U.S. Army Corps of Engineers – Alaska District

2000 Remedial Investigation Report

Final

Remedial Investigation/Feasibility Study
Yakutat Area, Alaska

Prepared by

ENSR INTERNATIONAL

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LIST OF ABBREVIATIONS AND ACRONYMS

AAC	Alaska Administration Code
AACS	Army Airways Communication System
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AGRA	AGRA Earth and Environmental, Inc.
AK	Alaska Method
ASTDR	Agency for Toxic Substances and Disease Registry
ASTM	American Society for Testing and Materials
ATH	Ambient temperature headspace
AWS	Air Warning System
B.P.	Before present
bgs	Below ground surface
BLM	Bureau of Land Management
BMEWS	Ballistic Missile Early Warning System
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CAA	Civil Aeronautics Administration
CEMRD-L	USACE Missouri River Division Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDQR	Chemical Data Quality Review
CLP	Contract laboratory program
COC	Chemical of concern
COPC	Chemical of potential concern
DDD	Dichlorodiphenyldichloroethane
DERP	Defense Environmental Restoration Program
DoD	U.S. Department of the Defense
DRO	Diesel range organics
E&E	Ecology and Environment, Inc.
ENSR	ENSR Corporation
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FAA	Federal Aviation Administration
FS	Feasibility Study

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

FUDS	Formerly Used Defense Sites
GC/MS	Gas chromatography/mass spectrometry
GPS	Global Positioning System
GRO	Gasoline range organics
HERB	Chlorinated herbicides
ID	Inside diameter
MCUL	Minimum Sediment Cleanup Level
mg/kg	Milligrams per kilogram
mL	Milliliter
MLLW	Mean lower low water
mm	Millimeter
MQL	Method quantitation limit
MS/MSD	Matrix spike/matrix spike duplicate
NAD	North American Datum
NGS	National Geodetic Survey
NOAA	National Oceanic and Atmospheric Administration
OCDD	Octachlorodibenzo-p-dioxin
OCRR	Ocean Cape Radio Relay (Station)
OSCI	Oil Spill Consultants, Inc.
PAHs	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzo-furan
PEST	Organochlorine pesticides
pg/g	Picograms per gram
pg/L	Picograms per liter
PID	Photoionization detector
POL	Petroleum, oil, and lubricants
PPE	Personal protective equipment
ppb	Parts per billion
ppm	Parts per million

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

ppq	Parts per quadrillion
ppt	Parts per trillion
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RBC	Risk-based concentration
RCA	Recording Company America Alaska Communications, Inc.
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RRO	Residual range organics
SAS	Sound Analytical Services, Inc.
SQuiRTs	Screening Quick Reference Tables
SW	Solid waste
TCDD	2,3,7,8-trichlorodibenzo-p-dioxin
TEF	Toxic equivalency factor
Terrasat	Terrasat, Inc. Alaska
TOC	Total organic carbon
TRPH	Total recoverable petroleum hydrocarbons
UCL	Upper confidence limit
USACE	U.S. Army Corps of Engineers
USAED-AK	U.S. Army Engineer District – Alaska
USGS	U.S. Geological Society
UST	Underground storage tank
VOA	Volatile organic analysis
VOC	Volatile organic compound
WACS	White Alice Communications System

1.0 INTRODUCTION

This Remedial Investigation (RI) report has been developed for the U.S. Department of the Army (Army) under contract to the U.S. Army Corps of Engineers (USACE) by ENSR Corporation (ENSR) and presents the findings of the 2000 Remedial Investigation for the Yakutat Area, Alaska. The investigation was conducted under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). This report is presented as Delivery Order No. 0011 under Contract No. DACA85-98-D0017 and includes evaluation of field data and site characteristics.

This report is organized as follows:

- Section 1.0 introduces the RI and summarizes historic information about the Yakutat area.
- Section 2.0 describes the physical characteristics of the Yakutat area, including demography, ecology, geology, and hydrology.
- Section 3.0 describes the field investigation methods, the analytical program, and the data interpretation process.
- Section 4.0 provides detailed information about each of the six sites (subdivided into 12 areas of concern) investigated during the 2000 field season. Included in this section are an in-depth description and history of each site, findings of previous investigations, an explanation of investigation methods employed, and findings from the analytical and field programs.
- Section 5.0 provides conclusions for each of the six sites investigated during the 2000 field season.
- Section 6.0 is a bibliography of cited references and other documents used to compose this report.

In addition, the following appendices are included with this report:

- Analytical data are provided in Appendix A.
- The Data Assessment Report and the Chemical Data Quality Review are provided in Appendix B.
- Arsenic and chromium background sample statistics are provided in Appendix C.
- Boring logs and well diagrams are included in Appendix D.
- Appendix E contains well development and groundwater sampling field sheets.
- Appendix F includes copies of the 2000 field logbooks and the 1999 site walkover logbook.

- A copy of the geophysical report is included as Appendix G.
- Appendix H contains site photographs of the 2000 investigation.

1.1 Remedial Investigation Report – Purpose and Overview

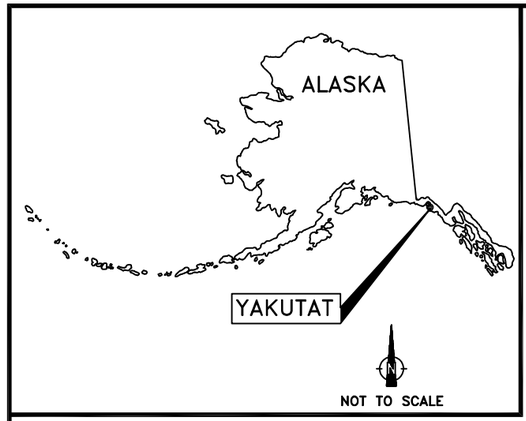
The purpose of this RI is to characterize suspected contaminated areas that USACE has identified as eligible for the DERP under the FUDS program. The RI program has been divided into two phases over 2 years, and the following reports will be generated from the RI:

- This report presents the results of the 2000 field investigation activities.
- A separate RI report will present the results of the 2001 field program with a summary of the 2000 field program findings.
- A separate Feasibility Study (FS) will present the most appropriate method of closing all DERP-qualified FUDS sites in the Yakutat area and will be submitted at a later date. The FS will serve as the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

The various military sites in the Yakutat area are associated with three primary functional areas: the airfield area (also known as the Yakutat Air Base); the naval facility area (including the Seaplane Base); and the Ocean Cape Radio Relay (OCRR) Station area. For this project, the areas of investigation have been divided into eleven sites, which have been subdivided into 28 individual areas of concern. This RI report focuses on 12 areas of concern within six sites investigated during the 2000 field program (Figure 1-1). The six sites investigated were:

- Point Carrew Garrison (Site C)
- Northwest Drum Dump/Quartermaster Loop Area (Site E)
- Minor Naval Air Facility (Seaplane Base) (Site G)
- Ocean Cape Radio Relay Station (Site H)
- Solid Waste Disposal Dump No. 4 Area (Site K)
- Post Powerhouse/25,000-Gallon Tactical Underground Storage Tank (Site M)

At each location investigated, surface soil, subsurface soil, surface water, sediment, and groundwater samples were collected (where appropriate) and analyzed for target chemicals of potential concern (COPCs) identified through previous site investigations or suspected from past military activities at the sites. The intent of the sampling program was to provide and record data necessary to develop a site closure approach. The procedures followed during this investigation adhere to the guidelines set forth by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program; regulations under Title 18 of the Alaska Administrative Code (AAC), Chapter 75; and USACE protocols.



SITE LIST W/RESPECTIVE CONCERNS

POINT CARREW GARRISON
- C1 Ankau Bridge Area– Garbage/Drum Dump
- C2 Drum Dump Site–Pt Carrew
- C3 Powerhouse Foundation Potential Release
- C4 Surface Debris–Garrison

NORTHWEST DRUM DUMP QUARTERMASTER LOOP AREA
- E1 Drum Dump: Remaining Debris and Potential Contamination

MINOR NAVAL AIR FACILITY (SEAPLANE BASE)
- G1 Former Pipeline Paths
- G2 Surface Debris–Seaplane Base
- G3 Suspected UST

OCEAN CAPE RADIO RELAY STATION
- H2 Culture Camp

SOLID WASTE DISPOSAL DUMP #4 AREA
- K1 Dump Site

POST POWER HOUSE/25,000–GAL. TACTICAL UST
- M1 Suspected Hangar Pipeline System/25,000–Gal. Tactical UST
- M2 Fuel/Water Separator and Pressure Tank Pit

N

0 2250 4500

SCALE IN FEET

FINAL REMEDIAL INVESTIGATION REPORT
YAKUTAT AREA RI/FS
YAKUTAT, ALASKA

FIGURE 1–1
2000 FIELD INVESTIGATION SITE LOCATION MAP

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C/SC: 1:1PS ZIP: 39/00	P.M.: S. WRENN	CHECKED: S. WRENN	PROJECT: 9000–216–132

1.2 Yakutat Area Background

The following condensed version of Yakutat's history is based on a combination of historical documents, previously documented history, and oral tradition. Please refer to Section 6.0, References, for a listing of documents reviewed.

Yakutat, translated from Tlingit as "the place where canoes rest," has a diverse, relatively short, cultural history. The Yakutat Bay area was used quite extensively during the late prehistoric or historic times, or both, as a stopover and trade point for travelers along the coast and Interior Indians. Eyak/Athapaskan-speaking people of the Copper River region to the northwest first occupied the area 500 to 600 years ago, shortly after glacial recession and isostatic rebound. The indigenous people settled here because there were abundant food sources, such as fish, shellfish, and wildlife. This society was either displaced or merged with the Tlingit-speaking people from the south during the precontact-protohistoric transition. Today, Yakutat appears to be a typical Tlingit village, but the social structure is very complex.

Europeans may have first sighted the area when Russian explorer Ivan Ivanovich Bering made his famous voyage of discovery in 1741 or when British explorer James Cook sailed past in 1778. However, the first documented visit was in 1786 when French explorer Jean Francios de Galaup de La Perouse named Monti Bay after one of his officers. For some reason, the officer reported that there was no suitable place to anchor in the bay. The following year, British explorer George Dixon entered the bay and named Port Mulgrave on Khantaak Island. He found the port very suitable for anchorage and made the first soundings of Yakutat Bay. He also described the Natives and their mode of living. British explorer Captain William Douglass anchored in Yakutat Bay in 1788 but left no descriptions of the region. In 1791, Italian navigator Alessandro Malaspina, in the service of Spain surveying for a northwest passage connecting the Pacific and Atlantic Oceans, carefully explored Yakutat Bay, naming Disenchantment Bay and measuring Mount Saint Elias. British navigator Peter Puget anchored and explored the bay in 1794 as British explorer George Vancouver passed the entrance. Both Malaspina's and Puget's explorations encountered impenetrable pack ice in the vicinity of Haenke Island.

The first European settlement in the Yakutat area was a Russian fortification and blockhouse, referred to as "New Russia" or "Glory of Russia," established in 1796 on the south side of Kardy Lake. This was a useful trade control center and stopover for Russian hunters on their way to Sitka. Yakutat Bay was also an important source for sea otter skins. Relations between the Russians and the Tlingits were tense, and the fort was destroyed in 1805. No significant attempt was made to reassert Russian authority. After the Russian expulsion, Yakutat had only sporadic visits from Russian and British cartographers in 1807, 1823, and 1837. A smallpox epidemic devastated the Tlingit population between 1836 and 1839.

The U.S. Coast Survey began charting the area in 1874. American traders followed, and the Yakutat area witnessed intensive exploration, fur trading, mineral prospecting, fishing industry

development, and fox farming over the next 50 years. Placer mining of the black sand beaches was well under way by 1886. In 1887, the Swedish Free Mission Church arrived and began establishing schools and churches. Professor Russell made his famous explorations of the area in 1890 and 1891, reaching the head of the inlet and entering the area now know as Russell Fiord. An excellent topographic map of Yakutat Bay was produced in connection with the Boundary Survey of 1895. In 1899, the Harriman Alaska Expedition, piloted by a Yakutat Indian, entered Yakutat Bay and sailed to the head of the bay. This valuable expedition photographed, studied, and reported on many aspects of the area, including descriptions of the bay, summer sealing village, birds, forests, geography, geology, and glaciers. In 1903, the Yakutat and Southern Railroad Company was incorporated and built a sawmill, a cannery, and a rail system dedicated to the hauling of raw fish. This railroad transported fish 11 miles from Johnson's Slough to the cannery complex in Monti Bay, providing a steady economy for the area. Operations ceased in 1969, and the train is now a historical monument. In 1921, parcels at Ocean Cape and Point Carrew were reserved for lighthouse purposes.

U.S. military interest in Yakutat began by Executive Order in 1929 with the creation of the Yakutat Bay Naval Reservation. However, occupation was not set in motion until 1939 with a proposal by the Civil Aeronautics Administration (CAA) to develop a landing field. Runway construction began in 1940 for an "Auxiliary Landing Field and Staging Area" (also known as the Yakutat Air Base). With the arrival of the first troops in October of that year, the Yakutat Landing Field was activated. A dock and wharf facilities were built on Monti Bay in support of the air base. Natural resources of timber and aggregate were used in bridge and foundation construction. The air base was completed in June 1943. An additional 42,437 acres, known as Tract B, which included the city of Yakutat and the active Yakutat airport, were obtained from the U.S. Department of the Interior that September, making the total area approximately 46,080 acres. The Yakutat Naval Base was established as a "Naval Air Facility" in September 1942 and was redesigned as a "Naval Auxiliary Air Facility" in February 1943. This small naval facility includes the Seaplane Base.

Military facilities were established in Yakutat due to its strategic geographic location. The Yakutat Air Base was operated as an auxiliary airfield capable of supporting pursuit and bombardment aircraft during World War II. No aircraft were permanently assigned to Yakutat; instead, the base served as a ferrying post and temporary station for aircraft squadrons and as a refueling stop between the 48 contiguous states and points in Alaska. The Yakutat Air Base also hosted large military vessels in Monti Bay.

The air base was placed on caretaker status in April 1944, declared surplus in December 1945, and ceased operations in 1946. Tract B was relinquished to the U.S. Department of the Interior, Bureau of Land Management (BLM) in two portions in 1946 and 1947. Another section, Tract C, containing 147 acres, was retransferred to the CAA in 1948; while the remaining 3,499 acres, Tract A, were relinquished and retransferred to the Department of the Navy in 1949. The Yakutat Bay Naval Reservation was revoked in 1953, and all but 266 acres were designated as part of the Tongass National Forest. The remaining land was placed in federal land holding for

the CAA (now known as the Federal Aviation Administration [FAA]). The USACE carried out cleanup operations around Yakutat in 1984. Remaining Department of Defense facilities were slated to be removed. Although no project report is available, it appears that most of the infrastructure was removed at that time.

In 1960, the U.S. Air Force acquired 78.6 acres of land from the U.S. Forest Service and 96.96 acres of tidelands from the State of Alaska Division of Lands to construct a radio link between Cape Yakataga and Hoonah. The Ocean Cape Radio Relay (OCRR) Station facility served as a tropospheric communications station as part of the Ballistic Missile Early Warning System under the White Alice Communications System (WACS). An additional 69.27 acres were obtained from the BLM in 1967 and 1968 for gravel removal. The site, located on the Phipps Peninsula at the end of Point Carrew Road, approximately 5 miles west of the city of Yakutat, included industrial buildings, support facilities, water and fuel storage tanks, pipelines, billboard antennae, a bridge, roads, and utility lines. The facilities were leased to Recording Company America Alaska Communications, Inc. (RCA) between 1974 and 1976. The Ocean Cape Radio Relay Station was declared excess by the U.S. Air Force in June 1976. The land was relinquished to the BLM in 1977 and conveyed to the Tlingit tribe in 1983. It has remained property of Yak-Tat Kwaan, Inc., since. The four tropo dishes, industrial buildings, and associated equipment were removed during the 1984 USACE cleanup activities. Sewer manholes were filled with gravel. A 50,000-gallon tank; a petroleum, oil, and lubricants (POL) pump house; a heavy equipment maintenance shop; and a water tower remain on site as requested by Yak-Tat Kwaan, Inc.

Figure 1-2 shows the current major land ownership of the Yakutat area.

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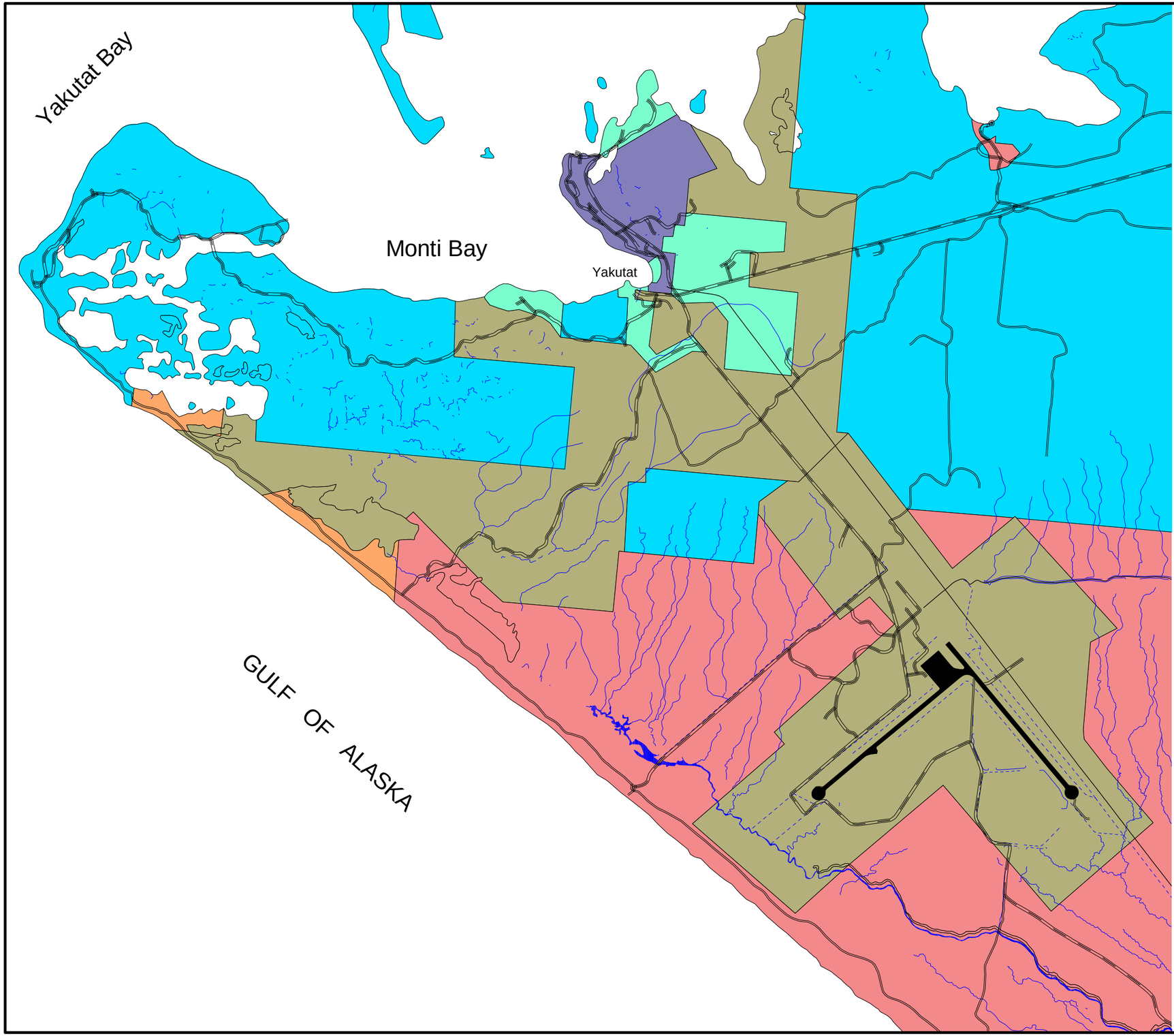

LEGEND

Major Land Owners
- USFS
- City Government
- State of Alaska
- USFS - Wilderness
- Regional Native Corporation Land (Patented or Interim Conveyed)
- Regional Native Corporation Land Selections
- Village Native Corporation Lands Selections

- Class 3 Road
- Class 4 Road
- Trail

- Stream
- Ditch or Canal

N
W E
S

1 0 1 Miles

FINAL REMEDIAL INVESTIGATION REPORT
YAKUTAT AREA RI/FS
YAKUTAT, ALASKA

FIGURE 1-2
MAJOR LAND OWNERSHIP

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2.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

Yakutat, Alaska, is a small coastal village with many modern conveniences in the northern end of Alaska's southeast panhandle (Figure 1-1). It is located roughly 225 miles northwest of Juneau and 220 miles southeast of Cordova, 59° 33′ N Latitude, 139° 44′ W Longitude (Sec 30, T027S, R034E, Copper River Meridian). Situated on Monti Bay in Yakutat Bay, Yakutat is the only sheltered deepwater port in the Gulf of Alaska between the inside passage of Southeast Alaska and Prince William Sound.

2.1 Demography

Information for this section was obtained from the Alaska Department of Labor and Workforce Development, Research and Analysis, and 1990 U.S. Census data compiled by the Alaska Department of Community and Economic Development, which are listed in the References section.

According to the Alaska Department of Community and Economic Development, the population of the Yakutat Borough is 744 (certified December 2000). Slightly more than half of the population consists of Alaskan Natives, the majority of whom are Tlingit. Incorporated in 1992, the Borough's economy is dependant on fishing, fish processing, and government employment. Based on the 1990 U.S. Census, median household income is $36,875, with 10.5 percent of the area residents falling below poverty level. Average unemployment for the year 2000 was 12.1 percent, although 41 percent of the adults are not in the labor force. Almost 23 percent of Yakutat's residents hold commercial fishing permits.

The public water system is derived and chlorinated from four community wells and used by 87.6 percent of the households. The public sewer system serves 82 percent of the households. The majority of homes are heated using fuel oil and kerosene with 12.6 percent using alternative methods, mainly wood or electricity. Refuse is collected by a private firm and deposited in the Borough-operated landfill, often frequented by bears. Electricity is produced by four diesel-fueled generators operated in Yakutat by Yakutat Power, Inc. Hydroelectric potential is being considered at Chicago Harbor, located approximately 15 miles northeast of Yakutat.

The community has a health center, police department, volunteer fire department, youth center, state magistrate, and Borough jail. The local school teaches grades kindergarten through 12 and has a zero-percent dropout rate. The school has a swimming pool and a library.

The State-owned airport has daily scheduled flights and air taxi services. Visitor accommodations include lodges, bed and breakfasts, restaurants, car rental, and taxi service. Tourist attractions include hunting, fishing, camping, hiking, and glacier viewing.

2.2 Ecology

Historically, the rich fisheries, wildlife, and plants of the region have been used for subsistence living. The Yakutat area hosts numerous productive habitat types that are generally healthy and affected little by human intervention. The local economy is largely dependent on the natural resources of the area. Most residents still rely at least partly on subsistence hunting and fishing.

2.2.1 Flora

Three types of plant communities exist within the coastal area: true forest, grass-sedge meadows, and muskeg. The true forest generally consists of dense old-growth Sitka spruce, some Western hemlock and cottonwood, with skunk cabbage and devil's club for ground cover. Salmonberries, blueberries, and highbush cranberries are found within the forest. The forested areas in and around the Ankau Saltchucks on Point Carrew have historically been used to gather berries.

Grass-sedge meadows often border freshwater ponds and lakes and are found at the mouth of river deltas. Fireweed, lousewort, paintbrush, lupine, and strawberries exist in this environment. Muskeg are interspersed throughout the forest, containing sedges, deer cabbage, heather, Alaska cotton grass, Arctic iris, yellow pond lily, willow, and Nagoon berry.

2.2.2 Fauna

Yakutat is renowned for its wealth of wildlife. Many land animals and birds frequent the area. Big game furbearers include moose, Sitka black-tailed deer, wolves, mountain goat, coyote, black bear, brown bear, and glacier bear (an extremely rare type of black bear with a blue coloring due to genetics, also known as blue bear). The Yakutat area has the highest known concentration of glacier bear (BLM 1980). Wolverines, weasels, martens, mink, marmots, and fox all are found on the Yakutat foreland. River otters and beaver occupy the riparian habitats. Squirrels, voles, shrews, and brown bats can also be found. Some of these animals are important food sources for the local residents. The Cape Phipps Peninsula is an important productive subsistence area (USACE 1984).

The waters surrounding the Yakutat area contain a rich variety of marine life. Sponges, polychaete worms, crustaceans, and echinoderms thrive on phytoplankton and algae. Clams and other shellfish are gathered from the Ankau Head to the Ankau Saltchucks. Sea lions, seals, porpoises, and whales can be seen along the shores. Every waterway on the Yakutat foreland is a major destination for anglers, and many are important spawning grounds for salmon and steelhead. Monti Bay and Yakutat Bay are also active fishing areas.

2.2.3 Endangered and Threatened Species

Many species listed as endangered by the U.S. Fish and Wildlife thrive in Alaska. Currently, the Alaska Department of Fish and Game (ADF&G) lists five species as endangered. Two of these

species have a range that includes the Yakutat area: the short-tailed albatross and the humpback whale. The short-tailed albatross breeds in Japan and crosses the North Pacific. Historically, they have been sighted in the Gulf of Alaska during the summer nonbreeding season. The humpback whale breeds in subtropical areas during the winter and migrates northward during the summer months. Their habitat includes shallow waters off the continental coasts throughout the Gulf of Alaska. Some individuals return yearly to the same area for feeding. Two other listed whales, the Northern Right Whale and the Blue Whale, also inhabit the Gulf of Alaska off the continental shelf. However, they are seldom seen in coastal Alaska waters (ADF&G 2001).

The State of Alaska also administers a list of "Species of Special Concern," last updated in November 1998. Several of the listed species have a habitat range that includes the Yakutat area, such as the American peregrine falcon, the Arctic peregrine falcon, and the Townsend's Warbler. The American and Arctic peregrine falcons nest throughout the forested interior and treeless tundra area of Alaska. Both falcon species migrate through Yakutat, but no nesting is known to occur in the area (USACE 1984). As of August 1999, the U.S. Fish and Wildlife Service delisted both of these species from the national endangered species list. Little is known about the Townsend's Warbler. Nesting almost exclusively in coniferous trees, its breading range generally extends from east-central Alaska south to the Rocky Mountains of the northwest contiguous United States. Its range in Alaska may be expanding northwards or fluctuating (Wright et al. 1998). Four other avian Species of Special Concern have habitat ranges that border on Yakutat and may be present in the area. Other species on the Alaska Department of Environmental Conservation's (ADEC's) Species of Special Concern list whose habitat encompasses the Gulf of Alaska include the Steller sea lion, the harbor seal, and the Chinook salmon (Snake River fall stock). The Snake River fall stock of Chinook salmon spawn in the Snake River, located in Oregon.

2.2.4 Climatology

Yakutat's climate is dominated by its proximity to the coast. These maritime conditions often are cloudy and wet. Precipitation and temperature data from 1949 to 1989 show precipitation in the Yakutat area averages 145.92 inches per year. June is the driest month with an average of 6.43 inches. September and October are the two wettest months with an average of 18.26 and 20.85 inches, respectively. Total winter snowfall averages 193.5 inches although average snow depths during the winter and early spring months are typically less than 15 inches.

The average temperature in Yakutat is 45.9 degrees Fahrenheit (°F). Average August temperatures range from 46.6°F to 61.1°F and January temperatures range from 17.8°F to 31.1°F. The most extreme temperatures recorded were -24°F in December 1964 and 87°F in June 1995. Prevailing winds average 7.3 miles per hour throughout the year, blowing from the east to southeast.

2.3 Geology

The following summary of the surficial geology of the Yakutat area is taken from a U.S. Geological Survey (USGS) paper (1979) on the Yakutat area, except where noted.

According to the USGS, "Within the Yakutat region are some of the tallest mountains, some of the heaviest snowfalls, and the largest glacier (Malaspina) in North America. Between the abrupt mountain front and the Gulf of Alaska lies a very gently sloping plain of outwash derived from repeated cycles of advance and retreat of glaciers during the Quaternary Period."

The city of Yakutat is located on the Yakutat foreland, a gently sloping glacial outwash plain between the Saint Elias Mountains and the Gulf of Alaska. Repeated cycles of glacial advance and retreat deposited the moraine complex and outer border of outwash that now comprise the Yakutat foreland. A great glacier occupying Yakutat Bay extended to Ocean Cape, creating the Phipps Peninsula and other moraine deposit in the area. A submerged shoal stretching across Yakutat Bay from Ocean Cape to Point Manby suggests the end-moraine of the expanded glacier. Radiocarbon-age wood collected from Ocean Cape identifies the last major glacial advance at 560 ± 75 years before present (B.P.). Age dating of trees rooted on the surface of the outwash gives it an approximate age of 550 years. The moraines are thought to be deposits of outwash overridden by glacier advance, as suggested by a thin layer of organic material and marine sediments underneath these deposits.

Eight dominant surficial deposits have been mapped in the Yakutat area, all of Holocene age. These include artificial fill, organic, eolian, beach, delta-estuarine, alluvial, outwash, and moraine deposits. Artificial fill is mostly present under the airport runways and other areas that were extensively modified during construction, including the civic center of Yakutat. Organic deposits, interpreted from aerial photographs, are divided into two subunits based on underlying material. Where the organic deposits are prevalent, thickness probably ranges from 3 to 6 feet. Eolian sand dune deposits are principally located near the estuary of the Situk River. Beach deposits are subdivided into three subunits based on age, the oldest being timbered ridges inland near Tawah Creek and Lost and Situk rivers. Four subunits of delta-estuarine deposits, based on age, have been mapped, mostly near Tawah Creek and Lost and Situk rivers with some deposits near Ophir Creek. Alluvial deposits are located chiefly near the Situk River.

Two outwash deposits are mapped, based on grain size. Outwash deposits range from 3 to 40 feet thick, with an average of approximately 21 feet. Cobble gravel is the major constituent of the outwash close to the moraines. Sands and gravel in the plain become steadily finer toward the Situk River, providing a perfect example of an outwash plain grading into a moraine (USGS 1909). The outwash deposits overlie old delta-estuarine sediments, probably some buried moraine deposits, and, locally, coarse-grained outwash.

End- and ground-moraine deposits have not been separated into subunits. Average moraine thickness is approximately 75 feet, with a maximum of approximately 200 feet. The mixture of

till that composes the moraines consists mainly of gravel-laden silt and sand, in varying proportions, with lesser amounts of cobbles, clay, and boulders. Rarely, organic material is present within the till. Numerous bogs and ponds are present between moraine ridges. Subordinate alluvial deposits, including kames, eskers, crevasse fillings, and minor outwash, also exist between moraine ridges.

The structural geology of the local bedrock is somewhat complex. The present tectonic structure in the northern Gulf of Alaska is made up of the transform strike-slip boundary between the North American and Pacific plates, the convergent subduction boundary between the Pacific plate and Alaska, and the transitional margin between the two boundaries. The Yakutat block has recently been recognized as an isolated terrain located at this transitional margin. The Yakutat block is moving with the Pacific plate, colliding with, and subducting beneath, southern Alaska. This collision is a central element of the principal orogeny that uplifted the Chugach, Saint Elias, and Fairweather mountains rimming the northern Gulf of Alaska. It is also suggested that this collision has caused a casual effect on the Wrangell volcanoes' magmatic events (USGS 1985).

The modern plate boundaries of the Yakutat block are defined moderately well by offshore geophysical data, dredge samples, onshore geology, exploratory wells, and historical large earthquakes. Figure 2-1 shows the tectonic setting of the northern Gulf of Alaska. The Queen Charlotte fault, the Fairweather fault, the Chugach-Saint Elias fault system, Kayak Island and its structural extension, and the Transition fault bound the Yakutat block. The Queen Charlotte and Fairweather faults are transform faults separating the North American plate from the Pacific plate. The north end of the Fairweather fault merges with the Chugach-Saint Elias fault near Yakutat Bay. The Chugach-Saint Elias fault extends west to about Kayak Island where it joins with the Aleutian trench subduction zone. The Transition fault is a major tectonic boundary between the Yakutat block and the Pacific plate. The Transition fault has not been active during Pliocene and Quaternary time, indicating that the Yakutat block has been attached to and moving with the Pacific plate for at least the last 5 million years (USGS 1985).

At least 13 earthquakes of magnitude 5 or greater have occurred within 130 kilometers of Yakutat since 1899. Shaking from the September 4, 1899, earthquake, with an estimated magnitude of 8.4, lasted about 2 to 5 minutes. Six days later, two earthquakes shook the area with estimated magnitudes of 7.8 and 8.6. The greatest onshore uplift ever recorded for an earthquake sequence occurred at Bancas Point, about 28 miles north of Yakutat, during the September 1899 earthquakes. An earthquake of magnitude 7.9 hit on July 10, 1958, shaking the ground for 3 to 4.5 minutes, causing several submarine landslides and large waves in Monti Bay. Earth shaking caused by the Good Friday earthquake (March 27, 1964) lasted 4 to 6 minutes.

Yakutat has had only minor earthquake damage over the years but has the potential for major earthquake damage. Yakutat lies within a seismic risk zone 4 and is subject to major to severe damage from earthquakes greater than or equal to magnitude 6 (Figure 2-2). Future large

earthquakes will continue to affect the Yakutat area and cause ground shaking, liquefaction, ground fracturing and water-sediment ejection, compaction and related subsidence, subterrestrial and underwater landslides, and tsunamis and other earthquake-related water waves.

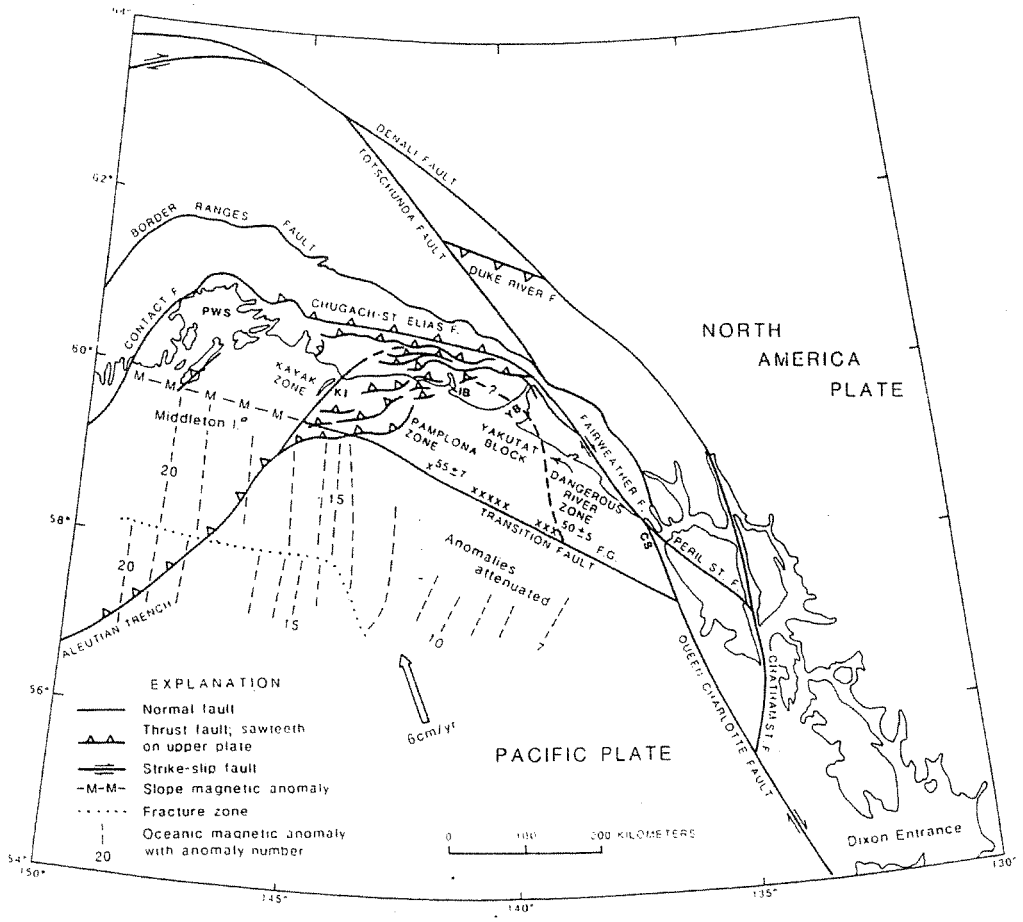
2.4 Hydrology

Groundwater in the Yakutat area generally occurs within 10 feet of ground surface in most areas. The flow of groundwater in the region generally follows topography downgradient to the south or southwest toward streams, lakes, the coastline, and manufactured drains (USGS 1998).

The Yakutat Foreland aquifer is a water-table aquifer fed by precipitation infiltration and drained by small streams. Recharge can also occur by the streams when the stage of streams is higher than the local water-table. Groundwater flows both vertically and horizontally through the unconfined regional aquifer. Glacial moraine and outwash deposits comprise the majority of the regional aquifer. These materials typically exhibit a wide range of hydrogeologic parameters that are based on the depositional history and grain size of the deposits. Moraine deposits vary in thickness up to approximately 250 feet and generally contain poorly sorted, gravel-rich sand and silt, with some clay, cobbles, and boulders. Outwash alluvial deposits begin close to the end moraine near Yakutat Bay and range in thickness from approximately 3 to 56 feet. They are generally well sorted, coarsely grained materials having a higher permeability than moraines and tills. Grain size decreases farther southward of the end moraines, which are poorly sorted and contain silts and clays (USGS 1998).

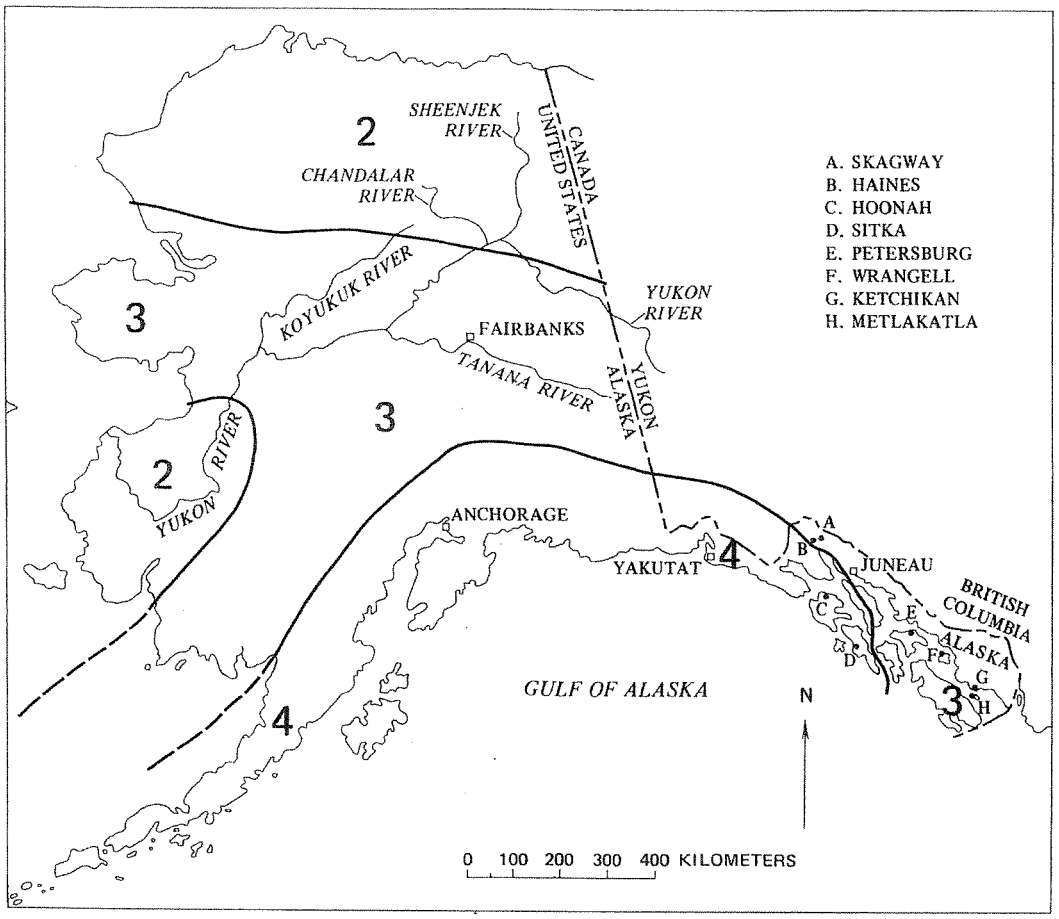
The primary surface drainage features within the investigation areas are the Ankau Saltchucks, Ophir Creek, and Tawah Creek. The Ankau Saltchucks is a tidally influenced shallow water system on Point Carrew connected to Monti Bay through the Ankau Head. Ophir Creek begins in the hummocky glacier moraine terrain between Monti Bay and Redfield Cove and flows toward the southwest to Summit Lake. Tawah Creek begins at Summit Lake and flows southeast to Lost River, collecting many small streams and manufactured drains originating in the area. Most streams in the Yakutat foreland flow toward the southwest. The southeasterly flow of Tawah Creek is due to the beach deposits creating a topographical barrier along the Gulf of Alaska (USGS 1998).

Figure 2-1. Tectonic Setting of Northern Gulf of Alaska.



Note: Tectonic setting of northern Gulf of Alaska showing magnetic anomalies and major structural features. Stippled area shows extent of Yakutat block, Slope magnetic anomaly shows south edge of subducted part of block. Small x's indicate where basalt has been dredged from the continental slope. Large arrow indicates current Pacific-North America relative convergence vector. CS-Cross Sound; FG-Fairweather Ground; IB-Icy Bay; KI-Kayak Island; PWS-Prince William Sound; YB-Yakutat Bay.-- *Source: USGS 1985.*

Figure 2-2. Seismic Risk Map of Alaska.



EXPLANATION

Zone	Possible maximum damage to structures	Magnitude of largest probable earthquake
2	Moderate	<6.0
3	Major	≥6.0
4	Major to very severe	≥6.0

Source: USGS 1985.

3.0 STUDY AREA INVESTIGATION

This section describes the study area investigation for the RI at Yakutat Area. The general objectives of the study area investigation were to:

- Assess the presence or absence of contaminated soils;
- Where present, assess the nature and extent of surface and subsurface soil contamination;
- Assess the presence or absence of water contamination;
- Where present, assess the nature and extent of groundwater and/or surface water contamination;
- Collect sufficient data to assess human health risk and consider ecological risk, if necessary; and
- Collect sufficient data to evaluate remedial action objectives and to identify remedial action alternatives, if necessary.

3.1 Field Investigation Methods

The first phase of the field investigation began on September 14, 2000, and ended on October 18, 2000. Field activities included geophysical surveying, soil boring and monitoring well installation, groundwater sampling, surface soil sampling, surface water sampling, and sediment sampling. A summary of sampling at each of the six sites investigated during the 2000 field program (in 12 areas of concern) is provided in Table 3-1 and Table 3-2.

In support of the project objectives, borings and wells were installed in appropriate number and location to determine subsurface conditions and identify potential subsurface contamination. Groundwater monitoring wells were typically installed in triangular pattern with a single upgradient well and a minimum of two downgradient wells. Surface soil samples were retrieved in areas likely to have been impacted, or if impact areas were not known, in a random pattern intended to define site conditions. Sediment and surface water sample locations were selected to accurately represent potential contamination associated with the concern.

Presampling activities included utility clearance, site clearance, equipment calibration, sample container organization and labeling, and field form assembling.

All decontamination fluids were handled in accordance with the Waste Management Plan (ENSR 2000b). Proper use of personal protective equipment (PPE) was implemented to ensure the protection of workers from immediate and long-term toxic effects of chemical releases, foul weather, and other life-safety matters. PPE used on site included hearing protection, eye protection, steel-toed boots, hard hats, foul-weather clothing, personal floatation devices,

respiratory protection, and other safety equipment. Other safety equipment included first-aid kits and bear protection.

Brief descriptions of sampling methodology are presented in the following subsections. Soil boring logs and well completion diagrams are presented in Appendix D. Well development and groundwater sampling field sheets are presented in Appendix E. Field logbooks are presented in Appendix F. Detailed descriptions of the field activities are included in the Yakutat Area Sampling and Analysis Plan (ENSR 2000a). Analytical results are discussed by source area in Section 4.0.

3.1.1 Geophysical Surveying

Geophysical techniques were used to characterize landfill sites and to determine the presence of underground storage tanks (USTs) and associated piping. ENSR contracted Terrasat, Inc. (Terrasat) of Alaska, Anchorage, Alaska to perform low-resolution surveys. This investigation used a combination of magnetic and electromagnetic techniques to delineate the extent of buried metal within landfills and other areas of concern. The G-858G Magmapper Gradiometer and the EM-61 Electromagnetic Sensor were used for this investigation.

Field methodology consisted of four steps: (1) identifying the approximate area of concern, (2) setting up a survey grid, (3) acquiring data, and (4) processing data. Each survey site consisted of survey lines, spaced at 20-foot increments, covering the areas of concern. Representatives of ENSR and Terrasat determined optimal survey grid patterns based on field observations. Representatives of ENSR and Malaspina Investments set up and cleared the survey lines of trees and brush. Data were collected by the geophysical instruments along the survey lines at regularly timed intervals. Topographic variances caused variable rates of travel along survey lines. Fiduciary points were embedded into the data stream at 25-foot increments along the survey lines as markers corresponding to specific grid locations. Data from each survey line were resampled between the fiduciary points to convert the temporal data into spatial data. The data were then filtered and corrected for the effects of instrument drift (noise introduced from external influences that affect the electronic components). The final stage in processing involved gridding the data and applying a sequence of mathematical algorithms to convert the spatial data into frequency domain data. An automatic color stretch was applied to the intensity values to enhance features within the grids. The processed data from both the G-858G and the EM-61 were then analyzed to delineate anomalies within the survey areas. More information on instrumentation specifications, limitations, and field methodology is included in the geophysical report (Appendix G).

3.1.2 Surface Soil Sampling Procedures

Surface soil samples were collected from most of the sites visited during the 2000 field investigation. Samples were analyzed for gasoline range organics (GRO), diesel range

Table 3-1. 2000 Field Investigation Soil Sample Summary.

Site	2000 FIELD SEASON SOIL SAMPLES	Soil Borings	Monitoring Wells Installed	Soil Boring Samples	Surface Soil Samples	Sediment Samples	DRO	GRO	RRO	BTEX	VOC	PAH	PCB	PEST	HERB	Metals	Dioxin	TOC	Field QC Duplicate	QC Trip Blanks	MS/MSD	QA Referee	QA Trip Blanks
	Background Samples	**7**	**7**	**6**	**0**	**0**	**6**	**0**	**0**	**0**	**6**	**6**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
C	**Point Carrew Garrison**																						
C1	Ankau Bridge Garbage/Drum Dump	6	5	12	10		22	22	22		22	22	22	22	22	22		6	3	2	1	3	
C2	Drum Dump - Point Carrew	3	2	6	6	1	13	13	13		13	13	13	13	13	13		3	3			3	
C3	Powerhouse Foundation #1:Potential Release	3	2	6	6		12	12	12		12	12	12	12	12	12		3					
C4	Surface Debris: Garrison				6		6	6	6		6	6	6	6	6	6		0					
	Totals for Site	**12**	**9**	**24**	**28**	**1**	**53**	**53**	**53**	**0**	**53**	**53**	**53**	**53**	**53**	**53**	**0**	**12**	**6**	**2**	**1**	**6**	**0**
E	**Northwest Drum Dump/Quartermaster Loop Area**																						
E1	Drum Dump/Remaining Debris and Potential Contamination	16	6	13	12	4	29	29	29	7	22	29	22	22	22	22		6	3	1	1	3	
	Totals for Site	**16**	**6**	**13**	**12**	**4**	**29**	**29**	**29**	**7**	**22**	**29**	**22**	**22**	**22**	**22**	**0**	**6**	**3**	**1**	**1**	**3**	**0**
G	**Minor Naval Air Facility (Seaplane Base)**																						
G4	Seaplane Base Slough					1	1	1	1		1	1	1	1	1	1							
	Totals for Site	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
H	**Ocean Cape Radio Relay Station**																						
H2	Culture Camp				6	3	9	9	9		9	9	9	9	9	9	9	3	1			1	
	Totals for Site	**0**	**0**	**0**	**6**	**3**	**9**	**9**	**9**	**0**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**3**	**1**	**0**	**0**	**1**	**0**
K	**Solid Waste Area #4**																						
K1	Dump Area	6	6	12	6		18	18	12		18	18	18	18	18	18		6	2		2	2	1
	Totals for Site	**6**	**6**	**12**	**6**	**0**	**18**	**18**	**12**	**0**	**18**	**18**	**18**	**18**	**18**	**18**	**0**	**6**	**2**	**0**	**2**	**2**	**1**
M	**Post Powerhouse/25-Gallon Tactical UST**																						
M1	Suspected Hangar Pipeline System/25,000-Gallon Tactical UST	3	3	6	3		9	9	9		9	9	9	9	9	9		3	1		1	1	
M2	Fuel/Water Separator and Pressure Tank Pit	3	3	6	6		12	12	12		12	12	12	12	12	12		3	1			1	
	Totals for Site	**6**	**6**	**12**	**9**	**0**	**21**	**21**	**21**	**0**	**21**	**21**	**21**	**21**	**21**	**21**	**0**	**6**	**2**	**0**	**1**	**2**	**0**
	TOTALS FOR ALL SITES	**47**	**34**	**67**	**61**	**9**	**137**	**131**	**125**	**7**	**130**	**137**	**124**	**124**	**124**	**130**	**9**	**33**	**14**	**3**	**5**	**14**	**1**

Notes:

Concerns C2, C3, and C4 were combined and called 'C2' for sampling purposes.

QC/QA analytes are listed on Table 3-3.

Key:

DRO = Diesel Range Organics
GRO = Gasoline Range Organics
RRO =Residual Range Organics
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes (total)
VOC = Volatile Organic Compounds
PAH = polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyls
PEST = Pesticides
HERB = Herbicides
TOC = Total Organic Carbon

MS = Matrix Spike
MSD = Matrix Spike Duplicate
QA = Quality Assurance
QC = Quality Control

Table 3-2. 2000 Field Investigation Water Sample Summary.

Site	2000 FIELD SEASON WATER SAMPLES	Monitoring Wells Installed	Groundwater Samples	Surface Water Samples	DRO	GRO	VOC	PAH	PCB	PEST	HERB	Metals	Dioxin	Project QC Samples	Field QC Duplicate	QC Trip Blanks	MS/MSD	QA Referee	QA Trip Blanks
	Background Samples	**7**	**6**	**0**	**6**	**0**	**6**	**6**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
C	**Point Carrew Garrison**																		
C1	Ankau Bridge Garbage/Drum Dump	5	5		5	5	5	5	5	5	5	5			1	1	1		1
C2	Drum Dump- Point Carrew	2	2	1	3	2	3	3	3	3	3	3				2		1	
C3	Powerhouse Foundation #1:Potential Release	2	2		2	2	2	2	2	2	2	2							
C4	Surface Debris: Garrison																		
	Totals for Site	**9**	**9**	**1**	**10**	**9**	**10**	**10**	**10**	**10**	**10**	**10**	**0**	**0**	**1**	**3**	**1**	**1**	**1**
E	**Northwest Drum Dump/Quartermaster Loop Area**																		
E1	Drum Dump/Remaining Debris and Potential Contamination	6	6		6	6	6	6	6	6	6	6			1	2	1	1	1
	Totals for Site	**6**	**6**	**0**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**0**	**0**	**1**	**2**	**1**	**1**	**1**
G	**Minor Naval Air Facility (Seaplane Base)**																		
G4	Seaplane Base Slough			1	1	1	1	1	1	1	1	1							
	Totals for Site	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**		**0**	**0**
H	**Ocean Cape Radio Relay Station**																		
H2	Culture Camp			3	3		3	3	3	3	3	3	3		1	1			1
	Totals for Site	**0**	**0**	**3**	**3**	**0**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**0**	**1**	**1**	**0**	**0**	**1**
K	**Solid Waste Area #4**																		
K1	Dump Area	6																	
	Totals for Site	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
M	**Post Powerhouse/25-Gallon Tactical UST**																		
M1	Suspected Hangar Pipeline System/25,000-Gallon Tactical UST	3	3		3	3	3	3	3	3	3	3			1	1	2		1
M2	Fuel/Water Separator and Pressure Tank Pit	3	3		3	3	3	3	3	3	3	3							
	Totals for Site	**6**	**6**	**0**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**0**	**0**	**1**	**1**	**2**	**0**	**1**
	Equipment Blank						**1**							**1**					
	Rinsate Blank						**1**							**1**					
	TOTALS FOR ALL SITES	**34**	**27**	**5**	**32**	**22**	**32**	**32**	**26**	**26**	**26**	**32**	**3**	**2**	**4**	**7**	**4**	**2**	**4**

Notes:
Concerns C2, C3, and C4 were combined and called 'C2' for sampling purposes.
QC/QA analytes are listed on Table 3-3.

Key:
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
VOC = Volatile Organic Compounds
PAH = Polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyls
PEST = Pesticides
HERB = Herbicides
RRO =Residual Range Organics
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QA = Quality Assurance
QC = Quality Control

organics (DRO), residual range organics (RRO), volatile organic compounds (VOCs), Resource Conservation and Recovery Act (RCRA) metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine pesticides (PEST), and chlorinated herbicides (HERB). At Concern H2 (Culture Camp) surface soil samples were also analyzed for total organic carbons (TOCs) and dioxins.

All organic surface material (e.g., rocks, twigs, and leaves) was removed from each sampling location before sampling. A decontaminated stainless-steel hand trowel was used to collect the soil samples. A sufficient quantity of soil was obtained and tightly packed, keeping the void spaces at a minimum (i.e., headspace-free), into appropriate labeled sample containers (Teflon®-sealed glass jars) for the desired analyses. VOC sample containers were prepared with methanol preservative by the analytical laboratory. The soil samples were then wrapped in resealable, plastic storage bags and immediately placed into precooled ice chests where they remained until prepared in accordance with the Sampling and Analysis Plan (ENSR 2000a) for delivery to the laboratory for analysis. Documentation of the sampling location, depth, date, and time were recorded in the field activities logbook. Also recorded were the soil type, color, moisture, and any other observations. For each sample collected, a duplicate soil sample was collected and field screened for VOCs using a calibrated photoionization detector (PID) following headspace analytical screening procedures. Sampling tools were decontaminated and all decontamination fluids were handled in accordance with the Waste Management Plan (ENSR 2000b).

3.1.3 Soil Borehole Sampling and Logging Procedures

Soil borings were advanced at many of the sites visited during the 2000 field investigation. Borings were used for logging soil conditions, collecting subsurface soil samples, and installing groundwater monitoring wells. Borings not converted to monitoring wells were backfilled with bentonite pellets or chips and hydrated with water. A description of the standard monitoring well construction used is presented in Section 3.1.4.1. The geologist supervising the operation listed conditions encountered during drilling in the boring logs. Soil boring logs are presented in Appendix D.

Soil borings were drilled with a FN60 Nodwell-mounted CME-45 drilling rig using a 3.25-inch inside diameter (ID) hollow-stem auger. All soil cuttings and discarded soil cores were placed into 55-gallon drums and stored on site until final disposal in accordance with the Waste Management Plan (ENSR 2000b). All drilling and sampling equipment was decontaminated in accordance with procedures identified in the Work Plan (ENSR 2000c).

Two subsurface soil samples were collected from each boring at various depths using a 2-inch ID, 24-inch-long split spoon sampler driven by a standard 140-pound hammer. Samples were analyzed for GRO, DRO, RRO, VOCs, RCRA metals, PAHs, PCBs, PEST, HERB, and TOCs. At Concern E1 (Northwest Drum Dump) additional exploration borings were advanced in order

to delineate petroleum hydrocarbons observed. Samples obtained from the exploration borings were analyzed for GRO; benzene, toluene, ethylbenzene, and total xylenes (BTEX); PAHs; and TOCs. The number of blows required to advance the split-spoon sampler in 6-inch intervals and amount of soil recovered were recorded on the boring log for each sample attempted. Soil samples collected from the recovered soil for chemical analysis were handled in accordance with the Sampling and Analysis Plan (ENSR 2000a). Each split-spoon soil sample was also field screened for VOCs using the ambient temperature headspace (ATH) method with a PID. Soil type characteristics of each sample were recorded in accordance with American Society for Testing and Materials (ASTM) D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). One geotechnical sample for particle-size analysis was collected from each boring at different sample depths or at each change of lithology. The split-spoon sampler and other sampling tools were decontaminated after each sample in accordance with procedures identified in the Sampling and Analysis Plan (ENSR 2000a).

3.1.4 Monitoring Well Installation and Development

A total of 34 monitoring wells were installed. All drilling and well installation procedures were supervised by the field geologist and recorded in the monitoring well construction logbook. Monitoring wells were screened in the unconfined aquifer. Monitoring well diagrams are included in Appendix D.

3.1.4.1 Standard Monitoring Well Construction

Monitoring wells were constructed using machine-slotted, prepacked, Schedule 40 polyvinyl chloride (PVC) screen with Schedule 40 PVC riser pipe. The screen (2-inch ID, 0.020-slot) and riser pipe were coupled using flush-joint, threaded PVC. No PVC glue or solvent was used in the well installations.

The bottom of the screen was capped, and the well was set by lowering through the augers to the bottom of boring. Ideally, all well screens were placed at a depth where the water-table would remain within the screened interval during seasonal fluctuations. Riser pipe was installed to approximately 3 feet above ground surface. The prepacked screened section was then backfilled with No. 10 to 20, clean silica sand to above top of screen. A bentonite pellet seal was placed on top of the sand pack to create an impermeable seal. The annulus above the bentonite seal was filled with neat bentonite grout. A small notch was cut into the PVC riser as a permanent reference point for which survey data and water levels could be measured.

Monitoring wells were completed with an above-grade, 4-inch-diameter, tubular steel protective casing with a locking cover. Locks were set to a USACE-defined combination. The protective casing was installed a minimum of 1.5 feet embedded into the ground with 3.5 feet of casing above ground surface. The PVC casing inside the steel casing was capped with a locking, expandable, watertight well plug.

3.1.4.2 Well Development

New monitoring wells were developed no sooner than 48 hours after the final completion of the well to allow the grout sufficient time to set. Section 3.1.4.1 presents a discussion of materials used during well construction. The purpose of well development was to remove any fine sand or silt particles that may have settled around the well screen during installation. Development also enhances the hydrologic connection between the well and the aquifer.

The equipment used to develop the wells was constructed of materials that would not adversely affect the quality of the water. In general, the development procedure involved surging and bailing of the wells until the discharged water was relatively sediment-free. During development, the purged water was measured for pH, specific conductivity, temperature, turbidity, dissolved oxygen, and water clarity. Parameter measurements were recorded in the field logbook after each well volume was removed. The color and odor of the purged water was also recorded in the field logbook. The well was considered developed after the above-mentioned parameters met with the criteria established in the Sampling and Analysis Plan (ENSR 2000a). Field parameters measured during well development are provided in Appendix E in the Well Development Field Sheets. Water from well development was containerized and handled in accordance with the Waste Management Plan (ENSR 2000b).

3.1.5 Groundwater Sampling Procedures

Monitoring wells were sampled no sooner than 24 hours after the development. Static water level and total well depth were measured from the permanent reference point notched on the PVC casing and recorded on the well development field sheets. Wells were sampled when a minimum of three well-borehole volumes had been purged and water parameters consisting of specific conductance, water temperature, pH, dissolved oxygen, redox potential, and turbidity met the criteria established in the Sampling and Analysis Plan (ENSR 2000a). The wells were purged by either hand-bailing or using a Grundfos RediFlo submersible pump. If, during development, a well was determined to be "slow recharging," it was purged with a Teflon® bailer in accordance with the Sampling and Analysis Plan (ENSR 2000a).

Samples were collected using a disposable Teflon® bailer. Samples were analyzed for GRO, DRO, VOCs, PAHs, PCBs, PEST, HERB, and RCRA metals. Any observations made during sampling, such as odor or sheen, were recorded in the field logbook (Appendix F). Groundwater sampling field sheets are included in Appendix E. Water purged during well sampling was containerized and handled in accordance with the Waste Management Plan (ENSR 2000b).

3.1.6 Surface Water and Sediment Sampling Procedures

Surface water samples were collected from three concerns visited during the 2000 field investigation. Samples were analyzed for GRO, DRO, VOCs, PAHs, PCBs, PEST, HERB, and RCRA metals. At Concern H2 (Culture Camp), surface water samples were also analyzed for dioxins. Samples were collected where surface water may have been impacted from

contaminated sites or source areas related to military activities. Surface water samples for semivolatile or metals analysis were collected by immersing the sample jars into the water column until almost full. Sample jars were then withdrawn from the water column and filled to final capacity at the water's surface to prevent spillage of sample preservatives. Care was taken not to immerse the container once full. Volatile samples collected in 40-milliliter (mL) volatile organic analysis (VOA) vials were filled at the water surface and were filled to a positive meniscus using the vial cap before capping. The sampling location was recorded on a site map and marked with a flagged stake for surveying. Water parameters, including pH, specific conductance, temperature, turbidity, redox, and dissolved oxygen, were collected at each sampling location.

Sediment samples were generally collected along with surface water samples. Samples were analyzed for GRO, DRO, RRO, VOCs, RCRA metals, PAHs, PCBs, PEST, and HERB. At Concern H2 (Culture Camp), sediment samples were also analyzed for dioxins. Samples were obtained with a hand trowel; when necessary, a decontaminated bucket was used as a dredge for bottom sampling where wading was prohibited due to water depth. Excess water was drained, and the sample was tightly packed in the appropriate labeled sample container, keeping the void spaces at a minimum (i.e., headspace-free).

Sediment sample point locations were logged in the field activities logbook. Measurement to the bottom of the water body was obtained using a weighted measuring tape. Observations such as sediment type, color, odor, and sample depth were also recorded in the field activities logbook.

3.1.7 Background Sampling

Seven monitoring wells were installed to establish background concentrations of COPCs. Background wells were placed in areas sufficiently distant from military sites and source areas to ensure the integrity of background data, and in areas considered to be geologically representative of the project sites. Soil boring samples were collected in the same manner as discussed in Section 3.1.3, however only one sample per boring was collected. The Sampling and Analysis Plan identified a reduced analytical program for the background sampling; however, soil samples were analyzed for VOCs, GRO, DRO, RRO, RCRA metals, PAHs, PCBs, PEST, HERB, and TOC. Background monitoring well installation, development, and sampling was performed as described in Section 3.1.4 and Section 3.1.5. Water samples were analyzed for GRO, DRO, VOCs, PAHs, and RCRA metals. Further details about background sampling are provided in Section 4.1.

3.1.8 Surveying

Site surveying was performed by McClintock Land Associates of Anchorage on November 4 through November 7, 2000. Surveying was conducted to provide ground elevations and horizontal locations of soil borings, monitoring wells, surface soil samples, surface water samples,

and sediment samples. The elevations of the tops of the PVC monitoring well casings were also provided. Elevations were measured to an accuracy of 0.01 foot, and horizontal locations were measured to an accuracy of 0.1 foot. Bearings and distances, in feet, are shown in Alaska State Plane, Zone 1, North American Datum (NAD) 1983. Delta alpha is -5° 11' 13.85," and the mean scale factor is 1.000009767 at the position of the Global Positioning System (GPS) base unit near the radio towers, which were used as the basis of local coordinates, "CENTER RADIO TOWER," UV2817. Vertical datum in feet above mean lower low water (MLLW) is based upon the published elevation for tidal benchmark 3220 Y 1986 (CP-4; NGS 1991).

3.2 Analytical Program

The analytical program for the Yakutat Area data collection activities consisted of submitting primary samples, field quality control (QC) duplicate samples, project QC samples, and quality assurance (QA) referee samples to designated USACE Hazardous, Toxic, and Radiological Waste laboratories, which have been approved by the USACE Missouri River Division Laboratory (CEMRD-L). Designation of the number of primary, field QC duplicate, and QA referee samples collected are presented in Table 3-3.

Primary project samples were analyzed by Sound Analytical Services, Inc. (SAS), located in Tacoma, Washington. SAS subcontracted the analysis for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzo-furans (PCDFs) (EPA Solid Waste [SW]-846 Method 8290) to the Severn Trent Laboratories (STL) facility in West Sacramento, California. QA referee samples were shipped directly to and analyzed by Laucks Analytical Services in Seattle, Washington.

Analysis methods are defined by EPA SW-846 (EPA 1994 and 1996), and ADEC (1999) methodology, as described below:

- Petroleum hydrocarbons were assessed by State of Alaska (ADEC 1999) methodology as "Method for the Determination of Gasoline Range Organics" (Alaska Method AK101), "Method for the Determination of Diesel Range Organics" (AK102), and "Method for the Determination of Residual Range Organics" (AK103).
- VOCs were assessed by gas chromatography/mass spectrometry (GC/MS) technique and EPA SW-846 Method 8260B. Low-concentration and high-concentration VOC samples were collected for soils by the procedures described in EPA SW-846 Method 5035. High-concentration soil samples (i.e., 25-gram samples) were extracted in the field with methanol (i.e., 25-mL volume). Low-concentration soil samples (i.e., 5-gram samples) were extracted in the field with sodium bisulfate preservative solution in a volatile organics container.
- PAHs were assessed by EPA SW-846 (1996) Method 8270C.
- PEST were assessed by EPA SW-846 Method 8081A.
- PCBs were assessed by EPA SW-846 Method 8082.

- HERB were assessed by EPA SW-846 Method 8151A.
- PCDDs and PCDFs were assessed by EPA SW-846 Method 8290.
- The general chemistry parameter of TOC was assessed by EPA SW-846 Method 9060.
- RCRA metals were assessed by EPA SW-846 Methods 6010B, 6020, and 7000 series analysis. Inductively coupled plasma spectroscopy by EPA Method 6010B was employed to assess the target analytes of barium, chromium, silver, and lead. Inductively coupled plasma-mass spectrometry by EPA Method 6020 was employed to assess the target analytes of arsenic, cadmium, and selenium at less than microgram-per-liter concentrations. Analysis by cold vapor atomic absorption technique was employed to assess the target analyte mercury in soil by EPA SW-846 Method 7471A and in water by EPA SW-846 Method 7470A.

A complete cross-check of laboratory identification numbers with ENSR field identification numbers was performed to ensure that analysis had been performed as specified in the chain-of-custody documentation. Missing information regarding samples was noted and resolved with laboratory personnel.

Data verification procedures were performed to ensure the competency of the reported results. Data validation procedures were subcontracted by the U.S. Army Engineer District - Alaska (USAED-AK). The USAED-AK Project Chemist provided a Chemical Data Quality Review (CDQR) to ENSR. The ENSR Project Chemist reviewed the CDQR validation recommendations and summarized the results in a Data Assessment Report (DAR). Appendix B presents the DAR and includes the CDQR.

3.3 Data Interpretation and Selection of Chemicals of Potential Concern

Following validation and verification of the chemical data, the next step in the RI process is to interpret the data to determine whether any of the compounds detected in various media should be considered as a chemical of potential concern (COPC). While the scope of this investigation does not include a complete risk assessment, the following data interpretation steps were employed:

- Performing an initial data review and analysis (using the DAR and CDQR);
- Comparing chemical concentrations to ADEC Method Two soil cleanup levels, ADEC groundwater cleanup levels, or Alaska Water Quality Standards (AWQS);
- Comparing chemical concentrations to background levels; and
- Performing a risk-based screening evaluation (where appropriate).

Detected compounds in surface soil and soil boring samples were considered COPCs if the reported concentrations exceeded the most stringent ADEC Method Two soil cleanup levels for an over 40 inch rainfall zone, usually based on the migration to groundwater pathway. The soil

cleanup levels based on the ingestion pathway for PCBs and some PAHs are more stringent and were used in COPC consideration. On the other hand, naturally occurring background concentrations of arsenic and chromium in soils throughout the Yakutat area generally exceeded their respective ADEC Method Two soil cleanup levels. Arsenic and chromium concentrations in soil were considered as COPCs if the detected concentrations were above the background levels. Background sampling and concentrations are discussed in Section 4.1.

Detected compounds in groundwater were considered COPCs if the reported concentrations exceeded the ADEC groundwater cleanup levels.

Detected compounds in surface water were considered COPCs if the reported concentrations exceeded the AWQS surface water cleanup levels.

The State of Alaska has not established cleanup levels for sediment. In order to evaluate sediment results, the reported analyte concentrations were compared to ADEC Method Two soil cleanup levels as a first-level (conservative) screening tool. Because of the difference in media, a direct comparison cannot be made. However, as a screening tool, this comparison can provide a frame of reference regarding the observed contaminant concentrations. A better tool for evaluating sediment concentrations is the Sediment Quality Chemical Criteria developed and published by the State of Washington Department of Ecology. These standards were established in part to provide a management and decision process for the cleanup of contaminated *marine* sediments.

Pentachlorophenol was detected at two sites. There is the possibility that pentachlorophenol levels may be associated with wood preservatives that may also have included arsenic or chromium, or both. Therefore, at sites where pentachlorophenol was detected, arsenic and chromium in the same media were considered as COPCs if their concentrations were above the ADEC Method Two soil cleanup levels.

Pentachlorophenol was assessed by EPA SW-846 Method 8151A for soils with a method quantitation limit (MQL) of 6.7 μg/kg, which is within a factor of the ADEC Method Two soil cleanup level of 9 μg/kg. Generally, soil and sediment samples reporting percent solids less than 74 percent elevated MQL above the soil cleanup level. Low percent solids may be due to high moisture or organic content. Percent solids are presented in the analytical data tables in Appendix A.

Soil, sediment, and surface water samples retrieved from Concern H2 (Culture Camp) were analyzed for dioxins by EPA SW-846 Method 8290. Because ADEC has not established cleanup levels for dioxins in these media, comparison was made to several screening criteria to determine COPCs. Further discussion regarding these comparisons is presented in Section 4.5.1.5.

Results of the data interpretation process are discussed on a concern-by-concern basis in Section 4.0 of this RI.

Table 3-1. 2000 Field Investigation Quality Assurance/Quality Control Sample Summary.

Soils	DRO AK102	GRO AK101	RRO AK103	BTEX 8260B	VOC High 8260B	VOC Low 8260B	PAH 8270C	PCB 8082	PEST 8081A	HERB 8151A	Metals 6010A	Dioxins 8290	TOC 9060A
Primary Sample	129	123	117	7	3	119	129	116	116	116	122	6	33
Field QC Duplicate	13	12	12			13	13	13	13	13	13	1	
QC Trip Blanks		2			2								
MS/MSD Sample	5	5	5			5	5	5	5	5	5		1
QA Referee	13	12	13		9	4	13	13	13	13	13	1	
QA Trip Blanks						1							
Total	**160**	**154**	**147**	**7**	**14**	**142**	**160**	**147**	**147**	**147**	**153**	**8**	**34**

Groundwater	DRO AK102	GRO AK101	RRO AK103	BTEX 8260B	VOC 8260B	VOC Low 8260B	PAH 8270C	PCB 8082	PEST 8081A	HERB 8151A	Metals 6010A	Dioxins 8290	TOC 9060A
Primary Sample	27	21			27		27	21	21	21	27		
Field QC Duplicate	3	3			3		3	3	3	3	3		
QC Trip Blanks		5			5								
MS/MSD Sample	1	1			1		1	1	1	1	1		
QA Referee	3	3			3		3	3	3	3	3		
QA Trip Blanks		3			3								
Total	**34**	**36**	**0**	**0**	**42**	**0**	**34**	**28**	**28**	**28**	**34**	**0**	**0**

Surface Water	DRO AK102	GRO AK101	RRO AK103	BTEX 8260B	VOC 8260B	VOC Low 8260B	PAH 8270C	PCB 8082	PEST 8081A	HERB 8151A	Metals 6010A	Dioxins 8290	TOC 9060A
Primary Sample	5	1			5		5	5	5	5	5	3	
Field QC Duplicate	1				1		1	1	1	1	1	1	
QC Trip Blanks		2			2								
MS/MSD Sample	1	1			1		1	1	1	1	1		
QA Referee	1	1			1		1	1	1	1	1	1	
QA Trip Blanks		1			1								
QC Source Water					1								
QC Equipment Rinsate					1								
Total	**8**	**6**	**0**	**0**	**13**	**0**	**8**	**8**	**8**	**8**	**8**	**5**	**0**

Sediment	DRO AK102	GRO AK101	RRO AK103	BTEX 8260B	VOC High 8260B	VOC Low 8260B	PAH 8270C	PCB 8082	PEST 8081A	HERB 8151A	Metals 6010A	Dioxins 8290	TOC 9060A
Primary Sample	9	9	9			9	9	9	9	9	9	3	
Field QC Duplicate	1	1	1			1	1	1	1	1	1		
QC Trip Blanks						1							
MS/MSD Sample													
QA Referee	1	1	1		1		1	1	1	1	1		
QA Trip Blanks													
Total	**11**	**11**	**11**	**0**	**1**	**11**	**11**	**11**	**11**	**11**	**11**	**3**	**0**

~~Key:~~

DRO = Diesel Range Organics
GRO = Gasoline Range
RRO =Residual Range Organics
BTEX = Benzene,
VOC = Volatile Organic Compounds
PAH = polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyls
PEST = Pesticides
HERB = Herbicides
TOC = Total Organic Carbon
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QA = Quality Assurance
QC = Quality Control

4.0 SITE DESCRIPTIONS AND NATURE AND EXTENT OF CONTAMINATION

Site descriptions for each area of concern investigated during the 2000 field season include historical use, physical locations and settings, and previous investigations, along with a discussion of fieldwork performed and findings. Field logbooks from the 2000 field season are presented in Appendix F. Site descriptions are presented in the following order:

Section 4.1 – Background Sampling

Section 4.2 – Site C: Point Carrew Garrison

Section 4.3 – Site E: Northwest Drum Dump/Quartermaster Loop Area

Section 4.4 – Site G: Minor Naval Air Facility (Seaplane Base)

Section 4.5 – Site H: Ocean Cape Radio Relay Station

Section 4.6 – Site K: Solid Waste Disposal Dump No. 4 Area

Section 4.7 – Site M: Post Powerhouse/25,000-Gallon Tactical Tank

Section 4.8 – Additional Activities: Initial Field Investigations

4.1 Background Sampling

A total of seven background soil borings/wells were installed during the 2000 field season to establish background analyte concentrations in soil and groundwater. Background soil and groundwater samples were analyzed for DRO, VOCs, PAHs, and RCRA metals. Background wells were placed in areas sufficiently distant from known military sites and source areas to ensure the distinctive nature of background data but in areas considered to be geologically representative of the project sites. Figure 4-1 shows the location of background wells installed during this investigation.

The first background well installed (AP-006) was found to be dry the day following installation. An attempt was made to install another well at this location but was abandoned due to difficult drilling conditions at depth, and groundwater was not encountered. The soil-boring sample collected from AP-006 was not submitted for laboratory analysis. ENSR field personnel decided to relocate additional borings closer to the sites being investigated so that the borings would be more representative of the geological conditions of the project sites.

Four attempts were made before installing well AP-009. One attempt on the south of Concern C1 was abandoned when groundwater was not encountered after drilling 20 feet below ground

surface (bgs). Three attempts east of AP-009 were abandoned after auger refusal at approximately 5 feet bgs in each boring

A total of six soil and six groundwater samples were analyzed from the background borings/wells.

4.1.1 Findings

The following is a discussion by media of analytes exceeding cleanup levels in the background samples and the statistical evaluation used in determining background concentrations. A summary of elevated analytical results is presented as Table 4-1. Complete analytical results from background sampling conducted during the 2000 investigation are presented in Appendix A, Tables 1 and 2.

Soil Borings

Arsenic was detected at concentrations from 2.1 mg/kg to 5.4 mg/kg in background soil samples. All of the reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg.

Chromium was detected at concentrations from 20 mg/kg to 30 mg/kg. Five of the six reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg.

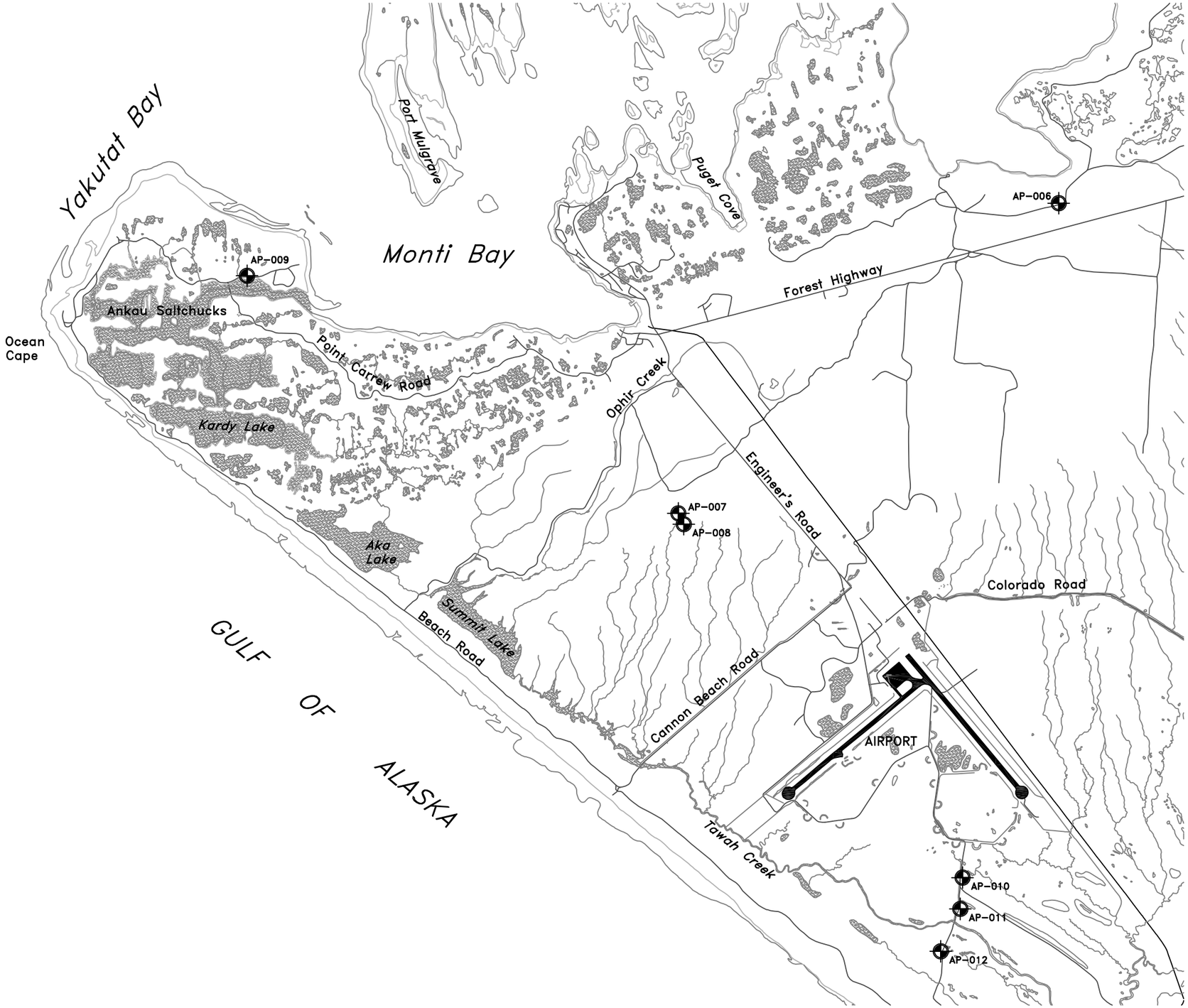
No other analytes were detected at concentrations that exceeded ADEC Method Two cleanup levels.

Groundwater

No detected analytes in the background groundwater samples were reported above the ADEC groundwater cleanup levels.

Statistical Evaluation

As discussed in greater detail in subsequent sections, naturally occurring metals were reported in every soil sample analyzed during the RI/FS investigation. A total of 91 percent of all arsenic concentrations and 58 percent of all chromium concentrations exceeded the ADEC Method Two soil cleanup level. These apparently elevated concentrations can be considered typical of normal background levels present in the soils in the Yakutat area. It is therefore important to distinguish site-related contamination from naturally occurring or other non-site-related concentrations. This is the reason for establishing background concentrations. Where site sample analytical levels (particularly metals) exceeded regulatory cleanup levels, comparison to background concentrations can identify whether the reported concentrations are within the range of naturally occurring mineral concentrations, or whether they might be associated with anthropogenic, or development, activities.



LEGEND

BACKGROUND MONITORING WELL LOCATION

N

0 2250 4500

SCALE IN FEET

2000 REMEDIAL INVESTIGATION REPORT
YAKUTAT AREA RI/FS
YAKUTAT, ALASKA

FIGURE 4-1
BACKGROUND MONITORING WELLS
LOCATION MAP

DATE: 03/14/02	DRAWN BY: MNS	SCALE: AS SHOWN	DRAWING: 00F4-1BGW
C/SC: 1:1PS ZIP: 39/00	P.M.: S. WRENN	CHECKED: S. WRENN	PROJECT: 9000-216-132

Table 4-1. Background Samples - Summary of Elevated Analytical Results.

Location		Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Soil Borings				
AP-007	(0-2' bgs)	Arsenic	4.1	1.8
		Chromium	23	23
AP-008	(0-2' bgs)	Arsenic	5.4	230
		Chromium	29	23
AP-009	(0-2' bgs)	Arsenic	2.1	1.8
		Chromium	29	23
AP-010	(0-2' bgs)	Arsenic	2.4	1.8
		Chromium	30	23
AP-011	(0-2' bgs)	Arsenic	2.2	1.8
		Chromium	20	23
AP-012	(0-2' bgs)	Arsenic	2.3	1.8
		Chromium	30	23

Notes:
All analytes detected greater than one-half the cleanup levels are presented.
See Appendix A for details regarding cleanup levels.
Key:
' bgs = Feet below ground surface
mg/kg = Milligrams per kilogram

For the Yakutat area RI/FS program, it was determined that in order to identify normal background concentrations of both arsenic and chromium, a statistical evaluation of all project data for these two analytes from both the 2000 and 2001 field investigations would be performed to identify outliers (i.e., those data that differ statistically from the rest of the data). For this project, all data within two standard deviations (2-sigma) of the mean were considered to be representative of a standard data distribution and represents background concentrations. Those data that exceeded a value greater than two standard deviations from the mean value of all project data were considered abnormally high and therefore were considered to be contaminants of potential concern (COPC).

The data were first assessed for normality by dividing the skewness and kurtosis of each dataset by the standard error. If the results were between -2 to 2, the dataset was considered to be normal; otherwise, the dataset was considered log normal. Chromium data were found to be normally distributed, and a value of 41.47 mg/kg was determined to be the upper-limit of background concentrations (+2-sigma). Arsenic data were found to be lognormal, and a value of 14.16 mg/kg was determined to be the upper-limit of background concentrations (+2-sigma). Site arsenic and chromium soil analytical results were compared to these upper limit background concentrations for COPC selection. All statistical calculations are presented in Appendix C.

4.2 Site C: Point Carrew Garrison

The Point Carrew Garrison facilities were built to support Panama gun emplacements along the west and south coast of Phipps Peninsula during World War II military presence in Yakutat. Infrastructure on the peninsula included fuel and ammunition storage facilities; 155-millimeter (mm), rigid-mount gun emplacements and housing; a Coast Artillery Garrison; four warehouses; a small dock (on the Ankau Inlet); a plotting room; powerhouses; and a garbage dump. Most of the buildings were removed during the 1985 USACE cleanup efforts. Historically and currently, Point Carrew, the Ankau waters, and Ocean Cape provide a subsistence food source. The entire Phipps Peninsula is used to hunt moose and ducks; collect berries, clams, cockles, and seaweed; and fish for salmon.

4.2.1 Concern C1: Ankau Bridge Area – Garbage/Drum Dump

Yakutat Landing Field layout plans from 1943 indicated a garbage dump off the southwest edge of Artillery Road (Point Carrew Road) approximately 100 yards south of the Ankau Inlet Bridge. Several large, moss-covered, fallen trees between the landfill and road edge were observed in 1999, possibly left there during road construction. This dump site was not evident from the road and had been overgrown by forest. Field observations during the October 1999 site survey located over 20 partially buried, severely rusted drums with miscellaneous garbage (e.g., tires and bottles) at the site. Topography slopes to the south, and the area is well-covered with moss, alders, and spruce trees. Point Carrew Road is built up 1 to 6 feet above the original ground surface. There is a small creek at the south end of the site. A site map is presented as Figure 4-2.

Possible contaminant sources for this site are the severely rusted 55-gallon drums and other debris partially buried in the dump. Any contamination associated with this dump site could have migrated toward the small creek or infiltrated through the subsurface soils to groundwater.

4.2.1.1 Objectives

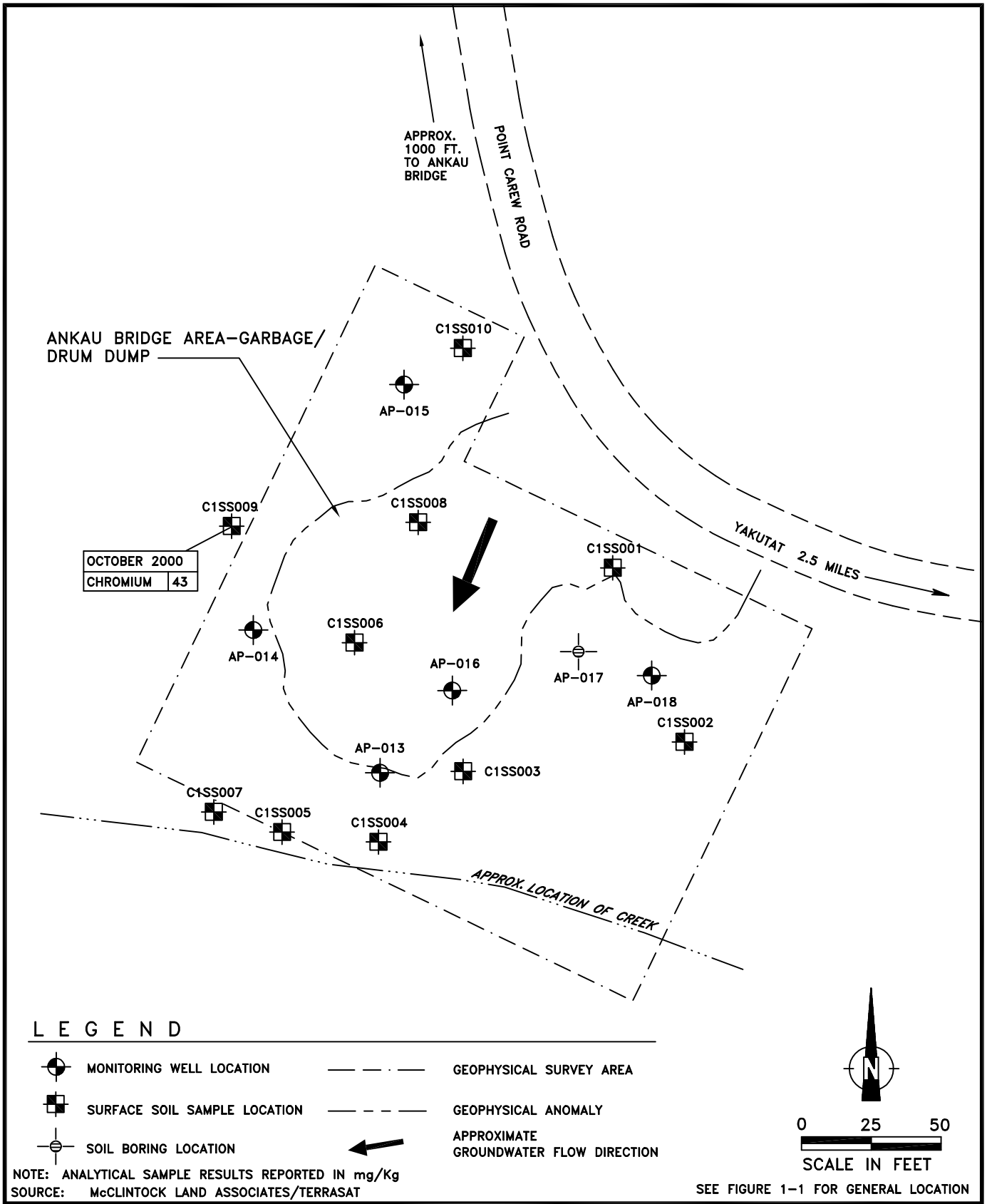
The primary objectives for the garbage/drum dump at the Ankau Bridge area were to delineate the extent of buried debris and to determine whether any contaminants associated with the disposal area are present in the surface soil, subsurface soil, and groundwater.

4.2.1.2 Previous Investigations

One previous investigation has been conducted at the Ankau Bridge garbage/drum dump (Concern C1). The following is a summary of the investigation findings.

1996 – Summary Investigation of DoD Activities on Yakutat Tribal Lands

One soil and one water sample were collected in 1996 by AGRA Earth and Environmental, Inc. (AGRA) during a summary investigation of U.S. Department of Defense (DoD) activities on



DRAWING: 00F4–2C1 DRAWN: MNS C/SC: 1:1PS ZIP: 39/00 12/21/01 CHECK: J.H.	FIGURE 4–2 POINT CARREW GARRISON CONCERN C1	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000–216–132

Yakutat tribal lands. The text within the AGRA report labeled both samples as soil; however, the associated data tables reported one sample as soil and one sample as water. The samples were collected from the south side of the landfill in the area of the small creek (AGRA 1997).

For the purpose of AGRA's Qualitative Risk Assessment, a chemical was identified as a chemical of concern (COC) if the concentration of that chemical exceeded its EPA Region 3 residential risk-based concentration (RBC). The RBC of a chemical is the concentration of that substance in soil or water above which an adverse toxicological effect would likely result. EPA Region 3 RBCs were used by convention because the EPA Region 10 (including Alaska) recognizes Region 3 RBCs as a valid tool for evaluating risk. Both samples had detectable concentrations of PCDDs (polychlorinated dibenzo-p-dioxins) and PCDFs (polychlorinated dibenzo-furans). The calculated 2,3,7,8-tridichlorodibenzo-p-dioxin (TCDD) equivalents were 0.00 parts per trillion (ppt) for the soil sample and 0.038 ppt for the water sample. Both calculated equivalents were below the RBC of 4 ppt, showing no quantifiable risk associated with the soil and water at the sample locations. Therefore, it was reported that no COCs were found in the samples collected at this site (AGRA 1997).

4.2.1.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objectives at the Ankau Bridge garbage/drum dump (Concern C1). Sample locations are shown on Figure 4-2.

Geophysical Survey

A geophysical survey was conducted at this concern before sampling activities to delineate the extent of remaining drums and debris in the landfill. Results of the survey indicate a strong, broad anomaly that represents the lateral extents of the dump area. The dump area covers approximately 12,440 square feet. The preliminary field-delineated anomaly of the dump area was used to control the positioning of soil borings.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

Surface Soil Sampling

Ten surface locations within and around the former landfill were sampled to determine whether surface soil contamination exists. Between 1 and 2 feet of moss, debris, and other surface material were removed from each sample location before the mineral soil was collected. The surface soil samples consisted of gray silt with some gravel in the south half of the site and brown, silty sand with gravel in the north half. Cobbles and boulders up to 5 feet in diameter were present on the surface along the south edge of the site area, near the small creek. PID

readings ranged from 0.0 to 1.7 parts per million (ppm), with the highest reading detected within the landfill.

Soil Borehole Sampling

Six soil borings were advanced to depths of 4 to 11 feet bgs to determine whether contaminants were present in subsurface soils. Borings were placed around the perimeter and downgradient of the landfill (as delineated by the geophysical survey). The surveyed location of AP-016 appears to be within the landfill limits; however, the location was selected based on preliminary geophysical results, and no subsurface debris were present at this location. Subsequent interpretation of the geophysical data placed the landfill boundary to the east of the boring location. Two drive samples were collected from each boring at different intervals for sample collection and subsurface characterization. Five of the borings were advanced to total depth for monitoring well installation. Soil boring AP-017 was advanced a total depth of 11 feet and did not encounter groundwater before refusal. No monitoring well was installed, and this boring was backfilled with bentonite chips. Boring logs are presented in Appendix D.

Each boring encountered 0.4 to 0.8 feet of organic material (i.e., moss, muskeg, and peat). Gravel was present under the organic layer throughout the northwest half of the landfill, ranging from brown gravel with sand toward the north to light gray, clayey gravel toward the west. The clay content in the gravel appears to diminish with depth. This gravel was not present to the south and east of AP-016 and appears to pinch out. Silty sand was encountered under the organic topsoil in the southeast half of the landfill. The silty sand was light gray to mottled light grayish tan and brown, poorly graded, medium to coarse, and interbedded with clay layers generally less than 2 to 3 inches think. This sandy material was encountered beneath the gravel in AP-016 but appears to pinch out and was not observed further north or west. Light gray silt underlies the sand in AP-013 at a depth of 2.25 feet bgs whereas light gray clay lies beneath the gravel to the north at approximately 2.5 feet bgs in AP-015. Angular fragments of quartz monzonite comprise most of the gravel and were observed in all but one boring. A quartz monzonite erratic boulder was observed near the Ankau Bridge. PID readings ranged between 0.0 and 0.3 ppm.

Five of the borings were completed as monitoring wells. Well construction diagrams are presented in Appendix D. Well development records are presented in Appendix E. Soil boring AP-017 was advanced a total depth of 11 feet and did not encounter groundwater before refusal. The cause of the refusal appeared to be a quartz monzonite bedrock (or possibly an erratic). While it is widely reported that sedimentary rock is the predominate country rock in the area, it would not be uncommon for a small stock or apophysis of monzonite to be exposed in this area. The Yakutat Group is known to be intruded by Eocene granitic plutons (USGS 1985). The boring was backfilled with bentonite chips.

Groundwater Sampling

Samples were collected from each well to determine whether contaminants were leaching into the groundwater. Groundwater levels measured on the day of sampling averaged 7.5 inches bgs with a range between 2.2 and 15.8 inches bgs. The groundwater flow direction appears to be toward the south-southwest. Wells AP-014 and AP-018 were slow to recharge during development and sampling but did not meet the definition of a "slow recharging well" per the Work Plan (ENSR 2000c). These wells were purged and sampled with Teflon® bailers. Samples were collected after removing more than the required well volume although not all water parameters had fully stabilized. Although turbidity and dissolved oxygen remained above the accepted parameter, the other parameters were used to determine well stabilization. The remaining three wells were purged and sampled as fast recharging wells in accordance to the groundwater sampling plan. Groundwater sampling records are presented in Appendix E.

4.2.1.4 Findings

The following is a discussion by media of analytes exceeding cleanup levels at the Ankau Bridge Area garbage/drum dump (Concern C1). A summary of elevated analytical results is presented as Table 4-2. Complete analytical results from the 2000 investigation are presented in Appendix A, Tables 3, 4, and 5.

Surface Soil

Arsenic was detected at concentrations from 2.7 mg/kg to 9.6 mg/kg in surface soil. All of the reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported arsenic values exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Because the reported arsenic concentrations did not exceed the background concentration, arsenic in surface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations from 11 mg/kg to 43 mg/kg. These values were considered estimated due to laboratory QC matrix duplicate sample results exceeding the precision goal for duplicated analysis. Four of the ten reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. One reported concentration, located approximately 20 feet west of the garbage/drum dump at sample location C1SS009 (43 mg/kg), exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in surface soil will be considered a COPC at this concern.

Although pentachlorophenol was not detected in any of the surface soil samples, low percent solids in four samples slightly elevated the MQLs above the ADEC Method Two soil cleanup level of 9 µg/kg. In one instance, an associated field QC duplicate sample had a MQL below the cleanup level. The presence of pentachlorophenol in three samples was indeterminate, but because it was not detected in any soil or water samples collected at this concern, it is not considered a COPC in any media at this concern.

Besides chromium, no other analytes in surface soils are considered as COPCs at this concern.

Soil Borings

Arsenic was detected at concentrations from 2.7 mg/kg to 7.8 mg/kg in the soil boring samples, exceeding the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported values exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in subsurface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations from 14 mg/kg to 32 mg/kg. Four of the ten reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. However, none of the reported chromium concentrations exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Because the reported chromium concentrations did not exceed the background concentration, chromium in subsurface soil will not be considered a COPC at this concern.

Although pentachlorophenol was not detected in any of the soil boring samples, low percent solids in two samples slightly elevated the MQLs above the ADEC Method Two soil cleanup level of 9 µg/kg. The presence of pentachlorophenol in those two samples was indeterminate; however, because pentachlorophenol was not detected in any soil or water samples collected at this concern, it is not considered a COPC in any media at this concern.

No analytes in subsurface soils are considered as COPCs at this concern.

Groundwater

All groundwater analytical results were below ADEC groundwater cleanup levels. No analytes in groundwater are considered as COPCs at this concern.

Summary of Findings

The investigative objectives for the garbage/drum dump at the Ankau Bridge Area were to delineate the extent of buried debris and to determine if any contaminants associated with the disposal area are present. The dump area, as delineated by the geophysical survey, covers an area of approximately 12,440 square feet. Ten surface samples, twelve soil boring samples, and five groundwater samples were collected and analyzed.

Chromium was detected in one surface soil sample at a concentration that slightly exceeded the background level. No other detected concentrations exceeded their respective ADEC Method Two soil cleanup levels. There is no indication of a release of any hazardous material from the garbage/drum dump. Chromium in surface soil is the only contaminant that will be considered a COPC at this concern.

Table 4-1. Concern C1 – Summary of Elevated Analytical Results.

Location		Analyte	Result (mg/kg)	Cleanup Level (mg/kg)
Surface Soils				
C1SS001		Arsenic	5.7	1.8
		Chromium	14 J	23
C1SS002		Arsenic	2.7	1.8
C1SS003		Arsenic	9.3	1.8
		Chromium	33 J	23
C1SS004		Arsenic	5.4	1.8
		Chromium	20 J	23
C1SS005		Arsenic	9	1.8
		Chromium	24 J	23
C1SS006		Arsenic	6	1.8
		Chromium	23 J	23
C1SS007		Arsenic	7.5	1.8
		Chromium	34 J	23
C1SS008		Arsenic	8.4	1.8
		Chromium	24.7 J	23
C1SS009		Arsenic	9.6	1.8
		Chromium	43 J	23
C1SS010		Arsenic	6.3	1.8
		Chromium	20 J	23
Soil Borings				
AP-013	(0-2’ bgs)	Arsenic	6.1	1.8
		Chromium	18	23
	(3-5’ bgs)	Arsenic	3.2	1.8
		Chromium	32	23
AP-014	(0-2’ bgs)	Arsenic	7.8	1.8
		Chromium	30	23
	(2-4’ bgs)	Arsenic	5.1	1.8
		Chromium	20	23
AP-015	(0-2’ bgs)	Arsenic	3.9	1.8
		Chromium	16	23
	(3.5-5.5’ bgs)	Arsenic	5.3	1.8
		Chromium	24	23
AP-016	(1-3’ bgs)	Arsenic	2.9	1.8
		Chromium	21	23
	(3-5’ bgs)	Arsenic	7 J	1.8
		Chromium	27	23
AP-017	(5-7’ bgs)	Arsenic	4.2	1.8
		Chromium	23	23
	(7-9’ bgs)	Arsenic	4	1.8
		Chromium	23	23
AP-018	(0-2’ bgs)	Arsenic	2.7	1.8
		Chromium	19	23
	(2-4’ bgs)	Arsenic	4.7	1.8
		Chromium	14	23

Table 4-2. Concern C1 – Summary of Elevated Analytical Results. (Continued)

Location	Analyte	Result *(mg/L)*	Cleanup Level (*mg/L)*
Groundwater			
AP-018	Arsenic	0.029	0.05
	Lead	0.015	0.015

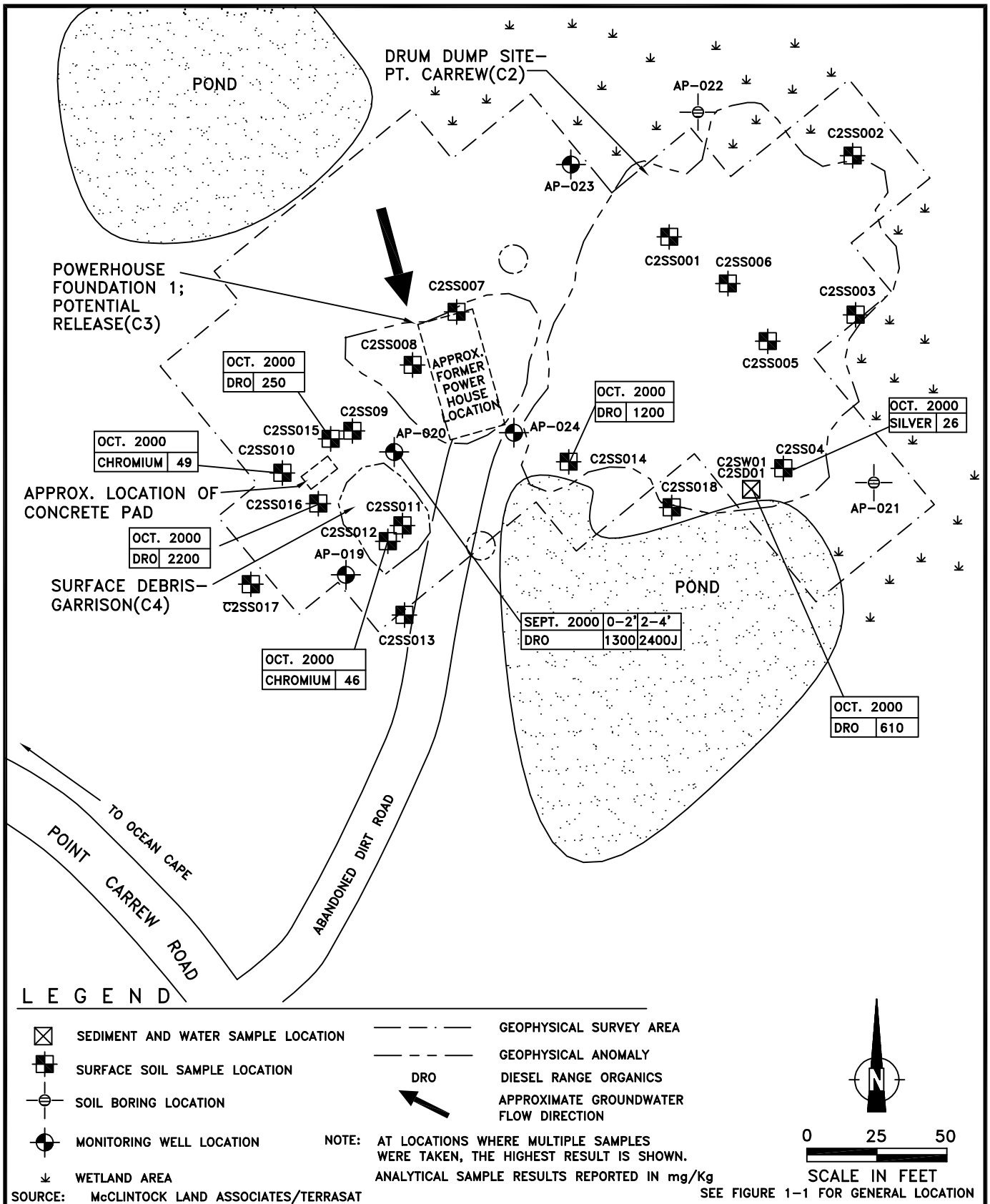
Notes:
All analytes detected greater than one-half the cleanup levels are presented.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
J = Result is considered an estimate value
' bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
QA/QC = Quality Assurance/Quality Control

4.2.2 Concern C2, C3, and C4: Drum Dump – Point Carrew, Powerhouse Foundation 1 Potential Release, and Surface Debris – Garrison

Yakutat Landing Field layout plans from 1943 show an access road leading to a powerhouse near the north side of Point Carrew Road approximately 1.4 miles from Ocean Cape. No landfill is shown on the 1943 drawings in association with the powerhouse. The landfill has been referred to locally as the RCA dump, but it is not known when this area was first used as a landfill. A former RCA worker interviewed by AGRA reported that the Army deposed of "lots of material … at a dump site between the WACS site and the Ankau Inlet bridge" (AGRA 1997), indicating that this area was used as a landfill prior to 1984. Military-generated debris in the area were removed during the 1984 cleanup effort (USACE 1984b).

Based on historical documentation regarding polychlorinated biphenyls (PCBs) in transformer oil, the potential for contamination in the area exists. Fuel contamination is also considered possible depending on former fuel handling and storage practices and fuel tank disposal practices.

Surface debris – including tires and engine parts – were visible at the end of the access road during the 1999 site walkover. The landfill surface (Concern C2) is presently at approximately the same level as the access road and is surrounded by swamp/bog wetlands on three sides. A concrete pad (Concern C3) was observed and is suspected to be the former powerhouse foundation. It appears that this pad has been moved from the original powerhouse location. Also, various partially buried, severely rusted pipes, gasoline cans, 55-gallon drums, and other surface debris (Concern C4) were found adjacent to the west side of the access road. The area was heavily overgrown, making it difficult to determine the extent of debris. These concerns are referred to as the Point Carrew Garrison dump area. A site map is presented as Figure 4-3.



DRAWING:00F4–3C234 DRAWN: MNS C/SC: 1:1PS ZIP: NA DATE: 01/07/02 CHECK: J.H.	FIGURE 4–3 POINT CARREW GARRISON CONCERN C2, C3 & C4	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000–216–132

Areas of concerns C2 (Drum Dump – Point Carrew), C3 (Powerhouse Foundation 1 Potential Release), and C4 (Surface Debris – Garrison) were investigated as a single area because of (1) their close proximity and (2) the difficulty of distinguishing between them. Although sample numbers from this area refer to Concern C2, all three concerns were included in this investigation.

4.2.2.1 Objectives

The primary objectives at the Point Carrew Garrison dump area were to delineate the extent of buried debris in the drum dump and surface debris areas; conduct follow-up sampling to determine whether contaminants are present in the surface soil, subsurface soil, and groundwater; identify contaminants possibly migrating out of the landfill; and assess the presence of fuel and PCB contamination associated with the former powerhouse.

4.2.2.2 Previous Investigations

Four previous investigations have been conducted at the Point Carrew Garrison dump area (concerns C2, C3, and C4). The following is a summary of past findings.

1984 – Environmental Restoration Defense Account Debris Cleanup and Site Restoration

One water sample was collected in 1984 from a submerged, punctured barrel and analyzed by GC/MS (AGRA 1997). No aliphatic hydrocarbons or common organic solvents were detected. During the 1984 cleanup, the powerhouse ruins, an engine block, and trash were removed from the powerhouse site. A debris pile and lots of trash were removed from the landfill, and 55-gallon drums were removed from the debris area. Two medium-sized Quonset huts were also removed from the general area (USACE 1984b).

1994 – Field Investigation Report, Former Yakutat Air Base

In 1994, one sediment sample was collected near a potentially leaking drum located in the surface debris area (Ecology and Environment, Inc. [E&E] 1994). Petroleum odor and a fuel sheen were generated when adjacent sediment was disturbed. DRO test results from that sample were estimated at 4,700 mg/kg. Total recoverable petroleum hydrocarbon (TRPH) and GRO were also detected at 9,000 and 29 mg/kg, respectively. DRO and TRPH sample results were estimated because the high concentration of fuel in the sample diluted the matrix spike. GRO sample results were estimated because the chromatogram did not match the typical gasoline fingerprint. E&E estimated the area of contaminated sediment associated with the landfill to be 1,000 square feet. The depth of contamination was not determined.

1996 – Summary Investigation of DoD Activities on Yakutat Tribal Lands

In 1996, two soil samples were collected from the former powerhouse area, one soil sample was collected near drums south of the powerhouse, and two surface soil samples and one

water sample were collected from the landfill area (AGRA 1997). The water sample, collected from the trench in the landfill, contained detectable concentrations of PCBs (Aroclor 1242 at 0.051 mg/L and Aroclor 1260 at 0.0008 mg/L), bis(2-ethylhexyl)phthalate (0.048 mg/L), 3- and 4-methylphenol (0.022 mg/L), naphthalene (0.004 mg/L and 0.011 mg/L), and 2-methylnaphthalene (0.023 mg/L), 1,4-dichlorobenzene (0.0032 mg/L), ethylbenzene (0.0005 mg/L), xylenes (0.0047 mg/L), 1,2,4-trimethylbenzene (0.003 mg/L), and 1,3,5-trimethylbenzene (0.003 mg/L). AGRA concluded that no COCs were identified in the surface water. No VOCs were detected in the soil samples from the landfill. One sample collected from the landfill was considered by AGRA to have "the highest potential of containing dioxins for their respective locations" and was analyzed by the P450 Reporter Gene Assay test. That sample did not exhibit a level of toxicity consistent with the possible presence of PCDDs or PCDFs. One soil sample from the former powerhouse had detectable concentrations of PAHs; however, none of the chemicals exceeded its respective RBC (AGRA 1997).

1997 – Yakutat Air Base/Ocean Cape Radio Relay Site Investigation Report

In 1997, four soil samples were collected: three from the Point Carrew Garrison dump area and one from beneath a collapsed Quonset hut on the other side of Point Carrew Road. Elevated concentrations of bis(2-ethylhexyl)phthalate, 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), aldrin, Aroclor 1242, Aroclor 1260, and lead were detected at the drum dump. None of these contaminant concentrations exceeded regulatory guidelines. The surface soil RRO concentrations at the landfill (1,000 mg/kg) and the DRO concentrations at the surface debris area (1,500 mg/kg) exceeded ADEC matrix score sheet cleanup guidance Level A values (E&E 1997).

4.2.2.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objectives at the Point Carrew Garrison dump area (concerns C2, C3, and C4). Sample locations are shown on Figure 4-3.

Geophysical Survey

A geophysical survey was conducted at this site prior to sampling activities to delineate the extent of remaining surface and buried debris. One survey grid was set to cover all three concerns. Results of the survey indicate five anomalies suggesting several areas where metallic debris are buried. One strong, broad anomaly represents the lateral extent of the drum dump (Concern C2). The drum dump covers an area of approximately 13,000 square feet. A strong, broad anomaly in the area of Concern C3 suggests significant amounts of surface and buried metal associated with the powerhouse foundation. In the surface debris area (Concern C4), a strong, broad anomaly suggests significant amounts of buried metal. The surface debris area covers an area of approximately 830 square feet although nonmetallic debris may cover a larger area. Two isolated, moderately sized anomalies suggest surface metal or small near-

surface targets. The preliminary field-delineated anomalies were used to control the positioning of soil borings.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

Surface Soil Sampling

Eighteen surface locations in the Point Carrew Garrison dump area were sampled to determine whether surface soil contamination exists. Surface soil sample locations were selected to adequately cover the three areas of concern. Eight samples were collected from the drum dump (Concern C2), two samples were collected from the former powerhouse location (Concern C3), four samples were concentrated around the concrete pad suspected to be the powerhouse foundation (these samples covered the surface debris area as well), and four samples were collected from the surface debris area (Concern C4). Between 6 and 18 inches of moss, debris, and other surface materials were removed from each sample location prior to mineral soil sample collection. The surface soil samples collected from the drum dump area consisted of brown, gravelly sand fill material. PID readings for this area were consistently 0.0 ppm. The surface soil samples collected from the powerhouse foundation area consisted of brown sands. PID readings for this area were consistently 0.0 ppm. The surface soil samples collected from the surface debris area consisted of from brown sand to gray, sandy gravelly silt. PID readings in this area range from 0.0 to 4.0 ppm. The highest PID reading (4.0 ppm) was recorded from location C2SS016, adjacent to the concrete pad suspected to be the former powerhouse building foundation. DRO concentration at this location was reported at 2,200 mg/kg.

Soil Borehole Sampling

Six soil borings were advanced to depths of 4 to 11 feet bgs to determine whether contaminants were present in subsurface soil. Boring locations were placed around the perimeter of the landfill (as delineated by the geophysical survey), downgradient of the former powerhouse location, and both upgradient and downgradient of the surface debris area. Two drive samples were collected in the first 4 feet of the borings for sample analysis and subsurface characterization. Four of the borings were advanced to total depths of 11 feet bgs for monitoring well installation. Soil borings AP-021 and AP-022 were advanced for subsurface soil sampling only. Monitoring wells could not be constructed in the boggy wetland areas. Boring logs are presented in Appendix D.

Each boring encountered 5 to 10 inches of organic material (i.e., moss, muskeg, and peat). Subsurface soils in this area generally consisted of gray silt to fine sandy silts with minor amounts of fine gravel. Boring AP-021, from the southeast edge of the landfill, encountered a fine to medium sand layer 0.9-feet thick underlain by gray clay interbedded with fine to medium sand in layers less than 2 inches thick. Boring AP-024 was placed on the edge of the access road and encountered fill material, a light gray, gravelly, sandy silt. PID readings generally

ranged between 0.0 and 0.2 ppm. A moderate hydrocarbon odor was noted in boring AP-020, and PID readings of 38.6 and 62.6 were measured in the drive samples. DRO concentrations in the soil samples collected from AP-020 were 1,300 and 2,400 ppm.

Four of the borings were completed as monitoring wells. Soil borings AP-021 and AP-022 were advanced for subsurface soil sampling only since monitoring wells could not be constructed in the boggy wetland areas. Well construction diagrams are presented in Appendix D. Well development records are presented in Appendix E.

Groundwater Sampling

Samples were collected from each well to determine whether contaminants were leaching into the groundwater. Although surface water and wetland vegetation is present surrounding the landfill, groundwater levels measured on the day of sampling averaged 11.2 feet bgs, ranging from 9.12 to 12.31 feet. The groundwater flow direction appears to be toward the south-southeast. Wells AP-020, AP-023, and AP-024 were determined to be "slow recharging" during development and were purged and sampled using Teflon® bailers. Before sampling, these wells were allowed to recharge for 2 hours after one well volume was removed from each well. Water parameters were recorded during the initial purging. A complete set of sample bottles for these wells could not be filled at the same time due to the slow recharge of the wells. The wells were allowed to recharge overnight before finishing sampling. Well AP-024 was extremely "slow recharging" and needed an additional 8 hours of recharge to complete sampling. Well AP-019, determined to be a fast-recharging well during development, did not recharge rapidly enough to use the submersible pump and was purged and sampled using a Teflon® bailer after the required well volume was removed although not all water parameters had stabilized. Although turbidity remained above the accepted parameter, the other parameters were used to determine well stabilization. Groundwater sampling records are presented in Appendix E.

Surface Water and Sediment Sampling

One surface water and one collocated sediment sample were collected from the boggy area to the south (downgradient) of the landfill to determine whether contaminants were migrating out of the landfill. The surface water sample had a brown-yellow tint; surface water may have been slightly agitated by recent heavy wind and rain. Slight disturbance of the underlining muck was unavoidable during sampling. Water depth was between 0 and 1 foot with a loose organic muck bottom greater than 3 feet thick; a solid bottom was not detected. The sediment sample, taken from the same location, was collected using a dredge from 1 to 1.5 feet below water surface. The sample consisted of decayed organic matter and had a slight sulfuric odor.

4.2.2.4 Findings

The following is a discussion by media of analytes exceeding cleanup levels at the Point Carrew Garrison dump area (Concerns C2, C3, and C4). A summary of elevated analytical results is

presented as Table 4-3. Complete analytical results from the 2000 investigation are presented in Appendix A, Tables 6, 7, and 8.

Surface Soil

DRO was detected in six surface soil samples at concentrations from 21 mg/kg to 2,200 mg/kg. Three reported values exceeded the ADEC Method Two soil cleanup level of 230 mg/kg. The concentration at sample location C2SS014 in the surface debris area (C4) was reported at 1,200 mg/kg; while 2,200 mg/kg DRO was reported at location C2SS016 in the southwest corner of the drum dump (C2). DRO was detected at a concentration of 250 mg/kg in the QA referee sample collected from location C2SS015 in the surface debris area; however, DRO concentrations were not reported below the detection level of 40 mg/kg in the associated primary sample. The DRO concentrations reported in the primary sample and the associated field QC duplicate sample (21 mg/kg) show reasonable correlation, suggesting the elevated concentration of the single QA referee sample was an aberration at this location. Analytical results for the QA referee soil samples are presented in Table 27, Appendix A. DRO in surface soil will be considered a COPC at the surface debris area (Concern C4) and the drum dump (Concern C2).

Silver was detected at a concentration that slightly exceeded the ADEC Method Two soil cleanup level of 19 mg/kg at location C2SS004 (26 mg/kg) in the southeast corner of the drum dump (C2). Silver in surface soil will be considered a COPC at the drum dump (Concern C2).

Arsenic was detected at concentrations from 1.4 mg/kg to 14 mg/kg. Fourteen reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported arsenic concentrations exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in surface soil will not be considered a COPC at these concerns.

Chromium was detected at concentrations from 17 mg/kg to 49 mg/kg. Sixteen reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. Reported concentrations at two locations in the surface debris area (C2SS010, 49 mg/kg; and C2SS012, 46 mg/kg) exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in surface soil will be considered a COPC at the surface debris area (Concern C4).

Although pentachlorophenol was not detected in any of the surface soil samples, low percent solids in one sample slightly elevated the MQL above the ADEC Method Two soil cleanup level of 9 µg/kg. However, because pentachlorophenol was not detected in any soil or water samples collected from this area, it is not considered a COPC in any media at these concerns.

Besides DRO, silver, and chromium, no other analytes in surface soils are considered as COPCs at these concerns.

Table 4-1. Concerns C2, C3, C4 – Summary of Elevated Analytical Results.

Location	Analyte	Result (mg/kg)	Cleanup Level (mg/kg)
Surface Soils			
C2SS001	Arsenic	2.3	1.8
	Chromium	34	23
C2SS002	Arsenic	2	1.8
	Chromium	36	23
C2SS003	Arsenic	1.5	1.8
	Chromium	31	23
C2SS004	Arsenic	2.3	1.8
	Chromium	38	23
	Silver	26	19
C2SS005	Arsenic	3.8	1.8
	Chromium	35	23
C2SS006	Arsenic	3.3	1.8
	Chromium	30	23
C2SS007	Arsenic	1.6	1.8
	Chromium	27	23
C2SS008	Arsenic	1.8	1.8
	Chromium	26	23
C2SS009	Arsenic	1.9	1.8
	Chromium	30	23
C2SS010	Arsenic	14	1.8
	Chromium	49	23
C2SS011	Arsenic	4	1.8
	Chromium	32	23
C2SS012	Arsenic	6.7	1.8
	Chromium	46	23
C2SS013	Arsenic	3.1	1.8
	Chromium	23	23
C2SS014	DRO	1200	230
	RRO	7900 J	8300
	Arsenic	4.6	1.8
	Chromium	39	23
C2SS015	Arsenic	8.3	1.8
	Chromium	30	23
C2SS016	DRO	2200	230
	Arsenic	1.4	1.8
	Chromium	17	23
C2SS017	Arsenic	6.4	1.8
	Chromium	37	23
C2SS018	Arsenic	2	1.8
	Chromium	27	23

Table 4-3. Concerns C2, C3, C4 – Summary of Elevated Analytical Results. (Continued)

Location		Analyte	Result (*mg/kg*)	Cleanup Level (*mg/kg*)
Soil Borings				
AP-019	(0-2' bgs)	Arsenic	2.3	1.8
		Chromium	25	23
	(2-4' bgs)	Arsenic	2.8	1.8
		Chromium	24	23
AP-020	(0-2' bgs)	DRO	1300	230
		Arsenic	3.5	1.8
		Chromium	24	23
	(2-4' bgs)	DRO	2400 J	230
		Arsenic	2.4	1.8
		Chromium	20	23
AP-021	(0-2' bgs)	Arsenic	1.3	1.8
		Chromium	25	23
	(2-4' bgs)	Arsenic	1.6	1.8
		Chromium	23	23
AP-022	(0-2' bgs)	Arsenic	2.2	1.8
		Chromium	36	23
	(2-4' bgs)	Arsenic	3.2	1.8
		Chromium	21	23
AP-023	(0-2' bgs)	Arsenic	4	1.8
		Chromium	37	23
	(2-4' bgs)	Arsenic	3.6	1.8
		Chromium	24	23
AP-024	(0-2' bgs)	Arsenic	3.2	1.8
		Chromium	23	23
	(2-4' bgs)	Arsenic	3.5	1.8
		Chromium	22	23
Sediment				
C2SD001		DRO	610	NA
		Arsenic	4.8	NA
		Chromium	12 J	NA
		Cadmium	3.4 J	NA
		Selenium	2.7 J	NA
Location		**Analyte**	**Result (*mg/L*)**	**Cleanup Level (*mg/L*)**
Groundwater				
AP-020		DRO	0.86	1.5
AP-023		Arsenic	0.028	0.05
		Chromium	0.085	0.1
		Lead	0.0094 J	0.015
AP-024		Chromium	0.054	0.1

Table 4-3. Concerns C2, C3, C4 – Summary of Elevated Analytical Results. (Continued)

Location	Analyte	Result *(mg/L)*	Cleanup Level (*mg/L)*
Surface Water			
C2SW001	DRO	1.2 J	NA
	Lead	0.013	NA

Notes:
All analytes detected greater than one-half the cleanup levels are presented.
Sediment analytes detected greater than one-half the ADEC Method Two soil cleanup level are presented.
Surface water analytes detected greater than one-half the ADEC Groundwater cleanup levels are presented.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
DRO = Diesel Range Organics
RRO = Residual Range Organics
J = Result is considered an estimate value
' bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
NA = Not applicable
QA/QC = Quality Assurance/Quality Control

Soil Borings

DRO concentrations were detected in both boring samples from AP-020 at levels that exceeded the ADEC Method Two soil cleanup level of 230 mg/kg (1,300 mg/kg at 0-2 feet bgs; and 2,400 mg/kg at 2-4 feet bgs). The DRO concentration reported for sample 00C2B2004SO (2,400 mg/kg) exceeded the calibration range of the testing instrument and was considered an estimated value. DRO in subsurface soil will be considered a COPC at the surface debris area (Concern C4).

Arsenic was detected at concentrations from 1.3 mg/kg to 4.0 mg/kg. Ten reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported arsenic concentrations exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in subsurface soil will not be considered a COPC at these concerns.

Chromium was detected at concentrations from 20 mg/kg to 37 mg/kg. Seven reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. However, none of the reported chromium concentrations exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in subsurface soil will not be considered a COPC at these concerns.

The soil sample collected from 0 to 2 feet bgs in AP-020 did not allow VOC analyzes by the low-concentration VOC method due to excessive amounts of non-target interference (DRO). This sample was analyzed by the high-concentration VOC method, which elevated MQLs of some VOC analytes above the ADEC Method Two soil cleanup levels. Most of the VOCs in AP-020 with MQLs above the ADEC Method Two soil cleanup level were not detected in any other soil boring sample at this site. However, benzene and trichloroethene were detected at very low levels below their respective cleanup levels in the second sample from this boring. The presence of benzene and trichloroethene at concentrations above the ADEC Method Two soil cleanup levels in the soil sample collected from 0 to 2 feet bgs in AP-020 was indeterminate. VOCs in subsurface soils will not be considered as COPCs at these concerns.

Besides DRO, no other analytes in subsurface soils are considered to be COPCs at these concerns.

Groundwater

All groundwater analytical results were below ADEC groundwater cleanup levels. No analytes in groundwater are considered as COPCs at this site.

Surface Water

Surface water analytical results were below AWQS cleanup levels. No analytes in surface water are considered as COPCs at this site.

Sediment

Sediment results were compared to ADEC Method Two soil cleanup levels and background concentrations as first-level conservative screening tools. The published minimum sediment cleanup level (MCULs) for sediments developed by the State of Washington Department of Ecology were used as a second-level conservative screening tool. The sediments being evaluated at this site are *freshwater* sediments; therefore, these standards are not directly applicable but should be viewed as a second-level conservative screening tool in COPC selection. Please refer to Section 3.9 for more information on selection of COPCs in sediment.

DRO was detected in the sediment sample at 610 mg/kg. The reported value was above the ADEC Method Two soil cleanup level of 230 mg/kg. No MCUL has been established for DRO. DRO in sediment will be considered a COPC at the drum dump (Concern C2).

Arsenic was detected at 4.8 mg/kg. This reported value was above the ADEC Method Two soil cleanup level of 1.8 mg/kg, but was below the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). The MCUL for arsenic is 93 mg/kg. Because the reported arsenic concentration is below the MCUL and background concentration, arsenic in sediment will not be considered a COPC at these concerns.

Methylene chloride was reportedly detected in the sediment sample at 11 mg/kg. Methylene chloride was also detected in the associated trip blank for this sample. Trip blank analytical

results are presented in Appendix A, Tables 25 and 26. The Data Assessment Report (included as Appendix B) recommends the reported value be considered non-detect due to the demonstrated field- and/or laboratory-introduced contamination. The ADEC Method Two soil cleanup level for methylene chloride is 10 mg/kg. No MCUL has been established for methylene chloride. However, since the reported methylene chloride concentration was recommended to be considered non-detect, it will not be considered a COPC in sediment at these concerns.

The sediment sample exhibited a low percent solids of 8.3 percent. The very low percent solids elevated the MQLs for all analytes tested for in this sample. The elevated MQLs of some analytes were above the ADEC Method Two soil cleanup levels used as a first-level (conservative) screening tool. In particular, the presence of pentachlorophenol, and five pesticides above the ADEC Method Two soil cleanup levels was indeterminate. However, the MQL for pentachlorophenol was below the MCUL of 360 µg/kg, and pentachlorophenol was not detected in any soil or water samples collected from this area. Therefore, it is not considered a COPC in any media at these concerns. MCULs have not been set for pesticides, however none were detected in any soil or water samples collected from this area. Therefore, pesticides are not considered a COPC in any media at these concerns.

Besides DRO, no other analytes in sediment are considered to be COPCs at these concerns.

Summary of Findings

The investigative objectives at the Point Carrew Garrison dump area (Concerns C2, C3 and C4) were to delineate the extent of buried debris in the drum dump and surface debris areas; conduct follow-up sampling to determine whether contaminants are present in the surface soil, subsurface soil, and groundwater; identify contaminants possibly migrating out of the landfill; and assess the presence of fuel and PCB contamination associated with the former powerhouse. The drum dump (C2) delineated by the geophysical survey covers an area of approximately 13,000 square feet. The surface debris area (C4) covers an area of approximately 830 square feet although nonmetallic debris may cover a larger area. Eighteen surface samples, twelve soil boring samples, four groundwater samples, and one collocated surface water and sediment samples were collected and analyzed.

DRO was documented in three surface soil samples, two soil boring samples, and the sediment sample at concentrations above the ADEC Method Two soil cleanup level. The lateral and vertical extent of DRO contamination was not determined; however, the elevated levels were detected in samples from the surface debris area (C4), and the southern edge of the dump site (C2). However, groundwater and surface water samples contained detectable concentrations of DRO below ADEC cleanup levels. DRO will be considered a COPC in surface soil, subsurface soil, and sediment at the drum dump (Concern C2) and surface debris area (Concern C4).

Silver was reported in one surface soil sample collected from the drum dump (C2) at a concentration above the ADEC Method Two soil cleanup level. Silver in surface soil will be considered a COPC at the drum dump (Concern C2).

Chromium was reported in two surface soil samples at concentrations above the background levels. Both samples were collected from the surface debris area (C4). Chromium in surface soil will be considered a COPC at the surface debris area (Concern C4).

No PCB or fuel contamination was found to be associated with the former powerhouse. No COPCs were identified at the former powerhouse location.

No other analytes are considered COPCs at this site.

4.3 Site E: Northwest Drum Dump/Quartermaster Loop Area

4.3.1 Concern E1: Drum Dump – Remaining Debris and Potential Contamination

In support of the runway and airfield facility construction, petroleum products were transported in 55-gallon drums to the Yakutat Air Base area. Empty 55-gallon drums were stockpiled in several clearings north of the airport. One stockpile area previously containing drums is referred to as the Northwest Drum Dump and is located in a clearing on the south side of the rifle range access road off the east side of Quartermaster Loop, approximately 300 feet north of Colorado Road (Oil Spill Consultants, Inc. [OSCI] 1999). This area was the site of a drum removal action that was conducted by the USAED-AK during 1999. Additional details concerning the removal action are presented in Section 4.3.2.1, below.

ENSR performed an initial site walkover in October 1999. At the time of the site walkover, this area was under 2 to 4 inches of water, making it difficult to see anything beyond the edge of the road. The water level was lower during the 2000 field investigation, allowing better access to the area. Site workers from the drum-removal project provided guidance regarding the former locations of the drums. No surface debris were observed remaining after the 1999 removal actions. A site map is presented as Figure 4-4.

4.3.1.1 Objectives

The primary objective at this drum dump was to confirm that no surface and subsurface debris or contaminants remain following the 1999 drum-removal activities.

4.3.1.2 Previous Investigations

Four previous investigations have been conducted at the Northwest Drum Dump (Concern E1). The following is a summary of the findings.

1994 – Field Investigation Report, Former Yakutat Air Base

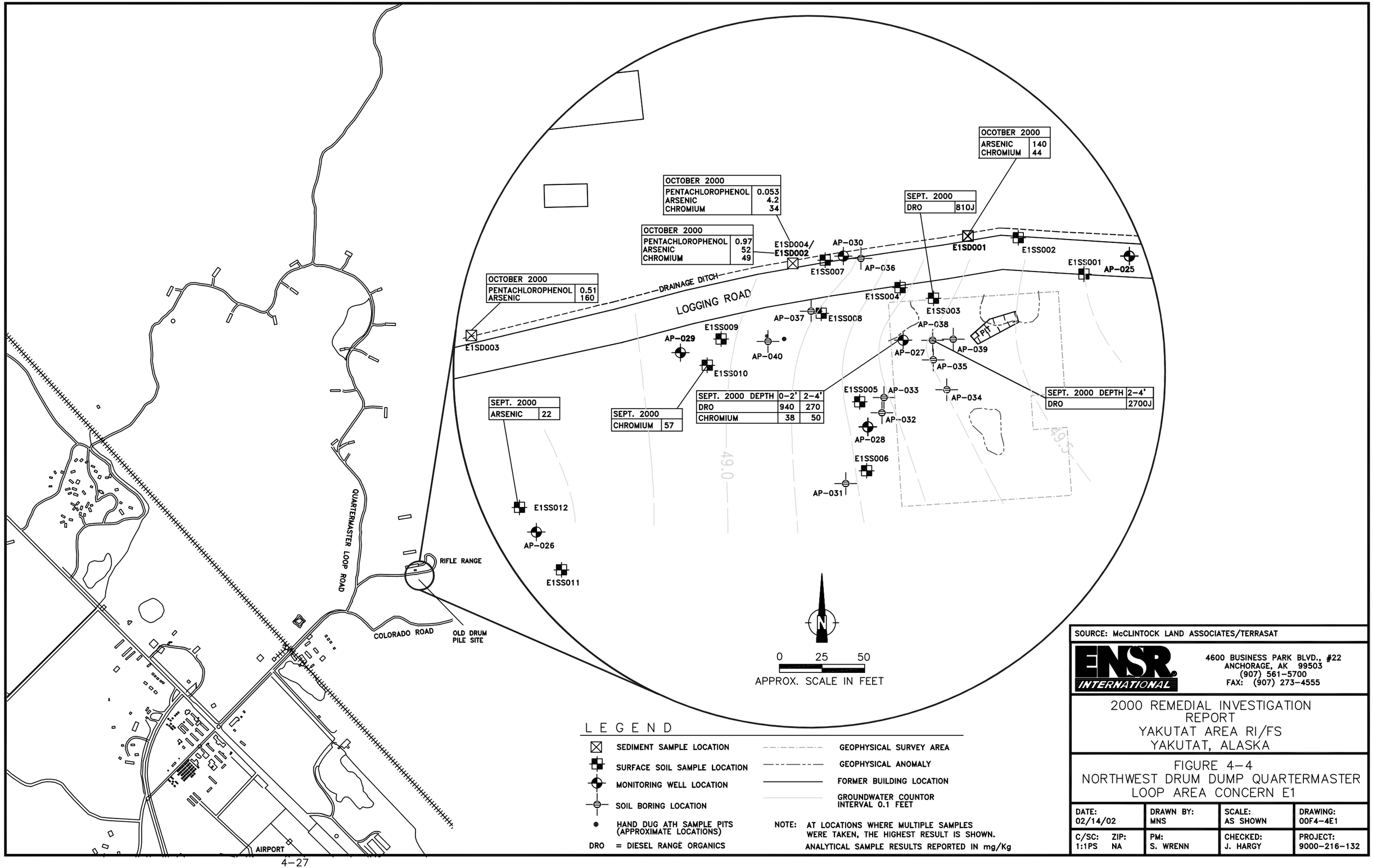
In 1994, an investigation of this area included the collection of one sediment and three triplicate soil samples from a drum area (E&E 1994). It appears from the site map that the samples were collected from a drum dump on the east side of Quartermaster Loop Road, 300 to 400 feet north of the rifle range access road. DRO concentrations in each sample (2,500 mg/kg in the sediment sample and ranging from 145 to 322 mg/kg in the soil samples) were above ADEC matrix score-sheet cleanup guidance Level A values. TRPH was detected in all of the samples; however, only the sediment sample (7,800 mg/kg) exceeded cleanup levels. The area of contamination was estimated to be 160,000 square feet. Depth of contamination was not determined.

1996 – Summary Investigation of DoD Activities on Yakutat Tribal Lands

In 1996, another investigation included the collection of one sediment sample from a drainage ditch downslope of the drum dump sampled in 1994. It appears that this sample was collected from the drainage ditch on the north side of the rifle range access road, south of the 1994 sample locations. No COCs were identified in this sample (AGRA 1997).

1997 – Yakutat Air Base/Ocean Cape Radio Relay Site Investigation Report

In 1997, samples were again collected in this area (E&E 1997). Seven surface soil samples were collected among the estimated 400 to 500 drums scattered over approximately 300 feet "along the east side of a trail off Colorado Road" (E&E 1997). It appears that the samples were collected from the southeast side of the rifle range access road in the area now referred to as the Northwest Drum Dump. One additional soil sample was collected from the north end of the drum dump at what appeared to be a berm for the former rifle range. The drums were described as rusted, and most were punctured or rusted through and overgrown with vegetation. Elevated concentrations of butyl benzyl phthalate were detected in two of eight surface soil sample locations at 580 µg/kg and 650 µg/kg. Two of eight surface soil samples contained elevated concentrations of lead. However, lead concentrations exceeded regulatory guidelines in only the surface soil sample (2982.5455 mg/kg) collected from the former rifle range berm at the north end of the drum dump. Two samples contained DRO concentrations at 3,500 mg/kg and 11,000 mg/kg, and one sample contained RRO concentrations at 26,000 mg/kg. All of these samples exceeded the ADEC matrix score sheet cleanup guidance Level A values. Four sediment samples were also collected from the drainage alongside the drum dump. No elevated contaminant concentrations were observed in the sediment samples. Samples were also collected from other rifle ranges in the area. Concentrations of lead were reported above the EPA Region 3 RBC for soil ingestion on residential sites and the State of Alaska maximum contaminant level for drinking water regulatory guidelines (E&E 1997).



SOURCE: McCLINTOCK LAND ASSOCIATES/TERRASAT

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2000 REMEDIAL INVESTIGATION
REPORT
YAKUTAT AREA RI/FS
YAKUTAT, ALASKA

FIGURE 4-4
NORTHWEST DRUM DUMP QUARTERMASTER LOOP AREA CONCERN E1

DATE: 02/14/02	DRAWN BY: MNS	SCALE: AS SHOWN	DRAWING: 00F4-4E1
C/SC: 1:1PS ZIP: NA	PM: S. WRENN	CHECKED: J. HARGY	PROJECT: 9000-216-132

1999 – Draft Remedial Action Report for Northwest Area Drum Dump

In 1999, a removal action was performed at the Northwest Drum Dump by OSCI under contract to the USACE. The Army initiated a cleanup to remove and dispose of an estimated 700 drums. According to the Draft Remedial Action Report (OSCI 1999), a total of 569 drums were removed, washed, crushed, and placed in connex shipping containers. In addition, 12,513 pounds of metal debris (i.e., culvert, cable spools, and farm equipment) were removed, crushed, and placed in connex shipping containers. Approximately 3.5 cubic yards of contaminated soil were also excavated from the site. The drums, metal debris, and contaminated soil were shipped to Seattle, Washington, for disposal. Soil samples collected following the removal action reported concentrations of DRO up to 28,600 mg/kg and RRO up to 20,000 mg/kg remaining at the site.

4.3.1.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objective at the Northwest Drum Dump (Concern E1). Sample locations are shown on Figure 4-4.

Geophysical Survey

A geophysical survey was conducted at this site prior to sampling activities to delineate the extent of remaining debris. The results of the survey indicate three anomalies, which suggest the presence of small amounts of surface metal or small near-surface targets. One anomaly in the northwest corner of the survey grid was attributed to surface metal (rust flakes). This surface metal may mask buried target(s) outside of the survey area. Moderately sized anomalies (grouped as one) suggest surface metal or a couple of small near-surface targets. Weak anomalies (grouped as one) suggest a few insignificant near-surface targets.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

Surface Soil Sampling

Twelve surface locations at the Northwest Drum Dump area were sampled to determine whether surface soil contamination exists. Surface soil sample locations were located within and around the area where the drums were originally stacked and along the drainage ditch on the opposite side of the road. Between 3.5 and 6 inches of moss, debris, and other surface materials were removed from each sample location before the mineral soil was collected. Over 2 feet of peat covered some of the investigation area. The surface soil samples consisted of gray gravelly sands. The PID readings for these samples were consistently 0.0 ppm.

Soil Borehole Sampling

Six soil borings were advanced to depths of 8 to 10 feet bgs to determine whether contaminants were present in subsurface soils. Borings were placed within and around the area where the drums were originally located (as identified by site workers) and along the drainage ditch on the opposite side of the road. Two drive samples were collected in the first 4 feet of the borings for sample collection and subsurface characterization. The borings were then advanced to total depth for installation of a monitoring well. Boring logs are presented in Appendix D.

Soil contamination (presumed to be petroleum hydrocarbons) was encountered while drilling AP-027. In order to define the lateral extent of the contamination, an additional 10 exploration borings (AP-031 through AP-040) were advanced to depths of 4 to 4.5 feet bgs to delineate the extent of soil contamination. Only a single soil sample was collected from the exploration borings. Contamination appeared to be located in a limited zone approximately 2 feet bgs. Two shallow pits were hand dug to 2 feet in depth, approximately 70 and 80 feet west of AP-027, to find an uncontaminated location for soil boring and well installation. No analytical samples were collected from these shallow pits. However, PID readings from these pits were 9.1 and 7.2 ppm. It appeared that contamination extends (if only in low concentrations) to the west of AP-027. Much of the area is scattered with rust flakes, suggesting that this was within the former drum storage area, and petroleum hydrocarbons observed in this area are likely associated with the drums.

Each boring encountered 3.5 and 6 inches of organics material (i.e., moss, muskeg, and peat). Subsurface soils in this area generally consisted of gray, poorly graded coarse gravel to sandy gravel. Sand grains were medium to coarse in size and mottled in places. Cobbles were encountered in four of the borings. A light gray, medium to coarse sand layer was encountered on the western part of the site and in AP-034. In the area of suspected contamination, PID readings ranged from 31.5 to 540.0 ppm. The maximum PID readings were detected in soil boring AP-027. PID readings ranged between 0.0 and 7.3 ppm in the borings outside of the suspected contaminated area.

The six soil borings were completed as monitoring wells. The additional 10 exploration borings were only advanced to delineate the extent of soil contamination, and were not completed as monitoring wells. Well construction diagrams are presented in Appendix D. Well development records are presented in Appendix E.

Groundwater Sampling

Samples were collected from each well to determine whether contaminants were leaching into the groundwater. Groundwater levels measured on the day of sampling ranged from the ground surface to 10 inches bgs. The groundwater flow direction appears to be toward the west. Groundwater contours are shown on Figure 4-4. Much of the area was covered by up to 6 inches of water at the time of sampling. Each well was purged and sampled as a fast

recharging well in accordance with the groundwater sampling plan. Groundwater sampling records are presented in Appendix E.

Sediment Sampling

Four sediment samples were collected from the drainage ditch on the north side of the road to determine if contaminants were migrating from the prior drum stockpile area. At the time of sampling the ditch was 4 to 6 feet deep and filled with 3 to 4 feet of sticks, leaves, and muck. One to two feet of brown stagnant water covered the muck. The top 6 inches of decomposed organics were removed from each sample location prior to sample collection. The sample from location E1SD001 was described as decayed organic black muck collected from 1.5 to 2.0 feet below surface water. The sample from location E1SD002 consisted of fine sand and silt with minor black muck and was collected from 2.0 to 2.5 feet below surface water. The sample from location E1SD003 consisted of decayed organic black muck and was collected from 2.5 to 3.0 feet below the water surface. The sample from location E1SD004 was gray-brown fine to medium sand with silt and trace gravel, and was collected from the bottom of the ditch, 3.5 to 4.0 feet below water surface.

4.3.1.4 Findings

The following is a discussion by media of analytes detected with concentrations exceeding cleanup levels at the Northwest Drum Dump (Concern E1). A summary of elevated analytical results is presented as Table 4-4. Complete analytical results from the 2000 investigation are presented in Appendix A, Tables 9, 10, and 11.

Surface Soil

DRO was detected above the ADEC Method Two soil cleanup level of 230 mg/kg in both primary (570 mg/kg) and field QC duplicate (630 mg/kg) samples collected at location E1SS03. DRO was detected at only one other surface soil sample location (E1SS08, 45 mg/kg), below the ADEC Method Two soil cleanup level. DRO in surface soil will be considered a COPC at this concern.

Arsenic was detected at concentrations from 0.54 mg/kg to 22 mg/kg in surface soil. Ten of the twelve reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. One reported arsenic concentration, located at the west end of the investigation area at sample location E1SS012 (22 mg/kg), exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in surface soil will be considered a COPC at this concern.

Chromium was detected at concentrations ranging from 18 mg/kg to 57 mg/kg. Eleven of the twelve reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. One reported chromium concentration, located in approximately 25 feet from the logging road at sample location E1SS010 (57 mg/kg), exceeded the background concentration of 41.47 mg/kg

Table 4-1. Concern E1 – Summary of Elevated Analytical Results.

Location		Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Surface Soil				
E1SS001		Arsenic	4.2	1.8
		Chromium	30	23
E1SS002		Arsenic	2.7	1.8
		Chromium	29	23
E1SS003		DRO	810 J	230
		Arsenic	4.2	1.8
		Chromium	36	23
E1SS004		Arsenic	2.6	1.8
		Chromium	33	23
E1SS005		Chromium	27	23
E1SS006		Arsenic	1.6	1.8
		Chromium	28	23
E1SS007		Arsenic	2.3	1.8
		Chromium	33	23
E1SS008		Arsenic	2.2	1.8
		Chromium	22	23
E1SS009		Arsenic	7.3	1.8
		Chromium	26	23
E1SS010		Arsenic	13	1.8
		Chromium	57	23
E1SS011		Arsenic	2.6	1.8
		Chromium	31	23
E1SS012		Arsenic	22	1.8
		Chromium	31	23
Soil Borings				
AP-025	(0.5-2.5' bgs)	Arsenic	2.5	1.8
		Chromium	23	23
	(2.5-4.5' bgs)	Arsenic	2.7	1.8
		Chromium	33	23
AP-026	(0-2' bgs)	Arsenic	5.6	1.8
		Chromium	33	23
	(2-4' bgs)	Arsenic	5	1.8
		Chromium	36	23
AP-027	(0-2' bgs)	DRO	940	230
		Arsenic	7.9	1.8
		Chromium	38	23
	(2-4' bgs)	DRO	270	230
		Arsenic	5.1	1.8
		Chromium	50	23
AP-038	(2-4' bgs)	DRO	2700 J	230

Table 4-4. Concern E1 – Summary of Elevated Analytical Results. (Continued)

Location	Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Sediments			
E1SD001	Arsenic	140	NA
	Chromium	44	NA
	Selenium	2.4 J	NA
E1SD002	DRO	130	NA
	Arsenic	52	NA
	Chromium	49	NA
	Pentachlorophenol	0.97	NA
E1SD003	DRO	120 J	NA
	Arsenic	160	NA
	Chromium	22	NA
	Pentachlorophenol	0.51	NA
E1SD004	Arsenic	4.2	NA
	Chromium	34	NA
	Pentachlorophenol	0.053	NA

Notes:
All analytes detected greater than one-half the cleanup levels are presented.
Sediment analytes detected greater than one-half the ADEC Method Two soil cleanup level are presented.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
DRO = Diesel Range Organics
J = Result is considered an estimate value
' bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
NA = Not applicable
QA/QC = Quality Assurance/Quality Control

(see Section 4.1.1 for discussion of background concentrations). Chromium in surface soil will be considered a COPC at this concern.

Although pentachlorophenol was not detected in any of the surface soil samples, due to low percent solids, the MQL of a field QC duplicate sample (9.3 µg/kg) was elevated slightly above the ADEC Method Two soil cleanup level of 9 µg/kg. Pentachlorophenol was not detected in the associated primary sample at a MQL of 7.4 µg/kg and therefore is not considered a COPC in surface soil at this concern.

Besides DRO, arsenic, and chromium, no other analytes in surface soils are considered to be COPCs at this concern .

Soil Borings

DRO was detected in three soil boring soil samples. Reported values from boring AP-027 (0-2 feet bgs, 940 mg/kg; and 2-4 feet bgs, 270 mg/kg) and boring AP-038 (2-4 feet bgs, 2,700

mg/kg) exceeded the ADEC Method Two soil cleanup level of 230 mg/kg. These two boring locations are in the same area as the surface soil location where an elevated DRO concentration was detected. DRO in subsurface soil will be considered a COPC at this concern.

Arsenic was detected at concentrations of 2.5 mg/kg to 7.9 mg/kg, exceeding the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported values exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in subsurface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations ranging from 23 mg/kg to 50 mg/kg. Five of the thirteen reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. One reported concentration from AP-027 (2-4 feet bgs, 50 mg/kg) exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in subsurface soil will be considered a COPC at this concern.

DRO concentrations in the two samples from soil boring AP-027 did not allow VOC analyzes by the low-concentration VOC method due to non-target interference (DRO). These soil samples (analyzed by the high-concentration VOC method) were diluted at a factor of 1,000 to prevent analytical instrument contamination problems. This dilution elevated MQLs of some VOC analytes above the ADEC Method Two soil cleanup levels. However, none of the VOCs in soil samples from AP-027 with elevated MQLs were detected in any other soil boring sample at this site. VOCs in subsurface soil are not considered as COPCs at this concern.

The non-detected analytical results for silver in the boring samples were rejected in the chemical data quality review due to technical deficiency of low recovery in matrix spike analysis. However, the silver non-detected results in the surface soil samples were not rejected. Silver was not detected in any soil or water sample at this concern and is not considered a COPC.

Besides DRO and chromium, no other analytes in subsurface soils at this concern are considered to be COPCs.

Groundwater

All groundwater analytical results were below ADEC groundwater cleanup levels. No analytes in groundwater are considered as COPCs.

Sediment

Sediment results were compared to ADEC Method Two soil cleanup levels and background concentrations as first-level conservative screening tools. The published MCULs for sediments developed by the State of Washington Department of Ecology were used as a second-level conservative screening tool. The sediments being evaluated at this site are *freshwater* sediments; therefore, these standards are not directly applicable but should be viewed as a second-level conservative screening tool. These standards are not directly applicable but

should be viewed as conservative screening tools in COPC selection. Please refer to Section 3.9 for more information on selection of COPCs in sediment

Pentachlorophenol was detected in three of four sediment samples at concentrations from 0.053 mg/kg to 0.97 mg/kg, which were above the ADEC Method Two soil cleanup level of 0.009 mg/kg. One of the sediment sample concentrations (00E1SD002SE, 0.97 mg/kg) was also above the MCUL for pentachlorophenol (0.69 mg/kg). Therefore, pentachlorophenol in sediment will be considered a COPC at Concern E1.

Arsenic was detected at concentrations from 3.4 mg/kg to 160 mg/kg, which were above the ADEC Method Two soil cleanup level of 1.8 mg/kg. Three of the four reported values were above the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Two of the reported concentrations (sample locations E1SD001 and E1SD003) were also above the MCUL for arsenic (93 mg/kg). Due to the elevated level of arsenic reported in sediment samples, arsenic in sediment will be considered a COPC at this concern.

Chromium was detected at concentrations from 22 mg/kg to 49 mg/kg. Three of the four reported values were above the ADEC Method Two soil cleanup level of 23 mg/kg. Two of the sediment sample concentrations (sample locations E1SD001 and E1SD002) were also above the background concentration of 41.47 mg/kg described in Section 4.1.1. None of the sample concentrations were above the MCUL for chromium (270 mg/kg). However, because chromium, arsenic, and pentachlorophenol are common wood preservatives and both arsenic and pentachlorophenol have been identified as COPCs in sediment at this concern, chromium in sediment will also be considered a COPC at Concern E1.

The sediment sample from location E1SD001 exhibited a low percent solids of 9.3 percent. The low percent solids elevated the MQLs for all analytes tested for in this sample. The elevated MQLs of some analytes were above the ADEC Method Two soil cleanup levels. In particular, the presence of pentachlorophenol, DRO, and five pesticides above the ADEC Method Two soil cleanup levels was indeterminate. There is a probability that pentachlorophenol is present at this location above the first-level screening tool based on the concentrations found in the other sediment samples. DRO may be present at an elevated concentration; however, it was not detected in the nearest surface soil sample (approximately 25 feet up-gradient) and any sediment samples downgradient. Based on surrounding sample results, DRO will not be considered a COPC in sediment. Pesticides are not considered COPCs since none were detected in any sample collected at this site, including surface soil, subsurface soil, and groundwater samples.

Sediment samples from locations E1SD002 and E1SD003 also exhibited a low percent solids of 28 percent and 16 percent, respectively, elevating MQLs. In particular, the presence of pesticides above the ADEC Method Two soil cleanup levels was indeterminate. MCULs have not been set for pesticides; however, no pesticides were detected in any soil or water samples

collected from this area. Therefore, pesticides are not considered a COPC in any media at these concerns.

Besides DRO, pentachlorophenol, arsenic, and chromium, no other analytes in sediment are considered to be COPCs at this concern.

Summary of Findings

The investigative objective at this concern was to confirm that no surface and subsurface objects or contaminants remained following the drum-removal activities. Twelve surface samples, thirteen soil boring samples, six groundwater samples, and four sediment samples were collected and analyzed. This investigation reports evidence that contamination remains. However, it appears that no surface or subsurface debris remains in the area investigated.

DRO was detected at concentrations that exceeded the ADEC Method Two soil cleanup level in one surface soil sample and thee soil boring samples. The lateral and vertical extent of DRO contamination was not fully defined; however, the elevated levels were detected in samples from the general area around rust flakes presumed to be associated with the drums previously stored at this location. The exploration borings suggest contamination is primarily limited to a depth of approximately 2 feet bgs and extends to at least 4 feet bgs at the AP-027 location. Two groundwater samples (from AP-027 and AP-028) contained detectable concentrations of DRO below ADEC groundwater cleanup levels. DRO will be considered a COPC in surface and subsurface soil at this concern.

Pentachlorophenol was detected above screening levels in three sediment samples collected from the drainage ditch bounding the north edge of the investigation area. The presence of pentachlorophenol in the remaining sediment sample was indeterminate due to elevated MQLs. Pentachlorophenol in sediment will be considered a COPC at this concern.

Arsenic was detected at concentrations above background concentration in one surface soil sample. All four sediment samples contained arsenic above screening levels. The lateral and vertical extent of arsenic contamination was not determined. Arsenic will be considered a COPC in surface soil and sediment at this concern.

Chromium was detected at concentrations above the background concentration in one surface soil sample and one subsurface soil sample. Three sediment samples also contained elevated levels of chromium. The lateral and vertical extent of chromium contamination was not determined. Chromium will be considered a COPC in surface soil, subsurface soil, and sediment at this concern.

No other analytes are considered COPCs at this concern.

4.4 Site G: Minor Naval Air Facility (Seaplane Base)

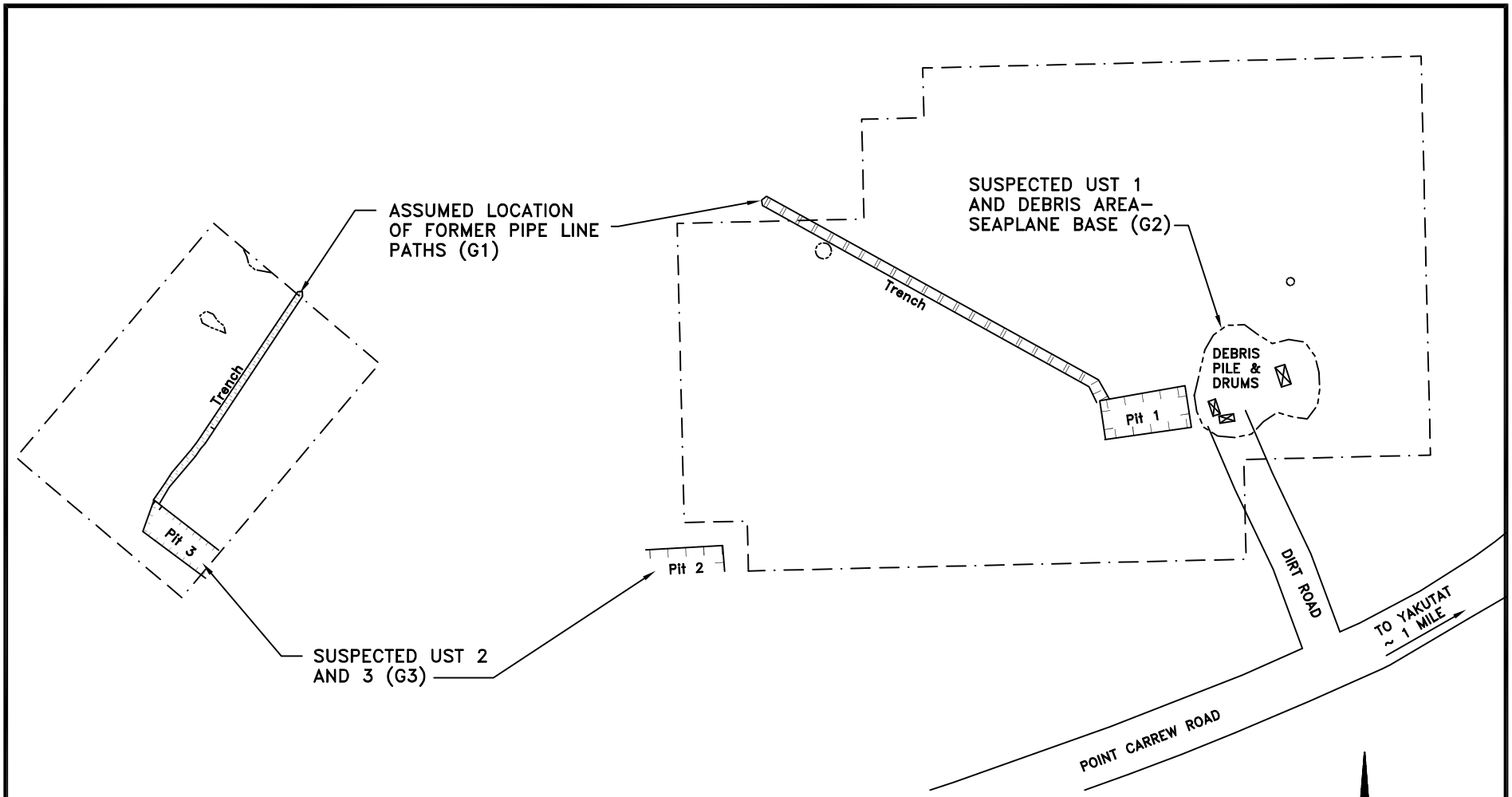
The Minor Naval Air Facility and Seaplane Base was constructed between 1942 and 1943 to dock, house, and repair military floatplanes. Facilities accommodated 12 scout observation planes and 4 patrol bombers. Seven barracks and three officers' quarters with mess facilities in separate structures were built to house 104 people. A two-story temporary structure and Quonset hut were built for offices, the dispensary, and radio transmitter/receiving stations. A total of 27,600 square yards was graded and surfaced for the warm-up apron, taxiway, and floatplane parking area. The 283-foot-long seaplane ramp was built of standard concrete and specialized treated timber construction. The lower 108 by 50 feet portion, or connecting section, consisted of a creosote-soaked timber raft countersunk with concrete weights. Power was supplied by a 50-kilowatt (kW) and 30-kW diesel-electric generator fueled by a 100-gallon gravity-filled diesel oil tank (U.S. Government Printing Office 1947). Initially, three 25,000-gallon USTs and the corresponding fueling system were intended to be built as part as the Seaplane Base POL System. A 1943 field progress report indicated that one tank was useable and noted that the remaining two tanks "may be deleted" from the construction schedule. It was not known if more than one tank was ever installed at the site. A site map is presented as Figure 4-5.

The majority of the Minor Naval Air Facility infrastructure was removed during the 1984 cleanup efforts.

4.4.1 Concern G1, G2, and G3: Former Pipeline Paths, Suspected UST 1 and Debris, and Suspected USTs 2 and 3.

The three concerns (G1, G2, and G3) were grouped as one (G) during field activities due to the association between the USTs and pipelines and the close proximity of the debris area to one of the UST pits. The site location is on the north side of Point Carrew Road, just past the road leading to the seaplane ramp, approximately 1 mile from the Point Carrew Road junction.

Three rectangle-shaped excavation pits filled with water and/or soil were present in the area and are suspected to be former UST locations. Pronounced visible spoil piles can be seen on each end of the pits. Several ditches were also present at this site. These ditches were about 2 feet deep and run from the suspected UST pits downhill toward the dock area. The ditches are suspected to be the former locations of the piping system that connected the USTs to the Seaplane Base (Figure 4-5). A review of historical construction records created during World War II leaves some doubt about whether all three of the tanks were installed. The Field Progress Report for Yakutat Landing Field for the period ending June, 30 1943, indicates that under Navy construction, the “gasoline system” consisted of three steel, 25,000-gallon tanks. The project was identified as 33 percent complete, with a note that the remaining two tanks may be deleted from the construction schedule. It is assumed from this that one of the tanks is verified as having been installed. No further clarification could be determined from these records.



LEGEND

GEOPHYSICAL SURVEY AREA

GEOPHYSICAL ANOMALY

SOURCE: McCLINTOCK LAND ASSOCIATES/TERRASAT

SEE FIGURE 1-1 FOR GENERAL LOCATION

DRAWING: 00F4-5G123	DRAWN: MNS	FIGURE 4-5 MINOR NAVAL AIR FACILITY (SEAPLANE BASE) CONCERNS G1,G2, AND G3
C/SC: 1:1PS	ZIP: 39/00	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000-216-132
DATE: 12/21/01	CHECK: J.H.	

Three 55-gallon drums and five gasoline cans, all heavily rusted and presumed to be remnants from World War II, were found near one of the partially backfilled pits during the 1999 site walkover. This debris is shown on Figure 4-5 as part of Concern G2.

4.4.1.1 Objectives

The primary objectives at the Minor Naval Air Facility were to confirm the existence or absence of the three suspected USTs and associated piping, assess if there had been a release associated with the former military use of the site, and determine whether any contaminants are present in the soil and groundwater as a result of the surface debris.

4.4.1.2 Previous Investigations

No previous sampling or investigations have been conducted at this site.

4.4.1.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objectives at the Minor Naval Air Facility (Seaplane Base) (Concerns G1, G2, and G3).

Geophysical Surveys

Two geophysical surveys were conducted at this site. This area was divided into two surveys to cover the three concerns. Geophysical techniques were used to determine the presence or absence of buried pipelines and USTs associated with trench and pit excavations. Anomalies present in the area were interpreted as surface metal, most of which was observed during the survey. The geophysical investigations indicate that there is no buried metal associated with the excavated pits and trenches.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

4.4.1.4 Findings

Due to evidence provided by the geophysical survey, it appears that there is no tank or piping system present. During the course of the 2000 field investigation, no further action was conducted at this site. Soil borings originally planned for this site were reallocated to Concern E1 to expand that subsurface investigation due to the observed presence of petroleum hydrocarbons in subsurface soils.

If the tanks and piping system had originally been installed and subsequently removed, any releases that may have occurred may still be evident. A complete investigation of this site is discussed in the 2001 Remedial Investigation Report, along with a summary of the 2000 field season results presented in this report.

4.5 Site H: Ocean Cape Radio Relay Station

The Ocean Cape Radio Relay (OCRR) Station is situated on about 244 acres located 5 miles west of the community of Yakutat at the end of Point Carrew Road. Site facilities included four 60-foot tropospheric antennas, eight industrial buildings, water and fuel storage tanks, fuel and water pipelines, utility lines, and access roads. The OCRR Station was used as a tropospheric communications station as part of the Ballistic Missile Early Warning System (BMEWS) of the WACS operated by the U.S. Air Force from 1960 to 1974. The U.S. Air Force terminated operation of the BMEWS portion of the WACS in June 1974. The site was leased to RCA between June 1974 and June 1976. RCA discontinued use of the site in 1976, following construction of a new satellite earth station nearby. The site is now owned by Yak-Tat Kwaan, Inc. (USACE 1999). A site map is presented as Figure 4-6.

In 1984, USACE conducted cleanup activities at the former OCRR Station site, including removing a few Quonset huts, the four communication towers and associated equipment, the well house and cistern, numerous wooden structures, and lots of trash and debris piles. Several items (i.e., a 74,000-gallon water tank and pump house; a heavy equipment shop facility; and a 150,000-gallon fuel oil tank, pump house, and some piping) remained as requested by Yak-Tat Kwaan, Inc. (USACE 1984a).

4.5.1 Concern H2: Culture Camp

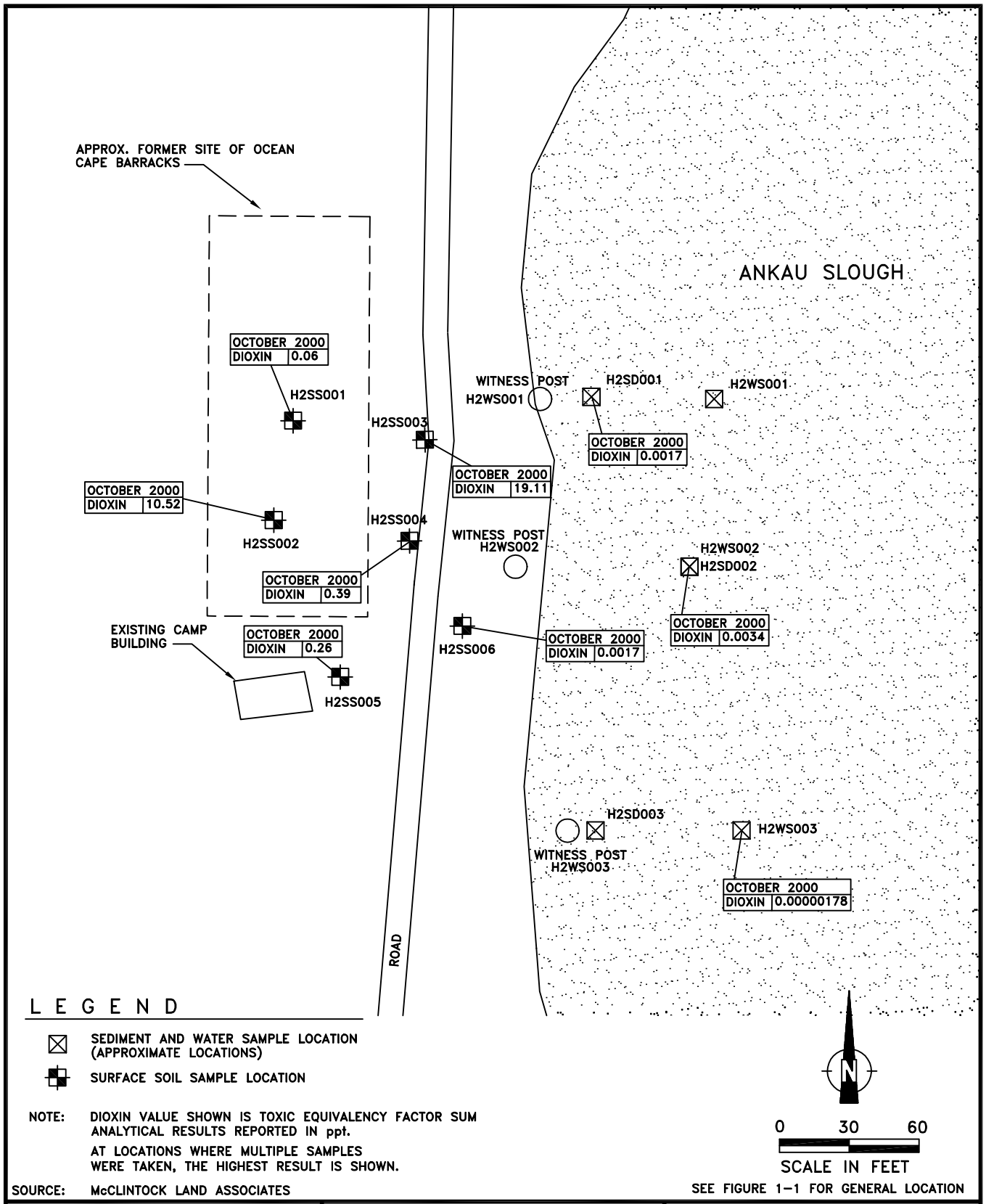
The Culture Camp is a youth camp that teaches subsistence practices and is owned by the Yakutat Tlingit Tribe. Local Native youths spend time during the summer learning subsistence life skills from the elders in the community, depending entirely on the natural resources surrounding the site. The site is located at the former OCRR Station barracks adjacent to Ankau Slough (Figure 4-6).

The 1984 cleanup efforts removed the housing ruins – three duplexes, garages, an old car, and miscellaneous trash.

No visual indication of contamination or other environmental concerns was identified during the 1999 preliminary site walkover. Discussion with community members indicated that aerial spraying of pesticides/herbicides has been performed in the area historically.

4.5.1.1 Objectives

The primary objectives at the Culture Camp were to perform follow-up sampling and analysis based on the previously-identified dioxins (AGRA 1997) and to determine the presence or absence of other contaminants in surface soil, surface water, and sediment associated with the former military use of the site.



NOTE: DIOXIN VALUE SHOWN IS TOXIC EQUIVALENCY FACTOR SUM ANALYTICAL RESULTS REPORTED IN ppt.
AT LOCATIONS WHERE MULTIPLE SAMPLES WERE TAKEN, THE HIGHEST RESULT IS SHOWN.

SOURCE: McCLINTOCK LAND ASSOCIATES

SEE FIGURE 1-1 FOR GENERAL LOCATION

DRAWING: 00F4-6H2 DRAWN: MNS C/SC: 1:1PS ZIP: 39/00 DATE: 12/21/01 CHECK: J.H.	FIGURE 4-6 OCEAN CAPE RADIO RELAY STATION CONCERN H2	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000-216-132

4.5.1.2 Previous Investigations

One previous investigation has been conducted at the Culture Camp, Concern H2. The following is a summary of the findings.

1996 – Summary Investigation of DoD Activities on Yakutat Tribal Lands

During a 1996 field investigation, one soil, one sediment, and two shellfish tissue samples were collected for laboratory analysis. The soil sample collected south of the culture camp building contained detectable concentrations of PCDD/PCDF isomers. The calculated TCDD equivalent for the soil sample (0.074 ppt) did not exceed the residential RBC for TCDD (4 ppt). One of the shellfish samples contained detectable concentrations of total TCDF with a calculated TCDD equivalent of 0 ppt. Not enough tissue was submitted for testing of the other shellfish sample. The sediment sample was not analyzed for dioxins. The local community depends on the natural resources in this area and is in direct interaction with the soil, sediment, and water. A heavy weighted incidental ingestion of contaminants in the surrounding media could result from this interaction. However, it was determined that one sample did not constitute an adequate survey for the area (AGRA 1997).

Also reported during the 1996 investigation was that analysis of one shellfish tissue sample, collected from the tidal area east of the Culture Camp, showed detectable concentrations of arsenic, barium, chromium, lead, and total tetrachlorodibenzofurans. No RBCs exist for these chemicals in shellfish tissue (AGRA 1997).

4.5.1.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objectives at the Culture Camp (Concern H2). Sample locations are shown on Figure 4-6.

Surface Soil Sampling

Six surface locations within and around the presumed location of the former barracks were sampled to determine whether contaminants were present in the surface soils. A local resident who recalled the layout of the structures assisted in locating the former building site. Six inches of grass, debris, and other surface materials were removed from each sample location before the mineral soil was collected. The surface soil samples in the area of the former barracks consisted of brown gravelly sand. The surface soil sample from location H2SS006 consisted of light brown to gray gravel with silt. PID readings for these samples were consistently 0.0 ppm.

Surface Water and Sediment Sampling

Three surface water and three sediment sample were collected to determine residual levels of persistent contaminants previously-identified as contaminants of concern. Water and sediment

sample locations were based on available surface water and its proximity to the site. The Ankau Slough is the only available surface water. Two surface water samples were collected from the tidal zone in 6 to 12 inches of water. These samples were cloudy due to wave action agitating the water. Sample location H2WS002 was a small tidal pool where grass was growing from the silty bottom. Water here was 4 to 6 inches deep and mostly clear. Water parameters could not be recorded while sampling because the samples had to be collected, packed, and shipped to the laboratory quickly to meet transportation deadlines. Instead, water parameters were recorded later that day while sediment samples were collected.

Three sediment samples were collected from the Ankau Slough tidal zone. The samples consisted of fine sand. Sediment samples were collected from the same locations as the collocated surface water samples when possible. Sample location H2SD001 was approximately 50 feet from the H2WS001 sample location. Sample location H2SD003 was approximately 75 feet from the H2WS003 sample location. Labeled wooden stakes were installed as witness posts on the shore above the high water line for surveying purposes. Actual sample locations were within 50 to 100 feet of the corresponding survey stakes.

4.5.1.4 Findings

The following is a discussion by media of analytes detected at the Culture Camp, Concern H2 with concentrations exceeding cleanup levels. A summary of elevated analytical results is presented as Table 4-5. Dioxin analytical results are discussed separately in Section 4.5.1.5. Complete analytical results from Concern H2 during the 2000 investigation are presented in Appendix A, Tables 12, 13, and 14.

Surface Soil

Arsenic was detected at concentrations from 1.9 mg/kg to 5 mg/kg in surface soil. All of the reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported arsenic concentrations exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in surface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations ranging from 25 mg/kg to 32 mg/kg, exceeding the ADEC Method Two soil cleanup level of 23 mg/kg. However, none of the reported concentrations exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in surface soil will not be considered a COPC at this concern.

Concentrations of dioxins were detected in each surface soil sample. These results are discussed in Section 4.5.1.5.

Table 4-1. Concern H2 – Summary of Elevated Analytical Results.

Location	Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Surface Soils			
H2SS001	Arsenic	2	1.8
	Chromium	29	23
H2SS002	Arsenic	2.9	1.8
	Chromium	31	23
	Cadmium	2.4	4.5
H2SS003	Arsenic	3.3	1.8
	Chromium	32	23
H2SS004	Arsenic	2	1.8
	Chromium	27	23
H2SS005	Arsenic	2	1.8
	Chromium	25	23
H2SS006	Arsenic	5	1.8
	Chromium	29	23
Sediments			
H2SD001	Arsenic	1.5	NA
	Chromium	20	NA
H2SD002	Chromium	17	NA
H2SD003	Arsenic	1.3	NA
	Chromium	18	NA

Notes:
All analytes detected greater than one-half the cleanup levels are presented.
Sediment analytes detected greater than one-half the ADEC Method Two soil cleanup level are presented.
Dioxin results are presented in Table 4-6.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
mg/kg = Milligrams per kilogram
NA = Not applicable
QA/QC = Quality Assurance/Quality Control

Surface Water

Surface water analytical results were below AWQS cleanup levels. No analytes in surface water are considered as COPCs at this concern.

Concentrations of dioxins were detected in the surface water QA referee sample collected at this concern. Table 28 in Appendix A present the QA referee water analytical results. These results are discussed in Section 4.5.1.5.

Sediment

Sediment results were compared to ADEC Method Two soil cleanup levels and background concentrations use as a first-level conservative screening tool. The published MCULs for

sediments developed by the State of Washington Department of Ecology were used as a second-level conservative screening tool. These standards are not directly applicable but should be viewed as conservative screening tools in COPC selection. Please refer to Section 3.9 for more information on selection of COPCs in sediment.

The sediment sample from location H2SD001 exhibited a low percent solids of 72.5 percent. The low percent solids elevated the MQLs for all analytes tested for in this sample. The elevated MQLs of some analytes were above the ADEC Method Two soil cleanup levels. In particular, the presence of pentachlorophenol and two pesticides above the ADEC Method Two soil cleanup levels was indeterminate. However, the MQL for pentachlorophenol was below the MCUL of 360 µg/kg, and pentachlorophenol was not detected in any soil or water samples collected from this area. Therefore, it is not considered a COPC in any media at this concern. MCULs have not been set for pesticides: however, no pesticides were detected in any soil or water samples collected from this area. Therefore, pesticides are not considered a COPC in any media at these concerns.

Concentrations of dioxins were detected in two of the three sediment samples. These results are discussed in Section 4.5.1.5.

Summary of Findings

The investigative objectives at this concern were to perform follow-up sampling and analysis based on the previously-identified dioxins (AGRA 1997) and to determine the presence or absence of other contaminants in surface soil, surface water, and sediment associated with the former military use of the site. Six surface soil samples, three surface water samples, and three sediment samples were collected and analyzed.

Dioxins were detected in most of the samples. Dioxin analytical results are discussed in the following section (Section 4.5.1.5).

With the exception of dioxins, no analytes at this concern are considered COPCs.

4.5.1.5 Dioxins – Preliminary Screening

One of the investigative objectives at this concern was to perform follow-up sampling and analysis based on previously-identified dioxins (AGRA 1997). Dioxin concentrations were detected in all surface soil samples, two of the three sediment samples, and the QA referee surface water sample. Table 14 in Appendix A documents the detected concentrations for dioxins from Concern H2. This table is also included in the text of this report as Table 4-6. Although ADEC does not have published soil, sediment, or surface water cleanup levels for dioxins, evaluation of dioxin concentrations can be made by comparing observed levels to published levels that have been shown to cause adverse effects. If the concentrations reported in site samples exceed these "screening effects thresholds," further evaluation may be warranted. However, where analytical results were less than effects thresholds or not detected

Table 4-6. Concern H2 – Dioxin Analytical Results.

			Surface Soil						
	Location ID:		H2SS001	H2SS002		H2SS003	H2SS004	H2SS005	H2SS006
	Sample ID:		00H2SS001SO	00H2SS002SO	00H2SS007SO	00H2SS003SO	00H2SS004SO	00H2SS005SO	00H2SS006SO
	Sample Date:		10/2/00	36801	10/2/00	10/2/00	10/2/00	10/2/00	10/2/00
	Sample QC Type:				Duplicate				
	Laboratory ID(s):		G0J100255-4	G0J100258-5	G0J100258-10	G0J100258-6	G0J100258-7	G0J100258-8	G0J100258-9
Parameter	Units	TEF[1]							
Dioxins [8290]									
2,3,7,8-TCDD	pg/g	1	ND [0.4]	ND [0.2]	ND [0.2]	ND [0.3]	ND [0.2]	ND [0.5]	ND [0.6]
Total TCDD	pg/g		ND [0.4]	ND [0.2]	ND [0.2]	0.6	ND [0.2]	ND [0.5]	ND [0.6]
1,2,3,7,8-PeCDD	pg/g	1	ND [1.9]	ND [0.3]	ND [0.3]	ND [0.4]	ND [0.2]	ND [1.1]	ND [1.4]
Total PeCDD	pg/g		ND [1.9]	ND [0.6]	ND [0.3]	ND [2.0]	ND [0.2]	ND [1.1]	ND [1.4]
1,2,3,4,7,8-HxCDD	pg/g	0.1	ND [0.7]	ND [0.6]	ND [0.4]	3.3 J	ND [0.4]	ND [0.6]	ND [0.6]
1,2,3,6,7,8-HxCDD	pg/g	0.1	ND [0.7]	12.0	9.7	18.0	ND [0.5]	ND [0.7]	ND [0.7]
1,2,3,7,8,9-HxCDD	pg/g	0.1	ND [0.7]	ND [1.5]	ND [1.3]	9.6	ND [0.4]	ND [0.6]	ND [0.6]
Total HxCDD	pg/g		ND [0.7]	30.0	22.0	120.0	ND [1.0]	ND [2.4]	ND [0.7]
1,2,3,4,6,7,8-HpCDD	pg/g	0.01	5.6 J	510.0	460.0	1200.0	35.0	21.0	ND [1.6]
Total HpCDD	pg/g		24.0	870.0	780.0	2400.0	68.0	80.0	ND [1.9]
OCDD	pg/g	0.0001	40.0	8000.0 J	7800.0 J	17000.0 J	430.0	170.0	17.0
2,3,7,8-TCDF	pg/g	0.1	ND [0.4]	ND [0.4]	ND [0.4]	ND [0.5]	ND [0.3]	ND [0.4]	ND [0.4]
Total TCDF	pg/g		3.3	1.0	1.0 [0.0]	6.5	1.8	6.9 [0.0]	ND [0.5]
1,2,3,7,8-PeCDF	pg/g	0.05	ND [0.9]	ND [0.3]	ND [0.2]	ND [1.4]	ND [0.1]	ND [0.7]	ND [0.8]
2,3,4,7,8-PeCDF	pg/g	0.5	ND [0.9]	ND [0.3]	ND [0.2]	ND [1.2]	ND [0.1]	ND [0.7]	ND [0.8]
Total PeCDF	pg/g		ND [1.0]	ND [2.4]	ND [1.6]	16.0	ND [0.2]	11.0	ND [1.0]
1,2,3,4,7,8-HxCDF	pg/g	0.1	ND [0.8]	15.0	11.0 [0.0]	7.3	ND [0.2]	ND [0.7]	ND [0.7]
1,2,3,6,7,8-HxCDF	pg/g	0.1	ND [0.8]	ND [2.6]	ND [2.0]	6.5	ND [0.2]	ND [1.0]	ND [0.7]
2,3,4,6,7,8-HxCDF	pg/g	0.1	ND [0.8]	ND [1.3]	ND [0.6]	2.9 J	ND [0.2]	ND [0.7]	ND [0.7]
1,2,3,7,8,9-HxCDF	pg/g	0.1	ND [0.8]	ND [0.4]	ND [0.3]	ND [1.4]	ND [0.2]	ND [0.7]	ND [0.7]
Total HxCDF	pg/g		ND [0.8]	210.0	160.0	97.0	ND [0.5]	4.3	ND [0.7]
1,2,3,4,6,7,8-HpCDF	pg/g	0.01	ND [0.6]	160.0	140.0	59.0	ND [0.8]	3.6 J	ND [0.5]
1,2,3,4,7,8,9-HpCDF	pg/g	0.01	ND [0.7]	27.0	24.0	4.7 J	ND [0.1]	ND [0.6]	ND [0.6]
Total HpCDF	pg/g		ND [1.0]	860.0	750.0	210.0	2.8	9.0	ND [0.6]
OCDF	pg/g	0.0001	ND [1.5]	520.0	490.0	150.0	ND [3.1]	8.0 J	ND [1.3]
TEF SUM[2]	**pg/g (ppt)**		**0.06**	**10.52**	**9.14**	**19.11**	**0.39**	**0.26**	**0.0017**

Notes:

[1] TEF Toxic Equivalency Factor taken from http://www.who.int/pcs/docs/dioxin-exec-sum/exe-sum-final.html is used to convert congener to the toxicity equivalent to 2,3,7,8-TCDD.

[2] TEF SUM is calculated as the sum of the product of each congener concentration times the TEF for all detects including J qualified values. Values in brackets [xxx.xx] are MQLs.

Key:

pg/g = Picograms per gram

ppt = Parts per trillion

J = Result is considered an estimate.

ND= Parameter not detected above the method quantitation limit (MQL).

Table 4-6. Concern H2 – Dioxin Analytical Results. (Continued)

			Surface Water				Sediment			
	Location ID:		H2SW001	H2SW002	H2SW003			H2SD001	H2SD002	H2SD003
	Sample ID:		00H2SW001WS	00H2SW002WS	00H2SW003WS	00H2SW004WS		00H2SD001SE	00H2SD002SE	00H2SD003SE
	Sample Date:		10/5/00	10/5/00	10/5/00	10/5/00 Duplicate		10/5/00	10/5/00	10/5/00
	Laboratory ID(s):		G0J100273-1	G0J100273-2	G0J100273-3	G0J100273-4		G0J100258-1	G0J100258-2	G0J100258-3
Parameter	Units	TEF[1]					Units			
Dioxins [8290]										
2,3,7,8-TCDD	pg/L	1	ND [2.6]	ND [4.2]	ND [3.8]	ND [3.7]	pg/g	ND [0.7]	ND [1.3]	ND [0.6]
Total TCDD	pg/L		ND [2.6]	ND [4.2]	ND [3.8]	ND [3.7]	pg/g	ND [0.7]	ND [1.3]	ND [0.6]
1,2,3,7,8-PeCDD	pg/L	1	ND [11.0]	ND [9.4]	ND [16.0]	ND [18.0]	pg/g	ND [2.7]	ND [4.0]	ND [2.2]
Total PeCDD	pg/L		ND [11.0]	ND [9.4]	ND [16.0]	ND [18.0]	pg/g	ND [2.7]	ND [4.0]	ND [2.2]
1,2,3,4,7,8-HxCDD	pg/L	0.1	ND [5.2]	ND [7.5]	ND [7.0]	ND [7.2]	pg/g	ND [1.1]	ND [1.8]	ND [1.0]
1,2,3,6,7,8-HxCDD	pg/L	0.1	ND [5.6]	ND [6.8]	ND [7.5]	ND [7.7]	pg/g	ND [1.2]	ND [2.0]	ND [1.1]
1,2,3,7,8,9-HxCDD	pg/L	0.1	ND [5.0]	ND [7.6]	ND [6.6]	ND [6.8]	pg/g	ND [1.1]	ND [1.7]	ND [0.9]
Total HxCDD	pg/L		ND [5.6]	ND [7.6]	ND [7.5]	ND [7.7]	pg/g	ND [1.2]	ND [2.0]	ND [1.1]
1,2,3,4,6,7,8-HpCDD	pg/L	0.01	ND [6.2]	ND [6.1]	ND [9.1]	ND [8.8]	pg/g	ND [2.0]	ND [3.4]	ND [1.5]
Total HpCDD	pg/L		ND [6.2]	ND [6.1]	ND [9.1]	ND [8.8]	pg/g	ND [4.0]	13.0	ND [1.5]
OCDD	pg/L	0.0001	ND [10.0]	ND [30.0]	ND [8.6]	ND [20.0]	pg/g	17.0 J	34.0	ND [2.8]
2,3,7,8-TCDF	pg/L	0.1	ND [2.8]	ND [3.4]	ND [3.7]	ND [4.3]	pg/g	ND [0.9]	ND [0.8]	ND [0.7]
Total TCDF	pg/L		ND [2.8]	ND [3.4]	ND [3.7]	ND [4.3]	pg/g	ND [0.9]	ND [0.8]	ND [0.7]
1,2,3,7,8-PeCDF	pg/L	0.05	ND [6.5]	ND [4.2]	ND [9.3]	ND [11.0]	pg/g	ND [1.5]	ND [2.2]	ND [1.4]
2,3,4,7,8-PeCDF	pg/L	0.5	ND [6.2]	ND [4.0]	ND [9.0]	ND [10.0]	pg/g	ND [1.5]	ND [2.1]	ND [1.4]
Total PeCDF	pg/L		ND [7.8]	ND [4.8]	ND [11.0]	ND [12.0]	pg/g	ND [1.7]	ND [2.3]	ND [1.6]
1,2,3,4,7,8-HxCDF	pg/L	0.1	ND [4.8]	ND [3.9]	ND [6.1]	ND [6.0]	pg/g	ND [1.1]	ND [1.6]	ND [1.0]
1,2,3,6,7,8-HxCDF	pg/L	0.1	ND [5.1]	ND [3.4]	ND [6.5]	ND [6.5]	pg/g	ND [1.1]	ND [1.7]	ND [1.1]
2,3,4,6,7,8-HxCDF	pg/L	0.1	ND [4.9]	ND [4.5]	ND [6.3]	ND [6.2]	pg/g	ND [1.1]	ND [1.6]	ND [1.0]
1,2,3,7,8,9-HxCDF	pg/L	0.1	ND [5.1]	ND [6.1]	ND [6.5]	ND [6.4]	pg/g	ND [1.1]	ND [1.7]	ND [1.1]
Total HxCDF	pg/L		ND [5.1]	ND [6.1]	ND [6.5]	ND [6.5]	pg/g	ND [1.1]	ND [1.7]	ND [1.1]
1,2,3,4,6,7,8-HpCDF	pg/L	0.01	ND [3.6]	ND [3.5]	ND [4.9]	ND [5.6]	pg/g	ND [0.8]	ND [1.2]	ND [1.0]
1,2,3,4,7,8,9-HpCDF	pg/L	0.01	ND [4.3]	ND [4.0]	ND [6.0]	ND [6.7]	pg/g	ND [1.0]	ND [1.5]	ND [1.2]
Total HpCDF	pg/L		ND [4.3]	ND [4.0]	ND [6.0]	ND [6.7]	pg/g	ND [1.0]	ND [1.5]	ND [1.2]
OCDF	pg/L	0.0001	ND [10.0]	ND [12.0]	ND [14.0]	ND [14.0]	pg/g	ND [2.1]	ND [3.0]	ND [2.4]
TEF SUM[2]							**pg/g (ppt)**	**0.0017**	**0.0034**	

Notes:

[1] TEF Toxic Equivalency Factor taken from http://www.who.int/pcs/docs/dioxin-exec-sum/exe-sum-final.html is used to convert congener to the toxicity equivalent to 2,3,7,8-TCDD.

[2] TEF SUM is calculated as the sum of the product of each congener concentration times the TEF for all detects including J qualified values. Values in brackets [xxx.xx] are MQLs.

Key:

pg/g = Picograms per gram
pg/L = Picograms per liter
ppt = Parts per trillion
J = Result is considered an estimate.
ND= Parameter not detected above the method quantitation limit (MQL).

below effects thresholds, further evaluation may not be warranted. While screening values from a number of sources are presented in this section, the primary soil screening guideline followed in this assessment is from the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR has adopted a policy guideline to assess the public health implications of dioxin and dioxin-like compounds in residential soils near or on hazardous waste sites (ATSDR 1997). Since this area may be used by the local population for subsistence purposes, protective guidelines appropriate to "agricultural" land use were also applied. In addition, EPA Region 3 risk-based concentrations (RBCs) were used (EPA 2002). EPA Region 3 RBCs are used by convention because the EPA Region 10 (including Alaska) recognizes Region 3 RBCs as a valid tool for evaluating risk.

Exposure Characterization

The term “dioxins” is used to collectively refer to a group of compounds – polychlorinated dibenzo-*p*-dioxins (PCDDs) andpolychlorinated dibenzofurans (PCDFs). Analytical data were reported for individual types of dioxins (congeners), and for some chemical subsets, total values were indicated. For sediment and soil, units are picograms per gram (pg/g) or parts per trillion (ppt). For water, units are presented as picograms per liter (pg/L) or parts per quadrillion (ppq) but were converted to ppt for discussion in the text. To help put these units into perspective, the concentration magnitude of one part per trillion is akin to taking a 1-minute vacation after working for 2,000,000 years or a 1-minute vacation in 2,000,000,000 years for one part per quadrillion.

In order to screen risk from multiple dioxin-like congeners, exposure concentrations are calculated by multiplying the individual detected concentrations, including those "J" qualified values, by a toxic equivalency factor (TEF). The TEFs take into account the relative toxicity of individual congeners as compared to 2,3,7,8-TCDD, the most studied and most toxic congener. TEFs developed by the World Health Organization (WHO, 1998) were used for this project. The sum of the exposure concentrations, known as the TEF sum, is used for risk characterization purposes and is reported in Table 4-6 and Table 14 (Appendix A).

Each of the seven soil samples (six primary and one field QC duplicate) from the site had detectable concentrations of dioxin-like congeners, with TEF sum concentrations ranging from 0.0017 to 19.11 ppt.

Two sediment samples had detectable concentrations of octachlorodibenzo-p-dioxin (OCDD) with TEF sums of 0.0017 and 0.0034 ppt.

There were no detected dioxin-like compounds found in the primary and field QC duplicate surface water samples from the site. However, the lowest detection limit of 2,3,7,8-TCDD of 0.0026 ppt (by high-resolution EPA Method 8290) is greater than the EPA Region 3 RBC for tap water of 0.00045 ppt. Therefore, human health drinking water exposures could not be evaluated due to analytical limitations. Dioxin-like compounds were detected in the surface water QA referee sample at a TEF of 0.00000178 ppt, which is well below the EPA Region 3 RBC.

Risk Characterization

To evaluate potential risk from exposure pathways, the TEF sum of the dioxin data in Table 4-6 and Table 14 (Appendix A) were evaluated by comparison to the effects concentrations reported in Table 4-7. This table summarizes concentrations for 2,3,7,8-TCDD from four different sources where effects to an organism have been observed (effects concentrations). Screening level thresholds of concern are reported for various media as potentially consumed by wildlife receptors and humans, including drinking water, freshwater, sediment, soils, and tissues.

The TEF sum of dioxin-like compounds in surface water in Table 4-6 were well below any of the surface water effects concentrations reported in Table 4-7. There is no predicted potential risk from exposure to site surface water dioxin concentrations.

The TEF sum of dioxin-like compounds in sediment in Table 4-6 were well below any of the sediment effects concentrations reported in Table 4-7. There is no predicted potential risk from exposure to site sediment dioxin concentrations.

The TEF sum of dioxin-like compounds in soil in Table 4-6 exceeded several of the soil effects concentrations listed in Table 4-7.

None of the soil sample TEF sums of dioxin-like compounds exceeded the screening level ATSDR (1997) policy guideline for residential soil cleanup of 50 ppt, and further evaluation may not be needed. ATSDR recommends that when residential soil concentrations exceed 1 part per billion (ppb) (1,000 ppt) and exposures are "significant," "ATSDR health assessors should consider judging the site a public health hazard and consider site-specific public health recommendations/actions to prevent or interdict exposures" (1997). All of the site soil samples had TEF sums of dioxin-like compounds less than the level where action is recommended, and the ATSDR guidelines indicate that the site is not a public health hazard from direct human ingestion of site soils.

Two samples exceeded the Canadian risk-based agricultural soil target value of 10 ppt. Residues greater than this value reported in the National Oceanic and Atmospheric Association (NOAA) Screening Quick Reference Tables (SQuiRTs) "require remediation to levels below target for applicable land use in British Columbia." Three samples exceeded the EPA Region 3 RBC for residential soil of 4.3 ppt and also exceeded the EPA Region 3 RBC (0.43 ppt) for protection of groundwater from soil contaminant migration.

There are no tissue concentration data to compare to wildlife effects concentrations. However, the TEF sum of dioxin-like compounds soil concentrations in Table 4-6 exceeded several of the wildlife toxicity reference values in Table 4-7. This suggests that a diet composed of site soils might be hazardous to wildlife receptors.

Conclusions

The observed concentrations of dioxin-like compounds in surface water and sediment at Concern H2 do not appear to warrant further ecological or human health risk investigation. Comparison of site surface water to tap water RBCs is not possible due to limitations to the

Table 4-2. Effects Concentrations for 2,3,7,8 TCDD – Screening Toxicity Reference Values from Various Sources.

Screening Level	ppt
1. NOAA SQUIRT TABLE AND EPA OFFICE OF WATER (WWW FACT SHEET) (NOAA 1999)	
Saltwater Sediment	
Apparent Effects Threshold (AET) from *Neanthes* bioassay (concentration of highest non-toxic sample)	3.6
Soil: Canadian Risk-Based Standards	
Agricultural Target	10
Urban Park/Residential Target	1,000
2. USFWS CONTAMINANT HAZARD REVIEWS (1986)	
General Recommendations	
Water (to protect aquatic life)	0.01
3. ATSDR INTERIM POLICY GUIDELINE—FOR SOIL CLEANUP (1997)	
Screening Level	50
Evaluation Level	50-1,000
Action Level	> 1,000
4. EPA REGION 3 RBC TABLE 4/02/02	
Tap water	0.00045
Soil-Industrial	38
Soil- Residential	4.3
Soil-Groundwater migration DAF - 1	0.43
Soil-Groundwater migration DAF - 20	8.6
Fish tissue	0.021

Key:
ATSDR = Agency for Toxic Substance Disease Registry.
DAF = Dilution attenuation factor.
EPA = U.S. Environmental Protection Agency.
NOAA = National Oceanic and Atmospheric Administration.
ppt = Parts per trillion.
USFWS = U.S. Fish and Wildlife Service.

analytical test methods. Surface soil concentrations did not exceed levels of concern based on ATSDR (1997) guidelines but do exceed some EPA Region 3 RBCs. The exceedance of the Canadian soil guideline for agricultural sites together with the exceedance of the EPA Region 3 RBCs suggest further evaluation is warranted for the ingestion exposure pathway, particularly since this site is associated with subsistence food collection. The absence of site tissue concentration data does not allow for a more definitive screening assessment of risks to human health or risks to wildlife from dietary exposures. Further site investigation may be needed to better define and to reduce the uncertainty associated with risk-based remedial action decisions at this site.

4.6 Site K: Solid Waste Disposal Dump No. 4 Area

Records indicate that a military disposal area existed on the southeast side of Cannon Beach Road, approximately 300 yards northeast of Tawah Creek. The area was leveled and covered with 2 feet of gravelly sand during the 1984 cleanup efforts. Currently, the landfill site is heavily vegetated with alders, spruce, and various berry bushes. The area surrounding the landfill consists of a flat grassy wetlands area with randomly scattered willow bushes. This area is often flooded from water overflowing from Tawah Creek. Water levels have been observed to rise and fall several feet within a day or so, depending on recent precipitation.

4.6.1 Concern K1: Dump Area

A large quantity of debris, including gas cans, drums, bottles, pipes, partially buried auto parts, and engines, were observed in the wetland area adjacent to Tawah Creek during the 1999 site walkover. Several large sheens were observed in the wetlands surrounding the landfill during the 2000 field investigation. The dump area, as delineated by the geophysical survey, covers an area of approximately 82,150 square feet. A site map is presented as Figure 4-7.

4.6.1.1 Objectives

The primary objectives at this landfill were to delineate the extent of buried debris and conduct follow-up sampling to determine whether contaminants are present in surface soil, subsurface soil, and groundwater as a result of the disposal area.

4.6.1.2 Previous Investigations

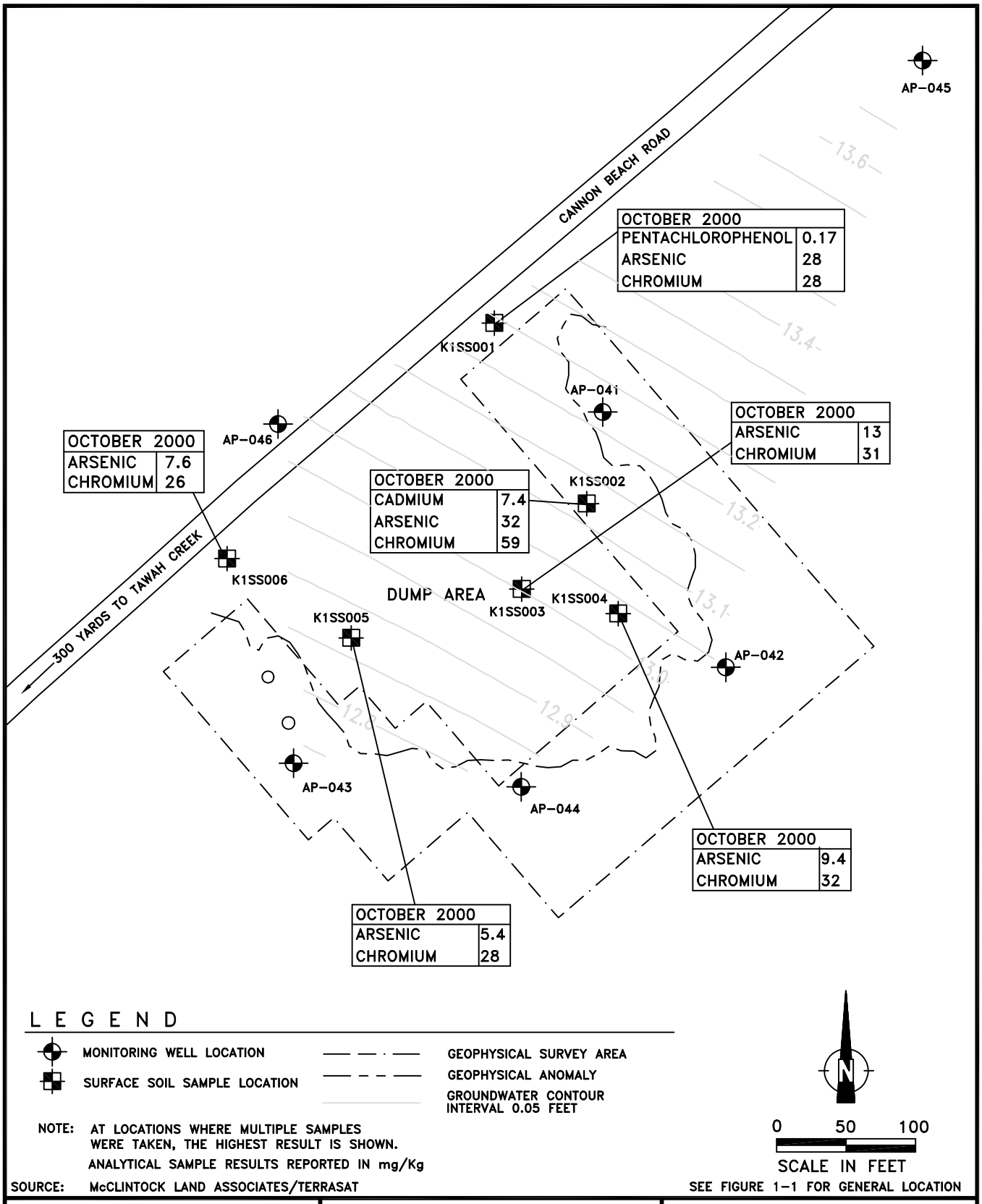
Two previous investigations have been conducted at the Dump Area, Concern K1. The following is a summary of the findings.

1994 – Field Investigation Report, Former Yakutat Air Base

A site walkover was conducted in 1994 (E&E 1994). At that time it, the site was considered ineligible for DERP-funded cleanup because no fuel sheen or stressed vegetation was noted.

1997 – Yakutat Air Base/Ocean Cape Radio Relay Site Investigation Report

A 1997 investigation included the collection of five surface soil samples from the perimeter of the dump near observed drums and debris on the south side of the landfill. One surface water sample was collected from the downgradient (south) side of the dump. One surface water sample was collected from the upgradient (north) side of the landfill as a background sample. The following analytes in the surface soil samples exceeded the EPA Region 3 RBC for soil ingestion on residential sites and the State of Alaska maximum contaminant level for drinking water regulatory guidelines: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, manganese, and iron. Concentrations of DRO in two surface soil samples exceeded ADEC matrix score sheet guidance Level A values. Elevated concentrations of arsenic, cadmium,



NOTE: AT LOCATIONS WHERE MULTIPLE SAMPLES WERE TAKEN, THE HIGHEST RESULT IS SHOWN.
ANALYTICAL SAMPLE RESULTS REPORTED IN mg/Kg

SOURCE: McCLINTOCK LAND ASSOCIATES/TERRASAT

SEE FIGURE 1-1 FOR GENERAL LOCATION

DRAWING: 00F4-7K1 DRAWN: MNA C/SC: 1:1PS ZIP: 39/00 DATE: 07/15/02 CHECK: J.H.	FIGURE 4-7 SOLID WASTE DISPOSAL DUMP #4 CONCERN K1	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000-216-132

chromium, copper, iron, and lead were observed in the surface water sample. Of the contaminants detected, cadmium and lead exceeded the EPA Region 3 RBC for soil ingestion on residential sites and the State of Alaska maximum contaminant level for drinking water regulatory guidelines.

4.6.1.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objectives at the Dump Area (Concern K1). Sample locations are shown on Figure 4-7.

Geophysical Survey

A geophysical survey was conducted at this site prior to sampling activities to delineate the extent of buried debris. Results from the survey indicate a strong, broad anomaly that represents the lateral extents of the landfill. The dump area covers an area of approximately 82,150 square feet. Two smaller isolated anomalies off the southwest edge of the landfill represent surface metal (55-gallon drums) observed during the survey. The survey area was limited to the east side of Cannon Beach Road due to high water in the drainage ditch on the west side of the road. The survey area did not cover the northwest extent of the landfill; however, the landfill is bounded to the northwest by Cannon Beach Road.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

Surface Soil Sampling

Six surface locations within the former landfill to were sampled determine whether contamination is present in the surface soils. Samples could not be collected from areas outside of the landfill due to high surface water. Six inches of topsoil and debris were removed from each sampling location prior to collecting the mineral soil. The surface soil samples consisted of gray to brown silty gravelly sand. PID readings ranged from 0.0 to 0.1 ppm.

Soil Borehole Sampling

Six soil borings were advanced to depths of 10 feet bgs to determine whether contaminants were present in the subsurface soils. Five of the six borings were evenly spaced along the perimeter and downgradient of the landfill (as delineated by the geophysical survey). Boring AP-045 was placed approximately 320 feet northeast of the landfill, approximately 40 feet off Cannon Beach Road, in an area where no sheen was observed, as an upgradient well for the site. Two drive samples were collected in the first 4 feet of each boring for sample collection and subsurface characterization. The borings were then advanced to total depths for monitoring well installation. Boring logs are presented in Appendix D.

Each boring encountered 3.5 to 12 inches of organic material (i.e., moss, muskeg, and peat). Subsurface soils in this area generally consisted of dark gray, mottled, medium to coarse sand. Gravelly sands were encountered beneath the sand in the northeast half of the area. AP-046, on the edge of Cannon Beach Road, encountered sand with gravel fill material to a depth of 3 feet. A sour/swampy odor was noted in all borings except AP-043 and AP-044, which were south of the landfill. PID readings ranged from 0.0 to 0.9 ppm.

All six borings were completed as monitoring wells. Well construction diagrams are presented in Appendix D. Well development records are presented in Appendix E.

Groundwater Sampling

Groundwater was not sampled at this site during the 2000 investigation due to high surface water at the time of the sampling event. Surface water was reported at each well at different depths, up to 1.5 feet above base of casing. The surface water level had risen approximately 1 foot between well development and attempted sampling due to the heavy precipitation. A rotten egg (sulfur) odor was noted in well AP-043 during development.

Groundwater samples were collected at this concern during the 2001 field season. Results are discussed in the 2001 Remedial Investigation Report. However, groundwater contours based on the 2001 sampling are shown on Figure 4-7. Groundwater flow direction appears to be toward the southwest.

4.6.1.4 Findings

The following is a discussion by media of analytes detected with concentrations exceeding cleanup levels at the Dump Area (Concern K1). A summary of elevated analytical results is presented as Table 4-8. Complete analytical results from the 2000 investigation are presented in Appendix A, Tables 15 and 16.

Surface Soil

Pentachlorophenol was detected at one surface soil sample location (K1SS01, 170 µg/kg) exceeding the ADEC Method Two soil cleanup level of 9 µg/kg. Due to low percent solids, the MQL of one of the six samples was elevated to 9.3 µg/kg, which was slightly above the ADEC Method Two soil cleanup level. The MQL of a field QC duplicate sample (11 µg/kg) also slightly exceeded the ADEC Method Two soil cleanup level; however, the associated primary sample MQL (8.3 µg/kg) was below the ADEC Method Two soil cleanup level. Pentachlorophenol will be considered a COPC in surface soil at this concern.

Arsenic was detected at concentrations from 4.9 mg/kg to 32 mg/kg, exceeding the ADEC Method Two soil cleanup level of 1.8 mg/kg. Two sample concentrations (from locations K1SS01, 28 mg/kg; and K1SS02, 32 mg/kg) exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). However, only the field

Table 4-1. Concern K1 – Summary of Elevated Analytical Results.

Location		Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Surface Soils				
K1SS001		Arsenic	28	1.8
		Chromium	28	23
		Pentachlorophenol	0.17	0.009
K1SS002		Arsenic	32	1.8
		Chromium	59	23
		Cadmium	7.4	4.5
K1SS003		Arsenic	13	1.8
		Chromium	31	23
K1SS004		Arsenic	9.4	1.8
		Chromium	32	23
K1SS005		Arsenic	5.4	1.8
		Chromium	28	23
K1SS006		Arsenic	7.6	1.8
		Chromium	26	23
Soil Borings				
AP-041	(0-2' bgs)	Arsenic	10	1.8
		Chromium	29	23
	(2-4' bgs)	Arsenic	12	1.8
		Chromium	29	23
AP-042	(0-2' bgs)	Arsenic	7.1	1.8
		Chromium	32	23
	(2-4' bgs)	Arsenic	4.2	1.8
		Chromium	26	23
AP-043	(0-2' bgs)	Arsenic	13	1.8
		Chromium	39	23
	(2-4' bgs)	Arsenic	7	1.8
		Chromium	35	23
AP-044	(0-2' bgs)	Arsenic	9.5	1.8
		Chromium	29	23
	(2-4' bgs)	Arsenic	12	1.8
		Chromium	22	23
AP-045	(0-2' bgs)	Arsenic	1.5	1.8
		Chromium	26	23
	(2-4' bgs)	Arsenic	2.4	1.8
		Chromium	27	23
AP-046	(0-2' bgs)	Arsenic	4.5	1.8
		Chromium	23	23
	(2-4' bgs)	Arsenic	10.3	1.8
		Chromium	31	23

Notes: All analytes detected greater than one-half the cleanup levels are presented.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
' bgs = Feet below ground surface, mg/kg = Milligrams per kilogram
QA/QC = Quality Assurance/Quality Control

QC duplicate sample from location K1SS02 exceeded the background concentration. The field QC duplicate sample exhibited variability that exceeded the USACE comparability criteria for metal target analytes (see the Data Assessment Report in Appendix B). The arsenic concentrations reported in the primary sample (4.9 mg/kg) and the QA referee sample (7.1J mg/kg) showed reasonable correlation and were below the background level, suggesting the elevated concentration of the single field QC duplicate sample was an aberration at this location. Due to the elevated level of arsenic reported at sample location K1SS01 and the presence of pentachlorophenol (arsenic levels may be associated with wood preservatives that may have also included pentachlorophenol and/or chromium), arsenic in surface soil will be considered a COPC.

Chromium was detected at concentrations ranging from 26 mg/kg to 59 mg/kg, exceeding the ADEC Method Two soil cleanup level of 23 mg/kg. However, only one reported value (from location K1SS02, 59 mg/kg) exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). However, as previously discussed, only the field QC duplicate sample from K1SS02 exceeded the background concentration. The field QC duplicate sample exhibited variability that exceeded the USACE comparability criteria for metal target analytes (see the Data Assessment Report in Appendix B). The chromium concentrations reported in the primary sample (27 mg/kg) and the QA referee sample (25.5J mg/kg) showed a high degree of correlation and were below the background level, suggesting the elevated concentration of the single field QC duplicate sample was an aberration at this location. Although chromium in surface soil above background levels may be an aberration, chromium in surface soil will be considered a COPC due to the presence of pentachlorophenol in surface soil (chromium levels may be associated with wood preservatives that may have also included pentachlorophenol and/or arsenic) .

Cadmium was detected at one surface soil sample location (K1SS02) at a concentration of 7.4 mg/kg, exceeding the ADEC Method Two soil cleanup level of 4.5 mg/kg. However, only the field QC duplicate sample from K1SS02 exceeded the soil ADEC Method Two soil cleanup level. Again, this field QC duplicate sample exhibited variability that exceeded the USACE comparability criteria for metal target analytes (see the Data Assessment Report in Appendix B). The reported cadmium concentrations in the primary sample (1.5 mg/kg) and the QA referee sample (2.2 mg/kg) showed reasonable correlation and were below the ADEC Method Two soil cleanup level, suggesting the elevated concentration of the single field QC duplicate sample was an aberration at this location. Cadmium will not be considered a COPC in surface soil at this concern.

Besides pentachlorophenol, arsenic, and chromium, no other analytes in surface soils are considered to be COPCs at this concern.

Soil Borings

Arsenic was detected at concentrations of 1.5 mg/kg to 13.0 mg/kg in the soil boring samples. Eleven of the twelve reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg (see Section 4.1.1 for discussion of background concentrations). However, the reported arsenic concentrations did not exceed the background concentration of 14.16 mg/kg. Arsenic in subsurface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations ranging from 22 mg/kg to 39 mg/kg. Ten of the twelve reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. However, the reported chromium concentrations did not exceed the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in subsurface soil will not be considered a COPC at this concern.

No analytes in subsurface soils are considered to be COPCs at this concern.

Groundwater

Groundwater samples were collected at Concern K1 during the 2001 field season. Results are discussed in the 2001 Remedial Investigation Report.

Summary of Findings

The investigative objectives at this concern were to delineate the extent of buried debris and conduct follow-up sampling to determine whether contaminants are present in surface soil, subsurface soil, and groundwater as a result of the disposal area. The dump area, as delineated by the geophysical survey, covers an area of approximately 82,150 square feet. Six surface samples and twelve soil boring samples were collected and analyzed.

Pentachlorophenol above the soil ADEC Method Two soil cleanup level and arsenic above background levels were detected at one surface soil sample location in the north part of the disposal area near Cannon Beach Road. Pentachlorophenol and arsenic in surface soil will be considered a COPC. Because of the possibility that pentachlorophenol levels may be associated with wood preservatives that may also have included chromium and/or arsenic, chromium in surface soil will also be considered a COPC.

No other analytes detected in surface or subsurface soil are considered COPCs at this concern. Groundwater samples were collected and analyzed during the 2001 field season. Results are discussed in the 2001 Remedial Investigation Report.

4.7 Site M: Post Powerhouse/25,000-Gallon Tactical Tank

The original Air Corps tactical gas system for the Yakutat Landing Field was designed to contain five 25,000-gallon storage tanks. The plans originally indicated that the tanks were to be located above ground in a wooded area for camouflage, but after further study, it was

determined to be more advantageous to reduce the length of the service line to the fueling pits and accomplish camouflage by underground construction. The system used water to push fuel through the piping system. The length of the service line, which was always full of a water/gasoline mixture when the system was in operation (approximately 1941-1947), was thus reduced by approximately 4,700 feet (U.S. War Department). A review of reference information indicates that it is likely that only one tank was actually installed at this location.

4.7.1 Concern M1: Suspected Hangar Pipeline System/Tactical UST

A pipeline ran from the reserve tank farm booster pump along the southwest side of Engineer's Road to the airfield hangar area fueling pits and truck fill stand. The majority of the pipeline path can be seen in 1948 aerial photographs. A ditch 8 feet wide and 3 feet deep was observed during the 1999 site walkover. The ditch is clearly visible in 1963 aerial photographs and follows the path of the pipeline seen in the 1948 aerial photographs. A large pit in the ground, approximately 20 feet by 40 feet, was also observed during the 1999 site walkover and in the 1963 aerial photographs. This pit is in the approximate location of the 25,000-gallon storage tank indicated on the 1943 revised tactical gas system map and is the suspected location of the former 25,000-gallon tactical UST. The bottom of the pit was about 5 feet bgs and contained water at the time of the site walkover. A site map is presented as Figure 4-8.

4.7.1.1 Objectives

The primary objectives at this concern were to determine the presence or absence of buried pipeline or associated debris and to assess the surface soil, subsurface soil, and groundwater in the area of the suspected hangar pipeline and tactical UST to determine whether any releases associated with former military use of the site had occurred that may still be detectable today.

4.7.1.2 Previous Investigations

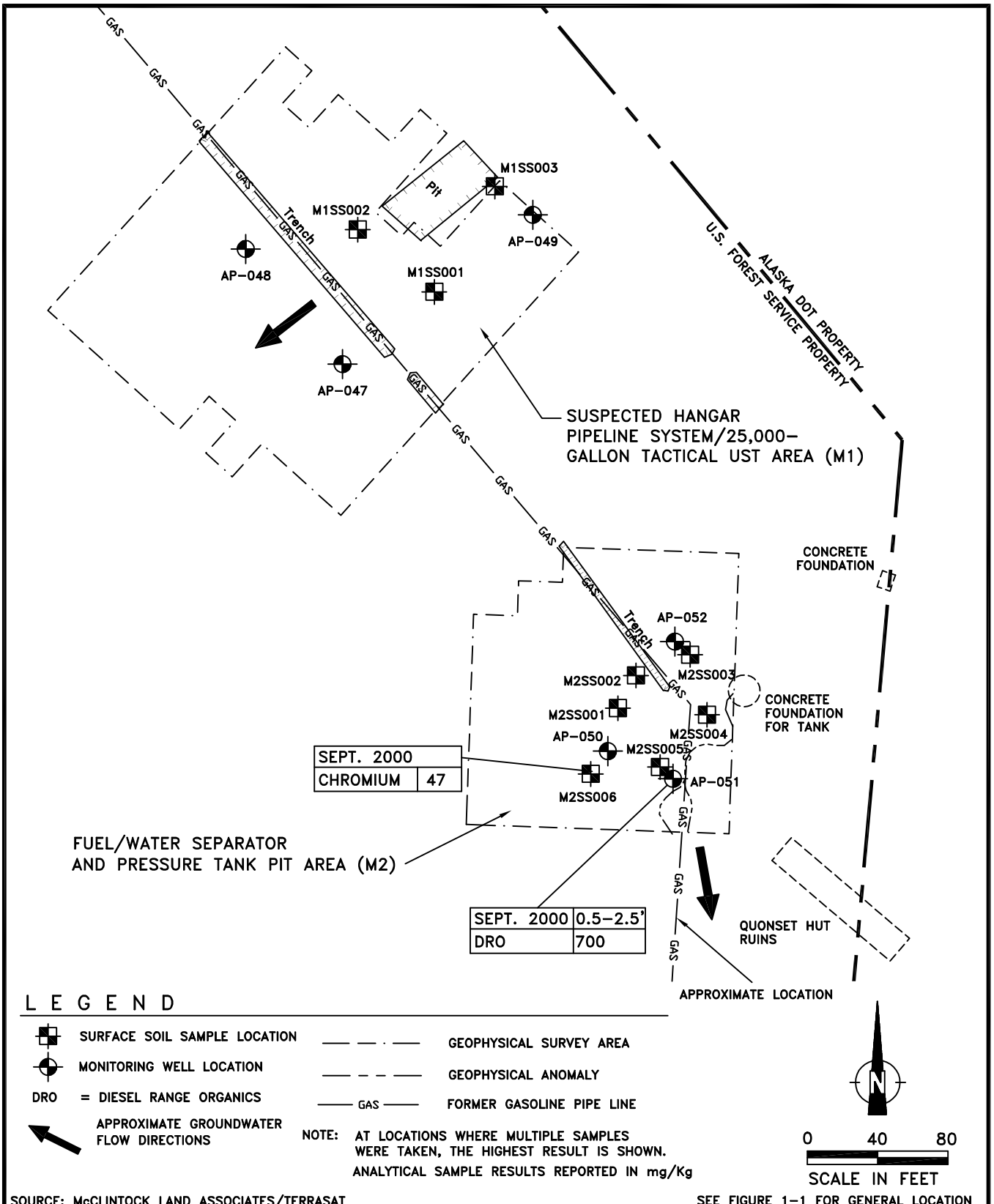
No previous investigations have been conducted at this site.

4.7.1.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objective at the Suspected Hangar Pipeline System/Tactical UST area (Concern M1). Sample locations are shown on Figure 4-8.

Geophysical Survey

A geophysical survey was conducted at this site prior to sampling activities to determine the presence or absence of buried pipelines and USTs associated with the pit and trench excavations. No anomalies of significance were detected within the survey area. The geophysical investigation indicates that there is no buried metal associated with the excavated pit and trench.



SOURCE: McCLINTOCK LAND ASSOCIATES/TERRASAT

SEE FIGURE 1-1 FOR GENERAL LOCATION

DRAWING: 00F4-8M12 DRAWN: MNS C/SC: 1:1PS ZIP: 39/00 DATE: 01/07/02 CHECK: J.H.	FIGURE 4-8 POST POWERHOUSE/ 25,000-GAL. TACTICAL UST CONCERNS M1 & M2	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000-216-132

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

4.7.1.4 Objectives

The primary objectives at this concern were to determine the presence or absence of buried pipeline or associated debris and to assess the surface soil, subsurface soil, and groundwater in the area of the suspected hangar pipeline and tactical UST to determine whether any releases associated with former military use of the site had occurred that may still be detectable today.

4.7.1.5 Previous Investigations

No previous investigations have been conducted at this site.

4.7.1.6 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objective at the Suspected Hangar Pipeline System/Tactical UST area (Concern M1). Sample locations are shown on Figure 4-8.

Geophysical Survey

A geophysical survey was conducted at this site prior to sampling activities to determine the presence or absence of buried pipelines and USTs associated with the pit and trench excavations. No anomalies of significance were detected within the survey area. The geophysical investigation indicates that there is no buried metal associated with the excavated pit and trench.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

Surface Soil Sampling

Three surface locations at three corners of the large pit suspected to be the location of the former 25,000-gallon tactical UST were sampled to determine whether contamination was present in surface soils. Six inches of topsoil and other debris were removed from each sampling location prior to collecting the mineral soil. The surface soil samples consisted of brown to dark-brown, gravelly sand, slightly silty in places.

Soil Borehole Sampling

Three soil borings were advanced to depths of 8 feet bgs to determine whether contaminants were present in subsurface soils. Boring were placed downgradient of the large pit and trench. Two drive samples were collected at various depths for sample collection and subsurface

characterization. The borings were then advanced to total depth for monitoring well installation. Boring logs are presented in Appendix D.

Each boring encountered less than 6 inches of organic material (i.e., moss and muskeg). Subsurface soils in this area consist of gray, poorly to well-graded gravel with coarse sand. PID readings were consistently 0.0 ppm for each sample.

All three borings were completed as monitoring wells. Well construction diagrams are presented in Appendix D. Well development records are presented in Appendix E.

Groundwater Sampling

Samples were collected from each well to determine whether contaminants were leaching into the groundwater. Groundwater levels measured on the day of sampling were less than 7.2 inches bgs. The groundwater flow direction appears to be toward the southwest. Wells were purged and sampled as fast recharging wells in accordance with the groundwater sampling plan. Groundwater sampling records are presented in Appendix E.

4.7.1.7 Findings

The following is a discussion by media of analytes detected at the Suspected Hangar Pipeline System/Tactical UST area (Concern M1) with concentrations exceeding cleanup levels. A summary of elevated analytical results is presented as Table 4-9. Complete analytical results from Concern M1 are presented in Appendix A, Tables 17, 18, and 19.

Surface Soil

Arsenic was detected at concentrations from 0.93 mg/kg to 3.6 mg/kg in surface soil. Two of the three reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, none of the reported arsenic concentrations exceeded the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in surface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations from 23 mg/kg to 31 mg/kg. Three of three reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. However, none of the reported chromium concentrations detected exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in surface soil will not be considered a COPC at this concern.

Although pentachlorophenol was not detected in any of the surface soil samples, due to low percent solids the MQLs of four of the ten samples were elevated slightly above the ADEC Method Two soil cleanup level of 9 µg/kg. However, because pentachlorophenol was not detected in any soil or water samples collected at this concern, it is not considered a COPC in any media at this concern.

No analytes in surface soils are considered to be COPCs at this concern.

Table 4-1. Concern M1 – Summary of Elevated Analytical Results.

Location		Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Surface Soils				
M1SS001		Arsenic	3.6	1.8
		Chromium	28	23
M1SS002		Arsenic	0.93	1.8
		Chromium	31	23
M1SS003		Arsenic	5.2 J	1.8
		Chromium	29	23
Soil Borings				
AP-047	(1-3' bgs)	Arsenic	3 J	1.8
		Chromium	35 J	23
	(5-7' bgs)	Arsenic	2.7 J	1.8
		Chromium	28 J	23
AP-048	(0-2' bgs)	Arsenic	2 J	1.8
		Chromium	30 J	23
	(2-4' bgs)	Arsenic	3.7 J	1.8
		Chromium	29 J	23
AP-049	(0.5-2.5' bgs)	Arsenic	3.3 J	1.8
		Chromium	30 J	23
	(2.5-4.5' bgs)	Arsenic	2.9 J	1.8
		Chromium	27 J	23

Notes:
All analytes detected greater than one-half the cleanup levels are presented.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
J = Result is considered an estimate value
' bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
QA/QC = Quality Assurance/Quality Control

Soil Borings

Arsenic was detected at estimated concentrations from 2 mg/kg to 3.7 mg/kg in the soil boring samples. The reported values were considered estimated due to laboratory QC matrix duplicate sample results exceeding the precision goal for duplicated analysis. All of the reported values exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, the reported arsenic concentrations did not exceed the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in subsurface soil will not be considered a COPC at this concern.

Chromium was detected at estimated concentrations ranging from 27 mg/kg to 35 mg/kg. The reported values were considered estimated due to laboratory QC matrix duplicate sample results exceeding the precision goal for duplicated analysis. All of the reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. However, the reported chromium concentrations did not exceed the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in subsurface soil will not be considered a COPC at this concern.

No analytes in subsurface soils are considered to be COPCs at this concern.

Groundwater

All groundwater analytical results were below ADEC groundwater cleanup levels. No analytes in groundwater are considered as COPCs.

Summary of Findings

The investigative objectives at this concern was to determine the presence or absence of buried pipeline or associated debris and to assess the surface soil, subsurface soil, and groundwater in the area of the suspected hangar pipeline and tactical UST to determine whether any releases associated with former military use of the site had occurred that may still be detectable today. Three surface samples, six soil boring samples, and three groundwater samples were collected and analyzed.

No analytes at this concern are considered COPCs. No buried pipeline or debris was detected by the geophysical survey.

4.7.2 Concern M2: Fuel/Water Separator and Pressure Tank Pit

The 1943 Field Revisions Air Corps Tactical Gas System map indicated that a fuel/water separator and pressure tank pit facility was located at a 45-degree bend in the piping system approximately 300 feet down line from the 25,000 tank. This facility was used to separate the water used to push fuel through the piping system. Details about ultimate disposal of the water were unable to be determined from the reference materials. This concern is included on Figure 4-8 (along with Concern M1).

A small, square, metal foundation was observed in the area during the 1999 site walkover and was suspected of being associated with the facility, but it was not possible to make that determination. A collapsed Quonset hut may be associated with the tactical gas system or with the airbase laundry facilities, which were also located in the general area. No pit was observed.

4.7.2.1 Objectives

The primary objective at this concern was to assess the surface soil, subsurface soil, and groundwater in the area of the fuel/water separator and pressure tank pit to determine whether

any releases associated with former military use of the site had occurred that may still be detectable today.

4.7.2.2 Previous Investigations

No previous investigations have been conducted at this site.

4.7.2.3 2000 Fieldwork

The following is a discussion of fieldwork conducted during the 2000 field season in support of the RI objective at the Fuel/Water Separator and Pressure Tank Pit area (Concern M2). Sample locations are shown on Figure 4-8

Geophysical Survey

A geophysical survey was conducted at this site prior to sampling activities to determine the presence or absence of a buried pipeline and other objects associated with this former military site. Two anomalies represent surface metal and a foundation. A third anomaly suggests buried metal. The geophysical investigation indicates that no buried pipe is present in this area.

Geophysical survey techniques are described in Section 3.1.1. Figures and information on instrumentation specifications, limitations, and field methodology are included in Appendix G.

Surface Soil Sampling

Six surface locations were sampled to determine if contamination associated with the former military use of the site is present in the surface soils. Sample locations were on either side of the trench and around the geophysical anomalies. Between 3.5 to 6 inches of topsoil and other debris were removed from each sampling location prior to collecting the mineral soil. The surface soil samples consisted of brown to gray gravelly sand, some slightly silty. PID readings were consistently 0.0 ppm for each sample.

Soil Borehole Sampling

Three soil borings were advanced to depths of 8 feet bgs to determine whether contaminants were present in the subsurface soils. Boring locations were placed on either side of the trench and near the geophysical anomalies. Two drive samples were collected at various depths for sample collection and subsurface characterization. The borings were then advanced to total depth for monitoring well installation. Boring logs are presented in Appendix D.

Each boring encountered less than 0.5 foot of organic material (i.e., moss and muskeg). Subsurface soils in this area consist of silts, sandy silts, and clay, mostly with a light gray color, brown in places. Some sands were mottled light gray and brown. The sand was medium to course, very coarse in a few places, and poorly graded. PID readings ranged between 0.0 and 0.1 ppm.

Soil Borehole Sampling

Three soil borings were advanced to depths of 8 feet bgs to determine whether contaminants were present in the subsurface soils. Boring locations were placed on either side of the trench and near the geophysical anomalies. Two drive samples were collected at various depths for sample collection and subsurface characterization. The borings were then advanced to total depth for monitoring well installation. Boring logs are presented in Appendix D.

Each boring encountered less than 0.5 foot of organic material (i.e., moss and muskeg). Subsurface soils in this area consist of silts, sandy silts, and clay, mostly with a light gray color, brown in places. Some sands were mottled light gray and brown. The sand was medium to course, very coarse in a few places, and poorly graded. PID readings ranged between 0.0 and 0.1 ppm.

All three borings were completed as monitoring wells. Well construction diagrams are presented in Appendix D. Well development records are presented in Appendix E.

Groundwater Sampling

Samples were collected from each well to determine whether contaminants were leaching into the groundwater. Groundwater levels measured on the day of sampling ranged from above the ground surface to 7 inches bgs. The groundwater flow direction appears to be toward the south. Wells were purged and sampled as fast recharging wells in accordance with the groundwater sampling plan. Groundwater sampling records are presented in Appendix E.

4.7.2.4 Findings

The following is a discussion by media of analytes exceeding cleanup levels at the Fuel/Water Separator and Pressure Tank Pit, Concern M2. A summary of elevated analytical results is presented as Table 4-10. Complete analytical results from the 2000 investigation are presented in Appendix A, Tables 20, 21, and 22.

Surface Soil

Arsenic was detected at concentrations from 0.61 mg/kg to 1.8 mg/kg in surface soil. However, none of samples exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. Arsenic in surface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations from 21 mg/kg to 47 mg/kg. Five of six reported values exceeded the ADEC Method Two soil cleanup level of 23 mg/kg. One sample concentration (00M2SS006SO, 47 mg/kg) exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in surface soil will be considered a COPC at this concern.

Table 4-1. Concern M2 – Summary of Elevated Analytical Results.

Location		Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Surface Soils				
M2SS001		Arsenic	1.2	1.8
		Chromium	28	23
M2SS002		Chromium	28	23
M2SS003		Arsenic	1.8	1.8
		Chromium	21	23
M2SS004		Chromium	31	23
M2SS005		Chromium	28	23
M2SS006		Arsenic	1.1	1.8
		Chromium	47	23
Soil Borings				
AP-050	(0.5-2.5' bgs)	Arsenic	1.8	1.8
		Chromium	29	23
	(2.5-4.5' bgs)	Arsenic	1.9	1.8
		Chromium	30	23
AP-051	(0.5-2.5' bgs)	DRO	700	230
		Arsenic	2.9	1.8
		Chromium	37	23
	(2.5-4.5' bgs)	Arsenic	1.9	1.8
		Chromium	26	23
AP-052	(0.5-2.5' bgs)	Arsenic	2.2	1.8
		Chromium	37	23
	(2.5-4.5' bgs)	Arsenic	2.4	1.8
		Chromium	28	23

Notes:
All analytes detected greater than one-half the cleanup levels are presented.
Where QA/QC samples were taken, only the greatest value is presented.
See Appendix A for details regarding cleanup levels.
Key:
DRO = Diesel Range Organics
' bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
QA/QC = Quality Assurance/Quality Control

Besides chromium, no other analytes detected in surface soils at this concern are considered to be COPCs.

Soil Borings

Arsenic was detected at concentrations ranging from 1.8 mg/kg to 2.5 mg/kg in the soil boring samples. Five of six samples concentrations exceeded the ADEC Method Two soil cleanup level of 1.8 mg/kg. However, the arsenic concentrations detected at this concern did not exceed

the background concentration of 14.16 mg/kg (see Section 4.1.1 for discussion of background concentrations). Arsenic in subsurface soil will not be considered a COPC at this concern.

Chromium was detected at concentrations ranging from 26 mg/kg to 37 mg/kg, exceeding the ADEC Method Two soil cleanup level of 23 mg/kg. However, none of the reported values exceeded the background concentration of 41.47 mg/kg (see Section 4.1.1 for discussion of background concentrations). Chromium in subsurface soil will not be considered a COPC at this concern. DRO was detected at a concentration that exceeded the ADEC Method Two soil cleanup level of 230 mg/kg at boring location AP-051 (700 mg/kg at 0.5 to 2.5 feet bgs). However, DRO concentrations reported in the associated field QC duplicate sample (below the detection level of 35 mg/kg) and the QA referee sample (2.3 mg/kg) showed reasonable correlation and were below the ADEC Method Two soil cleanup level, suggesting the elevated concentration of the single primary sample was an aberration at this location. The primary sample exhibited variability that exceeded the USACE comparability criteria for DRO (see the Data Assessment Report in Appendix B). DRO was reported at an estimated concentration of 30 mg/kg from the deepest sample retrieved from this boring, which was below the ADEC Method Two soil cleanup level. DRO in subsurface soil will not considered a COPC at this concern.

No other analytes in subsurface soils are considered to be COPCs at this concern.

Groundwater

All groundwater analytical results were below ADEC groundwater cleanup levels. No analytes in groundwater are considered as COPCs.

Summary of Findings

The investigative objective at this concern was to assess the surface soil, subsurface soil, and groundwater in the area of the fuel/water separator and pressure tank pit to determine whether any releases associated with former military use of the site had occurred that may still be detectable today. Six surface samples, six soil boring samples, and three groundwater samples were collected and analyzed.

Chromium was detected in one surface soil sample at a concentration that exceeded background levels. Therefore, chromium in surface soil will be considered a COPC at this concern. No other analytes are considered COPCs at this concern.

Low levels of DRO detected in surface and subsurface soil samples may be evidence of possible previous releases associated with the fuel/water separator and pressure tank pit. However, the reported concentrations were below the cleanup level (one concentration was reported above the cleanup lever; however, field QC duplicate and QA referee samples suggest that the reported elevated concentration was an aberration at this location). DRO will not be considered a COPC at this concern.

4.8 Additional Activities: Initial Field Investigations

Through the public participation process, additional sites were identified as areas of potential concern. The objectives of the 2000 initial field investigations were to visually identify those additional sites and confirm their locations. The field team leader investigated each site for any sign or suggestion of potential contaminants associated with FUDS-eligible sites. Figure 4-9 shows the location of the additional areas.

These additional areas included:

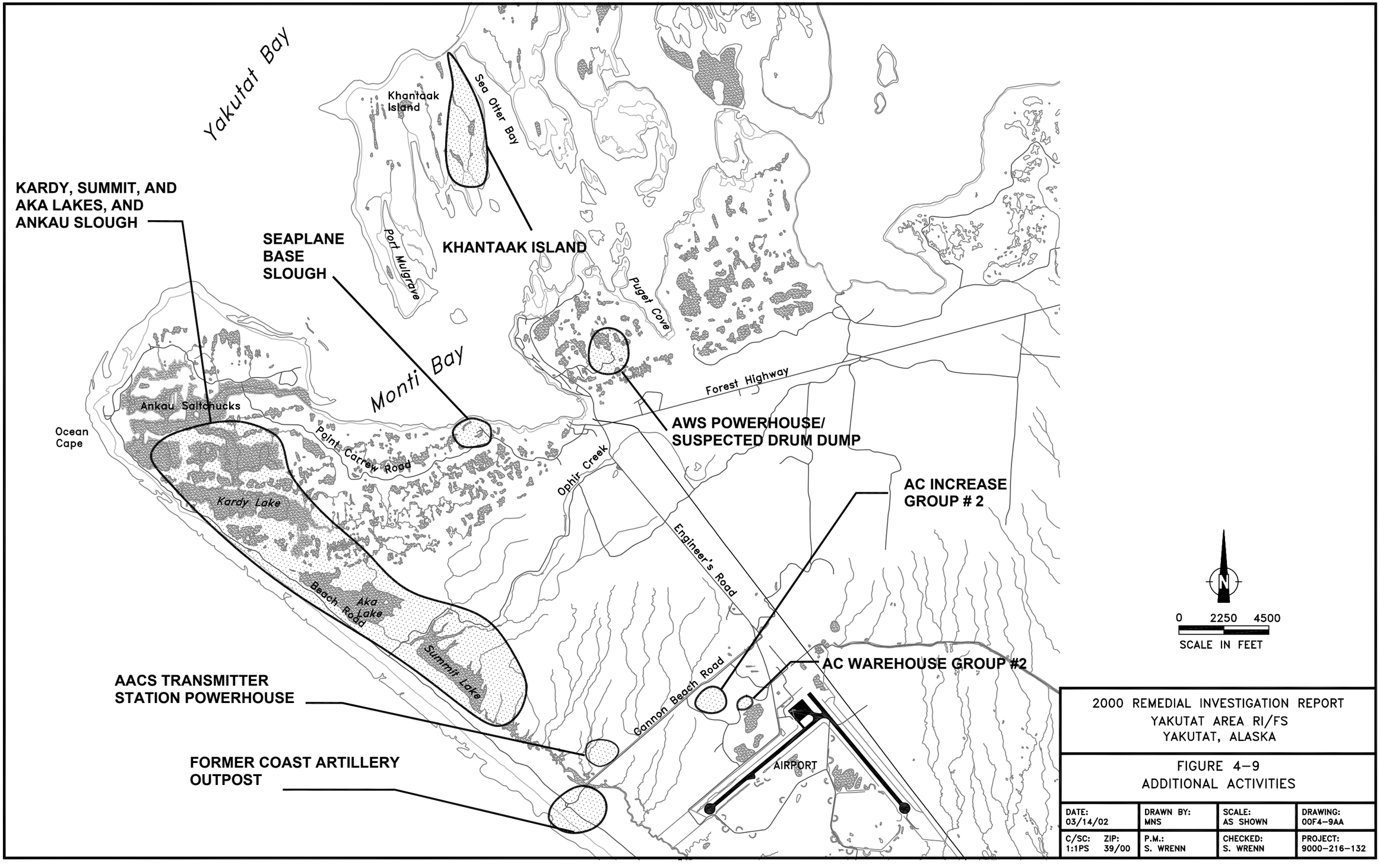
- Seaplane Base Slough
- Khantaak Island (Eastern)
- Kardy, Summit, and Aka Lakes and Ankau Slough
- Air Corps Increase Group No. 2
- Air Corps Warehouse Group No. 2
- Army Airways Communication System (AACS) Transmitter Station Powerhouse
- Former Coast Artillery Outpost
- Air Warning System (AWS) Powerhouse Building/Suspected Drum Dump

4.8.1 Seaplane Base Slough

A single drum was reported to exist in a slough near the property of a private resident of Yakutat. Based on 1942 Minor Naval Air Facilities maps, it appears that this slough was part of the draining system surrounding the Seaplane Base taxiway. The drum appeared to be similar in appearance to drums observed at other FUDS-eligible drum dumps in the Yakutat area. Figure 4-10 presents the general site layout and sample location.

During the investigation of this site, collocated surface water and sediment samples were collected 14 feet from the end of the culvert, next to the submerged drum, to determine whether any contaminants have been released by the drum. The slough was 1.5 to 2 feet deep by 15 feet wide and somewhat overgrown with alders. The bottom of the slough was covered with 0.5 feet of decayed organic matter. Water flow within the slough was imperceptible. The surface water sample was clear with a brown tint. The sediment sample was collected from 4 to 8 inches below the bottom of the slough, 1.5 to 2.0 feet below water surface, and consisted of gray organic sand and silt.

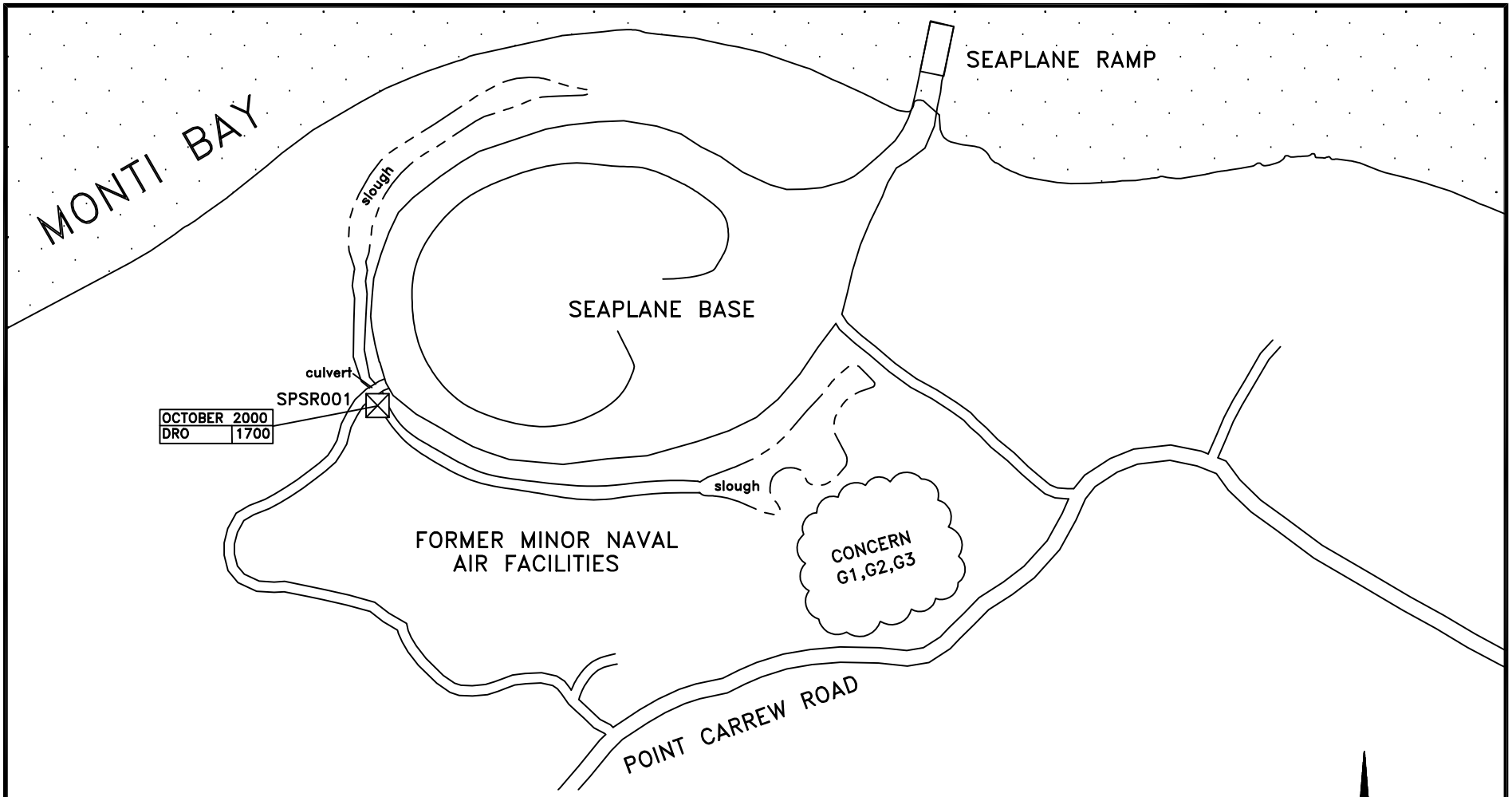
A sheen came to surface when bottom layers were disturbed, and the sediment sample had a strong petroleum odor. Analytical results for the sediment sample indicate a DRO concentration (1,700 mg/kg) above the ADEC Method Two soil cleanup level of 230 mg/kg used a screening tool. The only analyte detected in the surface water sample was barium (0.007 mg/L). Table 23 in Appendix A contains the seaplane base slough analytical results. Elevated analytical results from the seaplane base slough samples are presented in Table 4-11. Additional investigation in this area is recommended.



2000 REMEDIAL INVESTIGATION REPORT
YAKUTAT AREA RI/FS
YAKUTAT, ALASKA

FIGURE 4–9
ADDITIONAL ACTIVITIES

DATE: 03/14/02	DRAWN BY: MNS	SCALE: AS SHOWN	DRAWING: 00F4–9AA
C/SC: 1:1PS ZIP: 39/00	P.M.: S. WRENN	CHECKED: S. WRENN	PROJECT: 9000–216–132



LEGEND

⊠ SEDIMENT AND SURFACE WATER SAMPLE LOCATION

DRO = DIESEL RANGE ORGANICS

NOTE: ANALYTICAL RESULT REPORTED IN mg/Kg

SOURCE: McCLINTOCK LAND ASSOCIATES

SEE FIGURE 4-9 FOR GENERAL LOCATION

DRAWING: 00F4-10G4	DRAWN: MNS	FIGURE 4-10 MINOR NAVAL AIR FACILITY (SEAPLANE BASE) SEAPLANE BASE SLOUGH
C/SC: 1:1PS	ZIP: 39/00	2000 REMEDIAL INVESTIGATION REPORT YAKUTAT AREA RI/FS YAKUTAT, ALASKA PROJECT 9000-216-132
DATE: 12/21/01	CHECK: J.H.	

Table 4-1. Seaplane Base Slough – Summary of Elevated Analytical Results.

Location	Analyte	Result *(mg/kg)*	Cleanup Level *(mg/kg)*
Sediment			
SPSR001	DRO	1700	NA
	Arsenic	22	NA
	Chromium	42	NA

Notes:
Sediment analytes detected greater than one-half the ADEC Method Two soil cleanup level are presented.
Key:
DRO = Diesel Range Organics
mg/kg = Milligrams per kilogram
NA = Not applicable

4.8.2 Khantaak Island (Eastern)

The central-western area of Khantaak Island was visited during the 1999 site walkover and was not identified as a possible concern. However, the eastern area of the island was subsequently reported to contain numerous drums, some of which were still partially filled as recently as 1990. A field investigation was conducted in the Sea Otter Bay (also called Deep Bay) area of the island (see Figure 4-9).

The field team searched for the reported drums throughout the area, following game trails into the forested areas on the west side of the bay from the isthmus to the south end of the bay. No roads, signs of infrastructure, or associated drums were observed although approximately 10 scattered drums were observed along the beach, apparently washed up from Yakutat Bay rather than being associated with any Island activities. No additional work is recommended for Khantaak Island.

4.8.3 Kardy, Summit, and Aka Lakes and Ankau Slough

Verbal reports indicate that drums and other debris may have been disposed of in the lakes southeast of the OCRR Station. Several roads were followed between Kardy and Aka Lakes, but no drums or metal was observed. Two dumps were observed between the south edge of Aka Lake and Coast Guard Road (also called Ophir Creek Road). One dump was found on the north side of Beach Road between Aka Lake and Coast Guard Road. The other dump was found approximately 0.5 miles north of Coast Guard Road and Beach Road. Two drums and other buried debris were also observed in this area. These lakes are still considered to be possible dump sites, and additional investigation is recommended.

4.8.4 Air Corps Increase Group No. 2

The field team leader investigated an area 800 feet south of Concern A1 (not investigated during the 2000 field program), which was a suspected drum storage area. There were no indications of anything that would represent an environmental concern. No additional investigation is recommended.

4.8.5 Air Corps Warehouse Group No. 2

Although this area was not in the Work Plan, verbal reports indicated that several drums were present. Yakutat Landing Field Layout Plan Maps from 1943 labeled this area as Air Corps Warehouse Group No. 2. Over 45 drums, a 30- by 40-foot foundation, and 3 small drums containing what looked like joint grease were observed between the road and drainage ditch to the east. An investigation of this site is discussed in the 2001 Remedial Investigation Report.

4.8.6 AACS Transmitter Station Powerhouse

Access to the AACS Transmitter Station Powerhouse was not possible at the time of investigation due to high surface water in the drainage ditch along the west side of Cannon Beach Road. Additional investigation in this area is recommended.

4.8.7 Former Coast Artillery Outpost

This building served as a power source for a small installation on Cannon Beach Road. The field team investigated this area and found a small metal and debris pile and a wooden foundation in the forested area. Additional investigation may be warranted in this area.

4.8.8 AWS Powerhouse/Suspected Drum Dump

A review of file information indicated that a powerhouse was located near the center of Yakutat, which provided electrical power for the AWS Station. The area is presently privately owned and is the location of a llama farm. ENSR personnel visited the site and observed a concrete pad that was identified by a local resident as the former powerhouse foundation. Two drums and several metal cans were also observed. An investigation of this site is discussed in the 2001 Remedial Investigation Report.

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5.0 CONCLUSIONS

Based on data accumulated during this field investigation, the following conclusions have been determined:

Site C: Point Carrew Garrison

Concern C1: Ankau Bridge Area – Garbage/Drum Dump

- Results of the geophysical survey indicate that buried metal and/or surface debris in the dump area cover approximately 12,440 square feet. The boundary of the dump area is generally defined by visible surface debris.
- Arsenic and chromium are the only analytes that exceeded ADEC Method Two soil cleanup levels. Arsenic concentrations in both surface and subsurface soil did not exceed the background concentration of 14.16 mg/kg; therefore, arsenic will not be considered a COPC in these media at this concern. One surface soil sample collected outside of the dump area was reported to have a chromium concentration of 43 mg/kg, which is above the background concentration of 41.47 mg/kg. Chromium in surface soil will be considered a COPC at this concern.
- No other surface or subsurface soil samples contained analytes that exceeded ADEC Method Two soil cleanup levels.
- No groundwater samples contained analytes that exceeded ADEC groundwater cleanup levels.
- There is no indication of a release of any hazardous substances from the garbage/drum dump. Further action may be warranted to better define the extent of elevated chromium concentrations in the surface soils at this concern.
- Development of site-specific risk-based cleanup levels for chromium may be appropriate at this concern.

Concerns C2, C3, and C4: Drum Dump – Point Carrew, Powerhouse Foundation 1 Potential Release, and Surface Debris – Garrison

- Results of the geophysical survey indicate the dump area (Concern C2) covers an area of approximately 13,000 square feet. The extent of the dump is generally defined by the surrounding swamp/bog wetlands. One geophysical anomaly suggests significant amounts of surface and buried metal associated with the powerhouse foundation (Concern C3). Another anomaly suggests significant amounts of buried metal in the surface debris area (Concern C4) covering an area of approximately 830 square feet although nonmetallic debris may cover a larger area.

- DRO was detected at concentrations above the ADEC Method Two soil cleanup level of 230 mg/kg in surface soil, subsurface soil, and sediment from six sample locations. The maximum concentration detected was 2,400 mg/kg. Elevated concentrations were detected in samples from the surface debris area (C4), and the southern edge of the dump site (C2). DRO in surface soil, subsurface soil, and sediment will be considered a COPC at Concerns C2, C3, and C4.
- Silver was reported in a surface soil sample from the southeast corner of the dump area at 26 mg/kg, exceeding the ADEC Method Two soil cleanup level of 19 mg/kg. Silver in surface soil will be considered a COPC at the drum dump (Concern C2).
- Arsenic and chromium concentrations in soils also exceeded the ADEC Method Two soil cleanup levels. Arsenic concentrations in both surface and subsurface soil did not exceed the background concentration of 14.16 mg/kg; therefore, arsenic will not be considered a COPC in these media at this concern. Chromium was reported in two surface soil samples from the surface debris area at concentrations (46 mg/kg and 49 mg/kg) above the background level (41.47 mg/kg). Chromium in surface soil will be considered a COPC at Concern C4.
- No other surface soil, subsurface soil, or sediment samples contained analytes that are above ADEC Method Two soil cleanup levels.
- No groundwater samples contained analytes that exceeded ADEC groundwater cleanup levels.
- No PCB or fuel contamination was found to be associated with the former powerhouse. No COPCs were identified at the former powerhouse location.
- Additional investigation is recommended to better define the extent of DRO in subsurface and surface soils at Concerns C2, C3, and C4.
- Further action may be warranted to better define the extent of elevated chromium concentrations in the surface debris area and elevated silver concentrations in the landfill.
- Development of site-specific risk-based cleanup levels for silver and chromium may be appropriate at this concern.

Site E: Northwest Drum Dump/Quartermaster Loop Area

Concern E1: Drum Dump/Remaining Debris and Potential Contamination

- Remaining surface debris found in the area consists of small rust flakes presumed to be associated with the drums previously stored at this location.
- DRO was detected in four soil samples at concentrations above the ADEC Method Two soil cleanup level of 230 mg/kg. The maximum concentration detected was 2,700 mg/kg. Elevated concentrations were detected in samples collected near the

rust flakes. Contamination appears to be mostly limited to a depth of approximately 2 feet bgs but extends to at least 4 feet bgs at the AP-027 location. DRO in surface and subsurface soils will be considered a COPC at Concern E1.

- Three sediment samples from the drainage ditch on the north edge of the site contained concentrations of pentachlorophenol above the ADEC Method Two soil cleanup level of 9 µg/kg. The maximum concentration detected was 970 µg/kg. One sample concentration is above the Washington MCUL of 690 µg/kg. Pentachlorophenol in sediment will be considered a COPC at Concern E1.
- Arsenic and chromium concentrations detected in soil and sediment were above the ADEC Method Two soil cleanup levels. Three sediment samples and one surface soil sample contained arsenic concentrations above the background concentration of 14.16 mg/kg with a maximum concentration of 160 mg/kg. Two sediment sample concentrations were also above the Washington MCUL of 93 mg/kg. Chromium was reported in two sediment samples, one surface soil sample, and one soil boring sample at concentrations above the background concentration of 41.47 mg/kg, with a maximum concentration of 57 mg/kg. Arsenic and chromium in sediment and surface soil will be considered COPCs at Concern E1. Chromium in subsurface soil will also be considered a COPC at this concern.
- No other surface soil, subsurface soil, or sediment samples contained analytes that were above ADEC Method Two soil cleanup levels.
- No groundwater samples contained analytes that exceeded ADEC groundwater cleanup levels.
- Additional investigation is recommended to better define the extent of pentachlorophenol, arsenic, and chromium in the drainage ditch on the north edge of the site.
- Additional investigation is recommended to better define the extent of DRO contamination at the former drum location.
- Further action may be warranted to better define the extent of elevated arsenic and chromium concentrations in soils in the area.

Site G: Minor Naval Air Facility (Seaplane Base)

Concerns G1, G2, G3, and G4: Former Pipeline Paths, Suspected UST 1 and Debris, Suspected USTs 2 and 3, and Seaplane Base Slough

- Results of the geophysical surveys indicate that there is no buried metal associated with the excavated pits and trenches.
- DRO was detected at 1,200 mg/kg in the sediment sample collected near a partially submerged drum in the slough surrounding the seaplane base taxiway (Concern

G4). This concentration is above the ADEC Method Two soil cleanup level. A sheen was created on surface water while sampling. DRO will be considered a COPC at Concern G4.

- Arsenic and chromium are the only other analytes that are above ADEC Method Two soil cleanup levels; however, the detected concentrations are below background concentrations.
- The surface water sample did not contain any analytes that exceeded AWQS surface water cleanup levels.
- Additional characterization is recommended for Concern G4. Additional investigations at the Minor Naval Air Facility (Seaplane Base) Concerns G1, G2, and G3 were conducted during the 2001 field season. Results from those investigation are discussed in the 2001 Release Investigation Report.

Site H: Ocean Cape Radio Relay Station

Concern H1: Culture Camp

- Surface soils, surface water, and sediment contains detectable concentrations of dioxins. However, only dioxins in surface soil exceeded risk-based screening criteria and will be considered a COPC at Concern H2.
- No surface water samples contained analytes that exceeded AWQS surface water cleanup levels.
- The absence of site tissue concentration data does not allow for a more definitive screening assessment of risks to human health or risks to wildlife from dietary exposures. Follow-on sampling has been initiated by the USACE and local community.
- Arsenic and chromium are the only other analytes that exceeded ADEC Method Two soil cleanup levels; however, the detected concentrations are below background concentrations.

Site K: Solid Waste Disposal Dump No. 4

Concern K1: Dump Area

- Results of the geophysical survey indicate buried metal and/or surface debris in the dump area covers approximately 82,150 square feet. The boundary of the dump area is generally defined by the difference in vegetation between landfill and the surrounding wetlands.
- Pentachlorophenol was detected in one surface soil sample from within the dump area at a concentration of 170 µg/kg, above the ADEC Method Two soil cleanup

levels of 9 µg/kg. Pentachlorophenol in surface soil will be a considered COPC at Concern K1.

- Arsenic and chromium in soil were reported at concentrations that exceeded the ADEC Method Two soil cleanup levels. Two reported arsenic concentrations (28 mg/kg and 32 mg/kg) were above the background concentration (14.16 mg/kg). One reported chromium concentration (59 mg/kg) was above the background concentration (41.47 mg/kg). Arsenic and chromium will be considered COPCs at Concern K1.
- Cadmium was reported at a concentration of 7.4 mg/kg in a field QC duplicate sample, which exceeded the ADEC Method Two soil cleanup level of 4.5 mg/kg. However, the associated primary and QA referee samples sample are below the ADEC Method Two soil cleanup level, suggesting that the elevated concentration of the single field QC duplicate sample is an aberration at this location.
- No other surface or subsurface soil samples contained analytes that exceeded ADEC Method Two soil cleanup levels.
- Groundwater samples were collected at Concern K1 during the 2001 field season. Results are discussed in the 2001 Remedial Investigation Report.
- Additional sampling is recommended to determine the extent of pentachlorophenol, arsenic, and chromium in surface soil.

Site M: Post Powerhouse/25,000-Gallon Tactical Tank

Concerns M1 and M2: Suspected Hangar Pipeline System/Tactical UST, and Fuel/Water Separator and Pressure Tank Pit

- Results of the geophysical surveys indicate that there is no buried metal associated with the excavated pits and trenches.
- DRO was reported in one soil boring sample from Concern M2 at a concentration of 700 mg/kg, which exceeded the ADEC Method Two soil cleanup level of 230 mg/kg. However, associated field QC duplicate and QA referee samples were below the ADEC Method Two soil cleanup level of 230 mg/kg, suggesting the elevated concentration of the single primary sample was an aberration at this location.
- Arsenic and chromium were the only other analytes that exceeded ADEC Method Two soil cleanup levels. Chromium was reported in one surface soil sample from Concern M2 at a concentration of 47 mg/kg, which is above the background concentration of 41.47 mg/kg. Chromium in surface soil will be considered a COPC at this concern.
- No other surface or subsurface soil samples contained analytes that exceeded ADEC Method Two soil cleanup levels.

- No groundwater samples contained analytes that exceeded ADEC groundwater cleanup levels.
- Additional investigation is recommended to delineate the extent of DRO-contaminated soils.
- Further action may be warranted to better define the extent of elevated chromium concentrations in the surface soils at Concern M2.
- Development of site-specific risk-based cleanup levels for chromium may be appropriate at this concern.

Additional Activities Sites

Table 5-1 provides the results of the 2000 initial field investigations for the additional sites that were identified as areas of potential concern through the public participation process.

Table 5-1. 2000 Initial Field Investigation Results.

Site Name	Additional Investigation Recommended	No Further Action Recommended
Khantaak Island (Eastern)		✔
Kardy, Summit, and Aka Lakes and Ankau Slough	✔	
Air Corps Increase Group No. 2		✔
Air Corps Warehouse Group No. 2 (Concern O1)	✔	
Seaplane Base Slough (Concern G4)	✔	
AACS Transmitter Station Powerhouse (Concern N1)	✔	
Former Coast Artillery Outpost	✔	
AWS Powerhouse Building/Suspected Drum Dump	✔	

Key
AWS = Air Warning System.
AACS= Army Airways Communication System.

6.0 REFERENCES

Alaska Department of Community and Economic Development. Division of Community & Business Development. 2001. Yakutat Community Overview. February 21. Web Site: http://www.dced.state.ak.us/cbd/commdb/CF_BLOCK.htm

Alaska Department Environmental Conservation (ADEC). 1998. Technical Guidance Document on Determination of Background Concentrations. September 17.

ADEC. 1999. Underground Storage Tanks Procedures Manual – Guidance for Remediation of Petroleum-Contaminated Soil and Water and Standard Operating Procedures. March 1.

Alaska Department of Fish and Game (ADF&G). 2001. ADF&G Web Site Data for Blue Whale and Northern Right Whale. February 21. Web Site: http://www.state.ak.us/local/akpages/FISH.GAME/wildlife/geninfo/game

Alaska Department of Labor. Labor Force Statistics for Yakutat Borough: 1994 to Present. 2001. February 21. Web Site: http://www.labor.state.ak.us/research/emp_ue/yaklf.htm

Alaska Geological & Geophysical Surveys. 1995. Report of Investigations 94-29, Geologic Hazards in the Yakataga Planning Area, Southeastern Alaska: An Overview. By R. A. Combellick and R. J. Motyka. Fairbanks, Alaska: State of Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys. February.

AGRA Earth & Environmental, Inc. 1997. Summary Investigation of DoD Activities on Yakutat Tribal Lands, ANA Grant No.90NM0024/01, Yakutat, Alaska, Volume I and II. Anchorage, Alaska. Prepared for Yakutat Tlingit Tribe Yakutat Native Association. March. Document No. 6-014-1641-03.

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Dioxin and Dioxin-like Compounds in Soil, Part 1: ATSDR Interim Policy Guideline. Web Site: http://www.atsdr.cdc.gov/dioxindt.html

Ecology and Environment, Inc. (E&E). 1994. Field Investigation Report, Former Yakutat Air Base, Formerly Used Defense Site, Yakutat, Alaska, Site No. F10AK060600. Anchorage, Alaska. Prepared for USACE. August.

E&E. 1997. Yakutat Air Base/Ocean Cape Radio Relay Site Investigation Report, Yakutat, Alaska, Site No. F10AK060600. Anchorage, Alaska. Prepared for EPA. December.

ENSR Corporation (ENSR). 2000a. Sampling and Analysis Plan, Remedial Investigation/Feasibility Study, Yakutat Area, Alaska. Document No. 9000-216-230. August.

ENSR. 2000b. Waste Management Plan, Remedial Investigation/Feasibility Study, Yakutat Area, Alaska. Document No. 9000-216-250. April.

ENSR. 2000c. Work Plan, Remedial Investigation/Feasibility Study, Yakutat Area, Alaska. Document No. 9000-216-220. May.

Finley, J. Riehle, et al. 1978. Geology and Geologic Constraints of the Coastal Zone From Valdez Arm to Yakutat, Alaska. Preliminary. Prepared for the State of Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys. Anchorage, Alaska. February.

Fries, William C., 2nd Lt., Historic. 1944. History, Yakutat Landing Field, Alaska: 26 October 1940 to 31 May 1944. Prepared for the CO. Approved by John S. McIntosh, Jr. Major, Air Corps, Commanding. June. Secret Document. Classification Changed to Restricted 5 Feb. 48. Microfilm Roll Number 0141, Frame Numbers 1459-1642.

Gillette, Gary H. 1998. The Yakutat Fish Train. An Historic Overview of the Yakutat and Southern Railroad Located in Yakutat, Alaska. Prepared for Alaska Department of Transportation and Public Facilities, Southeast Region. March.

National Geodetic Survey (NGS). 1991. Data sheets for Yakutat Bay, September 25.

National Oceanic and Atmospheric Administration (NOAA). 1999. Screening Quick Reference Tables (SQuiRTs). October. Web site: http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

Oil Spill Consultants, Inc. 1999. Draft Remedial Action Report for Northwest Area Drum Dump, Yakutat, Alaska. December 15.

Sheinberg Associates. 1991. Yakutat Hazards Materials Profile. By Norman A. Cohen. Prepared for the City of Yakutat, Yakutat Local Emergency Planning Committee. October.

Terrasat, Inc. 2000. Geophysical Surveys Services in Support of RI/FS at Cape Yakutat Area, Alaska Final Report. Anchorage, Alaska. Prepared for ENSR. September.

U.S. Army Corps of Engineers (USACE). 1999. Environmental Assessment and Finding of No Significant Impact, Yakutat Air Base and Ocean Cape Radio Relay Station, Yakutat, Alaska. March.

USACE. 1995a. Defense Environmental Restoration Program, Formerly Used Defense Sites, Findings and Determination of Eligibility, Ocean Cape Radio Relay Site, Yakutat, Alaska, Site No. F10AK074700, Findings of Fact.

USACE. 1995b. Defense Environmental Restoration Program, Formerly Used Defense Sites, Findings and Determination of Eligibility, Yakutat Air Base, Yakutat, Alaska, Site No. F10AK060600, Findings of Fact.

USACE. 1984a. Cultural Resources Investigation Yakutat-Tawah Creek Debris Disposal and Restoration Environmental Restoration Defense Account Fiscal Year 1984.

USACE. 1984b. Environmental Restoration Defense Account Debris Cleanup and Site Restoration Design, Yakutat, Alaska Civil. Prepared by Frank Moolin & Associates, Inc. July. Maps.

USACE. 1984c. Environmental Assessment, Department of Defense, Environmental Restoration Defense Account, Yakutat/Tawah Creek. July.

USACE. 1941-1943. Yakutat Landing Field War Department Maps. U.S. Engineer Office: Seattle, Washington, and U.S. Engineer Office: Yakutat, Alaska. Maps.

USACE. 1942a. Yakutat, Alaska Minor Naval Air Facilities War Department Maps. U.S. Engineer Office: Seattle, Washington and Yakutat, Alaska. Maps.

USACE. 1942b. Yakutat Army Air Base War Department Maps. U.S. Engineer Office: Seattle, Washington and Yakutat, Alaska. Maps.

USACE. 1943. USACE, Real Estate Division, Real Property Title/Historical File 405-90h, Yakutat Air Base.

U.S. Bureau of Land Management. 1980. Final Environmental Impact Statement, Proposed Outer Continental Shelf Oil and Gas Lease Sale, Eastern Gulf of Alaska, Sale No. 55. March.

U.S. Environmental Protection Agency (USEPA). 1996. SW-846 Test Methods for Evaluating Solid Waste Final Update III. December.

USEPA. 1994. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response. EPA 540/R-94/012. February.

USEPA. 2002. Risk-Based Concentration Table. Region 3. April.

U.S. Fish and Wildlife Service (USFWS). 1986. Biological Report 85 (1.8) Contaminant Hazard Reviews Report No. 8, Dioxin Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. by Ronald E. Patuxent. Wildlife Research Center Laurel, MD. May. Web site: http://www.pwrc.usgs.gov/cgi-bin/om_isapi.dll?clientID=10750132&infobase=eisler1.nfo&softpage=Browse_Frame_Pg

U.S. Geological Survey (USGS). 1998. Open-File Report 98-199, Hydrologic Investigation of the Ophir Creek Watershed Near Yakutat, Alaska. By Edward G. Neal. Prepared in cooperation with Alaska Department of Fish and Game. Anchorage, Alaska.

USGS. 1994. Open-File Report 94-713, Overview of Environmental and Hydrogeologic Conditions at Yakutat, Alaska. By Walter F. Holmes and Joseph M. Dorava. Prepared in cooperation with Federal Aviation Administration. Anchorage, Alaska.

USGS. 1988. Professional Paper 1458, Element Concentrations in Soils and Other Surficial Materials of Alaska. By L. P. Gough, R. C. Severson and H. T. Shacklette. Washington, D.C.: U.S. Government Printing Office.

USGS. 1985. Open-File Report 85-13, Tectonics of the Yakutat Block, An Allochthonous Terrain in the Gulf of Alaska. Preliminary. By Terry R. Bruns. Menlo Park, California: U.S. Geological Survey. January.

USGS. 1979. Professional Paper 1017, Reconnaissance Engineering Geology of the Yakutat Area, Alaska, With Emphasis on Evaluation of Earthquakes and Other Geologic Hazards. By Lynn A. Yehle. Washington, D.C.: U.S. Government Printing Office.

USGS. 1971. Professional Paper 567, Dictionary of Alaska Place Names. Second Printing. By Donald J. Orth. Washington, D.C.: U.S. Government Printing Office.

USGS. 1970. Bulletin 1312-L, Geochemical and Geophysical Reconnaissance of Parts of the Yakutat and Mount Saint Elias Quadrangles, Alaska. By E. M. MacKevett, Jr., and George Plafker. Washington, D.C.: U.S. Government Printing Office.

USGS. 1909. Professional Paper 64, The Yakutat Bay Region, Alaska, Part I. Physiography and Glacial Geology. By Ralph S. Tarr. Washington, D.C.: U.S. Government Printing Office.

U.S. Government Printing Office. 1947. Building the Navy's Bases in World War II, History of the Bureau of Yards and Docks and the Civil Engineer Corps, 1940 - 1949, Volume II. Washington, D.C.: U.S. Government Printing Office.

United States War Department. 1941. A.C. Gasoline Tactical Storage Fueling System, Yakutat Landing Field, Alaska. Report from District Engineer to the Division Engineer, North Pacific Division, Portland, Oregon. Refer to File No. SE 5430 (Yakutat) 152.

World Health Organization (WHO). 1998. Assessment of the health risk of dioxins: re-evaluation of the Tolerable Daily Intake (TDI). Web site: http://www.who.int/pcs/docs/dioxin-exec-sum/exe-sum-final.html

Wright, A.L., et al. 1998. Townsend's Warbler (Dendroica townsendi). In The Birds of North America, No. 333 (A. Poole and F. Gill, eds.). The Birds of North America, Inc.: Philadelphia, PA.