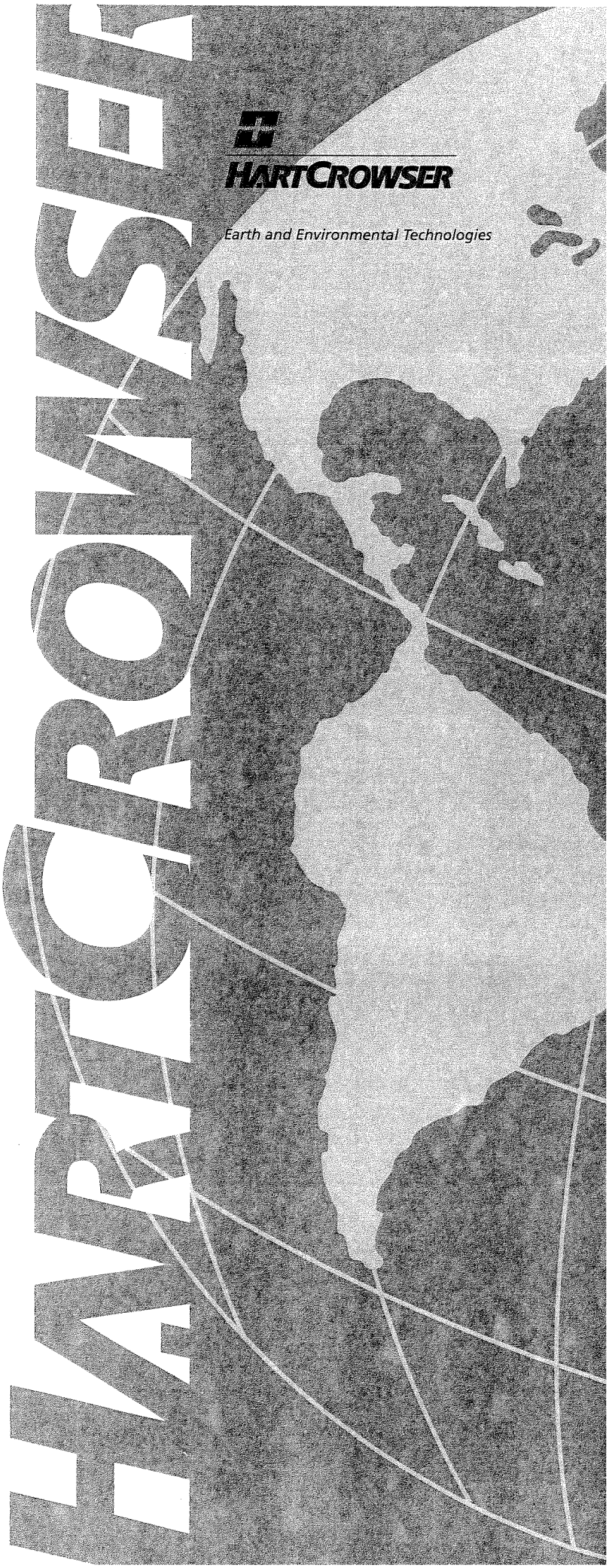


Final Report
Fall 1998 Sampling Event
Groundwater Monitoring
Investigation
Coastal Drilling Facility
Soldotna, Alaska

March 4, 1999
A-8574

CONTENTS

FINAL REPORT
FALL 1998 SAMPLING EVENT
GROUNDWATER MONITORING INVESTIGATION
COASTAL DRILLING FACILITY
SOLDOTNA, ALASKA

1.0 INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Response Program contracted Hart Crowser to perform a three-year groundwater monitoring investigation at the Coastal Drilling Facility. The purpose of the work is to further investigate possible groundwater contamination related to past maintenance and drilling support activities. The Coastal Drilling Facility is located at Mile 0.5, Kenai Spur Highway, in Soldotna, Alaska (Figure 1-1).

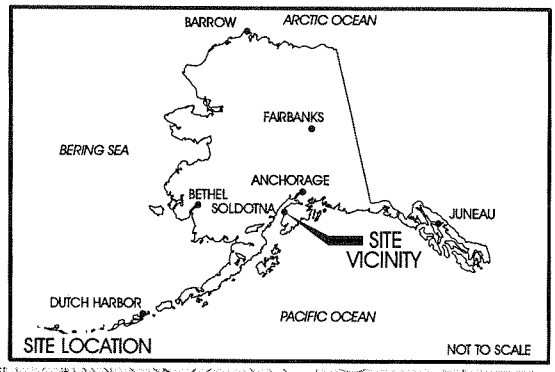
Presented in this document are the results of the Groundwater Monitoring Investigation - Fall 1998 Sampling Event completed on November 12, 1998. This report has been prepared in accordance with ADEC Contract Number ASPS No. 18-98-0135A, Notice to Proceed No. 1820121305A, and our Final Work Plan dated November 5, 1998.

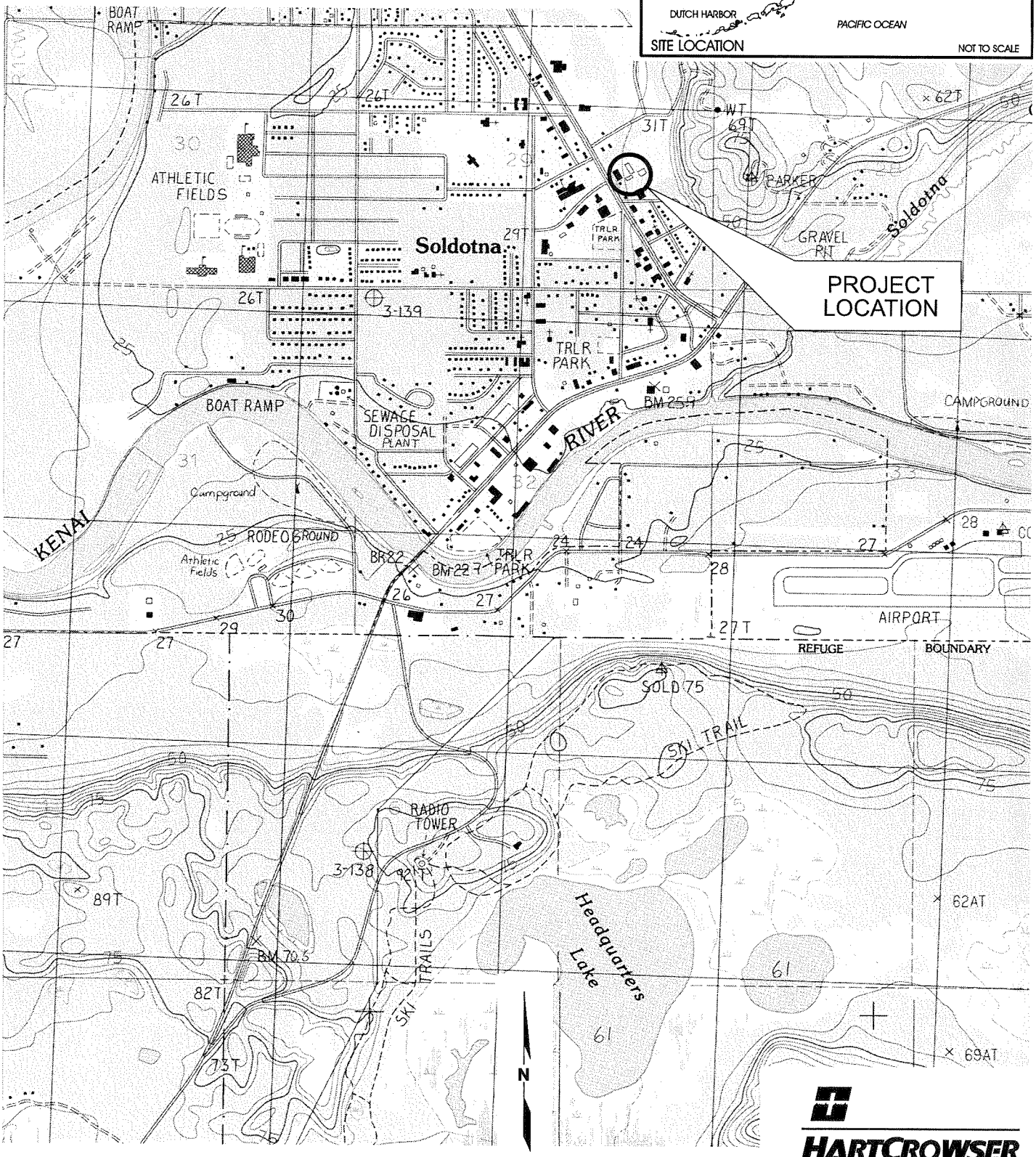
2.0 SUMMARY OF FINDINGS and RECOMMENDATIONS

The Fall 1998 sampling event initiated a three-year, semi-annual groundwater monitoring investigation to assess whether contaminants detected during previous investigations are migrating offsite and/or posing an imminent and substantial threat to the surrounding public and private drinking water wells. The site plan, with monitoring well locations, is provided on Figure 1-2.

The field effort included sampling groundwater from four selected onsite monitoring wells and an offsite drinking water well, and collecting water level measurements from the four well sampled to assess hydrologic conditions at the site. Horizontal locations and vertical reference elevations at the four sampled monitoring wells were established by a registered land surveyor. Due to unexpected conditions, several elements of the monitoring program presented in the Workplan were modified by the ADEC and Hart Crowser Project Managers.

Site Location and Vicinity Map
Coastal Drilling Facility
Soldotna, Alaska





0 2,200 4,400
APPROXIMATE SCALE IN FEET

SOURCE: USGS 1:25,000, KENAI (B-3) NW, ALASKA 1986

HARTCROWSER

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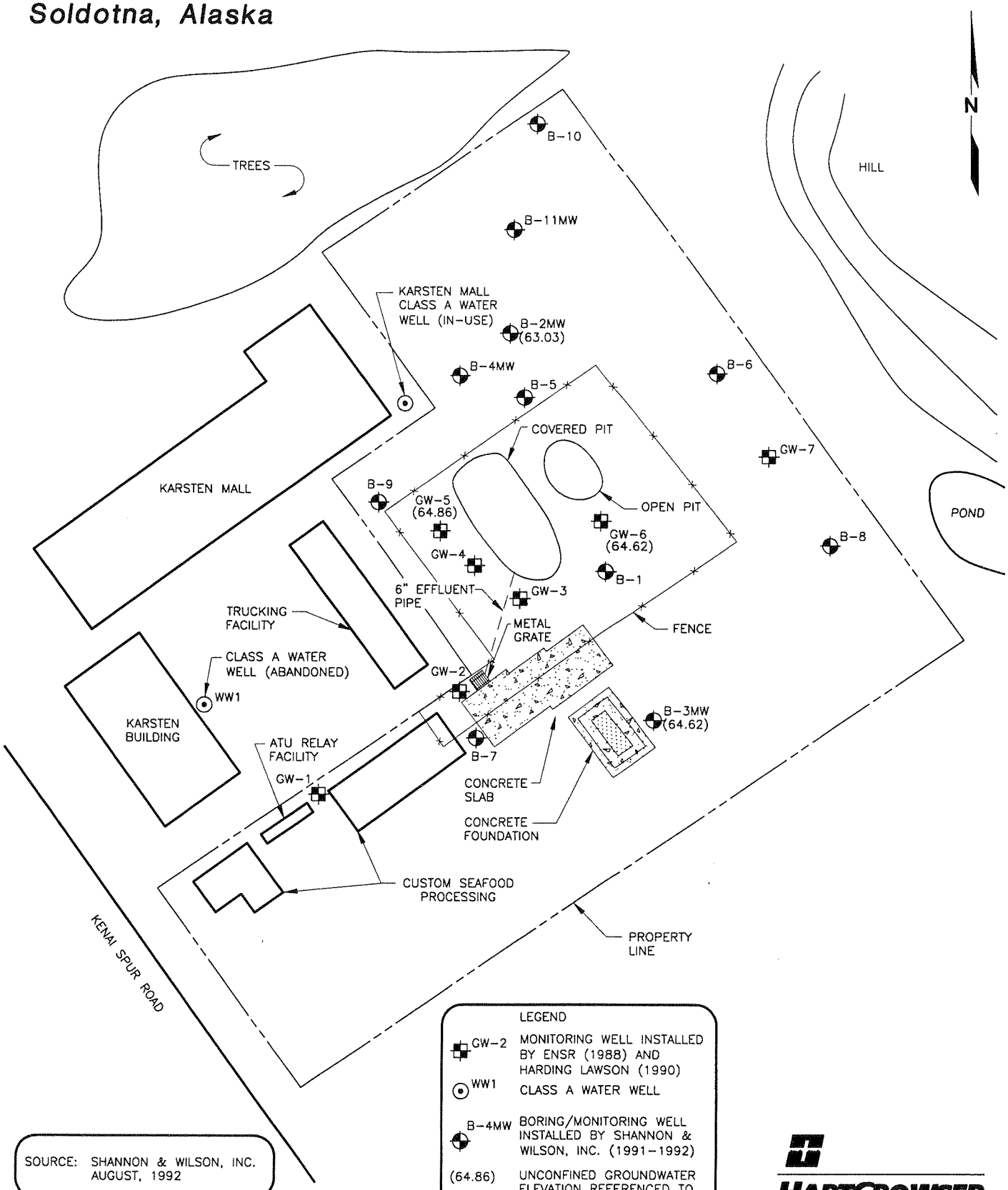
Figure 1-1

Site Plan
Coastal Drilling Facility
Soldotna, Alaska



LEGEND

GW-2	MONITORING WELL INSTALLED BY ENSR (1988) AND HARDING LAWSON (1990)
WW1	CLASS A WATER WELL
B-4MW	BORING/MONITORING WELL INSTALLED BY SHANNON & WILSON, INC. (1991-1992)
(64.86)	UNCONFINED GROUNDWATER ELEVATION REFERENCED TO AN ARBITRARY BENCHMARK OF 100 FEET PREVIOUSLY ESTABLISHED ONSITE.

SOURCE: SHANNON & WILSON, INC. AUGUST, 1992

0 100 200

Scale in Feet

BHJ 10/98 1=1 STD.PCP
558B

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A-8574 3/99

Figure 1-2

These modifications, which dealt with sampling locations, are detailed in Section 4.0. The following provides a summary of the field effort and results.

- **Hydrologic Conditions.** An unconfined and a confined aquifer exists beneath the Coast Drilling Site. A precise determination of unconfined groundwater flow direction is difficult to determine due to the limited number of data points available. Based on the four monitoring wells measurements, a northeast flow direction can be inferred. However, a possible easterly component was also noted, suggesting a the potential for some radiant flow emanating out from mounded groundwater in the central portion of the site. Unconfined groundwater elevations, referenced to a previously established, arbitrary benchmark of 100 feet, are provided on Figure 1-2.

  Based on a well log provided by the ADEC, the static water level in the Karsten Mall drinking water well, which is screened in the confined aquifer, is approximately 15 feet below ground surface (bgs). A comparison of static water levels in the unconfined and confined aquifers indicates that a fairly strong upward vertical hydraulic gradient exists in the confined aquifer at the site.

- **Confined and Unconfined Aquifer Water Quality.** Gasoline range organics (GRO), diesel range organics (DRO), benzene, ethylbenzene, toluene, and xylenes (BTEX), polychlorinated biphenyls (PCB), and dissolved lead were not detected in any of the samples. Halogenated volatile organic compounds (HVOC), and dissolved chromium and barium were not detected above regulatory limits in any of the four wells sampled onsite, or in the Karsten Mall drinking water well.

Summary and Recommendations. The groundwater quality data from this monitoring event suggests that the contaminants remaining in the ground apparently have not migrated to either the unconfined or the confined aquifers. The limited number of data points available makes a precise assessment of unconfined groundwater flow direction, and associate contaminant migration, difficult. Consequently, whether the sampled wells are in the appropriate locations to intercept potentially migrating contaminants cannot be specifically determined at this point. A more precise determination of unconfined groundwater flow, especially in relation to the contaminant source area in the vicinity of the pits, is necessary to reliably assess the potential for contaminant migration. To facilitate this, it is recommended that groundwater elevation data be collected from all site monitoring wells during the next sampling event.

3.0 BACKGROUND

Site History

The Coastal Drilling Site was developed in 1957 as a maintenance and support facility for petroleum and gas exploration in Cook Inlet. Disposal of old engines, drill rig parts, oil tanks, drums, drilling mud, used oil, and miscellaneous scrap metal, rubber, and timber is know to have occurred onsite. Two centrally-located, pits (one currently soil covered and one uncovered) were reportedly used as primary disposal sites and have been the focus of past environmental investigations. The covered pit was also reportedly used as a drain field for liquid wastes discharged into a metal grate located near a concrete slab reportedly used for vehicle and equipment washdown. The grate is connected to the pit by a 6-inch diameter steel pipe (Figure 1-2). Previous environmental investigations have encountered petroleum hydrocarbons, chlorinated solvents, and PCB in surface and subsurface soils. Low levels of aromatic hydrocarbons were previously identified in groundwater at the site. Previous investigations onsite are detailed in later in this section.

Site Description

This is an abandoned industrial site which occupies approximately 7.4 acres of land in Soldotna, Alaska. The site is located at Mile 0.5 of the Kenai Spur Highway (Section 29 of T5N, R10W, Seward Meridian, USGS Kenai (B-3) Quadrangle). The site consists of the open and covered disposal pits area, a concrete slab, a concrete foundation, and undeveloped land. The central portion of the property (around the disposal pits area) is fenced, although a portion of the fence has been knocked down. Vehicle parts and an assortment of metal and wood debris are scattered over the central portion of the site. The open disposal pit is filled with wood debris. Between 20 and 30 drums, presumably associated with previous environmental investigations, are also present on the property.

Two permanent structures exist on the site. An approximately 2,500 square foot wooden structure fronts the Kenai Spur Road. A second structure, approximately 6,000 square feet in size, is situated northwest of the first building. Both buildings are occupied by Custom Game and Seafood Processing. An ATU Communications relay antenna structure is situated between the buildings.

The areas immediately north and east of the property are vacant and undeveloped, however, residential areas lie beyond these undeveloped

portions. Light industrial and commercial businesses are located west and south. Soldotna Elementary School is located across the Kenai Spur Highway to the west.

The local surface topography is relatively flat, with a general slope toward the north and west. Hayward Hill, which is located northeast of the property, provides the highest relief in the immediate area. A gravel road runs along the base of the hill on the property's northeast boundary, and a small pond exists near the eastern margin of the property. The unoccupied areas to the north and east support native vegetation. Much of the property itself supports native vegetation. No major drainages are located in the immediate vicinity.

Site Hydrogeology

Soils encountered during previous subsurface investigation programs identified a well defined stratigraphy. The subsurface geology generally consists of a 2- to 3-foot layer of gravel fill underlain by discontinuous, layers or stringers of silt. The silt grades both vertically and horizontally into poorly sorted and typically wet silty sands and gravel with occasional cobbles. At a depth of approximately 35 to 45 feet bgs is an approximately 40-foot thick layer of blue clay. Water bearing gravel underlies the clay to an unknown depth.

Two principal groundwater systems are present in the area. An upper unconfined system is separated from a lower confined system by the approximately 40-foot thick layer of blue clay. The silt stringers result in discontinuous perched groundwater lenses above the unconfined system. Monitoring wells located onsite are screened at various depths within the perched and unconfined systems. A drinking water well located at the adjacent Karsten Mall is completed within the confined aquifer as an open casing at 73 feet bgs. The Karsten Mall well has a static water level of 15 feet. The confined aquifer supplies many of the water wells in the area, including Well A, an active, city-owned municipal water supply well located approximately 1,800 feet southwest of the Coastal Drilling Facility property.

Previous groundwater measurements made at various locations at the site suggested variable groundwater flow directions ranging from north to northwesterly within the unconfined aquifer. Determination of groundwater flow direction in previous investigations was complicated by the discontinuous nature of the perched water above the unconfined aquifer.

Previous Studies

This section discusses the previous investigations performed at the Coastal Drilling Facility site, focusing primarily on the potential for groundwater contamination.

Tryck, Nyman & Hayes, Inc., 1987. In 1987, a preliminary site assessment was performed by Tryck, Nyman & Hayes. Their report gave a general overview of the site history and documented disposal activities at the site as reported by a former Coastal Drilling employee, by a resident of Soldotna, and by the owner of Hydrotest, a company which leased building space on the property at the time. A site investigation was recommended based on the site's proximity to Soldotna drinking water wells and to the school.

ENSR, Inc., 1988. The Federal Savings and Loan Insurance Corporation contracted with ENSR to conduct an environmental site investigation at the site in 1988. ENSR used magnetometer and electromagnetic subsurface surveys and excavated 10 trench pits to evaluate the site. Three monitoring wells were also installed and sampled.

Laboratory results indicated that elevated concentrations of total petroleum hydrocarbons were present in soil samples from the two disposal pits area. Low levels of aromatic hydrocarbons were also present in the unconfined aquifer. PCBs were detected in one soil sample. ENSR suspected, but could not confirm, that contamination from the disposal pits area was migrating to surrounding undisturbed soils.

Harding Lawson Associates, Inc., 1990. In 1990, Harding Lawson Associates conducted a site investigation for the ADEC to characterize the horizontal and vertical extent of contamination, and to provide preliminary data with which to formulate a remediation plan. The project included trench excavation, soil borings, monitoring well installation and sampling, and an evaluation of onsite drums.

The investigation indicated that elevated concentrations of BTEX, total petroleum hydrocarbons (TPH), PCBs, trichloroethene (TCE), tetrachloroethene (PCE), and lead were present in soils near the metal grate and drainline, and in surface soils within the disposal pits area. Contaminants above federal drinking water maximum contaminant levels (MCLs) were not detected in groundwater samples. The concentrations of contaminants found outside the disposal pits area generally decreased with depth and with distance. The contaminants were not found to have migrated to any great extent to nearby soils or groundwater.

Based on the large head differential between perched water within the open disposal pit and groundwater levels measured in onsite monitoring wells, Harding Lawson concluded that hydraulic communication between the open disposal pit and the unconfined groundwater system was "very poor".

Max Schwenne, ADEC, 1991. A risk assessment for the site was prepared Mr. Max Schwenne for the ADEC in 1991. The risk assessment indicated that physical contact with soil posed a slight risk to human health under existing land use conditions. A higher potential risk to human health was indicated in the vent that the groundwater beneath the site should become contaminated.

Shannon & Wilson, Inc., 1991-1992. In 1991, the ADEC requested that Shannon & Wilson conduct an investigation which would further evaluate the vertical and horizontal extent of contamination at the site. Their investigation consisted of test pit excavation, installation and sampling of three monitoring wells, sampling of seven existing monitoring wells and one offsite drinking water well, and limited surface soil sampling. Shannon & Wilson continued their investigation of the site for the ADEC in 1992. Additional exploratory borings and monitoring well installations were used to further characterize the site during the 1992 work.

Shannon & Wilson concluded that the unconfined groundwater table was being recharged by surface water collecting in, and infiltrating through, the disposal pits. They also concluded that contaminants previously documented within the pits had not impacted the groundwater. In their opinion, there was a high potential that contaminants encountered onsite would eventually leach into and impact the unconfined groundwater.

Western Environmental Consultants, Inc., 1994. A corrective action plan was completed in 1994 by Western Environmental Consultants under contract to Northern Petroleum Services, Inc. A combination of soil stockpiling and stabilization, perched groundwater pre-discharge filtration, backfill, and confirmation sampling was recommended for remediation of the site. The plan has not yet been implemented.

Harding Lawson Associates, Inc., 1994. Harding Lawson Associates completed a feasibility study for the ADEC in 1994. Remedial objectives which specified contaminants of concern, potential exposure routes, and acceptable residual contaminant levels for each potential exposure route were developed. Five remedial alternatives were also developed. Each alternative was each assessed against the nine evaluation criteria developed by the Environmental Protection

Agency (EPA). Estimated costs to implement the remedial alternatives range from $190,000 to $5,850,000.

Rozack Engineering, Inc., 1995. Rozak Engineering performed additional soil borings and sampling for LandMark, Inc. (Mark Kulstad). Laboratory results indicated high concentrations of TPH and elevated barium and lead concentrations in soil collected from two of the borings.

4.0 WORK PERFORMED

Site Reconnaissance and Monitoring Well Selection

On Tuesday, October 20, 1998, Hart Crowser conducted a site reconnaissance of the property. The purpose was to locate previously installed groundwater monitoring wells and determine which were useable for the monitoring investigation. Mr. David Nyman of Restoration Science and Engineering, representing Mr. Mark Kulstad of LandMark, Inc., agent for Mr. Don Jack, the property owner, was also present during the site visit.

The site reconnaissance identified 11 groundwater monitoring wells and approximately 7 former soil boring locations. Table 4-1 provides a summary of observations for the monitoring wells. Monitoring well locations are provided on Figure 1-2. During the site visit, the existing Class A drinking water supply well at the east corner of the Karsten Mall was also located. The driller's log for that well was provided by the ADEC. The well is constructed of 6-inch diameter steel casing, 75 feet in length. Total depth is 73 feet bgs, and static water within the casing is at 15 feet bgs. Yield is approximately 60 gallons per minute.

The initial selection of four existing wells for the monitoring program was based on evaluation of location, screened interval, well casing condition, overcasing and concrete footer condition, and security.

One well situated upgradient of the disposal pits area and three wells located downgradient of the disposal pits area were selected. Based on the review of prior investigations, and our onsite inspection of the monitoring wells, the following wells were initially selected to be used for the monitoring program:

B-3MW Screened interval: 30 to 40 feet bgs. Selected as a hydraulically upgradient well.

TABLE 4-1 - MONITORING WELL SUMMARY
October 20, 1998

Monitoring Well	Total Depth[1] (feet)	Depth to Water[1] (feet)	Casing Stick-up (feet)	Screened Interval[2] (feet)	Locked or Secured?	Comments
GW-1	42.02	37.44	1.5	32 to 42	no	Intact 2-inch PVC within 6-inch steel overcasing set in concrete. Concrete has heaved, steel overcasing tilted. Locking nut broken.
GW-2	41.50	35.00	0.0	32 to 42	no	Intact 2-inch PVC within 6-inch flush-mount steel casing set in concrete, no means to lock. PVC cap in place.
GW-3	-	-	-	30 to 40	yes	Intact 2-inch PVC within 6-inch steel overcasing. Contained Well Wizard™ dedicated purging system. Access blocked.
GW-4	42.34	36.48	2.0	31 to 41	no	Intact 2-inch PVC within 6-inch steel overcasing set in concrete, lock in place but securing ring broken, PVC cap in place.
GW-5	-	-	-	30 to 40	yes	Intact 2-inch PVC within 6-inch steel overcasing. Contained Well Wizard™ dedicated purging system. Access blocked.
GW-6	41.35	36.71	1.5	31 to 41	yes	Intact 2-inch PVC within 6-inch steel overcasing set in concrete. PVC cap in place.
GW-7	36.80	32.85	2.5	24 to 34	no	Intact 2-inch PVC within 6-inch steel overcasing set in concrete, PVC cap missing.
B-2MW	47.34	40.40	2.85	34 to 44	yes	Intact 2-inch PVC within 6-inch steel overcasing. Concrete is cracked and overcasing is loose. PVC cap in place.
B-3MW	42.30	38.12	3.0	30 to 40	yes	Intact 2-inch PVC within 6-inch steel overcasing set in concrete. PVC cap in place.
B-4MW	-	-	-	32.5 to 42.5	yes	Intact 2-inch PVC within 6-inch steel overcasing. Contained Well Wizard™ dedicated purging system. Access blocked.
B-11MW	-	-	-	32 to 42	yes	Lock hasp bent over overcasing lid, access blocked.

Notes:

1 = Measured from top of PVC casing
2 = Measured from ground surface
bgs = Below ground surface

GW-5 Screened interval: 30 to 40 feet bgs. Selected as the well nearest the northwest property boundary. Contaminant migration offsite to the northwest will presumably be detected in this well first.

B-4MW Screened interval: 32.5 to 42.5 feet bgs. Selected due to its location midway between the disposal pit area and the northern property boundary and its orientation north-northwest of the disposal pit area.

B-11MW Screened interval: 32 to 42 feet bgs. Selected as the outlier or presumed downgradient sentinel well. Located almost due north of the disposal pit area near the northern property boundary.

In addition to the four monitoring wells above, the sampling program includes the existing Karsten Mall Class A drinking water well (designated KM-1).

Modifications to the Workplan

Due to unanticipated downhole conditions encountered in two of the wells, modifications to the Workplan were made in the field during the Fall 1998 sampling event (Hart Crowser, 1998). Each modification was made after consultation with, and obtaining approval from, the ADEC Project Manager, Mr. Don Seagren. The following is a summary of the nature of the problem encountered at each well, and the resulting modifications.

- **Monitoring Well B-11MW:** The well could not be accessed for inspection during the site reconnaissance due to a bent locking hasp. The hasp was repaired during the Fall 1998 sampling event. Upon inspection of the well, it was discovered that the PVC casing was broken approximately 1-foot bgs. The integrity of the well was considered to be compromised and monitoring well B-2MW was selected as a replacement.

- **Monitoring Well B-4MW:** The well could not be inspected during the site reconnaissance due to the presence of a Well Wizard™, a dedicated purge system installed during previous investigations. Upon removal of the system during the Fall 1998 sampling event, it was discovered that B-4MW did not contain groundwater. Monitoring well GW-6 was chosen as a replacement.

Groundwater Measurements

Groundwater level measurements were made in 11 accessible onsite monitoring wells during the site reconnaissance on October 20, 1998 (Table 4-1). Groundwater measurements were made during the Fall (November) 1998 sampling event in the four wells which were sampled only. Due to the presence of downhole plumbing and wiring which restricted access, groundwater

measurements were not made within the Karsten Mall drinking water well. All groundwater elevations are referenced to an arbitrary benchmark of 100 feet previously established onsite.

Groundwater Sampling

On November 12, 1998, Hart Crowser conducted the Fall 1998 sampling event. Existing monitoring wells B-2MW, B-3MW, GW-5, and GW-6, and the Karsten Mall drinking water well were sampled for analysis of GRO/BTEX, DRO, HVOC, PCBs, and dissolved metals (lead, chromium, and barium). A blind field duplicate sample was also collected at B-2MW and, in accordance with the Quality Assurance Project Plan (QAPP), was designated MW-50. Groundwater quality field parameters were measured prior to sampling. The methods used for groundwater sampling are provided in Appendix A - Field Methods. The analytical methods used were:

- GRO/ BTEX - Method AK 101/ EPA Method 8021M;
- DRO - Method AK 102;
- HVOC - EPA Method 8021;
- PCBs - EPA Method 8081; and
- Dissolved Metals (Lead, Chromium, and Barium) - EPA Method 6010.

Surveying

In order to accurately determine depth to groundwater and direction of groundwater flow, locations and measuring point elevations at each of the four monitoring well were established by Mr. Roy Whitford, a professional land surveyor. All elevational data was referenced to an arbitrary benchmark of 100 feet previously established onsite.

Investigation-Derived Waste

Investigation-derived waste (IDW), the wastes generated during the field portion of the sampling event, consisted of the following:

- Water from monitoring well purging; and
- Personal protective equipment (PPE) and general debris.

Water generated from purging was bulked in a single drum, labeled with the project number, the date, the well numbers, the designation "purge water," and a contact name and telephone number. Raven Contractors picked up and stored the drum at their facility pending laboratory results. Based on laboratory results, and with the permission of the ADEC Project Manager, Raven

Contractors disposed of the contents of the drum by pouring it onto the ground at their facility.

PPE and debris were placed in plastic bags and taped shut. The bags were placed, with permission from the Soldotna U-Haul manager Mr. Jim Raker, in the U-Haul dumpster, and ultimately, the Kenai Peninsula Borough landfill.

5.0 RESULTS

Hydrogeology

Table 5-1 presents the unconfined groundwater measurements collected at each location. Calculated groundwater elevations are provided on Table 5-1 and Figure 1-2. Based on the November 1998 groundwater level measurements at four site wells, localized groundwater flow in the unconfined aquifer can be generally inferred as trending toward the northeast. However, the data also indicates a slight component of flow to the east.

Due to the minimal number of data points available, groundwater flow inferences are considered preliminary at best. The unconfined groundwater elevation data suggests possible groundwater mounding in the vicinity of the buried pit near GW-5. Groundwater mounding may account for the multi-directional flow occurrence and could be an indication that a localized, radial groundwater flow pattern originates in that area.

Static water levels in the unconfined aquifer were, on average, 20 feet lower than the reported static water level of the confined aquifer, suggesting that a strong upward vertical gradient exists within the confined aquifer. Such a gradient significantly decreases the susceptibility of the confined aquifer to impacts associated with potential downward contaminant migration from the unconfined aquifer.

Groundwater Analytical Results

The project data quality was determined acceptable for the project needs and the data quality objectives were met. The review of the quality of the chemical data produced by MuliChem Analytical Services of Anchorage, Alaska and Renton, Washington included consideration of the following:

- Sample custody;
- Holding times;

TABLE 5-1 - PHYSICAL WELL DATA SUMMARY
November 12, 1998

Well Number	pH	Temp. ^{0}C	D.O. mg/L	Conductance uS/cm	Elevation[1] (Surface) (ft)	Elevation[1] (Casing) (ft)	Casing Stick-up (ft)	Depth to Groundwater (ft btoc)	Depth to Groundwater (ft bgs)	Elevation[1] (Groundwater) (ft)
B-2MW	7.4	4	5.2	211	100.6	103.46	2.9	40.43	37.6	63.0
B-3MW	7.3	2.7	2.08	232	99.9	102.84	2.9	38.22	35.3	64.6
GW-5	7.3	2.9	2.88	221	99.1	100.28	1.2	35.42	34.2	64.9
GW-6	7.4	3.1	3.71	239	99.7	101.42	1.7	36.80	35.1	64.6
KM-1	6.1	6.2	2.19	278	NA	NA	NA	NA	NA	NA

Notes:

1 = All elevations are referenced to an arbitrary benchmark of 100' previously established onsite

bgs = Below ground surface

btoc = Below top of PVC well casing

NA = Not available

- Method blank contamination;
- Reporting limits;
- Field and laboratory duplicate precision;
- Matrix spike and surrogate accuracy; and
- Completeness.

The analytical laboratory data including the chain of custody (COC) forms, and the internal data quality review for this sampling event are presented in Appendix B.

Table 5-2 presents a summary of the groundwater sample analytical results. The following section provides a description of the analytical results.

GRO. Concentrations of GRO above the detection limit of 100 micrograms per liter (ug/L) were not detected in the onsite wells or in the Karsten Mall drinking water well.

DRO. Concentrations of DRO above the maximum detection limit of 0.29 milligrams per liter (mg/L) were not detected in the onsite wells or in the Karsten Mall well.

BTEX. Concentrations of individual BTEX analytes above the detection limit of 0.50 ug/L were not detected in the onsite wells or in the Karsten Mall well.

HVOC. The compound 1,1-dichloroethane was detected at concentrations of 0.22 and 0.23 ug/L in the sample from monitoring well B-2MW and its duplicate (MW-50), respectively. HVOCs were not detected in any of the other wells onsite, nor were they detected in the Karsten Mall well. Based on Table C (October 10, 1998) of the ADEC's *Draft 18 AAC 75 Oil and Other Hazardous Substances Pollution Control Regulations,* the groundwater cleanup standard for 1,1-Dichloroethane is 3,650 ug/L. The concentration of the maximum detection is four orders of magnitude lower than this cleanup level.

PCB. PCBs were not detected above the detection limit of 0.94 ug/L in the onsite wells or in the Karsten Mall well.

Dissolved Metals. Barium was detected in each onsite well, and in the Karsten Mall well at concentrations which ranged from 0.017 to 0.27 mg/L. Based on Table C- Groundwater Cleanup Standards of the ADEC's *Draft 18 AAC 75 Oil and Other Hazardous Substances Pollution Control Regulations,* the groundwater cleanup standard for barium is 2.0 mg/L. The Alaska maximum contaminant level (MCL: 18 AAC 80) for barium is also 2 mg/L. The

TABLE 5-2 - ANALYTICAL WELL DATA SUMMARY
November 12, 1998

Well	GRO AK101 (ug/L)	DRO AK102 (mg/L)	BTEX (EPA 8021)				HVOC (EPA 8021) (ug/L)	PCBs (EPA 8081) (ug/L)	Dissolved Metals (EPA 6010)		
			Benzene (ug/L)	Ethylbenzene (ug/L)	Toluene (ug/L)	Xylenes (ug/L)			Lead (mg/L)	Chromium (mg/L)	Barium (mg/L)
B-2MW	ND (100)	ND (0.25)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	0.22[a]	ND (1.1)	ND (0.030)	ND (0.010)	0.040
B-2MW (duplicate)	ND (100)	ND (0.25)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	0.23[a]	ND (0.98)	ND (0.030)	0.079	0.27
B-3MW	ND (100)	ND (0.25)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (b)	ND (0.94)	ND (0.030)	ND (0.010)	0.017
GW-5	ND (100)	ND (0.29)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (b)	ND (0.97)	ND (0.030)	ND (0.010)	0.16
GW-6	ND (100)	ND (0.25)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (b)	ND (0.97)	ND (0.030)	ND (0.010)	0.019
KM-1	ND (100)	ND (0.25)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (b)	ND (0.97)	ND (0.030)	ND (0.010)	0.074
PCS	**1,300**	**1.5**	**5**	**700**	**100**	**10,000**	**3,650[a]**	**0.5**	**0.015**	**0.1**	**2.0**

Notes:

ND (0.50) = Not detected above detection limit indicated

a = 1,1-dichloroethane

b = Various detection limits. See Appendix B

PCS = Proposed State of Alaska Cleanup Standard, 18 ACC 75, Table C (10/20/98)

concentration of the maximum barium detection is two orders of magnitude lower than this cleanup level.

Chromium was detected in the duplicate collected at B-2MW (MW-50) at a concentration of 0.079 mg/L. Chromium, above the detection limit of 0.010 mg/L, was not detected in any other onsite well, nor was it detected in the Karsten Mall well. Based on Table C of the ADEC's *Draft 18 AAC 75 Oil and Other Hazardous Substances Pollution Control Regulations,* the groundwater cleanup standard for total and hexavalent chromium is 0.1 mg/L. The MCL for chromium is also 0.1 mg/L. The concentration of the chromium detection is below this cleanup level.

Lead was not detected above the detection limit of 0.03 mg/L in the onsite wells, nor was it detected in the Karsten Mall well.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Hydrogeology

- Based on available data, localized groundwater flow beneath the site is inferred as occurring in a primarily northeasterly direction. A very slight trending to the east was also noted.

- The unconfined groundwater elevation data, interpreted as is, potentially suggests that a groundwater mound exists in the vicinity of the buried pit at GW-5, and that a localized, radial groundwater flow pattern originates in that area. The data, and potential radial flow pattern, supports Shannon & Wilson's 1992 conclusion that the unconfined groundwater table is being recharged by surface water which is infiltrating preferentially through the disposal pits.

- When elevational data from the unconfined and confined aquifers are compared, it is apparent that an upward vertical gradient exists between the aquifers. Such a gradient decreases the susceptibility of the confined aquifer to impacts associated with potential downward contaminant migration from the unconfined aquifer.

- Existing groundwater flow direction inferences should be viewed as preliminary due to the minimal number of data points. Consequently, until the groundwater flow direction is established, it cannot be conclusively assumed that the monitoring wells being sampled are located in the

appropriate downgradient position to intercept any potential migrating contaminants.

Confined and Unconfined Groundwater Quality

- DRO, GRO, BTEX, PCBs, and dissolved lead were not detected either onsite or in the Karsten Mall drinking water well during this sampling event.
- HVOC were not detected above ADEC cleanup levels onsite or in the Karsten Mall well during this sampling event.
- Dissolved barium, chromium, and lead were not detected above ADEC cleanup levels onsite or in the Karsten Mall well during this sampling event.

Recommendations

A more precise determination of the unconfined groundwater flow pattern is needed to completely achieve the purpose of this investigation. The lack of a suitable number of data points for assessing groundwater flow directions is the primary concern.

Therefore, the following modifications are suggested for subsequent sampling events:

1) It is recommended that groundwater elevation data be collected at the following wells: GW-1, GW-2, GW-3, GW-4, GW-7, and B-4MW (if possible). Groundwater elevation data should also be measured at B-11MW using a suitable reference point other than the broken PVC casing.

2) In order to accurately determine depth to groundwater within these wells, these additional monitoring well locations and measuring point elevations at each should be established by a professional land surveyor.

LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work to be completed. It is intended for the exclusive use of ADEC for specific application to the project site. This report is not meant to represent a legal opinion, and no other warranty, express or implied, is made.

7.0 REFERENCES

ADEC, 1998. Draft Contaminated Sites Cleanup Standards of the 18 AAC 75 Oil and Hazardous Substances Pollution Control Regulations.

Hart Crowser, 1998. Final Work Plan For Groundwater Monitoring. Coastal Drilling Facility. Soldotna, Alaska. Prepared for Alaska Department of Environmental Conservation. November 5, 1998.

ENSR, Inc., 1988. *Property Transfer Assessment Phase II, Hayward Hill Subdivision, Soldotna, Alaska.* Prepared for the Federal Savings and Loan Insurance Corporation, November 16 1988.

Harding Lawson Associates, Inc., 1990. *Site Investigation, Coastal Drilling Salvage Site, Soldotna, Alaska* Prepared for the Alaska Department of Environmental Conservation, January 5, 1990.

Harding Lawson Associates, Inc., 1994. *Feasibility Study, Coastal Drilling Site, Soldotna, Alaska.* Prepared for the Alaska Department of Environmental Conservation, May 12, 1994.

Rozak Engineering, Inc., 1994. *Additional Site Investigation, Coastal Drilling Site, Soldotna, Alaska.* Prepared for the LandMark Company, December 9, 1994.

Schwenne, Max, 1991. *Coastal Drilling Risk Assessment.* Prepared for the Alaska Department of Environmental Conservation, November 29, 1991.

Shannon & Wilson, Inc.,1991. *Environmental Site Investigation, Coastal Drilling Facility, Soldotna, Alaska.* Prepared for the Alaska Department of Environmental Conservation, December 1991.

Shannon & Wilson, Inc., 1992. *Environmental Site Investigation, Coastal Drilling Facility, Soldotna, Alaska.* Prepared for the Alaska Department of Environmental Conservation, August 1992.

Tryck, Nyman, and Hayes, 1987. Coastal Drilling Site Assessment. Prepared for the Alaska Department of Environmental Conservation, August 4, 1987.

Western Environmental Consultants, Inc., 1994. *Corrective Action Plan, Coastal Drilling Facility, Soldotna, Alaska.* Prepared for Northern Petroleum Services/Alaska Homestead, April 13, 1994.

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APPENDIX A
FIELD METHODS

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FIELD METHODS

All field work conducted for this project was performed in accordance with 18 AAC 78, *Underground Storage Tanks.*

Monitoring Well Survey

In order to accurately assess depth to groundwater and direction of groundwater flow, the four monitoring well locations and measuring point elevations for each were established by Mr. Roy Whitford, a professional land surveyor registered in the state of Alaska.

Monitoring Well Water Level Measurements

Prior to groundwater sampling, monitoring wells were opened and the water level was measured using an electronic water level indicator. All measurements were made to the nearest 0.01 foot and referenced to the top of the PVC well casing.

Monitoring Well Sampling

After water level measurements were made, the casing volume was calculated and three casing volumes of water was purged from each well. After purging, pH, temperature, conductance, and dissolved oxygen were measured. Samples were collected using single-use disposable bailers. Samples for analysis of volatile analytes were collected first, followed by samples for non-volatile analytes. Dissolved metals samples were field-filtered using a peristaltic or similar pump and a 0.45 micron filter. Immediately after collection, the samples were labeled and placed in a cooler with "blue-ice" for delivery to the laboratory under chain of custody procedures. A trip blank accompanied each cooler containing BTEX, GRO, and HVO samples.

One blind duplicate sample (one per every 10 samples) was collected and submitted to the laboratory for analysis. In accordance with the QAPP, the duplicate was labeled MW-50. A notation in the field notes clearly indicated the location from which the duplicate was collected.

Sample Numbering System

Groundwater samples were labeled with the name of the monitoring well and included the date, the time of sampling, and the sampler's initials. The duplicate groundwater sample was labeled MW-50.

Field Documentation Procedures

The Hart Crowser field representative maintained a record of field activities in a logbook and on standard chain of custody forms. All field log book entries were dated and signed. Activities and observations noted in the log book or field report form included weather, sampling observations, deviations from the Workplan, development amounts and water quality measurements.

Decontamination Procedures

All sampling equipment was designed for one-time use and decontamination was not necessary.

Investigation-Derived Wastes

Investigation-derived waste (IDW), the wastes generated during the field portion of the sampling event, consisted of the following:

- Water from monitoring well purging; and
- Personal protective equipment (PPE) and general debris.

Water generated from purging was bulked in a single drum, labeled with the project number, the date, the well numbers, the designation "purge water," and a contact name and telephone number. Raven Contractors picked up and stored the drum pending laboratory results. Based on laboratory results, Raven Contractors disposed of the contents of the drum on the ground at their facility.

PPE and debris was placed in plastic bags and taped shut. The bags were disposed of, with permission from the Soldotna U-Haul manager Mr. Jim Raker, in the U-Haul dumpster, and ultimately, the Kenai Borough landfill.