6 L/min for 17 min, then 0.7 L/min (to decrease temp) for 22 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.6 deg. C
pH:	6.58
Conductivity:	0.126 millimhos/cm
Redox Potential:	145 millivolts
Odor:	None noticeable
Appearance:	Very clear throughout purging and sampling

Sample Number: 95FRGW29WA

Time of Sampling: 1030-1045 8 May 95

Rate of Sampling: Approx.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3452
29 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 32.57 ft
Casing top/bottom: 39.20 ft (from records)
Purge Volume: 5 gal
Purge Rate: approx. 1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.6 deg. C
pH:	6.68
Conductivity:	0.145 millimhos/cm
Redox Potential:	52 millivolts
Odor:	None noticeable
Appearance:	Water still turbid at time of sampling

Sample Number: 95FRGW75WA

Time of Sampling: 1302-1312 29 Jun 95

Rate of Sampling: approx. 1 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3453
10 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 28.28 ft
Casing top/bottom: 36.30 ft
Purge Volume: 8 gal
Purge Rate: approx. 1L/min

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.3 deg. C
pH:	6.38
Conductivity:	0.074 millimhos/cm
Redox Potential:	126 millivolts
Odor:	None noticeable
Appearance:	Very turbid at first, mostly clear at sampling

Sample Number: 95FRGW34WA

Time of Sampling: 1250-1300 10 May 95

Rate of Sampling: approx. 0.5 L/min for VOA, GRO; remainder at approx. 0.8 L/min

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons
- 180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3454
29 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 18.45 ft
Casing top/bottom: 26.8 ft (from records)
Purge Volume: 4 gal
Purge Rate: 1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	4.0 deg. C
pH:	6.42
Conductivity:	0.136 millimhos/cm
Redox Potential:	58 millivolts
Odor:	None noticeable
Appearance:	Not reported

Sample Number: 95FRGW74WA

Time of Sampling: 1025-1035 29 Jun 95

Rate of Sampling: 0.6 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3455
6 Jul 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Previously installed submersible pump will not work in this well becasue of low recharge rates. Pump removed from well on 6 Jul 95, and well was purged and sampled with a Teflon bailer.

Casing top/water: 77.95 ft
Casing top/bottom: 83.6 ft (from records)
Purge Volume: 3 gal
Purge Rate: avg. 0.2 L/min
Sampled by: C. Floyd/ J. Venner

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.7 deg. C
pH:	7.68
Conductivity:	0.352 millimhos/cm
Redox Potential:	83 millivolts
Odor:	None noticeable
Appearance:	Still turbid at time of sampling

Sample Number: 95FRGW77WA
-79WA (Quality Control Duplicate - Turbidity only)

Time of Sampling: 1610-1635 6 Jul 95

Rate of Sampling: avg. 0.18 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3457
13 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 38.47 ft
Casing top/bottom: 51.75 ft (from records)
Purge Volume: Well purged to dryness twice
Purge Rate: Approx. 1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.3 deg. C
pH:	6.75
Conductivity:	0.297 millimhos/cm
Redox Potential:	151 millivolts
Odor:	No noticeable odor
Appearance:	Water still turbid at sampling. Sample passes through 0.45-micron filter very slowly

Sample Number: 95FRGW41WA

Time of Sampling: 1112-1115 13 Jun 95

Rate of Sampling: Approx. 0.3 L/min for VOA, GRO; 0.8 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Less than 1 L collected; discarded on grade

AP-3458
13 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 25.62 ft
Casing top/bottom: 38.5 ft (from records)
Purge Volume: 8 gal
Purge Rate: Variable, well tended to go dry; avg. 1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	11.0 deg. C
pH:	7.18
Conductivity:	0.417 millimhos/cm
Redox Potential:	-34 millivolts
Odor:	Possible very faint fuel odor
Appearance:	Slightly turbid at sampling

Sample Number: 94FRGW42WA

Time of Sampling: VOA, GRO 1252-1254; remainder 1320-1327

Rate of Sampling: 0.5 L/min for VOA, GRO (slowest unbroken flow); remainder at 0.7 L/min

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3459
13 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 10.75 ft
Casing top/bottom: 17 ft (from records)
Purge Volume: 4 gal
Purge Rate: 1.1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.0 deg. C
pH:	6.30
Conductivity:	0.179 millimhos/cm
Redox Potential:	93 millivolts
Odor:	None noticable
Appearance:	Slightly turbid at sampling

Sample Number: 95FRGW43WA

Time of Sampling: 1358-1405 13 Jun 95

Rate of Sampling: 0.6 L/min for VOA, GRO; 0.9 L/min for remainder

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3470
4 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 37.62 ft
Casing top/bottom: 47.20 ft (from records)
Purge Volume: 5 gal
Purge Rate: 1.1 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.2 deg. C
pH:	6.70
Conductivity:	0.248 millimhos/cm
Redox Potential:	101 millivolts
Odor:	None noticable
Appearance:	Very clear

Sample Number: 95FRGW23WA

Time of Sampling: 1133-1150 4 May 95

Rate of Sampling: 0.15 L/min for VOA, GRO; approx. 0.5 L/min for remainder

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons
- 180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3471
26 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 91.54 ft
Casing top/bottom: 107.5 ft (from records)
Purge Volume: 7 gal
Purge Rate: 1.5 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.4 deg. C
pH:	7.50
Conductivity:	0.448 millimhos/cm
Redox Potential:	111 millivolts
Odor:	None noticeable
Appearance:	Very clear

Sample Number: 95FRGW68WA

Time of Sampling: 1135-1145 26 Jun 94

Rate of Sampling: 0.5 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3472
26 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-vc = 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 127.85 ft
Casing top/bottom: 142.8 ft (from records)
Purge Volume: 7 gal
Purge Rate: 1 L/min for 10 min, then 2.2 L/min for 9 min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.8 deg. C
pH:	7.03
Conductivity:	0.440 millimhos/cm
Redox Potential:	129 millivolts
Odor:	None noticeable
Appearance:	Very clear at sampling

Sample Number: 95FRGW67WA

Time of Sampling: 1025-1040 26 Jun 95

Rate of Sampling: 0.3 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3473
4 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 177.58 ft
Casing top/bottom: 194.35 ft (from records)
Purge Volume: 15 gal
Purge Rate: avg. 1.6 L/min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.8 deg. C
pH:	7.59
Conductivity:	0.271 millimhos/cm
Redox Potential:	142 millivolts
Odor:	None noticeable
Appearance:	Water turbid and foamy at first; very clear and colorless at time of sampling

Sample Number: 95FRGW24WA

Time of Sampling: 1325-1340 4 May 95

Rate of Sampling: approx. 0.5 L/min for VOA, GRO (slowest unbroken flow; approx. 0.8 L/min for remainder.

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3474
12 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240 volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 116.17 ft
Casing top/bottom: 132.0 ft
Purge Volume: 35 gal
Purge Rate: 0.7 L/min to 4.7 L/min (flow rate increased and reduced repeatedly over approx. 60 min period to determine relationship between flow rate and temperature)
Sampled by:

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.3 deg. C
pH:	7.10
Conductivity:	0.425 millimhos/cm
Redox Potential:	100 millivolts
Odor:	None noticeable
Appearance:	Very clear through purging and sampling

Sample Number: 95FRGW36WA
-37WA (Quality Control Duplicate)
-38WA (Quality Assurance Duplicate)

Time of Sampling: 1103-1130

Rate of Sampling: 0.7 L/min for all analyses (slowest unbroken flow)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3476
26 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 137.14 ft
Casing top/bottom: 152.3 ft (from records)
Purge Volume: 8 gal
Purge Rate: 0.8 L/min for 20 min, then 2.7 L/min for 8 min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.8 deg. C
pH:	7.26
Conductivity:	0.679 millimhos/cm
Redox Potential:	113 millivolts
Odor:	None noticeable
Appearance:	Still turbid at time of sampling

Sample Number: 95FRGW64WA
-65WA (Quality Control Duplicate)
-66WA (Quality Assurance Duplicate) [except Turbidity]

Time of Sampling: 1305-1330 26 Jun 95

Rate of Sampling: 0.5 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3475
10 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 157.58 ft
Casing top/bottom: 172.90 ft
Purge Volume: 8 gal
Purge Rate: 0.75 L/min for 10 min, then 1.0 L/min for 20 min (flow increased to limit rise in temp)
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.5 deg. C
pH:	6.78
Conductivity:	0.237 millimhos/cm
Redox Potential:	119 millivolts
Odor:	None noticeable
Appearance:	Very clear at sampling

Sample Number: 95FRGW33WA

Time of Sampling: 1125-1135 10 May 95

Rate of Sampling: approx. 0.4 L/min for VOA, GRO (slowest unbroken flow); remainder at 0.75 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3477
10 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 155.46 ft
Casing top/bottom: 171.20 ft
Purge Volume: 9 gal
Purge Rate: 2.5 L/min for 10 min, then 0.5 L/min for 17 min, then 2.5 L/min for 8 min (increased to reduce rising temp)
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.4 deg. C
pH:	6.80
Conductivity:	0.143 millimhos/cm
Redox Potential:	116 millivolts
Odor:	None noticeable
Appearance:	Very clear at sampling

Sample Number: 95FRGW30WA

Time of Sampling: 1010-1020 10 May 95

Rate of Sampling: 0.5 L/min for all analyses (slowest unbroken flow)

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons
- 180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3478
4 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible mp (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 2 volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Tefl sampling tube

Casing top/water: 47.97 ft
Casing top/bottom: 109.00 ft
Purge Volume: 29 gal
Purge Rate: 1.7 L/min for 17 min

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.4 deg. C
pH:	7.10
Conductivity:	0.247 millimhos/cm
Redox Potential:	128 millivolts
Odor:	None noticeable
Appearance:	Very clear throughout purging and sampling

Sample Number: 95FRGW22WA

Time of Sampling: 1036-1045 4 May 95

Rate of Sampling: approx. 0.5 L/min for VOA, GRO (slowest unbroken flow); approx. 0.8 L/min for remainder

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons
- 180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3479
14 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 15.40 ft
Casing top/bottom: 79.50 ft (from records)
Purge Volume: 33 gal
Purge Rate: 3.8 L/min for 33 min, then 1.9 L/min for 20 min
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	5.2 deg. C
pH:	7.38
Conductivity:	0.291 millimhos/cm
Redox Potential:	89 millivolts
Odor:	None noticeable
Appearance:	Slightly turbid at first; very clear at time of sampling

Sample Number: 95FRGW45WA

Time of Sampling: 1111-1118 14 Jun 95

Rate of Sampling: 0.6 L/min for all analyses (slowest unbroken flow)

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons
- 180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3480
12 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC riser; Homelight 4400-watt 240-v[illegible]t 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 104.00
Casing top/bottom: 117.5
Purge Volume: 6 gal
Purge Rate: 6.3 L/min for 2 min, then 1.3 L/min for 10 min, then approx. 2 L/min for 2 min.
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.1 deg. C
pH:	7.35
Conductivity:	0.514 millimhos/cm
Redox Potential:	129 millivolts
Odor:	None noticeable
Appearance:	Very clear at sampling

Sample Number: 95FRGW39WA

Time of Sampling: 1234-1244 12 May 95

Rate of Sampling: Approx. 0.2 L/min for VOA, GRO; 0.7 L/min for remainder

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3481
22 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 81.11 ft
Casing top/bottom: 94.0 ft (from records)
Purge Volume: 7.5 gal
Purge Rate: 1 L/min
Sampled by: B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.4 deg. C
pH:	6.83
Conductivity:	0.183 millimhos/cm
Redox Potential:	79 millivolts
Odor:	None noticeable
Appearance:	Very clear at time of sampling

Sample Number: 95FRGW58WA

Time of Sampling: 1605-1620 22 Jun 95

Rate of Sampling: 0.5 L/min for all analyses

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3482
23 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 39.78 ft
Casing top/bottom: 103.0 ft (from records)
Purge Volume: 29 gal
Purge Rate: 3.3 L/min for 20 min, then 2.5 L/min for 18 min
Sampled by: C. Floyd/ J. Venner

Physical Parameters and Observations at time of Sample Collection

Temperature:	6.3 deg. C
pH:	6.35
Conductivity:	0.189 millimhos/cm
Redox Potential:	93 millivolts
Odor:	None noticeable
Appearance:	Very clear at time of sampling

Sample Number: 95FRGW62WA

Time of Sampling: 1410-1422 23 Jun 95

Rate of Sampling: 0.4 L/min for VOA, GRO; 0.6 L/min for remainder

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3483
14 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 94.86 ft
Casing top/bottom: 117.5 ft (from records)
Purge Volume: 16 gal
Purge Rate: 1 L/min for 36 min, then 2 L/min for 8 min (flow increased to limit rise in temperature)
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.5 deg. C
pH:	7.46
Conductivity:	0.312 millimhos/cm
Redox Potential:	121 millivolts
Odor:	None noticeable
Appearance:	Turbid at first; very clear at time of sampling

Sample Number: 95FRGW46WA

Time of Sampling: 1249-1256 14 Jun 95

Rate of Sampling: 0.7 L/min for all analyses (slowest unbroken flow)

Analyses Requested:
- 8260 Volatile Organic Compounds
- 8015 (modified, ADEC Version) Gasoline Range Organics
- 8100 (modified, ADEC Version) Diesel Range Organics
- 23 TAL Metals, total
- 23 TAL Metals, dissolved
- 8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3484
10 May 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 24 volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflc sampling tube

Casing top/water: 88.54 ft
Casing top/bottom: 100.5 ft
Purge Volume: 8 gal
Purge Rate: 0.75 L/min for 15 min, then 2 L/min for 14 min (flow increased to limit rise in temp)
Sampled by: C. Floyd

Physical Parameters and Observations at time of Sample Collection

Temperature:	8.6 deg. C
pH:	6.12
Conductivity:	0.258 millimhos/cm
Redox Potential:	107 millivolts
Odor:	None noticeable
Appearance:	Clear at time of sampling

Sample Number: 95FRGW35WA

Time of Sampling: 1502-1512 10 May 95

Rate of Sampling: approx. 0.5 L/min for VOA, GRO; remainder at approx. 0.8 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3485
22 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 56.23 ft
Casing top/bottom: 106.2 ft (from records)
Purge Volume: 25 gal
Purge Rate: 1 L/min
Sampled by: B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.2 deg. C
pH:	7.81
Conductivity:	0.280 millimhos/cm
Redox Potential:	58 millivolts
Odor:	None noticeable
Appearance:	Very clear at time of sampling

Sample Number: 95FRGW57WA

Time of Sampling: 1443-1505 22 Jun 95

Rate of Sampling: approx. 0.5 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3530
27 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 112.59 ft
Casing top/bottom: 120.00 ft (from records)
Purge Volume: 5 gal
Purge Rate: 0.9 L/min
Sampled by: C. Floyd/J. Venner

Physical Parameters and Observations at time of Sample Collection

Temperature:	8.8 deg. C
pH:	7.24
Conductivity:	0.396 millimhos/cm
Redox Potential:	98 millivolts
Odor:	None noticeable
Appearance:	Very clear at time of sampling

Sample Number: 95FRGW69WA

Time of Sampling: 1150-1158 27 Jun 95

Rate of Sampling: 0.7 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3531
27 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 116.61 ft
Casing top/bottom: 120.0 ft (from records)
Purge Volume: 5 gal
Purge Rate: 1.2 L/min
Sampled by: C. Floyd/ J. Venner

Physical Parameters and Observations at time of Sample Collection

Temperature:	7.6 deg. C
pH:	7.25
Conductivity:	0.379 millimhos/cm
Redox Potential:	87 millivolts
Odor:	None noticeable
Appearance:	Very clear at time of sampling

Sample Number: 95FRGW70WA

Time of Sampling: 1234-1244 27 Jun 95

Rate of Sampling: 0.6 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
23 TAL Metals, total
23 TAL Metals, dissolved
8310 Polyaromatic Hydrocarbons
180.1 Turbidity

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3532
28 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 111.07 ft
Casing top/bottom: 133 ft (from records)
Purge Volume: 12 gal
Purge Rate: 1 L/min for 36 min, then 1.5 L/min for 10 min
Sampled by: B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	9.4 deg. C
pH:	7.36
Conductivity:	0.369 millimhos/cm
Redox Potential:	88 millivolts
Odor:	None noticeable
Appearance:	Not recorded

Sample Number: 95FRGW72WA

Time of Sampling: 1156-1210 28 Jun 95

Rate of Sampling: 0.9 L/min for all analyses

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

AP-3533
28 Jun 95

Sampling Point: 2-inch diameter monitoring well
Equipment: Dedicated 2-inch stainless steel submersible pump (Grundfos RediFlow II); PVC risor; Homelight 4400-watt 240-volt 8 hp generator; Grundfos BMI/MP1 voltage control box; Teflon sampling tube

Casing top/water: 103.90 ft
Casing top/bottom: 131 ft (from records)
Purge Volume: 14 gal
Purge Rate: 1 L/min
Sampled by: B. Walters

Physical Parameters and Observations at time of Sample Collection

Temperature:	13.9 deg. C
pH:	7.45
Conductivity:	0.420 millimhos/cm
Redox Potential:	55 millivolts
Odor:	None noticeable
Appearance:	Not recorded

Sample Number: 95FRGW73WA

Time of Sampling: 1735-1745 28 Jun 95

Rate of Sampling: approx. 1 L/min

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version) Gasoline Range Organics
8100 (modified, ADEC Version) Diesel Range Organics
8310 Polyaromatic Hydrocarbons

Disposition of Purge Water: Containerized and turned in to DPW at Bldg 45-125, pending results of analysis.

Rinsate Blanks

1. Item: **Teflon/stainless steel hose**
Date Rinsate Prepared: 10 Apr 95
Rinsate Sample Numbers: 95FRGW05WA
-06WA (Quality Assurance Duplicate)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand

2. Item: **Teflon sampling tube** (Grunfos)
Date Rinsate Prepared: 8 May 95
Rinsate Sample Numbers: 95FRGW31WA
-32WA (Quality Assurance Duplicate)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
8310 Polyaromatic Hydrocarbons

3. Item: **Teflon bailer**
Date Rinsate Prepared: 7 Jul 95
Rinsate Sample Numbers: 95FRGW100WA
-101WA (Quality Assurance Dup.)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
8310 Polyaromatic Hydrocarbons

Rinsate Blanks

1. Item: **Teflon/stainless steel hose**
Date Rinsate Prepared: 10 Apr 95
Rinsate Sample Numbers: 95FRGW05WA
-06WA (Quality Assurance Duplicate)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
8310 Polyaromatic Hydrocarbons
8080 PCBs and Pesticides
418.1 Tot. Recov. Petro. Hydrocarbons
365.2 Total Phosphate
350.3 Ammonium Nitrogen
353.3 Nitrate/Nitrite
375.4 Sulfate
325.1 Chloride
310.1 Alkalinity
160.1 Total Dissolved Solids
415.1 Total Organic Carbon
410.1 Chemical Oxygen Demand

2. Item: **Teflon sampling tube** (Grunfos)
Date Rinsate Prepared: 8 May 95
Rinsate Sample Numbers: 95FRGW31WA
-32WA (Quality Assurance Duplicate)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
8310 Polyaromatic Hydrocarbons

3. Item: **Teflon bailer**
Date Rinsate Prepared: 7 Jul 95
Rinsate Sample Numbers: 95FRGW100WA
-101WA (Quality Assurance Dup.)

Analyses Requested:
8260 Volatile Organic Compounds
8015 (modified, ADEC Version)
Gasoline Range Organics
8100 (modified, ADEC Version)
Diesel Range Organics
23 TAL Metals, total
8310 Polyaromatic Hydrocarbons

Trip Blanks

All trip blanks were prepared by CAS in large lots and provided to CENPA-EN-G-MI; the trip blanks were submitted to the laboratories as blind samples for VOA and GRO analysis, with each cooler containing field samples for VOA and GRO analysis.

Before collection of a group of field samples, a set of trip blanks were "initiated" by labeling and dating with that day's date.

Trip Blank Sample # 95FRGW-	Date Initiated/ Submitted	Submitted with Field Samples 95FRGW-WA
-80WA	4 Apr/6 Apr 95	01, 02, 03
-81WA	6 Apr/12 Apr 95	04, 05, 07, 08, 10, 12, 13
-82WA (QA)	10 Apr/12 Apr 95	06, 11
-83WA	13 Apr/14 Apr 95	14, 15, 16, 17, 18
-84WA	25 Apr/1 May 95	19, 20
-85WA	3 May/4 May 95	21, 22, 23, 24
-86WA	8 May/9 May 95	25, 26, 27, 29
-87WA (QA)	8 May/9 May 95	28
-88WA	10 May/15 May 95	30, 31, 33, 34, 35, 36, 37, 39
-89WA (QA)	12 May/15 May 95	32, 38
-90WA	13 Jun/16 Jun 95	41, 42, 43, 44, 45, 46, 47,
-92WA (QA)	19 Jun/20 Jun 95	51
-93WA	22 Jun/26 Jun 95	57, 58, 59, 60, 62, 63
-94WA (QA)	23 Jun/27 Jun 95	61, 66
-95WA	26 Jun/30 Jun 95	64, 65, 67, 68, 69, 70, 71, 72, 73, 74, 75
-96WA	6 Jul/10 Jul 95	76, 77, 78, **100**
-97WA (QA)	6 Jul/10 Jul 95	101

Rinsate Blanks in boldface
(QA): Trip blank accompanying samples to NPD

Turbidity Blank

Sample 95FRGW99WA was a bottle of deionized water submitted for analysis by Method 180.1 Turbidity only.

Appendix B

Chemical Data Tables
Fall 1994

Summary of Extraction and Analytical Methods
Fall 1994
Page 1of 2

Compounds/Analytes	Primary Laboratory		QA Laboratory	
	Extraction Method	Analytical Method	Extraction Method	Analytical Method
Volatile Organic Compounds	5030	8260	5030	8260
Gasoline Range Organics	5030	8015 mod	5030	8015 mod
Diesel Range Organics	3510	8100 mod	3510	8100 mod
Semivolatile Organic Compds	3510	8270	3510	8270
PCBs and Pesticides	3510	8080	(method)	608
Total Recov. Pet. Hydrocarbons	(method)	418.1	(method)	418.1
Total Organic Carbon	(method)	415.1	(method)	415.1
Chemical Oxygen Demand	(method)	410.2	(method)	410.4
Biological Oxygen Demand	(method)	405.1	(method)	405.1
Total Phosphate	(method)	365.3	(method)	365.2
Ammonia Nitrogen	(method)	350.1	(method)	350.1
Nitrate & Nitrite Nitrogen	(method)	353.2	(method)	353.1
Sulfate	(method)	300.0	(method)	300.0
Chloride	(method)	300.0	(method)	300.0
Alkalinity	(method)	310.1	(method)	310.1
Hardness	(method)	130.2	(method)	SM 2340B
Turbidity	(method)	180.1	(method)	180.1
Aluminum	3010	6010	3010	6010
Antimony	3010	6010	3010	6010
Arsenic	3020	7060	3020	7060
Barium	3010	6010	3010	6010
Beryllium	3010	6010	3010	6010
Cadmium	3010	6010	3010	6010
Calcium	3010	6010	3010	6010
Chromium	3010	6010	3010	6010

Summary of Extraction and Analytical Methods
Fall 1994
Page 2 of 2

Compounds/Analytes	Primary Laboratory		QA Laboratory	
	Extraction Method	Analytical Method	Extraction Method	Analytical Method
Cobalt	3010	6010	3010	6010
Copper	3010	6010	3010	6010
Iron	3010	6010	3010	6010
Lead	3010	7421	3020	7421
Magnesium	3010	6010	3010	6010
Manganese	3010	6010	3010	6010
Mercury	(method)	7470	(method)	7470
Nickel	3010	6010	3010	6010
Potassium	3010	6010	3010	6010
Selenium	3020	7740	3020	7740
Silver	3010	6010	3010	6010
Sodium	3010	6010	3010	6010
Thallium	3020	7841	3020	7841
Vanadium	3010	6010	3010	6010
Zinc	3010	6010	3010	6010

ns: No sample provided to laboratory
nr: Not reported
8100 mod and 8015 mod are Alaska Department of Environmental Conservation approved modifications

Appendix C

Chemical Data Tables
Spring 1995

Summary of Extraction and Analytical Methods
Spring 1995

Compounds/Analytes	Primary Laboratory		QA Laboratory	
	Extraction Method	Analytical Method	Extraction Method	Analytical Method
Volatile Organic Compounds	5030A	8260	5030	8260
Gasoline Range Organics	5030	8015 mod	5030	8015 mod
Diesel Range Organics	3510	8100 mod	3510	8100 mod
Polyaromatic Hydrocarbons	3510	8310	3510	8310
Semivolatile Organic Compds	3510	8270	3510	8270
PCBs and Pesticides	3510	8080	3510	8080
Total Recov. Pet. Hydrocarbons	(method)	418.1	(method)	418.1
Total Organic Carbon	(method)	415.1	(method)	415.1
Chemical Oxygen Demand	(method)	410.2	(method)	410.2
Biological Oxygen Demand	(method)	405.1	ns	ns
Total Phosphate	(method)	365.3	(method)	365.2
Ammonia Nitrogen	(method)	350.3	(method)	350.1
Nitrate & Nitrite Nitrogen	(method)	352.1/354.1	(method)	353.1
Sulfate	(method)	300.0	(method)	300.0
Chloride	(method)	300.0	(method)	300.0
Alkalinity	(method)	310.1	(method)	310.1
Hardness	(method)	6010A	nr	nr
Turbidity	(method)	180.1	ns	ns
Aluminum	3010A	6010A	3010	6010
Antimony	3010A	7041	3050	7041
Arsenic	3020A	7060	(method)	7061
Barium	3010A	6010A	3010	6010
Beryllium	3010A	6010A	3010	6010
Cadmium	3010A	6010A	3010	6010
Calcium	3010A	6010A	3010	6010
Chromium	3010A	6010A	3010	6010

Summary of Extraction and Analytical Methods
Spring 1995

Compounds/Analytes	Primary Laboratory		QA Laboratory	
	Extraction Method	Analytical Method	Extraction Method	Analytical Method
Cobalt	3010A	6010A	3010	6010
Copper	3010A	6010A	3010	6010
Iron	3010A	6010A	3010	6010
Lead	3010A	7421	3020	7421
Magnesium	3010A	6010A	3010	6010
Manganese	3010A	6010A	3010	6010
Mercury	(method)	7470	(method)	7470
Nickel	3010A	6010A	3010	6010
Potassium	3010A	6010A	3010	6010
Selenium	3020A	7740	(method)	7741
Silver	3010A	6010A	3010	6010
Sodium	3010A	6010A	3010	6010
Thallium	3020A	7841	3020	7841
Vanadium	3010A	6010A	3010	6010
Zinc	3010A	6010A	3010	6010

ns: No sample provided to laboratory
nr: Not reported
8100 mod and 8015 mod are Alaska Department of Environmental Conservation approved modifications

Appendix D

Quality Assurance Reports

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION LABORATORY
CORPS OF ENGINEERS
1491 N.W. GRAHAM AVENUE
TROUTDALE, OREGON 97060-9503

CENPD-ET-P-L (1110-1-8100c) 27 Feb 95

MEMORANDUM FOR: Commander, Alaska District, ATTN: CENPA-EN-G (Thomas)

SUBJECT: W.O. 95-508, Results of Chemical Analysis

Project: FT. RICHARDSON GROUNDWATER STUDY - FALL 1994
Intended Use: Site Evaluation
Source of Material: Reference Chain of Custody Records
Submitted By: CENPA-EN-G-MI
Date Sampled: 13 Sep through 20 Dec 94 Date Received: 14 Sep through 20 Dec 94
Method of Test or Specification: Reference Enclosure 1
Reference: a) DD Form 448 currently being processed
b) Original report numbers K945895K, K947288K, K947414K, A940501, A940513, A940533, A940688, A940699, A940703, A940710, A940719, A940722 and A940757 from Columbia Analytical Services (CAS), Inc., previously submitted to your office by the laboratory

1. Enclosed are results of analyses and quality assurance data for environmental samples collected from the above site. Included are:

a. Enclosure 1, Original Chemical Quality Assurance Report.

b. Enclosure 2, Original report numbers 94.04266c, 94.04266b, 94.04383, 94.04472 94.05451, and 94.05802 from NET, Inc.

c. Enclosure 3, Original CENPD-ET-P-L Sample Cooler Receipt forms.

2. If you have any questions or comments regarding the Chemical Quality Assurance Report, please contact Dr. Ajmal M. Ilias at (503) 669-0246.

3. This completes all work requested for this project.

Enclosures

for Ajmal M. Ilias
TIMOTHY J. SEEMAN
Director

Copy Furnished: CENPD-PE-GE CEMRD-ED-EC CEMP-RT

CENPD-ET-P-L (1110-1-8100c)
SUBJECT: W.O. 95-508, Results of Chemical Analysis

MFR: Some project laboratories' data of dissolved metals, diesel range organics, and semi-volatiles could not be completely evaluated due to missing internal QC data. Most project and QA data agree except for data of a few analytes of volatiles and one out of two project data of dissolved metals in one out of seven comparisons did not agree. Dissolved metal data of sample -163WA is questionable. Complete copy in office file.

CENPD-ET-P-L (95-508) 27 Feb 95

CHEMICAL QUALITY ASSURANCE REPORT

GROUNDWATER STUDY (FALL) FORT RICHARDSON 1994

1. SUMMARY:

a. Project laboratory's data are summarized in Section 6. The majority of the project laboratories' data are accepted based on acceptable internal quality control (QC), blind duplicate and QA data agreements with the following exceptions or qualifications. Methylene chloride data should be considered with caution due to its presence in trip, rinsate and laboratory blanks. VOC data of CAS report A940533 should be considered estimates based on MS/MSD recoveries failure. The project laboratory's dissolved metals data could not be completely evaluated due to missing internal QC data. No MS/MSD recoveries for DRO in four reports and TRPH in three reports were provided. Data of these, in the respective reports, could not be completely evaluated. No duplicate results for nitrate/nitrite as nitrogen was provided in CAS report A940533. Data precision of this non-metallic parameter could not be determined. The project data of dissolved metals (iron, magnesium and manganese) of sample -106WA are questionable based on disagreement with its blind duplicate and QA data (Table IV-6).

b. The comparison of the project and QA laboratories data are shown in Tables II through VI. All of the data agree with each other with the following exceptions: The methylene chloride data disagreements in tables II-e-1 is due to varying degrees of laboratory cross-contamination. The presence of dissolved solids in QA rinsate blank - 132WA and absence in project laboratory sample, Table IId-4 is attributed to use of contaminated deionized water employed to prepare the rinsate samples, due to some sort of laboratory field or laboratory cross-contamination or sample switch. 1,1,1-Trichloroethane data (one out of twelve detected analytes) does not agree with the QA data in table III-1. Project samples were analyzed passed the holding times. Some of the VOC may have escaped during storage. One (1,2-dichloroethane) out of about a dozen of detected analytes in table IV-1 did not agree. Project data are accepted based on blind duplicate agreement and acceptable internal QC data. QA laboratory's data are questionable based on surrogate recovery failure. Project and QA naphthalene data in tables III-2 (BNA) and in table VI-1 VOC naphthalene did not agree. Project data are accepted based inpart to blind duplicate data agreement (table IV-2) and acceptable internal QC data. QA data are questionable based on laboratory cross-contamination. One of two project blind duplicate data of dissolved iron, magnesium and manganese data in table IV-6 did not agree with the QA data. This data disagreement is probably due to incomplete filtration of the sample. Project data of sample -106WA (table IV-6) agree with the QA data and are comparable.

2. **BACKGROUND:** The samples were collected on September 13, 19, 20, 21, 22, 25, 26, November 8, 9, 11, 14, 15, 16, 17, 18, 29, 30, December 1, 2, and 20, 1994 and they were received by the analytical laboratories on September 14, 15, 16, 20,21, 23, 24, 27, November 10, 11, 14, 17, 18, 19, 29, 30, December 1, 2, 21, and 23 1994.

3. **OBJECTIVES:**

a. Thirty-two water samples, including four rinsate and ten trip blank samples were collected to determine the extent of chemical contamination on the site.

b. Four QA water samples, three rinsate and three trip blank samples were submitted to evaluate the project laboratory's data.

4. **PROJECT ORGANIZATION:**

a. The samples were collected by U. S. Army Corps of Engineers, Alaska District.

b. The project samples were analyzed by Columbia Analytical Services (CAS), Anchorage, Alaska and Columbia Analytical Services (CAS), Kelso, Washington.

c. The QA samples were analyzed by NET Inc., Santa Rosa, California, and their subcontractor Brelje and Race Laboratories Inc., Santa Rosa, California.

5. **ANALYTICAL REFERENCES:**

Number	Title	Date
a. SW-846, Third Edition	Test Methods for Evaluating Solid Waste	8/93
b. GRO, DRO	State of Alaska Interim TPH Methods	2/92
c. EPA 600/4-88-039	Methods for the Determination of Organic Compounds in Drinking Water	7/91
d. EPA 600/4-79-020	Method for Chemical Analysis of Water and Wastes	3/83
e. SM 182340B	Standard Method for the Examination of Water and Wastewater, 18th Edition-Hardness	1992

6. THE PROJECT LABORATORY'S DATA:

a. Volatile Organic Compounds (VOC): Up to 5 ppb of 1,2,-dichloroethene, were found in sample FRGW106WA (CAS, Inc. report A940533) and sample -127WA (CAS, Inc. report K947414K); Up to 280 ppb of toluene was detected in sample -106WA and -163WA (CAS, Inc. report A940533), sample -101WA, 161WA and -127WA (CAS, Inc. report K947414K). Benzene (up to 55 ppb) was detected in sample -106WA and -163WA in above mentioned CAS report. Ethyl benzene (up to 71 ppb) was found in sample -163WA, -101WA and -161WA (CAS, Inc. reports A940533 and A940501). Total Xylenes (up to 285 ppb) was found in samples -101WA, 161WA and 163WA (CAS, Inc. reports A940533 and A940501). Isopropylbenzene were found in samples -106WA and -161WA (CAS, Inc. report -501). n-Propylbenzene (up to 8 ppb) were found in samples -106WA, 163WA and -161WA in the above mentioned CAS, Inc. reports. 1,3,5-Trimethylbenzene and 1,2,4-Trimethylbenzene (up to 64 and 116 ppb respectively) and Naphthalene (up to 36 ppb) were found in samples -106WA, 163WA and -161WA in the above mentioned CAS, Inc. reports. 4-Isopropyltoluene (up to 5 ppb) and sec-Butylbenzene (up to 5 ppb) were detected in samples -106WA and -163WA (CAS, Inc. report A940533). Up to 61 ppb of Methylene chloride was detected in sample -105WA and 114WA (CAS, Inc. report A940533), -171WA (CAS, Inc. report -501) and sample -172WA and -173WA (CAS, Inc. report -513) and sample -131WA (CAS, Inc. report -688) and sample -181WA (CAS, Inc. report -703) except that in the last two cases it was also found in method blanks (CAS, Inc. reports -669, -688 and -703) and is most probably contributed as some sort of laboratory contamination. Carbon disulfide at 7 ppb was found in sample -293WA of CAS report A940757.

b. Semi-Volatile Organics (BNA) and Chlorinated Pesticides/PCBs (pest/PCB): Up to 23 ppb of Naphthalene and 11 ppb of 2-methyl Naphthalene were detected in sample FRGW106WA (CAS, Inc. report A940533) and only naphthalene was found in sample -101WA (CAS, Inc. report A940513) and benzoic acid (640 ppb) was detected in sample -124WA (CAS, Inc. report A940699). No pest/PCBs were detected above detection limits in any samples.

c. Gasoline Range Organics (GRO) and Diesel Range Organics (DRO): Up to 1950 ppb of GRO were detected in samples -129WA, -105WA, 106WA, 101-WA and -122WA (CAS, Inc. reports A940722, A940533 and A940501). Up to 6.8 ppm of DRO was detected in samples -108WA, -120WA, -106WA, -167WA and -163WA; -101WA and -161WA and sample -124WA (CAS, Inc. report A940722, -542, -533, -501 and -699).

d. Total Metals: Up to 151 ppm of alkaline and alkaline earth metals including aluminum and manganese were found in total metals (unfiltered water samples). Up to 221, 26, 11, 158, 95, 305, 28, 1.4, 261, 190 and 352 ppm of antimony, arsenic, cadmium, chromium, cobalt, copper, lead, mercury, nickel, vanadium and zinc were found, respectively. Beryllium, selenium, silver and thallium were not detected above detection limits in any samples.

e. Dissolved Metals: Up to 122, 1.4, 25.2, 1.4, 1.3 and 9.2 ppm of calcium, iron, magnesium, manganese, potassium and sodium were found, respectively, in the dissolved metal water samples. Up to 6, 13, 18 and 16 ppb of arsenic, chromium, copper and zinc, respectively, were detected in a few dissolved water samples and the remaining twelve out of twenty-three metals were not detected in any samples.

f. Inorganic Non-Metallic Parameters: Alkalinity as calcium carbonate (up to 400 ppm) , hardness as calcium carbonate (up to 385 ppm), total dissolved solids (TDS) (up to 426 ppm) and total sulfate (up to 18 ppm) were detected in sample 94FRGW 119WA; (CAS report A940-757), -107WA (CAS, Inc. report -533), -116WA, -117WA (CAS, Inc. report K947288K), -118WA and -165WA (CAS report -719). Nitrate/Nitrite as nitrogen (up to 2 ppm) and chloride (up to 10 ppm) were detected in samples -119WA, -107WA, -116WA, -117WA and -118WA in aforementioned reference report. In addition chloride is also detected in sample -165WA (CAS, Inc. report -719). Ammonia as nitrogen is detected at a concentration of 0.07 ppm in sample 94FRGW 119WA (CAS, Inc. report -757) and is very close to the detection limit of 0.05 ppm. Total Phosphorus (0.11 ppm) was detected in sample -119WA (CAS, Inc. report -757). BOD (18 ppm) was detected in sample -108WA (CAS, Inc. report K945985K), Turbidity was detected (up to 310 NTU) in samples -119WA, (CAS, Inc. report -757), -120WA (CAS, Inc. report -542), -107WA (CAS, Inc. report 533) and -108WA (CAS, Inc. report K945895K), -116WA and -117WA (CAS report -710) and -115WA (CAS report -703). TOC was detected (up to 2.2. ppm) in samples -116WA, -117WA (CAS, Inc. report K947288K); -118WA, -133WA and -165WA (CAS, Inc. report -719).

7. EVALUATION OF THE PROJECT LABORATORY'S DATA:

a. Surrogate Recoveries: Three, six, two, one and one surrogates similar to the analytes of interest were used in analysis of VOC, BNA, pest/PCB, GRO and DRO using EPA methods 8260, 8270, 8080 and Alaska Department of Environmental Conservation (ADEC) method 8015M and 8100M respectively. All surrogate recoveries were within the EPA, ADEC and/or LE QC limits with the following exceptions:

I. VOC and BNA: One of the three surrogate recoveries (Dibromofluorobenzene) in sample -101WA was below the EPA QC limits (and were not flagged by CAS, Inc. project laboratory). However the data are accepted based on remaining acceptable surrogate recoveries as well as all of the matrix spike recoveries. One of the six BNA surrogates 1,4,6-Tribromophenol (TBP) in sample 94FRG 119WA and Phenol D-6 (PHL) in method blank, laboratory control sample (LCS_1 and LCS_2) were below the EPA QC limits. Data are accepted based on five remaining acceptable surrogate recoveries. Three acidic out of six BNA surrogates in sample -108WA were below the EPA QC limits. Two of six surrogates (2FP and PHL) in method blank were below the EPA QC limits as well as four of six surrogates in LCS_1 and one in LCS_2 were below the EPA QC limits. Although none of the targeted analytes (BNA) were detected in sample -108WA, however, some acidic analytes, if present, in low concentrations may not have been detected. Two of six surrogate recoveries in samples -107WA and -116WA and three out of six in sample -131WA were below EPA QC limits. Normally out of control surrogates were acidic, low levels of acidic BNA analytes, if present, at low levels may not have been detected in these samples. One out of six BNA surrogates in samples -117WA and -127WA were below EPA QC limits, data are accepted based on five remaining acceptable recoveries.

II Pest/PCB: One of the two Pest/PCB surrogates (decachlorobiphenyl) in the method blank (CAS, Inc. report A940757) was above the EPA QC limit. Since no Pest/PCB targeted analytes were detected in the associated sample (94 FRGW119WA), surrogate failure in the blank is considered insignificant.

III GRO and DRO: Initial analysis of the water sample -102WA (performed on 26 Sept 1994) gave low surrogate recoveries but re-analysis on 06 Oct 1994 (9 days past holding time) gave acceptable surrogate recoveries. Since no GRO was detected in this sample the data are not adversely affected.

b. Matrix Spike (MS), Matrix Spike Duplicate (MSD) and Laboratory Control Samples (LCS) Recoveries: All MS, MSD and LCS and laboratory control sample duplicates (LCSD) recoveries were within EPA, LE or ADEC method control limits with the following exceptions:

I VOC, BNA and Pest/PCB: One out of fourteen VOC MS/MSD and LCS/LCSD recoveries in CAS, Inc. report A940722 were below LE and marginally above the EPA QC limits respectively. Eight of fourteen VOC MS/MSD recoveries in CAS report A940542 were above the EPA QC limits. The data are not affected since none of the targeted VOC analytes

were detected in associated samples of above mentioned reports. Five of fourteen VOC MS/MSD in CAS, Inc. report A940533 were above the LE QC limits while one (MSD) was below the QC limits due to matrix interference. However, all LCS/LCSD recoveries were within the LE QC limits. The data for the targeted analytes should be considered an estimate. Two of fourteen and one of fourteen VOC MS/MSD recoveries in CAS, Inc. reports A940501 and A940719 were above and below the LE QC limits respectively. The data are accepted based on remaining acceptable MS/MSD and acceptable LCS/LCSD recoveries. Five of twenty-two BNA recoveries in CAS report A940542 and two of twenty-two recoveries in CAS reports A940710 and A940703 were below the LE QC limits. Data are accepted based on remaining twenty acceptable MS/MSD recoveries. No MS/MSD recoveries were reported for samples in CAS reports A940688 and A940699, but twenty-one out of twenty-two LC/LCD recoveries were within LE QC limits and are acceptable. PCB MS recoveries for CAS report A940757 was above the LE QC limits and PCB MS/MSD recoveries in CAS reports A940533 and A940501 were below the LE QC limits, but their LCS/LCSD recoveries were within LE acceptable QC limits. Since none of the targeted PCB analytes were detected in samples referenced in these reports, the data are not adversely affected.

II. GRO, DRO and Total Recoverable Petroleum Hydrocarbons (TRPH): No DRO MS/MSD recoveries data were reported for CAS reports A940757, A940542, A940533, A940710 and A940703. However LCS/LCSD data were reported for all of the afore- mentioned reports and were within acceptable ADEC QC limits. Therefore the data , particularly in CAS reports A940542 and A940533, could not be fully evaluated since positive DRO detections were reported in the associated samples. No TRPH MS/MSD data were reported for CAS reports A940757, A940710 and A940703. Since no TRPH were detected in the associated samples, and LC/LCD recoveries were within EPA QC limits, data are accepted.

III Total Metals, Dissolved Metals and Inorganic Non-Metallic Parameters: Total or dissolved calcium MS recovery in CAS, Inc. reports A940542 and A940533, A940688, A940710 and A940719 were reported as NC (Not Calculable) for calcium since its sample concentration exceeded four times the spike level. The total and dissolved calcium data are acceptable. No dissolved metal MS data specifically for CAS, Inc. reports A940722, A940542, A940533, A940501, A940513, A940719, A940710 and A940688 were reported. No MS data for inorganic non-metallic parameters in CAS, Inc. report A9840533 were reported. Therefore the accuracy of the associated samples for dissolved metals and inorganic non-metallic parameters could not be completely evaluated.

c. Laboratory Duplicates: All relative percent difference (RPDs) results were within EPA, ADEC, and /or LE method required QC limits with the following exceptions: No RPD results were reported for inorganic non-metallic parameters for CAS, Inc. report A940533. Therefore the precision of the inorganic parameters data for this report could not be completely evaluated. Four, one and one out of eleven MS/MSD and /or LCS/LCSD RPD results for BNA in CAS reports A940542, -699 and -688, respectively, were above the EPA/LE QC limits. The data are not affected since no targeted BNA were detected in the associated samples of these reports.

d. Project Blind Duplicate Results: The project blind duplicate data are presented in Tables III through V. All data agree with the following exceptions: Project blind duplicate data for dissolved iron, magnesium and manganese do not agree with each other (Table IV-6). Based on internal QC data, this discrepancy could not be analytically resolved. It is possible that something may have happened to sample -106WA during preparation for analysis. The project blind duplicate data of 1,3,5-trimethylbenzene for samples -101WA and -161WA (Table III-d) do not agree within a factor of three but are very close to agreement within an acceptable factor of three and are considered comparable.

e. Laboratory Method, Trip and Rinsate Blanks: All of the project laboratory's method blanks were free of targeted analytes for most of the methods except that up to 3 ppb of Methylene Chloride (VOC analyte) was detected in CAS reports A940688 and -699. The level of this analyte is close to the detection limit and is therefore considered insignificant. The project trip blank data are shown in Tables I-a through I-e. Methylene chloride was reported in some trip blanks. The project rinsate blanks data are presented in Tables II-a through II-d. All were free of targeted analytes with the following exceptions. Methylene chloride was detected in rinsate blank samples -105WA, -114WA, -131WA (Tables II-a and II-b) and 1.2 ppm TOC was detected in sample -133WA (Table II-d) indicating that some sort of cross-contamination did occur during sampling, shipping or storage.

f. Sample Holding Times and Detection Limits: All holding times and detection limits met the EPA, ADEC and/or LE QC limits with the following exceptions. Sample FRGW 101WA and -161WA (CAS, Inc. report A940501) was re-analyzed for VOC four and six days past the recommended maximum holding times (CAS project laboratory believed data were not affected significantly). Sample -102WA in CAS, Inc. report A940501 was re-analyzed for GRO surrogate recovery failure past nine days of the maximum holding time expiration. Low levels of GRO may have been lost during extended storage.

g. Chain-of-Custody Records and Sample Cooler Receipt Forms: All chain-of-custody (COC) records and sample cooler receipt (SCR) forms met U.S. Army Corps of Engineers (USACE) ER 1110-1-263 regulations and are acceptable with the following exceptions: There were no SCR forms submitted with CAS report A940501. Consequently no cooler temperatures were documented. The SCR forms for CAS report K945885K and A940513 recorded temperatures of 6.8 to 11 degrees Celsius. Therefore the data of low boiling analytes of VOC and GRO in these reports may have been compromised. USACE regulation state that cooler temperatures should be maintained at 4 degrees Celsius.

h. Overall Evaluation of the Project Laboratories' Data: The majority of the project laboratories' data are accepted based on acceptable internal quality control (QC), blind duplicate and QA data agreements with the following exceptions or qualifications. Methylene chloride data should be considered with caution due to its presence in trip, rinsate and laboratory blanks. VOC data of CAS report A940533 should be considered estimates based on MS/MSD recoveries failure. The project laboratory's dissolved metals data could not be completely evaluated due to missing internal QC data. No MS/MSD recoveries for DRO in four reports and TRPH in three reports were provided. Data of these, in the respective reports, could not be completely evaluated. No duplicate results for nitrate/nitrite as nitrogen was provided in CAS report A940533. Data precision of this non-metallic parameter could not be determined. The project data of dissolved metals (iron, magnesium and manganese) of sample -106WA are questionable based on disagreement with its blind duplicate and QA data (Table IV-6).

8. EVALUATION OF THE QA LABORATORIES DATA:

a. Surrogate Recoveries: All surrogate recoveries, where applicable, were within EPA, ADEC, and/or LE QC limits and are acceptable with the following qualifiers: One of three VOC surrogates (toluene d-8) in sample 94FRGW 162WA (NET report 94.04472) was above the EPA QC limits. Therefore, the VOC data for this sample should be considered a high estimate. GRO surrogate (BFB) recovery in sample -162WA was above the ADEC QC limits. Therefore the data for this sample should be considered a high estimate.

b. MS, MSD, LCS, LCSD Recoveries and RPD Values: All of the MS, MSD, LCS, LCSD and RPDs data were within EPA, ADEC and/or LE QC limits with the following exceptions: No BNA MS/MSD data were reported in NET, Inc. report 94.04472. Therefore, the accuracy of the data for the samples in this report could not be completely evaluated. Since no BNA RPD in NET, Inc. report 94.04472 were provided the precision of the data could not also be determined. DRO MS/MSD data in NET Inc. report 94.04472 and 94.05451 were not reported. Therefore, the accuracy of the DRO data for these reports could not be completely evaluated. MS recovery

of dissolved thallium was below EPA QC limits in NET, Inc. report 94.04472, data are accepted based on acceptable MS and LC recoveries. Because of MS failure, RPD of thallium was above EPA QC limits. Since no thallium was detected, high RPD did not effect the data adversely. One of the two RPD of total iron and lead was above EPA QC limits in NET, Inc. report 94.05451. Data of these two metals in the report should be considered estimates.

c. Laboratory Method, Trip and Rinsate Blanks: All laboratory method blanks were free of targeted analytes except Methylene chloride (up to 2 ppb) and naphthalene (up to 1.5 ppb) were detected in NET, Inc. reports 94.04472, 94.05451 and 94.05802 which may be attributed to some sort of laboratory contamination. The QA trip and blanks data are presented in tables I-c through I-e. Except for methylene chloride due to laboratory contamination, no other analytes were detected in the QA trip blanks. Rinsate blanks data are shown in tables II-b through II-d. 58 ppb of methylene chloride in table II-b-1 and 6.3 ppb in table II-c-1, was detected due either to contaminated water used and/or inpart to laboratory cross-contamination. 0.3 ppb of aluminum in table II-e-5, 230 ppm of TDS in table II-d-4 and 0.1 in NTU (table II-d-5) of turbidity were found in the QA rinsates due probably to field cross-contamination.

d. Sample Holding Times and Detection Limits: All detection limits and sample holding times met the EPA, ADEC and/or LE QC method required limits for all requested methods.

e. Chain-Of-Custody Records and Sample Cooler Receipt Forms: All chain-of-custody (COC) records met the U.S. Army Corps of Engineers (USACE) ER-1110-1-263 regulations and all cooler temperatures recorded met EPA QC requirements. In NET, Inc. report 94.05451, indicates analysis of sample number MW-1 and MW-3 for TPH method 530/8015M and for BTEX method EPA 8020 but these samples could not be traced or identified in the chain-of-custody record.

f. Overall Evaluation of the QA Laboratory's Data: All data are acceptable with the following qualifications: The VOC data and GRO data for the sample 94FRGW 162WA should be considered a high estimate due to elevated surrogate recovery. The accuracy and precision of the BNA data in NET report 94.04472 could not be completely evaluated due to missing MS/MSD and RPDs data. The accuracy of DRO data in NET, Inc. reports 94.04472 and 94.05451 could not be completely evaluated due also to missing MS/MSD recoveries.

9. **COMPARISON OF THE PROJECT AND QA LABORATORIES' DATA:** The comparison of the project and QA laboratories data are shown in Tables II through VI. All of the data agree with each other with the following exceptions: The methylene chloride data

disagreements in tables II-e-1 is due to varying degrees of laboratory cross-contamination. The presence of dissolved solids in QA rinsate blank - 132WA and absence in project laboratory sample, Table IId-4 is attributed to use of contaminated deionized water employed to prepare the rinsate samples or due to some sort of laboratory or field sample switch. 1,1,1-Trichloroethane data (one out of twelve detected analytes) does not agree with the QA data. Project samples were analyzed passed the holding times. Some of the VOC may have escaped during storage. One (1,2-dichloroethane) out of about a dozen of detected analytes in table IV-1 did not agree. Project data are accepted based on blind duplicate agreement and acceptable internal QC data. QA laboratory's data are questionable based on surrogate recovery failure. Project and QA naphthalene data in tables III-2 (BNA) and in table VI-1 (VOC naphthalene) did not agree. Project data are accepted based inpart to blind duplicate data agreement (table IV-2) and acceptable internal QC data. QA data are questionable based on laboratory cross-contamination. One of two project blind duplicate data of dissolved iron, magnesium and manganese data in table IV-6 did not agree with the QA data. This data disagreement is probably due to incomplete filtration of the sample. Project data of sample -106WA (table IV-6) agree with the QA data and are comparable.

10. PROBLEMS ENCOUNTERED/CORRECTIVE ACTIONS TAKEN:

a. There were no SCR forms submitted with CAS, Inc. report A940501. Therefore no cooler temperatures were documented.

b. The SCR for CAS, Inc. reports K945885K and A940513 recorded temperature of 6.8 and 11 degrees Celsius respectively and this may have resulted in compromising some of the samples of VOC and GRO.

c. In NET, Inc. report 940545I some samples were listed as MW-1 and MW-3 for TPH method 5030/8015M and for BTEX method 8020 but could to be traced/identified in chain-of custody of this report.