ADEC
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NAVFAC
Naval Facilities Engineering Command

FINAL
AUGUST 2006

Decision Document
SWMU 62,
New Housing Fuel Leak Site

Former Adak Naval Complex
Adak, Alaska

ADEC Database Record Key 198925X906701

Department of the Navy
Naval Facilities Engineering Command Northwest
1101 Tautog Circle
Silverdale, WA 98315

Alaska Department of Environmental Conservation
555 Cordova St
Anchorage, AK 99502

FINAL DECISION DOCUMENT
SWMU 62, NEW HOUSING FUEL LEAK
FORMER ADAK NAVAL COMPLEX
ADAK ISLAND, ALASKA

COVER SHEET AND SIGNATURE PAGE

SITE NAME: Solid Waste Management Unit (SWMU) 62, New Housing Fuel Leak

ALASKA DEC DATABASE RECORD KEY: 198925X906701

ALASKA DEC REGULATORY AUTHORITY: Oil and Other Hazardous Substances Pollution Control (18 AAC 75, Article 3)

RESPONSIBLE PARTY: Department of the Navy
BRAC Program
Management Office, West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310

CHEMICALS OF POTENTIAL CONCERN/MEDIA IMPACTED:

Soil: Petroleum hydrocarbons
Groundwater: Petroleum hydrocarbons, semivolatile organic compounds (SVOCs), and volatile organic compounds (VOCs)
Surface Water: Petroleum hydrocarbons and VOCs
Sediment: Petroleum hydrocarbons and SVOCs

ON-SITE CONTAMINANT CONCENTRATIONS:

Diesel-range organics (DRO) were detected in surface soil at concentrations greater than the alternative cleanup levels (ACLs), which were calculated using Alaska Department of Environmental Conservation (DEC) Method Four [18 Alaska Administrative Code (AAC) 75.340(a)(4)]. The maximum and minimum detected concentrations of DRO in surface soil are provided in Table 1. Benzene, DRO, ethylbenzene, GRO, and toluene were detected at concentrations greater than the tabulated groundwater cleanup levels [18 AAC 75.345(a)(1), Table C]. The maximum and minimum detected concentrations for these chemicals in groundwater are provided in Table 2. The human health risk assessment for this site established that the existing concentrations in surface water and sediment do not pose an unacceptable risk to humans. In addition, the ecological risk assessment established that no ecological threat exists for any ecological receptor from petroleum hydrocarbons released at the SWMU 62, New Housing Fuel Leak site. Therefore, no cleanup levels were established for surface water and sediment, and contaminant concentrations for these media are not included in the table below.

Table 1
Concentrations of Chemicals Exceeding ACLs in Surface Soil

Chemical	Surface Soil	
	Min. Conc. (mg/kg)	Max. Conc. (mg/kg)
DRO	6.2	17,000 J

Notes:
conc. - concentration
DRO - diesel-range organics
J - estimated value
max. - maximum
mg/kg - milligram per kilogram
min. - minimum

Table 2
Concentrations of Chemicals Exceeding the Tabulated Groundwater Cleanup Levels

Chemical	Groundwater	
	Min. Conc. (µg/L)	Max. Conc. (µg/L)
Benzene	0.337	250
Ethylbenzene	0.54	2,600
Toluene	0.5	5,690
DRO	135	3,150,000 J
GRO	6.1 J	44,100

Notes:
conc. - concentration
DRO - diesel-range organics
GRO - gasoline-range organics
J - estimated value
max. - maximum
µg/L - microgram per liter
min. - minimum

CLEANUP LEVELS:

Soil: Cleanup levels specified for soil are based on Alaska DEC Method Four criteria [18 AAC 75.340(a)(4)], which uses site-specific risk assessments to establish ACLs. The ACL for soils at the SWMU 62, New Housing Fuel Leak site is:

- DRO 6,111 milligrams per kilogram (mg/kg)

Groundwater: Cleanup levels are based on the tabulated groundwater cleanup levels [18 AAC 75.345(a)(1), Table C] because groundwater is a potential future source of drinking water. The groundwater cleanup levels for the SWMU 62, New Housing Fuel Leak site are:

- Benzene 5 µg/L (0.005 mg/L)
- Ethylbenzene 700 µg/L (0.7 mg/L)

- Toluene 1,000 µg/L (1 mg/L)
- DRO 1,500 µg/L (1.5 mg/L)
- GRO 1,300 µg/L (1.3 mg/L)

Surface Water and Sediment: The human health risk assessment for this site established that the existing concentrations in surface water and sediment do not pose an unacceptable risk to humans. In addition, the ecological risk assessment established that no ecological threat exists for any ecological receptor from petroleum hydrocarbons released at the SWMU 62, New Housing Fuel Leak site. Therefore, no risk-based cleanup levels were calculated for surface water or sediment at the site and no cleanup is necessary.

CLEANUP REMEDY:

Alternative 2–Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and Monitored Natural Attenuation (MNA) for Groundwater–is selected as the remedial alternative for the SWMU 62, New Housing Fuel Leak site. A free-product collection/containment trench will be installed to prevent migration of free-phase product to surface water, thus eliminating the source of the sheen to East Canal. Four new wells will be installed, and free-phase product will be removed from the new wells and existing site wells using automated passive skimmers, passive skimmers, and/or sorbent socks. Surface soil in Sandy Cove Housing 102, 107, and 146 Area with detected concentrations exceeding the ACLs will be excavated and treated. Petroleum concentrations in groundwater will be reduced through natural attenuation. Finally, institutional controls will be used to protect human health and the environment until groundwater no longer exceeds Alaska DEC groundwater cleanup levels and surface water no longer exceeds the Alaska DEC Water Quality Standard for sheen (URS 2005a).

REVIEW OF CLEANUP ACTION AFTER SITE CLOSURE:

Under 18 AAC 75.380(d)(1), the Alaska DEC may require the Navy to perform additional cleanup if new information is discovered which leads Alaska DEC to make a determination that the cleanup described in this decision document is not protective of human health, safety, and welfare or the environment, or if new information becomes available which indicates the presence of previously undiscovered contamination or exposure routes related to Navy activities.

ACCEPTANCE BY PARTIES:

The State of Alaska and the Navy have agreed to the decisions outlined in this document.

8/22/06

Ted P. Jones, P.E.
Adak BRAC Environmental Coordinator
U.S. Navy, Naval Facilities Engineering
Command Northwest

Date

Aug. 16 2006

Jennifer Roberts
Federal Facilities Restoration Program Manager
Alaska Department of Environmental Conservation

Date

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ABBREVIATIONS AND ACRONYMS

AAC	Alaska Administrative Code
ACL	alternative cleanup level
ARAR	applicable or relevant and appropriate requirements
ARC	Adak Reuse Corporation
AST	aboveground storage tank
avgas	aviation gasoline
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
bws	below water surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COPC	chemicals of potential concern
CR	cancer risk
CSM	conceptual site model
cy	cubic yards
DD	decision document
DEC	Department of Environmental Conservation
DO	dissolved oxygen
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentrations
FFA	Federal Facilities Agreement
FFS	focused feasibility study
ft^2	square feet
GRO	gasoline-range organics
GW	groundwater
HI	hazard index
ICMP	institutional control management plan
J	estimated value
JP	jet petroleum
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/L	milligram per liter
MLLW	mean lower low water
MNA	monitored natural attenuation
Navy	U.S. Navy
NMCB	Naval Mobile Construction Battalion
NPDES	National Pollution Discharge Elimination System

ABBREVIATIONS AND ACRONYMS (Continued)

NPL	National Priorities List
O&M	operation and maintenance
ORP	oxidation-reduction potential
OU	operable unit
PAH	polycyclic aromatic hydrocarbons
PVC	polyvinyl chloride
RAB	Restoration Advisory Board
RAO	remedial action objectives
RCRA	Resource Conservation Recovery Act
ROD	Record of Decision
RRO	residual-range organics
SAERA	State-Adak Environmental Restoration Agreement
SARA	Superfund Amendments and Reauthorization Act of 1986
SOP	standard operating procedures
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TAC	The Aleut Corporation
TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
TPH	total petroleum hydrocarbons
UST	underground storage tank
VOC	volatile organic compound

DECLARATION

1.0 INTRODUCTION

This decision document (DD) presents the selected cleanup alternative and the supporting rationale for cleanup of the Solid Waste Management Unit (SWMU) 62, New Housing Fuel Leak site at the former Adak Naval Complex, Adak Island, Alaska. The decisions documented in this DD are based on supporting documents in the Administrative Record located at the offices of Naval Facilities Engineering Command Northwest in Silverdale, Washington. The State of Alaska and U.S. Navy (Navy) have agreed to the decisions outlined in this document. Also, The Aleut Corporation (TAC), the current property owner, has concurred with the selected cleanup alternative. The Navy is responsible for implementing the cleanup alternative presented in this DD.

The former Adak Naval Complex is located on Adak Island, which is approximately 1,200 air miles southwest of Anchorage, Alaska, in the Aleutian Island chain (Figure 1-1). Figure 1-2 shows the general location of the SWMU 62, New Housing Fuel Leak site. A legal description specifying the boundary of the site is included as Appendix A. A site map showing the legal boundary of the SWMU 62, New Housing Fuel Leak site is also provided (Figure 1-3). The legal boundary was developed for land transfer purposes and does not necessarily correspond with the extent of contamination.

Alternative 2–Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and Monitored Natural Attenuation (MNA) for Groundwater–is selected as the remedial alternative for the SWMU 62, New Housing Fuel Leak site. The selected cleanup alternative for the SWMU 62, New Housing Fuel Leak site is discussed in more detail in Section 9.

This DD was developed in accordance with State of Alaska regulations governing petroleum-release sites, the Alaska Department of Environmental Conservation (DEC) Oil and Other Hazardous Substances Pollution Control Regulations (18 Alaska Administrative Code [AAC] Chapter 75). Other regulatory requirements applicable to the implementation of the selected cleanup alternative are provided in Section 10.

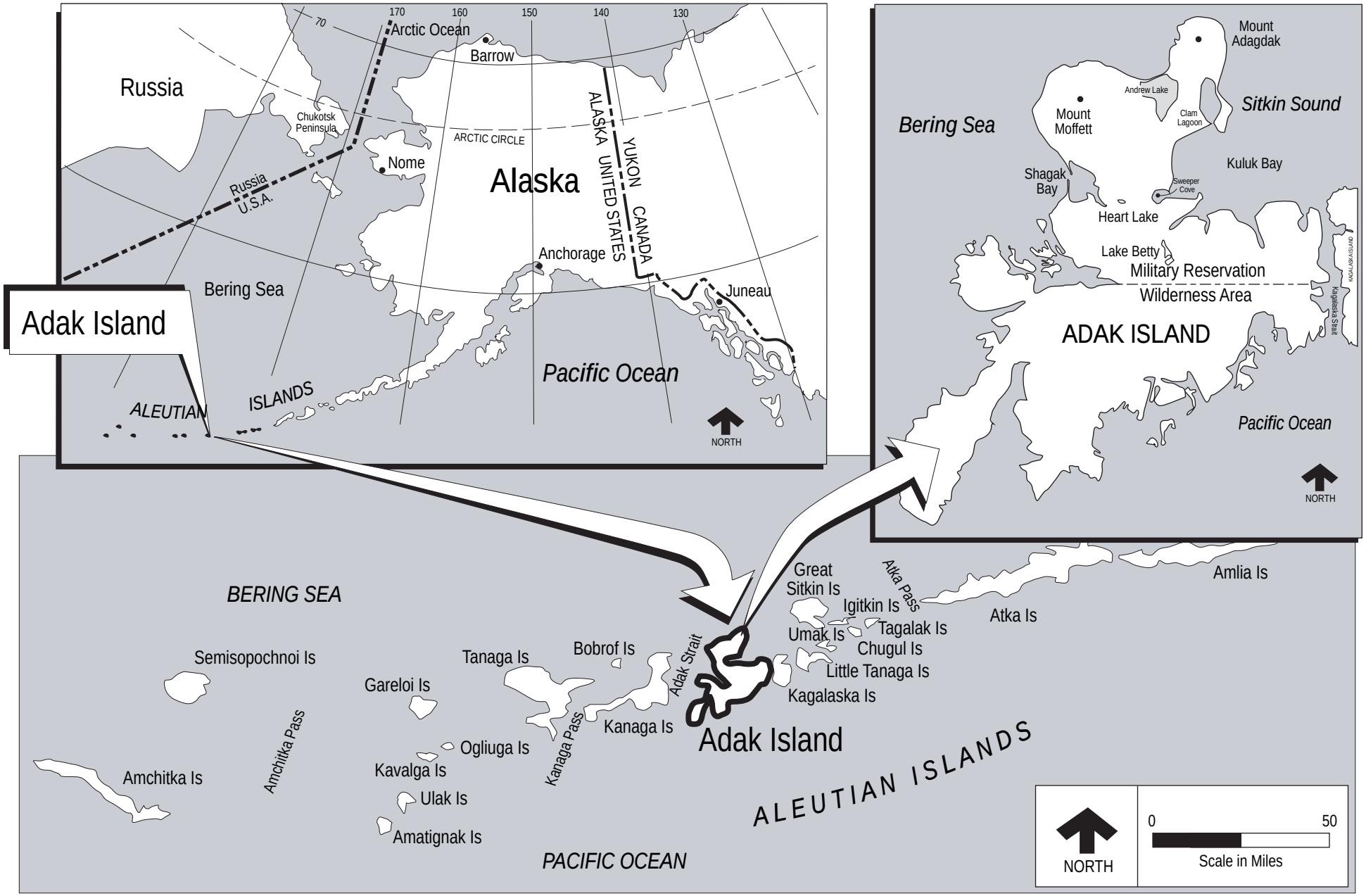

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Figure 1-1
Adak Island Vicinity

Adak Island, AK
DECISION DOCUMENT

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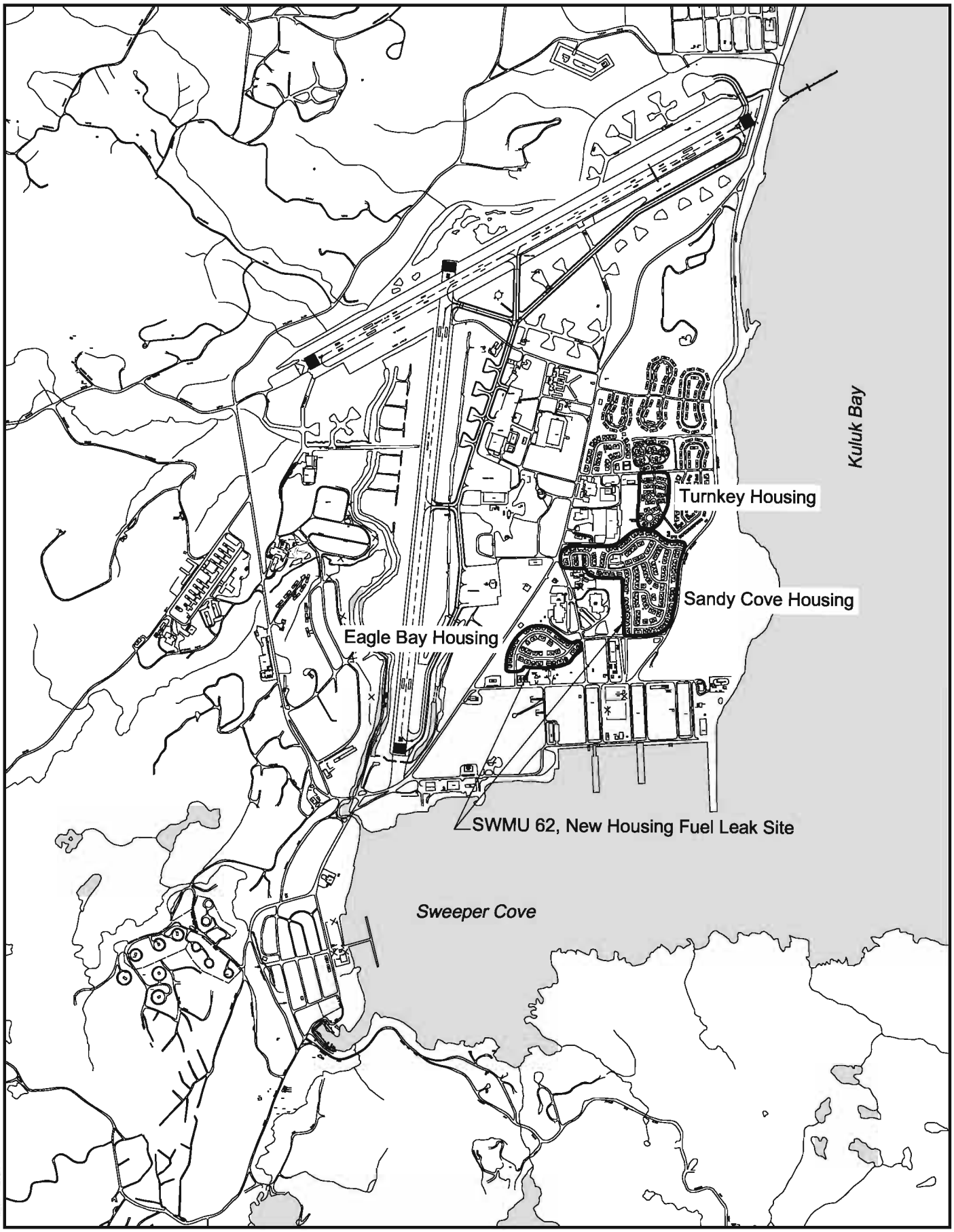

FILENAME: T:\ADAK\DIQ\Sub-Tasks\DO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 1-2 SITE LOC.dwg
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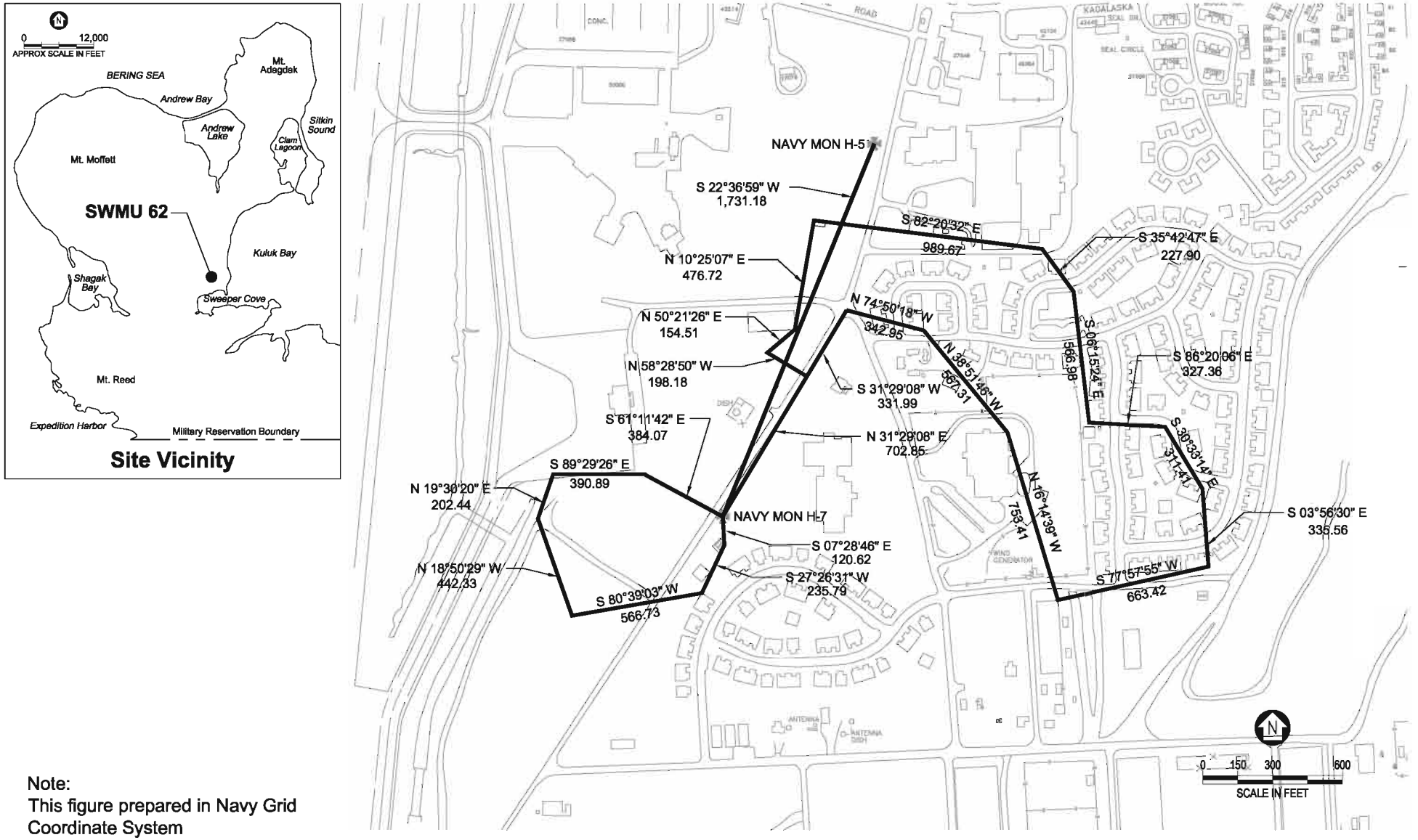
U.S. NAVY	N 0 500 1,000 2,000 SCALE IN FEET	**Figure 1-2** **Site Location** **SWMU 62, New Housing Fuel Leak Site**	Adak Island, AK DECISION DOCUMENT



Note:
This figure prepared in Navy Grid Coordinate System

Scale as Shown	**Figure 1-3** **Legal Boundaries,** **SWMU 62, New Housing Fuel Leak Site**	Adak Island, AK DECISION DOCUMENT

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2.0 BACKGROUND

General background information for the SWMU 62, New Housing Fuel Leak site is provided in this section. Additional information for the SWMU 62, New Housing Fuel Leak site is provided in the focused feasibility study (FFS) report (URS 2005a).

2.1 SITE HISTORY

Military presence on Adak began in 1942 with its occupation as a staging area to mount a counter-offensive to dislodge the Japanese from Attu and Kiska Islands. The Navy presence at Adak was officially recognized by Public Land Order 1949, dated August 19, 1959, which withdrew the northern portion of Adak Island, comprising approximately 76,800 acres, for use by the Navy for military purposes. The Navy also used the base to conduct a variety of Cold War-era military activities. Naval Air Facility Adak was on the list of Department of Defense installations recommended for closure in 1995, and that recommendation became final when Congress did not disapprove the list. The active Navy mission ceased, and the base operationally closed on March 31, 1997.

From April 1997 through September 2000, critical facilities such as the power plant, airfield, and environmental cleanup systems were operated by the Navy through a caretaker contractor. In June 1998, the Navy entered into a lease with the Adak Reuse Corporation (ARC), the designated local redevelopment authority that authorized ARC to use or sublease property in the developed core of the military reservation for commercial reuse purposes. In October 2000, ARC commenced operation of community facilities such as the airfield and utility systems in support of reuse activities under the authority of this lease.

In September 2000, the federal government entered into a land transfer agreement with TAC, a Native corporation, as documented in the Agreement Concerning the Conveyance of Property at the Adak Naval Complex, Adak, Alaska. This agreement set forth the terms and conditions for the conveyance of approximately 47,000 acres of the former Adak Naval Complex property to TAC. The actual conveyance or transfer of property occurred on March 17, 2004. The land transfer included all of the downtown area, housing units, and industrial facilities. Excluded from this transfer were any offshore islands, islets, rocks, reefs, and spires; those fixtures and equipment owned by the United States and associated with the airfield; those improvements owned by the United States and managed by the Federal Aviation Administration (FAA); and those improvements owned by the United States and managed by the Fish and Wildlife Service. TAC transferred the portion of the former Naval Air Facility known as Adak Airport and associated facilities and aviation easements, not including FAA navigation aids or weather

reporting equipment, to the State of Alaska. As a result of the land transfer agreement, TAC owns the SWMU 62, New Housing Fuel Leak site.

The transferred land has institutional controls currently in place as specified in the Interim Conveyance document. The institutional controls that have been implemented at the former Adak Naval Complex through the final institutional control management plan (ICMP) (U.S. Navy 2004) include:

1. Land use restrictions, primarily limited to areas designated for commercial or industrial use

2. Notification to the Navy of intrusive soil excavation activities deeper than 2 feet

3. Groundwater restrictions that prohibit use of the downtown aquifer as a drinking water resource

These institutional controls are discussed in more detail in Section 2.7.

2.1.1 Site Regulatory History

Investigation and cleanup of petroleum-contaminated sites at the former Adak Naval Complex have been ongoing since 1986. Adak was initially proposed for placement on the National Priorities List (NPL) in 1992 and was officially listed in 1994. The Navy, as lead agency, entered into a three-party Federal Facilities Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) and Alaska DEC as well as a two-party State-Adak Environmental Restoration Agreement (SAERA) with the Alaska DEC to facilitate investigation and cleanup activities.

In 1993, the Navy, EPA, and Alaska DEC signed the FFA, which incorporates the EPA's cleanup process under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The CERCLA exclusion of petroleum as a hazardous substance required that cleanup of petroleum-related chemicals would follow State of Alaska regulations. Therefore, the FFA stated that petroleum-contaminated sites, such as those containing underground storage tanks (USTs) and leaking underground fuel lines, would be evaluated under a separate two-party agreement between the Navy and the State of Alaska. This agreement, the SAERA, was signed in April 1994.

The former Adak Naval Complex was divided into two operable units (OU), OU A and OU B, for investigation and cleanup activities. OU A includes CERCLA and petroleum sites, and OU B includes ordnance explosive sites. A total of 180 sites were evaluated within OU A. The

FFA listed 84 CERCLA sites, and the SAERA listed 128 petroleum sites. The number of CERCLA sites plus the number of petroleum sites is greater than 180, because some sites that were originally listed as CERCLA sites were evaluated under SAERA and some sites were evaluated under both CERCLA and SAERA. In May 1997, the Navy and Alaska DEC agreed to integrate the cleanup decision process for petroleum sites with the cleanup decision process being conducted for hazardous substance release sites under CERCLA. As a result, the Record of Decision (ROD) for OU A was prepared for both the petroleum-contaminated sites and the hazardous-substance-release sites. The ROD was signed by the Navy, the EPA, and the Alaska DEC in 2000.

The OU A ROD selected final or interim remedies for each of the 128 petroleum-contaminated sites identified on Adak Island. The interim remedy, free-product recovery, was selected for 14 sites that contained measurable quantities of free-phase petroleum product. In addition, the OU A ROD specified that these 14 sites would require future remedy selection pursuant to the two-party SAERA. To clarify regulatory authority, the OU A ROD was amended in 2003 to remove these petroleum sites and 48 others with further action from CERCLA authority. Therefore, final remedies for the 14 petroleum-contaminated sites will be selected in accordance with Alaska State regulation 18 AAC 75.325 through AAC 75.390 which provides the regulatory procedures and requirements for petroleum cleanup decisions.

This DD addresses one of the 14 free-product recovery sites. The 10 sites where the remaining petroleum-related chemicals pose no risk to human health or the environment above target health goals, provided that institutional controls remain in effect, were previously addressed in a separate DD (U.S. Navy and ADEC 2005b). This site is one of the three sites where petroleum-related chemicals pose a potential risk to human health or the environment above target health goals. The other two sites (the Naval Mobile Construction Battalion [NMCB] Building T-1416 Expanded Area and the South of Runway 18-36 Area and will be addressed in separate DDs. The NMCB Building T-1416 Expanded Area DD will be executed in 2006. The South of Runway 18-36 Area DD will be issued later in 2006. The SWMU 17 Power Plant No. 3 site was originally included as one of the sites where petroleum-related chemicals pose a potential risk to human health or the environment above target health goals, because the initial draft FFS prepared in August 2004 (using information current through November 2002) concluded that contaminants in sediment in Yakutat Creek posed a potential unacceptable risk. Because risks were only slightly above target health goals, the data used to evaluate the ecological risk were more than 6 years old, and samples were collected before the upgradient contaminant sources were remediated, the Navy performed additional sediment sampling in Yakutat Creek in June 2005. Risks were recalculated using the additional data. As a result, the revised risk assessment concluded that contaminants in Yakutat Creek are unlikely to pose a significant risk. The SWMU 17 Power Plant No. 3 site DD will be issued in a separate DD based on these conclusions later in 2006.

2.1.2 Site Release History

During 1988 and 1989, the Navy conducted inventory record reviews and visual site inspections in housing units and crawl spaces after occupants reported hydrocarbon-like odors. Five leaks in the heating fuel piping were discovered and repaired. The heating fuel distribution system was subsequently pressure-tested to assess the extent of potential releases. Sixteen additional piping leaks were detected and repaired as a result of pressure testing; 13 in Sandy Cove Housing, 2 in Eagle Bay Housing, and 1 in Turnkey Housing (GeoEngineers 1990). Figure 2-1 shows the 14 housing units where the 21 piping leaks were identified during inspections and pressure testing. The volume of fuel released to the environment from the heating fuel distribution system at the SWMU 62, New Housing Fuel Leak site has not been determined. Based on these findings, further investigation of the identified releases was undertaken.

Fuel-oil burning furnaces and water heaters located in each housing unit provide heating for living space and water, respectively. Jet petroleum (JP)-5 was formerly distributed from large above-ground storage tanks (ASTs) to individual housing units by underground iron piping coated with polyvinyl chloride (PVC). Figure 2-2 shows the location of the major fuel distribution pipelines in the vicinity of the SWMU 62, New Housing Fuel Leak site. These pipelines include an aviation gasoline (avgas) distribution system formerly used to provide fuel to truck fill stands along the airfield, as well as the primary JP-5 pipelines and associated ASTs that stored fuel for distribution to the individual housing units. Fuel for the SWMU 62, New Housing Fuel Leak site was stored as follows (EMCON 1994):

- For Sandy Cove Housing, two 30,000-gallon ASTs constructed on raised earthen pads at the junction of Raven Street and Bayshore Highway

- For Eagle Bay Housing, two 12,000-gallon ASTs constructed on raised earthen pads located along Main Road approximately 400 feet southwest of the High School

- For Turnkey Housing, two 37,000-gallon ASTs constructed on raised earthen pads located north of Kagalaska Drive northwest of Turnkey Housing

The piping that distributed fuel to the individual housing units consisted of 2-inch-diameter main trunk-line piping connected to 0.75- or 1-inch-diameter lateral lines to the duplexes, triplexes and four-plexes. A 0.5-inch-diameter copper pipe supplied fuel from the lateral lines to individual units. These smaller diameter pipelines are not shown on Figure 2-2. The fuel distribution system was designed to provide fuel to the housing units under gravity flow. However, booster pumps reportedly were installed to increase fuel flow to housing units near the end of the distribution system (GeoEngineers 1990).

2.2 PHYSICAL CHARACTERISTICS

Adak Island experiences a polar maritime climate characterized by persistently overcast skies, high winds, frequent and often violent storms, and a narrow range of temperature fluctuation throughout the year. The average total annual precipitation for Adak Island is about 60 inches, most of which falls as rain in the lower elevations. Average monthly precipitation varies from a low of about 3 inches during June and July to a high of 7 to 8 inches during November and December. Snowfall averages over 100 inches a year at sea level.

The SWMU 62, New Housing Fuel Leak site is located in the downtown area of Adak Island, east of Runway 18-36, north of Public Works Road, west of Bayshore Highway, and south of Kagalaska Drive (Figure 2-2). The SWMU 62, New Housing Fuel Leak site consists primarily of personnel housing units and includes Sandy Cove Housing (88 units), Eagle Bay Housing (33 units), and Turnkey Housing (15 units). Each unit contains between two to four individual townhouses. Turnkey and Eagle Bay Housing are no longer occupied. These housing areas occupy an area of approximately 100 acres that includes open areas between the separate housing complexes. Two school buildings, their associated play yards, and miscellaneous public facilities are adjacent to the SWMU 62, New Housing Fuel Leak site, but are not included as part of the site itself.

Ground surface surrounding the housing units at SWMU 62, New Housing Fuel Leak site consists of grass-covered residential lawns, paved streets, sidewalks, and driveways. The general topography of the site is flat to slightly undulating, with surface drainage predominantly collected and discharged to surface water bodies by ditches and the storm sewer system. Ground surface elevations in this area are generally about 24 to 30 feet above mean lower low water (MLLW). The regional topography in the vicinity of the site typically slopes gently downward toward the west and southwest. However, the topography in the northeast portion of the Sandy Cove Housing and Turnkey Housing areas slopes downward toward the northeast.

Prior to the military use of Adak Island during World War II, the western portion of the downtown area was occupied by a back-beach lagoon. The lagoon was separated from Kuluk Bay by a series of sand dunes located in the eastern portion of the downtown area, a portion of which is currently occupied by the SWMU 62, New Housing Fuel Leak site. Aerial photos of Adak Island taken prior to the arrival of military forces indicate the presence of small lakes or ponds within low-lying areas between the dunes. The lagoon was filled with sand and rock by the military forces to construct the airfield. The site occupied by the SWMU 62, New Housing Fuel Leak site was the source of a substantial portion of the fill material placed into the lagoon. The low-lying areas containing small lakes or ponds within the boundaries of the SWMU 62, New Housing Fuel Leak site were also filled as military construction progressed.

Groundwater is found as both a perched (laterally discontinuous) and a regional aquifer beneath the SWMU 62, New Housing Fuel Leak site. Perched groundwater occurs approximately 8 to 12 feet below ground surface (bgs) beneath Sandy Cove and Turnkey Housing. This perched groundwater collects on top of the lower permeability, organic-rich silt layers believed to represent bottom sediments deposited within small lakes or ponds formerly located at the site. Boring logs from investigations conducted in the area indicate that perched water-bearing zones are less prevalent beneath Eagle Bay Housing (URSG 1999a). Below the perched water zone, the regional aquifer is encountered between approximately 18 feet bgs in the vicinity of Unit 139 (northeast of the Elementary School) to about 30 feet bgs west of Eagle Bay Housing.

Groundwater within the regional aquifer beneath the site appears to flow towards three downgradient surface water bodies; Kuluk Bay, the East Canal of the Airport Ditch system, and Sweeper Cove (see Figure 1-2). The approximate location of the groundwater divide is shown on Figure 2-3. The position of this groundwater divide was approximated based on depth to groundwater data collected during product recovery operations at the site (URSG 1999a). West of this groundwater divide, groundwater generally flows to the west and southwest, toward the East Canal. In the vicinity of MW-134-10, located in the southeast extension of Sandy Cove Housing, groundwater flow becomes more southern toward Sweeper Cove. Northeast of the groundwater divide, including some or all of Turnkey Housing, groundwater appears to flow east-northeast toward Kuluk Bay. A more detailed description of the hydrogeology at the site is provided in the FFS (URS 2005).

Surface water in the vicinity of the SWMU 62, New Housing Fuel Leak site includes Kuluk Bay, Sweeper Cove (an extension of Kuluk Bay), and the East Canal of the airport ditch system (see Figure 1-2). Kuluk Bay is a marine environment located approximately 1,200 feet east of the housing units in Turnkey Housing and the north-eastern portion of Sandy Cove Housing. It is the closest downgradient surface water to these housing units. Sweeper Cove is a large saltwater inlet off Kuluk Bay. It is located approximately 1,700 feet south of the southern-most portion of Sandy Cove Housing and Eagle Bay Housing. The East Canal of the airport ditch system is the closest surface water body to the western portions of the SWMU 62, New Housing Fuel Leak site. It is located about 800 feet west of the western-most Eagle Bay Housing units and about 1,700 feet west of the western-most Sandy Cove Housing units. The East Canal is an engineered diversionary structure designed to collect surface runoff from the airfield and surrounding area, and convey it from the airport runway area. It parallels the north-south runway (Runway 18-36) and consists of a series of interconnected ditches. Water in the East Canal flows through the Crossover Canal (which is totally contained in underground culverts) into the West Canal, where it is transferred through turbine pumps into South Sweeper Creek. This renders the airport ditch system (including the East Canal) an isolated, intrastate, and non-navigable waterway. Therefore East Canal is not considered an ecological endpoint, as is South Sweeper Creek (and Kuluk Bay and Sweeper Cove). South Sweeper Creek, located approximately 3,800 feet from the Eagle Bay

Housing Area, is the closest downgradient water body along this transport pathway that is considered navigable waters of the United States.

The stormwater conveyances in SWMU 62, New Housing Fuel Leak site consist primarily of ditches, culverts, catchbasin inlets, manholes, and outlets. In general, stormwater west of Main Road flows via ditches or, after percolating into soil, with groundwater toward the East Canal of the airport ditch system and ultimately South Sweeper Creek. Stormwater in Turnkey and Sandy Cove Housing that is captured by stormdrain systems is discharged from three outlets into Kuluk Bay. The outlets from the stormdrain systems in Turnkey and Sandy Cove Housing are located along the Kuluk Bay shoreline between NORPAC Hill and Monument Hill. Stormwater collected by the stormdrain system in Eagle Bay Housing discharges into Sweeper Cove (Ecology and Environment 1995).

2.3 DESCRIPTION OF CONTAMINANTS AND MEDIA IMPACTED

Decisions documented in this DD are based upon information gathered from various environmental field investigations performed by the Navy at the site between 1988 and 2001, as indicated in Table 2-1. These investigations included site investigations, a release investigation, and a corrective action evaluation to evaluate subsurface conditions and investigate potential sources of contamination. Results of these investigations indicated that petroleum-related chemicals are confirmed in soil and groundwater samples collected from numerous locations at the SWMU 62, New Housing Fuel Leak site. In addition, a petroleum seep into the East Canal of the airport ditch system was identified west of the Eagle Bay Housing area. The concentrations of petroleum hydrocarbons in both soil and groundwater exceeded the applicable Alaska DEC cleanup levels. However, Alaska regulations have not established numerical cleanup criteria for individual petroleum hydrocarbons in surface water and sediment.

2.4 CLEANUP ACTIVITIES PERFORMED TO DATE

Cleanup activities that have been implemented at the SWMU 62, New Housing Fuel Leak site include:

- Contaminated soil removal and installation of vapor barriers to seal housing unit foundations
- Free-product recovery
- Natural attenuation monitoring

A summary of the cleanup activities performed at the site is provided in Table 2-2. In addition, results of the free-product recovery activities performed at the site are provided in Table 2-3. Additional information on the cleanup activities performed at the site is provided in the FFS report (URS 2005a).

Contaminated Soil Removal and Installation of Vapor Barriers to Seal Housing Unit Foundations

During 1989, the Navy conducted soil removal actions from under selected housing units where heating fuel was released through piping leaks. Surface soil sampling activities associated with these removal actions consisted primarily of field screening soils samples collected from the crawl spaces beneath housing units where pipelines had been repaired. Field screening consisted of soil vapor headspace and sheen testing (GeoEngineers 1990). These activities resulted in the removal of approximately 102 cubic yards (cy) of soil (URSG 1999a). The excavated material was replaced with clean sand, and vapor barriers sealed to the housing unit foundations were installed. These removal actions eliminated surface exposure to released petroleum hydrocarbons in the housing area.

Free-Product Recovery

As a result of the release investigations conducted by the Navy, a free-product recovery trench and 16 free-product recovery wells were installed during 1989. The recovery system was extensively modified from dual-stage recovery system to a lower maintenance total-fluids recovery system during October 1996. The recovery system operated until May 2000 when it was determined to have met the negotiated product recovery endpoints in the OU A ROD for systems that are dependent on water table depression and was shut down. As summarized in Table 2-3, this system recovered an estimated 154,000 gallons of free product from multiple plumes during its 11-year operational life (URSG 1999b).

Natural Attenuation Monitoring

To evaluate the potential for natural processes to attenuate petroleum-related chemicals in the SWMU 62, New Housing Fuel Leak site, natural attenuation monitoring was conducted in the 11 monitoring wells at the site that were sampled during 2002 as part of the annual groundwater monitoring activities. Analyses were performed on the groundwater samples for natural attenuation indicator parameters. These natural attenuation indicator parameters consist of dissolved oxygen (DO), nitrate/nitrite, ferrous iron, sulfate/sulfide, dissolved methane, alkalinity, chloride, and oxidation-reduction potential (ORP). Typically comparisons are made relative to upgradient locations versus source area and down-gradient locations. Because no wells are located at the site such that groundwater samples represent upgradient conditions, comparisons were made relative to downgradient wells where petroleum-related chemicals have not been

reported in groundwater samples. Taken as a body of evidence, the natural attenuation parameters measured at the SWMU 62, New Housing Fuel Leak site indicate both aerobic and anaerobic conditions were present at the site on the occasion of the 2002 sampling event. Aerobic conditions predominate in the areas beyond the limits of the dissolved petroleum plumes, while anaerobic conditions predominate within the dissolved petroleum plumes. These conditions indicate that biologic degradation of petroleum hydrocarbons is occurring within groundwater beneath the SWMU 62, New Housing Fuel Leak site.

In addition to the natural attenuation monitoring performed at the SWMU 62, New Housing Fuel Leak site, natural attenuation monitoring was performed at 10 sites on Adak in May and June of 2003 (USGS 2005). The site closest to the SWMU 62, New Housing Fuel Leak site that was monitored during this investigation was the Former Power Plant Building T-1451. The report concluded that the natural attenuation parameter data that have been collected to date demonstrate that biodegradation plays a significant role in natural attenuation in the downtown area of Adak Island.

2.5 LAND USE

Historical land use at the site now occupied by the SWMU 62, New Housing Fuel Leak site is based on a review of historical aerial photographs. Specific land uses at this site are uncertain. Aerial photographs taken from 1943 to 1946 indicate that the area was heavily used during this time period. Land uses included storage, housing, offices, and other activities, including commercial and industrial. As time passed, the intensity of land use decreased, as is evidenced in aerial photographs dated from 1946 to 1973.

Future land use at the SWMU 62, New Housing Fuel Leak site is designated to remain residential or future residential by the Adak Reuse Corporation (Figure 2-4). The uses of this category are oriented toward serving the residential needs of the community. Proposed uses for land surrounding the SWMU 62, New Housing Fuel Leak site are designated for either commercial, future residential, or public facilities reuse (ARC 2000).

2.6 GROUNDWATER USE

According to Alaska regulations (18 AAC 65.350), groundwater is considered to be a drinking water source unless it can be demonstrated that the groundwater is not currently being used as a drinking water source and groundwater is not a reasonably expected potential future source of drinking water. Although groundwater is not being used as a drinking water source on Adak and institutional controls are in place preventing the use of the downtown aquifer, groundwater is

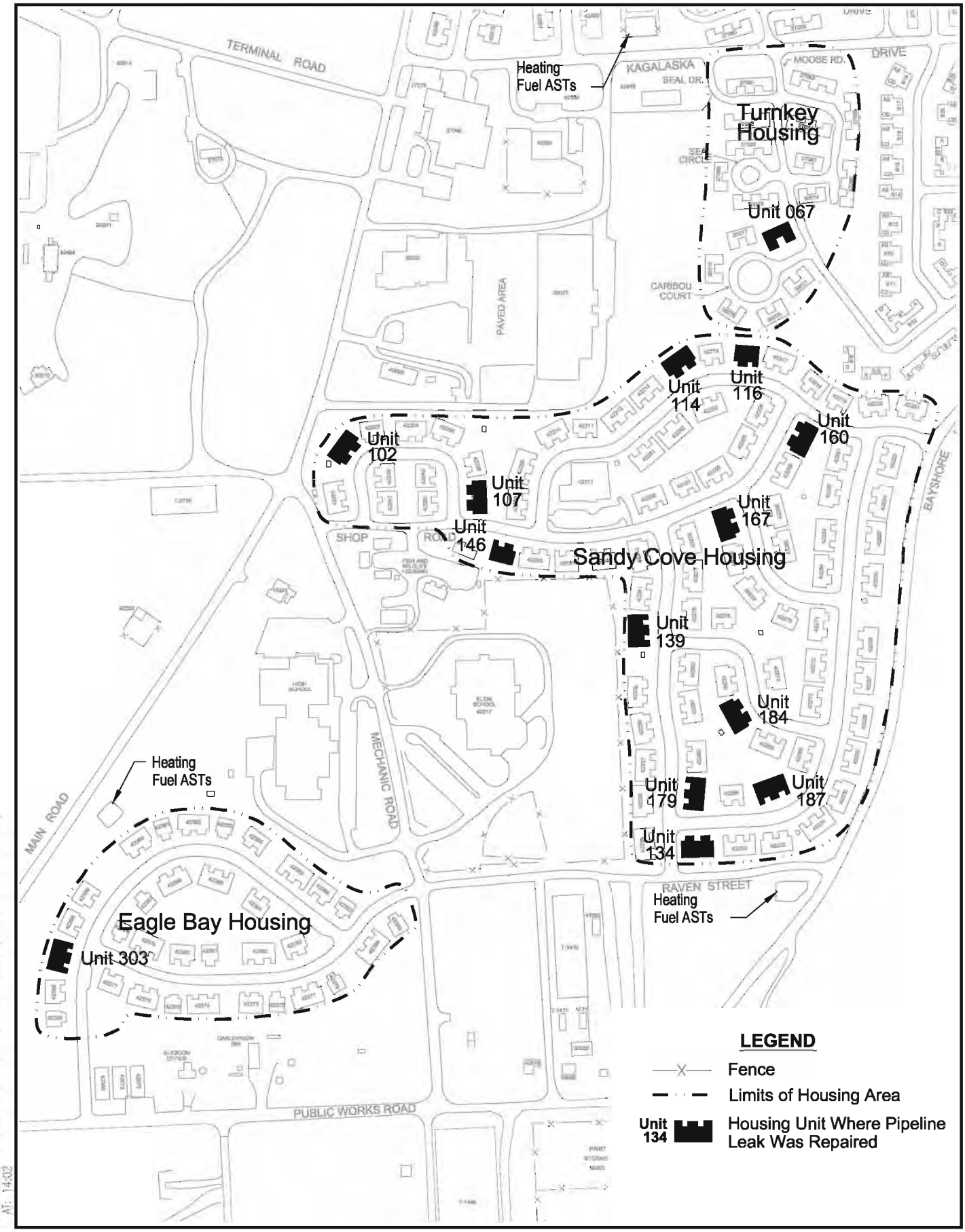
still considered to be a potential future source of drinking water at the SWMU 62, New Housing Fuel Leak site because potable water could be obtained from a well installed at the site.

2.7 INSTITUTIONAL CONTROLS

Institutional controls are measures to prevent or limit exposure to hazardous substances left in place at a site, or assure effectiveness of the chosen remedy until cleanup levels are achieved. Institutional controls are placed on property where contaminants remain at levels above regulatory requirements for cleanup, and where exposure pathways, if they exist, may cause harm to human health and the environment. For the SWMU 62, New Housing Fuel Leak site addressed in this DD, the institutional controls specified in the Interim Conveyance document include excavation restrictions and groundwater restrictions. Groundwater restrictions prohibit use of the downtown aquifer as a drinking water resource. The excavation restrictions are discussed in more detail below.

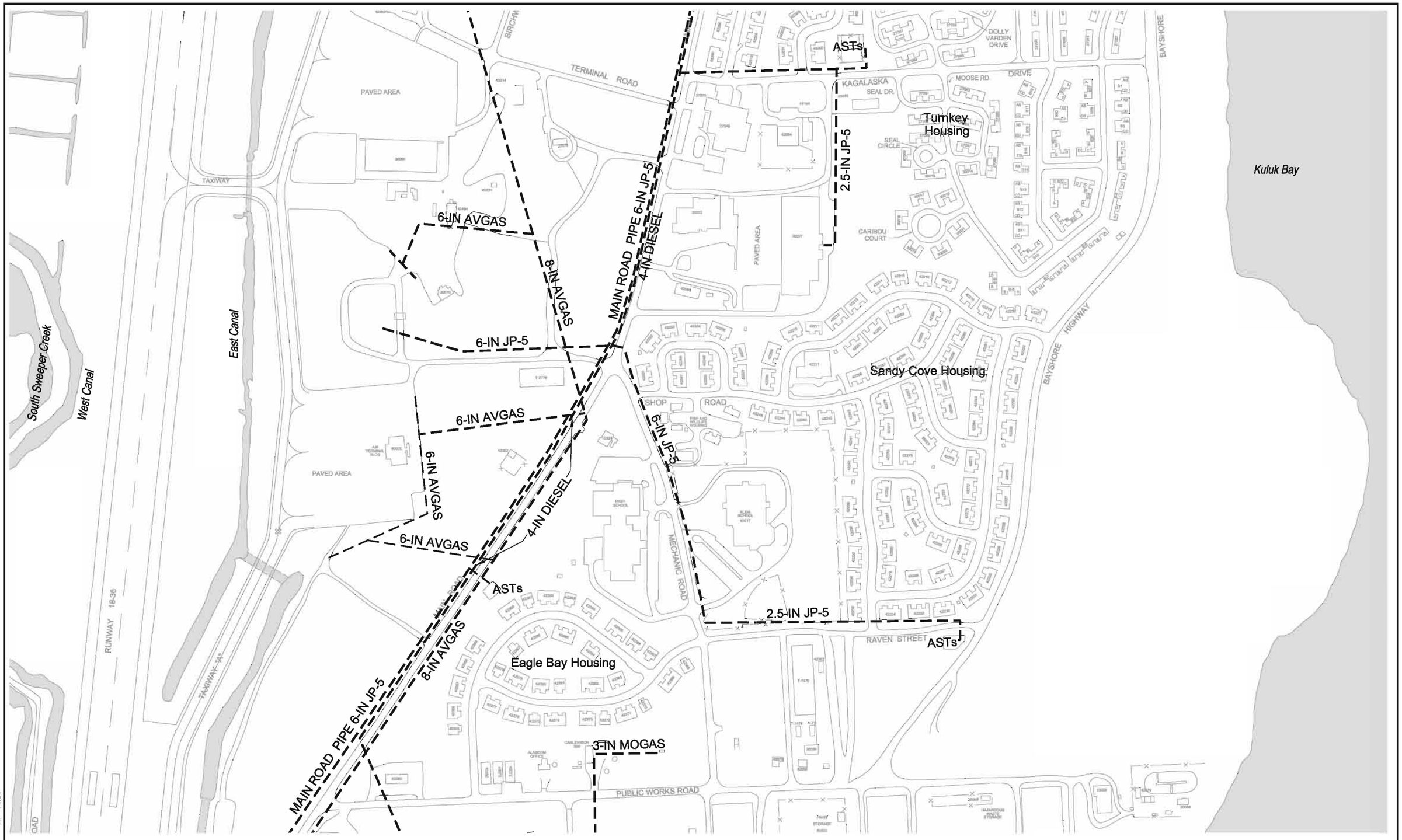
There are two types of soil excavation restrictions implemented at the former Adak Naval Complex through the Interim Land Conveyance document: (1) excavation notifications and (2) absolute excavation prohibitions. Excavation notification is required for proposed excavations below 2 feet at each of the institutional controls sites, including the SWMU 62, New Housing Fuel Leak site.

At some sites, such as former landfills, or where the remedy in place is a protective cover, excavation by non-Navy personnel is absolutely prohibited. Absolute excavation prohibitions are not applicable to the SWMU 62, New Housing Fuel Leak site. Excavation for the purpose of digging a domestic use well in the downtown area is also prohibited. Excavation prohibitions have been implemented through the Interim Conveyance document and the Final ICMP (U.S. Navy 2004).



FILENAME: T:\ADAK\DIQ\Sub-Tasks\DQ 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 2-1 PIPE LEAKS.dwg
EDIT DATE: 05/04/06 AT: 14:02

U.S. NAVY	N 0 100 200 400 SCALE IN FEET	**Figure 2-1** **Housing Units Where Pipeline Leaks Were Reported** **SWMU 62, New Housing Fuel Leak Site**	Adak Island, AK DECISION DOCUMENT



LEGEND

- - - Major Fuel Distribution Pipelines (Secondary Pipelines Not Shown)

U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 100 200 400 SCALE IN FEET	**Figure 2-2** **Major Fuel Distribution Pipelines** **SWMU 62, New Housing Fuel Leak Site**

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 2-2 FUEL PIPES.dwg
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LEGEND

- Fence
- Elevation Contour (ft Above MLLW)
- Monitoring Well
- Abandoned Well
- Recovery Well
- Geoprobe Well
- Groundwater Flow Direction
- MLLW — Mean Lower Low Water
- 5 — Groundwater Elevation Contour (ft Above MLLW)
- Groundwater Divide Location Approximate
- Location Type
- Location Xref
- Ground Surface Elevation (Ft Above MLLW)
- Groundwater Elevation (Ft Above MLLW) Measured on August 29/30, 2001

03-101 | 24.64 | 7.87

Sandy Cove Housing

Eagle Bay Housing

East Canal

Kuluk Bay

Sweeper Cove

U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 60 120 240 SCALE IN FEET	**Figure 2-3** **Inferred Groundwater Flow Map for Regional Aquifer** **SWMU 62, New Housing Fuel Leak Site**

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 2-3 GW FLOW.dwg
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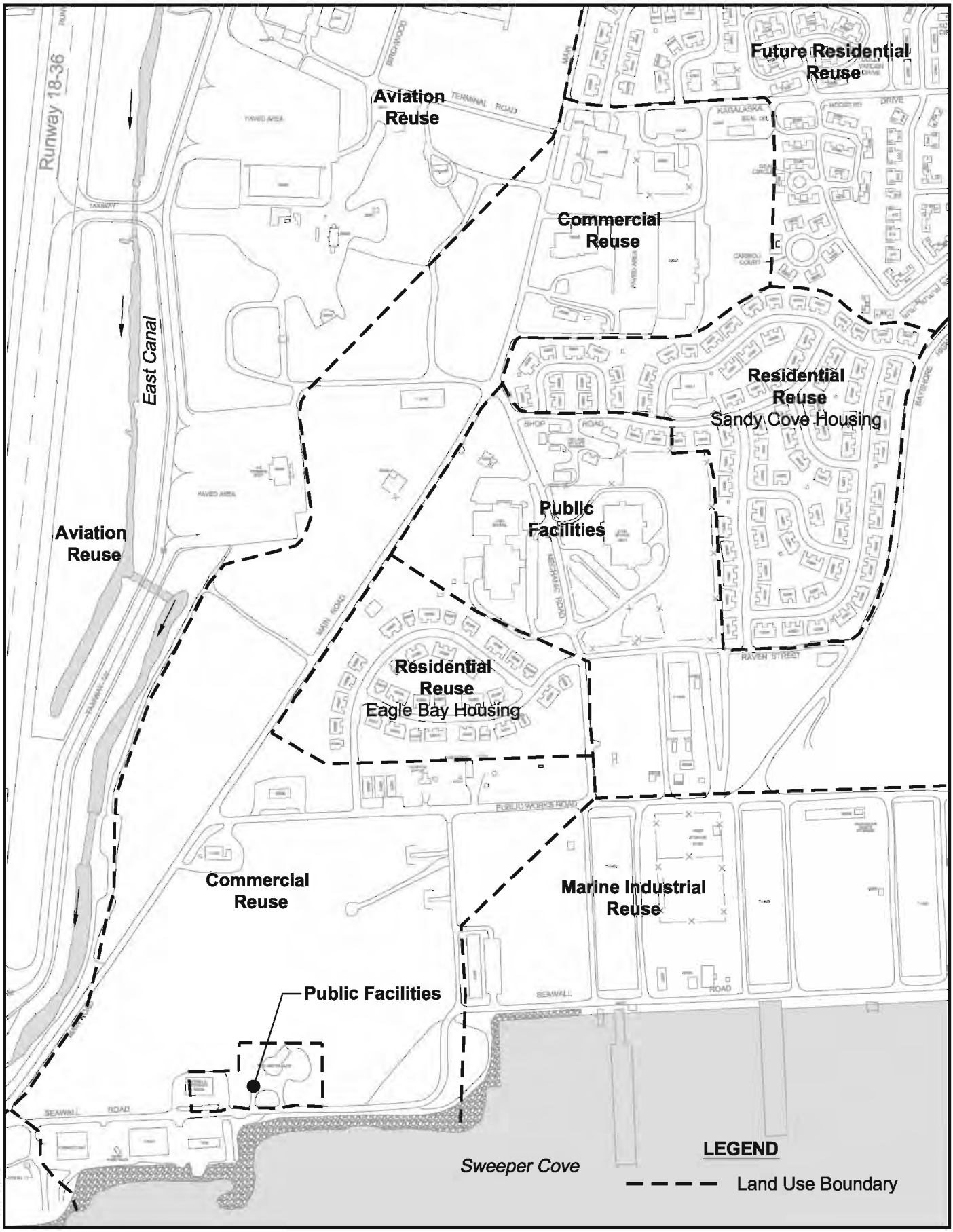

U.S. NAVY	0 150 300 600 SCALE IN FEET	Figure 2-4 Proposed Future Land Use SWMU 62, New Housing Fuel Leak Site	Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 2-4 LAND USE.dwg
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Table 2-1
Summary of Environmental Field Investigations, SWMU 62, New Housing Fuel Leak

Date	Investigation Activity
1988-1989	Release investigation to identify and repair petroleum leaks in the fuel distribution system at the site, evaluate the extent of petroleum fuel released, and initiate product recovery (GeoEngineers 1990)
1993	Corrective action evaluation of the existing product recovery system with additional site characterization to better define the extent of free product released at the site (EMCON 1994)
1993	Investigation to evaluate possible petroleum releases associated with the Main Road pipeline (URS 1994)
1999	Preparation of a site summary report to present all site data collected to that point (URSG 1999a)
1999	Free-product recovery closure report to demonstrate that the existing free-product recovery system has recovered product to its practicable endpoint (URSG 1999b)
2000	Pilot study to evaluate the feasibility of low-maintenance, self-sufficient product recovery technologies that do not require external power (Hart Crowser 2000)
2001	Focused feasibility study to identify remaining areas of free product and groundwater contamination and evaluate technologies capable of reducing concentrations of petroleum-related chemicals in soil and groundwater at the site (Hart Crowser 2001b)
2001	Groundwater sampling and analyses investigation to address data gaps identified during the focused feasibility study (Hart Crowser 2001a)

Table 2-2
Summary of Site Cleanup Activities, SWMU 62, New Housing Fuel Leak

Date	Cleanup Activity
1989	Removal of approximately 102 cubic yards of contaminated soil from under housing units where heating fuel leaked and installation of vapor barriers to seal housing unit foundations
1989-2000 [a]	Free-product recovery (total of approximately 154,000 gallons recovered)
2002	Natural attenuation monitoring

[a]Intermittent operation

Table 2-3
Free-Product Recovery Data, SWMU 62, New Housing Fuel Leak

Year	Gallons Recovered
1989	70,000
1990	12,000
1991	6,500
1992	3,000
1993	NA
1994	26,000
1995	11,000
1996	13,400
1997	9,500
1998	1,600
1999	500
2000	NA
Total	**154,000**

NA - not available

3.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

Petroleum hydrocarbons, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and metals have been detected in soil, groundwater, surface water, and sediment at the SWMU 62, New Housing Fuel Leak site. The concentrations of contaminants in these media at this site were compared to Alaska DEC cleanup criteria and/or human health risk-based screening criteria to identify the chemicals of potential concern (COPCs). The ecological risk assessment concluded that no complete significant exposure pathways are present at the SWMU 62, New Housing Fuel Leak site. Therefore, no ecological threat exists, and a quantitative evaluation of risk was not performed. The COPCs in soil, groundwater, surface water, and sediment are presented below.

3.1 SOIL

A chemical was identified as a COPC if its concentration exceeded the Alaska Method Two cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone (18 AAC 75.341, Tables B1 and B2) or if it was identified as a COPC in the human health risk assessment. The following is a listing of the COPCs identified at the SWMU 62, New Housing Fuel Leak site:

- Diesel-range organics (DRO)
- Gasoline-range organics (GRO)

Concentrations of DRO and GRO in soil at the site exceeded the most stringent Alaska DEC Method Two soil criteria in one or more samples. Therefore, they were included as COPCs for the site. However, GRO was not included as a COPC in the human health risk assessment because GRO concentrations in samples collected at depths less than 15 feet bgs were below the screening level. Samples collected at depths greater than 15 feet bgs are not included in the human health risk assessment because there is no human exposure to soils at these depths.

3.2 GROUNDWATER

A chemical was identified as a COPC if its concentration exceeded the Alaska DEC groundwater cleanup levels [18 AAC 75.345(b)(2)] or if it was identified as a COPC in the human health risk assessment. Although the concentrations of 1,1,1-trichloroethane and trichloroethene exceeded the Alaska DEC groundwater cleanup levels in samples collected from MW-134-10, these two chemicals are not included in the list of COPCs. The area where MW-134-10 is located formerly contained the SWMU 10, Baler Building site and an automotive repair facility. Chlorinated solvent data from this location is associated with the SWMU 10 site. SWMU 10 was evaluated

under CERCLA, and a final remedy is in place for the chlorinated solvent contamination as described in the OU A ROD. The following is a listing of the COPCs identified at the SWMU 62, New Housing Fuel Leak site:

- 2-Methylnaphthalene
- Benzene
- Ethylbenzene
- Naphthalene
- Toluene
- Xylenes
- DRO
- GRO

All chemicals that exceeded the Alaska DEC groundwater cleanup levels (benzene, DRO, ethylbenzene, GRO, and toluene) in one or more groundwater samples were also included as COPCs in the human health risk assessment. 2-Methylnaphthalene, naphthalene, and xylenes were included in the list above because they were identified as COPCs in the human health risk assessment even though their concentrations did not exceed the Alaska DEC groundwater cleanup levels.

3.3 SURFACE WATER AND SEDIMENT

A chemical was identified as a COPC in surface water if its concentration exceeded the Alaska DEC water quality standards (18 AAC Chapter 70) or if it was identified as a COPC in the human health risk assessment. The following is a listing of the COPCs identified for surface water at the SWMU 62, New Housing Fuel Leak site:

- Benzene
- DRO

No chemicals in surface water exceeded the Alaska DEC water quality standards. The two chemicals listed above were identified as COPCs for the site because they were identified as COPCs in the human health risk assessment.

A chemical was identified as a COPC in sediment if it was identified as a COPC in the human health risk assessment. The following is a listing of the COPCs identified for sediment at the SWMU 62, New Housing Fuel Leak site:

- Benzo(a)pyrene
- DRO

4.0 CONTAMINANT CONCENTRATIONS AND POTENTIAL EXTENT OF CONTAMINATION

Decisions documented in this DD are based upon information gathered from various environmental field investigations performed at the SWMU 62, New Housing Fuel Leak site between 1988 and 2002. The environmental field investigations that have been performed at or in the vicinity of the SWMU 62, New Housing Fuel Leak site are summarized in Table 2-1.

Results of these investigations indicated that petroleum hydrocarbons, SVOCs, VOCs, and metals were confirmed in samples of soil, groundwater, sediment, and surface water collected from numerous locations at the SWMU 62, New Housing Fuel Leak site. In addition, free product continues to be detected in wells at the site and observed in the East Canal of the airport ditch system west of the Eagle Bay Housing area. Detailed characterization information for the site is provided in the FFS report (URS 2005a) and is summarized below.

4.1 EXTENT OF FREE PRODUCT

Since site investigation activities began during 1989, more than 200 groundwater wells have been installed within the SWMU 62, New Housing Fuel Leak site. These wells were periodically gauged for the presence of free product between November 1992 and October 2003. During this time period, free product was observed at a measurable thickness in 112 wells. The maximum measured free-product thickness reported at the site was 5.63 feet in RW-303-9 on February 16, 1996. Well RW-303-9 is located within the Eagle Bay Housing Area. The maximum measured free-product thickness in the Sandy Cove Housing Area was 3.74 feet, in well RW-107-1 on March 27, 1997. Figure 4-1 shows the estimated extent of residual free product at the site based on the maximum measured free-product thickness reported in each well from 2000 through 2003. During this time period, measurable thicknesses of free product were detected in three areas in the Eagle Bay Housing area and seven areas in the Sandy Cove Housing area as presented in Figure 4-1. These areas total approximately 5.7 acres. Free product has not been detected in the Turnkey Housing Area. Based on the product thickness measurements data collected from 2000 through 2003, an estimated 1,400 to 6,900 gallons of recoverable free product may remain in the subsurface at the site.

In compliance with Alaska DEC interim removal requirements (18 AAC 75.330), remedial actions for free-product recovery were in progress at the SWMU 62, New Housing Fuel Leak site between October 1989 and May 2000. These actions resulted in the removal of approximately 154,000 gallons of free product as summarized in Table 2-3. A detailed discussion of free-product recovery activities was prepared and submitted to the Alaska DEC for

review as the *Free-Product Recovery Closure Report, SWMU 62, New Housing Fuel Leak, Adak Naval Complex, Adak Island, Alaska* (URSG 1999b).

The Navy began product recovery at the site during 1989 by installing 16 free-product recovery wells in the Sandy Cove and Eagle Bay Housing areas and one product recovery trench adjacent to and west of Sandy Cove Housing unit 167. Product recovery commenced at these 17 locations using a dual-pump recovery system. This system utilized one pump to create a "cone of depression" on the groundwater surface to induce free product to flow into the wells, and a second product-only pump to remove the product as it accumulated in each well. This recovery system operated regularly during the first year. However, after the second year of operation, maintenance issues caused the system to operate intermittently.

During 1993, the Navy had the product-recovery system re-evaluated because of problems with system operations, including declining recovery rates, system component failures, and bio-fouling of the pumps and wells (EMCON 1994). The recovery system was deemed no longer effective; excessive equipment maintenance requirements and insufficient capture of the free-product plume were cited as the major problems by the investigators. Based on this re-evaluation, the Navy redeveloped the 16 existing recovery wells, installed 10 additional recovery wells, and modified the system to a total-fluids extraction system, including the addition of a soil vapor recovery system.

The Navy also contracted repairs to the existing dual-pump recovery system and maintenance of the system until final design and installation of the total-fluids system was completed. The existing dual-pump recovery system was restarted after the contracted repairs were completed in 1994 and continued to run until October 1996. The volumes reported on Table 2-3 for this period of time include an unknown volume of water. Problems with the system during this 3-year period allowed a percentage of groundwater removed from system recovery wells to be measured as free product. A rough estimate based on data taken when the problem was identified suggests as much as 22 percent of the reported product recovery was groundwater (Foster Wheeler 1997).

Installation of the total-fluids product-recovery system was completed during October 1996, and the system was started during November 1996. The system operated relatively continuously until May 1, 2000, except for planned shutdowns for well development and maintenance. The ROD for OU A established the criteria for cessation of free-product recovery based on achievement of technically practicable endpoints (U.S. Navy, USEPA, ADEC 2000). These criteria are based on the operational performance of the total-fluids recovery system at the SWMU 62, New Housing Fuel Leak site that pumps groundwater for hydraulic control to capture product. The criterion for evaluating the performance of recovery systems that are dependent on water table depression for recovery (active recovery) is as follows:

> *When less than 0.5 gallon of free product per 1,000 gallons of treated groundwater is recovered by a system that pumps groundwater for hydraulic control, the technically practicable endpoint for recovery has been reached. If this endpoint criterion has been met for a period of 1 year, the existing recovery system is considered to meet the technically practicable endpoint and recovery can be discontinued (URSG 1999c).*

The Navy prepared the Draft Free-Product Recovery Closure Report for SWMU 62, New Housing Fuel Leak site that presented a comparison of the system recovery to endpoint criteria (URSG 1999b). Based on the comparison of the volume of recovered product with the volume of total fluids pumped during 1999, the product recovery system at the SWMU 62, New Housing Fuel Leak site was shown to meet the criterion established to achieve its practicable endpoint. Subsequently, the product-recovery system was shut down on May 1, 2000. Following shutdown of the free-product recovery system, post-recovery monitoring was performed from May 2001 through May 2002 (ICRC 2003). Twenty-two wells were gauged for free product in June, September, and November of 2001 and May of 2002. Free product was not detected in the 22 wells during these monitoring activities. Therefore, the contractor concluded that SWMU 62 has met the OU A ROD endpoints.

4.2 POTENTIAL EXTENT OF CONTAMINATION IN SOIL AND GROUNDWATER

The potential extent of contamination in soil and groundwater at the SWMU 62, New Housing Fuel Leak site was estimated in the FFS report (URS 2005a) and is summarized in this DD. The potential extent of contamination in soil and groundwater was based on data collected through 2002. Because no soil samples were collected after 2002 and groundwater samples were only collected from two wells (03-155 and 03-619), data collected after 2002 do not change the conclusions regarding the potential extent of contamination. The potential extent of contamination was estimated by comparing site concentrations from samples collected between 1992 and 2002 to the Alaska DEC cleanup levels. Locations where the concentrations exceeded the Alaska DEC cleanup levels were identified and then used to delineate the area of potential contamination on Figure 4-2.

The Alaska DEC Method Two cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone (18 AAC 75.341, Tables B1 and B2) were used to estimate the potential extent of soil impacted by petroleum contamination at the SWMU 62, New Housing Fuel Leak site. The tabulated groundwater cleanup levels [18 AAC 75.345(b)(1), Table C] were used to estimate the potential extent of groundwater impacted by petroleum contamination at the site. The potential extents of contamination shown in Figure 4-2 are based solely on exceedances of the Alaska DEC cleanup levels. The potential extents of contamination shown on this figure do not necessarily represent areas where risks are

unacceptable or where cleanup actions will be required. However, these areas were considered to be a potential concern and therefore required further evaluation in a risk assessment. The site data used to estimate the potential extents of contamination were used in the risk assessment to determine if contaminant concentrations at the site pose an unacceptable risk to humans and ecological receptors.

The analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in soil and groundwater are provided in Appendix B. Analytical results obtained for DRO and GRO are included in the analysis conducted to establish the potential extent of contamination in soil at the site, and analytical results obtained for benzene, ethylbenzene, toluene, DRO, and GRO are included in the analysis conducted to establish the potential extent of contamination in groundwater at the site. No other chemicals were detected at concentrations greater than Alaska DEC cleanup levels in soil and groundwater with the exception of 1,1,1-trichloroethane and trichloroethene. The presence of these two chlorinated solvents at the site was attributed to the SWMU 10, Baler Building site. As discussed in Section 3, SWMU 10 was evaluated under CERCLA and a final remedy is in place for the chlorinated solvent contamination detected at the site as described in the OU A ROD.

Basic summary statistics for all COPCs in soil and groundwater are provided in Table 4-1. The COPCs included on Table 4-1 were previously identified in Section 3. These statistics include:

- The total number of samples collected at the SWMU 62, New Housing Fuel Leak site including field duplicates
- Samples used in the risk assessment
- The minimum concentration used in the risk assessment
- The maximum concentration used in the risk assessment
- The location of the maximum concentration used in the risk assessment
- The detection frequency
- The range of detection limits

The concentrations of contaminants at the site were compared to Alaska DEC cleanup criteria and/or human health and ecological risk-based screening criteria to identify the COPCs in soil, groundwater, surface water, and sediment. Therefore, some chemicals listed in Table 4-1 may only have been detected at concentrations which exceeded the human health and/or ecological risk-based screening criteria and not the Alaska DEC cleanup levels.

The extent of contamination in soil and groundwater is discussed by subdividing the SWMU 62, New Housing Fuel Leak site into the following six subareas:

- Turnkey Housing Area
- Sandy Cove Housing 102, 107, and 146 Area
- Sandy Cove Housing 114, 116, 160, and 167 Area
- Sandy Cove Housing 134, 179, and 187 Area
- Sandy Cove Housing 139 and 148 Area
- Eagle Bay Housing 303 Area

These six subareas are shown on Figure 4-2.

Turnkey Housing Area

Analytical results for DRO in soil samples collected within the Turnkey Housing area are presented in Table B-1. Results of chemical analyses for DRO are available for one soil sample collected from one location. DRO was reported in the soil sample collected from the Turnkey Housing area at a concentration less than the most stringent Alaska DEC soil cleanup criteria established for the protection of groundwater in the over 40-inches of rainfall zone.

Analytical results for DRO in groundwater samples collected within the Turnkey Housing area are presented in Table B-2. Results of chemical analyses for DRO are available for three groundwater samples collected from three locations. DRO was detected in all three groundwater samples collected within the Turnkey Housing area during 1993. However, only the perched groundwater sample collected from location HMW-67-1 contained DRO at a concentration above the Alaska DEC groundwater cleanup level established for groundwater that is used as a drinking water source. Groundwater samples collected from the two remaining wells completed in the deeper groundwater aquifer contained DRO at concentrations below the applicable Alaska DEC groundwater cleanup level. The area of perched groundwater containing DRO at a concentration greater than the applicable Alaska DEC groundwater cleanup level within the Turnkey Housing area is estimated to encompass approximately 3,200 square feet (ft^2) (Figure 4-2). This perched groundwater body is estimated to be between 4 and 5 feet thick.

Sandy Cove Housing Area – 102, 107, and 146 Area

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in soil samples collected within the Sandy Cove Housing 102, 107, and 146 area are presented in Table B-3. Detected concentrations of DRO and GRO greater than their respective Alaska DEC soil cleanup criteria were reported in 22 soil samples collected from 22 locations. No other chemicals were detected at concentrations above their respective Alaska DEC soil cleanup criteria. As shown on Figure 4-2, these soil samples were collected from two general areas within the Sandy Cove

Housing 102, 107, and 146 area. One group of samples is clustered in the vicinity of the Main Road, downgradient from housing unit 102. This cluster of samples represent: surface soil at location RW-102-1, three small pockets of soil situated in the vadose zone (3.5 to 7 feet bgs), and one larger expanse of soil situated at the regional groundwater surface (16 to 20 feet bgs). A second group of samples are clustered around housing units 107 and 146. These samples represent surface soil at locations RW-107-1, RW-107-2, and RW-107-3, shallow, near-surface soil (1 to 3 feet bgs) located south of unit 146, two small pockets of vadose zone soil (6 to 9 feet bgs) associated with perched groundwater located north and east of unit 107, and a larger expanse of soil situated at the surface of the regional aquifer (16 to 18 feet bgs).

The areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the applicable Alaska DEC soil criteria within the Sandy Cove Housing 102, 107, and 146 area are indicated by the dashed lines shown on Figure 4-2. Combined, these areas are estimated to encompass approximately 3.2 acres. The volume of soil within this investigation subarea containing petroleum-related chemicals at concentrations above the most stringent Alaska DEC soil criteria was also estimated. The volume estimates are calculated based on the areal distributions shown in Figure 4-2 and an assumed thickness of contaminated media based on a review of soil boring information and historical groundwater elevation data. Approximately 26,000 cy of soil is estimated to contain petroleum-related chemicals at concentrations above the most stringent Alaska DEC soil criteria.

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in groundwater samples collected within the Sandy Cove Housing 102, 107, and 146 area are presented in Table B-4. Monitoring wells at the site have been sampled multiple times on a nonuniform schedule. In addition, groundwater samples collected from the monitoring wells were chemically analyzed for a nonuniform list of chemicals. Only the most recent information available for each chemical at each location is compared to the groundwater cleanup levels to determine the potential extent of contamination in groundwater.

DRO, GRO, benzene, toluene, and ethylbenzene were reported in the most recent groundwater samples collected from 23 locations at concentrations greater than their respective Alaska DEC groundwater cleanup criteria for groundwater that is used as a drinking water source. No other chemicals were detected at concentrations above their respective Alaska DEC groundwater cleanup criteria. As shown on Figure 4-2, these groundwater samples were collected from two areas within the Sandy Cove Housing 102, 107, and 146 area. One group of samples is clustered in the vicinity of, and downgradient from, housing unit 102. This cluster of samples represents groundwater within the regional aquifer situated approximately 18 feet bgs. A second group of samples are clustered around housing units 107 and 146, and extends in a narrow band to the southeast toward housing unit 139. These samples also represent groundwater within the regional aquifer situated approximately 18 feet bgs. In addition, concentrations exceeding

applicable Alaska DEC groundwater criteria were reported in groundwater samples collected from two locations (03-692 and MRP-MW3), representing perched groundwater.

The combined areas of groundwater containing petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria within the Sandy Cove Housing 102, 107, and 146 area are estimated to encompass approximately 7.25 acres. This combined area includes approximately 15,000 $ft^2$of perched groundwater encountered between 5 and 8 feet bgs. This perched groundwater body is estimated to be approximately 2 to 5 feet thick. The remaining groundwater is within the regional aquifer, situated approximately 18 feet bgs. The groundwater within this regional aquifer containing petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria is estimated to be between 10 and 15 feet thick.

Sandy Cove Housing Area – 114, 116, 160, and 167 Area

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in soil samples collected within the Sandy Cove Housing 114, 116, 160, and 167 area are presented in Table B-5. Analytical results for DRO are available for six soil samples collected from six locations; GRO and benzene, toluene, ethylbenzene, and xylenes (BTEX) are available for two soil samples from two locations. None of the petroleum-related chemicals tested for in the six soil samples were reported at detected concentrations above their respective Alaska DEC soil cleanup criteria established for the protection of groundwater in the over 40-inches of rainfall zone.

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in groundwater samples collected within the Sandy Cove Housing 114, 116, 160, and 167 area are presented in Table B-6. Monitoring wells at the site have been sampled multiple times on a nonuniform schedule. In addition, groundwater samples collected from the monitoring wells were chemically analyzed for a nonuniform list of chemicals. Only the most recent information available for each chemical at each location is compared to the groundwater cleanup levels to determine the potential extent of contamination in groundwater.

DRO was reported in the most recent groundwater sample collected from one location (MW-160-3) at a concentration greater than its Alaska DEC groundwater cleanup criteria for groundwater that is used as a drinking water source. No other chemicals were detected at concentrations above their respective Alaska DEC groundwater cleanup criteria. Well MW-160-3 was completed to a depth of 10 feet bgs and was used to monitor perched groundwater. The area of perched groundwater containing petroleum-related chemicals at concentrations greater than their applicable Alaska DEC groundwater criteria within the Sandy Cove Housing 114, 116, 160, and 167 area (based on 1993 data for location MW-160-3) is

estimated to encompass approximately 2,500 ft^2 (Figure 4-2). This perched groundwater body is estimated to be between 2 and 5 feet thick.

Sandy Cove Housing Area - 134, 179, and 187 Area

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in soil samples collected within the Sandy Cove Housing 134, 179, and 187 area are presented in Table B-7. DRO was reported in 2 soil samples collected from 2 locations at concentrations greater than its respective Alaska DEC soil cleanup criteria established for the protection of groundwater in the over 40-inches of rainfall zone. No other chemicals were detected at concentrations above their respective Alaska DEC soil cleanup criteria. As shown on Figure 4-2, these soil samples were collected from two locations (609 and HMW-134-3) within the vicinity of housing unit 134. The sample from location HMW-134-3 was collected from a reported depth of 1.5 feet bgs and represents surface or near surface soil. The sample from location 609 was collected from a reported depth of 17 to 18 feet bgs and represents soil at the groundwater surface. The area estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC soil criteria within the Sandy Cove Housing 134, 179, and 187 area is indicated by the dashed lines shown on Figure 4-2 and is interpreted to extend beneath the entire footprint of the adjacent building. This area is estimated to encompass approximately 12,800 ft^2. The volume of soil within this investigation subarea containing petroleum-related chemicals at concentrations above the most stringent Alaska DEC soil criteria was estimated to be approximately 6,600 cy.

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in groundwater samples collected within the Sandy Cove Housing 134, 179, and 187 area are presented in Table B-8. Monitoring wells at the site have been sampled multiple times on a nonuniform schedule. In addition, groundwater samples collected from the monitoring wells were chemically analyzed for a nonuniform list of chemicals. Only the most recent information available for each chemical at each location is compared to the groundwater cleanup levels to determine the potential extent of contamination in groundwater.

DRO, GRO, and benzene were reported in the most recent groundwater samples collected from 12 locations at concentrations greater than their respective Alaska DEC groundwater cleanup criteria for groundwater that is used as a drinking water source. Although the concentrations of 1,1,1-trichloroethane and trichloroethene exceeded the Alaska DEC groundwater cleanup levels in samples collected from MW-134-10, these two chemicals were not used in determining the potential extent of contamination. (The area where MW-134-10 is located formerly contained the SWMU 10, Baler Building site and an automotive repair facility. Chlorinated solvent data from this location is associated with the SWMU 10 site. SWMU 10 was evaluated under CERCLA and a final remedy is in place for the chlorinated solvent contamination as described in the OU A ROD.) No other chemicals were detected at concentrations above their respective

Alaska DEC groundwater cleanup criteria. As shown on Figure 4-2, the groundwater samples with concentrations of petroleum hydrocarbons greater than their respective Alaska DEC groundwater cleanup criteria were collected from two areas within the Sandy Cove Housing 134, 179, and 187 area. Two samples were obtained from wells MW-179-4 and MW-187-1 located north of housing units 179 and 187. These samples, collected during July 1993, represent groundwater from the regional aquifer situated approximately 17 feet bgs. A second group of samples are clustered around housing unit 138. These samples also represent groundwater within the regional aquifer situated approximately 17 feet bgs.

The combined areas containing petroleum-related chemicals in groundwater at concentrations greater than the applicable Alaska DEC groundwater criteria within the Sandy Cove Housing 134, 179, and 187 area are estimated to encompass approximately 2.4 acres. This groundwater is within the regional aquifer, situated approximately 17 feet bgs. The groundwater within this regional aquifer containing petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria is estimated to be between 10 and 15 feet thick.

Sandy Cove Housing Area - 139 and 148 Area

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in soil samples collected within the Sandy Cove Housing 139 and 184 area are presented in Table B-9. DRO was reported in 8 soil samples collected from 6 locations at concentrations greater than its respective Alaska DEC soil cleanup criteria established for the protection of groundwater in the over 40-inches of rainfall zone. No other chemicals were detected at concentrations above their respective Alaska DEC soil cleanup criteria. As shown on Figure 4-2, five of these six locations are clustered between Sandy Cove Housing and the Elementary School. This cluster of samples represent soil situated within the vadose zone (3 to 7.5 feet bgs) at locations 03-603, 03-695, and HMW-146-3, and soil situated at the groundwater surface (16 to 19 feet bgs) at locations 03-695, 03-696, and HMW-139-2. The remaining sample where DRO was reported at a concentration above the applicable Alaska DEC soil criteria is from 12.5 feet bgs at location HMW-184-2. This location represents the eastern most sample location within the area. The areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC soil criteria within the Sandy Cove Housing 139 and 184 area are indicated by dashed lines shown on Figure 4-2. Combined, these areas are estimated to encompass approximately 1.2 acres. The volume of soil within this investigation subarea containing petroleum-related chemicals at concentrations above the most stringent Alaska DEC soil criteria was estimated to be approximately 3,300 cy.

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in groundwater samples collected within the Sandy Cove Housing 139 and 184 area are presented in Table B-10. Monitoring wells at the site have been sampled multiple times on a nonuniform schedule. In addition, groundwater samples collected from the monitoring wells were chemically analyzed for

a nonuniform list of chemicals. Only the most recent information available for each chemical at each location is compared to the groundwater cleanup levels to determine the potential extent of contamination in groundwater.

DRO and benzene were reported in the most recent groundwater samples collected from five locations at concentrations greater than their respective Alaska DEC groundwater cleanup criteria for groundwater that is used as a drinking water source. No other chemicals were detected at concentrations above their respective Alaska DEC groundwater cleanup criteria. As shown on Figure 4-2, the five locations where DRO and benzene were reported above criteria in the most recent groundwater samples represent groundwater within a narrow band extending from well HMW-184-2 northwest toward well HMW0146-3. Groundwater samples collected from four of these five locations (HMW-139-2, HMW-146-3, HMW-184-2, and MW-139-3) represent the regional aquifer, situated approximately 18 feet bgs. The groundwater sample from location MW-184-2 represents perched groundwater at this location.

The area of groundwater estimated to contain petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria within the Sandy Cove Housing 139 and 184 area encompasses approximately 2.2 acres. This combined area includes approximately 4,500 ft^2 of perched groundwater encountered 8 feet bgs. This perched groundwater body is estimated to be between 2 to 4 feet thick. The remaining groundwater is within the regional aquifer, situated approximately 18 feet bgs. The groundwater within this regional aquifer containing petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria is estimated to be between 7 and 10 feet thick. The groundwater plume in the 139 and 184 area is contiguous with the more easterly groundwater plume in the 102, 107, and 146 area.

Eagle Bay Housing Area - 303 Area

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in soil samples collected within the Eagle Bay Housing 303 area are presented in Table B-11. DRO was reported in 12 soil samples collected from 12 locations at concentrations greater than its respective Alaska DEC soil cleanup criterion established for the protection of groundwater in the over 40-inches of rainfall zone. No other chemicals were detected at concentrations above their respective Alaska DEC soil cleanup criteria. As shown on Figure 4-2, these 12 locations are scattered between Eagle Bay Housing and the East Canal. The soil sample from location HMW-303-12 was collected at a depth of 2.5 feet bgs. The remaining soil samples containing concentrations of DRO above the criteria were all collected at depths ranging from nine to 27 feet bgs. These samples represent soil situated at the groundwater surface. The areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC soil criteria within the Eagle Bay Housing 303 area are indicated by dashed lines shown on Figure 4-2. Combined, these areas are estimated to encompass

approximately 2.5 acres. The volume of soil within this investigation subarea containing petroleum-related chemicals at concentrations above the most stringent Alaska DEC soil criteria was estimated to be approximately 21,000 cy.

Analytical results for benzene, ethylbenzene, DRO, GRO, toluene, and xylenes in groundwater samples collected within the Eagle Bay Housing 303 area are presented in Table B-12. Monitoring wells at the site have been sampled multiple times on a nonuniform schedule. In addition, groundwater samples collected from the monitoring wells were chemically analyzed for a nonuniform list of chemicals. Only the most recent information available for each chemical at each location is compared to the groundwater cleanup levels to determine the potential extent of contamination in groundwater.

Benzene, ethylbenzene, DRO, GRO, and toluene were reported in the most recent groundwater samples collected from 19 locations at concentrations greater than their respective Alaska DEC groundwater cleanup criteria for groundwater that is used as a drinking water source. No other chemicals were detected at concentrations above their respective Alaska DEC groundwater cleanup criteria. As shown on Figure 4-2, the 19 locations where petroleum-related chemicals were reported above applicable groundwater criteria in the most recent groundwater samples represent groundwater within a broad expanse extending northwest from location MW-303-4 toward the East Canal, and south from location MRP-MW4 nearly to location 03-109. Groundwater samples collected from these locations represent the regional aquifer.

The area of groundwater containing petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria within the Eagle Bay Housing 303 area is estimated to encompass approximately 8.1 acres. This groundwater is within the regional aquifer, situated between 22 and 26 feet bgs in the eastern portion of the 303 subarea, but approximately 5 feet bgs adjacent to the East Canal. The groundwater within this regional aquifer containing petroleum-related chemicals at concentrations greater than the applicable Alaska DEC groundwater criteria is estimated to be between 8 and 12 feet thick.

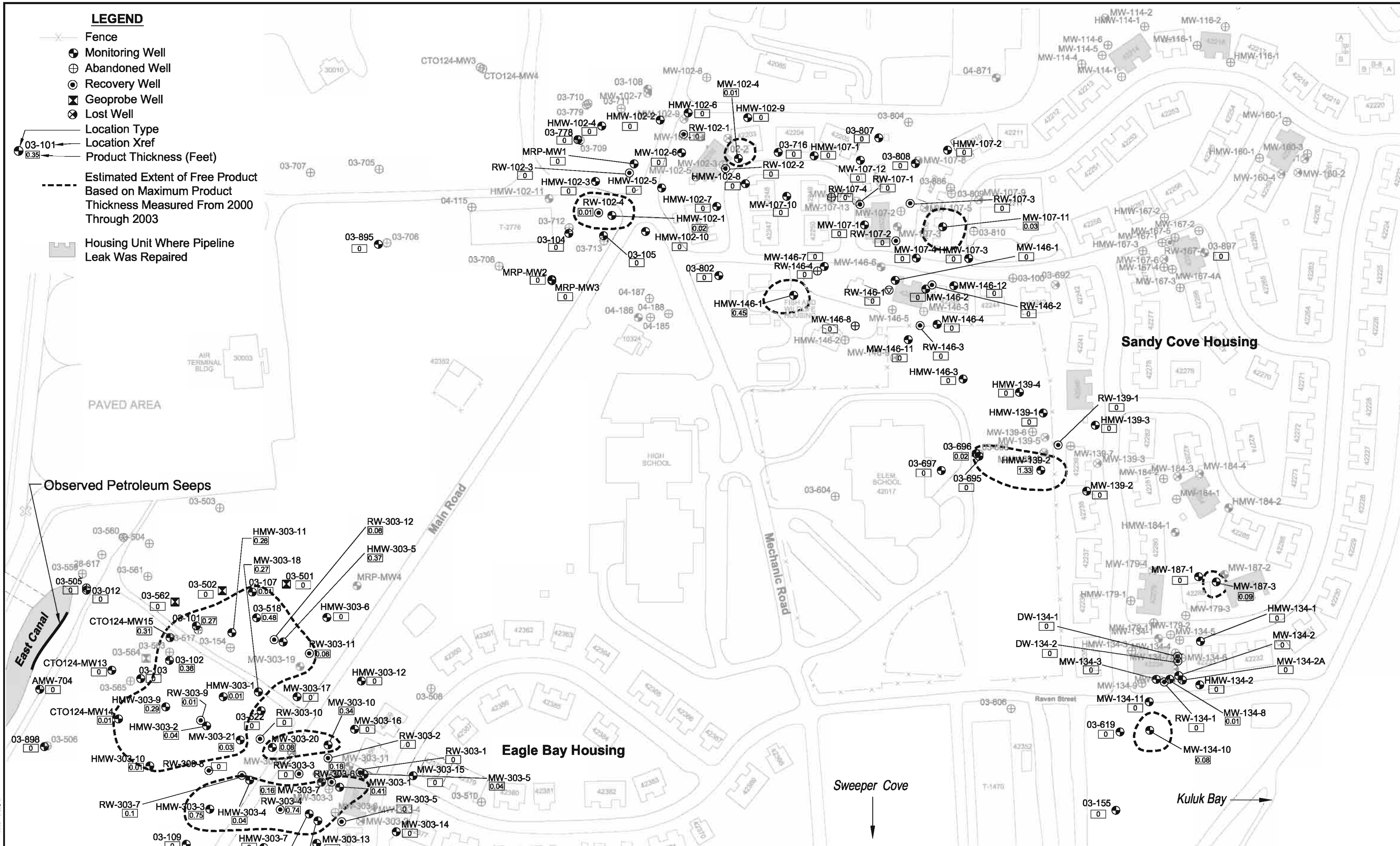
Potential Extent of Contamination in Surface Water and Sediment

The potential extent of contamination in sediment and surface water at the SWMU 62, New Housing Fuel Leak site was estimated in the FFS report (URS 2005a) and is summarized in this DD. Sediment and surface water samples were collected within the East Canal located at the western margin of the Eagle Bay Housing 303 area. Sediment samples were collected at two locations. Analytical results for GRO, DRO, residual-range organics (RRO), BTEX, and polycyclic aromatic hydrocarbons (PAH) compounds in sediment samples collected from these locations are presented in Table B-13.

Results of the analyses conducted on sediment samples identified the presence of DRO and RRO at estimated concentrations of 215 mg/kg and 102 mg/kg respectively at location 28-618. Selected PAH compounds were also identified in this sediment sample at detected concentrations ranging from 0.3 to 1.6 mg/kg. GRO and BTEX compounds were not present at concentrations above the detection limits in this sample. DRO was reported at a concentration of 1,660 mg/kg in the sediment sample from location E DITCH (N T-1451), while RRO was reported at an estimated concentration of 280 mg/kg at this location. GRO, BTEX, and PAH compounds were not present at concentrations above the detection limits in this sample.

Two surface water samples were collected from location CH-703 during July 1997. One sample was collected just below the water surface while the second sample was collected at a depth of 1 foot below the water surface (bws). Analytical results for DRO, GRO, VOC including BTEX, and SVOC compounds including PAHs in surface water samples collected from this location are summarized in Table B-14.

Results of the analyses conducted on surface water samples identified the presence of BTEX compounds and cis-1,2-dichloroethene at concentrations ranging from 0.8 to 6 µg/L. GRO, DRO, and PAH compounds were not present at concentrations above the detection limits in these samples. Total aromatic hydrocarbons (TAH, sum of BTEX compounds) were reported at 11.4 µg/L in the sample collected at the water surface and 12.5 µg/L in the sample collected from a depth of 1 foot bws. These concentrations exceed the Alaska DEC water quality criteria of 10 µg/L established for TAH in surface water. Total aqueous hydrocarbons (TAqH) (sum of BTEX and PAH compounds) were reported at 13.9 µg/L in the sample collected at the water surface and 15 µg/L in the sample collected from a depth of 1 foot bws. These concentrations are less than or equal to the Alaska DEC water quality criterion of 15 µg/L established for TAqH in surface water.



U.S. NAVY

Adak Island, AK
DECISION DOCUMENT

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SCALE IN FEET

Figure 4-1
Estimated Extent of Residual Free Product
SWMU 62, New Housing Fuel Leak Site

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LEGEND

- Fence
- Monitoring Well
- Abandoned Well
- Recovery Well
- Borehole
- Surface Water (Channel/Ditch)
- Excavation
- Hand Auger
- Hydro Punch
- Lost Well
- Geoprobe
- Geoprobe Well
- Ground Surface
- Housing Unit Where Pipeline Leak Was Repaired
- Estimated Area Where Petroleum-Related Chemicals in Soil Exceed the Most Stringent Alaska DEC Method 2 Criteria
- Extent of Groundwater Where Petroleum-Related Chemicals Exceed the Groundwater Cleanup Levels

Sandy Cove Housing 102, 107, and 146 Area

Turnkey Housing Area

Sandy Cove Housing 114, 116, 160, and 167 Area

Sandy Cove Housing 139 and 184 Area

Sandy Cove Housing 134, 179, and 187 Area

Eagle Bay Housing 303 Area

Observed Petroleum Seeps

Perched

Bayshore Highway

Main Road

Mechanic Road

East Canal

Raven Street

E DITCH (N T-1451)

CH-703

U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 65 130 260 SCALE IN FEET	**Figure 4-2** **Estimated Potential Extent of Soil and Groundwater Contamination** **SWMU 62, New Housing Fuel Leak Site**

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Table 4-1
Summary of Analytical Results for Chemicals of Potential Concern
SWMU 62, New Housing Fuel Leak Site

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2,3,4)	Minimum Concentration (5)	Minimum Qualifier	Maximum Concentration (5)	Maximum Qualifier	Unit	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
SOIL										
Total Petroleum Hydrocarbons										
Diesel-Range Organics	160	92	6.2		19,000		mg/kg	HMW-102-5	58/92	4.5 - 50
Gasoline-Range Organics	111	53	1.6		51		mg/kg	03-563	10/53	0.3 - 6.5
GROUNDWATER										
Volatile Organic Compounds										
2-Methylnaphthalene	98	86	0.03	J	102	J	ug/L	03-517	46/86	2 - 21.1
Benzene	227	195	0.238		250		ug/L	HMW-134-2	53/195	0.2 - 100
Ethylbenzene	227	195	0.54		2,600		ug/L	MRP-MW3	87/195	0.2 - 100
Naphthalene	98	86	0.15	J	177	J	ug/L	HMW-134-2	43/86	2 - 21.1
Toluene	227	195	0.5		5,690		ug/L	MRP-MW3	50/195	0.2 - 100
Xylenes	227	195	0.2		10,100		ug/L	MRP-MW3	168/195	0.2 - 3
Total Petroleum Hydrocarbons										
Diesel-Range Organics	308	238	135		3,150,000	J	ug/L	03-517	159/238	50 - 6930
Gasoline-Range Organics	225	193	6.1	J	44,100		ug/L	MRP-MW3	82/193	5 - 1800
SEDIMENT										
Semivolatile Organic Compounds										
Benzo(a)pyrene (6)	2	12	0.2		0.9		mg/kg	E DITCH STAIN (CTR)	5/12	0.2
Total Petroleum Hydrocarbons										
Diesel-Range Organics (6)	2	14	215	J	33000	J	mg/kg	02-349	14/14	--
SURFACE WATER										
Volatile Organic Compounds										
Benzene (6)	2	13	0.78	J	1.6	J	ug/L	ASW-010	8/13	1
Total Petroleum Hydrocarbons										
Diesel-Range Organics (6)	2	15	1300		8400		ug/L	02-349	5/15	200-300

Notes:
(1) Number includes field duplicates.
(2) Number does not include samples collected at location 03-896 because that well is not impacted by site contamination.
(3) Number does not include soil samples collected at depths greater than 15 feet below ground surface.
(4) Number does not include groundwater samples analyzed using VPH, EPH, Method 418.1, AK 102-AA, or AK 103-AA.
(5) Minimum/maximum detected concentration used in the risk assessment
(6) The total number of samples collected for sediment and surface water from East Canal include only those samples from the SWMU 62, New Housing Fuel Leak Site. The number of samples used in the risk assessment also included data collected from East Canal, downgradient of SWMU 62, between SWMU 62 and Crossover Canal.

Definitions: J - estimated value
mg/kg - milligrams per kilogram
ug/L - micrograms per liter
na - not available

5.0 SUMMARY OF RISK ASSESSMENT

Baseline human health and ecological risk assessments were conducted to determine if residual petroleum at the SWMU 62, New Housing Fuel Leak site would pose unacceptable risk to human health or the environment if no cleanup actions were to take place. Contaminant concentrations reported in Section 4 were used to calculate risks and hazards. Hazards calculated for human exposures to chemicals in soil were found to be greater than target health goals. Target health goals established for free-product petroleum sites at the former Adak Naval Complex are the following:

- Human health cancer risk (CR) of 1×10^{-5}
- Human health hazard index (HI) of 1 based on compounds other than total petroleum hydrocarbon (TPH) compounds
- Human health HI of 1 based on TPH
- Ecological HI of 1

5.1 HUMAN HEALTH

Alaska DEC provides guidance for four methods of determining cleanup levels (beginning with Method One) that increase in level of effort and site-specificity. Method Four uses risk assessment to determine site specific cleanup levels (ADEC 2000a). Sufficient site information is available to determine Method Four cleanup levels and the results are summarized below. Details are provided in Appendix C of the FFS report (URS 2005a).

Previous investigations have identified petroleum compounds in soil and groundwater and surface water and sediment of the East Canal ditch at concentrations above regulatory levels. These elevated concentrations at the site are likely the result of leakage from subsurface heating fuel distribution lines. The risk assessment, conducted according to the risk assessment procedures specified by Alaska DEC (2000a), evaluated whether potential health risks were present if people encountered these petroleum-impacted materials in their environment. Exposure pathways were determined to be complete and significant based on the site-specific human health conceptual site model (CSM). The human health CSM for the SWMU 62, New Housing Fuel Leak site is depicted on Figure 5-1. This section provides a summary of the human health risk assessment conducted for this site. The complete, detailed human health risk assessment is included as Appendix C of the FFS report (URS 2005a).

5.1.1 Human Health Risk Assessment Procedures

A baseline risk assessment typically consists of four major steps: (1) data evaluation, (2) exposure assessment, including development of a CSM, (3) toxicity assessment, and (4) risk characterization and calculation of cleanup levels. A final step is a qualitative analysis of the major uncertainties involved in risk assessment calculations. Details of the procedures used to calculate the health risks are summarized below.

Data Evaluation

At step one, the data applicable to human health exposures are selected and compared to de minimis health-based screening levels. Chemicals with concentrations greater than the de minimis levels are selected as "COPCs" for evaluation in the risk assessment. Eight chemicals were selected as COPCs in groundwater:

- 2-Methylnaphthalene
- Benzene
- Ethylbenzene
- Naphthalene
- Toluene
- Xylenes
- DRO
- GRO

One chemical, DRO was selected as a COPC in soil. DRO and benzo(a)pyrene were selected as COPCs in sediment. DRO and benzene were selected as COPCs in surface water.

Exposure Assessment

Once COPCs are selected, the second step in risk assessment is an evaluation of the exposure pathways by which people could encounter chemicals. The exposure assessment identifies the populations potentially exposed to chemicals at the site, the means by which exposure occurs, and the amount of chemical received from each exposure medium (i.e., the dose). Only complete exposure pathways are quantitatively evaluated. Complete pathways consist of four elements: (1) a source and mechanism of chemical release, (2) a retention or transport medium (e.g., groundwater), (3) a point of potential human contact with the affected medium, and (4) a means of entry into the body at the contact point. Figure 5-1 presents the CSM, which depicts the complete pathways for this site.

Future land use at the SWMU 62, New Housing Fuel Leak site is classified as mostly residential reuse with adjacent areas a mixture of commercial and public land uses. Several areas adjacent

to the housing areas were impacted by fuel releases associated with the SWMU 62, New Housing Fuel Leak site. Therefore, for the purposes of the risk assessment, these areas were evaluated as part of the SWMU 62, New Housing Fuel Leak site. These areas include the area of SWMU 62, New Housing Fuel Leak site between Sandy Cove Housing and Eagle Bay Housing which is classified as public facilities and contains the elementary school and the high school buildings; and the areas immediately west of Sandy Cove Housing and Eagle Bay Housing which are designated as commercial reuse. Building T-2776 is currently used intermittently as a vehicle maintenance building and is expected to continue to be used as such. Therefore, building workers of Building T-2776 are considered a population of concern. Although no construction activities are planned at this time, intrusive subsurface activities could occur in the future. Construction workers could be exposed to both soil and groundwater during intrusive activities. Adults and children currently occupy some of the Sandy Cove Housing units. Eagle Bay is currently not occupied; however, it could be occupied in the future. Therefore, current residents of Sandy Cove Housing and future potential residents of Eagle Bay Housing are populations of concern for exposure to surface soil and groundwater. The East Canal of the airport ditch system is about 300 feet from the western boundary of the SWMU 62, New Housing Fuel Leak site, but approximately 1,800 feet from the nearest occupied homes. Although residents are not living near the East Canal, trespassers may occasionally enter the East Canal ditch. Currently, there is no fence surrounding the East Canal but the area is restricted to airport personnel. The populations of concern for exposure to surface water and sediment from East Canal are trespassing, elementary-aged school children (aged 6 to 12 years) who may travel from the housing areas.

The following exposure pathways were selected for quantitative evaluation under current and future conditions:

- Construction workers potentially disturbing soil in the course of construction activity could be exposed through incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile chemicals in soil (to a depth of 15 feet).

- Construction workers conducting intrusive subsurface work could be exposed to chemicals in shallow groundwater (less than 15 feet bgs) through dermal contact and inhalation of volatile chemicals.

- On-site workers occupying Building T-2776 could be exposed to vapors in indoor air volatilizing from groundwater beneath the building. In addition, on-site workers could be exposed to chemicals in surface soil through incidental ingestion and dermal contact.

- Current and future child and adult residents of the SWMU 62, New Housing Fuel Leak site could be exposed to vapors in indoor air volatilizing from groundwater

beneath the housing units. In addition, residents could be exposed to chemicals in surface soil through incidental ingestion and dermal contact.

- Elementary School-Aged Child Trespassers could be exposed to chemicals in surface water and sediment of the East Canal of the airport ditch system through incidental ingestion and dermal contact. Surface water and sediment data collected from the East Canal of the airport ditch system in the vicinity of the SWMU 62, New Housing Fuel Leak site, as well as downgradient to the cross-over canal were included in the evaluation of recreational child exposures in the East Canal of the airport ditch system. While not all of the data were collected specifically for the evaluation of contamination from the New Housing Fuel Leak, the downgradient locations were included to fully characterize exposures of child residents of the SWMU 62, New Housing Fuel Leak site to contamination in the East Canal ditch.

Ingestion of groundwater is considered an incomplete pathway for all receptors. Institutional controls are currently in place for groundwater which restrict the use of groundwater as drinking water.

The exposure factors used in the risk calculations for each population are summarized on Tables 5-1 through 5-8.

5.1.2 Toxicity Assessment

The third step in risk assessment is an evaluation of the toxicity of the COPCs by an assessment of the relationship between the dose of a chemical and the occurrence of toxic effects. Chemical toxicity criteria, which are based on this relationship, consider both cancer effects and effects other than cancer (noncancer effects). Tables 5-9 and 5-10 present the cancer and noncancer criteria, respectively. The toxicity criteria are combined with the exposure factors when quantifying potential health risks for each COPC. The toxicity criteria are required in order to quantify the potential health risks due to the COPCs. Benzene and ethylbenzene in groundwater, and benzo(a)pyrene in surface water were evaluated for cancer effects; and the other chemicals (where toxicity information exists) were evaluated for noncancer effects.

Note, only noncancer toxicity criteria are available for the petroleum groups. Carcinogenic effects are not evaluated for the petroleum ranges. Rather, the individual carcinogenic compounds present in petroleum (i.e., benzene) are evaluated separately.

5.1.3 Risk Characterization

The last step in human health risk assessment is a characterization of the health risks. The exposure factors, media concentrations, and toxicity criteria are combined to calculate health risks. Health risks are calculated differently for chemicals that cause cancer and for chemicals that cause noncancer effects. The calculation of CR assumes that no level of the chemical is without some risk, whereas for chemicals with noncancer effects, a "threshold" dose exists. Risks (for cancer) and hazards (for noncancer effects) are calculated for the reasonable maximum exposure (RME) for each pathway, a calculation that overestimates risks for the majority of the population in order to ensure that public health is protected. CR estimates represent the potential for cancer effects by estimating the probability of developing cancer over a lifetime due to site exposures. Noncancer hazards assume there is a level of chemical intake that is not associated with an adverse health effect even in sensitive individuals.

The following bulleted text summarize the results of the risk characterization. The exposure point concentrations (EPCs) used to calculate these risks and hazards are presented on Table 5-11.

- **Construction Workers.** Total CRs (5×10^{-8}) and TPH and non-TPH noncancer hazards (0.1 and 0.05, respectively) for combined exposures to soil and groundwater are below target health goals (see Table 5-12). Therefore, concentrations of the COPCs in soil and groundwater at the site are not present in concentrations that are a health concern for construction worker exposures.

- **On-Site Workers.** Total CRs (5×10^{-7}) and TPH and non-TPH noncancer hazards (0.04 and 0.6, respectively) for combined exposures to surface soil and groundwater vapors are below target health goals (see Table 5-13). Therefore, concentrations of the COPCs in surface soil and groundwater at the site are not present in concentrations that are a health concern for on-site worker exposures.

- **Child and Adult Residents.** Table 5-14 summarizes the results of the risk characterization for residential exposures to chemicals in soil and groundwater. Total CRs and non-TPH hazards for combined exposures to surface soil and groundwater vapors are below target health goals for child and integrated child/adult exposures. CRs were 1×10^{-6}; child non-TPH hazards were 0.08; and child/adult non-TPH hazards were 0.04. In addition, TPH hazard indices for exposures to groundwater vapors were also below target health goals for child (0.5) and integrated child/adult exposures (0.3). However, the child TPH HI of 2 for exposures to surface soil are slightly above the target health goal of 1. The exceedance above target health goals is due almost entirely to incidental ingestion of DRO in surface soil.

- **Elementary Child Trespasser.** Total CRs (7×10^{-8}) and TPH and non-TPH noncancer hazards (0.06 and 0.0002, respectively) for combined exposures to sediment and surface water of the East Canal of the airport ditch system are below target health goals (see Table 5-15). Therefore, concentrations of the COPCs in surface water and sediment are not present in the East Canal of the airport ditch in concentrations that are a health concern for on-site worker exposures.

- **Exposure to Free-Phase Petroleum Product.** Risks and hazards to free product cannot be quantified using standard risk assessment techniques. If free product is encountered in sufficient amounts, this could constitute a hazard. The presence of free product is generally assumed to present a situation where workers should take precautions to prevent exposure. Construction workers performing subsurface activities in the vicinity between Eagle Bay Housing Area and the East Canal of the airport ditch system, where depth to groundwater is less than 15 feet bgs (the maximum depth at which construction activities are expected to occur), could potentially contact free-phase petroleum during the course of their work. In the event that free product is encountered by construction workers, appropriate health and safety measures should be taken to minimize contact.

Because TPH chemicals in soil exceeded target health goals for child residential exposures and because there is sufficient free product remaining at the site that direct contact with free product could constitute a health risk, action-based alternative cleanup levels (ACLs) were calculated for DRO in soil as allowed under 18 AAC 75.340. The proposed action-based ACL is 6,111 mg/kg for DRO. This action-based ACL was calculated by defining a target health goal and then solving the basic risk assessment equations for concentration, rather than for risk or for hazard. The same site-specific information developed for calculating health risks was used in the action-based ACL calculations. Because only noncancer health effects are a concern, the ACL is protective of noncancer health end points.

Site-specific cleanup levels for groundwater were not calculated. While institutional controls are currently in place for groundwater, which restrict the use of groundwater as a drinking water source, the water is potentially potable (i.e., yield is sufficient and there is no saltwater intrusion). Therefore, the proposed groundwater cleanup levels for SWMU 62, New Housing Fuel Leak site are the Alaska DEC cleanup levels established for groundwater that is considered to be a reasonably expected potential future source of drinking water.

5.2 ECOLOGICAL

This section provides a summary of the ecological risk assessment conducted for this site. The complete, detailed ecological risk assessment is included as Appendix C of the FFS report (URS 2005a).

5.2.1 Ecological Risk Assessment Procedures

Ecological risk assessment procedures begin with determining whether a detailed ecological risk assessment of that site is required. A detailed ecological risk assessment of a given site is required whenever the potential for an ecological threat from chemicals exists. The decision on whether to perform a detailed ecological risk assessment or not is made during the problem formulation stage of the risk assessment process. Before a decision can be made on the need for a detailed ecological risk assessment of a given site, a determination is made regarding the following:

1. The presence of sensitive environments, critical habitats, or sensitive species at a site

2. The presence of complete exposure pathways which result in the exposure of ecological receptors to site contaminants

If it is determined that no sensitive environments, critical habitats or sensitive species are present at a given site, and complete exposure pathways cannot be identified, Alaska DEC guidance permits the ecological risk assessment process for that site to be terminated.

5.2.2 Problem Formulation

An ecological checklist (found in Appendix B of the Alaska DEC Risk Assessment Procedures Manual [ADEC 2000a] and included in Appendix C-II of the FFS [URS 2005a]) was completed, describing the location and characteristics (e.g., environmental setting, land use, environmental fate-and-transport, and ecological receptors) of specific environments within the boundaries of the SWMU 62, New Housing Fuel Leak site. Through this exercise, it was determined that no state or federal sensitive environment or critical habitat is found within the site boundaries.

An ecological conceptual site model (CSM) was also prepared for the SWMU 62, New Housing Fuel Leak site, describing the completeness and significance of exposure pathways by which ecological receptors may potentially be exposed to site contaminants. The CSM (included as Figure 5-2) revealed that no complete exposure pathways have been identified for any ecological receptors that warrant quantitative risk assessment. Several minor or insignificant exposure

pathways are present, none of which result in any ecologically significant exposure to contaminants at the site, and none of which requires quantitative evaluation.

5.2.3 Conclusion

Based on this assessment presented, it is concluded that no ecological threat exists for any ecological receptor from petroleum products released at the SWMU 62, New Housing Fuel Leak site. Therefore, no further ecological risk assessment is warranted for this site.

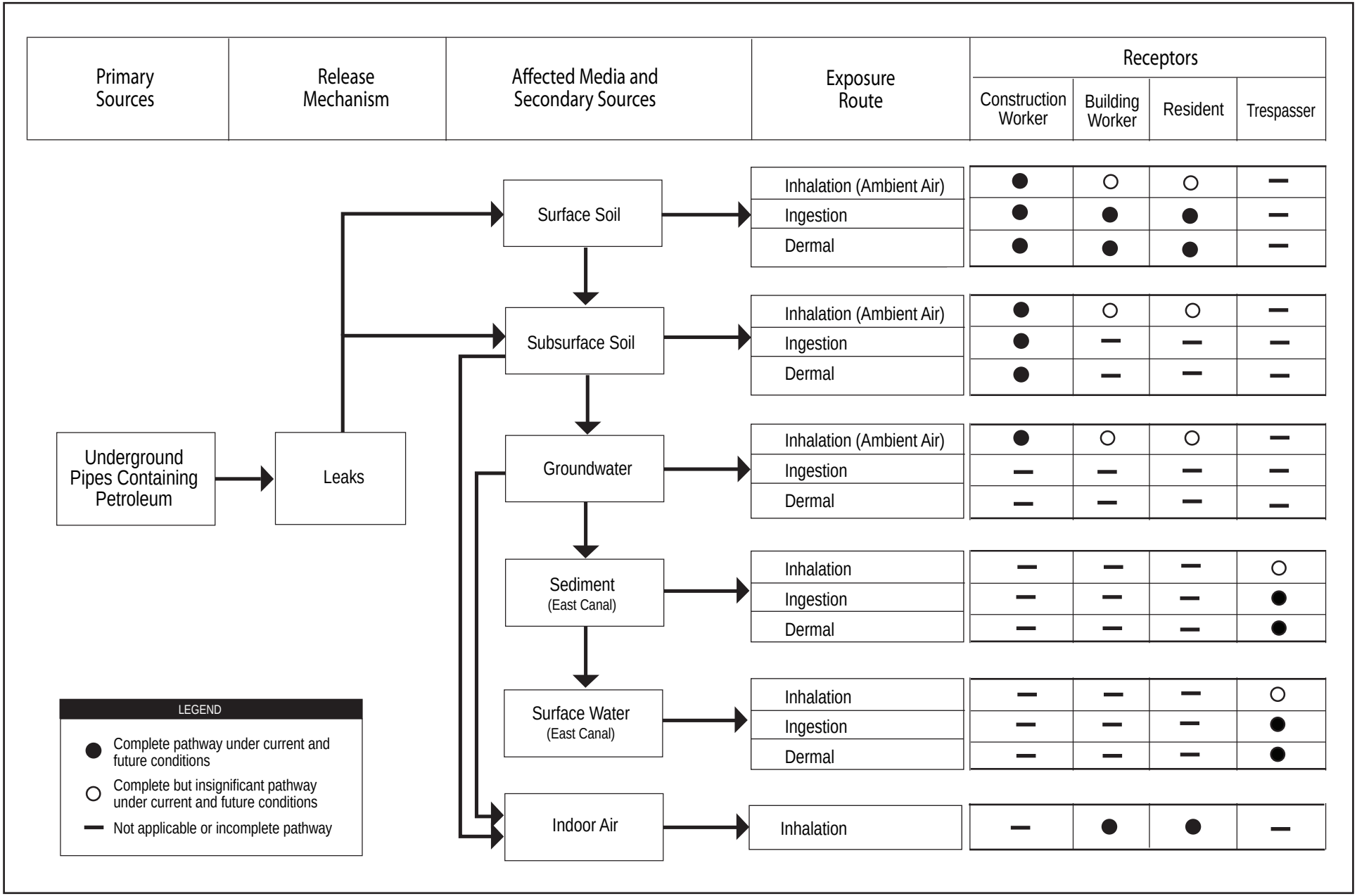

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Figure 5-1
Human Health Conceptual Site Model
SWMU 62, New Housing Fuel Leak Site

Adak Island, AK
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Primary Source	Primary Release Mechanism	Secondary Source	Secondary Release Mechanism	Tertiary Source	Tertiary Release Mechanism	Exposure Medium	Exposure Route	Potential Ecological Receptors									
								Terrestrial Biota				Aquatic Biota					
								Plants		Invertebrates		Macrophytes		Plankton		Invertebrates	
								Root Uptake	Shoot Sorption	Ingestion	Dermal Contact	Root Uptake	Shoot Sorption	Ingestion	Dermal Contact	Ingestion	Dermal Contact
ASTs, ags Pipes, Fuel Dispensers, Drums, FCTs, Fill Spouts on USTs, and/or Unknown	Spills/Leaks of Chemicals into Soil	On-Site Surface Soil	Dust Generation and Volitilization		Particulate and Volatile Emissions	Air	Inhalation	—	—	—	—	—	—	—	—	—	—
						On-Site Surface Soil (0-6 feet bgs)	Incidental Ingestion	—	—	—	—	—	—	—	—	—	—
							Dermal Contact/ Root Uptake		—	—	—	—	—	—	—	—	—
							Food Web	—	—	—	—	—	—	—	—	—	—
USTs, bgs Pipes, Disposal Area, and/or Unknown		On-Site Subsurface Soil	Overland Runoff			On-Site Subsurface Soil (>6 feet bgs)		—	—	○	○	—	—	—	—	—	—
							Incidental Ingestion	—	—	○	○	—	—	—	—	—	—
							Dermal Contact/ Root Uptake	—	—	○	○	—	—	—	—	—	—
			Leaching and Infiltration	Groundwater	Discharge to Drainage Ditch	East Canal Sweeper Creek Sweeper Cove Kuluk Bay surface water	Incidental Ingestion	○	○	○	○	○	○	○	○	○	○
								○	○	○	○	○	○	○	○	○	○
							Food Web	○	○	○	○	○	○	○	○	○	○
Storm and Wastewater Discharge	Spills/Leaks of Chemicals into Airport Ditch System																
			Slope Erosion			Sediments	Incidental Ingestion	○	○	○	○	○	○	○	○	○	○
							Dermal Contact/ Root Uptake	○	○	○	○	○	○	○	○	○	○
			Sedimentation, Sorption				Food Web	○	○	○	○	○	○	○	○	○	○

LEGEND

- ● Potentially Complete Pathway
- ○ Minor or Insignificant Pathway
- — Incomplete Pathway
- ags Above Ground Surface
- AST Above Ground Storage Tank
- bgs Below Ground Surface
- FCT Field Constructed Tank
- UST Underground Storage Tank

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Figure 5-2
Ecological Conceptual Site Model
SWMU 62, New Housing Fuel Leak Site

Table 5-1
Construction Worker Exposures to Groundwater, Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CW * SIF

$$SIF_{derm} = \frac{CF1 \cdot CF2 \cdot SA \cdot EF \cdot ET \cdot ED \cdot PC}{BW \cdot AT}$$

$$SIF_{inh} = \frac{CF1 \cdot InhR \cdot EF \cdot ED \cdot VFw}{BW \cdot AT}$$

Where:

SIF_{derm} (L-mg/ug-kg-day) = summary intake factor for dermal contact with groundwater
SIF_{inh} (L-mg/ug-kg-day) = summary intake factor for inhalation of groundwater vapors

Parameter	Definition	Value	Units	Source
CW	Chemical concentration in	chemical specific	ug/L	analytical data
CF1	Conversion factor	1.00E-03	mg/ug	not applicable
CF2	Conversion factor	1.00E-03	L/cm^3	not applicable
SA	Skin surface area	3300	cm^2	default value, USEPA 2002c
PC	Dermal permeability constant	chemical specific	cm/hr	USEPA 2003b
InhR	Inhalation rate	20	m^3/day	default value, USEPA 2002c
VFw	Volatilization factor for water	0.01	L/m^3	site-specific, USEPA 1999a
EF	Exposure frequency	190	days/year	site-specific
ET	Exposure time	8	hours/day	site-specific
ED	Exposure duration	1	years	site-specific
BW	Body weight	70	kg	default value, USEPA 2002c
ATnc	Averaging time (noncarcinogen)	ED x 365 days/year	days	default value, USEPA 2002c
ATca	Averaging time (carcinogen)	25,550	days	default value, USEPA 2002c

Notes:

cm - centimeter
cm^2 - centimeters squared
cm^3 - cubic centimeters
hr - hour
kg - kilograms
L - liters
m^3 - cubic meters
mg - milligrams
ug - micrograms
USEPA - United States Environmental Protection Agency

Table 5-2
Construction Worker Exposures to Soil, Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CS * SIF

$$SIF_{ing} = \frac{IR \bullet CF \bullet EF \bullet ED}{BW \bullet AT}$$

$$SIF_{derm} = \frac{CF \bullet SA \bullet AF \bullet ABS \bullet EF \bullet ED}{BW \bullet AT}$$

$$SIF_{inh} = \frac{InhR \bullet EF \bullet ED \bullet (1/PEF)}{BW \bullet AT}$$

Where:

SIF_{ing} (day^{-1}) = summary intake factor for ingestion of soil
SIF_{derm} (day^{-1}) = summary intake factor for dermal contact with soil
SIF_{inh} (day^{-1}) = summary intake factor for inhalation of fugitive dust

Parameter	Definition	Value	Units	Source
CS	Chemical concentration in soil	chemical specific	mg/kg	analytical data
IR	Ingestion rate	330	mg/day	default value, USEPA 2002c
CF	Conversion factor	1.00E-06	kg/mg	not applicable
SA	Surface area	3300	cm^2	default value, USEPA 2002c
AF	Soil to skin adherence factor	0.3	mg/cm^2-day	default value, USEPA 2002c
ABS	Absorption factor	chemical specific	unitless	USEPA 2003b
InhR	Inhalation rate	20	m^3/day	default value, USEPA 2002c
PEF	Particulate emission factor	chemical specific	m^3/kg	site-specific, USEPA 2002c
EF	Exposure frequency	190	days/year	site-specific
ED	Exposure duration	1	years	site-specific
BW	Body weight	70	kg	default value, USEPA 2002c
ATnc	Averaging time (noncarcinogen)	ED x 365 days/year	days	default value, USEPA 2002c
ATca	Averaging time (carcinogen)	25,550	days	default value, USEPA 2002c

Notes:

cm^2 - centimeters squared
kg - kilograms
m^3 - cubic meters
mg - milligrams
USEPA - United States Environmental Protection Agency

Table 5-3
Building Worker Exposures to Vapors in Indoor Air
Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CA * SIF

$$SIF_{inh} = \frac{CF1 \bullet InhR \bullet EF \bullet ED \bullet ET}{BW \bullet AT}$$

Where:

SIF_{inh} (L-mg/ug-kg-day) = summary intake factor for inhalation of vapors from affected media

Parameter	Definition	Value	Units	Source
CA	Chemical concentration in air	chemical specific	$\mu g/m^3$	Calculated using the Johnson-Ettinger (1991) Model (USEPA 2003c) to estimate chemical movement from affected media (i.e., soil or groundwater) to air.
CF1	Conversion factor	1.00E-03	mg/μg	Not applicable
InhR	Inhalation rate	1.3	m^3/hour	Default value (USEPA 1997a)
EF	Exposure frequency	250	days/year	Default value (USEPA 1991)
ET	Exposure time	8	hours/day	Site-specific
ED	Exposure duration	25	years	Default value (USEPA 1991)
BW	Body weight	70	kg	Default value (USEPA 2002c)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeter
cm^3 - cubic centimeter
hr - hour
kg - kilogram
L - liter
m^3 - cubic meter
mg - milligram
ug - microgram
USEPA - United States Environmental Protection Agency

Table 5-4
Building Worker Exposures to Surface Soil
Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CS * SIF

$$SIF_{ing} = \frac{IR \bullet CF \bullet EF \bullet ED}{BW \bullet AT}$$

$$SIF_{derm} = \frac{CF \bullet SA \bullet AF \bullet ABS \bullet EF \bullet ED}{BW \bullet AT}$$

Where:

SIF_{ing} (day^{-1}) = summary intake factor for ingestion of soil
SIF_{derm} (day^{-1}) = summary intake factor for dermal contact with soil

Parameter	Definition	Value	Units	Source
CS	Chemical concentration in soil	chemical specific	mg/kg	Analytical data
IR	Ingestion rate	100	mg/day	Default value (USEPA 2002c)
CF	Conversion factor	1.00E-06	kg/mg	Not applicable
SA	Surface area	3300	cm^2	Default value (USEPA 2002c)
AF	Soil to skin adherence factor	0.2	mg/cm^2-day	Default value (USEPA 2002c)
ABS	Absorption factor	chemical specific	unitless	USEPA 2003b
EF	Exposure frequency	250	days/year	Default value (USEPA 2002c)
ED	Exposure duration	25	year	Default value (USEPA 2002c)
BW	Body weight	70	kg	Default value (USEPA 2002c)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeters
kg - kilograms
m^3 - cubic meters
mg - milligrams
USEPA - United States Environmental Protection Agency

Table 5-5
Residential Exposures to Vapors in Indoor Air
Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CA * SIF

$$SIF_{inh\text{-}nc} = \frac{CF1 \bullet InhRc \bullet EF \bullet EDc}{BWc \bullet ATnc}$$

$$SIF_{inh\text{-}ca} = \frac{[(InhRc \bullet EDc / BWc) + (InhRa \bullet EDa / BWa)] \bullet EF \bullet CF1}{ATca}$$

Where:

$SIF_{inh\text{-}nc}$ (L-mg/ug-kg-day) = summary intake factor for inhalation of vapors from affected media - noncarcinogenic effects
$SIF_{inh\text{-}ca}$ (L-mg/ug-kg-day) = summary intake factor for inhalation of vapors from affected media - carcinogenic effects

Parameter	Definition	Value	Units	Source
CA	Chemical concentration in air	Chemical-specific	ug/m^3	Calculated using the Johnson-Ettinger (1991) Model (USEPA 2003c) to estimate chemical movement from affected media (i.e., soil or groundwater) to air.
CF1	Conversion factor	1.00E-03	mg/ug	Not applicable
InhRc	Inhalation rate—child	10	m^3/day	Default value (USEPA 1998)
InhRa	Inhalation rate—adult	20	m^3/day	Default value (USEPA 1998)
EF	Exposure frequency	350	days/year	Default value (USEPA 1991)
EDc	Exposure duration—child	6	years	Default value (USEPA 1991)
EDa	Exposure duration—adult	24	years	Default value (USEPA 1991)
BWc	Body weight—child	15	kg	Default value (USEPA 1991)
Bwa	Body weight—adult	70	kg	Default value (USEPA 1991)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeter
cm^3 - cubic centimeter
hr - hour
kg - kilogram
L - liter
m^3 - cubic meter
mg - milligram
ug - microgram
USEPA - United States Environmental Protection Agency

Table 5-6
Residential Exposures to Surface Soil
Exposure Assumptions and Intake Equations

Equations:

$$\text{Chemical intake (mg/kg-day)} = CS \bullet SIF$$

$$SIF_{ing\text{-}nc} = \frac{IRc \bullet CF \bullet EF \bullet EDc}{BWc \bullet ATnc}$$

$$SIF_{ing\text{-}ca} = \frac{[(IRc \bullet EDc / BWc) + (IRa \bullet EDa / BWa)] \bullet EF \bullet CF}{ATca}$$

$$SIF_{derm\text{-}nc} = \frac{CF \bullet SAc \bullet AFc \bullet ABS \bullet EF \bullet EDc}{BWc \bullet ATnc}$$

$$SIF_{derm\text{-}ca} = \frac{[(SAc \bullet AFc \bullet EDc / BWc) + (SAa \bullet AFa \bullet EDa / BWa)] \bullet ABS \bullet EF \bullet CF}{ATca}$$

Where:

$SIF_{ing\text{-}nc}$ (day^{-1}) = summary intake factor for ingestion of soil-noncarcinogenic effects
$SIF_{ing\text{-}ca}$ (day^{-1}) = summary intake factor for ingestion of soil-carcinogenic effects
$SIF_{derm\text{-}nc}$ (day^{-1}) = summary intake factor for dermal contact with soil-noncarcinogenic effects
$SIF_{derm\text{-}ca}$ (day^{-1}) = summary intake factor for dermal contact with soil-carcinogenic effects

Parameter	Definition	Value	Units	Source
CS	Chemical concentration in soil	chemical specific	mg/kg	Analytical data
IRc	Ingestion rate-child	200	mg/day	Default value (USEPA 2002a)
IRa	Ingestion rate-adult	100	mg/day	Default value (USEPA 2002a)
CF	Conversion factor	1.00E-06	kg/mg	Not applicable
SAc	Surface area-child	2,800	cm^2	Default value (USEPA 2002a)
SAa	Surface area-adult	5,700	cm^2	Default value (USEPA 2002a)
AFc	Soil to skin adherence factor-child	0.2	mg/cm^2-day	Default value (USEPA 2002a)
AFa	Soil to skin adherence factor-adult	0.07	mg/cm^2-day	Default value (USEPA 2002a)
ABS	Absorption factor	chemical specific	unitless	USEPA 2003b
EF	Exposure frequency	350	days/year	Default value (USEPA 1991)
EDc	Exposure duration-child	6	years	Default value (USEPA 1991)
EDa	Exposure duration-adult	24	years	Default value (USEPA 1991)
BWc	Body weight-child	15	kg	Default value (USEPA 1991)
BWa	Body weight-adult	70	kg	Default value (USEPA 1991)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeter
derm - dermal
ing - ingestion
kg - kilogram
m^3 - cubic meter
mg - milligram
USEPA - United States Environmental Protection Agency

Table 5-7
Trespasser/Recreational Exposures to Surface Water, Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CW * SIF

$$SIF_{derm} = \frac{CF1 \cdot CF2 \cdot SA \cdot EF \cdot ET \cdot ED \cdot PC}{BW \cdot AT}$$

$$SIF_{ing} = \frac{IR \cdot CF1 \cdot CF2 \cdot ET \cdot EF \cdot ED}{BW \cdot AT}$$

Where:

SIF_{derm} (L-mg/ug-kg-day) = summary intake factor for dermal contact with groundwater
SIF_{ing} (L-mg/ug-kg-day) = summary intake factor for inhalation of groundwater vapors

Parameter	Definition	Value	Units	Source
CW	Chemical concentration in	chemical specific	ug/L	analytical data
CF1	Conversion factor	1.00E-03	mg/ug	not applicable
CF2	Conversion factor	1.00E-03	L/cm^3	not applicable
SA	Skin surface area	2314	cm^2	default value, USEPA 1997a
PC	Dermal permeability constant	chemical specific	cm/hr	USEPA 2003b
IR	Ingestion rate	30	mL/hr	default value, USEPA 1998
VFw	Volatilization factor for water	0.01	L/m^3	site-specific, USEPA 1999a
EF	Exposure frequency	190	days/year	site-specific
ET	Exposure time	5	hours/day	site-specific
ED	Exposure duration	1	years	site-specific
BW	Body weight	33	kg	default value, USEPA 1997a
ATnc	Averaging time (noncarcinogen)	ED x 365 days/year	days	default value, USEPA 1989
ATca	Averaging time (carcinogen)	25,550	days	default value, USEPA 1989

Notes:
cm - centimeter
cm^2 - centimeters squared
cm^3 - cubic centimeters
derm - dermal
hr - hour
ing - ingestion
kg - kilograms
L - liters
m^3 - cubic meters
mg - milligrams
ug - micrograms
mL - milliliter
USEPA - United States Environmental Protection Agency

Table 5-8
Trespasser/Recreational Exposures to Sediment, Exposure Assumptions and Intake Equations

Equations:

Chemical intake (mg/kg-day) = CSd * SIF

$$SIF_{ing} = \frac{IR \cdot CF \cdot EF \cdot ED}{BW \cdot AT}$$

$$SIF_{derm} = \frac{CF \cdot SA \cdot AF \cdot ABS \cdot EF \cdot ED}{BW \cdot AT}$$

Where:

SIF_{ing} (day^{-1}) = summary intake factor for ingestion of sediment
SIF_{derm} (day^{-1}) = summary intake factor for dermal contact with sediment

Parameter	Definition	Value	Units	Source
CSd	Chemical concentration in	chemical specific	mg/kg	analytical data
IR	Ingestion rate	300	mg/day	default value, USEPA 1999c
CF	Conversion factor	1.00E-06	kg/mg	not applicable
SA	Surface area	2,314	cm^2	site-specific, USEPA 1997a
AF	Soil to skin adherence factor	0.2	mg/cm^2-event	default value, USEPA 2003b
ABS	Absorption factor	chemical specific	unitless	USEPA 2003b
EF	Exposure frequency	7.5(ing)/21(derm)	events/year	site-specific
ED	Exposure duration	6	years	site-specific
BW	Body weight	33	kg	default value, USEPA 1997a
ATnc	Averaging time (noncarcinogen)	ED x 365 days/year	days	default value, USEPA 1989
ATca	Averaging time (carcinogen)	25,550	days	default value, USEPA 1989

Notes:

cm^2 - centimeters squared
kg - kilograms
m^3 - cubic meters
mg - milligrams
ing - ingestion
derm - dermal
USEPA - United States Environmental Protection Agency

Table 5-9
Carcinogenic Toxicity Criteria for the Chemicals of Potential Concern

Chemical	Oral Cancer: Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer: Slope Factor $(mg/kg\text{-}day)^{-1}$	Tumor Type	EPA Cancer Classification[a]	Reference
2-Methylnaphthalene	None	None	NA	Not classified	NA
Benzene	0.055	0.029	Leukemia (human)	EPA Group A carcinogen	USEPA 2002a
Benzo(a)pyrene	7.3	3.1	Forestomach, larynx, and esophagus tumors (oral); Pharynx, larynx tumors (inhalation)	EPA Group B2 carcinogen	USEPA 2003a (oral) USEPA 1994 (inhalation)
Ethylbenzene	None	0.0039	Renal and testicular cancer (male rats)	EPA Group D carcinogen[b]	USEPA 2002a
Naphthalene	None	None	NA	EPA Group D carcinogen	USEPA 2002a
Toluene	None	None	NA	EPA Group D carcinogen	USEPA 2002a
Xylenes	None	None	NA	EPA Group D carcinogen	USEPA 2002a
DRO aliphatics	None	None	NA	Not classified	ADEC 2000b
DRO aromatics	None	None	NA	Not classified	ADEC 2000b
GRO aliphatic	None	None	NA	Not classified	ADEC 2000b
GRO aromatics	None	None	NA	Not classified	ADEC 2000b

Notes:
[a]EPA's Weight-of-Evidence Classification System:
Group A - human carcinogen (sufficient evidence in humans)
Group B1 - probable human carcinogen (limited human data available)
Group B2 - probable human carcinogen (sufficient evidence in animals, inadequate or no evidence in humans)
Group C - possible human carcinogen (limited evidence in animals)
Group D - not classifiable as to human carcinogenicity
[b]The IRIS file has not been updated yet to reflect the carcinogenicity of ethylbenzene. Therefore, the cancer classification will likely change.
ADEC - Alaska Department of Environmental Conservation
DRO - diesel-range organics
EPA - Environmental Protection Agency
GRO - gasoline-range organics
kg - kilogram
mg - milligram
NA - not applicable
SF - slope factor
USEPA - United States Environmental Protection Agency

Table 5-10
Noncarcinogenic Chronic and Subchronic Toxicity Criteria for the Chemicals of Potential Concern

Chemical	Chronic RfD (mg/kg-day)	Toxic Endpoint	Critical Study	Chronic RfD UF[a]	RfD Source	Adjustment from Chronic to Subchronic	Subchronic RfD (mg/kg-day)	EPA Subchronic Source[b]
Inhalation Exposures								
2-Methylnaphthalene	none[c]	--	--	--	NCEA-S-1400 (USEPA 2003d)	insufficient information	--	
Benzene	0.009	Decreased lymphocyte count	subchronic human occupational	300	IRIS	no adjustment for subchronic warranted, primary study is already occupational	0.009	
Benzo(a)pyrene	none[d]	--	--	--	--	--	--	
Ethylbenzene	0.29	Developmental toxicity	subchronic female rats	300	IRIS	Based on developmental effects during gestational exposures. No subchronic to chronic UF used; therefore, no subchronic value proposed.	0.29	
Naphthalene	0.00086	Nasal effects	chronic mouse	3,000	IRIS	remove adjustment from 5 to 7 days[e]	0.0043	
Toluene	0.11	Neurological effects	chronic human occupational	300	IRIS	no adjustment for subchronic warranted, primary study is already occupational	0.11	
Xylenes	0.029	Hyperactivity, decreased body weight, and increased mortality	subchronic male rats	300	IRIS	remove UF of 3 for subchronic to chronic	0.09	
DRO aliphatics	0.29	hepatic and hematological changes	NA	NA	ADEC 2000b	The petroleum fraction RfD values presented in ADEC guidance were not adjusted because of their status in State guidance and because of insufficient information on how those values were derived.	0.29	
DRO aromatics	0.06	Decreased body weight	NA	NA	ADEC 2000b		0.06	
GRO aliphatics	5.3	Neurotoxicity	NA	NA	ADEC 2000b		5.3	
GRO aromatics	0.11	Hepatotoxicity and nephrotoxicity	NA	NA	ADEC 2000b		0.11	
Oral Exposures								
2-Methylnaphthalene	0.009	pulmonary alveolar proteinosis	chronic male mice	1,000	NCEA-S-1400 (USEPA 2003d)	no adjustment for subchronic warranted because no UF applied for subchronic to chronic.	0.009	
Benzene	0.004	Decreased lymphocyte count	subchronic human occupational	300	IRIS	no adjustment for subchronic warranted, primary study is already occupational	0.004	
Benzo(a)pyrene	none[d]	--	--	--	--	--	--	
Ethylbenzene	0.10	Liver and kidney toxicity	subchronic mouse	1,000	IRIS	remove UF of 10 for subchronic to chronic	1	
Naphthalene	0.02	Decreased body weight	subchronic rat	3,000	IRIS	remove UF of 10 for subchronic to chronic	0.2	
Toluene	0.2	Changes in liver and kidney	subchronic rats	1,000	IRIS	remove UF of 10 for subchronic to chronic	2	*HEAST*
Xylenes	0.2	Hyperactivity, decreased body weight, and increased mortality	chronic rat	1,000	IRIS	remove adjustment from 5 to 7 days[e]	0.25	

Table 5-10 (Continued)
Noncarcinogenic Chronic and Subchronic Toxicity Criteria for the Chemicals of Potential Concern

Chemical	Chronic RfD (mg/kg-day)	Toxic Endpoint	Critical Study	Chronic RfD UF[a]	RfD Source	Adjustment from Chronic to Subchronic	Subchronic RfD (mg/kg-day)	EPA Subchronic Source[b]
Oral Exposures (Continued)								
DRO aliphatics	0.1	hepatic and hematological changes	NA	NA	ADEC 2000b	The petroleum fraction RfD values presented in ADEC guidance were not adjusted because of their status in State guidance and because of insufficient information on how those values were derived.	0.1	
DRO aromatics	0.04	Decreased body weight	NA	NA	ADEC 2000b		0.04	
GRO aliphatics	5.00	Neurotoxicity	NA	NA	ADEC 2000b		5.00	
GRO aromatics	0.2	Hepatotoxicity and nephrotoxicity	NA	NA	ADEC 2000b		0.2	

Notes

[a]EPA indicates that there are generally 5 areas of uncertainty where an application of a UF may be warranted

1 variation between species (applied when extrapolating from animal to human)
2 variation within species (applied to account for differences in human response and sensitive subpopulations)
3 use of a subchronic study to evaluate chronic exposure
4 use of a LOAEL, rather than a NOAEL
5 deficiencies in the data base

[b]If a subchronic value was obtained from a published source, rather than calculated, the source is listed in this column

[c]No inhalation criteria are available for this chemical and NCEA specifically states the route-to-route extrapolation from oral to inhalation is not recommended for this chemical (NCEA-S-1400, April 2003).

[e]This chemical is not a concern based on noncancer health effects. Therefore, there are no noncancer toxicity criteria for this chemical.

[e]EPA adjusted the 5-day per week exposure of the NOAEL to a 7-day NOAEL to account for continuous exposure (chronic), rather than subchronic, exposures

ADEC: Alaska Department of Environmental Conservation
DRO: diesel-range organics
EPA: Environmental Protection Agency
GRO: gasoline-range organics
IRIS: EPA's Integrated Risk Information System (on-line data base) (USEPA 2003a)
LOAEL: lowest-observed-adverse-effect-level
mg/kg-day: milligram per kilogram per day
NA: not applicable
NCEA: EPA's National Center for Environmental Assessment
NOAEL: no-observed-adverse-effect-level
RfD: Reference Dose
UF: Uncertainty factor

Table 5-11
Summary of Exposure Point Concentrations (EPCs)

Chemical of Potential Concern	Units	EPC [a]
Construction Worker Groundwater		
2-Methylnaphthalene	µg/L	11
Benzene	µg/L	15.4
Ethylbenzene	µg/L	91
Naphthalene	µg/L	22
Toluene	µg/L	133
Xylenes	µg/L	390
DRO (C_9-C_{24} aliphatics)	µg/L	32,302
DRO (C_9-C_{24} aromatics)	µg/L	16,151
GRO (C_6-C_8 aliphatics)	µg/L	1,145
GRO (C_6-C_8 aromatics)	µg/L	818
Construction Worker Soil		
DRO (C_9-C_{24} aliphatics)	mg/kg	1,600
DRO (C_9-C_{24} aromatics)	mg/kg	800
Residential Groundwater (Indoor Air)[b]		
2-Methylnaphthalene[c]	µg/L (µg/m^3)	0.18 (0.0004)
Benzene[c]	µg/L (µg/m^3)	3.56 (0.21)
Ethylbenzene[c]	µg/L (µg/m^3)	14.3 (0.84)
Naphthalene[c]	µg/L (µg/m^3)	11.8 J (0.0286)
Toluene[c]	µg/L (µg/m^3)	1.24 (0.077)
Xylenes[c]	µg/L (µg/m^3)	34.1 (1.74)
DRO (C_9-C_{24} aliphatics)	µg/L (µg/m^3)	[b]
DRO (C_9-C_{24} aromatics)	µg/L (µg/m^3)	[b]
GRO (C_6-C_8 aliphatics)[c]	µg/L (µg/m^3)	185 (2970)
GRO (C_6-C_8 aromatics)[c]	µg/L (µg/m^3)	132 (25.8)
Residential Surface Soil		
DRO (C_9-C_{24} aliphatics)	mg/kg	6,232
DRO (C_9-C_{24} aromatics)	mg/kg	3,116
On-site Worker Groundwater (Indoor Air)[b]		
2-Methylnaphthalene[c]	µg/L (µg/m^3)	32.5 (0.0027)
Benzene	µg/L (µg/m^3)	85 (0.168)
Ethylbenzene	µg/L (µg/m^3)	961 (2.07)
Naphthalene[c]	µg/L (µg/m^3)	66.6 (0.0063)

Table 5-11 (Continued)
Summary of Exposure Point Concentrations (EPCs)

Chemical of Potential Concern	Units	EPC [a]
Toluene	µg/L (µg/m^3)	1672 (3.52)
Xylenes	µg/L (µg/m^3)	4400 (8.54)
DRO (C_9-C_{24} aliphatics)	µg/L (µg/m^3)	[b]
DRO (C_9-C_{24} aromatics)	µg/L (µg/m^3)	[b]
GRO (C_6-C_8 aliphatics)	µg/L (µg/m^3)	11979 (514)
GRO (C_6-C_8 aromatics)	µg/L (µg/m^3)	8557 (53)
On-site Worker Surface Soil		
DRO (C_9-C_{24} aliphatics)[c]	mg/kg	13,600
DRO (C_9-C_{24} aromatics)[c]	mg/kg	6,800
Recreational/Trespasser Surface Water		
Benzene	µg/L	1.1
C9-C24 aliphatics	µg/L	1687
C9-C24 aromatics	µg/L	843
Recreational/Trespasser Sediment		
Benzo(a)pyrene	mg/kg	0.4
C9-C24 aliphatics	mg/kg	7,852
C9-C24 aromatics	mg/kg	3,926

[a] All EPCs are the 95 percent upper confidence limit of the mean, unless otherwise marked.
[b] The indoor air pathway is only complete for volatile chemicals. Indoor air EPCs were estimated using the Johnson-Ettinger Model for Vapor Intrusion from contaminated groundwater. Data from the wells in the closest proximity to the buildings were considered most representative of groundwater concentrations beneath the building. The model-predicted indoor air concentrations follow the groundwater concentrations in parentheses.
[c] This data set contains fewer than 10 samples; therefore the maximum detected concentration was used as the EPC. For groundwater, the maximum detected concentration from the most recent sampling investigation was used as the EPC.

DRO - diesel-range organics
EPC - exposure point concentration
GRO - gasoline-range organics
µg/L - micrograms of chemical per liter of water
µg/m^3 - micrograms of chemical per cubic meter of air
mg/kg - milligrams of chemicals per kilogram of soil

Table 5-12
Summary of Risks and Hazards for the Construction Worker

Chemicals of Potential Concern	Combined Groundwater and Soil		Groundwater						Surface Soil							
	Total		Inhalation		Dermal Contact		Total		Ingestion		Dermal Contact		Inhalation		Total	
	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR
2-Methylnaphthalene	na	na	b	b	b	b	na	na	a	a	a	a	a	a	na	na
Benzene	0.01	5E-08	0.003	9E-09	0.01	4E-08	0.01	5E-08	a	a	a	a	a	a	na	na
Ethylbenzene	0.001	7E-09	0.0005	7E-09	0.0009	--	0.001	7E-09	a	a	a	a	a	a	na	na
Naphthalene	0.009	na	0.008	--	0.001	--	0.009	na	a	a	a	a	a	a	na	na
Toluene	0.002	na	0.002	--	0.0004	--	0.002	na	a	a	a	a	a	a	na	na
Xylenes	0.03	na	0.006	--	0.02	--	0.03	na	a	a	a	a	a	a	na	na
Non-TPH Total Hazard/Risk[1]	0.06	5E-08	0.02	2E-08	0.03	4E-08	0.05	5E-08	na	na	na	na	na	na	na	na
C9-C24 aliphatics	0.05	na	c	c	b	b	na	na	0.04	--	0.01	--	0.000002	--	0.05	na
C9-C24 aromatics	0.06	na	c	c	b	b	na	na	0.05	--	0.01	--	0.000004	--	0.06	na
C6-C8 aliphatics	0.0003	na	0.0003	--	b	b	0.0003	na	a	a	a	a	a	a	na	na
C6-C8 aromatics	0.01	na	0.01	--	b	b	0.01	na	a	a	a	a	a	a	na	na
TPH Total Hazard/Risk[1]	0.1	na	0.01	na	na	na	0.01	na	0.09	na	0.03	na	0.000006	na	0.1	na

[1]Risk and hazard estimates are presented to one significant figure. Total risk and hazard values were calculated by summing unrounded values. Therefore, the total values may not equal the sum of the rounded values.

a - Chemical not selected as a COPC in this media

b - Toxicity criteria are not available to quantify exposures to the chemical by this pathway.

c - This chemical is not considered volatile. The inhalation pathway is only complete for volatile chemicals.

-- - Chemical not associated with carcinogenic/non-carcinogenic effects by this pathway.

na - not applicable, no values to total

HI - hazard index

COPC - chemical of potential concern

CR - cancer risk

TPH - total petroleum hydrocarbon

Table 5-13
Summary of Risks and Hazards for the On-Site Worker Exposures

Chemicals of Potential Concern	Combined Groundwater and Soil		Groundwater		Surface Soil					
	Total		Inhalation of Indoor Air		Incidental Ingestion		Dermal Contact		Total	
	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR
2-Methylnaphthalene	na	na	b	b	a	a	a	a	a	a
Benzene	0.002	2E-07	0.002	2E-07	a	a	a	a	a	a
Ethylbenzene	0.0007	3E-07	0.0007	3E-07	a	a	a	a	a	a
Naphthalene	0.0008	na	0.0008	--	a	a	a	a	a	a
Toluene	0.003	na	0.003	--	a	a	a	a	a	a
Xylenes	0.03	na	0.03	--	a	a	a	a	a	a
Non-TPH Total Hazard/Risk[1]	0.04	5E-07	0.04	5E-07	na	na	na	na	na	na
C9-C24 aliphatics	0.2	na	c	c	0.1	--	0.09	--	0.2	--
C9-C24 aromatics	0.3	na	c	c	0.2	--	0.1	--	0.3	--
C6-C8 aliphatics	0.01	na	0.01	--	a	a	a	a	a	a
C6-C8 aromatics	0.05	na	0.05	--	a	a	a	a	a	a
TPH Total Hazard/Risk[1]	0.6	na	0.06	na	0.3	na	0.2	na	0.5	na

[1]Risk and hazard estimates are presented to one significant figure. Total risk and hazard values were calculated by summing unrounded values. Therefore, the total values may not equal the sum of the rounded values.

a - Chemical not selected as a COPC in this media
b - Toxicity criteria are not available to quantify exposures to the chemical by this pathway.
c - This chemical is not considered volatile. The inhalation pathway is only complete for volatile chemicals.
-- - Chemical not associated with carcinogenic/non-carcinogenic effects by this pathway.
na - not applicable, no values to total
HI - hazard index
COPC - chemical of potential concern
CR - cancer risk
TPH - total petroleum hydrocarbon

Table 5-14
Summary of Risks and Hazards for the Child and Adult Residents

Chemicals of Potential Concern	Combined Groundwater and Soil			Groundwater			Surface Soil								
	Total			Inhalation of Indoor Air			Incidental Ingestion			Dermal Contact			Total		
	HI (child)	HI (child/adult)	CR (child/adult)	HI (child)	HI (child/adult)	CR (child/adult)	HI (child)	HI (child/adult)	CR (child/adult)	HI (child)	HI (child/adult)	CR (child/adult)	HI (child)	HI (child/adult)	CR (child/adult)
2-Methylnaphthalene	na	na	na	b	b	--	a	a	a	a	a	a	na	na	na
Benzene	0.01	0.008	9E-07	0.01	0.008	9E-07	a	a	a	a	a	a	na	na	na
Ethylbenzene	0.002	0.001	5E-07	0.002	0.001	5E-07	a	a	a	a	a	a	na	na	na
Naphthalene	0.02	0.01	na	0.02	0.01	--	a	a	a	a	a	a	na	na	na
Toluene	0.0004	0.0002	na	0.0004	0.0002	--	a	a	a	a	a	a	na	na	na
Xylenes	0.04	0.02	na	0.04	0.02	--	a	a	a	a	a	a	na	na	na
Non-TPH Total Hazard/Risk[1]	0.08	0.04	1E-06	0.08	0.04	1E-06	na	na	na	na	na	na	na	na	na
C9-C24 aliphatics	1	0.3	na	c	c	c	0.8	0.2	--	0.2	0.07	--	1	0.3	na
C9-C24 aromatics	1	0.4	na	c	c	c	1	0.3	--	0.3	0.09	--	1	0.4	na
C6-C8 aliphatics	0.4	0.2	na	0.4	0.2	--	a	a	a	a	a	a	na	na	na
C6-C8 aromatics	0.2	0.08	na	0.2	0.08	--	a	a	a	a	a	a	na	na	na
Hazard/Risk[1]	3	1	na	0.5	0.3	na	2	0.5	na	0.5	0.2	na	2	0.7	na

[1]Risk and hazard estimates are presented to one significant figure. Total risk and hazard values were calculated by summing unrounded values. Therefore, the total values may not equal the sum of the rounded values.

a - Chemical not selected as a COPC in this media

b - Toxicity criteria are not available to quantify exposures to the chemical by this pathway.

c - This chemical is not considered volatile. The inhalation pathway is only complete for volatile chemicals.

-- - Chemical not associated with carcinogenic/non-carcinogenic effects by this pathway.

na - not applicable, no values to total

HI - hazard index

COPC - chemical of potential concern

CR - cancer risk

TPH - total petroleum hydrocarbon

Table 5-15
Summary of Risks and Hazards for the Child Trespasser

Chemicals of Potential Concern	Combined Surface Water and Sediment		Surface Water						Sediment					
	Total		Ingestion		Dermal Contact		Total		Ingestion		Dermal Contact		Total	
	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR	HI	CR
Benzene	0.0002	3E-09	0.00007	1E-09	0.00008	2E-09	0.0002	3E-09	b	b	b	b	na	na
Benzo(a)pyrene	na	7E-08	b	b	b	b	na	na	--	5E-08	--	3E-08	na	7E-08
Hazard/Risk[1]	0.0002	8E-08	0.00007	1E-09	0.00008	2E-09	0.0002	3E-09	na	5E-08	na	3E-08	na	7E-08
C9-C24 aliphatics	0.03	na	0.004	--	b	b	0.004	na	0.01	--	0.006	--	0.02	na
C9-C24 aromatics	0.03	na	0.006	--	b	b	0.006	na	0.02	--	0.008	--	0.03	na
TPH Total Hazard/Risk[1]	0.06	na	0.01	na	na	na	0.01	na	0.03	na	0.01	na	0.05	na

[1]Risk and hazard estimates are presented to one significant figure. Total risk and hazard values were calculated by summing unrounded values. Therefore, the total values may not equal the sum of the rounded values.

a - Chemical not selected as a COPC in this media

b - Toxicity criteria are not available to quantify exposures to the chemical by this pathway.

c - This chemical is not considered volatile. The inhalation pathway is only complete for volatile chemicals.

-- - Chemical not associated with carcinogenic/non-carcinogenic effects by this pathway.

na - not applicable, no values to total

HI - hazard index

COPC - chemical of potential concern

CR - cancer risk

TPH - total petroleum hydrocarbon

6.0 REMEDIAL ACTION OBJECTIVES AND CLEANUP LEVELS

This section describes the remedial action objectives (RAOs) and the cleanup levels established for the SWMU 62, New Housing Fuel Leak site.

6.1 REMEDIAL ACTION OBJECTIVES

Based on the human health risk assessment conducted for this site and the regulatory requirements, the following RAOs were developed for the protection of human health at the SWMU 62, New Housing Fuel Leak site:

- Prevent human exposure to petroleum hydrocarbons in surface soil that would result in adverse health effects.
- Reduce petroleum hydrocarbons in groundwater to concentrations less than or equal to the Alaska DEC groundwater cleanup levels established for groundwater used as a drinking water source
- Minimize exposure to free-phase product in soil, groundwater, and surface water
- Prevent migration of free product to surface water that would result in an exceedance of the Alaska DEC surface water quality standard (sheen only)

Based on the results of the ecological risk assessment discussed in Section 5, no ecological threat exists for any ecological receptor from petroleum products released at the SWMU 62, New Housing Fuel Leak site. Therefore, no RAOs were developed for ecological receptors at the site.

6.2 CLEANUP LEVELS

Chemical-specific screening criteria and cleanup levels for soil and groundwater have been established for petroleum-contaminated sites at the former Adak Naval Complex in accordance with Alaska DEC regulation 18 AAC Chapter 75. Screening criteria were used to estimate the potential extent of contamination. Cleanup levels are the specified concentrations for remediation. The soil and groundwater screening criteria and cleanup levels proposed for the SWMU 62, New Housing Fuel Leak site are provided in Table 6-1.

The Alaska regulations establish four methods for determining cleanup levels for soil [18 AAC 75.340]. The Alaska DEC Method Two cleanup levels, the most stringent cleanup levels for soil, were established to prevent migration of contaminants from soil to groundwater in the over

40 inches of rainfall zone (18 AAC 75.341, Tables B1 and B2). The Alaska DEC Method Two cleanup levels were used as screening criteria for SWMU 62, New Housing Fuel Leak site to estimate the potential extent of soil impacted by petroleum contamination at the site (see Section 4). (ACLs) are specified for remediation of soil and are based on Alaska DEC Method Four [18 AAC 75.340(a)(4)], which uses site-specific risk assessments to establish cleanup levels. Site-specific ACLs were calculated as discussed in the Section 5. The ACLs are established at concentrations such that risks from hazardous substances do not exceed the following target health goals:

- Cumulative carcinogenic risk of 1 in 100,000
- Cumulative noncarcinogenic HI of 1.0 (18 AAC 75.325(h)).

The Alaska regulations establish three methods for determining cleanup levels for groundwater [18 AAC 75.345]. The tabulated groundwater cleanup levels [18 AAC 75.345(b)(1), Table C] were used as screening criteria to estimate the potential extent of groundwater impacted by petroleum contamination at the site (see Section 4). Cleanup levels specified for remediation of groundwater at the SWMU 62, New Housing Fuel Leak site are also based on the tabulated groundwater cleanup levels because groundwater is considered to be a reasonably expected potential future source of drinking water.

The East Canal of the airport ditch system is the only surface water body impacted by releases from the SWMU 62, New Housing Fuel Leak site. For surface water bodies of the state, Alaska regulation 18 AAC Chapter 70 establishes water quality standards based on water use classes and subclasses. The canals of the airport ditch system, including the East Canal, fall within the fresh water class, and the secondary recreation subclass. The water quality standards established for this use class and subclass specify that petroleum hydrocarbons, oils and grease may not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines, and surface waters must be virtually free from floating oils [18 AAC 70.020(b)(5)(B)(ii)]. Based on the results of the risk assessment (see Section 5), no ecological threat exists for any ecological receptor from petroleum hydrocarbons released at the SWMU 62, New Housing Fuel Leak site. Therefore, no risk-based cleanup levels were calculated for surface water or sediment at the site.

6.3 EXTENT OF CONTAMINATION

The media of concern for which RAOs were established in Section 6.1 include soil, groundwater, and free-phase product. The extent of contamination for these media is summarized below.

The ACL discussed in Section 4 was used to delimit the area that exceeds acceptable risk for human exposure to petroleum hydrocarbons in surface soil. An ACL has been defined for DRO at a concentration of 6,111 mg/kg. One small area shown on Figure 6-1 was identified as

containing surface soil with DRO concentrations exceeding the ACL. The area exceeding the ACL is approximately 6,100 ft^2. Surface soil exceeding the ACL was found between 0 and 2 feet bgs. Based on the area and depths of the surface soil exceedances, the volume of soil exceeding the ACL was estimated to be 450 cy.

The extent of groundwater that exceeds Alaska DEC criteria established for groundwater used as drinking water source is delimited in Section 4 and shown on Figure 6-1. The Alaska DEC criteria established for groundwater not currently used for, or not reasonably expected to be used for drinking water at this site are:

- Benzene 5 µg/L (0.005 milligrams per liter [mg/L])
- Ethylbenzene 700 µg/L (0.7 mg/L)
- Toluene 1,000 µg/L (1 mg/L)
- DRO 1,500 µg/L (1.5 mg/L)
- GRO 1,300 µg/L (1.3 mg/L)

The areas that potentially exceed the Alaska DEC criteria for groundwater not used for drinking water total approximately 20 acres.

The approximate extent of free-product remaining on the site is also presented in Section 4. The estimated extent of residual free product for 2000 through 2003 is shown on Figure 4-1. During this time period, measurable thicknesses of free product were detected in three areas in the Eagle Bay Housing area and seven areas in the Sandy Cove Housing area as presented on Figure 4-1. These areas total approximately 5.7 acres. An estimated 1,400 to 6,900 gallons of recoverable free product may remain in the subsurface at the site.

LEGEND

- Fence
- Monitoring Well
- Abandoned Well
- Recovery Well
- Geoprobe Well
- Lost Well
- Extent of Groundwater Where Petroleum-Related Chemicals Exceed the Groundwater Cleanup Levels
- Extent of Surface Soil Where Petroleum-Related Chemicals Exceed the ACL for DRO
- Housing Unit Where Pipeline Leak Was Repaired

Perched

Perched

Perched

Observed Petroleum Seeps

Sandy Cove Housing

Eagle Bay Housing

PAVED AREA

Main Road

Mechanic Road

Bayshore Highway

East Canal

Sweeper Cove

Kuluk Bay

Raven Street

U.S. NAVY

Adak Island, AK
DECISION DOCUMENT

0 60 120 240
SCALE IN FEET

Figure 6-1
Extent of Surface Soil and Groundwater Contamination
SWMU 62, New Housing Fuel Leak Site

FILENAME: T:\ADAK\UDIQ\Sub-Tasks\UO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 6-1 SUR_GW CONTAM.dwg
EDIT DATE: 05/04/06 AT: 14:42

Table 6-1
Soil and Groundwater Cleanup Levels, SWMU 62, New Housing Fuel Leak Site

Chemical	Soil		Groundwater
	Screening Criteria (Method Two)[a] (mg/kg)	Surface Soil ACL (Method Four)[b, c] (mg/kg)	Screening Criteria and Cleanup Levels (Table C)[a, b] (mg/L)
Total Petroleum Hydrocarbons			
DRO	230	6,111	1.5
GRO	260	NC	1.3
Volatile Organic Compounds			
Benzene	0.02	NC	0.005
Ethylbenzene	5	NC	0.7
Toluene	4.8	NC	1
Trichloroethene	0.02	NC	0.005

[a]Used as screening criteria to determine potential extent of contamination
[b]Used as cleanup levels for remediation
[c]Surface soil is soil less than two feet deep

Notes:
ACL - alternative cleanup level
DRO - diesel-range organics
GRO - gasoline-range organics
mg/kg - milligrams per kilogram
mg/L - milligram per liter
NC - not calculated, risk less than target health goal

7.0 REMEDIAL ACTION ALTERNATIVES

Remedial technology types and process options were identified and screened first for the downtown sites as a group, because focused feasibility studies will be prepared for four downtown Adak petroleum sites (NMCB Building Expanded Area; South of Runway 18-36 Area; SWMU 17, Power Plant No. 3 Area; and SWMU 62, New Housing Fuel Leak site) that have similar characteristics. Then, the technology types and process options determined to be applicable to the downtown petroleum sites (i.e., the "short list") were evaluated using site-specific information to identify those applicable to SWMU 62, New Housing Fuel Leak site. This evaluation was conducted with respect to protectiveness, ability to meet cleanup levels, and implementability, which are the three criteria identified in Alaska DEC guidance (Alaska DEC 1999b). The technologies and process options that passed the screening steps were combined to form candidate remedial alternatives for the SWMU 62, New Housing Fuel Leak site. These candidate remedial alternatives represent the most effective combination of actions for meeting the RAOs. A conceptual design for each alternative was developed and used to estimate capital, operation and maintenance (O&M), and present worth costs for each alternative.

Brief descriptions of the candidate remedial alternatives, including costs, are as follows:

- **Alternative 1 – No Action**: No action or monitoring would be implemented with this alternative. Institutional controls (equitable servitude restrictions), as described in the ICMP, are currently in place for the site. Equitable servitude restrictions applicable to this site include restrictions on land development (i.e., residential land development would be prohibited), the downtown groundwater use prohibition, and the soil excavation notification requirements. This alternative would rely solely on natural attenuation to reduce concentrations of petroleum in the soil and groundwater. However, because monitoring is not included as part of this alternative, there would be no way to verify whether the cleanup levels and RAOs had been achieved. This alternative was retained as the baseline alternative with which the other alternatives were compared.

  Cost: $0

- **Alternative 2 – Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA for Groundwater:** This alternative consists of: institutional controls that are already in place for soil and groundwater as described in the ICMP: installation of one free-product collection/containment trench, installation of four new free-product recovery/groundwater monitoring wells, surface soil excavation: disposal of soil from the free-product collection/containment trench and the surface soil

excavation area, free-phase product collection/containment in the free-product collection/containment trench, passive free-phase product recovery from new and existing wells, sorbent boom maintenance, and MNA for groundwater (see Figure 7-1). Free product would be removed from the free-product collection/containment trench and 38 wells (1 new and 37 existing) using automated passive skimmers, passive skimmers, and/or sorbent socks; surface soil exceeding the ACLs would be excavated and disposed of; petroleum concentrations in groundwater would be reduced through natural attenuation; and institutional controls would be used to protect human health and the environment as long as groundwater concentrations were greater than groundwater cleanup levels.

Cost: Capital - $1.1 million, Annual O&M for Free-Product Collection/ Containment Trench - $150,000 for the first 2 years and $100,000 for years 3 to 18, Annual O&M for Passive Free-Product Recovery in Wells - $410,000 for the first 2 years and $350,000 for years 3 to 5, Annual O&M for sorbent boom maintenance - $33,000, Annual O&M for MNA in Groundwater - $70,000, Total Present Worth Cost - $5.5 million

- **Alternative 3 – Institutional Controls, Free-Product Containment and Active Recovery, Canal Bank Soil and Surface Soil Excavation, and MNA for Groundwater:** This alternative consists of institutional controls that are already in place as described in the ICMP, installation of one free-product collection/containment trench, surface soil and canal bank excavation, disposal of soil from the free-product collection/containment trench, surface soil excavation area, and canal bank excavation area, installation of seven new free-product recovery wells, modification and start up of the existing total fluids free-product recovery system at Eagle Bay Housing area, passive free-product recovery from the free-product collection/containment trench and existing wells in Sandy Cove Housing area, installation of four new monitoring wells for groundwater monitoring, and MNA for groundwater (see Figure 7-2). Active free-product recovery in the Eagle Bay Housing Area using the existing total fluids recovery system would occur in 11 wells (7 new and 4 existing); free product would be removed from the free-product collection/containment trench and 10 existing wells in the Sandy Cove Housing area using automated passive skimmers, passive skimmers, and sorbent socks; surface soil exceeding target health goals would be excavated and disposed of; petroleum concentrations in groundwater would be reduced through natural attenuation; and institutional controls would be used to protect human health and the environment as long as soil and groundwater

concentrations are greater than cleanup levels and surface water exceeds the Alaska DEC water quality standards for sheen.

Cost: Capital – $2.6 million, Annual O&M for Free-Product Collection/Containment Trench – $150,000 for the first 2 years and $97,000 for years 3 to 13, Annual O&M for Active Free-Product Recovery System – $1.4 million, Annual O&M for Passive Free-Product Recovery in Wells – $140,000, Annual O&M for MNA in Groundwater – $70,000, Total Present Worth Cost – $7.5 million

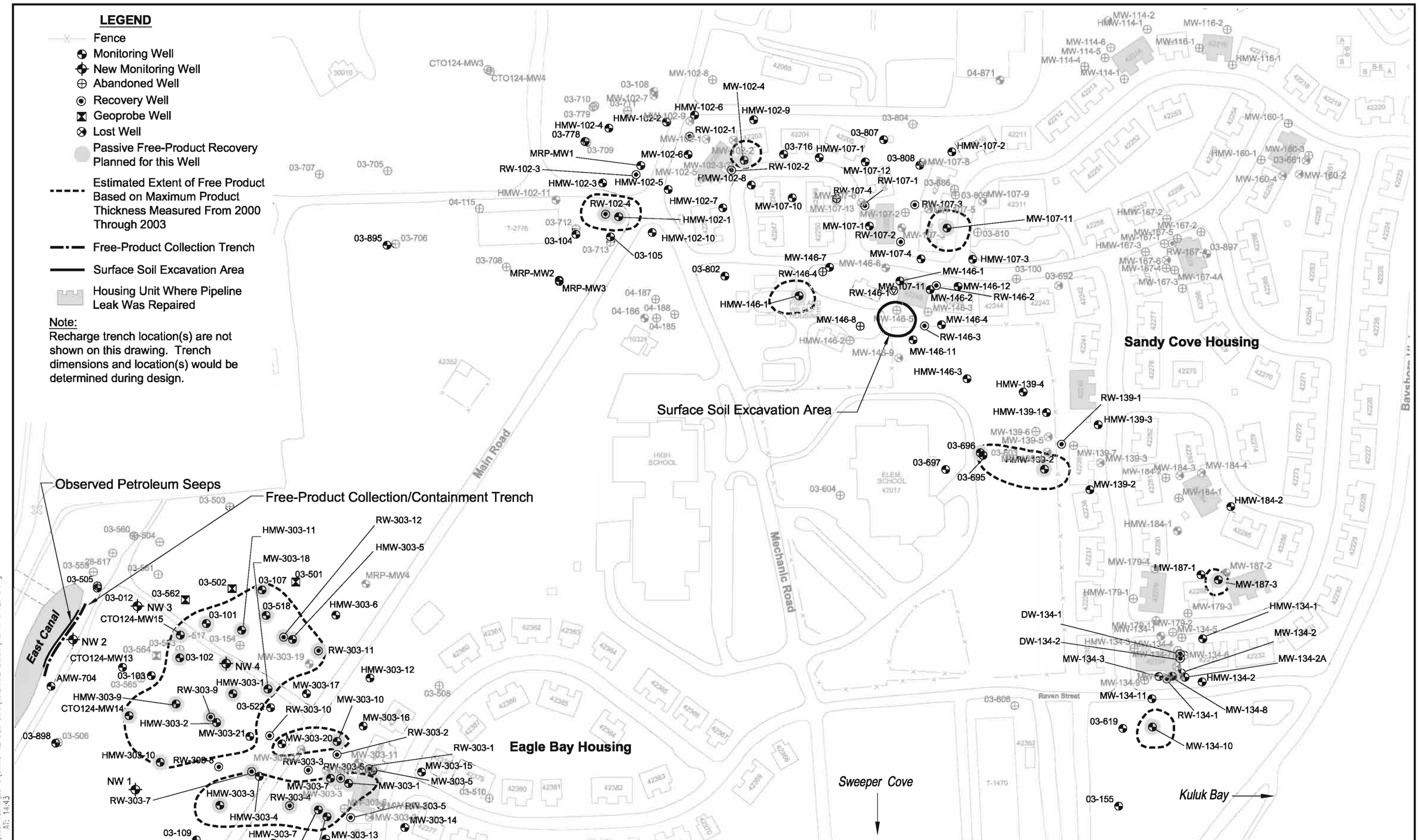
- **Alternative 4 – Institutional Controls, Passive Free-Product Recovery, Surface Soil Excavation, In Situ Steam Stripping, and MNA for Groundwater:** This alternative consists of institutional controls that are already in place as described in the ICMP, surface soil excavation and disposal, in situ steam stripping in the Eagle Bay Housing area, installation of 10 new wells to replace wells that would be abandoned prior to in situ steam stripping for groundwater monitoring, passive free-phase product recovery in existing wells in Sandy Cove Housing area, installation of three new groundwater monitoring wells in the Eagle Bay Housing area, MNA for groundwater, and sorbent boom maintenance. In situ steam stripping would be implemented in the Eagle Bay Housing area, the area with the majority of the remaining free product and the area impacting the East Canal; free product would be removed from 10 existing wells in the Sandy Cove Housing area using automated passive skimmers, passive skimmers, and sorbent socks; surface soil exceeding target health goals would be excavated and disposed of; petroleum concentrations in groundwater would be reduced through natural attenuation; and institutional controls would be used to protect human health and the environment as long as soil and groundwater concentrations are greater than cleanup levels and surface water no longer exceeds the Alaska DEC water quality standards for sheen.

  Cost: Capital – $18 million, Annual O&M for Passive Free-Product Recovery in Wells – $140,000, Annual O&M for sorbent boom maintenance – $33,000, Annual O&M for MNA in Groundwater – $70,000, Total Present Worth Cost – $19 million

LEGEND

- Fence
- Monitoring Well
- New Monitoring Well
- Abandoned Well
- Recovery Well
- Geoprobe Well
- Lost Well
- Passive Free-Product Recovery Planned for this Well
- Estimated Extent of Free Product Based on Maximum Product Thickness Measured From 2000 Through 2003
- Free-Product Collection Trench
- Surface Soil Excavation Area
- Housing Unit Where Pipeline Leak Was Repaired

Note:
Recharge trench location(s) are not shown on this drawing. Trench dimensions and location(s) would be determined during design.



U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 110 220 SCALE IN FEET	**Figure 7-1** **Alternative 2 - Passive Free-Product Recovery and Surface Soil Excavation** **SWMU 62, New Housing Fuel Leak Site**

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LEGEND

- Fence
- Monitoring Well
- New Monitoring Well
- Abandoned Well
- Recovery Well
- Geoprobe Well
- New Extraction Well
- Lost Well
- Passive Free-Product Recovery Planned for this Well
- Canal Bank Soil Excavation Area
- Estimated Extent of Free Product Based on Maximum Product Thickness Measured From 2000 Through 2003
- Free-Product Collection Trench
- Surface Soil Excavation Area
- Housing Unit Where Pipeline Leak Was Repaired

Note:
Recharge trench location(s) are not shown on this drawing. Trench dimensions and location(s) would be determined during design.

Observed Petroleum Seeps

Free-Product Collection/Containment Trench

Canal Bank Excavation Area

Surface Soil Excavation Area

Sandy Cove Housing

Eagle Bay Housing

East Canal

Main Road

Mechanic Road

Raven Street

Sweeper Cove

Kuluk Bay

U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 110 220 SCALE IN FEET	**Figure 7-2** **Alternative 3 - Active Free-Product Recovery and Surface/Canal Bank Soil Excavation** **SWMU 62, New Housing Fuel Leak Site**

FILENAME: T:\ADAK\DWG\Sub-Tasks\DO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 7-2 ALT 3.dwg
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LEGEND

- Fence
- Monitoring Well
- New Monitoring Well
- Abandoned Well
- Recovery Well
- Geoprobe Well
- Lost Well
- Passive Free-Product Recovery Planned for this Well
- In Situ Steam Stripping Area
- Estimated Extent of Free Product Based on Maximum Product Thickness Measured From 2000 Through 2003
- Surface Soil Excavation Area
- Housing Unit Where Pipeline Leak Was Repaired

Note:
Recharge trench location(s) are not shown on this drawing. Trench dimensions and location(s) would be determined during design.

Observed Petroleum Seeps

East Canal

Main Road

Mechanic Road

Area 1

Area 2

Area 3

In Situ Steam Stripping Area

In Situ Steam Stripping Areas

Surface Soil Excavation Area

Sandy Cove Housing

Eagle Bay Housing

Sweeper Cove

Kuluk Bay

Raven Street

HIGH SCHOOL

ELEM. SCHOOL

U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 110 220 SCALE IN FEET	**Figure 7-3** **Alternative 4 - In Situ Steam Stripping and Surface Soil Excavation** **SWMU 62, New Housing Fuel Leak Site**

FILENAME: I:\ADAK\UDQ\Sub-Tasks\UO 3\SWMU 62 DEC DOC\INTERNAL DRAFT\FIG 7-3 ALT 4.dwg
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8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

Each alternative for the SWMU 62, New Housing Fuel Leak site was evaluated using the five criteria established by the Alaska DEC in *Guidance on Decision Documentation under the Site Cleanup Rules* (Alaska DEC 1999b): protectiveness; practicability; short- and long-term effectiveness; regulations; and public input. These criteria are summarized in Table 8-1. Public input was not evaluated in the FFS (URS 2005a), because comments had not yet been solicited from the public. Therefore, public input was evaluated after public comments on the proposed plan were received, and the evaluation is included in this document. Each remedial alternative was assessed and assigned a rating of poor, fair, good, excellent, or superior for each evaluation criteria as presented in Figure 8-1. Based on the evaluation of the individual criteria, each alternative was also given an overall rating (poor, fair, good, excellent, or superior).

Alternatives 2 and 3 were both given overall ratings of good. Alternative 2 provides superior implementability and excellent short-term effectiveness and is protective of human health and the environment. However, this alternative requires more time to achieve groundwater cleanup goals than Alternatives 3 and 4. Although Alternative 3 provides excellent long-term effectiveness and protectiveness, it received ratings of good for cost effectiveness, short-term effectiveness, time to achieve cleanup goals, and compliance with regulations. This alternative is capable of achieving the groundwater cleanup goals more quickly than Alternative 2; however, there are additional short-term risks and costs associated with this alternative when compared to Alternative 2.

Alternative 4 was given an overall rating of fair. This alternative was rated lower than Alternatives 2 and 3 because of the difficulty of implementing this complex alternative, the high cost, and the additional short-term risks associated with this alternative. This alternative received superior ratings for time to achieve cleanup goals and long-term effectiveness, and excellent ratings for protectiveness and regulations. Although this alternative provides superior long-term effectiveness, it achieves that through additional remedial actions, which have additional short-term risks and costs.

Alternative 1 was given a rating of poor. This alternative received poor ratings for protectiveness, time to achieve cleanup goals, regulations, and long-term effectiveness. Although this alternative would be easy to implement and would cost nothing, the alternative would not be protective of human health and the environment.

Alternatives 2 and 3 both received the highest overall rating. Therefore, only these two alternatives were considered for selection at the SWMU 62, New Housing Fuel Leak site. A summary of the issues at the SWMU 62, New Housing Fuel Leak site and how Alternatives 2

and 3 address these issues is provided in Table 8-2. A summary of the advantages and disadvantages of these two alternatives is provided in Table 8-3.

Based on these comparisons, Alternative 2, Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA for Groundwater, was the selected remedial alternative for the SWMU 62, New Housing Fuel Leak site. This alternative will provide an appropriate, cost-effective remedy that protects human health and the environment and that can be implemented at the earliest possible time, as discussed in more detail below. In addition, the state concurs with the selection of this alternative and it is acceptable to the public.

Alternative 2 is selected for SWMU 62, New Housing Fuel Leak site because the additional cleanup activities and costs associated with Alternative 3 are not warranted given that Alternative 2 is protective of human health and the environment. Both Alternatives 2 and 3 effectively protect child residents through excavation and disposal of surface soil. Risks due to construction worker exposure to free product may be slightly higher for Alternative 2 than 3 because the passive free-product recovery activities proposed for Alternative 2 will require more time to reduce measurable quantities of free product in the subsurface when compared to the active free-product recovery activities proposed for Alternative 3. However, appropriate measures can be easily implemented to minimize contact and exposure as long as free product is present in the subsurface. Groundwater cleanup levels will be achieved more quickly with Alternative 3 than with Alternative 2 because of the more aggressive free-product recovery activities proposed for Alternative 3. However, human health will be protected in the interim, for either alternative, because institutional controls prevent the use of the groundwater as a drinking water source. Finally, elimination of the sheen on East Canal is anticipated to take longer with Alternative 2 when compared to Alternative 3. This is due to the implementation of canal bank soil excavation included with Alternative 3, which will quickly eliminate the source of the sheen when compared to implementation of the free-product recovery/containment trench alone, as proposed for Alternative 2. However, sorbent booms will be used in the interim to minimize impacts. Achieving the groundwater cleanup levels and Alaska DEC surface water quality standards for sheen more quickly would result in implementation of a much more complicated system which would be considerably more difficult to implement due to the remoteness of Adak Island. Because Alternative 2 would be much easier to implement than Alternative 3 and Alternative 2 would be protective of human health and the environment, Alternative 2 is the preferred cleanup alternative for the SWMU 62, New Housing Fuel Leak site.

Matrix SWMU 62 for DD.ai

Alaska DEC Criteria	Rating of Alternatives			
	Alternative 1 No Action	Alternative 2 Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA for Groundwater	Alternative 3 Institutional Controls, Free-Product Containment and Active Recovery, Canal Bank/Surface Soil Excavation, and MNA for Groundwater	Alternative 4 Institutional Controls, Passive Free-Product Recovery, Surface Soil Excavation, In-Situ Steam Stripping, and MNA for Groundwater
Protectiveness	○	◒	◔	◔
Practicable - Implementability	◔	●	◔	○
Practicable - Cost Effectiveness	●	◒	◒	○
Short- and Long-term Effectiveness Short-term Effectiveness	●	◔	◒	○
Short- and Long-term Effectiveness Time to Achieve Cleanup Goals	○	◔	◒	●
Short- and Long-term Effectiveness Long-term Effectiveness	○	◒	◔	●
Regulations	○	◔	◒	◔
Public Input	○	◒	◒	◒
Overall	○	◒	◒	◔

○ Poor ◔ Fair ◒ Good ◔ Excellent ● Superior

Notes:
MNA - monitored natural attenuation

U.S. NAVY

Figure 8-1
Evaluation of Remedial Alternatives
SWMU 62, New Housing Fuel Leak Site

Adak Island, AK
DECISION DOCUMENT

Table 8-1
Alaska DEC Criteria for Evaluating Remedial Alternatives

Criteria	Description
Protectiveness	Whether the remedial alternatives protect human health and the environment both during and after the cleanup actions by eliminating, reducing, or controlling exposures to hazardous substances or contaminants and by protecting human health from physical and other hazards directly associated with the cleanup action
Practicable	Whether the remedial alternatives can be designed, constructed, and implemented in a reliable and cost-effective manner. For ease of evaluation, this criterion is subdivided into two separate criteria; implementability and cost.
Short- and Long-term Effectiveness	Ability of the alternatives to protect human health and the environment during the construction/implementation phase (short-term) and after completion of the cleanup (long-term). The speed with which the alternatives achieve the cleanup goals is also evaluated. For ease of evaluation, this criterion is subdivided into three separate criteria; short-term effectiveness, time to achieve cleanup goals, and long-term effectiveness.
Regulations	Ability of alternatives to attain federal and state applicable or relevant and appropriate requirements or to provide justification for invoking a waiver.
Public input	Whether the public agrees with, opposes, or has no comment on the preferred alternative. Public input will be evaluated after receipt of the public comments on this proposed plan.

Note:
DEC - Department of Environmental Conservation

Table 8-2
What are the Key Issues at SWMU 62, New Housing Fuel Leak Site and How Do the Alternatives Address These Issues?

Issue	How is the Issue Addressed?	
	Alternative 2	**Alternative 3**
Free product in groundwater and sheen in East Canal	Institutional controls (excavation notification), passive free-product recovery and containment in Eagle Bay and Sandy Cove Housing, and natural recovery	Institutional controls (excavation notification), active free-product recovery and free-product containment in Eagle Bay Housing, passive free-product recovery in Sandy Cove Housing, canal bank excavation, and natural recovery
Unacceptable risks to child residents	Surface soil excavation and disposal	Surface soil excavation and disposal
Groundwater concentrations exceed groundwater cleanup levels (Table C values)	Institutional controls (downtown groundwater use prohibition), passive free-product recovery in Eagle Bay and Sandy Cove Housing, and MNA	Institutional controls (downtown groundwater use prohibition), active free-product recovery in Eagle Bay Housing, passive free-product recovery in Sandy Cove Housing, and MNA

Note:
MNA - monitored natural attenuation

Table 8-3
Summary of Advantages and Disadvantages of Alternatives 2 and 3, SWMU 62, New Housing Fuel Leak Site

Advantages and Disadvantages	Alternative 2 – Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA for Groundwater	Alternative 3 – Institutional Controls, Free-Product Containment and Active Recovery, Canal Bank Soil and Surface Soil Excavation, and MNA for Groundwater
Advantages	• Effectively controls exposure to groundwater through institutional controls • Effectively controls human health risk through surface soil excavation and disposal • Reduces volume of free product in subsurface through passive free-product recovery and containment • Reduces sheen on surface water through free-product containment • Reduces groundwater concentrations through passive free-product recovery and natural attenuation • Less expensive • Easy to implement	• Effectively controls exposure to groundwater through institutional controls • Effectively controls human health risk through surface soil excavation and disposal • Reduces volume of free product in subsurface through active free-product recovery, passive free-product recovery, and containment • Reduces sheen on surface water through canal bank excavation and free-product containment • Reduces groundwater concentrations through active free-product recovery, passive free-product recovery, and natural attenuation
Disadvantages	• Passive free-product containment alone (not including canal bank soil excavation, as is included for Alternative 3) may require time to reduce sheen in surface water to below water quality criteria. • Passive free-product recovery may require time to reduce groundwater concentrations to below the Alaska DEC Table C values	• More expensive • Relatively difficult to implement for the following reasons: ▪ Canal bank soil excavation below the groundwater table complicated by dewatering and shoring requirements ▪ Soil excavation on Adak complicated by the high rainfall ▪ Treatment of water from excavation dewatering complicated because of the extensive treatment required to meet marine surface water quality criteria ▪ Modification and restart of active free-product recovery system adds complexity

Notes:
MNA - monitored natural attenuation

9.0 DESCRIPTION OF SELECTED CLEANUP ACTION

Alternative 2 – Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA for Groundwater - is selected as the remedial alternative for the SWMU 62, New Housing Fuel Leak site. This cleanup alternative was selected for the SWMU 62, New Housing Fuel Leak site based on its ability to meet the four RAOs:

1. Prevent human exposure to petroleum hydrocarbons in surface soil that would result in adverse health effects

2. Reduce petroleum hydrocarbons in groundwater to concentrations less than or equal to the Alaska DEC groundwater cleanup levels established for groundwater used as a drinking water source

3. Minimize exposure to free-phase product in soil, groundwater, and surface water

4. Prevent migration of free product to surface water that would result in an exceedance of the Alaska DEC surface water quality standard (sheen only)

The selected cleanup alternative is shown on Figure 9-1 and described below.

The selected cleanup alternative, Alternative 2, consists of institutional controls for soil, groundwater, and surface water; free-phase product containment and passive recovery; excavation and treatment of surface soil; and MNA for groundwater. A free-product collection/containment trench will be installed to prevent migration of free-phase product to surface water, thus eliminating the source of the sheen to East Canal. Sorbent booms will be used as an interim measure to reduce surface water sheen on East Canal until the free-product collection/containment trench effectively eliminates the source of the sheen. Although operation of the free-product system at SWMU 62, New Housing Fuel Leak site has been discontinued, between 1,400 and 6,900 gallons of recoverable product are estimated to still remain at the site. Therefore, four new wells will be installed, and free-phase product will be removed from the new wells and existing site wells using automated passive skimmers, passive skimmers, or sorbent socks. Surface soil in Sandy Cove Housing 102, 107, and 146 Area with DRO concentrations exceeding the ACLs will be excavated and treated. Petroleum concentrations in groundwater will be reduced through natural attenuation. Finally, institutional controls will be used to protect human health and the environment until groundwater no longer exceeds Alaska DEC groundwater cleanup levels and surface water no longer exceeds the Alaska DEC Water Quality Standard for sheen.

Soil cleanup goals will be achieved immediately after excavation of surface soils. The MNA timeframe for the site cannot be accurately predicted at this time. However, the timeframe needed to achieve the Alaska DEC groundwater cleanup levels will be estimated after 5 years of monitoring has been completed. Surface water cleanup goals for East Canal consist of a requirement for no sheen. Soils between East Canal and the free-product collection/containment trench will not be excavated, and these soils will act as a continuing source of sheen until the remaining free product is flushed from the soils. Very small amounts of free product can result in a sheen on the surface water body. However, the large rainfall amount on Adak is expected to result in relatively quick flushing of the free product from canal bank soils. Based on this, it is anticipated that within approximately 8 years of construction of the free-product collection/containment trenches, no sheen will be visible on East Canal. Recovery from the free-product collection/containment trench will continue until free-product has been reduced to thicknesses less than 0.01 feet or no sounding of the oil/water interface probe has been experienced for 1 year or more (estimated at 20 years). It is anticipated that free-product recovery will be completed within 5 years of the start of recovery operations in the new and existing wells. Short-term risks associated with free-product collection/containment trench installation, new well installation, surface soil excavation, MNA, and product recovery will be controlled through the use of personal protective equipment. Once surface soil has been excavated, groundwater concentrations have been reduced to levels less than the Alaska DEC groundwater cleanup levels established for groundwater used for drinking water, and free product has been removed to the extent practicable in accordance with the OU A ROD, residual risks at the site are expected to be acceptable. Note that pockets of free product may remain at the site, even if none is detected in on-site wells. Therefore, some residual risk may remain at a site once cleanup actions have been completed. However, if groundwater concentrations are below cleanup levels throughout the site, the extent of free product is expected to be very limited.

The institutional controls implemented at this site consist of equitable servitude restrictions including the downtown groundwater use prohibition and soil excavation notification requirements. These institutional controls have already been implemented on Adak Island. The Navy has an established institutional controls program that was developed to ensure that institutional controls, including the equitable servitude restrictions, selected in the OU A ROD remain effective and reliable. The Navy has prepared an ICMP (U.S. Navy 2004) documenting the approach the Navy will use to ensure that the equitable servitude restrictions remain protective. The ICMP provides details of the institutional controls management program, and therefore, a detailed description of the equitable servitude restrictions to be implemented at the SWMU 62, New Housing Fuel Leak site is not included here. Access restrictions including temporary fences and signs will be used to prevent access to contaminated materials during free-product collection/containment trench installation and surface soil excavation. Site inspections will be used to evaluate compliance with equitable servitude restrictions and access restrictions.

Visual site inspections will also be used to evaluate whether surface water no longer exceeds the Alaska DEC Water Quality Standards for sheen in East Canal. Monitoring of groundwater will continue until groundwater cleanup goals are achieved.

Monitoring of natural attenuation will involve periodic groundwater sampling at the site for a period of time sufficient to assess the progress of the natural degradation of petroleum hydrocarbons in groundwater. Details of the monitoring program will be incorporated into subsequent versions of the comprehensive monitoring plan for the Former Adak Naval Complex (CMP) (URS 2004). The CMP describes the existing monitoring program for groundwater as prescribed in the OU A ROD. Groundwater monitoring will be conducted at a frequency to be established by the Navy and Alaska DEC to evaluate whether petroleum-related chemicals in the groundwater are attenuating to concentrations below applicable Alaska DEC groundwater cleanup levels at locations to be specified in the CMP. Concentrations of petroleum-related chemicals currently exceeding the Alaska DEC cleanup levels will be monitored, as well as natural attenuation indicator parameters. Groundwater sampling will be conducted following procedures specified in the appropriate Navy Standard Operating Procedures (SOPs) as specified in future versions of the CMP. Groundwater samples will only be collected for chemical analyses from individual wells if the measured product thickness in the well is less than 0.02 foot. The Navy proposes to initiate remedy-based MNA at this site in conjunction with annual monitoring activities planned for 2006 as specified in the CMP. All groundwater monitoring activities at SWMU 62, New Housing Fuel Leak site will be coordinated with the ongoing annual monitoring activities described in the CMP.

All available site-specific data will be evaluated after each year of monitoring is completed. These data evaluations will be performed to assess whether specified institutional controls are being successfully implemented at the sites, concentrations of petroleum-related chemicals in groundwater are decreasing, and/or free product is being recovered to the extent practicable. These analyses will incorporate historical, site-specific data where appropriate. Once the annual data evaluation is completed, the Navy will make recommendations for modifications to the monitoring program, as appropriate. If the groundwater contaminant plume is shown to be stable or shrinking during three consecutive annual monitoring events, then the Navy will petition Alaska DEC for less frequent monitoring. MNA and free-product monitoring will be discontinued once the Alaska DEC groundwater cleanup levels for groundwater used as drinking water are achieved during three consecutive monitoring events in all site wells selected for monitoring in the CMP.

As part of the 5-year reviews required by Amendment Number 3 to the Adak FFA (U.S. Navy, USEPA, and ADEC 2002) and Amendment Number 0001 to the SAERA between the Navy and ADEC (U.S. Navy and ADEC 2002), the results of monitoring will be summarized by the Navy and submitted for review by the Alaska DEC. The 5-year reviews will evaluate the effectiveness of the selected remedy at the SWMU 62, New Housing Fuel Leak site. Based on these reviews,

the Navy and the Alaska DEC will decide whether continued monitoring, or additional actions, are necessary at the site.

A free-phase product collection trench will be installed in the general area shown on Figure 9-1. This general location was selected based on the occurrence of a sheen on East Canal and free-product thicknesses in groundwater near to East Canal in the Eagle Bay Housing 303 Area based on measurements from 2000 through 2003. The trench will be constructed such that free product will be collected within the maximum range of groundwater fluctuation. The exact dimensions of the trench will be determined during remedial design. Sumps for free-product recovery will be installed in the trench. Because of the uncertainty of the recoverable free-product volume remaining at the SWMU 62, New Housing Fuel Leak site, initially, automated passive skimmers will be installed in each sump to recover free-phase product. Recovery rates are assumed to decline with time, and the automated passive skimmers will be replaced with sorbent socks. Recovery from the free-product trench will continue until product has been reduced to less than 0.01 inches or no sounding of the oil/water interface probe has been experienced for 1 year or more.

Groundwater encountered during trench excavation will be pumped to a water treatment system. Recovered product from the water treatment system will be placed in 55-gallon drums for off-site disposal or recycling on-island. The treated groundwater will be discharged to East Canal. (Note that the conceptual design presentation in the FFS included discharge to an infiltration trench.) The discharged water will meet all Alaska DEC surface water criteria (18 AAC 70). Since EPA has deferred authority to the Alaska DEC and the total volume that will be discharged to surface water is anticipated to be less than 250,000 gallons, Alaska DEC has determined that permits will not be required. However, the discharge must meet the substantive requirements of the Alaska DEC General Excavation Dewatering Permit 2004DB0101. Soil from the free-product collection/containment trench excavation will be shipped to the mainland for treatment and disposal, unless soil treatment using thermal desorption could be timed to coincide with the thermal desorption of soil from other sites on Adak. Estimated costs for this alternative assumed off-site treatment/disposal because thermal desorption for soils from this site alone will not be cost effective, and concurrent work with another site cannot be guaranteed.

Recoverable product will also be removed from new wells and existing site wells using automated passive skimmers, passive skimmers, or sorbent socks (see Figure 9-1). Automated passive skimmers will be installed in existing wells with a maximum free-product thickness greater than 0.5 feet measured between 2000 and 2003. Passive skimmers will be installed in existing wells with a maximum free-product thickness greater than or equal to 0.1 feet and less than or equal to 0.5 feet. Sorbent socks will be installed in existing wells with a maximum free-product thickness less than 0.1 feet. Therefore, automated passive skimmers will be installed in five wells: HMW-139-2, HMW-303-3, MW-303-12, MW-303-8, RW-303-4. Passive skimmers will be installed in 14 wells: HMW-146-1, 03-101, 03-102, 03-518, CTO124-MW15,

HMW-303-11, HMW-303-5, HMW-303-9, MW-303-1, MW-303-10, MW-303-18, MW-303-7, RW-303-6, and RW-303-7. Finally, sorbent socks will be installed in 18 wells: HMW-102-1, MW-102-4, MW-107-11, RW-102-4, MW-187-3, MW-134-10, MW-134-8, 03-696, 03-107, CTO 124-MW14, HMW-303-1, HMW-303-10, HMW-303-2, HMW-303-4, MW-303-5, RW-303-11, RW-303-12, and RW-303-9. Four new wells, NW 1 through NW 4 (Figure 9-1), will be installed in locations between two wells containing product or in locations to be used to better define the extent of free product. The goal of installing new wells will be to increase the effective area of product recovery and decrease the recovery duration, thereby optimizing recovery. If free product is detected in these new wells, passive skimmers will be installed. The new wells will also be used for groundwater monitoring. Free-product recovery in all wells will occur on a schedule commensurate with skimmer capacity. This schedule may be modified to optimize the recovery rate. The wells utilized to recover product may change due to changes in site conditions. In addition, the technology used to recover free product will change with time as free product is recovered at the site. Automated passive skimmers and passive skimmers will be replaced with sorbent socks as the volume of recoverable product declines at the site.

Free product occurrence will be measured in additional wells as part of the monitoring of natural attenuation to assess if free product is migrating and if additional wells should be added to the recovery system in the future. The installation of additional product recovery or monitoring wells, if needed, is considered a contingent component of the selected remedy. Any future decision by the Navy and ADEC to install and operate additional product recovery or monitoring wells will not be considered a basis for amending or reopening this DD. Removal of free-phase product will continue until the technically practicable endpoint for passive free-phase product recovery, as defined in the OU A ROD (U.S. Navy et al. 2000), is achieved. The technically practicable endpoint for product recovery systems not dependent on water table depression is as follows:

> *When the monthly volume of recovered product averaged over the most recent 6 months (6-month moving average) is less than 5 gallons of product recovered per month, the technically practicable endpoint for recovery has been reached. If this endpoint criterion has been met for a period of 12 months of product recovery, the system is considered to meet the technically practicable endpoint and recovery can be discontinued (URSG 1999b).*

To quickly eliminate the unacceptable health risks to children due to exposure to surface soils in Sandy Cove Housing 102, 107, and 146 Area, surface soils with concentrations of DRO greater than the ACL (6,111 mg/kg) will be excavated. The approximate area of the surface soil excavation is shown on Figure 9-1. Soil will be removed to a depth of 2 feet. The limits of excavation will be better defined prior to or during excavation activities. Soil from the surface soil excavation will be combined with the soil excavated during trench installation and will be shipped to the mainland for treatment and disposal, unless thermal desorption could be timed to

coincide with the thermal desorption of soils from other sites on Adak. Clean fill will be used to backfill the surface soil excavation area.

The costs for this alternative are presented in Table 9-2 and are based on the conceptual design presented in the FFS (URS 2005). These cost estimates include capital costs, periodic maintenance, and monitoring. The capital costs for installation of the free-product collection/containment trench with automated passive skimmers, installation of four new wells with passive skimmers, installation of automated passive skimmers, passive skimmers and/or sorbent socks in existing wells, and surface soil excavation, including mobilization and demobilization, are estimated to be $1.1 million. Annual O&M costs to operate the free-product collection/containment trench are $150,000 for the first 2 years and $100,000 for years 3 to 18. Annual O&M costs to recover free product from the 38 wells are $410,000 for the first 2 years and $350,000 for years 3 to 5. Annual O&M costs to maintain the sorbent boom are estimated to be $33,000. Annual costs to implement MNA for groundwater are estimated to be $70,000. The costs associated with MNA are the incremental costs associated with the SWMU 62, New Housing Fuel Leak site, which are above the base program costs associated with monitoring activities specified in the CMP. The MNA estimate includes the costs associated with sample collection at the SWMU 62, New Housing Fuel Leak site, sample analysis, and the incremental reporting and mobilization costs.

The present worth cost for this alternative based on the conceptual design presented in the FFS assuming a 5 percent discount rate, a 60-year natural attenuation monitoring period, 20 years of free-product recovery from the free-product collection/containment trenches, and 5 years of passive free-phase recovery from the existing wells is $5.5 million (URS 2005). Total capital and O&M costs (no present worth) for this alternative are estimated to be $9.1 million. Costs associated with the implementation of institutional controls at this site were not estimated because existing island-wide institutional controls will cover site-specific restrictions. The duration of monitoring and product recovery may vary substantially from the estimated values used in the cost estimate. Actual duration of monitoring and product recovery will be based on endpoints specified earlier in this section.

LEGEND

- Fence
- Monitoring Well
- New Monitoring Well
- Recovery Well
- Geoprobe Well
- Lost Well
- Passive Free-Product Recovery Planned for this Well
- Estimated Extent of Free Product Based on Maximum Product Thickness Measured From 2000 Through 2003
- Extent of Groundwater Where Petroleum-Related Chemicals Exceed the Groundwater Cleanup Levels
- Free-Product Collection Trench
- Surface Soil Excavation Area
- Housing Unit Where Pipeline Leak Was Repaired

Note:
Recharge trench location(s) are not shown on this drawing. Trench dimensions and location(s) would be determined during design.

Observed Petroleum Seeps

Free-Product Collection/Containment Trench

Surface Soil Excavation Area

Sandy Cove Housing

Eagle Bay Housing

East Canal

Main Road

Mechanic Road

Raven Street

Sweeper Cove

Kuluk Bay

U.S. NAVY	Adak Island, AK DECISION DOCUMENT	N 0 110 220 SCALE IN FEET	**Figure 9-1** **Selected Cleanup Alternative** **SWMU 62, New Housing Fuel Leak Site**

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Table 9-1
SWMU 62, New Housing Fuel Leak Site
Cost Estimate For Alternative 2:
Institutional Controls, Free-Product Containment and Passive Recovery,
Surface Soil Excavation, and MNA

Item	Unit Cost	Units	Quantity	Cost
CAPITAL DIRECT COSTS (INSTALLED)				
Free-Product Collection/Containment Trench Installation				
Mobilization of Excavation Equipment				
Mobilize/Demobilize	$75,000	LS	1	$75,000
Barge to Adak Island (round trip)	$150,000	LS	1	$150,000
Trench Installation				
Excavate/backfill trench with gravel	$2.75	SF	1,300	$3,575
12-inch stainless steel sumps	$350	LF	60	$21,000
Automated passive skimmers	$2,500	EA	6	$15,000
Installation of remote system/battery power	$4,500	EA	6	$27,000
Equipment installation	$8,000	Week	1	$8,000
Dewatering and Treatment				
Dewatering	$160	Days	2	$320
Water distribution infrastructure	$500	LS	1	$500
Treatment - Connect to existing OWS	$2,500	LS	1	$2,500
Treatment - Bag Filter/Activated Carbon Filtration	$600	Day	2	$1,200
Installation of Recharge Trenches	$10	SF	260	$2,600
Off-island landfill disposal of trench soil	$525	CY	190	$99,750
Sorbent boom installation and disposal	$4.00	LF	400	$1,600
Surface Soil Excavation				
Soil Excavation				
2-4 CY Excavator	$10,000	Week	1	$10,000
Fill source excavation, placement and haul	$1,725	Week	1	$1,725
Misc. Supplies and Labor	$500	Day	3	$1,500
Off-island landfill disposal of surface soil	$525	CY	450	$236,250
Well Installation Costs				
Mob/Demob crew/equip	$20,000	LS	1	$20,000
Per Diem	$4,700	Week	1	$4,700
Equipment Rental	$2,200	Week	1	$2,200
Well Construction (Labor)	$15,000	Week	1	$15,000
Well Construction (Materials)	$1,000	Well	4	$4,000
Passive Skimmer and Sorbent Sock Installation				
Automated passive skimmers	$2,500	Well	5	$12,500
Passive skimmers	$450	Well	15	$6,750
Sorbent socks	$8.50	Well	18	$153
Equipment Install	$8,000	Week	1	$8,000
Subtotal Capital Costs				$730,823

Table 9-1 (Continued)
SWMU 62, New Housing Fuel Leak Site
Cost Estimate For Alternative 2:
Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA

Item	Unit Cost	Units	Quantity	Cost
Subtotal Capital Costs				$730,823
Contingency Allowances		%	25	$182,706
TOTAL CAPITAL DIRECT COSTS (DC)				$730,000
CAPITAL INDIRECT COSTS				
Preliminary Design	DC	%	5	$36,500
Engineering Design	DC	%	10	$73,000
Regulatory Compliance	DC	%	5	$36,500
Construction QA and Management	DC	%	7	$51,100
System Startup	DC	%	5	$36,500
Closure Documentation	DC	%	5	$36,500
TOTAL CAPITAL INDIRECT COSTS				$270,000
Total Direct and Indirect Capital Costs				$1,000,000
Site Inspection and Overhead Costs	Total Costs	%	8	$80,000
TOTAL CAPITAL COSTS				**$1,100,000**
ANNUAL O&M COSTS				
Annual Free-Product Collection/Containement Trench (Years 1-2)				
Mobilization				
Mobilize/Demobilize	$2,000	Month	12	$24,000
Shipping	$7.00	CF	600	$4,200
Monitoring/Maintenance				
Project Management/Coordination	$1,440	EA	6	$8,640
Field Labor	$2,400	EA	6	$14,400
Supplies	$3,000	EA	6	$18,000
Free Product Recycling/Disposal	$15,000	YR	1	$15,000
Battery/remote system repair/replacement	$25,000	YR	1	$25,000
SUBTOTAL TRENCH COSTS				$109,240
Contingency Allowances		%	25	$27,310
Site Inspection and Overhead Costs		%	8	$10,924
TOTAL ANNUAL TRENCH COSTS (YRS 1-2)				**$150,000**
Cost Projection for 2 years				**$300,000**
2-Yr Present Worth Trench Recovery*				**$280,000**

Table 9-1 (Continued)
SWMU 62, New Housing Fuel Leak Site
Cost Estimate For Alternative 2:
Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA

Item	Unit Cost	Units	Quantity	Cost
Annual Free-Product Collection/Containement Trench (Years 3-18)				
Mobilization				
Mobilize/Demobilize	$2,000	Month	12	$24,000
Shipping	$7.00	CF	400	$2,800
Monitoring/Maintenance				
Project Management/Coordination	$1,440	EA	6	$8,640
Field Labor	$2,400	EA	6	$14,400
Supplies	$2,000	EA	6	$12,000
Sorbent Disposal	$15,000	YR	1	$15,000
SUBTOTAL TRENCH COSTS				$76,840
Contingency Allowances		%	25	$19,210
Site Inspection and Overhead Costs		%	8	$7,684
TOTAL ANNUAL PRODUCT TRENCH RECOVERY				**$100,000**
Cost Projection for 18 years				**$1,800,000**
18-Yr Present Worth Trench Recovery*				**$1,000,000**
Annual Passive Free-Product Recovery in Wells (Years 1-2)				
Mobilization				
Mobilize/Demobilize	$2,000	Month	12	$24,000
Shipping	$7.00	CF	1,000	$7,000
Monitoring/Maintenance				
Project Management/Coordination	$1,440	EA	38	$54,720
Field Labor	$2,400	EA	38	$91,200
Supplies	$3,000	EA	38	$114,000
Free Product Recycling/Disposal	$15,000	YR	1	$15,000
SUBTOTAL RECOVERY COSTS				$305,920
Contingency Allowances		%	25	$76,480
Site Inspection and Overhead Costs		%	8	$30,592
TOTAL PRODUCT RECOVERY COSTS (YRS 1-2)				**$410,000**
Cost Projection for 2 years				**$820,000**
2-Yr Present Worth Free Product Recovery*				**$760,000**

Table 9-1 (Continued)
SWMU 62, New Housing Fuel Leak Site
Cost Estimate For Alternative 2:
Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA

Item	Unit Cost	Units	Quantity	Cost
Annual Passive Free-Product Recovery in Wells (Years 3-5)				
Mobilization				
Mobilize/Demobilize	$2,000	Month	12	$24,000
Shipping	$7.00	CF	600	$4,200
Monitoring/Maintenance				
Project Management/Coordination	$1,440	EA	38	$54,720
Field Labor	$2,400	EA	38	$91,200
Supplies	$2,000	EA	38	$76,000
Sorbent Disposal	$10,000	YR	1	$10,000
SUBTOTAL RECOVERY COSTS				$260,120
Contingency Allowances		%	25	$65,030
Site Inspection and Overhead Costs		%	8	$26,012
TOTAL PRODUCT RECOVERY COSTS (YRS 3-5)				**$350,000**
Cost Projection for 3 years				**$1,050,000**
3-Yr Present Worth Free Product Recovery*				**$820,000**
Annual Sorbent Boom Maintenance Costs				
Mobilization				
Mobilize/Demobilize	$2,000	Month	12	$24,000
Shipping	$7	CF	300	$2,100
Sorbent Boom Replacement and Disposal	$1,600	EA	4	$6,400
TOTAL ANNUAL BOOM MAINTENANCE COST				**$33,000**
Cost Projection for 8 years				**$260,000**
8-Yr Present Worth Boom Maintenance*				**$210,000**
Annual MNA Costs				
Mobilization				
Mobilize/Demobilize	$2,000	LS	1	$2,000
Shipping	$7.00	CF	1,000	$7,000
Monitoring				
Project Management/Coordination	$120	Well	25	$3,000
Field Labor	$480	Well	25	$12,000
Hydrogeologist	$100	Well	25	$2,500
Equipment Rental	$1,620	Week	2	$3,240
Sampling Supplies	$45	Well	25	$1,125
Analytical (DRO, GRO, BTEX, SVOCs)	$850	Well	25	$21,250
SUBTOTAL MNA COSTS				$52,115
Contingency Allowances		%	25	$13,029
Site Inspection and Overhead Costs		%	8	$5,212
TOTAL ANNUAL MNA COST				**$70,000**
Cost Projection for 60 years				**$4,200,000**
60-Yr Present Worth MNA*				**$1,330,000**

Table 9-1 (Continued)
SWMU 62, New Housing Fuel Leak Site
Cost Estimate For Alternative 2:
Institutional Controls, Free-Product Containment and Passive Recovery, Surface Soil Excavation, and MNA

Item	Unit Cost	Units	Quantity	Cost
TOTAL CAPITAL COSTS				**$1,100,000**
TOTAL O&M COSTS (60 YEARS)				**$8,000,000**
TOTAL CAPITAL AND O&M COSTS (60 YEARS)				**$9,100,000**
PRESENT WORTH O&M COSTS*				**$4,400,000**
TOTAL PROJECT PRESENT WORTH*				**$5,500,000**

* Present worth costs calculated using a 5% discount rate.
Notes:
CF = Cubic Feet
CY = Cubic yard
EA = Each
LB = Pound
LF = Linear Feet
LS = Lump Sum
MNA = Monitored natural attentuation
O&M = Operation and maintenance
OWS = Oil/Water Separator
QA = Quality assurance
SF = Square Feet
YR = Year

10.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or relevant and appropriate requirements (ARARs) are promulgated federal and state laws and regulations that are either applicable to the conditions at a cleanup site or are relevant and appropriate. Relevant and appropriate requirements address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the site. Three kinds of ARARs exist for cleanup of petroleum release sites on Adak Island: chemical-specific, location-specific, and action-specific.

10.1 CHEMICAL-SPECIFIC ARARS

Chemical-specific ARARs are generally risk-based concentration limits or discharge limits for specific chemicals. When a specific chemical is subject to more than one discharge or exposure limit, the more stringent requirement is used. Chemical-specific ARARs for the SWMU 62, New Housing Fuel Leak site include Alaska DEC regulations 18 AAC 75 and 18 AAC 70 and the Clean Water Act.

As discussed in Section 6, Alaska DEC regulation 18 AAC 75 specifies soil and groundwater cleanup criteria established for petroleum-release sites located within the State of Alaska. Cleanup levels specified for soil at free-product recovery petroleum sites on the Former Adak Naval Complex are based on Alaska DEC Method Four criteria [18 AAC 75.340(a)(4)]. Cleanup levels specified for groundwater at the South of Runway 18-36 Area are based on the tabulated groundwater cleanup levels [18 AAC 75.345(b)(1), Table C] because groundwater is a potential future source of drinking water. Alaska regulations [18 AAC 75.345(f)] specify that groundwater hydrologically connected to nearby surface water may not cause a violation of the water quality standards in 18 AAC 70 for surface water. In addition, ambient water quality criteria (33 United States Code 1314, Clean Water Act) are relevant and appropriate for surface water that could be impacted by plume migration.

10.2 LOCATION-SPECIFIC ARARS

Location-specific ARARs are those requirements that relate to the geographic position or physical condition of the site. These requirements may limit the type of remedial activities that can be implemented or may impose additional constraints. There are no potential location-specific ARARs for SWMU 62, New Housing Fuel Leak site because remedial actions are not proposed in sensitive environments.

10.3 ACTION-SPECIFIC ARARS

Action-specific ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities. Potentially applicable action-specific ARARs for the selected cleanup alternative include the following:

- Alaska Air Quality Control (18 AAC 50.300 through 50.380)
- Resource Conservation and Recovery Act (RCRA) regulations (40 Code of Federal Regulations [CFR] Parts 261, 262, 268)
- Alaska Hazardous Waste Disposal Regulation (18 AAC 62)
- Alaska Oil and Hazardous Substances Pollution Control (18 AAC 75.325 through 375)
- Alaska Water Quality Standards (18 AAC 70.20)
- Alaska Wastewater Disposal (18 AAC 72.500 through 72.610)
- Federal Clean Water Act – National Pollution Discharge Elimination System (NPDES) Program (40 CFR Part 131)

11.0 PUBLIC INVOLVEMENT

11.1 PUBLIC INVOLVEMENT ACTIVITIES

The Navy established a community involvement program in 1994 to provide interested Alaska citizens and Adak residents with timely and updated information on the environmental cleanup and the transfer and reuse of Navy land and facilities. The community involvement program also provides a mechanism for public input on environmental cleanup decisions. Information is conveyed to the public via fact sheets and newsletters, Restoration Advisory Board (RAB) meetings and other formal public meetings, web site announcements (www.adakupdate.com), information repositories on Adak Island (Bob Reeve High School building, second floor) and in Anchorage (University of Alaska library, reserve room), and the administrative record file located at Naval Facilities Engineering Command Northwest, Silverdale, Washington. In addition, a mailing list is maintained and updated to inform concerned citizens of upcoming meetings and significant activities, such as public comment periods. Public input is obtained through RAB meetings and other formal public meetings, community interviews, requests for public comments, and a telephone hotline.

The proposed plan (U.S. Navy and Alaska DEC 2005a) was provided to the public for review during the 30-day public comment period beginning on December 13, 2005. In addition, TAC (the current landowner) was provided a copy of the FFS report (URS 2005a) and the proposed plan (U.S. Navy and Alaska DEC 2005a) and was invited to comment on these documents. No comments were received.

11.2 FUTURE CONTACTS

Adak community members are encouraged to contact Navy and Alaska DEC site managers with questions or comments. The Navy and Alaska DEC site managers are:

Gary D. Simmons
Naval Facilities Engineering Command Northwest
1101 Tautog Circle
Silverdale, WA 98370-7570
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Email: jason_weigle@dec.state.ak.us

12.0 RESPONSIVENESS SUMMARY

No comments received.

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APPENDIX A

Legal Description

That portion of Adak Island, State of Alaska, described as follows:

Commencing at U.S. Navy control point H-7 (NAD 83 - N=317,457.30 E=3,135,573.38), which is South 22°36′59″ West 1,731.18 feet from U.S. Navy control point H-5; thence South 07°28’46” East 120.62 feet; thence South 27°26’31” West 235.79 feet; thence South 80°39’03” West 566.73 feet; thence North 18°50’29” West 442.33 feet; thence North 19°30’20” East 202.44 feet; thence South 89°29’26” East 390.89 feet; thence South 61°11’42” East 384.07 feet to the POINT OF BEGINNING. Containing 8.58 acres more or less. ALSO

That portion of Adak Island, State of Alaska, described as follows:

Commencing at said U.S. Navy control point H-7 thence North 31°29’08” East 702.85 feet to the POINT OF BEGINNING; thence North 58°28’50” West 198.18 feet; thence North 50°21’26” East 154.51 feet; thence North 10°25’07” East 476.72 feet; thence South 82°20’32” East 989.67 feet; thence South 35°42’47” East 227.90 feet; thence South 06°15’24” East 566.98 feet; thence South 86°20’06” East 327.36 feet; thence South 30°33’14” East 311.41 feet; thence South 03°56’30” East 335.56 feet; thence South 77°57’55” West 663.42 feet; thence North 16°14’39” West 753.41 feet; thence North 38°51’46” West 567.31 feet; thence North 74°50’18” West 342.95 feet; thence South 31°29’08” West 331.99 feet to the POINT OF BEGINNING. Containing 27.09 acres more or less.

APPENDIX B

Analytical Results

Table B-1
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples,
SWMU 62, New Housing Fuel Leak Site, Turnkey Housing Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)
472	HMW-67-1	8/21/1993	5 to 5	10	NA	NA	NA	NA	NA
Screening Criteria[a]				8,250	1,400	120	17,000	8,300	166,000
Screening Criteria[b]				12,500	1,400	6.4	180	89	81
Screening Criteria[c]				230	260	0.02	4.8	5	69

[a]Alaska DEC Method 2 soil criteria for human ingestion.

[b]Alaska DEC Method 2 soil criteria for human inhalation.

[c]Alaska DEC Method 2 soil criteria to prevent migration to groundwater.

Notes:
Shading indicates detected concentrations that exceed the most stringent Alaska DEC Method 2 soil criteria.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
J - estimated concentration
mg/kg - milligram per kilogram
NA - not analyzed
U - not detected at concentration shown

Table B-2
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Turnkey Housing Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
Perched Groundwater									
472	HMW-67-1	AW	8/24/1993	7,220	NA	NA	NA	NA	NA
Primary Groundwater Unit									
470	MW-67-1	LW	7/2/1993	420	NA	NA	NA	NA	NA
471	MW-67-2	AW	7/2/1993	910	NA	NA	NA	NA	NA
			Cleanup Criteria[a]	1,500	1,300	5	1,000	700	10,000

[a] Alaska DEC criteria for groundwater used as a drinking water source

Notes:
Shading indicates detected concentrations that exceed Alaska DEC criteria for groundwater used as a drinking water source
AW - abandoned well
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
GW - Geoprobe well
J - estimated concentration
LW - lost well
ug/L - microgram per liter
MW - monitoring well
NA - not analyzed
RW - recovery well
U - not detected at concentration shown

Table B-3
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
125	95	8/1/1993	6 to 8	4,500	NA	NA	NA	NA	NA
126	120	8/1/1993	6 to 8	26	NA	NA	NA	NA	NA
127	121	8/1/1993	6 to 8	52	NA	NA	NA	NA	NA
128	328	8/1/1993	6 to 8	17	NA	NA	NA	NA	NA
129	255	8/1/1993	6 to 8	240	NA	NA	NA	NA	NA
130	325	8/1/1993	6 to 8	66	NA	NA	NA	NA	NA
131	257	8/1/1993	6 to 8	200	NA	NA	NA	NA	NA
100	03-100	6/23/1997	6 to 7	18	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
104	03-104	6/21/1997	18.2 to 19.2	228	26 J	0.01 U	0.01 U	0.87	4.3
105	03-105	6/21/1997	18.3 to 19.3	5 U	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
108	03-108	6/20/1997	16 to 17	5 U	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
602	03-602	2/17/1997	5 to 6.5	16	1.1 U	0.029 U	0.029 U	0.029 U	0.029 U
705	03-705	1/31/1997	21 to 23	13 U	1.3 U	0.032 U	0.032 U	0.032 U	0.032 U
706	03-706	2/3/1997	15 to 17	11 U	1.1 U	0.028 U	0.028 U	0.028 U	0.028 U
707	03-707	12/5/1996	14.25 to 16	5 UJ	0.3 U	0.01 UJ	0.01 UJ	0.01 UJ	0.03 U
708	03-708	1/31/1997	3 to 5	13 U	1.3 U	0.031 U	0.034	0.031 U	0.13
709	03-709	3/26/1997	5 to 7	37	1.3 U	0.033 U	0.033 U	0.033 U	0.033 U
			15 to 17	12 U	1.7	0.031 U	0.031 U	0.031 U	0.031 U
710	03-710	3/26/1997	15 to 17	12 U	1.9	0.031 U	0.031 U	0.031 U	0.031 U
711	03-711	3/27/1997	14 to 16	12 U	1.6	0.03 U	0.03 U	0.03 U	0.03 U
712	03-712	3/25/1997	18 to 20	2,700	13 J	0.028 U	0.028 U	0.47 J	2
713	03-713	3/24/1997	19 to 21	1,800	14	0.058 U	0.058 U	0.51	1.8

Table B-3 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
716	03-716	6/23/1997	17.5 to 19.5	21	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
778	03-778	5/12/1997	15 to 16	5.1	2.9 U	0.029 U	0.029 U	0.029 U	0.029 U
779	03-779	5/13/1997	3.5 to 3.5	2,400	7.6	0.028 U	0.028 U	0.028 U	0.028 U
			16 to 17	4.4 U	2.7 U	0.027 U	0.027 U	0.027 U	0.027 U
802	03-802	2/18/1997	5 to 6	14 U	4.9	0.034 U	0.034 U	0.034 U	0.047
			14.5 to 16	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
804	03-804	2/15/1997	8 to 9	700	4.5 U	0.11 U	0.11 U	0.11 U	0.61
805	03-805	2/16/1997	7 to 8	94	4.3 U	0.11 U	0.11 U	0.11 U	0.11 U
			17 to 18	10,000	37 J	0.06 U	1.4 J	0.079 J	5.5
807	03-807	6/20/1997	16 to 17	5 U	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
808	03-808	6/20/1997	16 to 17	981	16 J	0.01 U	0.01 U	0.59	2.19
809	03-809	4/28/1997	7 to 9	4.7 U	2.9 U	0.029 U	0.029 U	0.029 U	0.029 U
810	03-810	3/29/1997	6 to 8	9,700	19	0.059 U	0.059 U	1	1.7
			16 to 18	12 U	1.2 U	0.03 U	0.03 U	0.03 U	0.03 U
886	03-886	6/20/1997	16 to 17	965	13	0.01 U	0.01 U	0.36	1.9
895	03-895	7/16/1998	17 to 18	4.8 U	3 U	0.03 U	0.12	0.031	0.28
185	04-185	9/23/1996	8 to 10	38	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
			20 to 22	23	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
186	04-186	9/24/1996	5 to 7	21	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
			19 to 21	15	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
187	04-187	9/24/1996	18 to 20	12	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
188	04-188	9/24/1996	15 to 17	34	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U

Table B-3 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
871	04-871	7/20/1999	15 to 17	4 U	5 U	0.05 U	0.1 U	0.1 U	0.1 U
			18 to 20	4 U	5 U	0.05 U	0.1 U	0.1 U	0.1 U
880	FS-001	9/30/1996	2 to 2.4	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
881	FS-006	9/30/1996	1.3 to 1.7	12,000 J	29 J	0.27 U	0.27 U	1.3 J	3.2
882	FS-007	9/30/1996	1.3 to 1.7	11,000 J	27 J	0.27 U	0.27 U	1.2 J	4.4
883	FS-008	9/30/1996	2.8 to 3.2	19,000 J	36 J	0.28 U	0.28 U	2.4 J	6.8
884	FS-011	9/30/1996	1.6 to 2	17,000 J	41 J	0.29 U	0.29 U	2 J	4.5
885	FS-012	9/30/1996	2.1 to 2.5	37	1.1 U	0.028 U	0.028 U	0.028 U	0.028 U
764	HMW-102-5	8/13/1993	7.5 to 8.5	175	NA	NA	NA	NA	NA
			17.5 to 18.5	30,000 J	NA	NA	NA	NA	NA
765	HMW-102-6	8/13/1993	7.5 to 7.5	36	NA	NA	NA	NA	NA
767	HMW-102-8	8/13/1993	10 to 10	10 U	NA	NA	NA	NA	NA
769	HMW-102-10	8/21/1993	7.5 to 7.5	10 U	NA	NA	NA	NA	NA
			17.5 to 17.5	5,330 J	NA	NA	NA	NA	NA
202	HMW-102-11	8/31/1993	7.5 to 7.5	15	NA	NA	NA	NA	NA
841	HMW-107-2	8/18/1993	5 to 5	10 U	NA	NA	NA	NA	NA
842	HMW-107-3	8/18/1993	12.5 to 12.5	10 U	NA	NA	NA	NA	NA
750	MRP-MW1	8/1/1993	8 to 10	34	NA	NA	NA	NA	NA
			12 to 14	160	NA	NA	NA	NA	NA
			16 to 18	20,000	410	NA	NA	NA	NA
			18 to 20	16	NA	NA	NA	NA	NA
			22 to 24	50	NA	NA	NA	NA	NA

Table B-3 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
751	MRP-MW2	8/1/1993	5 to 7	450	NA	NA	NA	NA	NA
			9 to 11	24	NA	NA	NA	NA	NA
			14 to 15	50 U	NA	NA	NA	NA	NA
			17 to 19	33	43	NA	NA	NA	NA
			21 to 23	50 U	NA	NA	NA	NA	NA
770	RW-102-1	8/14/1996	0	1,070	5 U	0.05 U	0.05 U	0.05 U	0.05 U
850	RW-107-1	8/14/1996	0	72	5 U	0.05 U	0.05 U	0.05 U	0.05 U
851	RW-107-2	8/14/1996	0	333	7	0.05 U	0.05 U	0.05 U	0.05 U
852	RW-107-3	8/14/1996	0	284	5 U	0.05 U	0.05 U	0.05 U	0.05 U
Screening Criteria[a]				8,250	1,400	120	17,000	8,300	166,000
Screening Criteria[b]				12,500	1,400	6.4	180	89	81
Screening Criteria[c]				230	260	0.02	4.8	5	69

[a]Alaska DEC Method 2 soil criteria for human ingestion.

[b]Alaska DEC Method 2 soil criteria for human inhalation.

[c]Alaska DEC Method 2 soil criteria to prevent migration to groundwater.

Table B-3 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples,
SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Notes:
Shading indicates detected concentrations that exceed the most stringent Alaska DEC Method 2 soil criteria.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
J - estimated concentration
mg/kg - milligram per kilogram
NA - not analyzed
U - not detected at concentration shown

Table B-4
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
Perched Groundwater									
100	03-100	MW	7/13/1997	50 UJ	5 U	0.2 U	0.2 U	0.2 U	0.2 U
692	03-692	MW	2/11/1997	2,100 J	100 U	1 U	1 U	1 U	3.4
708	03-708	GW	2/5/1997	760	470	4.6 J	10 J	3.3 J	48
752	MRP-MW3	MW	2/5/1997	17,000	23,000	55	1,300	2,600	7,500
			11/5/1997	5,600	37,000 J	5.1	3,700	1,900 J	9,100
			9/3/2001	6,930 UJ	44,100	40 U	5,690	1,860	10,100
Primary Groundwater Unit									
104	03-104	MW	9/3/2001	11,500	199 UJ	0.2 U	0.684	2.24	18.6
108	03-108	MW	8/4/1997	270 J	100 U	1 U	1 U	1 U	1 U
185	04-185	AW	10/18/1996	630	232	0.2 U	2	1	2
186	04-186	MW	10/18/1996	400	147	0.2 U	0.2 U	0.2 U	2
			9/7/1998	400	150	1.7	1 U	3.8	3.3
188	04-188	AW	10/18/1996	250 U	204	0.2 U	0.2 U	0.2 U	2
269	03-269	GB	1/23/1997	2,300	100 U	1 U	1.2	1.4	13
347	03-347	GW	1/2/1997	290 J	930	4.2	3.3	2	2.4
705	03-705	GW	2/4/1997	250 U	100 U	1 U	1 U	1 U	1 U
706	03-706	GW	2/4/1997	250 U	100 U	1 U	1 U	1 U	1 U
707	03-707	GW	12/7/1996	250 U	100 U	1 U	1 U	1 U	1 U
712	03-712	GW	5/1/1997	7,800	130	1 U	3.2	8.4	66
713	03-713	GW	5/1/1997	2,700	100 U	1 U	1 U	1	22
716	03-716	MW	7/14/1997	50 U	5 U	0.2 U	0.2 U	0.2 U	0.2 U
778	03-778	MW	5/16/1997	430	100 U	0.5 U	0.5 U	0.55	1.7
			8/11/1998	200 UJ	100 U	1 U	1 U	1 U	1 U
			9/3/2001	4,620	101	0.238	0.597	8.73	12.8

Table B-4 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples,
SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
779	03-779	MW	7/14/1997	50 U	5 U	0.2 U	0.2 U	0.2 U	0.2 U
802	03-802	MW	7/14/1997	50 U	5 U	0.2 U	0.2 U	0.2 U	0.2 U
807	03-807	MW	8/6/1997	690	100 UJ	1 U	1 U	1 U	1 U
			9/15/1997	1,100	100 U	1 U	1 U	1 U	1 U
886	03-886	MW	7/30/1997	5,500 J	160	1 U	3.7	17	100
			9/3/2001	6,700	443 J	1.96 J	5.05 J	26.7 J	106 J
895	03-895	MW	8/10/1998	190 U	100 U	1 U	1 U	1 U	1 U
			8/25/1999	NA	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			11/19/1999	180 UJ	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			2/21/2000	150 U	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			10/8/2001	568 U	90 U	0.5 U	2 U	2 U	2U
			10/1/2002	170 U	50 U	1 U	1 U	1 U	3 U
755	CTO124-MW4	MW	2/14/1997	250 U	100 U	1 U	1 U	1 U	1 U
			5/1/1997	260 U	100 U	1 U	1 U	1 U	1 U
760	HMW-102-1	MW	2/13/1997	12,000 J	250	1 U	6.8	9.8	96
			9/3/2001	15,800 J	111 UJ	0.2 U	0.805	2.91	25.2
761	HMW-102-2	MW	8/20/1993	43,000	NA	NA	NA	NA	NA
763	HMW-102-4	MW	8/20/1993	4,310	NA	NA	NA	NA	NA
			2/6/1997	1,000	100 U	1 U	3.5	1 U	11
764	HMW-102-5	MW	8/20/1993	42,000	NA	NA	NA	NA	NA
765	HMW-102-6	MW	8/20/1993	15,000	NA	NA	NA	NA	NA
766	HMW-102-7	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
			2/7/1997	250 U	100 U	1 U	1 U	1 U	1 U
767	HMW-102-8	MW	8/20/1993	280	NA	NA	NA	NA	NA
			2/7/1997	250 U	100 U	1 U	1 U	1 U	1 U

Table B-4 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples,
SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
768	HMW-102-9	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
			2/7/1997	250 U	100 U	1 U	1 U	1 U	1 U
769	HMW-102-10	MW	8/24/1993	17,300	NA	NA	NA	NA	NA
202	HMW-102-11	MW	9/6/1993	4,030	NA	NA	NA	NA	NA
			11/8/1996	3,500	100 U	1.3	1.7	10	44
840	HMW-107-1	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
			2/12/1997	310 J	100 U	1 U	1 U	1 U	1 U
841	HMW-107-2	MW	8/21/1993	270	NA	NA	NA	NA	NA
			2/12/1997	250 U	100 U	1 U	1 U	1 U	1.6
842	HMW-107-3	MW	8/21/1993	2,200	NA	NA	NA	NA	NA
855	HMW-146-1	MW	9/6/1993	420	NA	NA	NA	NA	NA
			2/15/1997	250 U	280	1 U	1 U	2	1.3
856	HMW-146-2	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
			2/15/1997	250 U	100 U	1 U	1 U	1 U	1 U
750	MRP-MW1	MW	2/5/1997	18,000	620	5 U	28	18	220
			9/3/2001	9,790	359 J	0.435 J	2.02 J	25.6 J	93.3 J
751	MRP-MW2	MW	11/6/1992	8,600	NA	NA	NA	NA	NA
			2/5/1997	3,200	7,500	220	620	20	3,500
			11/5/1997	1,400	9,400 J	180	25	720 J	2,606
			9/3/2001	2,590 UJ	18,200	137	25 U	440	3,040
757	MW-102-4	MW	2/12/1997	16,000 J	410	1 U	1.5	18	80
			9/3/2001	18,700	101	0.2 U	0.5 U	5.03	9
758	MW-102-6	MW	7/2/1993	220,000	NA	NA	NA	NA	NA
7	MW-102-7	LW	7/2/1993	660	NA	NA	NA	NA	NA
759	MW-102-8	AW	7/2/1993	270	NA	NA	NA	NA	NA
9	MW-107-9	LW	7/11/1993	580	NA	NA	NA	NA	NA

Table B-4 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples,
SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 102, 107, and 146 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
846	MW-107-10	MW	7/2/1993	930	NA	NA	NA	NA	NA
			2/12/1997	250 UJ	100 U	1 U	1 U	1 U	1 U
849	MW-107-13	MW	2/12/1997	14,000	100 UJ	1 U	1 U	1.2	15
858	MW-146-1	MW	7/3/1993	250 U	NA	NA	NA	NA	NA
872	MW-146-3	MW	9/3/2001	15,900	350 UJ	0.4 U	5.34	19.3	72.1
860	MW-146-4	MW	8/3/1997	4,800 J	1,800 UJ	100 U	100 U	100 U	300
			9/3/2001	6,250 J	114 UJ	0.2 U	0.5 U	3.57 J	16.3 J
864	MW-146-8	MW	7/3/1993	500	NA	NA	NA	NA	NA
9	MW-146-9	LW	7/11/1993	320	NA	NA	NA	NA	NA
865	MW-146-11	MW	7/3/1993	11,600	NA	NA	NA	NA	NA
Cleanup Criteria[a]				1,500	1,300	5	1,000	700	10,000

[a] Alaska DEC criteria for groundwater used as a drinking water source

Notes:
Shading indicates detected concentrations that exceed Alaska DEC criteria for groundwater used as a drinking water source
AW - abandoned well
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
GW - Geoprobe well
J - estimated concentration
LW - lost well
ug/L - microgram per liter
MW - monitoring well
NA - not analyzed
RW - recovery well
U - not detected at concentration shown

Table B-5
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 114, 116, 160, and 167 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
896	03-896	7/15/1998	13.5 to 14	5 UJ	3.1 U	0.03 U	0.03 U	0.03 U	0.03 U
897	03-897	8/4/1998	17 to 19	4.8 U	3 U	0.03 U	0.03 U	0.03 U	0.03 U
686	HMW-114-1	8/19/1993	7.5 to 7.5	172	NA	NA	NA	NA	NA
689	HMW-116-1	8/19/1993	7.5 to 7.5	10 U	NA	NA	NA	NA	NA
660	HMW-160-1	8/18/1993	7.5 to 7.5	10 U	NA	NA	NA	NA	NA
663	HMW-167-2	8/18/1993	10 to 10	10 U	NA	NA	NA	NA	NA
Screening Criteria[a]				8,250	1,400	120	17,000	8,300	166,000
Screening Criteria[b]				12,500	1,400	6.4	180	89	81
Screening Criteria[c]				230	260	0.02	4.8	5	69

[a]Alaska DEC Method 2 soil criteria for human ingestion.
[b]Alaska DEC Method 2 soil criteria for human inhalation.
[c]Alaska DEC Method 2 soil criteria to prevent migration to groundwater.

Notes:
Shading indicates detected concentrations that exceed the most stringent Alaska DEC Method 2 soil criteria.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
J - estimated concentration
mg/kg - milligram per kilogram
NA - not analyzed
U - not detected at concentration shown

Table B-6
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples,
SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 114, 116, 160, and 167 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
Perched Groundwater									
686	HMW-114-1	MW	8/21/1993	250 U	NA	NA	NA	NA	NA
689	HMW-116-1	MW	8/21/1993	320	NA	NA	NA	NA	NA
660	HMW-160-1	MW	8/21/1993	320	NA	NA	NA	NA	NA
664	HMW-167-3	MW	8/21/1993	250 U	NA	NA	NA	NA	NA
			1/24/1997	260 U	100 U	1 U	1 U	1 U	1 U
684	MW-114-1	MW	7/3/1993	740	NA	NA	NA	NA	NA
685	MW-114-5	MW	7/3/1993	250 U	NA	NA	NA	NA	NA
688	MW-116-2	MW	7/3/1993	250 U	NA	NA	NA	NA	NA
3	MW-160-3	AW	7/2/1993	25,000	NA	NA	NA	NA	NA
666	MW-167-2	AW	7/2/1993	250 U	NA	NA	NA	NA	NA
			1/24/1997	240 U	100 U	1 U	1 U	1 U	1 U
667	MW-167-3	AW	7/3/1993	2,060	NA	NA	NA	NA	NA
			1/24/1997	250 U	100 U	1 U	1 U	1 U	1 U
670	MW-167-5	AW	7/11/1993	900	NA	NA	NA	NA	NA
Primary Groundwater Unit									
896	03-896	MW	8/25/1999	NA	20 U	0.2 U	0.3 U	0.2 U	0.6
			11/18/1999	270 UJ	21	0.2 U	0.3 U	0.2 U	0.41
			2/10/2000	480	28	0.2 U	0.3 U	0.2 U	0.46
			7/1/2000	160 UJ	25	0.2 U	0.3 U	0.2 U	0.74 J
			10/8/2001	543 U	90 U	0.5 U	2 U	2 U	2 U
			10/3/2002	160 U	35 J	1 U	1 U	0.64	3 U

Table B-6 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 114, 116, 160, and 167 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
897	03-897	MW	9/5/1998	1,100	120	1.1	1 U	12	8.3
			8/25/1999	NA	65 J	0.98 J	0.3 UJ	15	3.81
			11/19/1999	390 UJ	91	0.76	0.3 U	10	3.4 J
			2/10/2000	160 U	120	0.98	0.3 U	9.9	3.5
			7/1/2000	560 J	150	0.6	0.3 U	14	3.7
			10/8/2001	969	100	0.5 U	2 U	6.92	2.57
			10/2/2002	730	220	0.39 J	1 U	14	5.3
663	HMW-167-2	MW	8/21/1993	250 U	NA	NA	NA	NA	NA
			1/24/1997	270 U	100 U	1 U	1 U	1 U	1 U
Cleanup Criteria[a]				1,500	1,300	5	1,000	700	10,000

[a] Alaska DEC criteria for groundwater used as a drinking water source

Notes:
Shading indicates detected concentrations that exceed Alaska DEC criteria for groundwater used as a drinking water source
AW - abandoned well
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
GW - Geoprobe well
J - estimated concentration
LW - lost well
ug/L - microgram per liter
MW - monitoring well
NA - not analyzed
RW - recovery well
U - not detected at concentration shown

Table B-7
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 134, 179, and 187 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
606	03-606	2/18/1997	10 to 12	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
			15 to 16	11 U	1.1 U	0.028 U	0.028 U	0.028 U	0.028 U
609	03-609	2/17/1997	17 to 18	12,000	95	0.15 U	4.3	0.54	16
610	03-610	2/17/1997	3 to 5	56	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
			17 to 19	11 U	1.1 U	0.029 U	0.029 U	0.029 U	0.029 U
619	03-619	2/13/1997	15 to 16	4.9 U	2.9 U	0.029 U	0.029 U	0.029 U	0.029 U
630	HMW-134-1	8/18/1993	7.5 to 7.5	46	NA	NA	NA	NA	NA
632	HMW-134-3	8/18/1993	1.5 to 1.5	434	NA	NA	NA	NA	NA
			7.5 to 7.5	133	NA	NA	NA	NA	NA
674	HMW-179-1	8/18/1993	7.5 to 7.5	55	NA	NA	NA	NA	NA
Screening Criteria[a]				8,250	1,400	120	17,000	8,300	166,000
Screening Criteria[b]				12,500	1,400	6.4	180	89	81
Screening Criteria[c]				230	260	0.02	4.8	5	69

[a]Alaska DEC Method 2 soil criteria for human ingestion.

[b]Alaska DEC Method 2 soil criteria for human inhalation.

[c]Alaska DEC Method 2 soil criteria to prevent migration to groundwater.

Table B-7 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 134, 179, and 187 Area

Notes:
Shading indicates detected concentrations that exceed the most stringent Alaska DEC Method 2 soil criteria.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
J - estimated concentration
mg/kg - milligram per kilogram
NA - not analyzed
U - not detected at concentration shown

Table B-8
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 134, 179, and 187 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
Perched Groundwater									
639	MW-134-4	AW	7/11/1993	410,000	NA	NA	NA	NA	NA
682	MW-187-2	MW	7/3/1993	790	NA	NA	NA	NA	NA
683	MW-187-3	MW	7/3/1993	1,090	NA	NA	NA	NA	NA
Primary Groundwater Unit									
606	03-606	AW	9/16/1997	200	100 U	1 U	1 U	1 U	1 U
619	03-619	MW	8/25/1999	NA	250	10	2.5	10	11.5
			11/18/1999	240 UJ	420	12	2.4	5.5	11
			2/21/2000	150 U	650	3.9 J	4.8	9	9
			6/28/2000	180 J	1,700	32	43	73	46
			9/2/2001	2,600	124 J	1.34	0.5 U	0.5 U	1 U
			10/8/2001	1,280	203	0.954	2 U	2 U	2 U
			10/1/2002	1,600	250	3.8	1 U	1.3	2.8 J
649	DW-134-2	RW	9/2/2001	5,840	264	1.14	1 U	9.95	30.6
630	HMW-134-1	MW	8/21/1993	370	NA	NA	NA	NA	NA
631	HMW-134-2	MW	8/21/1993	2,640	NA	NA	NA	NA	NA
			1/23/1997	3,200	3,300	240	200	240	910
			11/10/1997	3,900	4,900 J	250	100 J	400 J	1,140
			11/24/1997	3,400	NA	NA	NA	NA	NA
			9/2/2001	2,870	3,850 J	152	32.2	302	373
632	HMW-134-3	AW	8/20/1993	2,850	NA	NA	NA	NA	NA
			1/23/1997	2,700	100 U	1 U	1 U	13	31

Table B-8 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples,
SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 134, 179, and 187 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
674	HMW-179-1	AW	8/21/1993	250 U	NA	NA	NA	NA	NA
			1/24/1997	250 U	100 U	1 U	1 U	1 U	1 U
641	MW-134-6	AW	1/23/1997	19,000 J	190	1 U	3.1	11	78
643	MW-134-8	MW	7/3/1993	24,000	NA	NA	NA	NA	NA
644	MW-134-9	MW	7/3/1993	8,030	NA	NA	NA	NA	NA
			1/23/1997	23,000	100 U	1 U	2.5	2.1	8.5
645	MW-134-10	MW	7/3/1993	27,000	NA	57	25 U	74	150
			9/27/1996	2,700	150	4.6 J	2	15	31
			9/2/2001	5,030	689	7.22 J	3.56 J	44.2 J	156 J
646	MW-134-11	MW	7/11/1993	3,600	NA	NA	NA	NA	NA
			9/27/1996	2,600	980 J	65 J	9.9	130	70
			8/11/1998	2,600 J	200	3.7	1 U	1 U	22
			9/2/2001	7,450	214	3.56	1.24	14.3	34.1
675	MW-179-1	AW	7/2/1993	260	NA	NA	NA	NA	NA
677	MW-179-3	AW	7/2/1993	270	NA	NA	NA	NA	NA
4	MW-179-4	AW	7/11/1993	3,600	NA	NA	NA	NA	NA
681	MW-187-1	MW	7/3/1993	5,870	NA	NA	NA	NA	NA
Cleanup Criteria[a]				1,500	1,300	5	1,000	700	10,000

Table B-8 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 134, 179, and 187 Area

[a] Alaska DEC criteria for groundwater used as a drinking water source

Notes:

Shading indicates detected concentrations that exceed Alaska DEC criteria for groundwater used as a drinking water source

AW - abandoned well
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
GW - Geoprobe well
J - estimated concentration
LW - lost well
MW - monitoring well
ug/L - microgram per liter
NA - not analyzed
RW - recovery well
U - not detected at concentration shown

Table B-9
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 139 and 184 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
21/22	OX-6-11-21	5/17/1997	13.5 to 14.5	12 U	6.5 U	0.032 U	0.032 U	0.032 U	0.032 U
			15.5 to 16.5	12 U	5.7 U	0.029 U	0.029 U	0.029 U	0.029 U
			16.5 to 17.5	11 U	5.6 U	0.028 U	0.028 U	0.028 U	0.028 U
			18.5 to 19.5	11 U	5.7 U	0.028 U	0.028 U	0.028 U	0.028 U
			19.5 to 20.5	11 U	5.5 U	0.027 U	0.027 U	0.027 U	0.027 U
603	03-603	1/24/1997	3 to 5	5,900	2.8 U	0.028 U	0.028 U	0.028 U	0.028 U
604	03-604	12/6/1996	21 to 23	4.8 U	2.9 U	0.029 U	0.029 U	0.029 U	0.029 U
695	03-695	7/2/1999	2 to 4	4,120	5 U	0.05 U	0.1 U	0.1 U	0.1 U
			5.5 to 6	257	5 U	0.05 U	0.1 U	0.1 U	0.1 U
			16 to 18	10 U	5 U	0.05 U	0.1 U	0.1 U	0.1 U
			18 to 19	12,000	60	0.2 U	0.4 U	0.7	2.7
696	03-696	7/2/1999	16 to 18	10 U	5 U	0.05 U	0.1 U	0.1 U	0.1 U
			18 to 19	12,000	60	0.2 U	0.4 U	0.7	2.7
652	HMW-139-2	8/17/1993	16 to 16	31,000 J	NA	NA	NA	NA	NA
857	HMW-146-3	8/17/1993	7.5 to 7.5	326	NA	NA	NA	NA	NA
678	HMW-184-1	8/18/1993	7.5 to 7.5	11	NA	NA	NA	NA	NA
679	HMW-184-2	8/21/1993	12.5 to 12.5	847 J	NA	NA	NA	NA	NA
Screening Criteria[a]				8,250	1,400	120	17,000	8,300	166,000
Screening Criteria[b]				12,500	1,400	6.4	180	89	81
Screening Criteria[c]				230	260	0.02	4.8	5	69

Table B-9 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 139 and 184 Area

[a]Alaska DEC Method 2 soil criteria for human ingestion.
[b]Alaska DEC Method 2 soil criteria for human inhalation.
[c]Alaska DEC Method 2 soil criteria to prevent migration to groundwater.

Notes:
Shading indicates detected concentrations that exceed the most stringent Alaska DEC Method 2 soil criteria.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
J - estimated concentration
mg/kg - milligram per kilogram
NA - not analyzed
U - not detected at concentration shown

Table B-10
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 139 and 184 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
Perched Groundwater									
603	03-603	GW	1/27/1997	500	100 U	1 U	1 U	1 U	1 U
695	03-695	MW	11/17/1999	210	20 U	0.2 U	0.3 U	0.2 U	0.2
			2/27/2000	160 U	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			10/8/2001	959	90 U	0.5 U	2 U	2 U	2 U
			10/2/2002	740	50 U	1 U	1 U	1 U	3 U
680	MW-184-2	AW	7/3/1993	7,630	NA	NA	NA	NA	NA
Primary Groundwater Unit									
604	03-604	GW	12/7/1996	250 U	100 U	1 U	1 U	1 U	1 U
696	03-696	MW	2/25/2000	150 U	110 J	0.2 U	0.3 U	0.84 J	1.1 J
			9/2/2001	1,870	162 UJ	0.2 U	0.5	9.19	28.8
			10/8/2001	1,980	394	0.5 U	2 U	17.8	38
			10/2/2002	780	520	1 U	1 U	16	65
697	03-697	MW	10/14/2001	556 U	90 U	0.5 U	2 U	2 U	2 U
			10/2/2002	160 U	7 J	1 U	1 U	1 U	3 U
652	HMW-139-2	MW	8/22/1993	51,000	NA	NA	NA	NA	NA
			1/23/1997	7,700	330	14	4.9	43	230
			11/8/1997	NA	564 J	6.9	5 U	53	230
			9/2/2001	8,940	961	19.4	4.32	43.4	193
653	HMW-139-3	MW	8/20/1993	410	NA	NA	NA	NA	NA
654	HMW-139-4	MW	9/6/1993	350	NA	NA	NA	NA	NA
			9/2/2001	178	50 U	0.2 U	0.5 U	0.5 U	1 U

Table B-10 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples, SWMU 62, New Housing Fuel Leak Site, Sandy Cove Housing 139 and 184 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
857	HMW-146-3	MW	8/22/1993	1,620	NA	NA	NA	NA	NA
			2/15/1997	2,300	100 U	1 U	1 U	1 U	1.4
			9/2/2001	2,070	50 U	0.2 U	0.5 U	0.5 U	1.07
678	HMW-184-1	MW	8/24/1993	250 U	NA	NA	NA	NA	NA
679	HMW-184-2	MW	8/24/1993	11,300	NA	NA	NA	NA	NA
656	MW-139-2	MW	7/2/1993	250 U	NA	NA	NA	NA	NA
3	MW-139-3	LW	7/2/1993	57,000	NA	NA	NA	NA	NA
657	MW-139-6	MW	7/2/1993	420	NA	NA	NA	NA	NA
Cleanup Criteria[a]				1,500	1,300	5	1,000	700	10,000

[a] Alaska DEC criteria for groundwater used as a drinking water source

Notes:

Shading indicates detected concentrations that exceed Alaska DEC criteria for groundwater used as a drinking water source

AW - abandoned well
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
GW - Geoprobe well
J - estimated concentration
LW - lost well
MW - monitoring well
µg/L - microgram per liter
NA - not analyzed
RW - recovery well
U - not detected at concentration shown

Table B-11
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples,
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
12	03-012	8/22/1998	5.5 to 6	4.9 U	3 U	0.03 U	0.03 U	0.03 U	0.03 U
101	03-101	6/18/1997	17.5 to 18.5	15,000	150	0.01 U	0.3	2	10
102	03-102	6/18/1997	10 to 11	8,600	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
103	03-103	6/18/1997	12.5 to 13.5	11	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
107	03-107	6/18/1997	22.5 to 23.5	7,500 J	79	0.01 U	0.01 U	0.41	5.1
109	03-109	6/23/1997	25 to 25.5	5 U	0.3 UJ	0.01 UJ	0.01 UJ	0.01 UJ	0.03 U
154	03-154	3/31/1998	21 to 24	1,400	2.5	0.02 U	0.02 U	0.02	0.15
501	03-501	2/19/1997	3 to 5	12 U	1.2 U	0.03 U	0.03 U	0.03 U	0.03 U
502	03-502	2/15/1997	24 to 26	120	110	0.032 U	0.49 J	0.27 J	0.77
503	03-503	5/8/1997	10 to 12	13 U	1.3 U	0.031 U	0.031 U	0.031 U	0.031 U
504	03-504	2/15/1997	4 to 5	11 U	1.1 U	0.028 U	0.028 U	0.028 U	0.028 U
505	03-505	4/30/1997	4 to 6	5 U	3 U	0.03 U	0.03 U	0.03 U	0.03 U
506	03-506	5/8/1997	9 to 11	13 U	1.3 U	0.032 U	0.032 U	0.032 U	0.032 U
507	03-507	6/9/1997	19 to 21	5 U	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
508	03-508	2/17/1997	21 to 23	11 U	1.1 U	0.029 U	0.029 U	0.029 U	0.029 U
510	03-510	2/18/1997	21 to 23	12 U	1.2 U	0.031 U	0.031 U	0.031 U	0.031 U
511	03-511	2/15/1997	23 to 25	4,700	20 J	0.064 U	0.73 J	0.064 U	3.6
512	03-512	2/19/1997	23 to 24	15,000	81	0.14 U	2.6	0.22	14
513	03-513	2/18/1997	0.5 to 1	13	1.1 U	0.028 U	0.028 U	0.028 U	0.028 U
			2.5 to 3	11 U	1.1 U	0.028 U	0.028 U	0.028 U	0.028 U
			5 to 7	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
514	03-514	2/18/1997	0.5 to 1.2	41	1.2 U	0.029 U	0.029 U	0.029 U	0.029 U
			2.5 to 3.5	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
			5 to 6	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
517	03-517	5/5/1997	18 to 20	4,800	17	0.055 U	0.062	0.19	1.2
518	03-518	4/28/1997	25 to 27	240	14	0.031 U	0.031 U	0.063	0.66

Table B-11 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples,
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Sampling Date	Depth Range (feet bgs)	Diesel-Range Organics (mg/kg)	Gasoline-Range Organics (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)
522	03-522	4/29/1997	24 to 26	61	3 U	0.03 U	0.03 U	0.03 U	0.03 U
559	03-559	5/1/1997	0 to 1	12	2.9 U	0.029 U	0.029 U	0.029 U	0.029 U
560	03-560	4/30/1997	4 to 6	4.7 U	2.8 U	0.028 U	0.028 U	0.028 U	0.028 U
561	03-561	5/1/1997	9 to 11	1,900	2.9 U	0.029 U	0.029 U	0.029 U	0.029 U
562	03-562	5/2/1997	9 to 11	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
563	03-563	5/2/1997	14 to 16	18,000	51	0.15 U	0.24	1.2	2.1
564	03-564	5/3/1997	8 to 10	11 U	1.1 U	0.027 U	0.027 U	0.027 U	0.027 U
			15 to 17	13 U	1.3 U	0.031 U	0.031 U	0.031 U	0.031 U
565	03-565	5/3/1997	15 to 17	1,200	11	0.063 U	0.063 U	0.16	1.3
898	03-898	7/17/1998	12.5 to 13	31	2.9 U	0.03 U	0.03 U	0.03 U	0.03 U
617	28-617	12/4/1996	4 to 6	12 J	0.3 U	0.01 U	0.01 U	0.01 U	0.03 U
621	28-619	12/10/1996	1.75 to 2.5	4.5 U	NA	NA	NA	NA	NA
620	28-620	12/10/1996	0.5 to 1.1	6.2	NA	NA	NA	NA	NA
575	HMW-303-5	8/10/1993	7.5 to 7.5	11 U	NA	NA	NA	NA	NA
576	HMW-303-6	8/10/1993	7.5 to 7.5	10 U	NA	NA	NA	NA	NA
582	HMW-303-12	8/31/1993	2.5 to 2.5	964	NA	NA	NA	NA	NA
Screening Criteria[a]				8,250	1,400	120	17,000	8,300	166,000
Screening Criteria[b]				12,500	1,400	6.4	180	89	81
Screening Criteria[c]				230	260	0.02	4.8	5	69

[a]Alaska DEC Method 2 soil criteria for human ingestion.

[b]Alaska DEC Method 2 soil criteria for human inhalation.

[c]Alaska DEC Method 2 soil criteria to prevent migration to groundwater.

Table B-11 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Soil Samples,
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Notes:

Shading indicates detected concentrations that exceed the most stringent Alaska DEC Method 2 soil criteria.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
J - estimated concentration
mg/kg - milligram per kilogram
NA - not analyzed
U - not detected at concentration shown

Table B-12
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
Perched Groundwater									
501	03-501	GW	4/30/1997	280 U	100 U	1 U	1 U	1 U	1 U
Primary Groundwater Unit									
12	03-012	MW	10/14/1998	200 U	100 U	1 U	1 U	1 U	1 U
			8/25/1999	NA	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			11/18/1999	160 UJ	20 U	0.2 U	0.3 U	0.2 U	0.2
			2/14/2000	160 UJ	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			7/4/2000	160 UJ	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			9/4/2001	100 U	50 U	0.2 U	0.5 U	0.5 U	1 U
			10/4/2001	549 U	90 U	0.5 U	2 U	2 U	2 U
			10/1/2002	160 U	50 U	1 U	1 U	1 U	3 U
103	03-103	MW	10/22/1997	12,000	298	5 U	5 U	19	86
			9/4/2001	744	50 U	0.2 U	0.5 U	0.5 U	3.5
107	03-107	MW	1/14/1998	3,000	10,000	21	1,100	730	2,000
			9/3/2001	19,300	10,600	82.1	938	712	1,820
109	03-109	MW	1/13/1998	260	100 U	1 U	1 U	1 U	1 U
			8/26/1999	NA	28	0.2 U	0.3 U	0.2 U	0.44
			11/18/1999	290 UJ	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			2/27/2000	150 U	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			7/10/2000	160 UJ	20 U	0.2 UJ	0.3 U	0.2 U	0.2
			9/4/2001	100 U	50 U	0.2 U	0.5 U	0.5 U	1 U
			10/4/2001	588 U	90 U	0.5 U	2 U	2 U	2 U
			10/2/2002	160 U	6.1 J	1 U	1 U	1 U	3 U

Table B-12 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
502	03-502	GW	1/14/1998	1,700	1,400	1 U	2.5	12	36
503	03-503	AW	5/15/1997	250 U	100 U	1 U	1 U	1 U	1 U
504	03-504	AW	4/29/1997	280 U	100 U	1 U	1 U	1 U	1 U
505	03-505	AW	5/14/1997	260 U	100 U	1 U	1 U	1 U	1 U
			7/13/1998	240 U	100 U	1 U	1 U	1 U	1 U
506	03-506	AW	5/30/1997	250 U	100 U	1 U	1 U	1 U	1 U
508	03-508	AW	4/30/1997	280 U	100 U	1 U	1 U	1 U	1 U
510	03-510	AW	4/29/1997	280 U	100 U	1 U	1 U	1 U	1 U
517	03-517	AW	5/31/1997	5,800	600	6.4	5 U	43	170
			10/14/1997	3,150,000 J	1,180	6.2 J	12 J	45 J	208
522	03-522	MW	5/15/1997	3,500	100 U	1 U	1 U	1 U	24
559	03-559	AW	5/16/1997	250 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U
560	03-560	AW	5/16/1997	260 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U
561	03-561	AW	5/16/1997	250 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U
562	03-562	GW	5/31/1997	250 U	100 U	1 U	1.2	1 U	1.4
			9/4/2001	100 U	50 U	0.2 U	0.5 U	0.5 U	1 U
563	03-563	AW	5/16/1997	7,500	180	2.7	0.6 U	6	33
564	03-564	GW	5/30/1997	2,500	100 U	1 U	1 U	1 U	6.9
565	03-565	GW	5/31/1997	800	100 U	1 U	1 U	1 U	20
898	03-898	MW	8/10/1998	200 U	100 U	1 U	1 U	1 U	1 U
			8/27/1999	NA	27 J	0.2 U	0.3 U	0.2 U	0.4 U
			11/19/1999	160 UJ	33	0.2 U	0.3 U	0.2 U	0.4 U
			2/21/2000	150 U	20 U	0.2 U	0.3 U	0.2 U	0.4 U

Table B-12 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
			6/26/2000	160 UJ	20 U	0.2 U	0.3 U	0.2 U	0.4 U
			9/4/2001	135	50 U	0.2 U	0.5 U	0.5 U	1 U
			10/4/2001	581 U	90 U	0.5 U	2 U	2 U	2 U
617	28-617	AW	12/7/1996	840	3,600	97	110	160	250
553	AMW-704	MW	8/27/1993	250 U	250 U	1 U	1 U	1 U	2 U
			2/13/1997	240 UJ	100 U	1 U	1 U	1 U	1 U
			7/13/1998	540	100 U	1 U	1 U	2.6	8.9
			8/27/1999	NA	88 J	0.2 U	0.3 U	1.5 J	17
			11/20/1999	370 UJ	42	0.2 U	0.3 U	0.67	5.8 J
			2/14/2000	340 J	48	0.2 U	0.3 U	0.54	4.2
			7/3/2000	480 J	82	0.2 U	0.3 U	0.78	11.3
			9/4/2001	4,170	150	0.337	0.5 U	1.51	15.6
			10/4/2001	2,110	101	0.5 U	2 U	2.74	7.59
			10/1/2002	1,200	99	0.39 J	1 U	6.5	7.6
554	CTO124-MW13	MW	2/13/1997	500 J	100 U	1 U	1 U	1 U	1 U
			7/13/1998	780	100 U	1 U	1 U	1 U	5.7
555	CTO124-MW14	MW	2/13/1997	770 J	100 U	1 U	1 U	1 U	2.8
			7/13/1998	1,900	100 U	1.4	1 U	2.3	2.6
556	CTO124-MW15	MW	2/13/1997	14,000 J	120	1.6	1 U	8.9	70
			11/9/1997	5,000	262	5 U	5 U	9.7 J	28
			9/3/2001	9,820	551	1.16	3.48	23.9	136
571	HMW-303-1	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
			9/4/2001	313	50 U	0.2 U	0.5 U	0.5 U	1 U

Table B-12 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
572	HMW-303-2	MW	2/17/1997	23,000	180	1.5	20	3.2	86
			9/4/2001	13,900 J	551	0.92	0.754	4.44	58.5
573	HMW-303-3	MW	8/20/1993	550	NA	NA	NA	NA	NA
			2/17/1997	4,500	100 U	1 U	2.3	1.0	21
574	HMW-303-4	MW	9/4/2001	19,900	421	1 U	3.56	6.72	33.4
576	HMW-303-6	MW	4/29/1997	9,900	1,100	10 U	14	100	400
577	HMW-303-7	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
578	HMW-303-8	MW	8/20/1993	250 U	NA	NA	NA	NA	NA
579	HMW-303-9	MW	9/4/1993	3,940	NA	NA	NA	NA	NA
580	HMW-303-10	MW	9/4/1993	660	NA	NA	NA	NA	NA
			2/13/1997	1,500	100 U	1 U	1 U	1 U	1 U
			9/4/2001	4,850	60.3	1.99	0.5 U	3.84	3.93
581	HMW-303-11	MW	9/6/1993	11,300	NA	NA	NA	NA	NA
582	HMW-303-12	MW	9/4/1993	330	NA	NA	NA	NA	NA
550	MRP-MW4	MW	11/6/1992	4,200	NA	NA	NA	NA	NA
			7/5/1993	2,160	NA	NA	NA	NA	NA
4	MW-303-4	LW	7/1/1993	55,000	NA	NA	NA	NA	NA
540	MW-303-13	MW	7/1/1993	250 U	NA	NA	NA	NA	NA
			9/4/2001	100 U	50 U	0.2 U	0.5 U	0.5 U	1 U
541	MW-303-14	MW	7/1/1993	910	NA	NA	NA	NA	NA
542	MW-303-15	MW	7/1/1993	250 U	NA	NA	NA	NA	NA
543	MW-303-16	MW	7/3/1993	250 U	NA	NA	NA	NA	NA
			9/3/2001	100 U	50 U	0.2 U	0.5 U	0.5 U	1 U

Table B-12 (Continued)
Summary of Analytical Results for DRO, GRO, and BTEX in Groundwater Samples
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location ID	Location Cross-Reference	Location Type	Sampling Date	Diesel-Range Organics (ug/L)	Gasoline-Range Organics (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
544	MW-303-17	MW	7/2/1993	2,030	NA	NA	NA	NA	NA
			9/4/2001	155	50 U	0.2 U	0.5 U	0.5 U	1 U
545	MW-303-18	MW	7/1/1993	20,700	NA	NA	NA	NA	NA
Cleanup Criteria[a]				1,500	1,300	5	1,000	700	10,000

[a] Alaska DEC criteria for groundwater used as a drinking water source

Notes:
Shading indicates detected concentrations that exceed Alaska DEC criteria for groundwater used as a drinking water source
AW - abandoned well
BTEX - benzene, toluene, ethylbenzene, and xylenes
DEC - Department of Environmental Conservation
DRO - diesel-range organics
GRO - gasoline-range organics
GW - Geoprobe well
J - estimated concentration
LW - lost well
MW - monitoring well
µg/L - microgram per liter
NA - not analyzed
RW - recovery well
U - not detected at concentration shown

Table B-13
Summary of Analytical Results for Sediment Samples from the East Canal
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location Number	754	618
Location Cross-Reference	E DITCH (N T-1451)	28-618
Sample Date	8/29/1997	12/4/1996
Sample Depth (feet bgs)	0 to 0.33	0.3 to 0.5
Units	(mg/kg)	(mg/kg)
Petroleum Hydrocarbons		
Gasoline-range organics	5 U	0.3 U
Diesel-range organics	1,660	215 J
Residual-range organics	280 J	102 J
BTEX		
Benzene	0.05 U	0.01 UJ
Ethylbenzene	0.1 U	0.01 UJ
Toluene	0.1 U	0.01 UJ
Xylenes (total)	0.1 U	0.03 U
Noncarcinogenic PAHs		
2-Methylnaphthalene	0.2 U	0.2 U
Acenaphthene	0.2 U	0.3
Acenaphthylene	0.2 U	0.2 U
Anthracene	0.2 U	0.4
Benzo(g,h,i)perylene	0.2 U	0.3
Fluoranthene	0.2 U	1.5
Fluorene	0.2 U	0.3
Naphthalene	0.2 U	0.2 U
Phenanthrene	0.2 U	1.6
Pyrene	0.2 U	1.1
Carcinogenic PAHs		
Benzo(a)anthracene	0.2 U	0.5
Benzo(a)pyrene	0.2 U	0.5
Benzo(b)fluoranthene	0.2 U	0.5
Benzo(k)fluoranthene	0.2 U	0.5
Chrysene	0.2 U	0.6
Dibenz(a,h)anthracene	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.2 U	0.4

Notes:
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and xylenes
J - estimated concentration
mg/kg - milligram per kilogram
PAH - Polycyclic Aromatic Hydrocarbons
NA - not analyzed
U - not detected at concentration shown

Table B-14
Summary of Analytical Results for Surface Water Samples from the East Canal
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

Location Number	513	513
Location Cross-Reference	CH-703	CH-703
Sample Date	7/20/1997	7/20/1997
Sample Depth (feet bws)	0	1
Units	(ug/L)	(ug/L)
Petroleum Hydrocarbons		
Gasoline-range organics	100 U	100 U
Diesel-range organics	250 UJ	250 UJ
Residual-range organics	NA	NA
Volatile Organic Compounds		
Benzene	0.78 J	0.86 J
Ethylbenzene	2.9	3.1
Toluene	2.3	2.5
Xylenes (total)	5.4	6
Total aromatic hydrocarbons (TAH)[a]	11.4	12.5
cis-1,2-Dichloroethene	0.94 J	1.1
All other VOCs	< 5 U	< 5 U
Noncarcinogenic PAH		
2-Methylnaphthalene	5 U	5 U
Acenaphthene	5 U	5 U
Acenaphthylene	5 U	5 U
Anthracene	5 U	5 U
Benzo(g,h,i)perylene	5 U	5 U
Fluoranthene	5 U	5 U
Fluorene	5 U	5 U
Naphthalene	5 U	5 U
Phenanthrene	5 U	5 U
Pyrene	5 U	5 U
Carcinogenic PAH		
Benzo(a)anthracene	5 U	5 U
Benzo(a)pyrene	5 U	5 U
Benzo(b)fluoranthene	5 U	5 U
Benzo(k)fluoranthene	5 U	5 U
Chrysene	5 U	5 U
Dibenz(a,h)anthracene	5 U	5 U
Indeno(1,2,3-cd)pyrene	5 U	5 U
Total aqueous hydrocarbons (TAqH)[b]	13.9	15
All other SVOCs	< 20 U	< 20 U

Table B-14 (Continued)
Summary of Analytical Results for Surface Water Samples from the East Canal
SWMU 62, New Housing Fuel Leak Site, Eagle Bay Housing 303 Area

[a] TAH means the sum of benzene, toluene, ethylbenzene, and total xylene concentrations. One half the reported detection limit is used for compounds reported as not detected.

[b] TAqH means the sum of TAH and PAH concentrations. One half the reported detection limit is used for compounds reported as not detected.

Notes:

bws - below water surface
J - estimated concentration
NA - not analyzed
PAH - Polycyclic Aromatic Hydrocarbons
SVOCs - Semivolatile Organic Compounds
TAH - total aromatic hydrocarbons
TAqH - total aqueous hydrocarbons
U - not detected at concentration shown
µg/L - microgram per liter
VOCs - Volatile Organic Compounds